An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin – 2009 Report



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INTRODUCTION

Fish habitat protection and restoration are both key components to managing and maintaining quality populations of stream-dwelling salmonids. A large-scale effort to restore and protect fish habitat is currently underway in the Upper Clark Fork River Basin (UCFRB). This effort was spearheaded by litigation between the State of Montana and the Atlantic Richfield Company (ARCO) regarding damages to the natural resources of the UCFRB caused by historic mining activities in the drainage. Recent developments in this litigation has led to a consent decree between the State of Montana and ARCO, which includes a substantial monetary settlement aimed at remediation and restoration of fisheries resources in the UCFRB.

While fish habitat restoration and protection are valuable tools for managing fish populations, these efforts need to be prioritized to ensure that they are: 1) focused in areas that will provide the most benefit to the target fisheries and 2) focused on addressing factors that currently limit fish populations. This is particularly true in the UCFRB, as a substantial amount of money will be available to complete habitat restoration and protection efforts in the future. A lack of prioritization of these efforts could lead to the use of a substantial amount of monetary resources without maximizing the protection and enhancement of target fish populations.

As part of its restoration planning process for the Clark Fork River restoration damage claim, the State of Montana considered alternatives involving restoration work on the tributaries that would best help the Clark Fork River fishery reach baseline conditions. Based on its evaluation of existing information on tributary fisheries, however, the State concluded that there was insufficient information to conduct such a prioritization. Thus in 2007, Montana Fish, Wildlife, and Parks began a phased tributary restoration prioritization effort. Through discussions of this effort, three goals were established for prioritizing tributaries to the Clark Fork River. These goals were to:

- 1) Restore the Clark Fork River fishery to levels similar to other area rivers.
- 2) Maintain and enhance viable native trout populations throughout the UCFRB
- 3) Replace lost angling opportunity in the Clark Fork River by enhancing tributary fisheries.

In order to complete a tributary prioritization, a fish distribution study needed to be completed in tributaries to the Upper Clark Fork River. This step was identified as critical, as the knowledge of what species are present, their relative abundance, and their distribution within these drainages, is all necessary information needed to begin prioritization. While fish distribution data existed for some tributaries in the Upper Clark Fork drainage, a substantial number of streams had not been previously sampled, or where data had been collected, it was quite dated.

In addition to fish distribution data, riparian and fish habitat assessment data were also collected as part of the phased tributary restoration prioritization effort. This data was

largely collected as a secondary effort in an attempt to document current habitat conditions at the sample locations, as well as to highlight potential habitat deficiencies at these sites. This effort however, was not aimed at identifying all potential impacts to riparian and fish habitat in the sample drainages, and was limited in its spatial scope (see methods).

This report represents an annual progress report for the third year's (2009) effort to collect fish distribution and riparian assessment data throughout the Upper Clark Fork drainage.

METHODS

Stream Selection

Streams chosen for sampling during this study were selected largely by size and presumed importance (or potential importance) to mainstem Clark Fork River trout recruitment. Larger tributaries and drainage networks were prioritized because these systems generally produce larger and greater numbers of fish, which in turn, increase potential trout recruitment to the Clark Fork River.

Another important factor considered during stream selection was the known or presumed presence of bull trout *Salvelinus confluentus* and/or westslope cutthroat trout *Oncorhynchus clarki lewisi* in a stream or watershed. Bull trout are listed as a Threatened Species under the Endangered Species Act, while westslope cutthroat trout are listed as a Species of Special Concern by the State of Montana, and as a Sensitive Species by the US Forest Service. Both are important indicator species of stream health, and westslope cutthroat trout provide a unique native species angling opportunity in the UCFRB.

Finally, drainages that appeared to have possible restoration potential based on available literature and discussions with other land management agencies (i.e. Forest Service) and watershed groups were also considered during the stream selection process.

Sample Reach Selection

Sample reaches were selected by examining topographic maps and aerial photographs of each selected stream in conjunction with reviewing recent data and literature that was available for each stream. Streams were stratified by multiple factors including channel type, gradient, and noticeable changes in riparian condition in an effort to describe the range of habitat conditions and, hopefully, fishery conditions present in each selected stream. Multiple reaches were generally delineated for each stream. Sample sites were also purposefully spaced longitudinally with enough distance between sites to reflect likely changes in species composition, as it was assumed that both habitat and the location of the section within the drainage likely would affect species composition.

Because many sample reaches were located on private land, cooperation by landowners was critical to gaining access to many sampling locations. Fortunately, a majority of land owners were willing to grant access for these sampling efforts. However, permission was denied by a few landowners, some of which owned relatively large portions of target drainages. In these situations, reaches that were relatively close in location (longitudinally) and maintained similar channel types and habitat were selected.

Fish Sampling

Electrofishing was used to sample fish at all sample sites. The focus of electrofishing was primarily to assess species composition and general abundance at a broad scale. For this reason, single-pass, catch-per-unit-effort (CPUE) electrofishing was used as the standard procedure. Single-pass surveys were able to be done quickly and provided information on species composition, size (and indirectly age structure), and a rough measure of abundance. Single-pass surveys did not however, provide a precise abundance estimate of fish in a given reach, and should not be viewed as such. To get an abundance estimate with an associated standard error, it is necessary to obtain a measure of capture efficiency using multiple-pass electrofishing techniques (i.e. depletion and mark-and-recapture). Due to time constraints, it was not possible to do this at all sample sites and the time saved by not conducting these estimates at every site allowed crews to complete more single-pass surveys in a greater number of streams and sample reaches. We did however, conduct multiple-pass mark-recapture estimates at a few sites. These population estimates were calculated using the partial log-likelihood algorithm provided by Montana Fish, Wildlife and Parks' FA+ fisheries analysis software.

For small streams (i.e. streams less than approximately 15' in width), a backpack electrofishing unit (Smith-Root LR-24) was used to sample fish in 100 m reaches. At these sites, a block net was placed at the lower end of the reach to increase capture efficiency. Electrofishing was completed in a downstream direction towards the block net, except at sites where high turbidity created poor visibility. In these instances, electrofishing was completed in an upstream direction. In larger streams (i.e. streams greater than approximately 15' in width), an electrofishing tote barge system (Smith-Root SR-6 w/ 2.5 GPP) was used for fish sampling. This system was more efficient at capturing fish due to its increased power output. Reaches where the tote barge system was used were significantly longer than the standard 100 m reaches sampled in smaller streams.

At each sample reach, all captured fish were identified to species, weighed, measured and released. Genetic samples were collected in drainages and sections suspected to contain pure westslope cutthroat trout. Genetic samples were also collected from suspected bull trout / brook trout *Salvelinus fontinalis* hybrids to confirm hybridization. All fish data were collected on standard Montana Fish, Wildlife & Parks (MFWP) electrofishing data sheets using MFWP species abbreviations. These abbreviations were also used in the tables presented in the results section of this report. Below is a key for interpreting these abbreviations.

WCT = westslope cutthroat trout BULL = bull trout LL = brown trout (Salmo trutta) RB = rainbow trout (Oncorhynchus mykiss) EB = brook trout MWF = mountain whitefish EBxBULL = brook trout / bull trout hybrid ONC = Oncorhynchus unidentified- used at sites with rainbow trout and westslope cutthroat trout or potential hybrids between these species. TRT = unidentified trout LN_SU= longnose sucker LN_DC= longnose dace

It is important to note that sampling fish in short, delineated reaches represents a snapshot in time and space. It is likely that species distribution and abundance may change in a sample reach given different conditions (i.e. flow conditions, season, etc). This is always a drawback of intensively sampling short reaches. However, this method also allowed fish sampling to be completed in multiple drainages during the field season rather than only a few.

Riparian Assessments

Riparian assessments were conducted at each delineated reach where fish sampling occurred. These assessments were completed to identify possible relationships between the observed riparian condition and the existing fishery, as well as help identify areas for potential restoration or protection. Riparian assessments were completed using a modified version of the USDA Natural Resources Conservation Service (NRCS) Montana Riparian Assessment Methodology (including the supplemental attributes). The methodology was modified to include a scored component that evaluated the relative condition of fish habitat in each survey reach largely based on available cover. A majority of the overall assessment survey consisted of a visual examination of stream and riparian character and condition. The only quantitative measurements collected at each site during these assessments were bankfull width and bankfull depth. All other portions of the assessment, including Rosgen channel type classification, were based on visual observations and estimates.

The NRCS Montana Riparian Assessment Methodology provides a rapid, qualitative evaluation of riparian condition by defining the stability and sustainability of current physical and ecological processes observed in a stream reach. It is not designed to give a quantitative or comprehensive analysis of these processes however. Specific habitat problems identified during these surveys may need to be further evaluated using more specific assessment techniques, which were not completed during these initial surveys. Additionally, due to time constraints, riparian assessments conducted during this sampling effort occurred only at fish sampling reaches, and not throughout the entirety of each watershed. Thus, it is doubtful that we observed all of the factors affecting riparian health in each stream basin sampled, and subsequently, it must be assumed that not all potential habitat restoration and protection projects were observed during these sampling efforts.

Water Temperature

Stream temperature was monitored in many (but not all) of the streams sampled. Temperature monitoring consisted of the deployment of one or more thermographs (ONSET Computer Corp, Model: HOBO Water Temp Pro V2) in the target drainages. In streams where only one thermograph was deployed, the thermographs were generally placed near the mouth of the stream. In streams where multiple thermographs were deployed, the thermographs were generally distributed throughout the watershed with one being deployed near the mouth. Thermographs were set to measure temperature every hour.

Data Summary

All data collected during these sampling efforts were summarized for each sampled stream reach and were organized by stream and drainage. Each sample section was identified by a river mile (RM) that marks the top of the survey site. River miles were measured beginning at the mouth of each stream and were obtained using a geographic information system (GIS).

Fishery data was summarized by species and included the number of fish captured at each site, catch-per-unit-effort (standardized to number of fish per 100m of channel), mean and range of fish lengths, and percent of species composition. A table displaying this information was created for each sampled stream. Additionally, length-frequency histograms were also produced for each sample reach when two or more fish of a given species were present in the reach. These data are provided as an appendix (Appendix A). Only trout species were considered in these data summary efforts although observations of others species were noted in the write-ups.

Riparian assessment data were separated into three distinct categories, which included geomorphology (NRCS Montana Riparian Assessment Methodology, questions 1-3 and 10), vegetation (NRCS Montana Riparian Assessment Methodology, questions 4-9), and fish habitat (MFWP Fish Habitat Assessment Worksheet, question 1). These categories were created to allow readers to better comprehend the results of the riparian assessment surveys and to better define habitat deficiencies at survey sites. Total scores from each category, as well as a total overall riparian assessment score, were summarized in tables created for each sample stream.

Water temperature data (where available) was summarized by the maximum daily temperature recorded at each site, as well as the number of days maximum daily temperature rose above 15° C and 20° C. Charts displaying mean and max daily temperature during the period of record are provided as an appendix (Appendix B).

RESULTS

Gold Creek Drainage

Gold Creek

Fish sampling (including riparian assessments) and temperature monitoring were conducted in Gold Creek in 2007 and 2008 (temperature monitoring only). Results of this survey work were summarized in *An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin* (2008) and *An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin* (2008) and *An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin: Phase II* (2009). In 2009, no additional fish sampling or riparian assessments were completed on Gold Creek. However, water temperature was again monitored.

In 2009, water temperature was monitored in Gold Creek from June 25 through October 19 at RM 0.1 and 5.7 (Figure 1; Appendix B). At RM 0.1, maximum daily water temperature exceeded 15°C on 67 days. On no days did maximum daily water temperature exceed 20°C. The maximum-recorded temperature at RM 0.1 was 19.1°C on August 11. At RM 5.7, maximum daily water temperature did not exceed 15°C during the entire 2009 sampling period. The maximum-recorded temperature at this site was 12.9°C on August 21.

