RECLAMATION

Managing Water in the West

Technical Memorandum No. 86-68290-09-04

McKay Creek Instream Flow Assessment

McKay Creek – 23 cfs

McKay Creek – 10 cfs

U.S. Department of the Interior
Bureau of Reclamation
Lower Columbia Area Office
Portland, Oregon

July 2009

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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McKay Creek Instream Flow Assessment

McKay Creek
Umatilla Basin Project, Oregon

by

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Umatilla Basin Project, Oregon

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Introduction

The Bureau of Reclamation's (Reclamation) Technical Service Center (TSC) has been conducting habitat surveys in lower McKay Creek, located near Pendleton, Oregon, (Figure 1) since 2006 to address the National Marine Fisheries Service (NMFS) Umatilla Project Biological Opinion (BiOp) Reasonable and Prudent Measure (RPM) number (#) 3 (monitoring) under Terms and Conditions (T&C), Section 3bii:

"*Assess habitat conditions in McKay Creek from November through April during flows of 10 cfs to ensure that the 10-cfs minimum release is adequate to minimize take of rearing juvenile MCR steelhead." Also, T&C, Section 1a of the BiOP states: "Release a minimum of 10 cfs continuously from McKay Reservoir from November 1st through April 30th in order to maintain flows in McKay Creek sufficient to provide minimal habitat levels and prevent stranding of juvenile MCR steelhead.*"

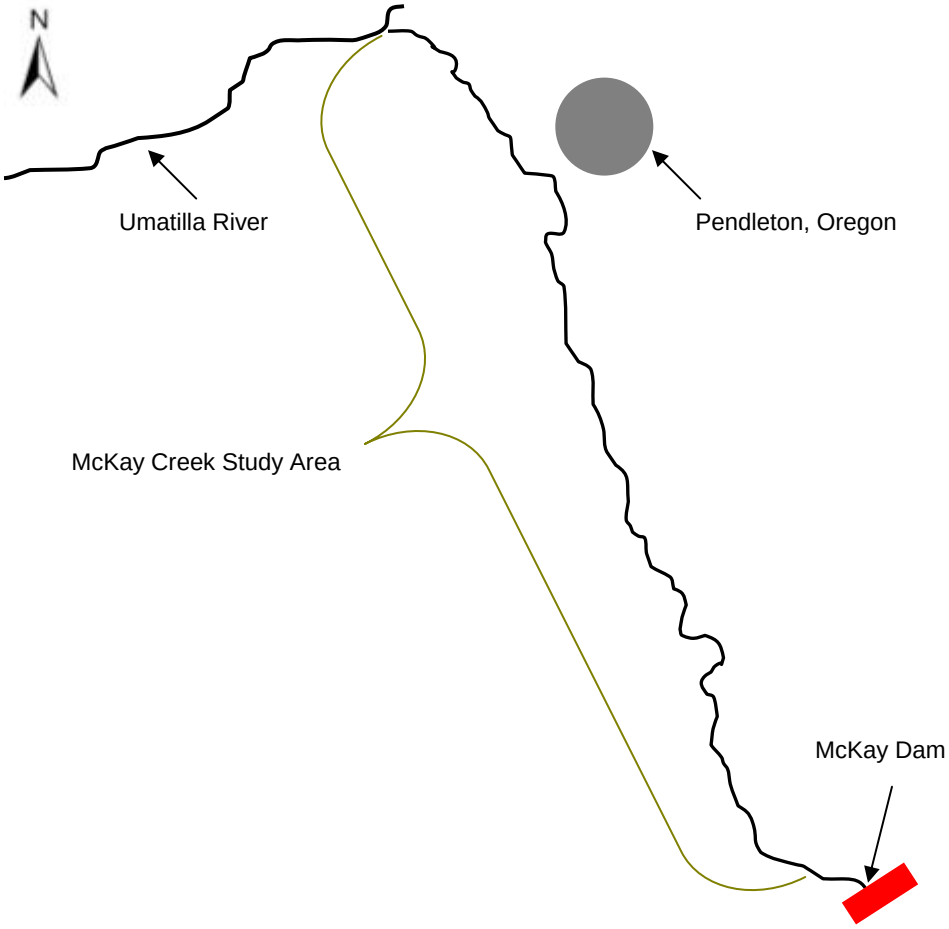

Figure 1 The lower 6-mile study area of McKay Creek, northeastern Oregon

Initially, the TSC conducted a habitat mapping survey on McKay Creek downstream from McKay Reservoir in March 2006 (Sutton 2006). One objective of the 2006 survey was to provide information that could be used to help select representative study sites for further habitat assessment. Using this information, the TSC conducted a steelhead (*Onchorynchus mykiss*) habitat use and availability survey on McKay Creek at 10 cfs in February, 2008. The survey was conducted at the same time that an electroshocking effort was being conducted by Confederated Tribes of the Umatilla Indian Reservation (CTUIR) biologists. Two additional fish sampling surveys were conducted in the spring by CTUIR. The TSC analyzed all habitat and fishery data from these surveys and prepared a final technical memorandum in August, 2008 (Sutton 2008).

This project addresses the following two recommendations made in the August, 2008 report:

1. *To further assess whether habitat conditions are suitable for overwintering juvenile O. mykiss in McKay Creek at a 10-cfs flow, this study should be extended at a minimum of two additional flows within a range of 20 to 50 cfs for comparative purposes.*

2. *Habitat use data should be collected during all electrofishing field efforts to increase the number of samples relative to habitat availability data.*

In addition, this report addresses the following suggested study to assess the suitability of 10 cfs at shallow riffles areas in Lower McKay Creek during the winter for juvenile *O. mykiss* as presented in Reclamation's FY 09 Monitoring and Evaluation Plan for the Umatilla Project:
"conduct physical habitat surveys during the spring 2009 managed 10 cfs flow period at shallow riffle areas in lower McKay Creek. This information may be used to assess stream reaches that could provide minimal fish passage and habitat connectivity for juvenile steelhead/rainbow trout."

It should be noted that an existing adult fish barrier weir located at the mouth of McKay Creek allows juvenile *O. mykiss* and other small fish to enter the stream from the Umatilla River. Any juvenile anadromous *O. mykiss* are presumed to originate from another source and use lower McKay Creek only for juvenile rearing.

Methods

Discharge in McKay Creek was held constant at 23 cfs for four consecutive days during fall rampdown (November 22-25, 2008) through coordination with and approval from the Umatilla Managment Monitoring Evaluation and Oversight Committee (UMMEOC) members and others. The TSC coordinated the habitat survey with the CTUIR electrofishing effort during the constant discharge in the same representative study sites from the February, 2008 survey. CTUIR used a backpack electroshocker under their collecting permit from NMFS to determine presence/absence of juvenile *O. mykiss*. Captured *O. mykiss* were held in a live well with aeration and measured (fork length), weighed, and checked for Passive Integrated Transponder (PIT) tags before being

released at the point of capture. Unmarked *O. mykiss* greater than 60 mm length were PIT-tagged. Tagging was conducted by CTUIR during fish sampling using PIT tags provided by Reclamation. *O. mykiss* locations were marked using floats and a total station was used to reference fish locations to a local benchmark. Microhabitat "use" data were collected (i.e., depth, mean column velocity (MCV), cover, distance to cover, substrate, and temperature) at each location where at least one fish was observed. Cover and substrate codes are defined by Sutton (2008). As in February, multiple fish captured at the same location was considered one observation (i.e., non-repeat observations).

In the same mesohabitats where steelhead were located during the February, 2008 survey, the same 33 transects were surveyed again in November, 2008 to capture the hydraulic and habitat variability within the mesohabitats at the different flow levels. Transects were surveyed using a total station with water surface elevations referenced to the same local benchmark referenced by fish locations. Discharge was measured in each mesohabitat during both surveys. In addition, microhabitat "availability" data were collected along each transect (i.e., depth, MCV, and distance to cover). Available substrate and cover was recorded (coded) in February (Sutton 2008).

Habitat use and availability data were analyzed to evaluate how much available habitat was actually used by *O. mykiss* in McKay Creek, based on the range of available habitat conditions when they were collected in February (10 cfs) and November (23 cfs). Statistical analyses were completed using Statgraphics Version XV a non-parametric statistical test to determine if there was a significant difference ($p = 0.05$) between habitat use by *O. mykiss* and availability at 23 cfs compared to 10 cfs.

Significant differences between two independent parameters were determined using the Mann-Whitney (Wilcoxon) W test to compare medians with the following hypotheses:

Null hypothesis: median1 = median2
Alt. hypothesis: median1 NE median2

This test is constructed by combining the two samples, sorting the data from smallest to largest, and comparing the average ranks of the two samples in the combined data. If the p-value is greater than or equal to 0.05, there is not a statistically significant difference between the medians at the 95.0% confidence level.

Nonparametric testing was considered more appropriate than parametric testing because most data were not normally distributed (see Results and Discussion).

Fulton condition factors (K) were computed for the November fish data set using the following formula:
$K = W/L^3 * 100$

Where: W = the weight of the fish in grams
L = the fork length in cm

Juvenile fish passage was assessed in McKay Creek at two shallow riffles identified as

potential passage barriers at low flow during the March 2006 habitat survey (Sutton 2006). A single transect was placed across the shallowest portion of each riffle on May 27, 2009 to measure the cross-sectional profile, slope, and water surface elevations at a flow of 48 cfs. A time constraint did not allow these riffles to be surveyed during the 23 cfs flow in November, 2008. These data were input into a model that used Manning's equation to calculate water surface elevations at flows less than 48 cfs. Given the water surface and cross-sectional profile, Manning's calculates the hydraulic radius and cross-sectional area and determines the conveyance factor (C), which varies exponentially as: $C_q = (C_{cal})^{\beta}$, where C_q is the conveyance factor at a simulated discharge, C_{cal} is the conveyance factor at the calibration discharge, and β is the slope of a regression line relating C to discharge. Model calibration is accomplished by a trial and error procedure to select a "β" coefficient in the equation that minimizes the error between observed and simulated water surface elevation at the measured discharge. An assessment was made using this information and literature-based information to determine a flow that would provide sufficient connectivity between habitats and allow movements of juvenile *O. mykiss*.

Results and Discussion

Table 1 shows summary statistics for the sample data sets in November and February. Of particular interest are the standardized skewness and standardized kurtosis parameters, which can be used to determine whether the samples come from normally distributed populations. Values of these statistics outside the range of -2 to +2 indicate significant departures from normality, which would tend to invalidate tests which compare the standard deviations. In this case, all samples except "February Utilized Cover" had either standardized skewness or standardized kurtosis values outside the normal range. Thus, nonparametric, not parametric, statistics were used to analyze differences between medians.

Complete summaries of available habitat data collected at each transect in November 2008 are presented in Appendix A. Habitat use data are provided in Appendix B.

Table 1 Summary statistics for various available and utilized habitat parameters in McKay Creek, February and November, 2008.

Parameter	*All _ Use Depth _ft_*	*All _ Use MCV _ft_sec_*	*All Avail Depth _ft_*	*All Avail MCV _ft_sec_*	*Feb Use Cover Code*	*Feb Avail Cover Code*	*Feb Avail Dist Cover*	*Feb Use Dist to Cov*	*Feb Avail Depth _ft_*	*Feb Use Depth _ft_*
Count	143	143	1213	1213	42	653	518	42	581	42
Average	0.93042	0.858462	0.737329	0.848261	2.61905	2.36907	1.59865	0.778571	0.648485	0.77381
Standard deviation	0.522994	0.737262	0.577672	0.726183	1.26785	1.47268	1.66375	1.6931	0.529179	0.365633
Coeff. of variation	56.2105%	85.8818%	78.3466%	85.6085%	48.4087%	62.163%	104.072%	217.463%	81.6024%	47.251%
Minimum	0.1	0.0	0.01	0.0	1.0	0.0	0.0	0.0	0.01	0.3
Maximum	2.5	3.42	3.1	3.62	5.0	5.0	6.0	8.0	2.8	1.9
Range	2.4	3.42	3.09	3.62	4.0	5.0	6.0	8.0	2.79	1.6
Stnd. skewness	4.99669	4.79274	18.5488	12.0819	1.052	-3.35402	10.9541	7.76561	12.5516	3.17769
Stnd. kurtosis	1.49915	1.2618	10.4894	0.692457	-1.12573	-2.96902	2.34502	12.1441	6.86752	2.06185

Parameter	*Feb Avail MCV _ft_sec_*	*Feb Use MCV _ft_sec_*	*Feb Avail Sub Code*	*Feb Use Sub Code*	*Nov Avail Depth _ft_*	*Nov Use Depth _ft_*	*Nov Avail MCV _ft_sec_*	*Nov Use MCV _ft_sec_*	*Nov Use Cover Code*	*Nov Use Dist to Cov*
Count	581	42	652	42	632	101	632	101	101	72
Average	0.626196	0.831905	5.45245	5.97619	0.819003	0.995545	1.05241	0.869505	1.44554	1.70833
Standard deviation	0.587444	0.815009	1.02017	1.55372	0.607965	0.564805	0.780098	0.706464	1.41757	1.66096
Coeff. of variation	93.8115%	97.9691%	18.7103%	25.9985%	74.2323%	56.7333%	74.1253%	81.2489%	98.0648%	97.2272%
Minimum	0.0	0.01	1.0	1.0	0.01	0.1	0.0	0.0	0.0	0.0
Maximum	3.03	3.42	8.0	8.0	3.1	2.5	3.62	3.08	5.0	6.0
Range	3.03	3.41	7.0	7.0	3.09	2.4	3.62	3.08	5.0	6.0
Stnd. skewness	12.4432	3.40543	-1.74032	-5.85174	13.1603	3.41119	4.97414	3.37062	4.69426	4.54146
Stnd. kurtosis	7.52687	1.78637	24.2456	8.08016	6.52679	0.16306	-2.47104	0.119832	1.72836	1.80575

Parameter	*Nov Use Depth _ft_*	*Nov Use MCV _ft_sec_*	*Nov Use Sub Code*	*Feb fish length_cm*	*Nov fish length_cm*
Count	101	101	101	46	110
Average	0.995545	0.869505	5.55446	12.1891	14.39
Standard deviation	0.564805	0.706464	1.46612	3.6614	5.68829
Coeff. of variation	56.7333%	81.2489%	26.3954%	30.0383%	39.5295%
Minimum	0.1	0.0	1.0	7.6	7.5
Maximum	2.5	3.08	8.0	26.4	30.0
Range	2.4	3.08	7.0	18.8	22.5
Stnd. skewness	3.41119	3.37062	0.94625	5.11402	4.37685
Stnd. kurtosis	0.16306	0.119832	2.05785	7.03073	-0.145486

Habitat Suitability Analysis

Figures 2 and 3 compare depth and velocity microhabitat variable frequencies of available habitat measured in February and November 2008 with specific mesohabitat conditions used by *O. mykiss*. The study design did not provide for identification of anadromous vs. resident juvenile *O. mykiss*.

