

# Fraser Flats River Habitat Project

## 2018 Final Annual Monitoring Report

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This 2018 annual monitoring report on Learning By Doing's (LBD's) Fraser Flats River Habitat Project establishes a record of the project and its effect on the riparian and aquatic habitat. While not required as part of its U.S. Army Corps of Engineers (Corps) Section 404 Permit for the project (NWP#27; Corps File No. SPK-2017-00179), LBD has voluntarily elected to create a temporary monitoring program, which will follow the measures in the *Monitoring at-a-Glance* table enclosed at the end of this report.

### **Program Objectives**

The objectives of the Fraser Flats River Habitat Project monitoring program include documentation of the following parameters:

- Aquatic habitat features and substrate conditions
- Benthic macroinvertebrate abundance and diversity
- Trout population estimates and quality trout
- Riparian woody habitat
- Instream temperature monitoring

Construction of the project was completed in September 2017. This temporary monitoring program will be performed annually for at least 3 years post-project according to the program's guidelines finalized on October 20, 2017.<sup>1</sup>

### **Scope of 2018 Monitoring Program**

The scope of the 2018 monitoring program is to document and compare the 2018 conditions with the pre-construction (baseline) conditions of the project site.

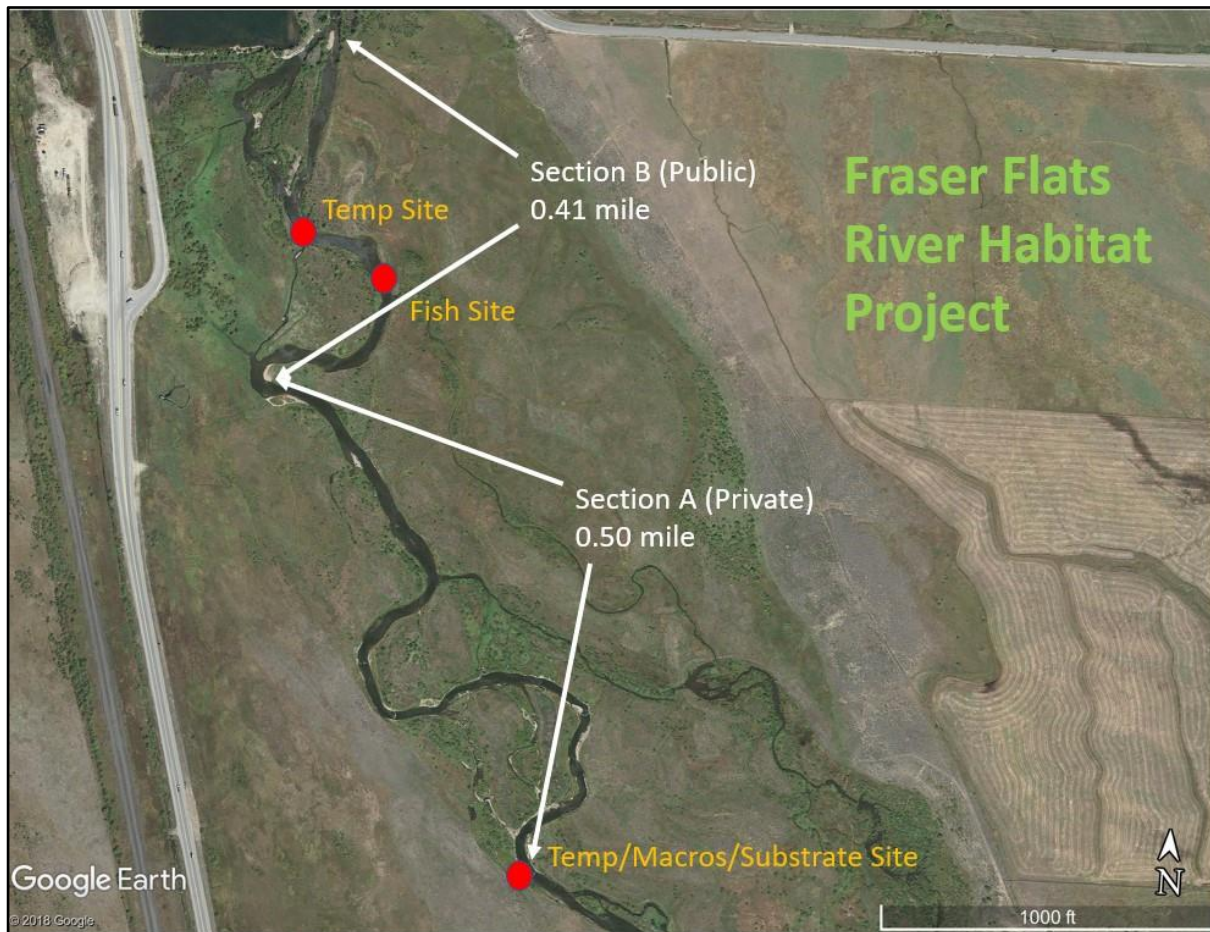
### **Monitoring Program Components**

The following provides a summary of the monitoring completed in 2018 and includes comparisons to available pre-project data. A map showing the locations of the sampling sites is provided as Figure 1.

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<sup>1</sup> LBD Monitoring Subcommittee, 2017. Fraser Flats River Habitat Project Monitoring Program Guidelines. Revised October 20, 2017 based on the August 16, 2016 monitoring plan.

Figure 1 - Map of 2018 Fraser Flats Monitoring Sites



## Aquatic Habitat and Substrate Conditions

The data below will be used to document progress made with regards to *Project Goal #1 - An increase in aquatic habitat features and improved substrate conditions.*

### Aquatic Habitat Features

The approach for monitoring aquatic habitat features includes pre- and post-construction photographs and inventory of the number of riffles and pools in the project reach. Pre- and post-construction photos of aquatic habitat features are provided in **Attachment 1**. Pre-project aquatic habitat features were inventoried based on field observations, photographs, and Google Earth images for the years 2016-2017. For the post-project inventory, Freestone Aquatics completed an as-built survey of the project reach in October 2017, immediately following the completion of construction. The as-built drawings were used to compare the existing and proposed site conditions detailed in the plan set. As it