Blum Creek

Blum Creek is a tributary to Gold Creek that drains for approximately 5 miles before reaching Gold Creek near RM 4.9. Connectivity between the two streams has not been evaluated. Landownership along Blum Creek is a mixture of private and public lands. The upper half of the watershed lies mostly on lands administered by the U.S. Forest Service, while the lower part of the drainage flows exclusively through private agricultural lands. The primary land use in the drainage is livestock grazing, although past timber harvest is also evident in the upper portion of the watershed. There are several irrigation diversions evident along the lower reaches of the stream.

Fish surveys were completed at two sites on Blum Creek in late September of 2009. The sites were located on U.S. Forest Service land at RM 2.6 and 4.6 (Table 1; Figure 1). The fish community at both locations was comprised entirely of westslope cutthroat trout. Fish density was similar at each of the sample locations, and fish of multiple age/size classes were present in each of the sections (Table 1; Appendix A). While fish tended to be larger at the upper sample section, fish at both sample sites were relatively small overall (Table 1). The largest fish captured during 2009 sampling was 159 mm in total length. This fish was likely an adult with a resident life history. Genetic sampling conducted in 1996 indicates that the westslope cutthroat trout population in Blum Creek is genetically pure.

Section	Species	Number	Fish per	Mean	Length	Species
Name		of Fish	100 m	Length	Range	Composition
		Captured	(CPUE)	(mm)	(mm)	(%)
RM 2.6	WCT	33	33.0	83	43-155	100
RM 4.6	WCT	43	43.0	109	57-159	100

Table 1. Electrofishing data collected at two sections of Blum Creek in 2009.

Riparian assessments were completed for both sites electrofished on Blum Creek in 2009. At RM 2.6, Blum Creek was classified as a Rosgen B channel type. The total riparian assessment score was 44 out of a potential score of 63 (70%) (Table 2). Riparian vegetation was comprised mainly of a spruce overstory and an alder understory. Woody plant density was fairly good, but plants were not continuous along the channel. Livestock use of the riparian area was apparent. Fish habitat in the surveyed reach was considered fair (score: 3 points out of a potential of 7; Table 2) and did not appear to be at its potential. Deep pools were lacking, and fine sediment accumulation was noticeable.

At RM 4.6, Blum Creek was situated in a narrow canyon and continued to exhibit qualities of a Rosgen B channel type. The total riparian assessment score was 42 out of a potential score of 63 (67%) (Table 2). Riparian vegetation was comprised mainly of a spruce and douglas fir overstory, and an alder understory. Woody shrub density was only fair and the area showed considerable use by livestock. In some areas of the survey reach, the channel appeared relatively entrenched, and bank trampling was evident in a number of locations. Fish habitat was considered fair (score: 3 points out of a potential of 7; Table 2) and was most limited by a lack of deep pools and high fine sediment accumulation.

Table 2. Kipana	Table 2. Ripartan assessment results for two sites surveyed on Brun Creek in 2007.						
Section	Geomorphology	Vegetation	Fish Habitat	Total Score			
RM 2.6	21/30 (70%)	20/26 (77%)	3/7 (43%)	44/63 (70%)			
RM 4.6	21/30 (70%)	18/26 (69%)	3/7 (43%)	42/63 (67%)			

Table 2. Riparian assessment results for two sites surveyed on Blum Creek in 2009.

Water temperature was not monitored in Blum Creek during 2009.



Figure 1. Map of the Clark Fork River drainage between Gold Creek and Garrison, MT showing sites of fish and temperature sampling conducted in 2009.

Warm Springs Creek Drainage (Near Garrison)

Warm Springs Creek

Fish sampling (including riparian assessments) was conducted on Warm Springs Creek in 2008. Results of this survey work were summarized in *An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin: Phase II* (2009). In 2009, no additional fish sampling or riparian assessments were completed on Warm Springs Creek. However, water temperature was monitored at one location from June 25 through October 19 (Appendix B). The thermograph was located near the mouth of the stream at RM 0.1 (Figure 1). Maximum daily water temperature at this site tended to be relatively warm exceeding 15 ° C on 92 days and 20 ° C on 42 of those days. The maximum-recorded temperature near the mouth of Warm Springs Creek was 23.4°C on July 22.

Willow Creek Drainage (Near Garrison)

Willow Creek

Willow Creek is a tributary to the Clark Fork River that drains for approximately 12 miles before reaching its terminus near Clark Fork RM 297.6. Connection to the Clark Fork has not been thoroughly evaluated, but is thought to be poor. It appears likely that the construction of the railroad near the confluence of the two streams reduced or eliminated connectivity. Land ownership along Willow Creek is a mixture of private and public lands. The lower five miles of the stream flows exclusively through private agricultural lands, while the upper portion of the watershed lies mostly on forested lands managed by the Montana State Prison and the U.S. Forest Service. The primary land use in the drainage is livestock grazing, although past timber harvest is evident throughout much of the upper watershed. Doney Lake, a 28-acre reservoir, is located on the stream at approximately RM 10.4.

Fish surveys were completed at two sites on Willow Creek in early September of 2009. The sites were located on land administered by the Montana State Prison and the U.S. Forest Service at RM 6.1 and 8.5 (Table 3; Figure 1). The fish community at both locations was comprised entirely of westslope cutthroat trout (Table 3). The largest fish captured during 2009 sampling was 199 mm in total length (Table 3; Appendix A). This fish was likely an adult with a resident life history. Genetic sampling conducted in 1996 indicates that the westslope cutthroat trout population in Willow Creek is genetically pure.

Section	Species	Number	Fish per	Mean	Length	Species
Name		of Fish	100 m	Length	Range	Composition
		Captured	(CPUE)	(mm)	(mm)	(%)
RM 6.1	WCT	4	4.0	136	119-164	100
RM 8.5	WCT	40	40.0	96	38-199	100

Table 3. Electrofishing data collected at two sections of Willow Creek in 2009.

Riparian assessments were completed for both sites electrofished on Willow Creek in 2009. At RM 6.1, the stream was classified as a Rosgen Bc channel type, but past channel manipulation in the area was obvious. Downstream of the survey section the stream had been ditched and straightened for a considerable distance. Within the survey reach, the total riparian assessment score was 34 out of a potential score of 64 (53%) (Table 4). The riparian area showed evidence of considerable livestock grazing pressure. Woody riparian vegetation was somewhat sparse and was comprised mainly of alder and aspen. Fish habitat in the surveyed reach was considered poor (score: 0 points out of a potential of 7; Table 4) and was not at its potential. Excessive fine sediment accumulation directly related to livestock presence in the riparian area was a primary factor affecting habitat quality.

At RM 8.5, Willow Creek was situated in a relatively narrow canyon and exhibited qualities of a Rosgen B channel type. The total riparian assessment score was 59 out of a potential score of 66 (89%) (Table 4). Riparian vegetation was comprised of a fairly dense spruce, lodgepole pine, and douglas fir overstory, and a sparse alder understory. The area showed a fair amount of use by livestock, and there were a number of cattle trail crossings within the survey reach. Fish habitat was considered good (score: 7 points out of a potential of 10; Table 4), but was somewhat limited by high fine sediment accumulation. Excessive sediment inputs reduced spawning habitat quality in the reach.

Tuble in Hiparian assessment results for two sites salveyed on which ereek in 2009.						
Section	Geomorphology	Vegetation	Fish Habitat	Total Score		
RM 6.1	17/30 (57%)	17/27 (63%)	0/7 (0%)	34/64 (53%)		
RM 8.5	27/30 (90%)	25/26 (96%)	7/10 (70%)	59/66 (89%)		

Table 4. Riparian assessment results for two sites surveyed on Willow Creek in 2009

Water temperature was not monitored in Willow Creek during 2009.

Rock Creek Drainage (Near Garrison)

Rock Creek

Rock Creek is a relatively large, direct tributary to the Clark Fork River that drains for approximately 18 miles before reaching the Clark Fork near RM 299.0. Connectivity between the two is good. Rock Creek Lake is located on the stream at RM 10.5. This 177-acre reservoir is surrounded entirely by private land and has no legal public access. Downstream of the lake, landownership along Rock Creek is dominated by private ownership, much of which is controlled by Rock Creek Cattle Company (RCCC). Upstream of the lake, much of the watershed lies within the Beaverhead-Deerlodge National Forest. Although much the Rock Creek drainage is relatively undeveloped, recent residential and recreational (i.e. private golf course) development has occurred along some of the lower reaches of the stream on lands owned by RCCC. Livestock grazing is relatively common throughout the drainage downstream of the lake, and some irrigated hay production is also present near the mouth of the stream. There are several sizeable irrigation diversions present on Rock Creek downstream of Rock Creek Lake, and Fish, Wildlife and Parks holds a water lease with a landowner near the mouth of the stream.

Fish surveys were completed at five sites on Rock Creek between late August and early October of 2009. The sites were located at RM 0.6, 1.6, 6.3, 9.7, and 12.6 (Table 5; Figure 1). Of the four sites that were situated downstream of Rock Creek Lake, three were on private land (RM 0.6, 1.6, and 9.7), and one was on land managed by the Montana State Prison (RM 6.3). The one site sampled upstream of the lake (RM 12.6) was situated on National Forest land. Brown trout dominated the trout community at all of the sites downstream of Rock Creek Lake, and fish density appeared to show an increasing upstream trend (Table 5). Multiple size classes of brown trout were present at all the sections, with fish ranging up to 441 mm in total length (Table 5; Appendix A).

At RM 0.6, trout were relatively uncommon with only 11 brown trout captured in the section. In contrast, mountain whitefish were found to be rather abundant, though most of the 96 individuals captured were juveniles. Also collected at RM 0.6 were a single longnose sucker and 33 slimy sculpin. At RM 1.6 and 6.3, brown trout density was similar at the two sites, with fish occurring in fair numbers at both (Table 5). In addition to brown trout, a single westslope cutthroat trout/rainbow trout hybrid was captured at RM 1.6, as were 21 mountain whitefish, a long nosed dace, and a number of slimy sculpin. At RM 6.3, the only fish captured other than brown trout were a single adult brook trout, and eight slimy sculpin. At RM 9.7, brown trout were relatively common and dominated the fish community at the site. The only other fish observed at this location were six brook trout and six longnose suckers.

The only sample site located upstream of Rock Creek Lake was at RM 12.6. Species composition at this site was in stark contrast to sites sampled below the lake. At this location, brook trout were very abundant and heavily dominated the fish community. Average fish size was relatively small with the largest fish captured being 227 mm in

total length (Table 5; Appendix A). Brown trout were absent at this location, and the only other fish captured in the survey reach was a single westslope cutthroat trout/rainbow trout hybrid.

Tuble 5. Lie	Tuble 5: Electronishing data concetted at tive sections of Rock Creek in 2007.						
Section	Species	Number	Fish per	Mean	Length	Species	
Name		of Fish	100 m	Length	Range	Composition	
		Captured	(CPUE)	(mm)	(mm)	(%)	
RM 0.6	LL	11	11.0	264	70-441	100	
RM 1.6	WCTxRB	1	1.0	222	222	4	
	LL	26	26.0	195	72-374	96	
RM 6.3	LL	31	31.0	145	61-263	97	
	EB	1	1.0	174	174	3	
RM 9.7	LL	55	55.0	191	52-305	90	
	EB	6	6.0	97	54-174	10	
RM 12.6	WCTxRB	1	1.0	192	192	1	
	EB	122	122.0	141	72-227	99	

Table 5. Electrofishing data collected at five sections of Rock Creek in 2009.

Riparian assessments were completed for three of the five sites surveyed on Rock Creek in 2009. Riparian assessments were not completed at RM 0.6 or 1.6. These sites were within a reach of the stream that had undergone restoration to create and increase available instream fish habitat around 2000. In this reach of the stream, Rock Creek was characteristic of a Rosgen Bc channel type. Riparian vegetation was dominated by mature cottonwood trees with sparse juniper and other shrubs also present along the stream banks. Livestock grazing was evident throughout the area. Fish habitat was generally thought to be good, and was near its potential given the high gradient nature of the stream channel.