Substrate and cover availability in February is compared to fish use in February and November in Figures 4 and 5.

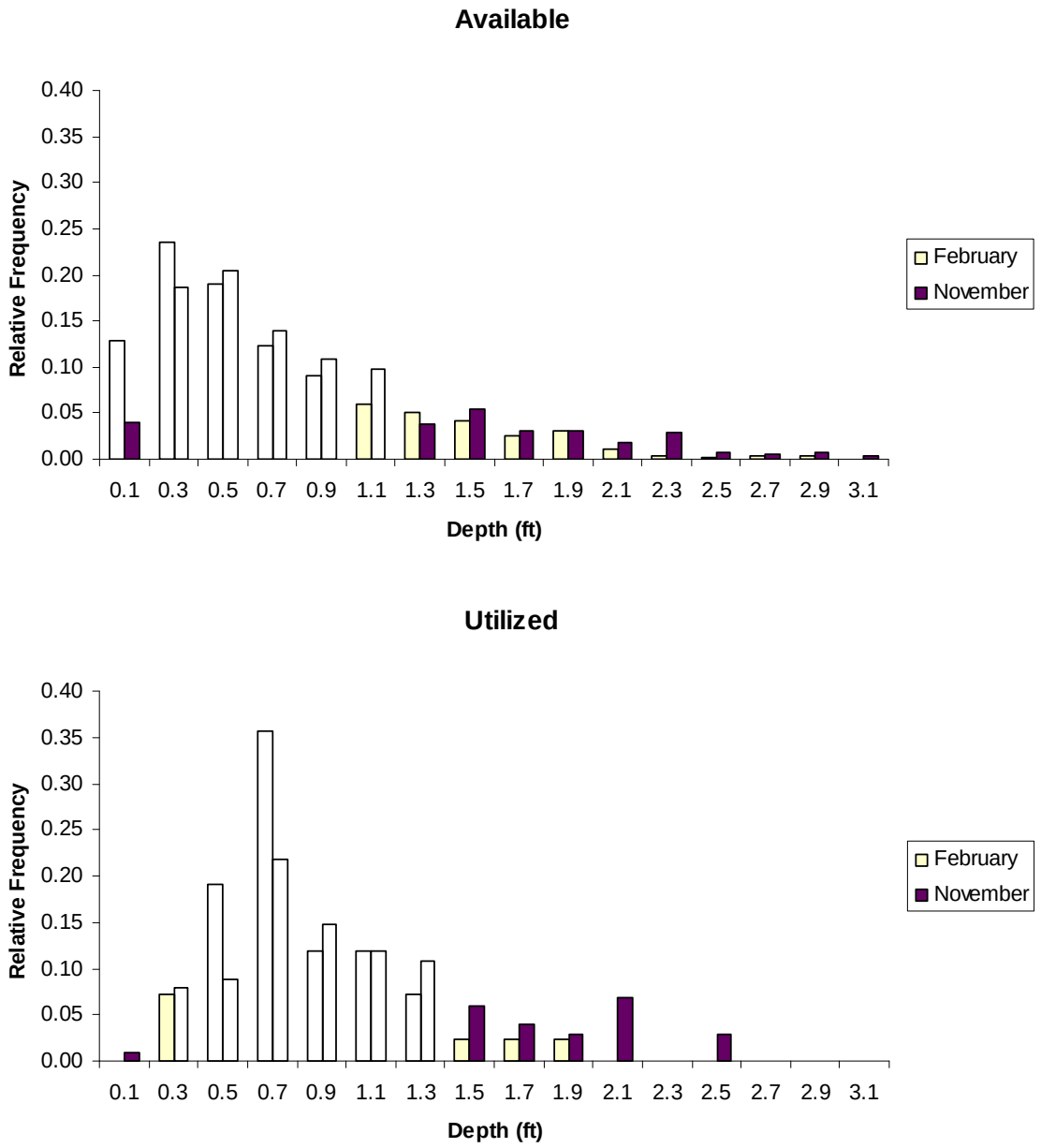

Figure 2 Depth availability distributions and frequency-of-use distributions for *O. mykiss* in McKay Creek in February (10 cfs) and November (23 cfs), 2008

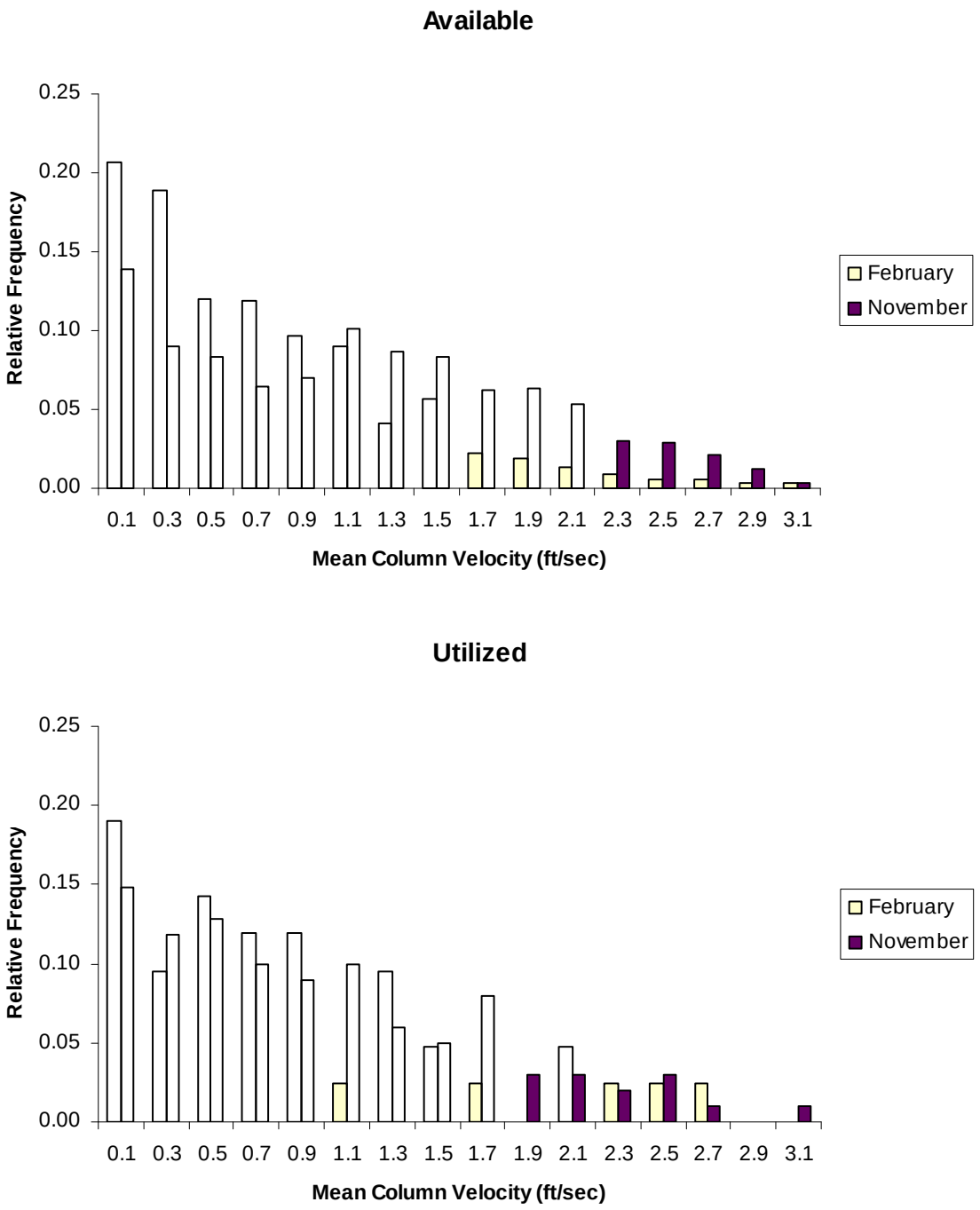

Figure 3 Mean column velocity availability distributions and frequency-of-use distributions for *O. mykiss* in McKay Creek in February (10 cfs) and November (23 cfs), 2008

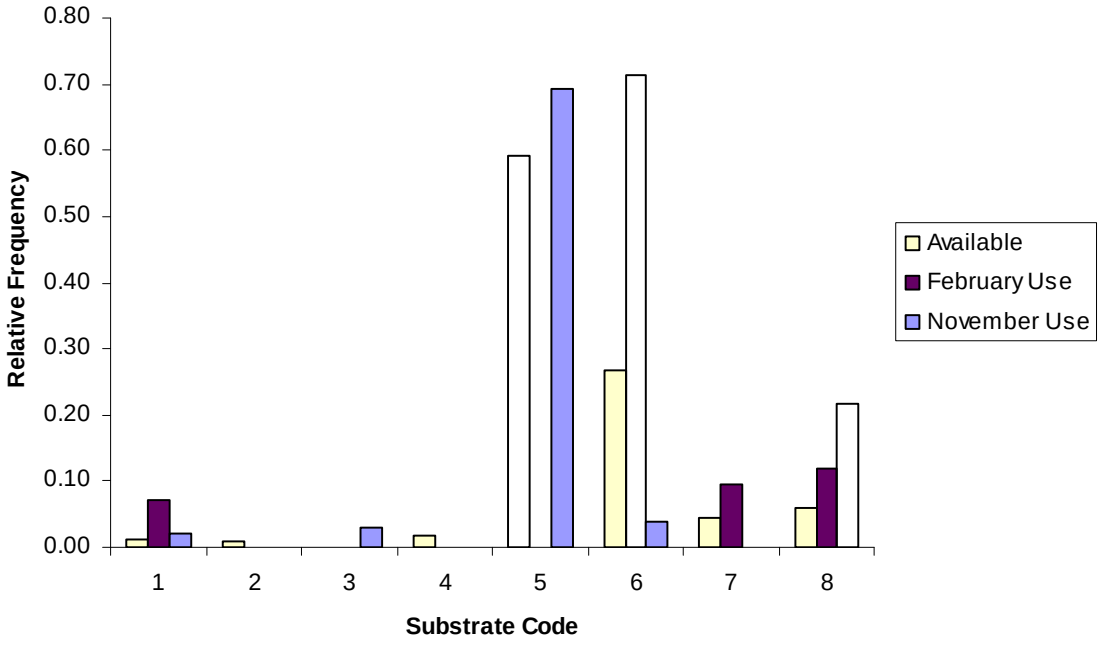

Figure 4 Substrate availability distribution and frequency-of-use distributions for *O. mykiss* in McKay Creek in February (10 cfs) and November (23 cfs), 2008 (see Sutton (2008) for code descriptions)

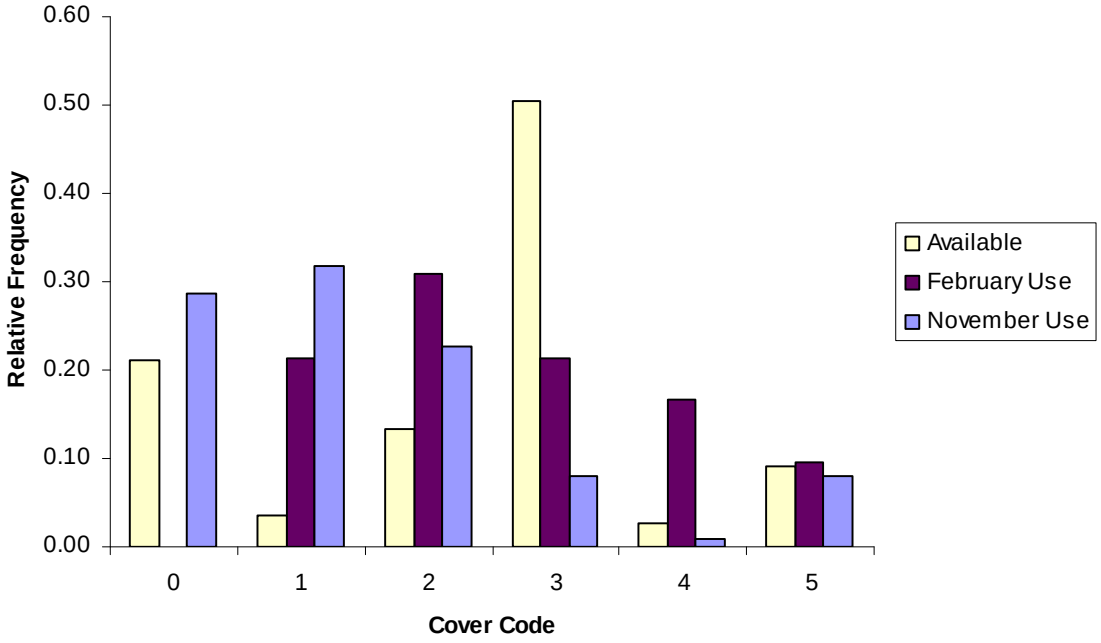

Figure 5 Cover availability distribution and frequency-of-use distributions for *O. mykiss* in McKay Creek in February (10 cfs) and November (23 cfs), 2008 (see Sutton (2008) for code descriptions)

Statistical analysis of the McKay Creek habitat use and availability data showed that juvenile *O. mykiss* used significantly different median depths of 0.70 ft in February (10 cfs) compared to 0.85 ft in November (23 cfs) (Table 2). These data showed that median water depths used by fish were significantly deeper than median available depth ($p=0.00$) in February and November. Median available and utilized depths were significantly higher in November than February ($p<0.05$) (Table 3).