was designed and expected, the number of instream habitat features increased after construction of the project as compared to pre-project conditions.

In 2018, the Monitoring Subcommittee purchased a laser level to survey elevations of the constructed instream habitat features, which is scheduled to begin in monitoring year 2019. These measurements will be used for year-to-year comparisons of the quality of the instream habitat features and will be used to determine how they have withstood seasonal high flows over time by conducting measurements such as thalweg and pool depth along the project reach. LBD will continue to monitor the aquatic habitat features in the project reach in 2019.

### Summary

Table 1 summarizes the number of 2016 (pre-project) and 2017-2018 (post-project) aquatic habitat features inventoried in the project reach. Although high flows were experienced during snowmelt runoff in 2018, the instream habitat features remained intact as constructed.

**Table 1 - Aquatic Habitat Features - Fraser Flats River Habitat Project**

	<b>2016 Pre-construction</b>	<b>2017 &amp; 2018 Post-construction</b>
<b>Habitat Feature</b>		
Riffles	26	31
Pools	30	32
Constructed overhanging log habitat for fish shelter	0	2
<b>TOTAL</b>	<b>56</b>	<b>65</b>
Source: GoogleEarth 2018, Freestone Aquatics 2017a/b		

Pebble counts (i.e. material sizes, presence of fines, embeddedness, and aquatic vegetation) were also sampled in the project reach by Tetra Tech in 2018, post-project. Tetra Tech's 2016 pebble count data for this site was used to document pre-project conditions.

In 2018, Tetra Tech observed small cobble (64-128 mm) as the dominant substrate size in the project reach with large cobble (128-256 mm) as the second-most dominant sized substrate. Sand and finer sediments (<2 mm) at the time of sampling were minimal to non-existent, proving to be well below the threshold of 27.5% identified by Policy 98-1 (CWQCC 2014) for preventing impacts to macroinvertebrate communities in Grand County (Sediment Region 1). Substrate embeddedness showed a decrease to approximately 3% in 2018 as compared to 17% embeddedness recorded in 2017. As compared to LBD's other substrate sampling sites in the Fraser River basin, the highest percentage of aquatic vegetation occurred on the Fraser River at the Fraser Special Project Upstream site (FR-15), which measured 86% (Tetra Tech 2019). LBD will continue to monitor substrate conditions in

the project reach in 2019. Table 2 summarizes the pebble count data for years 2016 (pre-project) and 2017-2018 (post-project).