At RM 6.3, Rock Creek was classified as a Rosgen Bc stream type. The total riparian assessment score was 53 out of a potential score of 68 (78%) (Table 6). Riparian vegetation consisted of an overstory dominated by mature cottonwood trees, and an understory comprised largely of alder, willow, and chokecherry. Moderate to heavy livestock grazing pressure was evident throughout the area. Disturbance induced vegetation dominated openings in the woody canopy, and bank erosion was present where woody vegetation was lacking. Fish habitat was rated as good (score: 7 points out of a potential of 10; Table 6), but was somewhat limited by heavy livestock use of the riparian area.

At RM 9.7, Rock Creek was situated in a relatively narrow, high-gradient canyon. The stream exhibited characteristics of a Rosgen B channel type. The riparian area was in good condition and the total riparian assessment score was 68 out of a potential score of 68 (100%) (Table 6). Woody vegetation was comprised of a conifer dominated overstory,

and an understory made up largely of alder and dogwood. Fish habitat was thought to be excellent (score: 10 points out of a potential of 10; Table 6), and was likely at its potential.

At RM 12.6, Rock Creek was classified as a Rosgen Bc stream type. The survey reach was situated in a low-gradient, meadow-like area. Downstream of the survey reach, gradient was much higher and cascades and small waterfalls were common. The total riparian assessment score in the survey reach was 70 out of a potential score of 70 (100%) (Table 6). Riparian vegetation was dominated by willows, with lodgepole pine and spruce trees also in the area. Fish habitat was thought to be excellent (score: 10 points out of a potential of 10; Table 6), and was likely at its potential.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 0.6	n/a	n/a	n/a	n/a
RM 1.6	n/a	n/a	n/a	n/a
RM 6.3	27/30 (90%)	19/28 (68%)	7/10 (70%)	53/68 (78%)
RM 9.7	30/30 (100%)	28/28 (100%)	10/10 (100%)	68/68 (100%)
RM 12.6	30/30 (100%)	30/30 (100%)	10/10 (100%)	70/70 (100%)

Table 6. Riparian assessment results for sites surveyed on Rock Creek in 2009.

Water temperature was monitored at one location on Rock Creek from June 25 through October 19, 2009 (Appendix B). The thermograph was located near the mouth of the stream at RM 0.0 (Figure 1). Maximum daily water temperature at this site exceeded 15°C on 70 days, but on no days did it exceed 20°C. The maximum-recorded temperature near the mouth of Rock Creek was 19.3°C on July 22.

Little Blackfoot River Drainage

Little Blackfoot River

Fish sampling (including riparian assessments) and temperature monitoring were conducted at a number of sites in the Little Blackfoot River during 2007 and 2008. Results of this survey work were summarized in *An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin* (2008) and *An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin* (2008) and *An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin* (2008) and *An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin: Phase II* (2009). In 2009, three sites first electrofished in 2007 were resurveyed, and thermographs were again deployed at five locations along the stream (Figure 2). Sites that were sampled included those at RM 9.6, 21.3, and 31.1. Riparian assessments were not completed at the re-sampled locations since physical characteristics of the sites had not changed appreciably from 2007.

At RM 9.6, brown trout continued to dominate the trout community in the survey reach (Table 7). Fish density and size was similar to what was found during 2007 sampling. A mark-recapture population estimate conducted in 2009 showed that there were approximately 637 (+/- 57: 95% confidence interval) brown trout greater than 150 mm in total length per kilometer at this location (2007 = 654/km). Fish varied in size from young of the year to adults as large as 471 mm (Table 7; Appendix A). The most notable change observed in the reach from 2007 to 2009 was the appearance of westslope cutthroat trout. In 2007 no westslope cutthroat trout were detected during the sampling effort. In 2009, the species was present throughout the reach yet only comprised 2% of the trout composition (Table 7). The 2009 mark-recapture population estimate (Modified Peterson estimate) for fish greater than 150 mm in total length was nine per kilometer. Those that were captured were adults and sub-adults. No young-of-the-year westslope cutthroat trout were observed.

At RM 21.3, brown trout continued to comprise the bulk of the trout in the reach (Table 7). A mark-recapture population estimate showed that there were approximately 918 (+/-83: 95% confidence interval) brown trout greater than 150 mm in total length per kilometer at this location. This was noticeably higher than the 2007 estimate, which was 664 per kilometer for the same size group. Average fish size (Table 7; Appendix A) was similar to what was observed in 2007. The 2009 mark-recapture population estimate (Modified Peterson estimate) for westslope cutthroat trout greater than 150 mm in total length was 25 per kilometer. Abundance was up slightly over 2007 when the estimate for the same size group was 10 per kilometer. Westslope cutthroat trout captured in the reach in 2009 were all adults and sub-adults. Similar to RM 9.6, no young-of-the-year cutthroat trout were observed. Brook trout continued to be present at low densities at RM 21.3, but no abundance estimate was generated for this species due to low capture efficiency.

At RM 31.1, westslope cutthroat trout became most abundant trout species in the reach (Table 7). This shift in species composition was also noted in 2007. Average fish size tended to be smaller than what was found at downstream reaches, and the presence of young-of-the-year westslope cutthroat trout suggests that the reach is likely used for

spawning by adult fish (Table 7; Appendix A). Brown trout were still relatively common in this segment of the stream, but were far less dense than at downstream reaches where the species dominates the trout community. Average fish size tended to be slightly smaller as well (Table 7; Appendix A). Brook trout were also present at RM 31.1, but like in 2007, only represented a relatively small proportion of the trout captured in the reach (Table 7).

Section Name	Species	Number of Fish	Fish per 100 m	Mean Length	Length Range	Species Composition
		Captured	(CPUE)	(mm)	(mm)	(%)
RM 9.6	WCT	7	0.6	254	222-303	2
	LL	418	34.8	239	65-471	98
RM 21.3	WCT	10	1.0	273	203-322	2
	LL	550	55.0	211	71-409	97
	EB	7	0.7	163	87-210	1
RM 31.1	WCT	41	41.0	147	42-250	55
	LL	26	26.0	180	56-375	35
_	EB	8	8.0	136	70-216	11

Table 7. Electrofishing data collected at three sections of the Little Blackfoot River in 2009.

Water temperature was monitored at five locations along the Little Blackfoot River between June 25 and October 19, 2009 (Appendix B). The monitoring sites were at the same locations as 2008 and were located at RM 0.5, 9.3, 21.3, 31.0, and 39.7 (Figure 2). At RM 0.5, maximum daily water temperature exceeded 15°C on 91 days, including 19 days in which it exceeded 20°C. The maximum-recorded temperature at this site was 21.1°C on July 22. At RM 9.3, maximum daily temperature exceeded 15°C on 80 days including 2 days in which it exceeded 20°C. The maximum-recorded temperature was 20.1°C on July 22. At RM 21.3, maximum daily temperature exceeded 15°C on 67 days, but did not exceed 20°C on any days. Maximum-recorded temperature at this site was 19.8°C on July 22. Further upstream at RM 31.0, daily high temperature exceeded 15°C on 50 days, but on no days did temperatures rise above 20°C. The maximum daily temperature at this site was 18.4°C recorded on July 22. At RM 34.8, the most upstream site, temperature was notably cooler than all downstream sites. The maximum-recorded temperature at this site was 15.5°C on July 22. Daily highs at RM 34.8 exceeded 15°C on only 5 days.



Figure 2. Map of the Clark Fork River drainage between Garrison and Deer Lodge, MT showing sites of fish and temperature sampling conducted in 2009.

O'Neill Creek Drainage

O'Neill Creek

O'Neill Creek is a small direct tributary to the Clark Fork River that drains for approximately 5 miles before entering the Clark Fork near RM 305.7. Connectivity between the two streams is seasonal in most years, with the lower reaches appearing to support flow only during spring runoff. Landownership along the stream was largely comprised of private land until fall 2010 when much of the land in the upper portion of the watershed was purchased by Fish, Wildlife and Parks as part of the Spotted Dog Wildlife Management Area acquisition. The primary land use in the watershed is livestock grazing.

A fish survey was completed at one 100 m section on O'Neill Creek in 2009. The site was located on private land at RM 1.5 (Table 8; Figure 2). Additional spot electrofishing was conducted just downstream of the selected site to check species composition below a road crossing where the current culvert provides only marginal upstream passage. The fish community at all sampled locations was comprised entirely of westslope cutthroat trout. In the section, fish density was relatively high considering the small size of the stream and limited available habitat. Most of the fish were fairly small with many being young-of-the-year. Multiple age classes were present however, and several fish were large enough to be resident adults (> 150 mm total length; Appendix A). Genetic sampling conducted in 2009 indicates that the westslope cutthroat trout population in O'Neill Creek is genetically pure.

Tuelle 0. Elle	ruble of Electronishing unu concercu ut one section of o ritem creek in 2009.					
Section	Species	Number	Fish per	Mean	Length	Species
Name		of Fish	100 m	Length	Range	Composition
		Captured	(CPUE)	(mm)	(mm)	(%)
RM 1.5	WCT	40*	40.0*	98.2*	35-238	100

Table 8. Electrofishing data collected at one section of O'Neill Creek in 2009.

* 71 additional young-of-the-year westslope cutthroat trout were counted in the section at RM 1.5 but were not captured or measured for fear of excessive mortality.

A riparian assessment was completed at the one site electrofished on O'Neill Creek in 2009. At RM 1.5, the total riparian assessment score was 48 out of a potential score of 67 (72%) (Table 9). The channel displayed characteristics of a Rosgen B channel type. However, the stream was entrenched in several areas, and there was a fair amount of bank erosion on the many high, vertical banks in the survey reach. Riparian vegetation was dominated by mature cottonwood trees, as well as dogwood, wild rose, willow and juniper. Noxious weeds (primarily spotted knapweed and Canada thistle) were rather common throughout the stream bottom. Fish habitat was rated only fair (score: 3 points out of a potential of 7; Table 9), and was most limited by low flows and high fine sediment accumulation. No active irrigation diversions were noted above the survey section (although several historic ditches and head gates were observed in the area), and it is likely that flow is naturally low in this stream during periods of drought.

Table 9. Riparian assessment results for one site surveyed on O'Neill Creek in 2009.

1			2	
Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 1.5	23/30 (77%)	22/30 (73%)	3/7 (43%)	48/67 (72%)

Water temperature was not monitored in O'Neill Creek during 2009.

Cottonwood Creek Drainage

Cottonwood Creek

Fish sampling (including riparian assessments) and temperature monitoring were conducted on Cottonwood Creek in 2007 and 2008 (temperature monitoring only). Results of this survey work were summarized in *An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin* (2008) and *An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin* (2008) and *An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin* (2008) and *An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin*: *Phase II* (2009). In 2009, no additional fish sampling or riparian assessments were completed on Cottonwood Creek. However, water temperature was again monitored at RM 0.3 from July 1 through October 19, 2009 (Figure 2; Appendix B). At this location, maximum daily water temperature exceeded 15°C on 82 days, including 35 days in which it exceeded 20°C. The maximum-recorded temperature was 23.3°C on July 22.

Taylor Creek Drainage

Taylor Creek

Taylor Creek is a small direct tributary to the Clark Fork River that drains for approximately 8 miles before reaching the Clark Fork near RM 314.2. Connectivity between the two streams appears fair. Landownership along the stream is comprised largely of private ownership in the lower reaches, with the upper reaches mostly on lands administered by the Montana State Prison. The primary land use in the watershed is livestock grazing, with residential development and urbanization also being common near the mouth. Taylor Creek is used extensively for irrigation in its lower reaches, and past channel manipulation in some areas is apparent. There are two reservoirs situated on the stream, one at RM 4.4 (Lower Taylor Reservoir; 3.7 acres), and the other at RM 4.9 (Upper Taylor Reservoir; 12.5 acres).