Median velocity used by *O. mykiss* was significantly lower than median available velocity in November ($p=0.03$) but median velocity used was not significantly different from median available velocity in February ($p=0.25$) (Table 2). Habitat use data showed that fish used similar median velocities in February (0.57 ft/sec) and November (0.72 ft/sec) (Table 3). However, significantly faster median velocities were available in November (0.99 ft/sec) at 23 cfs than in February (0.47 ft/sec) at 10 cfs ($p=0.00$) (Table 3). This suggests that the discharge that provides optimal velocities occurs between 10 and 23 cfs because median velocities used by fish were between available velocities at the two flows. However, this does not mean that optimal conditions (i.e., maximum habitat) are necessary to maintain suitable habitat for overwintering juvenile *O. mykiss*. Even under a natural flow regime the quantity and quality of freshwater habitat necessary to obtain food, grow, escape predation, resist disease, migrate, and survive extreme environmental events is highly variable and can become limiting (Bjornn and Reiser

1991). Stream-rearing salmonids must survive extended periods in freshwater through winter and summer rearing bottlenecks (Seelbach 1987; Bjornn and Reiser 1991).

Many instream flow recommendations are based on a percentage of optimal (maximum) habitat. For example, flows that provide 80% of maximum habitat have been recommended in some studies (ENTRIX 2004; EA Engineering 1991) and endorsed by NMFS (Arthaud et al. 2001). To further assess the suitability of overwintering habitat at 10 cfs for juvenile *O. mykiss*, an analysis is needed to develop a discharge-habitat relationship for McKay Creek that describes incrementally how a change in discharge affects juvenile *O. mykiss* habitat (i.e., small changes in discharge may result in large or small changes in habitat).

As noted by Sutton (2008), electrofishing disturbance may have affected our observations of *O. mykiss* microhabitat use by scaring fish towards cover. In November, most *O. mykiss* were sampled near overhead cover, followed by riprap. In February, *O. mykiss* were closely associated with a variety of cover types (i.e., overhead, riprap, rock, and vegetation). In February, *O. mykiss* were located closer to cover (distance to cover) than in November, possibly a reflection of fish size (i.e., smaller fish in February than in November) (see fish sampling results below).

Table 2 Summary statistics, including medians and results from habitat availability and utilization comparison Mann-Whitney tests for McKay Creek for February (10 cfs) and November (23 cfs), 2008

Parameter				
November, 2008	Available Median	Utilized Median	Test statistic (W)	P-value
Depth (ft)	0.60	0.85	7430	0.00
Mean column velocity (ft/sec)	0.99	0.72	-4272	0.03
Distance to Cover (ft)	1	1	1235	0.35
	February, 2008			
Depth (ft)	0.50	0.70	3391	0.00
Mean column velocity (ft/sec)	0.47	0.57	1292	0.25
Distance to Cover (ft)	1	0	-4720	0.00

Table 3 Summary statistics, including medians and results from comparing habitat availability and utilization data between February (10 cfs) and November (23 cfs), 2008 using Mann-Whitney tests for McKay Creek

Parameter	**November**	**February**	**Test statistic (W)**	**P-value**
Available	Median	Median		
Depth (ft)	0.60	0.50	34417	0.00
Mean column velocity (ft/sec)	0.99	0.47	58577	0.00
Utilized				
Depth (ft)	0.85	0.70	-465	0.04
Mean column velocity (ft/sec)	0.72	0.57	-159	0.48

Fish Sampling

All of the sampled juvenile *O. mykiss* were un-clipped, non-hatchery origin fish. The average length of the 46 *O. mykiss* sampled in February 2008 was 12.2 cm (7.6 to 26.4 cm range) (Sutton 2008). In November the average length of the 110 fish sampled was 14.4 cm (7.5 to 30.0 cm) (Table 4). Although fish were larger in November than February, median lengths were not significantly different (p=0.08) using the Mann-Whitney (Wilcoxon) test. It is well documented that larger *O. mykiss* utilize deeper, faster water than smaller fish (Everest and Chapman 1972; Bjornn and Reiser 1991; Baltz et al. 1991). Thus, it is not surprising that most *O. mykiss* used slightly deeper, faster water in November than February.

Seasonal differences in water temperatures may have also influenced habitat selection. In February, water temperatures in McKay Creek averaged 4°C during fish sampling. This was cooler than the average water temperature of about 9°C during the November sampling (source: Reclamation's Hydromet database - http://www.usbr.gov/pn-bin/rtindex.pl?cfg=umat). *O. mykiss* forage less efficiently in fast water at cooler water temperatures (Smith and Li 1983, as cited in Baltz et al. 1991). Baltz et al. (1991) found seasonal shifts in microhabitat use by juvenile *O. mykiss* (5-12 cm length) towards deeper, lower-velocity water in winter than summer in a small stream.

The one recaptured *O. mykiss* in November at site PM28 was initially tagged at the same location in February when it was 89 mm long. The growth rate of this recapture was 0.39 mm/day, similar to the average growth rate of the five recaptured *O. mykiss* in the spring of 2009 (0.42 mm/day; range = 0.30 – 0.61 (Sutton 2008). Average condition factor in November was 1.07 (range = 0.76-1.46), compared to 1.11 (range = 0.91-1.71) in February (Sutton 2008). Carlander (1969) reported mean condition factors for rainbow trout ranging from 0.68 to 1.46 from multiple studies throughout the United States. Thus, McKay Creek *O. mykiss* appeared to be in relatively good condition, particularly during the winter season when condition factors are typically lowest (Reimers 1963; Carlander 1969; Sutton et al. 2000). The complete data set for *O. mykiss* fish captured in November 2008 is provided in Appendix B.

Table 4 Summary of electrofishing data for *O. mykiss* captured in McKay Creek, November 2008 (source: Craig Contor, CTUIR)

Study Site	Number fish captured	Mean length (mm)	Number fish recaptured	Recaptured length (mm)	Recaptured date
PL2	14	168			
PL21	31	158			
PM28	19	151	1	195	22-Nov-08
PH56	46	124			
Total	110	144	1	195	22-Nov-08

Juvenile Passage

In order to determine minimum target flows to permit habitat connectivity and upstream and downstream movements for juvenile *O. mykiss* in McKay Creek, an online literature search was completed to locate methods and/or criteria for evaluating instream flows to permit juvenile salmonid upstream movement. No methods or criteria were located specifically for instream conditions, however several references evaluating juvenile passage through culverts were located and reviewed (Kahler and Quinn 1998; May and Thom 2007; Powers 1996). Depth and velocities were often cited as attributes important for evaluating ability of juvenile salmonids to pass upstream. NMFS protocol suggested that juvenile salmonids might need water depths of 0.4 foot to provide some passage and, thus, habitat connectivity in first order, high gradient streams (Arthaud et al. 2001). The NMFS protocol does not indicate any other criteria (e.g., percentage of wetted width at 0.4 feet depth). Based on this limited information, flows that would provide an average depth of 0.4 ft at the lower and upper shallow riffles in McKay Creek would be 30 and 40 cfs, respectively. However, at 10 cfs, the maximum depth in the lower and upper transects would be 0.5 and 0.6 ft, respectively (Figures 6 and 7), which should allow juvenile passage through a slot in each riffle.

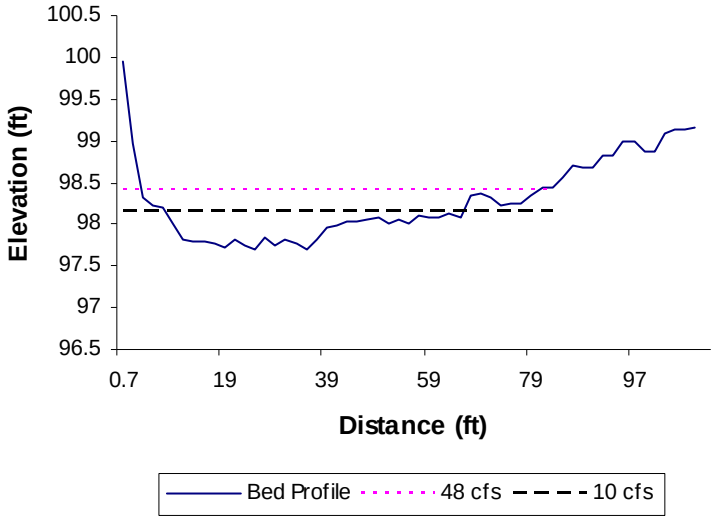

Figure 6 Photo (top) and bed profile (bottom) of transect (dog-legged) across potential passage barrier (habitat number 131 in Sutton (2006)) in McKay Creek at 48 cfs on May 27, 2009 (2.1 miles upstream from confluence with Umatilla River)

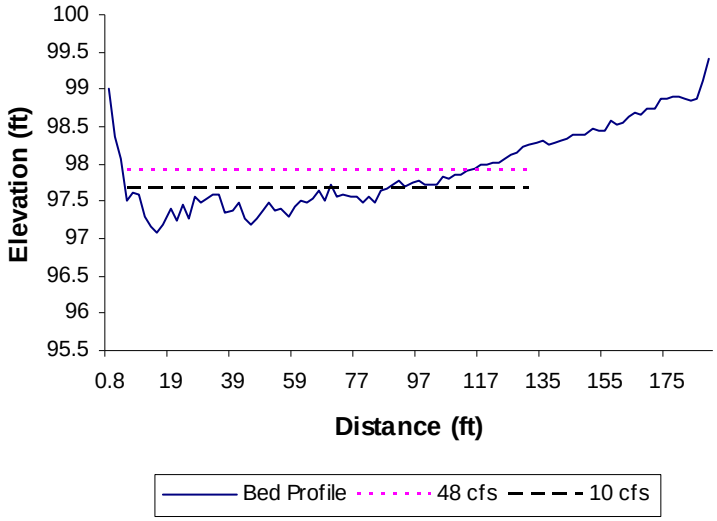

Figure 7 Photo (top) and bed profile (bottom) of transect (dog-legged) across potential passage barrier (habitat number 222 in Sutton (2006)) in McKay Creek at 48 cfs on May 27, 2009 (3.6 miles upstream from confluence with Umatilla River)

Conclusions

In November 2008, Reclamation continued a habitat use and availability study for *O. mykiss* in McKay Creek in selected mesohabitats (pools, riffles, glides) that covered a wide range of representative habitat conditions at 23 cfs. Study results apply generally to juvenile *O. mykiss*, but are not specific to anadromous or resident types. On May 27 2009, Reclamation surveyed two shallow riffles in McKay Creek to determine whether they were potential juvenile passage barriers at 10 cfs. The following observations were made:

- Data showed median available depths and mean column velocities were significantly higher in November (23 cfs) than February (10 cfs) ($p<0.05$). *O. mykiss* used significantly different median depths of 0.70 ft in February compared to 0.85 ft in November and similar, insignificantly different velocities in February (0.57 ft/sec) and November (0.72 ft/sec);

- Whereas habitat use data showed that fish used similar, insignificantly different velocities in February (0.57 ft/sec) and November (0.72 ft/sec), significantly faster velocities were available in November (0.99 ft/sec) at 23 cfs than in February (0.47 ft/sec) at 10 cfs ($p=0.00$). This suggests that the discharge that provides optimal velocities (maximum habitat) occurs between 10 and 23 cfs because median velocities used by fish were always within the range of available median velocities between the two flows;

- Most *O. mykiss* used slightly deeper, faster water in November than February, possibly a reflection of larger fish sampled in November than February or the availability of deeper, faster water conditions in November;

- The one recaptured *O. mykiss* in November at site PM28 was initially tagged at the same location in February;

- Condition factors suggested that McKay Creek *O. mykiss* were in relatively good condition, particularly during the winter season when condition factors are typically lowest.

- At 10 cfs, the maximum depth in lower and upper shallow riffle transects would be 0.5 and 0.6 ft, respectively, which should allow juvenile passage through a slot based on a suggested depth of 0.4 ft.

Recommendations

Analysis of existing data and observations suggest that 10 cfs is suitable for overwintering *O. mykiss.* However, we can improve our knowledge of the relationship between juvenile *O. mykiss* habitat and discharge with further analysis of existing data. Habitat use data could be used to develop habitat suitability criteria for depth, velocity, and cover and, combined with the habitat availability data from the two surveys, a functional relationship between discharge and juvenile habitat could be determined using

a one-dimensional hydraulic model (e.g., PHABSIM) from 0 to 23 cfs. Depending on the shape of the discharge-habitat curve, small flow changes may or may not result in major habitat changes and help assess the suitability of 10 cfs.

Acknowledgements

I thank Rich Pastor and Karen Blakney from Reclamation's Lower Columbia Area Office for assistance and financial support to conduct this study. Chet Sater from Reclamation's Hermiston field office and Vicky Johanson of Science Applications International Corporation (SAIC) assisted with field surveys. Craig Contor of CTUIR coordinated the electrofishing effort and provided the fishery data. Rich Pastor and Chet Sater reviewed an earlier draft.