**Table 2 - Pebble Count Data: Fraser Flats River Habitat Project**

Site Name: FR-SpProjU or FR-15	2016 Pre-construction	2017 Post-construction	2018 Post-construction
<b>Class size (mm)</b>			
0-2	1	4	
2-4			
4-8			
8-16	1	1	
16-32	2	1	1
32-64	18	25	12
64-128	46	57	55
128-256	29	13	32
256-512	3	2	2
512-1024			
1024-2048			
2048-4096			
<b>TOTAL</b>	<b>100</b>	<b>103</b>	<b>102</b>
<b>% Embedded</b>	<b>20</b>	<b>17</b>	<b>3</b>
<b>% Aquatic Vegetation</b>	<b>53</b>	<b>12</b>	<b>86</b>
Source: Tetra Tech 2018			

## Macroinvertebrates

The data below will be used to document progress made with regards to *Project Goal #2 - An increase in benthic macroinvertebrate abundance and diversity.*

### Macroinvertebrate Sampling

Macroinvertebrate field sampling was performed by GCWIN and Timberline Aquatics in 2016 and 2017, respectively (pre-project). In 2018, macroinvertebrate sampling was performed by Timberline Aquatics in September. In 2018, Multimetric Index (MMI) results for the FR-SpProjU or FR-15 site (located at the upstream edge of the project reach) were reported in both MMI version 3.0 and version 4.0 values, on account of the Division's recent adoption of MMI v4. This monitoring year is the first year of reporting MMI v4.0 values. In 2018, Timberline Aquatic's results showed that the FR-SpProjU site was in attainment for both MMI v3.0 and v4.0 scores.

In 2016, macroinvertebrate samples were collected by GCWIN (pre-project), and the MMI values for the FR-SpProjU site were "impaired" based on Hilsenoff Biotic Index (HBI) and high Shannon Diversity Index (SDI) scores. The first year of post-project sampling of macroinvertebrates occurred in 2018, using MMI version 4.0. The pre-project MMI values

were conducted using MMI version 3.0, so these scores will be calibrated in the future for ease of comparison of data across years. LBD will continue to monitor macroinvertebrates in the project reach in 2019.

### Summary

Table 3 summarizes the data on abundance and diversity of macroinvertebrates for years 2016-2017 (pre-project) and 2018 (post-project).

**Table 3 - Macroinvertebrates Data - Fraser Flats River Habitat Project**

Site Name: FR-SpProjU or FR-15	2016 Pre-construction <sup>1</sup>	2017 Pre-construction <sup>1</sup>	2018 Post-construction <sup>1</sup>	2018 Post-construction <sup>2</sup>
Sample Type*	1	4	4	4
Metric				
MMI	47.40	48.00	54.8	67.8
Aquatic Life Use Designation	Impaired	Attainment	Attainment	Attainment
HBI <sup>3</sup>	4.99	4.69	3.24	3.15
Shannon <sup>4</sup>	1.82	3.49	3.25	3.25
<sup>1</sup> All scores are based on the MMI (v3) subsampling process <sup>2</sup> All scores are based on the MMI (v4) subsampling process <sup>3</sup> Hilsenoff Biotic Index <sup>4</sup> Shannon Diversity Index Source: GCWIN 2016; Tetra Tech 2018; Timberline Aquatics 2019				

*Shorthand Key to Sample Type		
No.	Sampling Device	Total Organisms Counted in Subsample
1	Hess Sampler	500
2	Kick Net	300
3	Hess Sampler	1500
4	Hess Sampler	Full count
*Adapted from Tetra Tech 2018		

### Fish

The data below will be used to document progress made with regards to *Project Goal #3 - An increase in fish counts and quality trout.*

### CPW Electrofishing Survey

Colorado Parks and Wildlife (CPW) has an established electrofishing site in Section B (Grand County Water and Sanitation District #1 property) of the project reach (refer to Figure 1).

This site was sampled by electrofishing surveys in 2007 and 2016, which provides two years of baseline (pre-project) data. An electrofishing survey was performed by CPW in October of

2017 and 2018, post-project. CPW will continue to monitor the project reach in 2019 with the goal of documenting changes in<sup>2</sup>:

- Biomass (pounds per surface acre of water),
- Density of trout greater than 14 inches, and
- Expected densities of sculpin.

As shown in Table 4 below, CPW observed an immediate benefit after completion of the project, with greatly increased numbers of adult fish and a nearly fourfold increase in total trout biomass from 2016 to 2017. However, in 2018, the total biomass estimate declined by 38% from 127 to 79 lbs./surface acre for rainbow and brown trout. CPW states that this decline may be attributable to the high level of public fishing pressure that this section experienced in 2018. If public use of this reach becomes increasingly heavy in the future, some form of access management may be advisable in order to maintain the quality of the fishery (CPW 2019).