Fish surveys were completed at four locations on Taylor Creek in 2009. All of the sites were located on Montana State Prison administered land and were at RM 3.0, 5.3, 6.8, and 8.0 (Table 10; Figure 2). At the lower two sites, the fish community was comprised entirely of brook trout. At the lowest site (RM 3.0), brook trout were relatively common,

but average size was small at just 113 mm (Table 10; Appendix A). At RM 5.3, above upper Taylor Reservoir, brook trout were present but appeared to occur at very low densities (Table 10). Farther upstream at RM 6.8 and 8.0, westslope cutthroat trout were the only species captured in Taylor Creek. Fish tended to occur in low densities at both sites, and most of the fish captured were large enough to be resident adults (i.e. > 150 mm in total length) (Appendix A). Very few juvenile fish were observed, which suggests recruitment may be limited in this stream. Genetic sampling conducted in 2009 indicates that the westslope cutthroat trout population in upper Taylor Creek is genetically pure.

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Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
			()	()	()	(,.,)
RM 3.0	EB	55	55.0	113	45-240	100
RM 5 3	FB	5	5.0	165	65-221	100
R (1 5.5		5	5.0	105	05 221	100
	MOT	0	0.0	1	75 010	100
RM 6.8	WCI	9	9.0	157	/5-210	100
RM 8.0	WCT	1	1.0	185	185	100

Table 10. Electrofishing da	a collected at four sections of	f Taylor Creek in 2009.

Riparian assessments were completed at most of the sites electrofished on Taylor Creek in 2009. At RM 3.0, the stream was situated in an irrigated pasture. The total riparian assessment score was 43 out of a potential score of 67 (64%) (Table 11). The channel displayed Rosgen E-like tendencies, but past downcutting and active, lateral bank erosion was evident throughout the survey reach. Livestock use of the riparian area was notable, and most of the channel degradation could be attributed to this land use. Woody riparian vegetation was comprised mainly of willows, with some alder and aspen also present in the area. Mature willows were relatively common, but younger age classes were not very abundant. Additionally, there were numerous disturbance induced openings throughout the woody canopy. Fish habitat was rated only fair (score: 3 points out of a potential of 7; Table 11), and was most limited by excessive fine sediment accumulation.

At RM 5.3, Taylor Creek was situated just above Upper Taylor Reservoir. The total riparian assessment score was 48 out of a potential score of 63 (76%) (Table 11). The stream was classified as a Rosgen B channel type with some doubt. Within the survey reach, the channel was marginally incised and bank erosion was present on several outside banks lacking deep rooted vegetation. Also, there was evidence of past cattle hoofshear along the banks. Woody riparian vegetation was comprised largely of willow and alder, with the woody canopy somewhat discontinuous along the channel. Fish habitat was thought to be poor (score: 0 points out of a potential of 3; Table 11), but was not likely too far from its potential. Habitat was mostly limited by high fine sediment accumulation and low stream flows. Spawning habitat appeared limited and site specific.

At RM 6.8, Taylor Creek had transitioned out of an expansive, barren pasture-land and was situated in a conifer and aspen dominated draw at the foothills of the Flint Mountain Range. The stream was classified as a Rosgen B channel type, and the total riparian assessment score was 48 out of a potential score of 65 (74%) (Table 11). The channel was entrenched in many areas, but no evidence of active downcutting was noted. Livestock presence in the area was considerable, and areas of bank trampling and moderately browsed shrubs were observed. Fish habitat was rated only fair (score: 3 points out of a potential of 7; Table 11) throughout the survey reach, and was most limited by high fine sediment accumulation.

Table 11. Kipal	ian assessment result	s for sites surveye	cu oli Taylol Cleek	. III 2009.	
Section	Geomorphology	Vegetation	Fish Habitat	Total Score	
RM 3.0	21/30 (70%)	19/30 (63%)	3/7 (43%)	43/67 (64%)	
RM 5.3	23/30 (77%)	25/30 (83%)	0/3 (0%)	48/63 (76%)	
RM 6.8	23/30 (77%)	22/28 (79%)	3/7 (43%)	48/65 (74%)	
	· · · · · · · · · · · · · · · · · · ·	× ,	~ /	~ /	
RM 8.0	n/a	n/a	n/a	n/a	
					•

Table 11. Riparian assessment results for sites surveyed on Taylor Creek in 2009.

Water temperature was not monitored in Taylor Creek during 2009.

La Marche Creek

La Marche Creek is a small tributary to Taylor Creek that drains for approximately 4 miles before reaching Taylor Creek near RM 5.6. Connectivity between the two streams appears marginal, and may be seasonal at best. Landownership along the stream is comprised mostly of lands administered by the Montana State Prison as well as the U.S. Forest Service. The primary land uses in the watershed are livestock grazing and timber harvest.

Fish surveys were completed at two sites on La Marche Creek in 2009. Both sites were located on Montana State Prison administered land and were at RM 2.1 and 2.9 (Table 12; Figure 2). The fish community at both sites was comprised entirely of westslope cutthroat trout. Overall, fish density was relatively low despite multiple size classes of fish being present at each of the sites (Table 12; Appendix A). Genetic sampling conducted in 2009 indicates that the westslope cutthroat trout population in La Marche Creek is genetically pure.

1 doie 12. L	Table 12. Electronishing data concered at two sections of Ed Marche Creek in 2007.					
Section	Species	Number	Fish per	Mean	Length	Species
Name		of Fish	100 m	Length	Range	Composition
		Captured	(CPUE)	(mm)	(mm)	(%)
RM 2.1	WCT	16	16.0	137	82-203	100
RM 2.9	WCT	7	7.0	151	115-183	100

Table 12. Electrofishing data collected at two sections of La Marche Creek in 2009.

Riparian assessments were completed at both of the sites electrofished on La Marche Creek in 2009. At RM 2.1, La Marche Creek had transitioned out of an expansive, barren pasture-land and was situated in an aspen dominated draw at the foothills of the Flint Mountain Range. The stream was classified as a Rosgen B channel type, and the total riparian assessment score was 43 out of a potential score of 70 (61%) (Table 13). Some areas of the survey reach showed evidence of incisement, while other parts were still connected to the broader floodplain. It appeared that several debris accumulations in the channel were preventing several headcuts from occurring. Livestock use of the riparian area was quite heavy and bank trampling and browse pressure on palatable woody shrubs and trees was notable. Woody shrubs were patchy in some areas and absent in others. Downstream of the survey reach, La Marche Creek flowed for a considerable distance (~ 2 miles) with no woody shrubs along its banks. Fish habitat within the survey reach was rated fair at best (score: 3 points out of a potential of 10; Table 13), and was not at its potential. The main limiting factor was excessive fine sediment accumulation, which was primarily attributable to heavy use of the riparian area by livestock.

At RM 2.9, La Marche Creek was situated in a relatively narrow, conifer dominated canyon with some open, meadow-like areas also present along the channel. The stream continued to exhibit characteristics of a Rosgen B channel type, and the total riparian assessment score was 43 out of a potential score of 65 (66%) (Table 13). Within the survey reach, livestock presence in the riparian zone continued to be notable, and damage to streambanks from hoofshear was relatively common. Fish habitat was rated only fair (score: 3 points out of a potential of 7; Table 13), and was most limited by high fine sediment accumulation.

Table 15. Riparian assessment results for sites surveyed on La Marche Creek in 2007.						
Section	Geomorphology	Vegetation	Fish Habitat	Total Score		
RM 2.1	19/30 (63%)	21/30 (70%)	3/10 (30%)	43/70 (61%)		
RM 2.9	21/30 (70%)	19/28 (68%)	3/7 (43%)	43/65 (66%)		

Table 13. Riparian assessment results for sites surveyed on La Marche Creek in 2009.

Water temperature was not monitored in La Marche Creek during 2009.

Tin Cup Joe Creek Drainage

Tin Cup Joe Creek

Tin Cup Joe Creek is a direct tributary to the Clark Fork River that drains for approximately 14 miles before reaching the Clark Fork near RM 314.5. Connectivity between the two streams is marginal due to upstream water storage and diversion practices. A sizeable portion of the watershed lies on lands administered by the Montana State Prison, with private ownership largely confined to the lower two miles of the stream. The headwaters of Tin Cup Joe Creek are on lands managed by the U.S. Forest Service. The primary land uses in the watershed are irrigated hay production and livestock grazing. Timber harvest is also present in the upper extent of the watershed, and residential development and urbanization is common near the mouth. The stream flows through the middle of a golf course owned by Powell County near RM 2.0. Tin Cup Lake lies on the stream at RM 6.3. This 18-acre reservoir is operated by the Montana State Prison for irrigation storage.

Fish surveys were completed at five sites on Tin Cup Joe Creek in 2009. Most of the sites were located on land administered by the Montana State Prison. The uppermost site was the only sample location that was not. This site was situated on National Forest land. The sample locations were at RM 1.9, 3.4, 5.7, 7.2 and 9.2 (Table 14; Figure 2). The fish community at the lowest two sample sites (RM 1.9 & 3.4) was rather limited and was comprised primarily of brook trout (Table 14). At RM 1.9, two brown trout were also captured in the 50 m section. At RM 3.4, only small, juvenile brook trout were captured in the reach (Table 14; Appendix A). Further upstream at RM 5.7, brook trout became very abundant. Fish in this reach ranged in size from young-of-the-year to adults as large as 246 mm in total length (Table 14; Appendix A). The site at RM 7.2 was located upstream of Tin Cup Lake. At this sample location, brook trout continued to comprise much of the fish community, but westslope cutthroat trout were also present. Multiple size classes were observed for both species (Table 14; Appendix A). At the uppermost site sampled on Tin Cup Joe Creek in 2009, species composition had shifted to favor westslope cutthroat trout, which occurred in good densities throughout the reach. Brook trout were rare in the survey segment, and only comprised 5% of the fish captured (Table 14).

Section	Species	Number	Fish per 100	Mean	Length	Species
Name	Ĩ	of Fish	m	Length	Range	Composition
		Captured	(CPUE)	(mm)	(mm)	(%)
RM 1.9	LL	2	4.0	203	191-215	25
	EB	6	12.0	189	63-245	75
				- 0		
RM 3.4	EB	6	6.0	70	66-78	100
RM 5 7	FR	91	91.0	130	13-246	100
IXIVI 5.7	LD	71	91.0	150	73-270	100
RM 7.2	WCT	12	12.0	131	60-194	19
	EB	51	51.0	122	42-191	81
RM 9.2	WCT	63	63.0	120	50-195	95
	EB	3	3.0	155	132-187	5

Table 14. Electrofishing data collected at five sections of Tin Cup Joe Creek in 2009.

Riparian assessments were completed at most of the sites electrofished on Tin Cup Joe Creek in 2009. At RM 3.4, the stream was classified as a Rosgen B channel type. The total riparian assessment score was 44 out of a potential score of 67 (66%) (Table 15). The channel was slightly incised at this location, but appeared to be currently stable. Some minor bank erosion was noted on several outside bends lacking deep rooted, woody vegetation. Disturbance induced grasses were common throughout the riparian area, and

they appeared to limit woody plant recruitment. The woody plants that were present in the reach were comprised primarily of mature willows and alder. Fish habitat was rated only fair (score: 3 points out of a potential of 7; Table 15), and was most limited by low flows and fine sediment accumulation. It appeared likely that this reach may be dewatered completely during some periods of irrigation withdrawal. One, unscreened diversion was noted at the top of the sample section.