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Appendix A - Available Habitat Transect Data from McKay Creek, November 2008

Table A-1. Available habitat measured at study site PL2 in McKay Creek

11/23-24/2008

Transect 1 **Riffle**

(input) Distance	Width	*(input)* Depth	*(input)* Velocity	Area	Discharge
6.1	0.75	0.00	0.00	0.000	0.000
6.5	0.95	0.30	-0.01	0.285	-0.003
8.0	1.50	0.60	0.90	0.900	0.810
9.5	1.50	0.40	1.10	0.600	0.660
11.0	1.50	0.50	1.68	0.750	1.260
12.5	1.50	0.45	1.69	0.675	1.141
14.0	1.50	0.40	2.06	0.600	1.236
15.5	1.50	0.50	1.69	0.750	1.268
17.0	1.50	0.50	2.45	0.750	1.838
18.5	1.50	0.40	1.84	0.600	1.104
20.0	1.50	0.50	1.88	0.750	1.410
21.5	1.50	0.50	2.45	0.750	1.838
23.0	1.50	0.80	1.74	1.200	2.088
24.5	1.50	0.70	2.40	1.050	2.520
26.0	1.50	0.70	2.260	1.050	2.373
27.5	1.50	0.50	2.860	0.750	2.145
29.0	1.50	0.50	2.170	0.750	1.628
30.5	1.50	0.55	1.710	0.825	1.411
32.0	1.50	0.45	2.720	0.675	1.836
33.5	1.50	0.30	0.980	0.450	0.441
35.0	1.25	0.30	0.830	0.375	0.311
36.0	1.00	0.30	1.630	0.300	0.489
37.0	1.15	0.20	0.560	0.230	0.129
38.3	0.65	0.00	0.000	0.000	0.000

Width =	**32.1**
Area =	**15.07**
Velocity =	**1.85**
Discharge =	**27.9**

Transect 2 **Pool**

(input) Distance	Width	*(input)* Depth	*(input)* Velocity	Area	Discharge
1.6	0.35	0.00	0.00	0.000	0.000
2.3	0.70	0.40	0.01	0.280	0.003
3.0	0.70	0.30	0.01	0.210	0.002
3.7	0.70	0.00	0.00	0.000	0.000
4.4	0.70	0.20	0.37	0.140	0.052
5.1	0.70	1.50	0.05	1.050	0.053
5.8	0.70	1.60	0.08	1.120	0.090
6.5	0.70	1.60	0.53	1.120	0.594
7.2	0.70	1.50	0.86	1.050	0.903

7.9	0.70	2.00	1.01	1.400	1.414
8.6	0.70	2.10	0.92	1.470	1.352
9.3	0.70	2.20	1.66	1.540	2.556
10.0	0.70	2.20	2.01	1.540	3.095
10.7	0.70	1.90	1.830	1.330	2.434
11.4	0.70	2.00	1.610	1.400	2.254
12.1	0.70	2.00	1.280	1.400	1.792
12.8	0.70	1.90	1.260	1.330	1.676
13.5	0.70	1.80	1.280	1.260	1.613
14.2	0.85	1.50	1.270	1.275	1.619
15.2	1.00	1.30	1.350	1.300	1.755
16.2	1.00	1.00	1.200	1.000	1.200
17.2	1.00	0.85	1.040	0.850	0.884
18.2	1.15	0.70	0.630	0.805	0.507
19.5	1.30	0.45	0.640	0.585	0.374
20.8	0.65	0.00	0.000	0	0

Width =	**19.2**
Area =	**23.46**
Velocity =	**1.12**
Discharge =	**26.2**

Transect 3 **Glide**

(input) Distance	Width	*(input)* Depth	*(input)* Velocity	Area	Discharge
1.8	0.35	0.00	0.00	0.000	0.000
2.5	0.85	0.00	0.00	0.000	0.000
3.5	0.95	1.00	-0.03	0.950	-0.029
4.4	0.90	1.40	-0.06	1.260	-0.076
5.3	0.90	1.60	-0.02	1.440	-0.029
6.2	0.90	1.60	-0.12	1.440	-0.173
7.1	0.90	2.15	-0.02	1.935	-0.039
8.0	0.90	2.10	-0.19	1.890	-0.359
8.9	0.90	2.10	-0.11	1.890	-0.208
9.8	0.90	1.90	-0.10	1.710	-0.171
10.7	0.90	1.90	0.52	1.710	0.889
11.6	0.90	1.90	1.71	1.710	2.924
12.5	0.90	1.70	2.07	1.530	3.167
13.4	0.90	1.70	2.69	1.530	4.116
14.3	0.90	1.40	3.350	1.260	4.221
15.2	0.90	1.30	2.840	1.170	3.323
16.1	0.90	1.10	2.520	0.990	2.495
17.0	0.90	0.85	2.300	0.765	1.760
17.9	0.00	0.70	1.570	0.000	0.000
17.0	0.00	0.50	0.990	0.000	0.000
17.9	1.15	0.30	0.230	0.345	0.079
19.3	0.70	0.00	0.000	0.000	0.000

Width =	**17.5**
Area =	**23.53**
Velocity =	**0.93**

Discharge =	**21.9**

Transect 4	**Riffle**				
(input)		***(input)***	***(input)***		
Distance	**Width**	**Depth**	**Velocity**	**Area**	**Discharge**
5	0.25	0.00	0.00	0.000	0.000
5.5	1.00	0.30	0.04	0.300	0.012
7.0	1.50	0.60	1.40	0.900	1.260
8.5	1.50	0.80	2.24	1.200	2.688
10.0	1.50	1.00	2.13	1.500	3.195
11.5	1.50	0.90	2.30	1.350	3.105
13.0	1.50	0.70	2.39	1.050	2.510
14.5	1.50	0.70	1.77	1.050	1.859
16.0	1.50	0.50	2.35	0.750	1.763
17.5	1.50	0.50	2.40	0.750	1.800
19.0	1.50	0.60	2.16	0.900	1.944
20.5	1.50	0.60	1.92	0.900	1.728
22.0	1.50	0.50	1.50	0.750	1.125
23.5	1.50	0.40	1.56	0.600	0.936
25.0	1.50	0.30	1.33	0.450	0.599
26.5	1.50	0.25	0.990	0.375	0.371
28.0	1.50	0.30	0.810	0.450	0.365
29.5	1.50	0.20	1.150	0.300	0.345
31.0	1.50	0.25	0.710	0.375	0.266
32.5	1.50	0.30	1.020	0.450	0.459
34.0	1.50	0.30	0.260	0.450	0.117
35.5	1.50	0.20	0.520	0.300	0.156
37.0	1.50	0.20	0.100	0.300	0.030
38.5	1.00	0.00	0.000	0.000	0.000
39.0	0.25	0.00	0.000	0.000	0.000

Width =	**34.0**
Area =	**15.45**
Velocity =	**1.72**
Discharge =	**26.6**

Transect 5	**Pool**				
(input)		***(input)***	***(input)***		
Distance	**Width**	**Depth**	**Velocity**	**Area**	**Discharge**
7.9	1.30	0.00	0.00	0.000	0.000
10.5	1.80	0.20	0.06	0.360	0.022
11.5	1.00	0.30	0.24	0.300	0.072
12.5	1.50	0.50	0.46	0.750	0.345
13.5	1.50	0.60	0.83	0.900	0.747
14.5	1.50	0.70	0.85	1.050	0.893
15.5	1.00	0.60	1.08	0.600	0.648
16.5	1.00	0.75	1.26	0.750	0.945
17.5	1.00	0.70	1.30	0.700	0.910
18.5	1.00	0.90	1.41	0.900	1.269
19.5	1.00	1.10	1.26	1.100	1.386
20.5	1.00	1.10	1.46	1.100	1.606

21.5	1.00	1.20	1.35	1.200	1.620
22.5	1.00	1.25	1.39	1.250	1.738
23.5	1.00	1.30	1.310	1.300	1.703
24.5	1.00	1.40	1.430	1.400	2.002
25.5	1.00	1.40	1.370	1.400	1.918
26.5	1.00	1.45	1.140	1.450	1.653
27.5	1.00	1.40	1.010	1.400	1.414
28.5	1.00	1.40	1.010	1.400	1.414
29.5	1.00	1.00	1.020	1.000	1.020
30.5	1.00	0.80	0.890	0.800	0.712
31.5	1.00	0.70	0.360	0.700	0.252
32.5	1.00	0.40	0.000	0.400	0.000
33.5	0.75	0.10	0.000	0.075	0.000
34.0	0.25	0.00	0.000	0	0

Width =	**27.6**
Area =	**22.29**
Velocity =	**1.09**
Discharge =	**24.3**

Transect 6 **Glide**

(input) **Distance**	**Width**	***(input)*** **Depth**	***(input)*** **Velocity**	**Area**	**Discharge**
11.7	0.65	0.00	0.00	0.000	0.000
13.0	1.15	0.10	-0.02	0.115	-0.002
14.0	1.00	0.40	0.36	0.400	0.144
15.0	1.50	0.50	0.54	0.750	0.405
16.0	1.50	0.60	0.85	0.900	0.765
17.0	1.50	0.80	1.40	1.200	1.680
18.0	1.00	0.90	1.68	0.900	1.512
19.0	1.00	1.05	1.71	1.050	1.796
20.0	1.00	1.10	1.89	1.100	2.079
21.0	1.00	1.30	1.84	1.300	2.392
22.0	1.00	1.50	1.93	1.500	2.895
23.0	1.00	1.80	2.01	1.800	3.618
24.0	1.00	1.80	2.14	1.800	3.852
25.0	1.00	1.40	2.89	1.400	4.046
26.0	1.00	0.65	1.940	0.650	1.261
27.0	0.85	0.35	1.730	0.298	0.515
27.7	1.15	0.30	0.690	0.345	0.238
29.3	0.80	0.00	0.070	0.000	0.000

Width =	**19.1**
Area =	**15.51**
Velocity =	**1.75**
Discharge =	**27.2**

Transect 7 **Glide**

(input) **Distance**	**Width**	***(input)*** **Depth**	***(input)*** **Velocity**	**Area**	**Discharge**
12.7	1.65	0.00	0.00	0.000	0.000

16	2.15	0.35	1.46	0.753	1.099
17	1.00	0.30	2.70	0.300	0.810
18	1.00	0.60	3.39	0.600	2.034
19	1.00	0.80	2.78	0.800	2.224
20	1.00	1.00	2.92	1.000	2.920
21	1.00	1.10	2.51	1.100	2.761
22	1.00	1.40	1.97	1.400	2.758
23	1.00	1.70	1.51	1.700	2.567
24	1.00	1.60	1.37	1.600	2.192
25	1.00	1.60	1.93	1.600	3.088
26	1.00	1.40	1.51	1.400	2.114
27	1.00	1.00	0.84	1.000	0.840
28	0.70	0.90	0.08	0.630	0.050
28.4	0.20	0.25	-0.270	0.050	-0.014

Width =	**15.7**
Area =	**13.93**
Velocity =	**1.83**
Discharge =	**25.4**

Table A-2. Available habitat measured at study site PL21 in McKay Creek

11/24/2008

Transect 1 **Riffle**

(input) **Distance**	**Width**	***(input)*** **Depth**	***(input)*** **Velocity**	**Area**	**Discharge**
20	0.75	0.00	0.00	0.000	0.000
21.5	1.50	0.00	0.00	0.000	0.000
23.0	1.50	0.10	-0.18	0.150	-0.027
24.5	1.50	0.10	-0.05	0.150	-0.008
26.0	1.50	0.20	0.22	0.300	0.066
27.5	1.50	0.30	0.96	0.450	0.432
29.0	1.50	0.30	1.71	0.450	0.770
30.5	1.50	0.40	1.69	0.600	1.014
32.0	1.50	0.40	2.45	0.600	1.470
33.5	1.50	0.50	2.43	0.750	1.823
35.0	1.50	0.50	2.60	0.750	1.950
36.5	1.50	0.50	2.64	0.750	1.980
38.0	1.50	0.55	2.66	0.825	2.195
39.5	1.50	0.60	2.68	0.900	2.412
41.0	1.50	0.60	2.00	0.900	1.800
42.5	1.50	0.70	2.09	1.050	2.195
44.0	1.50	0.70	2.39	1.050	2.510
45.5	1.50	0.50	2.07	0.750	1.553
47.0	1.50	0.40	1.69	0.600	1.014
48.5	1.60	0.20	1.26	0.320	0.403
50.2	0.85	0.00	0.00	0.000	0.000

Width =	**30.2**
Area =	**11.35**
Velocity =	**2.08**
Discharge =	**23.5**

Transect 2 **Pool**

(input) Distance	Width	*(input)* Depth	*(input)* Velocity	Area	Discharge
4.5	0.50	0.00	0.00	0.000	0.000
5.5	1.25	0.20	-0.10	0.250	-0.025
7.0	1.50	0.50	-0.04	0.750	-0.030
8.5	1.50	1.30	0.55	1.950	1.073
10.0	1.50	1.10	0.72	1.650	1.188
11.5	1.50	1.00	0.92	1.500	1.380
13.0	1.50	1.00	1.19	1.500	1.785
14.5	1.50	1.00	1.23	1.500	1.845
16.0	1.50	0.90	1.24	1.350	1.674
17.5	1.50	0.95	1.34	1.425	1.910
19.0	1.50	1.00	1.39	1.500	2.085
20.5	1.50	1.00	1.42	1.500	2.130
22.0	1.50	0.90	1.26	1.350	1.701
23.5	1.50	0.80	1.31	1.200	1.572
25.0	1.50	0.60	1.20	0.900	1.080
26.5	1.50	0.55	1.08	0.825	0.891
28.0	1.50	0.50	0.52	0.750	0.390
29.5	1.50	0.50	0.99	0.750	0.743
31.0	1.50	0.40	0.90	0.600	0.540
32.5	1.50	0.35	0.55	0.525	0.289
34.0	2.75	0.35	0.69	0.963	0.664
38.0	2.00	0.00	0.00	0.000	0.000