### Summary

Table 4 summarizes the fish survey results for fish biomass, density of trout greater than 14 inches, and number of sculpin for years 2007 and 2016 (pre-project) and for 2017-2018 (post-project).

**Table 4 - Fish Data - Fraser Flats River Habitat Project**

Site Name: GCWSD#1 property	2007 Pre-construction	2016 Pre-construction	2017 Post-construction	2018 Post-construction
<b>Brown trout</b>				
Biomass <sup>1</sup>	33	26	111	60
Fish > 14" per acre	3	6	33	24
Fish > 6" per mile	752	430	923	528
<b>Rainbow trout</b>				
Biomass <sup>1</sup>	9	6	16	19
Fish > 14" per acre	3	2	8	12
Fish > 6" per mile	53	35	70	70
<b>Brook trout</b>				
Biomass <sup>1</sup>	2	1	0	0
Fish > 6" per mile	44	9	0	0
<b>Total trout biomass<sup>1</sup></b>	44	33	127	79
<b>Total sculpin captured</b>	726	971	264	377
Source: CPW 2018; CPW 2019				
<sup>1</sup> Pounds per surface acre				

<sup>2</sup> LBD Monitoring Subcommittee, 2017. Fraser Flats River Habitat Project Monitoring Program Guidelines. Revised October 20, 2017 based on the August 16, 2016 monitoring plan.

## Riparian Woody Habitat

The data below will be used to document progress made with regards to *Project Goal #4 - An increase in riparian woody habitat.*

### Riparian Woody Vegetation Survey

Pre-project photo points were established by Anna Drexler-Dreis to document canopy cover in 2016 and 2017. A map of the photo point locations is provided in **Attachment 2**. Pre- and post-construction photos of the riparian area are provided in **Attachment 3**. The canopy of willow and cottonwood stakes planted in the revegetated areas in May 2017 is expected to mature over time to provide bank stabilization and increased shade cover, which will benefit the river by helping to provide cool instream habitat.

During the summer of 2016, Ms. Drexler-Dreis established 13 photo points, took pre-project photos and identified the willows present on site. Post-planting, she conducted a stem count to see how many willow and cottonwood stems made it into the ground (Table 5). The actual number of willow stems varied from the expected number of willow stems for a variety of reasons: the area was too rocky to drive a metal stake into the ground, crew leaders expanded sections when they fell short on other sections, groups of willows were already present in the sections, and two rows were planted instead of three rows due to steep hillsides.

Post peak runoff, on June 28, 2017, Ms. Drexler-Dreis took post-project photos to show change and determine success rate. While it is too early to determine success rate, most of the willow stems and cottonwoods had leafed out (see photos at end of post-project photos). In total, approximately 2,500 trees were planted in the project reach.

The pre-project and post-project revegetation data will be evaluated in two ways: (i) spatially using aerial photographs (if available) and photos taken at the established photo points for year to year comparisons of the canopy re-establishment; and (ii) quantifying the number and condition of the willow and cottonwood plantings for year to year comparisons of the survival rate and health of the vegetation community. LBD will continue to monitor the riparian plantings in 2019.

### Summary

Table 5 summarizes the 2017 plantings and 2018 (post-project) riparian condition.

**Table 5 - Riparian Planting Data - Fraser Flats River Habitat Project**

	Site No.*	2017 Number of Trees	2018 Number of Trees

		Planted	Observed
Private Section A	1	117 <sup>1</sup>	21
	2	177	93
	3	89	37
	4	96	67
	6	37	35
	7	62	0
	8	160	89
	10 & 14	298	144
	11	160	116
	13	211	0
	15	94	54
	17	315	196
	18	267	248
	Public Section B	19	160
20		66	49
22		112	73
23		154	123
	<b>TOTAL</b>	<b>2,458</b>	<b>1,476</b>
	<b>% Survival willows + cottonwoods<sup>2</sup></b>		<b>60%</b>
*This list is not consecutive: numbers 5, 9, 12, 16, 21 are not missing sites. Source: Drexler-Dreis (2017)			
<sup>1</sup> Note the initial number of 177 may be incorrect based on 2018 observations			
<sup>2</sup> Survival defined as Good or Fair health condition assessment rating			

## Stream Temperature

### Stream Temperature Data Collection

The purpose of this task is to compare instream temperatures with pre-project conditions with the goal of documenting changes in instream temperatures over time. GCWIN maintains temperature loggers at the upstream project boundary on Section A (Devil's Thumb Ranch property) and the lower project boundary on Section B (Grand County Water and Sanitation District #1 property) (Figure 1). LBD will continue to collect stream temperature data at these locations in 2019.