At RM 5.7, Tin Cup Joe Creek was classified as a Rosgen B channel type. Stream gradient was rather high and much of the habitat consisted of fast-water areas with small pocket pools. There were also several quality scour pools created from coarse woody debris present in the reach. The total riparian assessment score at RM 5.7 was 62 out of a potential score of 65 (95%) (Table 15). The stream was somewhat entrenched, but appeared very stable. The riparian area was rather lush and woody vegetation was comprised primarily of aspen and alder with a few mature cottonwood trees present as well. Fish habitat was rated good (score: 7 points out of a potential of 7; Table 15), and was likely at its potential.

At RM 7.2, Tin Cup Joe Creek was somewhat entrenched in a narrow draw. Despite this, the survey reach had several areas where the channel was braided and in some places, over-widened. Evidence of past mining activity was apparent in the area. The total riparian assessment score in the survey reach was 49 out of a potential score of 68 (72%) (Table 15). There was some bank erosion evident on segments of the stream frequented by livestock, and woody vegetation was typically lacking in these areas as well. Riparian vegetation was comprised of a diversity of trees (douglas fir, aspen, and cottonwood) and shrubs (willow, alder, and dogwood), but plant density was lacking throughout much of the survey reach. Fish habitat was rated good (score: 7 points out of a potential of 10; Table 15), but large woody debris was somewhat lacking in the reach. Additionally, sparse woody canopy cover offered only limited overhead cover.

At RM 9.2, Tin Cup Joe Creek was situated in a relatively narrow, conifer-dominated canyon. Similar to downstream survey sites, the channel continued to exhibit qualities of a Rosgen B stream type. The total riparian assessment score was 49 out of a potential score of 68 (72%) (Table 15). The riparian zone was in relatively good condition despite some evidence of past mining activity and current use of the area by livestock. Fish habitat was rated good (score: 7 points out of a potential of 10; Table 15), but large woody debris was lacking in the reach. Most of the available habitat consisted of small pocket pools.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score	
RM 3.4	23/30 (77%)	18/30 (60%)	3/7 (43%)	44/67 (66%)	
RM 5.7	30/30 (100%)	25/28 (89%)	7/7 (100%)	62/65 (95%)	
			- //		
RM 7.2	25/30 (83%)	17/28 (61%)	7/10 (70%)	49/68 (72%)	
	20/20 (1000)				
RM 9.2	30/30 (100%)	26/28 (93%)	7/10(70%)	63/68 (93%)	

Table 15. Riparian assessment results for sites surveyed on Tin Cup Joe Creek in 2009.

Water temperature was not monitored in Tin Cup Joe Creek during 2009.

Racetrack Creek Drainage

Racetrack Creek

Fish sampling (including riparian assessments) and temperature monitoring were conducted on Racetrack Creek in 2007. Results of this survey work were summarized in *An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin* (2008). In 2009, no additional fish sampling or riparian assessments were completed on Racetrack Creek. However, water temperature was monitored at two locations.

Water temperature was monitored in Racetrack Creek from July 1 through October 19, 2009 at RM 0.8 and 10.8 (Figure 3; Appendix B). At RM 0.8, maximum daily water temperature exceeded 15°C on 50 days. On no days did maximum daily water temperature exceed 20°C during 2009 monitoring. The maximum-recorded temperature at RM 0.8 was 17.9°C on July 24. At RM 10.8, maximum daily water temperature only exceeded 15°C on two days. The maximum-recorded temperature at this site was 15.1°C on July 22.



Figure 3. Map of Clark Fork River drainage between Deer Lodge and Warm Springs, MT showing sites of fish and temperature sampling conducted in 2009.

Lost Creek Drainage

Lost Creek

Fish sampling (including riparian assessments) and temperature monitoring were conducted on Lost Creek in 2008. Results of this survey work were summarized in *An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin: Phase II* (2009). In 2009, no additional fish sampling or riparian assessments were completed on Lost Creek. However, water temperature was again monitored at the same locations as 2008.

Water temperature was monitored at three sites on Lost Creek from July 1 through October 19, 2009 (Appendix B). The sites were located at RM 1.4, 10.3, and 16.2 (Figure 3). At RM 1.4, maximum daily temperature exceeded 15°C on 77 days, and 20°C on 25 of those days. The maximum-recorded temperature at this site was 23.8°C on July 22. At RM 10.3, water temperatures exceeded 15°C on 8 days, but on no days did they exceed 20°C. The maximum-recorded temperature at this site was 16.1°C on September 8. At RM 16.2, maximum daily water temperatures never exceeded 15°C. The maximum-recorded temperatures never exceeded 15°C.

Warm Springs Creek Drainage

Warm Springs Creek

Fish sampling (including riparian assessments) and temperature monitoring were conducted at a number of sites in Warm Springs Creek during 2007 and 2008. Results of this survey work were summarized in *An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin* (2008) and *An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin* (2008) and *An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin: Phase II* (2009). In 2009, no new electrofishing or riparian assessments were conducted. However, water temperature was again monitored at three locations in the stream.

Water temperature was monitored at three sites on Warm Springs Creek from June 27 through October 19, 2009 (Appendix B). The sites were located at RM 1.0, 13.2, and 21.4 (Figure 3). At RM 1.0, maximum daily temperature exceeded 15°C on 35 days. The maximum-recorded temperature at this site was 17.5°C on August 4. At RM 13.2, maximum daily temperatures did not exceeded 15°C in 2009. The maximum-recorded temperature at this site was 14.6°C, which occurred on July 19. At RM 21.4, water temperatures were similar to what was recorded at RM 13.2. Maximum daily temperatures at this site exceeded 15°C on only 2 days. The maximum-recorded temperature at RM 21.4 was 15.2°C, which occurred on July 19.

German Gulch Drainage

German Gulch

Fish sampling (including riparian assessments) was conducted on German Creek in 2008. Results of this survey work were summarized in *An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin: Phase II* (2009). In 2009, no additional fish sampling or riparian assessments were completed on German Gulch. However, water temperature was monitored.

An attempt was made to monitor water temperature at two sites on German Gulch from June 27 to October 19, 2009. The thermographs were located near the mouth at RM 0.2 and farther up in the drainage at RM 4.3 (Figure 4). Unfortunately the thermograph at RM 0.2 was vandalized and no data was recovered. At RM 4.3, maximum daily temperature never exceeded 15°C (Appendix B). The maximum-recorded temperature at this site was 12.0°C on August 4.



Figure 4. Map of the lower Silver Bow Creek drainage showing sites of fish and temperature sampling conducted in 2009.

Browns Gulch Drainage

Browns Gulch

Browns Gulch is a direct tributary to Silver Bow Creek that drains for approximately 18 miles before reaching Silver Bow Creek near the town of Ramsay. Browns Gulch is the largest tributary to Silver Bow Creek. Connectivity between the two streams is fairly good, but can be seasonally compromised by irrigation withdrawal in the lower reaches. Landownership along Browns Gulch is dominated by private ownership, although some public land is present in the very upper extent of the watershed (National Forest land). The primary land uses in the drainage are irrigated hay/pasture production and livestock grazing. There is also some timber harvest in the upper extent of the watershed. Irrigation diversions are common throughout the middle and lower reaches of the stream.

Fish surveys were completed at seven sites on Browns Gulch in 2009. The sites were located at RM 2.6, 5.3, 8.8, 11.6, 13.9, 15.4, and 16.5 (Table 16; Figure 4). The lower four sites were situated on private land, while the upper three sites were located on National Forest land. The trout community was dominated by brook trout at each of the sample locations, with fish density ranging from low (CPUE < 20) to very high (CPUE >80) depending on survey site (Table 16). Generally, brook trout occurred at lower densities in the lower half of the drainage, and were more abundant in the upper reaches of the stream. Multiple size classes were observed at each of the sample sites, and while most fish were relatively small, fish as large as 420 mm in total length were observed (Table 16; Appendix A). Westslope cutthroat trout were also found to be present in Browns Gulch during 2009 sampling, but the species tended to be rather rare, and was not observed at all sample sections (Table 16). Nevertheless, fish of several size classes were collected at all of the reaches where the species was found (Table 16; Appendix A). Limited genetic sampling conducted in the upper reaches of Browns Gulch in 2005 indicates that the westslope cutthroat trout population is genetically pure. Longnose sucker and slimy sculpin were the only other fish species observed in Browns Gulch during 2009 sampling. Both species appeared to be isolated to the lower half of the drainage, and neither was overly abundant at the three sample reaches where they were found (RM 2.6, 5.3, and 8.8).

Section	Species	Number	Fish per	Mean	Length	Species
Name		of Fish	100 m	Length	Range	Composition
		Captured	(CPUE)	(mm)	(mm)	(%)
RM 2.6	EB	24	24.0	180	77-312	100
RM 5.3	EB	19	19.0	153	80-287	100
RM 8.8	WCT	4	4.0	210	133-272	19
	EB	17	17.0	239	138-420	81
RM 11.6	WCT	2	2.0	188	120-256	3
	EB	58	58.0	131	38-237	97
RM 13.9	EB	29	29.0	130	83-191	100
RM 15.4	WCT	7	7.0	127	78-195	7
	EB	95	95.0	122	43-190	93
RM 16.5	WCT	6	12.0	56	39-110	22
	EB	21	42.0	117	78-172	78

Table 16. Electrofishing data collected at seven sections of Browns Gulch in 2009.

Riparian assessments were completed at most of the sites electrofished on Browns Gulch in 2009. At RM 2.6, the stream was situated in a large hay meadow where the channel was entrenched and there was a fair amount of lateral erosion evident. The stream appeared altered from a natural state and exhibited characteristics of both a Rosgen F and G stream type depending on location in the reach. The total riparian assessment score was 21 out of a potential score of 69 (30%) (Table 17). Riparian vegetation was comprised mainly of disturbance induced grasses, with woody shrubs being relatively sparse. Those that were present were primarily decadent willows. Use of the riparian area by livestock was notable. Fish habitat at RM 2.6 was rated only fair (score: 3 points out of a potential of 10; Table 17), and was limited by high fine sediment accumulation and an overall lack of woody shrubs along the streambanks. Channel substrate consisted mostly of sand and silt, and areas suitable for trout spawning were largely absent.

At RM 5.3, Browns Gulch was situated in a rather confined portion of the valley inbetween two rather large hay meadows. The total riparian assessment score for the survey section was 30 out of a potential score of 69 (43%) (Table 17). The stream continued to exhibit tendencies of a Rosgen F and G stream type. The channel was rather incised, and bank erosion was widespread. Additionally, bank damage as result of livestock hoofshear was also very apparent throughout the reach. Woody riparian vegetation was comprised of alder and willow, but plants were largely confined to the immediate banks of the stream, and plant density was somewhat patchy. Fish habitat at RM 5.3 was rated only fair (score: 3 points out of a potential of 10; Table 17), and was limited by high fine sediment accumulation and a lack of habitat complexity. Channel substrate was again comprised primarily of sand and silt, and areas suitable for trout spawning were absent. At RM 8.8, Browns Gulch was again flowing through a large hay meadow. The channel was relatively straight, and was also somewhat entrenched. The stream type was classified as a Rosgen G. The total riparian assessment score for the survey section was 39 out of a potential score of 69 (57%) (Table 17). Riparian vegetation was comprised mainly of disturbance induced grasses, with woody shrubs being relatively sparse and widely spaced along the channel. Those that were observed were primarily older willows and alder. Younger plants were present, but were not overly common. Fish habitat was rated good (score: 7 points out of a potential of 10; Table 17) at RM 8.8, but was limited by a lack of woody vegetation along the streambanks that would have increased shade and cover, as well as added to habitat complexity. Fine sediment accumulation was also notable in the reach, but was not as severe as at downstream reaches.

At RM 11.6, Browns Gulch was classified as a Rosgen Bc stream type. The stream was flowing through a small hay meadow where the channel was slightly entrenched. The total riparian assessment score for the survey section was 47 out of a potential score of 70 (67%) (Table 17). Willows dominated the woody riparian vegetation, but plants were limited to the immediate banks of the stream and were not continuous along the channel. Disturbance induced grasses were widely distributed throughout the riparian zone. Fish habitat was rated as good (score: 7 points out of a potential of 10; Table 17), but was limited by relatively high fine sediment accumulation. Spawning substrate suitable for trout was present throughout the reach, but it tended to be quite embedded.