Width =	**33.5**
Area =	**22.74**
Velocity =	**1.01**
Discharge =	**22.9**

Transect 3 **Pool**

(input) Distance	Width	*(input)* Depth	*(input)* Velocity	Area	Discharge
2.4	0.30	0.00	0.00	0.000	0.000
3.0	1.05	0.40	-0.08	0.420	-0.034
4.5	1.50	0.40	-0.19	0.600	-0.114
6.0	1.50	1.30	0.11	1.950	0.215
7.5	1.50	2.20	0.25	3.300	0.825
9.0	1.50	1.10	0.52	1.650	0.858
10.5	1.50	2.70	0.90	4.050	3.645
12.0	1.50	2.60	1.02	3.900	3.978
13.5	1.50	2.50	0.91	3.750	3.413
15.0	1.50	2.20	0.65	3.300	2.145
16.5	1.50	2.15	0.60	3.225	1.935
18.0	1.50	1.95	0.56	2.925	1.638
19.5	1.50	1.70	0.27	2.550	0.689
21.0	1.50	1.25	0.22	1.875	0.413
22.5	1.50	1.00	0.13	1.500	0.195
24.0	1.50	0.80	-0.01	1.200	-0.012

25.5	1.50	0.50	-0.07	0.750	-0.053
27.0	1.50	0.30	-0.10	0.450	-0.045
28.5	1.40	0.10	-0.10	0.140	-0.014
29.8	0.65	0.00	0.00	0.000	0.000

Width =	**27.4**
Area =	**37.54**
Velocity =	**0.52**
Discharge =	**19.7**

Transect 4 **Pool**

(input) **Distance**	**Width**	***(input)*** **Depth**	***(input)*** **Velocity**	**Area**	**Discharge**
2.3	0.35	0.00	0.00	0.000	0.000
3.0	0.85	0.40	-0.10	0.340	-0.034
4.0	1.00	0.95	-0.01	0.950	-0.010
5.0	1.00	0.95	0.97	0.950	0.922
6.0	1.00	1.60	1.01	1.600	1.616
7.0	1.00	1.80	0.96	1.800	1.728
8.0	1.00	1.90	0.95	1.900	1.805
9.0	1.00	2.20	1.27	2.200	2.794
10.0	1.00	2.20	1.32	2.200	2.904
11.0	1.00	2.20	1.22	2.200	2.684
12.0	1.00	2.30	1.01	2.300	2.323
13.0	1.00	2.40	0.92	2.400	2.208
14.0	1.00	2.90	0.90	2.900	2.610
15.0	1.00	3.10	0.30	3.100	0.930
16.0	1.00	3.10	0.33	3.100	1.023
17.0	1.00	2.90	0.07	2.900	0.203
18.0	1.00	2.60	0.12	2.600	0.312
19.0	1.15	2.00	-0.04	2.300	-0.092
20.3	2.60	1.50	-0.16	3.900	-0.624
24.2	1.95	0.00	0.00	0.000	0.000

Width =	**21.9**
Area =	**39.64**
Velocity =	**0.59**
Discharge =	**23.3**

Transect 5 **Glide**

(input) **Distance**	**Width**	***(input)*** **Depth**	***(input)*** **Velocity**	**Area**	**Discharge**
7.5	0.40	0.00	0.00	0.000	0.000
8.3	0.80	1.40	-0.19	1.120	-0.213
9.1	0.80	1.45	-0.15	1.160	-0.174
9.9	0.80	1.00	0.99	0.800	0.792
10.7	0.80	1.65	0.90	1.320	1.188
11.5	0.80	1.50	1.65	1.200	1.980
12.3	0.80	1.60	2.00	1.280	2.560
13.1	0.80	1.60	2.12	1.280	2.714
13.9	0.80	1.45	2.59	1.160	3.004

14.7	0.80	1.40	1.50	1.120	1.680
15.5	0.80	1.20	1.91	0.960	1.834
16.3	0.80	1.10	1.75	0.880	1.540
17.1	0.80	1.10	1.30	0.880	1.144
17.9	0.80	1.00	1.00	0.800	0.800
18.7	0.80	0.90	0.97	0.720	0.698
19.5	0.80	0.75	0.71	0.600	0.426
20.3	0.80	0.60	0.61	0.480	0.293
21.1	0.80	0.60	0.44	0.480	0.211
21.9	0.80	0.50	0.43	0.400	0.172
22.7	0.65	0.30	0.31	0.195	0.060
23.2	0.75	0.20	0.05	0.150	0.008
24.2	0.50	0.00	0.00	0.000	0.000

Width =	**16.7**
Area =	**16.99**
Velocity =	**1.22**
Discharge =	**20.7**

Transect 6 **Riffle**

(input) Distance	Width	*(input)* Depth	*(input)* Velocity	Area	Discharge
3	1.00	0.00	0.00	0.000	0.000
5.0	2.00	0.30	0.05	0.600	0.030
7.0	2.00	0.40	1.13	0.800	0.904
9.0	2.00	0.30	2.02	0.600	1.212
11.0	2.00	0.35	1.15	0.700	0.805
13.0	2.00	0.30	1.72	0.600	1.032
15.0	2.00	0.30	1.49	0.600	0.894
17.0	2.00	0.45	1.71	0.900	1.539
19.0	2.00	0.40	2.83	0.800	2.264
21.0	2.00	0.50	2.04	1.000	2.040
23.0	2.00	0.50	1.75	1.000	1.750
25.0	1.50	0.50	1.92	0.750	1.440
26.0	1.50	0.45	1.64	0.675	1.107
28.0	2.00	0.40	2.03	0.800	1.624
30.0	2.00	0.30	1.45	0.600	0.870
32.0	2.00	0.30	1.30	0.600	0.780
34.0	2.00	0.30	1.90	0.600	1.140
36.0	2.00	0.30	0.84	0.600	0.504
38.0	2.00	0.50	1.50	1.000	1.500
40.0	2.00	0.60	0.14	1.200	0.168
42.0	1.75	0.80	0.15	1.400	0.210
43.5	0.75	0.00	0.000	0.000	0.000

Width =	**40.5**
Area =	**15.83**
Velocity =	**1.38**
Discharge =	**21.8**

Transect 7 **Glide**

(input) Distance	Width	*(input)* Depth	*(input)* Velocity	Area	Discharge
16.1	1.10	0.00	0.00	0.000	0.000
18.3	1.95	0.10	0.01	0.195	0.002
20.0	1.60	0.20	0.06	0.320	0.019
21.5	1.50	0.30	0.47	0.450	0.212
23.0	1.50	0.40	0.60	0.600	0.360
24.5	1.50	0.45	0.91	0.675	0.614
26.0	1.50	0.50	0.89	0.750	0.668
27.5	1.50	0.50	1.21	0.750	0.908
29.0	1.50	0.65	1.15	0.975	1.121
30.5	1.50	0.70	1.31	1.050	1.376
32.0	1.00	0.80	1.33	0.800	1.064
32.5	1.00	0.80	1.51	0.800	1.208
34.0	1.50	0.90	1.68	1.350	2.268
35.5	1.50	1.00	2.10	1.500	3.150
37.0	1.50	1.00	1.89	1.500	2.835
38.5	1.50	1.00	2.00	1.500	3.000
40.0	1.50	1.00	1.60	1.500	2.400
41.5	1.50	0.95	1.26	1.425	1.796
43.0	1.50	0.80	0.74	1.200	0.888
44.5	1.50	0.60	0.67	0.900	0.603
46.0	1.05	0.40	0.36	0.420	0.151
46.6	0.30	0.00	0.00	0.000	0.000

Width =	**30.5**
Area =	**18.66**
Velocity =	**1.32**
Discharge =	**24.6**

Transect 8 **Glide**

(input) Distance	Width	*(input)* Depth	*(input)* Velocity	Area	Discharge
9.8	1.10	0.00	0.00	0.000	0.000
12.0	1.85	0.10	0.00	0.185	0.000
13.5	1.50	0.10	0.76	0.150	0.114
15.0	1.50	0.35	0.96	0.525	0.504
16.5	1.50	0.40	1.86	0.600	1.116
18.0	1.50	0.60	0.95	0.900	0.855
19.5	1.50	0.65	1.15	0.975	1.121
21.0	1.50	0.80	1.69	1.200	2.028
22.5	1.50	0.90	1.77	1.350	2.390
24.0	1.50	0.80	1.84	1.200	2.208
25.5	1.25	0.95	1.46	1.188	1.734
26.5	1.25	1.00	1.37	1.250	1.713
28.0	1.50	1.00	1.66	1.500	2.490
29.5	1.50	0.90	1.53	1.350	2.066
31.0	1.50	0.90	1.63	1.350	2.201
32.5	1.50	0.90	1.26	1.350	1.701
34.0	1.50	0.90	0.84	1.350	1.134
35.5	1.50	0.90	0.37	1.350	0.500

37.0	1.50	0.70	0.09	1.050	0.095
38.5	1.50	0.40	-0.08	0.600	-0.048
40.0	0.90	0.10	-0.13	0.090	-0.012
40.3	0.15	0.00	0.00	0.000	0.000

Width =	**30.5**
Area =	**19.51**
Velocity =	**1.23**
Discharge =	**23.9**

Transect 9 **Riffle**

(input) Distance	Width	*(input)* Depth	*(input)* Velocity	Area	Discharge
1.8	0.35	0.20	0.94	0.070	0.066
2.5	1.35	0.20	1.12	0.270	0.302
4.5	2.00	0.10	1.08	0.200	0.216
6.5	2.00	0.60	1.49	1.200	1.788
8.5	2.00	0.50	1.87	1.000	1.870
10.5	2.00	0.30	0.38	0.600	0.228
12.5	2.00	0.40	0.73	0.800	0.584
14.5	2.00	0.30	0.50	0.600	0.300
16.5	2.00	0.30	1.04	0.600	0.624
18.5	2.00	0.40	1.01	0.800	0.808
20.5	2.00	0.30	0.76	0.600	0.456
22.5	2.00	0.40	1.44	0.800	1.152
24.5	2.00	0.50	1.83	1.000	1.830
26.5	2.00	0.50	2.21	1.000	2.210
28.5	2.00	0.60	1.76	1.200	2.112
30.5	2.00	0.60	2.69	1.200	3.228
32.5	2.00	0.60	1.61	1.200	1.932
34.5	2.00	0.65	2.06	1.300	2.678
36.5	2.00	0.40	1.09	0.800	0.872
38.5	2.25	0.20	0.60	0.450	0.270
41.0	2.50	0.05	0.18	0.125	0.023
43.5	1.25	0.00	0.00	0.000	0.000

Width =	**41.7**
Area =	**15.82**
Velocity =	**1.49**
Discharge =	**23.5**

Table A-3. Available habitat measured at study site PM28 in McKay Creek

11/25/2008

Transect 1 **Pool**

(input) Distance	Width	*(input)* Depth	*(input)* Velocity	Area	Discharge
5	1.50	0.00	0.00	0.000	0.000
8.0	2.50	0.30	0.38	0.750	0.285
10.0	2.00	0.45	0.24	0.900	0.216
12.0	2.00	0.50	0.80	1.000	0.800
14.0	2.00	0.80	0.99	1.600	1.584

16.0	2.00	1.30	0.91	2.600	2.366
18.0	2.00	1.50	1.55	3.000	4.650
20.0	2.00	2.00	1.83	4.000	7.320
22.0	2.00	2.15	1.39	4.300	5.977
24.0	2.00	2.40	-0.10	4.800	-0.480
26.0	2.00	2.25	-0.13	4.500	-0.585
28.0	2.00	1.80	0.21	3.600	0.756
30.0	2.00	1.70	0.42	3.400	1.428
32.0	1.25	0.80	-0.16	1.000	-0.160
32.5	0.40	0.40	-0.09	0.160	-0.014
32.8	0.15	0.00	0.00	0.000	0.000

Width =	**27.8**
Area =	**35.61**
Velocity =	**0.68**
Discharge =	**24.1**

Transect 2 **Glide**

(input) Distance	Width	*(input)* Depth	*(input)* Velocity	Area	Discharge
1.8	1.60	0.00	0.00	0.000	0.000
5.0	2.35	0.10	-0.02	0.235	-0.005
6.5	1.50	0.20	0.31	0.300	0.093
8.0	1.50	0.25	-0.07	0.375	-0.026
9.5	1.50	0.20	0.48	0.300	0.144
11.0	1.50	0.25	0.50	0.375	0.188
12.5	1.50	0.35	0.69	0.525	0.362
14.0	1.50	0.55	0.75	0.825	0.619
15.5	1.50	0.55	1.16	0.825	0.957
17.0	1.50	0.60	1.15	0.900	1.035
18.5	1.50	0.70	1.13	1.050	1.187
20.0	1.50	0.80	1.02	1.200	1.224
21.5	1.50	0.70	1.44	1.050	1.512
23.0	1.50	0.80	1.20	1.200	1.440
24.5	1.50	1.00	1.72	1.500	2.580
26.0	1.50	0.90	1.58	1.350	2.133
27.5	1.50	1.00	1.79	1.500	2.685
29.0	1.50	1.30	1.54	1.950	3.003
30.5	1.50	1.30	1.04	1.950	2.028
32.0	1.50	1.00	0.48	1.500	0.720
33.5	1.50	0.70	-0.04	1.050	-0.042
35.0	0.75	0.50	-0.08	0.375	-0.030
35.0	0.75	0.30	-0.15	0.225	-0.034
36.5	0.75	0.00	0.000	0.000	0.000