### Summary

Graphs summarizing the 2013-2016 (pre-project) and 2017-2018 (post-project) temperature data are provided in **Attachment 4**. As the data show, no exceedances have been recorded at the monitoring sites to date. In 2018, the following findings were noted in the project reach:



- Increased number of aquatic habitat features (riffles and pools) post-construction
- Small cobble and large cobble were the predominant substrate types, with a low degree of embeddedness (3%)
- MMI values for macroinvertebrates were in attainment
- Significant increase in total trout biomass post-construction in 2017; however, 2018 showed a 38% decrease as compared to 2017
- Approximately 2,500 trees planted; 60% survivorship observed in 2018
- No stream temperature exceedances

## References

Colorado Parks and Wildlife (CPW), 2018. Fraser River Fish Survey and Management Information. Prepared by Jon Ewert, Aquatic Biologist, Hot Sulphur Springs.

CPW, 2019. Fraser River Fishery Management Report. Link here:  
<https://cpw.state.co.us/thingstodo/Fishery%20Survey%20Summaries/FraserRiver.pdf>

Drexler-Dreis, Anna. 2017. Fraser Flats River Habitat Project. Western State Colorado University. July 29, 2017.

Freestone Aquatics, 2017a. Fraser Flats Aquatic Habitat Restoration Project. Fraser River, near Fraser, Colorado. January 1, 2017.

Freestone Aquatics, 2017b. Fraser Flats Aquatic Habitat Restoration Project As-Built Set. Fraser River, near Fraser, Colorado. September 29, 2017.

GoogleEarth, 2018. "Grand County, Colorado." 39° 58' 54.11" N, 105° 49' 49.50 W. Accessed on June 28, 2018.

Grand County Water Information Network (GCWIN), 2016. Macroinvertebrate sampling data for the Fraser Flats River Habitat Project site.

Tetra Tech, 2018. Final Draft Report, 2017 Monitoring Report, Grand County, Colorado. Prepared for Grand County, Colorado. May 10, 2018.

Tetra Tech, 2019. 2018 Substrate Monitoring, Grand County, Colorado. Technical Memorandum prepared for Learning By Doing. April 9, 2019.

**Monitoring At-A-Glance<sup>3</sup>**

	<b>Method</b>	<b>Agency</b>	<b>Frequency &amp; Duration</b>	<b>Sample Season</b>	<b>Site Location</b>	<b>Notes</b>
<b>Benthic macro-invertebrates</b>	NAMC* protocol	Timberline Aquatics	annual for 3 years post construction	September of each year	1) New site in restoration area 2) County Road 83	Reach-based approach, 8 samples per site, composited, subsampled to 300. Metrics are calculated from these results.
<b>Fish count surveys</b>	Electro-fishing	CPW	annual for 3 years post construction	September of each year	1) In restoration area 2) Fraser Safeway 3) Fraser, Kaibab Park in Granby	All trout species & sculpin will be totaled, and trout biomass (pounds per acre), fish >14" per surface acre, and >6" per mile will be reported.
<b>Riparian survey</b>	Photos and woody stem counts	Trout Unlimited	every 3-5 years for 10 years.	First two years post construction	1) In restoration area	Include: percentage of woody canopy and riparian plant species, monumented photo points and photos.
<b>Substrate conditions</b>	Pebble counts	Tetra Tech	annual for 3 years post construction	September of each year	1) New site in restoration area 2) County Road 83	Document bar material sizes, presence of fines and embeddedness.
<b>Aquatic habitat features</b>	Photo points	LBD/CPW	annual for 3 years post construction	Low flow	To be determined	Pre- and post-construction monitoring using photographs and the inventory of # of riffles, runs, pools in project reach.
<b>Stream Temperature</b>	Temperature loggers	GCWIN**	15-minute interval time-series; annual	Annually during ice off	1) Upstream project boundary 2) downstream project boundary	Measurable results as a result of the project are not anticipated because temperature depends upon several factors, and this is a relatively short, low gradient reach.

\*Bureau of Land Management/Utah State University National Aquatic Monitoring Center

\*\*Grand County Water Information Network

<sup>3</sup> This Monitoring At-A-Glance table is based on the 2016 Monitoring Plan guidelines developed by LBD. Some of the agency names and sampling methods may change, and if so, the Subcommittee will evaluate accordingly when comparing year to year data results of the program.