At RM 13.9, Browns Gulch was confined in a narrow canyon and exhibited characteristics of a Rosgen B stream type. The total riparian assessment score in the survey reach was 60 out of a potential score of 67 (90%) (Table 17). Woody riparian vegetation was fairly continuous along the channel, and was comprised mostly of willow, alder, and lodgepole pine. Despite good quantities of woody plants in the riparian zone, there were several disturbance induced openings where grasses, forbs and weedy species dominated. There was a minor amount of bank erosion noted on several outside bends in these areas. Fish habitat at RM 13.9 was rated as good (score: 7 points out of a potential of 7; Table 17), and was likely near its potential.

At RM 16.5, Browns Gulch was again classified as a Rosgen B stream type. The channel was situated in a narrow canyon where lodgepole pine dominated the overstory vegetation. The total riparian assessment score in the survey section was 48 out of a potential score of 65 (74%) (Table 17). Woody shrubs were sparse along this segment of Browns Gulch, and grasses and forbs dominated bank vegetation. There was a minor amount of bank erosion evident in the reach, which was likely associated with livestock presence in the riparian area. Fish habitat at RM 16.5 was rated only fair (score: 3 points out of a potential of 7; Table 17), and was most limited by the lack of woody shrubs along the stream banks. An improved shrub community would have increased shade and overhead cover, as well as added to habitat complexity.

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Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 2.6	11/30 (37%)	7/29 (24%)	3/10 (30%)	21/69 (30%)
PM 5 3	11/30 (37%)	16/20 (55%)	3/10 (30%)	30/60 (13%)
KIVI J.J	11/30 (3770)	10/29 (3370)	3/10(30%)	30/09 (43%)
RM 8.8	17/30 (57%)	15/29 (52%)	7/10 (70%)	39/69 (57%)
DM 11 C	22/20 (770/)	17/20 (570/)	7/10(700/)	(77)
KWI 11.0	25/30(77%)	17/30(37%)	//10(/0%)	4///0(0/%)
RM 13.9	27/30 (90%)	26/30 (87%)	7/7 (100%)	60/67 (90%)
DM 16 5	27/20(0.00)	10/20 (640/)	2/7 (420/)	49/65(740/)
KIVI 10.3	27/30 (90%)	18/28 (64%)	3/1 (43%)	48/03 (74%)

Table 17. Riparian assessment results for sites surveyed on Browns Gulch in 2009.

Water temperature was monitored at three sites on Browns Gulch from June 27 through October 19, 2009 (Appendix B). The sites were located at RM 0.8, 7.0, and 13.9 (Figure 4). At RM 0.8, maximum daily temperature exceeded 15°C on 72 days, but 20°C on only one of those days. The maximum-recorded temperature at this site was 20.4°C on September 2. At RM 7.0, water temperature exceeded 15°C on 62 days, but on no days did it exceed 20°C. The maximum-recorded temperature at this site was 19.4°C on July 1. At RM 13.9, maximum daily water temperature exceeded 15°C on 14 days. The maximum-recorded temperature at this site was 19.4°C on July 1.

Hail Columbia Gulch

Hail Columbia Gulch is a direct tributary to Browns Gulch that drains for approximately 7 miles before reaching Browns Gulch near RM 7.6. Connectivity between the two streams appears relatively good. Landownership along Hail Columbia Gulch is dominated by private ownership, although some U.S. Forest Service land is present in the very upper extent of the watershed. The primary land uses in the drainage are irrigated hay/pasture production and livestock grazing. There is also some rural, residential development in parts of the drainage, as well as timber harvest in the upper extent. An unpaved road follows and encroaches on the stream for much of its length, and contributes sediment at a number of locations.

Fish surveys were completed at three sites on Hail Columbia Gulch in 2009. The sites were located at RM 0.7, 4.0, and 5.4 (Table 18; Figure 4). The lowest site was situated on private land, while the remaining two sites were located on National Forest land. The fish community was dominated by brook trout at all of the sample locations (Table 18). Brook trout of multiple size classes were found at each of the electrofishing sections, and fish ranged in size from young-of-the-year to adults as large as 264 mm in total length (Table 18; Appendix A). Only one westslope cutthroat trout was captured in Hail Columbia Gulch during 2009 sampling. This fish was found at RM 0.7 and was a 114 mm (total length) juvenile. Although no westslope cutthroat trout could be found in the upper reaches of Hail Columbia Gulch in 2009, sampling conducted by the U.S. Forest Service
in 1999 turned up several fish. Genetic results from these fish indicated that the fish were genetically pure at that time.

Section Name	Species	Number of Fish	Fish per 100 m	Mean Length	Length Range	Species Composition
		Captured	(CPUE)	(mm)	(mm)	(%)
RM 0.7	WCT	1	1.0	114	114	3
	EB	30	30.0	135	60-264	97
RM 4.0	EB	36	36.0	145	55-214	100
RM 5.4	EB	13	13.0	144	66-225	100

Table 18. Electrofishing data collected at three sections of Hail Columbia Gulch in 2009.

Riparian assessments were completed at all of the sites electrofished on Hail Columbia Gulch in 2009. At RM 0.7, the stream was flowing through the middle of a hay meadow. The channel was relatively incised throughout the survey reach, and active lateral erosion was also notable. The total riparian assessment score in the survey section was 22 out of a potential score of 67 (33%) (Table 19). Woody vegetation was absent from the stream banks, and the riparian area was dominated by disturbance-induced grasses. Fish habitat at RM 0.7 was rated only fair (score: 3 points out of a potential of 7; Table 19), and was most limited by high sediment accumulation and the lack of woody shrubs along the stream banks. An improved shrub community would have increased shade and overhead cover, as well as added to habitat complexity and bank stability.

At RM 4.0, Hail Columbia Gulch was situated in a more confined and higher gradient canyon reach. The stream was slightly entrenched and may have been historically placer mined given the large size of the substrate present in the reach. The channel exhibited qualities of a relatively stable Rosgen B stream-type, although minor bank erosion was noted in several locations. The total riparian assessment score in the survey section was 57 out of a potential score of 68 (84%) (Table 19). Woody riparian vegetation was common throughout the reach and was comprised of a mix of douglas fir, aspen, willow, alder and juniper. Fish habitat at RM 4.0 was rated good (score: 7 points out of a potential of 10; Table 19), but was somewhat limited by fine sediment accumulation in pools and spawning gravels.

At RM 5.4, Hail Columbia Gulch was transitioning out of a large meadow and was entering a more confined portion of the valley. The stream was classified as a Rosgen B stream-type, but it also exhibited E-channel tendencies in some areas. The total riparian assessment score in the survey section was 48 out of a potential score of 65 (74%) (Table 19). Woody riparian vegetation was comprised mostly of willows, with lodgepole pine also present on the edge of the riparian zone. Livestock use of the area was notable, and bank trampling and hummocking was common in several areas of the survey reach. Fish habitat was rated only fair (score: 3 points out of a potential of 7; Table 19), and was most limited by high sediment accumulation. Most of the pools present in the reach were filled with fine sediment, and spawning areas suitable for trout were sparse.

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Section	Geomorphology	Vegetation	Fish Habitat	Total Score	
RM 0.7	13/30 (43%)	6/30 (20%)	3/7 (43%)	22/67 (33%)	
RM 4.0	25/30 (83%)	25/28 (89%)	7/10 (70%)	57/68 (84%)	
RM 5.4	23/30 (77%)	22/28 (79%)	3/7 (43%)	48/65 (74%)	

Table 19. Riparian assessment results for sites surveyed on Hail Columbia Gulch in 2009.

Water temperature was not monitored in Hail Columbia Gulch during 2009.

Meadow Gulch

Meadow Gulch is a small tributary to Browns Gulch that drains for approximately 4 miles before reaching Browns Gulch near RM 8.9. Connectivity between the two streams appears fair. Landownership along Meadow Gulch is dominated by private land. The primary land uses in the drainage are irrigated hay/pasture production and livestock grazing. There is also some past timber harvest evident in the upper extent of the watershed.

A fish survey was completed at only one site on Meadow Gulch in 2009. The site was located on private land near the mouth at RM 0.5 (Table 20; Figure 4). Fish density was relatively low at this location, and the fish community was comprised of both brook trout as well as westslope cutthroat trout (Table 20). Brook trout comprised the bulk of the fish biomass in the section and ranged in size from small juveniles to adults as large as 211 mm in total length (Table 20; Appendix A). Only one westslope cutthroat trout was identified in the section, and this fish was 136 mm in total length, and was likely a sub-adult. Seven young-of-the-year trout were also collected at the site, which were unable to be identified to species. It is possible that these fish were westslope cutthroat trout given the size of the fish and the time of year when the section was sampled (late August). No genetic testing has been conducted on westslope cutthroat trout in Meadow Gulch.

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Section	Species	Number	Fish per	Mean	Length	Species
Name		of Fish	100 m	Length	Range	Composition
		Captured	(CPUE)	(mm)	(mm)	(%)
RM 0.5	WCT	1	1.0	136	136	7
	EB	7	7.0	141	78-211	47
	TRT	7	7.0	52	47-56	47

Table 20.	Electrofishing	data collected at	one section	of Meadow	Gulch in	2009
1 4010 20.	Lieeuonsinng	auta concetea at	one section	01 1110440 11	Outen m	2007

A riparian assessment was completed at the one site electrofished on Meadow Gulch in 2009. At this location, the stream was quite small and was flowing within a larger gully. The channel displayed characteristics of both a Rosgen B and E stream-type. The total riparian assessment score in the survey section was 24 out of a potential score of 54 (44%) (Table 21). Past channel incision was apparent, and active lateral erosion was

evident on several streambanks in the reach. Woody vegetation was relatively sparse along the channel, and was comprised primarily of a few willow and juniper plants. There was also some decadent aspen in the area. Much of the riparian vegetation was dominated by grazed grasses and weedy species. Evidence of livestock use of the riparian area was considerable. Fish habitat at RM 0.5 was rated poor (score: 0 points out of a potential of 3; Table 21), and was limited by low flow, high sediment accumulation, and a lack of woody shrubs along the channel. Much of the reach lacked cover and shade, and the few pools present in the reach were filled with fine sediment.

-1 α β α β β α β β β α	Table 21. Ripa	arian assessment r	esults for sites s	surveyed on Meadow	Gulch in 2009.
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Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 0.5	15/26 (58%)	9/25 (36%)	0/3 (0%)	24/54 (44%)

Water temperature was not monitored in Meadow Gulch during 2009.

Telegraph Gulch

Telegraph Gulch is a small tributary to Browns Gulch that drains for approximately 4 miles before reaching Browns Gulch near RM 10.6. Connectivity between the two streams appears fair. Landownership along Telegraph Gulch is dominated by private land. The primary land uses in the drainage are irrigated hay/pasture production and livestock grazing. There is also some past timber harvest evident in the upper extent of the watershed.

A fish survey was completed at one site on Telegraph Gulch in 2009. The site was located on U.S. Forest Service land at RM 1.6 (Table 22; Figure 4). The stream was very difficult to sample at this location as the channel was covered with thimbleberry and other shrubby vegetation. The electrofishing reach was approximately 200 m in length, but only about 50 m of channel was able to be accessed to sample. Nevertheless, fish density was low at this location, with brook trout comprising the bulk of the fish community in the reach. All of the brook trout captured were larger adults (Table 22; Appendix A). Only one westslope cutthroat trout was captured at the survey site, and similar to the brook trout that were collected, it appeared to be a resident adult (Table 22). No genetic testing has been conducted on westslope cutthroat trout in Telegraph Gulch.