Width =	**34.7**
Area =	**20.56**
Velocity =	**1.06**
Discharge =	**21.8**

Transect 3 **Glide**

(input) Distance	Width	*(input)* Depth	*(input)* Velocity	Area	Discharge
8.8	1.10	0.00	0.00	0.000	0.000
11.0	1.85	0.20	0.04	0.370	0.015
12.5	1.50	0.20	0.10	0.300	0.030
14.0	1.50	0.35	0.17	0.525	0.089
15.5	1.50	0.40	0.78	0.600	0.468
17.0	1.50	0.20	0.64	0.300	0.192
18.5	1.50	0.45	0.61	0.675	0.412
20.0	1.50	0.60	0.93	0.900	0.837
21.5	1.50	0.50	1.07	0.750	0.803
23.0	1.50	0.70	0.93	1.050	0.977
24.5	1.50	0.80	1.27	1.200	1.524
26.0	1.50	1.10	1.14	1.650	1.881
27.5	1.50	1.35	1.45	2.025	2.936
29.0	1.50	1.40	1.75	2.100	3.675
30.5	1.50	1.30	1.86	1.950	3.627
32.0	1.50	0.90	2.00	1.350	2.700
33.5	1.50	0.75	0.56	1.125	0.630
35.0	1.65	0.50	-0.01	0.825	-0.008
36.8	1.50	0.30	-0.09	0.450	-0.041
38.0	0.60	0.00	0.00	0.000	0.000

Width =	**29.2**
Area =	**18.15**
Velocity =	**1.14**
Discharge =	**20.7**

Transect 4 **Riffle**

(input) Distance	Width	*(input)* Depth	*(input)* Velocity	Area	Discharge
16.0	1.25	0.00	0.00	0.000	0.000
18.5	2.00	0.10	0.15	0.200	0.030
20.0	1.25	0.20	-0.15	0.250	-0.038
21.0	1.00	0.30	1.08	0.300	0.324
22.0	1.00	0.25	1.04	0.250	0.260
23.0	1.00	0.50	1.61	0.500	0.805
24.0	1.00	0.50	2.08	0.500	1.040
25.0	1.00	0.50	2.24	0.500	1.120
26.0	1.00	0.20	1.97	0.200	0.394
27.0	1.00	0.40	2.39	0.400	0.956
28.0	1.00	0.50	1.42	0.500	0.710
29.0	1.00	0.80	1.98	0.800	1.584
30.0	1.00	1.00	1.68	1.000	1.680
31.0	1.00	1.10	2.41	1.100	2.651
32.0	1.00	1.40	2.22	1.400	3.108
33.0	1.00	1.80	2.21	1.800	3.978
34.0	1.00	1.50	2.16	1.500	3.240
35.0	0.50	0.00	0.00	0.000	0.000

Width =	**19.0**

Area =	**11.20**
Velocity =	**1.95**
Discharge =	**21.8**

Transect 5 **Riffle**

(input) Distance	Width	*(input)* Depth	*(input)* Velocity	Area	Discharge
16.8	1.10	0.00	0.00	0.000	0.000
19.0	1.85	0.10	-0.09	0.185	-0.017
20.5	1.50	0.10	-0.03	0.150	-0.005
22.0	1.50	0.20	0.69	0.300	0.207
23.5	1.50	0.35	1.38	0.525	0.725
25.0	1.50	0.40	1.04	0.600	0.624
26.5	1.50	0.30	1.08	0.450	0.486
28.0	1.50	0.40	1.54	0.600	0.924
29.5	1.50	0.60	2.41	0.900	2.169
31.0	1.50	0.60	2.36	0.900	2.124
32.5	1.50	0.55	1.78	0.825	1.469
34.0	1.50	0.70	2.39	1.050	2.510
35.5	1.50	0.55	2.26	0.825	1.865
37.0	1.50	0.50	2.90	0.750	2.175
38.5	1.50	0.50	3.46	0.750	2.595
40.0	1.50	0.50	3.62	0.750	2.715
41.5	1.50	0.80	2.35	1.200	2.820
43.0	1.50	0.40	1.31	0.600	0.786
44.5	1.50	0.30	2.05	0.450	0.923
46.0	1.25	0.20	0.96	0.250	0.240
47.0	0.50	0.00	0.00	0.000	0.000

Width =	**30.2**
Area =	**12.06**
Velocity =	**2.10**
Discharge =	**25.3**

Transect 6 **Riffle**

(input) Distance	Width	*(input)* Depth	*(input)* Velocity	Area	Discharge
4.8	0.60	0.00	0.00	0.000	0.000
6.0	1.60	0.20	-0.09	0.320	-0.029
8.0	2.00	0.20	0.40	0.400	0.160
10.0	2.00	0.20	0.32	0.400	0.128
12.0	2.00	0.25	0.04	0.500	0.020
14.0	2.00	0.20	0.19	0.400	0.076
16.0	2.00	0.20	0.11	0.400	0.044
18.0	2.00	0.40	0.69	0.800	0.552
20.0	2.00	0.45	0.97	0.900	0.873
22.0	2.00	0.70	1.25	1.400	1.750
24.0	2.00	0.70	1.40	1.400	1.960
26.0	2.00	0.70	1.40	1.400	1.960
28.0	2.00	0.70	0.79	1.400	1.106

30.0	2.00	0.80	1.78	1.600	2.848
32.0	2.00	0.90	1.47	1.800	2.646
34.0	2.00	0.85	1.39	1.700	2.363
36.0	2.00	0.80	1.02	1.600	1.632
38.0	2.00	0.70	1.86	1.400	2.604
40.0	2.00	0.55	1.29	1.100	1.419
42.0	2.00	0.45	0.73	0.900	0.657
44.0	1.50	0.25	0.160	0.375	0.060
45.0	0.75	0.30	-0.040	0.225	-0.009
45.5	0.25	0.00	0.000	0.000	0.000

Width =	**40.5**
Area =	**20.42**
Velocity =	**1.12**
Discharge =	**22.8**

Transect 7 **Glide**

(input)		***(input)***	***(input)***		
Distance	**Width**	**Depth**	**Velocity**	**Area**	**Discharge**
4.8	0.60	0.20	-0.09	0.120	-0.011
6.0	1.60	0.10	0.14	0.160	0.022
8.0	2.00	0.30	0.22	0.600	0.132
10.0	2.00	0.20	0.38	0.400	0.152
12.0	2.00	0.20	0.41	0.400	0.164
14.0	2.00	0.30	0.37	0.600	0.222
16.0	2.00	0.10	-0.08	0.200	-0.016
18.0	2.00	0.25	0.52	0.500	0.260
20.0	2.00	0.60	0.76	1.200	0.912
22.0	2.00	0.90	0.98	1.800	1.764
24.0	2.00	1.10	0.94	2.200	2.068
26.0	2.00	1.00	1.24	2.000	2.480
28.0	2.00	1.10	1.46	2.200	3.212
30.0	2.00	1.00	1.23	2.000	2.460
32.0	2.00	1.00	1.19	2.000	2.380
34.0	2.00	0.90	1.14	1.800	2.052
36.0	2.00	0.90	1.03	1.800	1.854
38.0	2.00	0.60	0.93	1.200	1.116
40.0	2.00	0.50	0.82	1.000	0.820
42.0	1.60	0.20	0.19	0.320	0.061
43.2	0.60	0.00	0.000	0.000	0.000

Width =	**38.4**
Area =	**22.50**
Velocity =	**0.98**
Discharge =	**22.1**

Transect 8 **Glide**

(input)		***(input)***	***(input)***		
Distance	**Width**	**Depth**	**Velocity**	**Area**	**Discharge**
2.3	1.35	0.00	0.00	0.000	0.000
5.0	2.35	0.15	0.40	0.353	0.141

7.0	2.00	0.20	0.20	0.400	0.080
9.0	2.00	0.20	0.00	0.400	0.000
11.0	2.00	0.20	-0.09	0.400	-0.036
13.0	1.50			0.000	0.000
14.0	1.00	0.01	0.13	0.010	0.001
15.0	1.50			0.000	0.000
17.0	2.00			0.000	0.000
19.0	2.00	0.30	0.00	0.600	0.000
21.0	2.00	0.65	0.60	1.300	0.780
23.0	2.00	0.80	1.58	1.600	2.528
25.0	2.00	0.90	1.18	1.800	2.124
27.0	2.00	0.90	1.49	1.800	2.682
29.0	2.00	1.00	1.14	2.000	2.280
31.0	2.00	1.20	1.35	2.400	3.240
33.0	2.00	1.10	0.88	2.200	1.936
35.0	2.00	0.90	1.31	1.800	2.358
37.0	2.00	1.00	1.40	2.000	2.800
39.0	2.00	1.40	0.67	2.800	1.876
41.0	2.00	1.20	0.14	2.400	0.336
43.0	2.00	0.80	-0.060	1.600	-0.096
45.0	1.15	0.20	0.100	0.230	0.023
45.3	0.15	0.00	0.000	0.000	0.000

Width =	**41.7**
Area =	**26.09**
Velocity =	**0.88**
Discharge =	**23.1**

Table A-4. Available habitat measured at study site PH56 in McKay Creek

11/24/2008

Transect 1 **Glide**

(input) **Distance**	**Width**	***(input)*** **Depth**	***(input)*** **Velocity**	**Area**	**Discharge**
1.5	0.75	0.00	0.00	0.000	0.000
3.0	1.50	0.30	0.06	0.450	0.027
4.5	1.50	0.45	0.92	0.675	0.621
6.0	1.50	0.70	1.43	1.050	1.502
7.5	1.50	0.90	1.63	1.350	2.201
9.0	1.50	0.90	2.31	1.350	3.119
10.5	1.50	0.95	1.81	1.425	2.579
12.0	1.50	0.70	2.00	1.050	2.100
13.5	1.50	0.70	1.91	1.050	2.006
15.0	1.50	0.70	1.92	1.050	2.016
16.5	1.50	0.70	1.50	1.050	1.575
18.0	1.50	0.50	1.39	0.750	1.043
19.5	1.50	0.50	1.37	0.750	1.028
21.0	1.50	0.40	1.47	0.600	0.882
22.5	1.50	0.50	1.21	0.750	0.908
24.0	2.00	0.45	1.26	0.900	1.134
26.5	4.50	0.30	0.95	1.350	1.283
33.0	3.25	0.00	0.00	0.000	0.000

Width =	**31.5**
Area =	**15.60**
Velocity =	**1.54**
Discharge =	**24.0**

Transect 2 **Glide**

(input) Distance	Width	*(input)* Depth	*(input)* Velocity	Area	Discharge
2	0.50	0.00	0.00	0.000	0.000
3.0	1.00	1.60	1.55	1.600	2.480
4.0	1.00	1.50	2.78	1.500	4.170
5.0	1.00	1.40	2.54	1.400	3.556
6.0	1.00	1.50	2.17	1.500	3.255
7.0	1.00	1.50	2.13	1.500	3.195
8.0	1.00	1.60	1.73	1.600	2.768
9.0	1.00	1.40	1.20	1.400	1.680
10.0	1.00	1.40	0.65	1.400	0.910
11.0	1.00	1.30	0.51	1.300	0.663
12.0	1.00	1.20	0.35	1.200	0.420
13.0	1.00	1.00	0.21	1.000	0.210
14.0	1.00	0.80	0.09	0.800	0.072
15.0	1.00	0.70	-0.05	0.700	-0.035
16.0	1.00	0.60	-0.07	0.600	-0.042
17.0	1.00	0.50	-0.09	0.500	-0.045
18.0	1.00	0.40	-0.07	0.400	-0.028
19.0	1.00	0.30	-0.10	0.300	-0.030
20.0	2.15	0.25	-0.13	0.538	-0.070
23.3	1.65	0.00	0.00	0.000	0.000

Width =	**21.3**
Area =	**19.24**
Velocity =	**1.20**
Discharge =	**23.1**

Transect 3 **Riffle**

(input) Distance	Width	*(input)* Depth	*(input)* Velocity	Area	Discharge
2	0.25	0.00	0.00	0.000	0.000
2.5	1.00	0.00	0.00	0.000	0.000
4.0	1.75	0.20	0.35	0.350	0.123
6.0	2.00	0.30	0.95	0.600	0.570
8.0	2.00	0.40	0.89	0.800	0.712
10.0	2.00	0.50	1.33	1.000	1.330
12.0	2.00	0.50	1.93	1.000	1.930
14.0	2.00	0.50	1.82	1.000	1.820
16.0	2.00	0.60	1.21	1.200	1.452
18.0	2.00	0.70	1.22	1.400	1.708
20.0	2.00	0.70	1.49	1.400	2.086
22.0	2.00	0.70	1.15	1.400	1.610
24.0	2.00	0.60	1.40	1.200	1.680

26.0	2.00	0.60	1.52	1.200	1.824
28.0	2.00	0.60	1.70	1.200	2.040
30.0	2.00	0.60	1.58	1.200	1.896
32.0	2.00	0.55	1.60	1.100	1.760
34.0	2.00	0.50	1.28	1.000	1.280
36.0	2.00	0.40	0.81	0.800	0.648
38.0	1.50	0.40	0.45	0.600	0.270
39.0	1.00	0.50	0.04	0.500	0.020
40.0	0.50	0.00	0.000	0.000	0.000

Width =	**38.0**
Area =	**18.95**
Velocity =	**1.31**
Discharge =	**24.8**

Transect 4 **Riffle**

(input) Distance	Width	*(input)* Depth	*(input)* Velocity	Area	Discharge
16	3.50	0.00	0.00	0.000	0.000
23.0	4.50	0.10	0.00	0.450	0.000
25.0	1.75	0.10	0.31	0.175	0.054
26.5	1.50	0.20	0.33	0.300	0.099
28.0	1.50	0.20	0.78	0.300	0.234
29.5	1.50	0.30	0.89	0.450	0.401
31.0	1.50	0.40	2.82	0.600	1.692
32.5	1.50	0.50	2.61	0.750	1.958
34.0	1.50	0.50	2.16	0.750	1.620
35.5	1.50	0.50	2.53	0.750	1.898
37.0	1.50	0.45	2.48	0.675	1.674
38.5	1.50	0.30	2.37	0.450	1.067
40.0	1.50	0.40	1.85	0.600	1.110
41.5	1.50	0.40	1.09	0.600	0.654
43.0	1.50	0.40	1.82	0.600	1.092
44.5	1.50	0.60	1.72	0.900	1.548
46.0	1.50	0.50	1.38	0.750	1.035
47.5	1.50	0.50	1.26	0.750	0.945
49.0	1.50	0.65	1.04	0.975	1.014
50.5	1.50	0.55	1.22	0.825	1.007
52.0	1.75	0.55	1.580	0.963	1.521
54.0	3.00	0.20	1.440	0.600	0.864
58.0	2.00	0.00	0.000	0.000	0.000

Width =	**42.0**
Area =	**13.21**
Velocity =	**1.63**
Discharge =	**21.5**

Transect 5 **Pool**

(input) Distance	Width	*(input)* Depth	*(input)* Velocity	Area	Discharge
4	0.75	0.00	0.00	0.000	0.000

5.5	1.50	1.10	-0.40	1.650	-0.660
7.0	1.50	1.80	-0.25	2.700	-0.675
8.5	1.50	2.00	0.13	3.000	0.390
10.0	1.50	2.30	0.91	3.450	3.140
11.5	1.50	2.35	1.13	3.525	3.983
13.0	1.50	2.20	1.19	3.300	3.927
14.5	1.50	2.25	0.80	3.375	2.700
16.0	1.50	2.25	0.37	3.375	1.249
17.5	1.50	2.15	0.04	3.225	0.129
19.0	1.50	1.80	0.02	2.700	0.054
20.5	1.50	1.75	-0.07	2.625	-0.184
22.0	1.50	1.80	-0.07	2.700	-0.189
23.5	1.50	1.80	-0.09	2.700	-0.243
25.0	1.50	1.50	-0.05	2.250	-0.113
26.5	1.50	1.00	-0.05	1.500	-0.075
28.0	1.50	0.70	-0.06	1.050	-0.063
29.5	1.40	0.30	-0.08	0.420	-0.034
30.8	0.65	0.00	0.00	0.000	0.000
54.3	2.35	0.00	0.00	0.000	0.000
59.0	3.35	0.30	0.840	1.005	0.844
61.0	2.00	0.40	1.990	0.800	1.592
63.0	1.65	0.30	1.790	0.495	0.886
64.3	2.20	0.30	1.750	0.660	1.155
67.4	1.55	0.00	0.000	0.000	0.000

Width =	**39.9**
Area =	**46.51**
Velocity =	**0.38**
Discharge =	**17.8**

Transect 6 **Glide**

(input) **Distance**	**Width**	***(input)*** **Depth**	***(input)*** **Velocity**	**Area**	**Discharge**
2.7	0.15	0.00	0.00	0.000	0.000
3.0	0.65	0.10	0.14	0.065	0.009
4.0	1.00	0.60	0.15	0.600	0.090
5.0	1.00	1.00	0.90	1.000	0.900
6.0	1.00	1.30	1.70	1.300	2.210
7.0	1.00	1.70	1.94	1.700	3.298
8.0	1.00	1.70	1.59	1.700	2.703
9.0	1.00	1.60	1.98	1.600	3.168
10.0	1.00	1.30	1.55	1.300	2.015
11.0	1.00	1.20	0.94	1.200	1.128
12.0	1.00	0.90	0.31	0.900	0.279
13.0	1.00	0.85	0.03	0.850	0.026
14.0	1.00	0.60	-0.02	0.600	-0.012
15.0	0.75	0.30	-0.18	0.225	-0.041
15.5	1.15	0.20	-0.13	0.230	-0.030
17.3	0.90	0.00	0.00	0.000	0.000
33.0	3.00	0.00	0.00	0.000	0.000
39.0	4.00	0.20	-0.030	0.800	-0.024

41.0	2.00	0.30	0.490	0.600	0.294
43.0	2.00	0.30	0.930	0.600	0.558
45.0	2.00	0.30	0.910	0.600	0.546
47.0	2.50	0.25	1.250	0.625	0.781
50.0	2.50	0.35	1.030	0.875	0.901
52.0	2.00	0.30	1.130	0.600	0.678
54.0	2.00	0.30	1.010	0.600	0.606
56.0	1.80	0.20	0.670	0.360	0.241
57.6	0.80	0.00	0.000	0.000	0.000
				Width =	**39.2**
				Area =	**18.93**
				Velocity =	**1.07**
				Discharge =	**20.3**

Transect 7 **Glide**

(input)		***(input)***	***(input)***		
Distance	**Width**	**Depth**	**Velocity**	**Area**	**Discharge**
2.8	0.10	0.00	0.00	0.000	0.000
3.0	0.60	0.10	0.37	0.060	0.022
4.0	1.00	0.30	1.34	0.300	0.402
5.0	1.00	0.60	2.64	0.600	1.584
6.0	1.00	0.80	3.18	0.800	2.544
7.0	1.00	0.90	1.97	0.900	1.773
8.0	1.00	0.75	2.61	0.750	1.958
9.0	1.00	0.70	3.04	0.700	2.128
10.0	1.00	0.80	2.28	0.800	1.824
11.0	1.00	0.50	2.97	0.500	1.485
12.0	1.00	0.50	1.98	0.500	0.990
13.0	1.00	0.40	2.03	0.400	0.812
14.0	1.00	0.50	1.55	0.500	0.775
15.0	1.00	0.25	0.47	0.250	0.118
16.0	1.00	0.10	0.53	0.100	0.053
17.0	1.00	0.10	0.20	0.100	0.020
18.0	2.50	0.20	0.230	0.500	0.115
22.0	3.50	0.00	0.00	0.000	0.000
25.0	3.00	0.10	0.150	0.300	0.045
28.0	3.00	0.20	0.45	0.600	0.270
31.0	3.00	0.20	0.770	0.600	0.462
34.0	3.00	0.40	0.900	1.200	1.080
37.0	3.00	0.45	0.840	1.350	1.134
40.0	3.00	0.40	0.600	1.200	0.720
43.0	3.00	0.30	0.470	0.900	0.423
46.0	3.00	0.25	0.580	0.750	0.435
49.0	3.10	0.50	0.010	1.550	0.016
52.2	1.60	0.00	0.000	0	0
				Width =	**47.8**
				Area =	**16.21**
				Velocity =	**1.31**
				Discharge =	**21.2**

Transect 8	Pool				
(input)		*(input)*	*(input)*		
Distance	**Width**	**Depth**	**Velocity**	**Area**	**Discharge**
1.5	1.00	0.00	0.00	0.000	0.000
3.5	2.00	0.80	0.00	1.600	0.000
5.5	2.00	1.10	0.38	2.200	0.836
7.5	2.00	1.50	-0.02	3.000	-0.060
9.5	2.00	1.65	0.35	3.300	1.155
11.5	2.00	1.40	0.76	2.800	2.128
13.5	2.00	1.20	0.80	2.400	1.920
15.5	2.00	1.00	0.70	2.000	1.400
17.5	2.00	0.95	0.71	1.900	1.349
19.5	2.00	0.95	0.74	1.900	1.406
21.5	2.00	0.95	0.68	1.900	1.292
23.5	2.00	0.75	0.64	1.500	0.960
25.5	2.00	0.80	0.61	1.600	0.976
27.5	2.00	0.75	0.55	1.500	0.825
29.5	2.00	0.80	0.46	1.600	0.736
31.5	2.00	0.80	0.45	1.600	0.720
33.5	2.00	0.90	0.50	1.800	0.900
35.5	2.00	1.00	0.46	2.000	0.920
37.5	2.00	1.00	0.47	2.000	0.940
39.5	2.00	1.10	0.430	2.200	0.946
41.5	2.00	1.15	0.260	2.300	0.598
43.5	1.95	1.00	-0.040	1.950	-0.078
45.4	2.05	0.70	0.020	1.435	0.029
47.6	1.10	0.00	0.000	0.000	0.000

Width =	**46.1**
Area =	**44.49**
Velocity =	**0.45**
Discharge =	**19.9**

Transect 9	Pool				
(input)		*(input)*	*(input)*		
Distance	**Width**	**Depth**	**Velocity**	**Area**	**Discharge**
3	1.00	0.00	0.00	0.000	0.000
5.0	2.00	0.30	0.04	0.600	0.024
7.0	2.00	2.80	0.04	5.600	0.224
9.0	2.00	1.80	0.28	3.600	1.008
11.0	2.00	2.85	0.41	5.700	2.337
13.0	2.00	2.75	0.45	5.500	2.475
15.0	2.00	2.70	0.55	5.400	2.970
17.0	2.00	2.50	0.50	5.000	2.500
19.0	2.00	2.25	0.36	4.500	1.620
21.0	2.00	2.00	0.36	4.000	1.440
23.0	2.00	1.85	0.31	3.700	1.147
25.0	2.00	1.60	0.33	3.200	1.056
27.0	2.00	1.35	0.28	2.700	0.756
29.0	2.00	1.15	0.20	2.300	0.460

31.0	2.00	1.00	0.03	2.000	0.060
33.0	2.00	0.85	0.18	1.700	0.306
35.0	2.00	0.80	0.13	1.600	0.208
37.0	2.00	0.95	-0.02	1.900	-0.038
39.0	1.90	0.65	0.01	1.235	0.012
40.8	0.90	0.00	0.000	0.000	0.000

Width =	**37.8**
Area =	**60.24**
Velocity =	**0.31**
Discharge =	**18.6**

Appendix B - Electrofishing Data, November 2008

Table B-1 Fish habitat use observations

Number	Depth (ft)	MCV (ft/sec)	Substrate	Cover	Cover code	Dist to Cov
February - 2008						
1	0.3	0.73	6	OHV	1	0.5
2	0.4	0.03	7	Riprap	2	0
3	0.7	0.35	8	Riprap	2	0
4	1.2	0.17	8	Riprap	2	0
5	1.1	0.15	8	Riprap	2	0
6	1	0.01	7	Riprap/Veg	2	0
7	0.6	2.12	6	Rock	3	0.7
8	1.2	0.5	6	OHV	1	0
9	0.7	0.07	6	Riprap	2	0
10	1.2	1.42	6	Riprap	2	1.5
11	1	1.21	6	Rock/Riprap	3	0
12	1.1	0.12	8	Riprap	2	0
13	1.1	0.39	8	Riprap	2	0
14	0.7	0.37	7	Riprap	2	2
15	0.7	0.59	1	Veg	4	0
16	0.8	0.76	7	Riprap	2	4
17	0.8	1.26	6	Veg	4	0
18	1.5	0.04	6	Riprap	2	0
19	1.9	1.46	6	Riprap	2	0
20	0.7	0.08	6	Veg	4	0
21	0.5	0.18	6	Rock	3	0.5
22	0.7	0.53	6	Rock	3	0
23	0.9	2.53	6	Rock	3	0
24	0.3	0.74	6	Rock	3	0
25	0.7	1.28	6	Rock	3	0
26	0.6	1.09	6	Rock	3	0
27	0.4	0.4	6	Rock/Veg	3	1.5
28	0.4	0.74	6	Wood	5	0
29	0.6	0.36	6	Wood	5	0
30	0.6	1.17	6	Wood	5	0
31	0.6	0.52	6	OHV	1	0.5
32	0.5	1.95	6	OHV	1	2
33	0.4	2.07	6	OHV	1	6
34	0.8	0.01	6	Veg	4	0
35	1.7	0.58	1	Veg	4	0
36	0.9	0.81	1	Veg	4	0
37	0.4	0.04	6	OHV	1	0
38	0.7	2.43	6	OHV	1	3
39	0.3	0.02	6	OHV	1	0.5
40	0.5	0.55	6	Veg	4	0
41	0.7	3.42	6	OHV	1	2
42	0.6	1.69	6	Wood	5	8
November – 2008						
43	0.8	0.03	8	Riprap	2	0

Number	Depth (ft)	MCV (ft/sec)	Substrate	Cover	Cover code	Dist to Cov
44	1.7	0.68	8	Riprap	2	2
45	1.3	0.14	8	Riprap	2	2
46	0.8	0.18	8	Riprap	2	1
47	2.1	0.29	8	Riprap	2	2
48	0.85	0.2	6	Rock	3	1
49	0.6	1.22	5	OHV	1	0.5
50	0.4	0.65	5	OHV	1	0
51	1.3	0.45	5	OHV	1	1
52	0.6	0.32	6	OHV	1	0
53	2	1.18	5			
54	0.8	0.09	8	Riprap	2	1
55	1.5	1.62	5			
56	1	0.1	8	Riprap	2	1
57	1.6	0.37	8	Riprap	2	1
58	0.75	0.02	3	OHV	1	3
59	0.6	0.91	5	OHV	1	0.5
60	0.6	0	8	Riprap	2	1
61	2.1	0.22	8	OHV	1	2
62	1.6	0.41	8	OHV	1	1
63	2.4	0.67	5			
64	2.5	0.22	5			
65	1.9	1.25	5			
66	2	1.42	8			
67	1.3	0.51	8	Riprap	2	2
68	1.4	0.61	8	Riprap	2	1
69	1.7	0.42	8	Riprap	2	0.5
70	0.9	0.02	8	Riprap	2	1
71	1	0.3	8	Riprap	2	1
72	0.9	0.04	8	Riprap	2	0
73	0.7	0.76	5	OHV	1	1
74	0.5	0.27	5	OHV	1	1
75	1.2	0.67	5	Riprap	2	1
76	1	0.74	8	Riprap	2	2
77	1.1	0.45	8	Riprap	2	2
78	0.75	2.28	5			
79	0.7	1.04	5	Rock	3	1
80	0.7	0.03	5	Rock	3	1
81	1	0.84	6	Riprap	2	4
82	1.25	1	5			
83	1.4	1.54	5	OHV	1	3
84	0.45	2.4	5			
85	0.55	1.79	1			
86	0.65	0.84	5	Veg	4	3
87	1.4	0.97	5			
88	2.1	0.87	5			
89	2	1.32	5	Riprap	2	3
90	0.6	1.05	5			
91	1.2	1.3	5			
92	1.1	1.69	5	Riprap	2	3