Table 22. Electronshing data collected at one section of Telegraph Guich in 2009.						
Section	Species	Number	Fish per	Mean	Length	Species
Name		of Fish	100 m	Length	Range	Composition
		Captured	(CPUE)	(mm)	(mm)	(%)
RM 1.6	WCT	1	2.0	210	210	17
	EB	5	10.0	205	181-227	83

Table 22.	Electrofishing	data collected	at one section	of Telegraph	Gulch in 2009.
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A riparian assessment was completed at the one site electrofished on Telegraph Gulch in 2009. At this location, the stream was situated in a relatively confined portion of the valley, and was classified as a Rosgen B stream-type. The total riparian assessment score was 50 out of a potential score of 60 (83%) (Table 23). Within the survey reach, the channel was very small and was also relatively entrenched. Woody riparian vegetation, comprised primarily of willow and aspen, was fairly common throughout the area, but openings in the canopy tended to be dominated by disturbance induced grasses as well as a few noxious weeds. Downstream of the survey section, the stream flowed through rather extensive hay meadows were woody vegetation was less common or absent. Fish habitat at RM 1.6 was relatively poor (score: 0 points out of a potential of 0; Table 23), but was likely not far from potential. There were very few pools present in the sample reach, and none were very deep. Streamflow was naturally low in this part of Telegraph Gulch, and fine sediment accumulation was fairly high.

Table 23. Riparian assessment results for sites surveyed on Telegraph Gulch in 2009.

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Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 1.6	26/30 (87%)	24/30 (80%)	0/0 (0%)	50/60 (83%)

Water temperature was not monitored in Telegraph Gulch during 2009.

Flume Gulch

Flume Gulch is a direct tributary to Browns Gulch that drains for about 4 miles before reaching Browns Gulch near RM 11.7. Connectivity between the two streams appears relatively good. Landownership along Flume Gulch is a mixture of private and National Forest lands. The primary land uses in the drainage are irrigated hay/pasture production and livestock grazing. There is also some timber harvest and evidence of past mining activity in the upper portion of the watershed.

Fish surveys were completed at three sites on Flume Gulch in 2009. The sites were located at RM 0.3, 1.0, and 2.1 (Table 24; Figure 4). The lowest site was situated on private land, while the upper two sites were located on National Forest land. The fish community at all of the sample sites was comprised of both brook trout and westslope cutthroat trout, with brook trout tending to be the more abundant species. At RM 0.3, brook trout comprised over ³/₄ of the fish captured in the reach (Table 24). Fish ranged in size from young-of-the-year to adults as large as 227 mm in total length (Table 24; Appendix A). Overall, fish density was relatively good in this reach of Flume Gulch, and westslope cutthroat trout were most common in this part of the stream (Table 24). Although not overly abundant, westslope cutthroat trout of several size classes were observed in the section indicating that successful recruitment occurs fairly regularly (Table 24; Appendix A). Further upstream at RM 1.0, brook trout dominated the species composition in the sample reach. At this location, only three juvenile westslope cutthroat trout were collected during the sampling effort. Brook trout on the other hand, tended to be more common, and fish of multiple size classes were observed in the reach, similar to what was found at RM 0.3 (Table 24; Appendix A). At the uppermost sample site (RM 2.1), fish tended to be less abundant than at downstream reaches, and both westslope cutthroat trout and brook trout occurred in similar numbers. All of the fish in this sample reach were of larger, older size classes, with no young-of-the-year or small juveniles

observed for either species (Table 24; Appendix A). Genetic sampling conducted in 1999 and 2005 indicates that the westslope cutthroat trout population in Flume Gulch is genetically pure.

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Section	Species	Number	Fish per	Mean	Length	Species
Name		of Fish	100 m	Length	Range	Composition
		Captured	(CPUE)	(mm)	(mm)	(%)
RM 0.3	WCT	13	13.0	137	65-209	24
	EB	41	41.0	119	46-227	76
RM 1.0	WCT	3	3.0	65	61-68	9
	EB	29	29.0	121	46-177	91
RM 2.1	WCT	5	5.0	172	135-228	45
	EB	6	6.0	170	135-211	55

Table 24. Electrofishing data collected at three section of Flume Gulch in 2009.

Riparian assessments were completed at all of the sites electrofished on Flume Gulch in 2009. At RM 0.3, the stream was flowing through the middle of a small hay meadow where the channel exhibited qualities of a Rosgen B stream-type despite being somewhat incised. The total riparian assessment score in the survey section was 45 out of a potential score of 67 (67%) (Table 25). The riparian corridor was very narrow, and woody vegetation was restricted to the immediate banks of the stream. Willow and alder comprised the bulk of the woody community, but plant density was not continuous along the channel, and most of the plants present were relatively mature. Fish habitat at RM 0.3 was rated only fair (score: 3 points out of a potential of 7; Table 25), and was most limited by high fine sediment accumulation. Most of the pools present in the reach lacked significant depth, and quality spawning habitat was limited.

At RM 1.0, Flume Gulch was situated in a narrow canyon and continued to exhibit tendencies of a Rosgen B stream-type. The total riparian assessment score in the survey reach was 45 out of a potential score of 65 (69%) (Table 25). The riparian area showed substantial use by livestock, and several areas of bank erosion and bank trampling were noted throughout the reach. The riparian area was relatively simple, and was dominated by grazed grasses and sedges. Woody vegetation was relatively sparse throughout the reach, and was comprised mainly of a few mature willow, alder, and conifer trees. Younger shrubs were present, but most showed evidence of browse pressure. Fish habitat at RM 1.0 was rated only fair (score: 3 points out of a potential of 7; Table 25), and was most limited by high fine sediment accumulation, and the lack of a more significant woody shrub community along the stream banks. Most of the pools present in the reach lacked significant depth, and quality spawning habitat was sparse. An improved shrub community would have increased shade and overhead cover, as well as added to habitat complexity and bank stability.

At RM 2.1, Flume Gulch had transitioned out of a large, privately-owned meadow where woody shrubs were mostly absent. Within the meadow, the stream had been recently channelized (without permits) for over a mile, leaving it straightened, entrenched, and in an erosive state. The survey section was located immediately below the impacted area in a more confined portion of the canyon. Within this area, Flume Gulch exhibited qualities of a Rosgen B stream-type although the channel was in a relatively degraded condition. The total riparian assessment score in the survey section was 33 out of a potential score of 65 (51%) (Table 25). The channel was moderately entrenched in several locations, and there was also rather extensive livestock induced bank trampling and erosion throughout the area. Woody riparian vegetation was lacking throughout the survey reach, and was mostly comprised of a just a few willows. Beetle-killed lodgepole pine was common in the uplands near the stream, and future large woody debris recruitment looked promising. As mentioned above, livestock use of the area was rather heavy, and the vegetative community in the riparian area showed considerable disturbance. Fish habitat at RM 2.1 was rated poor (score: 0 points out of a potential of 7; Table 25), and was severely limited by high fine sediment accumulation, and the lack of woody shrubs along the stream banks. Additionally, flow was relatively low at the time of the survey in late July.

Table 25. Ripar	Table 25. Ripartan assessment results for sites surveyed on France Outen in 2007.							
Section	Geomorphology	Vegetation	Fish Habitat	Total Score				
RM 0.3	23/30 (77%)	19/30 (63%)	3/7 (43%)	45/67 (67%)				
RM 1.0	25/30 (83%)	17/28 (61%)	3/7 (43%)	45/65 (69%)				
RM 2.1	16/30 (53%)	17/28 (61%)	0/7 (0%)	33/65 (51%)				

Table 25. Riparian assessment results for sites surveyed on Flume Gulch in 2009.

Water temperature was not continuously monitored in Flume Gulch during 2009. However, longitudinal spot temperature measurements were made on July 30 (between 1300 and 1430 hours) at RM 0.3, 1.0, and 2.1. At these sites, water temperature was 10.9°C, 15.0°C, and 22.6°C, respectively. These measurements indicated a notable warming trend occurring in an upstream direction. This abnormal pattern was likely related to groundwater inflows in lower reaches of the stream (cooling water temperature), and riparian and stream disturbance in the upper extent of the watershed (warming water temperature).

Alaska Gulch

Alaska Gulch is a direct tributary to Browns Gulch that drains for a little over 4 miles before reaching Browns Gulch near RM 14.8. Connectivity between the two streams appears relatively good. Landownership along Alaska Gulch is a mixture of private and National Forest lands, with private ownership confined to the lower mile of the stream. The primary land use in the drainage is livestock grazing. There is also some evidence of past timber harvest throughout the upper portion of the watershed.

Fish surveys were completed at three sites on Alaska Gulch in 2009. The sites were located at RM 1.1, 2.5, and 3.8 (Table 26; Figure 4). The fish community throughout the stream was comprised of both brook trout and westslope cutthroat trout, with brook trout being the more common species. At RM 1.1, brook trout comprised over 80% of the fish community (Table 26). Fish ranged in size from small juveniles to adults as large as 180 mm in total length (Table 26; Appendix A). Westslope cutthroat trout were relatively uncommon in the reach, but fish of several size classes were observed suggesting at least some limited recruitment has occurred (Table 26; Appendix A). At RM 2.5, fish density was very low, and most of fish captured in this reach were brook trout that ranged in size from 81 mm to 176 mm in total length (Table 26; Appendix A). Only one small, juvenile westslope cutthroat trout was observed at this survey site in 2009 (Table 26). At RM 3.8, no fish were captured in the sample section. Downstream of the section, a perched culvert was noted, and spot electrofishing below this site turned up two larger brook trout and one sub-adult westslope cutthroat trout. It appears likely that the perched culvert is a complete barrier to upstream fish passage under most flow conditions. It should be noted however, that there does not appear to be a significant amount of quality habitat above this location for fish to utilize. Genetic sampling conducted in 2004 indicates that the westslope cutthroat trout population in Alaska Gulch is genetically pure.

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Section Name	Species	Number of Fish	Fish per 100 m	Mean Length	Length Range	Species Composition
		Captured	(CPUE)	(mm)	(mm)	(%)
RM 1.1	WCT	8	8.0	130	54-183	18
	EB	37	37.0	139	78-180	82
RM 2.5	WCT	1	1.0	51	51	10
	EB	9	9.0	135	81-176	90
RM 3.8	No Fish	-	-	-	-	_

Table 26. Electrofishing data collected at three sections of Alaska Gulch in 2009.

Riparian assessments were completed at all of the sites electrofished on Alaska Gulch in 2009. At RM 1.1, the stream was flowing through a small meadow area where the channel exhibited tendencies of a Rosgen Eb stream-type. The total riparian assessment score in the survey section was 53 out of a potential score of 68 (78%) (Table 27). The channel was fairly entrenched throughout the survey reach, but there was very little evidence of active erosion. The banks tended to be well vegetated with dense grasses that appeared to be stabilizing the banks effectively. Woody vegetation was relatively sparse at RM 1.1, and mostly consisted of lodgepole pine and a few decadent willows. It appeared that willows had likely been more abundant in the past. The area was within a U.S. Forest Service managed grazing allotment, but there was little evidence of active use since the allotment was being rested at the time the survey. Fish habitat in this reach of Alaska Gulch was rated good (score: 7 points out of a potential of 10; Table 27), but was somewhat limited by a lack of in-channel large woody debris, as well as by the absence of a more robust shrub community along the stream banks. Improvements in each would

have increased shade and overhead cover, as well as added to habitat complexity throughout the reach.

At RM 2.5, Alaska Gulch was flowing through a narrow, grassy valley-bottom bounded by mature lodgepole pine trees. Within the survey reach, the stream exhibited characteristics of a Rosgen B stream-type. The total riparian assessment score was 40 out of a potential score of 61 (66%) (Table 27). There were several areas in the reach where lateral bank erosion and bank damage created by livestock hoofshear was evident. Grasses, forbs and weedy species dominated riparian vegetation at the survey location, and the valley bottom showed evidence of heavy livestock grazing pressure from previous years. Woody shrubs were largely absent from the stream banks at RM 2.5, and it was unknown if they had been present historically. Fish habitat in this reach of Alaska Gulch was rated only fair (score: 3 points out of a potential of 7; Table 27), and was mostly limited by high fine sediment accumulation and a lack of quality pools and overhead cover.

At RM 3.8, Alaska Gulch continued to exhibit qualities of a Rosgen B stream-type. At this location, the stream was flowing through a forested canopy dominated by spruce trees. The total riparian assessment score was 56 out of a potential score of 61 (92%) (Table 27). The channel appeared to be in a stable state as no significant downcutting or lateral erosion was observed in the survey reach. Woody shrubs were relatively sparse along the channel, and those present were comprised mostly of alder. Fish habitat at RM 3.8 was rated only fair (score: 3 points out of a potential of 3; Table 27), but was likely at its potential. Small stream size and limited stream flow for much of the year likely limit habitat quality in this part of Alaska Gulch.

Tuble 27: Repartan assessment results for sites sarveyed on maska Gulen in 2009.						
Section	Geomorphology	Vegetation	Fish Habitat	Total Score		
RM 1.1	26/30 (87%)	20/28 (71%)	7/10 (70%)	53/68 (78%)		
RM 2.5	25/30 (83%)	12/24 (50%)	3/7 (43%)	40/61 (66%)		
RM 3.8	30/30 (100%)	23/28 (82%)	3/3 (100%)	56/61 (92%)		

Table 27. Riparian assessment results for sites surveyed on Alaska Gulch in 2009.

Water temperature was not monitored in Alaska Gulch during 2009.

American Gulch

American Gulch is a direct tributary to Browns Gulch that drains for approximately 3 miles before reaching Browns Gulch near RM 15.6. Connectivity between the two streams appears fair. Landownership along American Gulch is comprised entirely of public lands administered by the U.S. Forest Service. The primary land use in the drainage is livestock grazing, although evidence of timber harvest activities is also present throughout the watershed.

Fish surveys were completed at three sites on American Gulch in 2009. The sites were located at RM 0.4, 1.2, and 2.4 (Table 28; Figure 4). The fish community at RM 0.4 and 1.2 was relatively similar. At both sites, westslope cutthroat trout and brook trout were present, with brook trout being the more common species (Table 28). While multiple size classes of fish were observed for each species at each of the sites, it appears that juvenile brook trout between 80 and 90 mm in total length comprised a sizeable proportion of the total brook trout captured at each of the reaches (Table 28; Appendix A). Further upstream at RM 2.4, fish density was very low. No brook trout were observed at this location, and only five westslope cutthroat trout were collected in the section. The majority of these fish appeared to be sub-adults based on size (< 150 mm total length) (Table 28; Appendix A). Genetic sampling conducted in 2004 indicates that the westslope cutthroat trout population in American Gulch is genetically pure.

	0					
Section	Species	Number	Fish per	Mean	Length	Species
Name		of Fish	100 m	Length	Range	Composition
		Captured	(CPUE)	(mm)	(mm)	(%)
RM 0.4	WCT	6	6.0	79	32-140	16
	EB	31	31.0	89	63-151	84
RM 1.2	WCT	8	8.0	114	38-167	28
	EB	21	21.0	123	80-185	72
RM 2.4	WCT	5	5.0	134	115-172	100

Table 28. Electrofishing data collected at three sections of American Gulch in 2009.

Riparian assessments were completed at two of the sites electrofished on American Gulch in 2009. The sites for which these assessments were completed were RM 0.4 and 2.4. At RM 0.4, the stream was situated in a relatively open area bounded on the edges by lodgepole pine. Within the survey reach, American Gulch exhibited tendencies of a Rosgen Eb stream-type. The total riparian assessment score was 42 out of a potential score of 65 (65%) (Table 29). The channel was somewhat entrenched throughout much of the sample section, and active bank erosion was evident on several outside bends. Despite these signs of past and present instability, much of the reach appeared to be in a healing state. Woody riparian vegetation such as willows and alder were very sparse throughout the reach, but upland species such as shrubby cinquefoil were rather common. Additionally, a few disturbance induced plants and weedy species were also present in the riparian zone. The area was within a U.S. Forest Service grazing allotment, and the reach showed a fair amount of past use by livestock. Fish habitat at RM 0.4 was rated only fair (score: 3 points out of a potential of 7; Table 29), and was most limited by high fine sediment accumulation and the lack of woody shrubs along the stream banks. An improved shrub community would have increased shade and overhead cover, as well as added to habitat complexity and bank stability.

At RM 2.4, American Gulch was flowing through a grassy valley-bottom bounded by mature lodgepole pine trees. Within the survey reach, the stream exhibited characteristics of a Rosgen B stream-type. The total riparian assessment score was 52 out of a potential

score of 61 (85%) (Table 29). Riparian vegetation consisted primarily of grasses, sedges, and forbs. Woody plants such as alder and willow were relatively sparse along this reach of American Gulch, and the few plants that were present were rather decadent. Past use of the area by livestock was notable. Fish habitat at RM 2.4 was rated only fair (score: 3 points out of a potential of 3; Table 29), but was likely near its potential. The channel was very small at this location, and flow was rather limited.

Table 29. Repartan assessment results for sites surveyed on American Outen in 2009.					
Section	Geomorphology	Vegetation	Fish Habitat	Total Score	
RM 0.4	23/30 (77%)	16/28 (57%)	3/7 (43%)	42/65 (65%)	
RM 2.4	30/30 (100%)	19/28 (68%)	3/3 (100%)	52/61 (85%)	

Table 29. Riparian assessment results for sites surveyed on American Gulch in 2009.

Water temperature was not monitored in American Gulch during 2009.

Basin Creek Drainage

Basin Creek

Basin Creek is a headwater tributary of Silver Bow Creek that drains for approximately 16 miles before joining Blacktail Creek to form Silver Bow Creek within the city of Butte. Landownership along the stream is comprised primarily of private lands, although some National Forest lands are present in the very upper extent of the watershed. A fair amount of the private ownership in the lower extent of the drainage consists of parcels developed for residential (and commercial) use. Other areas along the stream are largely undeveloped and are currently used primarily for livestock grazing. Basin Creek flows through the middle of the Bert-Mooney Airport between RM 0.7 and 3.5, and the channel has been extensively modified in this area. Basin Creek Reservoir is located on the stream near RM 11.0 and has historically been managed by the city-county government of Butte-Silver Bow as a municipal water source. Because of this, access to the upper Basin Creek watershed (above the reservoir) has been strictly controlled. Additionally, storage of water at this site has altered flows in Basin Creek immediately downstream of the reservoir. This reach of the stream typically sees rather low streamflow.

Fish surveys were completed at two sites on Basin Creek in 2009. The sites were located downstream of Basin Creek Reservoir at RM 0.9 and 9.8 (Table 30; Figure 5). At RM 0.9, the trout community was comprised entirely of brook trout that ranged in size from 80 mm to 320 mm in total length (Table 30; Appendix A). Other fish captured at this sample site included 20 longnose suckers and five central mudminnow. At RM 9.8, no trout were captured in the reach. Flow and habitat was very limited, and only two longnose suckers were observed. Although no fish sampling was conducted upstream of Basin Creek Reservoir in 2009, past sampling in this reach documented the presence of an isolated population of westslope cutthroat trout. The species comprises the entire fish community in this segment of the stream, and occurs in fairly good numbers. Genetic testing conducted in 2001 indicates that this population is genetically pure.

Tuble 50: Electronishing data concetted at two sections of Busin Creek in 2009.						
Section	Species	Number	Fish per	Mean	Length	Species
Name		of Fish	100 m	Length	Range	Composition
		Captured	(CPUE)	(mm)	(mm)	(%)
RM 0.9	EB	37	37	177	80-320	100
RM 9.8	No Trout	-	-	-	-	-

Table 30. Electrofishing data collected at two sections of Basin Creek in 2009

Riparian assessments were completed at the two sites electrofished on Basin Creek in 2009. At RM 0.9, the stream was flowing through a small hay meadow just downstream of the Bert-Mooney Airport. The channel displayed characteristics of a Rosgen E stream-type, although it tended to be rather entrenched throughout the survey reach. The total riparian assessment score was 28 out of a potential score of 66 (42%) (Table 31). Active lateral erosion was evident throughout much of the reach, and fine sediment accumulation was rather high. Riparian vegetation was dominated by disturbance induced grasses and weeds, with woody vegetation being largely absent from the reach. Fish habitat in this segment of Basin Creek was rated only fair (score: 3 points out of a potential of 7; Table 31), and was mostly limited by high fine sediment accumulation and a lack of quality pools and overhead cover. An improved shrub community would have increased shade and cover, as well as added to habitat complexity and bank stability.

At RM 9.8, Basin Creek was located in a small meadow about one mile downstream of Basin Creek Reservoir. The total riparian assessment score was 53 out of a potential score of 65 (82%) (Table 31). The channel was somewhat entrenched throughout the survey reach, but no current instability was observed. Riparian vegetation was dominated by a mature willow community that was largely confined to the immediate streambanks. Willows were rather dense, and appeared to encroach on the channel in a number of locations. Fish habitat in this reach of Basin Creek was rated only fair (score: 3 points out of a potential of 7; Table 31), and was largely limited by high fine sediment accumulation and relatively low stream flow. The stream bottom was covered in silt, and habitat suitable for trout spawning was absent.

Table 31. Ripanan assessment results for sites surveyed on Basin Creek in 2009.					
Section	Geomorphology	Vegetation	Fish Habitat	Total Score	
RM 0.9	17/30 (57%)	8/29 (28%)	3/7 (43%)	28/66 (42%)	
RM 9.8	26/30 (87%)	24/28 (86%)	3/7 (43%)	53/65 (82%)	

Table 31. Riparian assessment results for sites surveyed on Basin Creek in 2009.

Water temperature was not monitored in Basin Creek during 2009.



Figure 5. Map of the upper Silver Bow Creek drainage showing sites of fish and temperature sampling conducted in 2009.

Blacktail Creek Drainage

Blacktail Creek

Fish sampling (including riparian assessments) and temperature monitoring were conducted on Blacktail Creek in 2008. Results of this survey work were summarized in *An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin: Phase II* (2009). In 2009, no additional fish sampling or riparian assessments were completed on Blacktail Creek. However, water temperature was again monitored at the same locations as 2008.

Water temperature was monitored at two sites on Blacktail Creek from June 27 through October 19, 2009 (Appendix B). The sites were located at RM 0.2 and 6.6 (Figure 5). At RM 0.2, maximum daily temperature exceeded 15°C on 26 days. The maximum-recorded temperature at this site was 18.2°C on July 1. At RM 6.6, water temperatures exceeded 15°C on 10 days. The maximum-recorded temperature at this site was 15.8°C, which was measured on July 22.

APPENDIX A

Gold Creek Drainage







Willow Creek Drainage (Near Garrison)

Willow Creek





Rock Creek (Near Garrison)













Little Blackfoot River Drainage

Little Blackfoot River













O'Neill Creek Drainage







Taylor Creek Drainage

Taylor Creek





























Browns Gulch Drainage
























Hail Columbia Gulch











Telegraph Gulch

























American Gulch















APPENDIX B



Gold Creek Drainage







Warm Springs Creek Drainage (Near Garrison)

Warm Springs Creek





Rock Creek Drainage (Near Garrison)

Little Blackfoot River Drainage



Little Blackfoot River











Cottonwood Creek Drainage

Cottonwood Creek



Racetrack Creek Drainage

Racetrack Creek







Lost Creek Drainage

Lost Creek









Warm Springs Creek Drainage

Warm Springs Creek









German Gulch





Browns Gulch

0

6/25/09

7/10/09

7/25/09

8/9/09



8/24/09

Date

9/8/09

9/23/09

10/8/09 10/23/09

Browns Gulch Drainage







Blacktail Creek Drainage