Number	Depth (ft)	MCV (ft/sec)	Substrate	Cover	Cover code	Dist to Cov
93	1.4	1.93	5	Rock	3	3
94	1.3	2.16	5			
95	1.4	1.72	5			
96	0.6	1.54	5			
97	1	0.17	8	Riprap	2	1
98	0.1	0.05	5			
99	0.6	0.17	3	OHV	1	1
100	1	1.35	5	OHV	1	2
101	0.5	0.72	5	Wood	5	1
102	0.5	1.51	5			
103	1.2	1.09	5			
104	0.6	0.85	5	OHV	1	6
105	0.6	0.47	5	OHV	1	1
106	0.6	0.82	5	OHV	1	2
107	0.3	0.66	5	OHV	1	1
108	0.6	1.61	5			
109	1	1.67	5			
110	0.2	0.35	5	OHV	1	0
111	0.8	1.39	3	R/UC	5	0
112	1	2.05	5			
113	0.3	0.35	5	OHV	1	0
114	0.3	0.36	5	OHV	1	0
115	0.8	0.45	5	OHV	1	0
116	0.8	0.08	5	Wood	5	1
117	0.75	1.45	5			
118	0.6	0.3	5	Rock	3	4
119	1.1	1.79	5	Rock	3	3
120	1.2	1.53	6	Rock	3	1
121	0.7	2.1	5	OHV	1	6
122	0.6	0.96	5	OHV	1	1
123	0.6	2.41	5			
124	0.6	0.65	5			
125	0.2	0.2	5	OHV	1	0
126	0.2	0.45	5	OHV	1	1
127	0.9	1.26	5			
128	0.2	0.7	5	OHV	1	6
129	0.4	1.28	5	OHV	1	1
130	0.35	0.73	5	OHV	1	5
131	0.3	0.03	5	OHV	1	0
132	0.35	0.03	5	Rock	3	0.5
133	0.45	0.36	5	OHV	1	0
134	1.2	0.05	1	OHV	1	1
135	2.1	0.92	5	R/UC	5	6
136	1.85	0.68	5			
137	2.5	0.99	5	R/UC	5	4
138	1.3	0.99	5	R/UC	5	3
139	0.7	3.08	5			
140	0.85	2.52	5	Wood	5	6
141	1	2.34	5	OHV	1	4

Number	Depth (ft)	MCV (ft/sec)	Substrate	Cover	Cover code	Dist to Cov
142	1.8	0.08	5	Wood	5	1
143	0.9	0.03	8	RipRap	2	0
Min	0.1	0	1		1	0
Max	2.5	3.42	8		5	8
Diff	2.4	3.42	7		4	8
Mean	0.9	0.9	5.7		2.2	1.4

Table B-2 Captured O. mykiss measurements, November 2008 from McKay Creek

DATE	SITE	H2O_TEMP_C	Length (cm)	Weight (gm)	Condition factor	MARKS/CLIPS	PIT_TAG_ID	CONDITIONAL COMMENTS
22-Nov	PH56	9.3	23.1	120.3	0.98	None	3D9.1C2CDC372E	
	PH56	9.3	12.2	19.1	1.05	None	3D9.1C2CDC34D3	
	PH56	9.3	11.3	21.1	1.46	None	3D9.1C2CDB2FC8	
	PH56	9.3	20.9	117.1	1.28	None	3D9.1C2CDC37FB	
	PH56	9.3	11.4	17.1	1.15	None	3D9.1C2CDC3A15	
	PH56	9.3	23.5	145.1	1.12	None	3D9.1C2CDB315F	BS (Bird bites)
	PH56	9.3	12.5	24.1	1.23	None	3D9.1C2CDC1998	
	PH56	9.3	11.8	18.6	1.13	None	3D9.1C2CDB33D8	
	PH56	9.3	8.8	7.7	1.13	None	3D9.1C2CDB3264	
	PH56	9.3	9.7	10.5	1.15	None	3D9.1C2CDC3792	
	PH56	9.3	8.3	5.7	1.00	None	3D9.1C2CDC124B	
	PH56	9.3	11.7	14.0	0.87	None	3D9.1C2CC53AD8	
	PH56	9.3	19.4	77.5	1.06	None	3D9.1C2CDC3898	
	PH56	9.3	22.4	126.6	1.13	None	3D9.1C2CDC15E7	
	PH56	9.3	20.5	98.5	1.14	None	3D9.1C2CDC08FB	
	PH56	9.3	18.1	60.2	1.02	None	3D9.1C2CDC486B	
	PH56	9.3	13.5	23.4	0.95	None	3D9.1C2CDC2E7C	
	PH56	9.3	9.5	8.8	1.03	None	3D9.1C2CC53B5A	
	PH56	9.3	10.3	9.2	0.84	None	3D9.1C2CDBF844	
	PH56	9.3	9.7	8.0	0.88	None	3D9.1C2CDC0182	
	PH56	9.3	10.4	10.9	0.97	None	3D9.1C2CDC497D	
	PH56	9.3	8.5	5.9	0.96	None	3D9.1C2CDB4320	
	PH56	9.3	22.5	136.2	1.20	None	3D9.1C2CDC11A3	
	PH56	9.3	14.0	27.8	1.01	None	3D9.1C2CDC32CB	
	PH56	9.3	12.8	21.3	1.02	None	3D9.1C2CDC3004	
	PH56	9.3	25.5	176.0	1.06	None	3D9.1C2CDC399C	
	PH56	9.3	10.5	13.0	1.12	None	3D9.1C2CDC10DE	
	PH56	9.3	9.7	9.2	1.01	None	3D9.1C2CDC34AE	
	PH56	9.3	10.9	12.6	0.97	None	3D9.1C2CDB2F46	
	PH56	9.3	11.0	13.6	1.02	None	3D9.1C2CDB3242	
	PH56	9.3	11.4	15.1	1.02	None	3D9.1C2CC5328C	
	PH56	9.3	9.5	7.9	0.92	None	3D9.1C2CDC0AFD	
	PH56	9.3	9.9	9.4	0.97	None	3D9.1C2CDC10D6	
	PH56	9.3	9.1	8.4	1.11	None	3D9.1C2CC55076	
	PH56	9.3	8.6	5.9	0.93	None	3D9.1C2CDC0CAD	
	PH56	9.3	8.0	5.1	1.00	None	3D9.1C2CDC1612	
	PH56	9.3	7.7	5.4	1.18	None	3D9.1C2CDC175F	
	PH56	9.3	7.8	5.7	1.20	None	3D9.1C2CDC3215	
	PH56	9.3	11.1	13.9	1.02	None	3D9.1C2CDB2E65	
	PH56	9.3	9.2	9.5	1.22	None	3D9.1C2CDC18CF	
	PH56	9.3	9.2	8.5	1.09	None	3D9.1C2CDBFD43	
	PH56	9.3	10.1	10.1	0.98	None	3D9.1C2CDC3ADB	
	PH56	9.3	7.5	4.4	1.04	None	3D9.1C2CDC143E	
	PH56	9.3	8.7	6.9	1.05	None	3D9.1C2CDC1345	
	PH56	9.3	8.1	5.6	1.05	None	3D9.1C2CDC12CC	
	PH56	9.3	8.9	6.4	0.91	None	3D9.1C2CDBFE9F	
	PM28	9.9	22.4	109.5	0.97	None	3D9.1C2CDC1664	
	PM28	9.9	24.6	172.4	1.16	None	3D9.1C2CC582C6	

PM28	9.9	28.9	251.7	1.04	None	3D9.1C2CDC3382	
PM28	9.9	18.9	74.0	1.10	None	3D9.1C2CDC364D	
PM28	9.9	19.5	83.6	1.13	None	3D9.1C2C9DD532	RE (Recapture)
PM28	9.9	15.6	42.3	1.11	None	3D9.1C2CDC3217	
PM28	9.9	12.9	27.6	1.29	None	3D9.1C2CDC0F33	
PM28	9.9	9.3	9.2	1.14	None	3D9.1C2CDC2DB1	
PM28	9.9	10.8	12.2	0.97	None	3D9.1C2CC5525A	
PM28	9.9	11.4	14.5	0.98	None	3D9.1C2CDB32EA	
PM28	9.9	9.3	7.9	0.98	None	3D9.1C2CDC1681	
PM28	9.9	18.5	73.3	1.16	None	3D9.1C2CDBFC5A	
PM28	9.9	17.8	57.0	1.01	None	3D9.1C2CDC89C7	
PM28	9.9	13.3	26.0	1.11	None	3D9.1C2CDC1593	
PM28	9.9	11.0	13.1	0.98	None	3D9.1C2CDC0BBC	
PM28	9.9	11.0	14.5	1.09	None	3D9.1C2CDC10EF	
PM28	9.9	9.2	7.9	1.01	None	3D9.1C2CC5279E	
PM28	9.9	11.5	15.8	1.04	None	3D9.1C2CDC12CD	
PM28	9.9	11.4	11.3	0.76	None	3D9.1C2CDC1410	
PL21	8.1	25.1	167.9	1.06	None	3D9.1C2CDC47E6	
PL21	8.1	24.8	171.6	1.13	None	3D9.1C2CDC2CA0	
PL21	8.1	13.1	23.3	1.04	None	3D9.1C2CDB2F4B	
PL21	8.1	14.2	32.2	1.12	None	3D9.1C2CDC0B61	
PL21	8.1	15.8	43.4	1.10	None	3D9.1C2CDC0E6B	
PL21	8.1	14.3	33.5	1.15	None	3D9.1C2CDB41A2	
PL21	8.1	11.8	19.6	1.19	None	3D9.1C2CDB418F	
PL21	8.1	12.7	21.7	1.06	None	3D9.1C2CDB3E8C	
PL21	8.1	12.8	23.0	1.10	None	3D9.1C2CC53F27	
PL21	8.1	11.0	13.7	1.03	None	3D9.1C2CDB2F62	
PL21	8.1	13.6	26.4	1.05	None	3D9.1C2CDC09AC	
PL21	8.1	10.9	14.3	1.10	None	3D9.1C2CDC3078	
PL21	8.1	11.9	16.2	0.96	None	3D9.1C2CDC3102	
PL21	8.1	10.0	10.9	1.09	None	3D9.1C2CC590C8	
PL21	8.1	10.2	10.8	1.02	None	3D9.1C2CDC3B24	
PL21	8.1	9.2	8.1	1.04	None	3D9.1C2CDB4223	
PL21	8.1	27.4	221.4	1.08	None	3D9.1C2CDC11B7	BS (Bird bites)
PL21	8.1	25.7	193.1	1.14	None	3D9.1C2CDB3383	BS (Bird bites)
PL21	8.1	15.7	42.7	1.10	None	3D9.1C2CDC44C4	
PL21	8.1	11.0	10.9	0.82	None	3D9.1C2CDBFD0A	
PL21	8.1	25.8	218.3	1.27	None	3D9.1C2CDC11A8	
PL21	8.1	25.7	165.4	0.97	None	3D9.1C2CDC4431	BS (Bird bites)
PL21	8.1	20.3	91.7	1.10	None	3D9.1C2CDC12DD	
PL21	8.1	17.0	51.4	1.05	None	3D9.1C2CDC65CD	
PL21	8.1	13.4	26.4	1.10	None	3D9.1C2CDC3FCD	
PL21	8.1	12.5	22.5	1.15	None	3D9.1C2CDC11F0	
PL21	8.1	11.2	17.4	1.24	None	3D9.1C2CDC1005	
PL21	8.1	11.0	14.7	1.10	None	3D9.1C2CDC7B82	
PL21	8.1	11.6	18.5	1.19	None	3D9.1C2CDC1131	
PL21	8.1	21.5	106.0	1.07	None	3D9.1C2CDB319B	
PL21	8.1	19.8	74.2	0.96	None	3D9.1C2CDC196A	
PL2	8.6	26.3	225.1	1.24	None	3D9.1C2CC93212	
PL2	8.6	30.0	322.4	1.19	None	3D9.1C2CDC143B	

PL2	8.6	23.5	138.9	1.07	None	3D9.1C2CC5960E	
PL2	8.6	20.4	80.7	0.95	None	3D9.1C2CDB30DD	
PL2	8.6	16.8	54.5	1.15	None	3D9.1C2CDC43AE	1< (Descaled less than 10%)
PL2	8.6	15.3	39.8	1.11	None	3D9.1C2CDC342E	
PL2	8.6	13.0	22.4	1.02	None	3D9.1C2CDC884C	
PL2	8.6	15.3	35.6	0.99	None	3D9.1C2CDBFA22	
PL2	8.6	14.4	34.8	1.17	None	3D9.1C2CDC2D1A	
PL2	8.6	13.7	32.8	1.28	None	3D9.1C2CDC327F	
PL2	8.6	12.0	17.5	1.01	None	3D9.1C2CC55649	
PL2	8.6	12.4	21.6	1.13	None	3D9.1C2CDC0161	
PL2	8.6	13.3	26.1	1.11	None	3D9.1C2CDC2C95	
PL2	8.6	9.0	7.7	1.06	None	3D9.1C2CDB30A8	