Small Stream Surveys in the Big Hole River Drainage 2008-2010.

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Abstract: A total of 57 streams in the Big Hole River drainage were surveyed from 2008-2010. The goal of this survey was to update existing information or survey streams that have previously not been inventoried. The emphasis for much of the research covered in this report was to revisit streams with known westslope cutthroat trout populations which were surveyed last over 10 years ago. In that time several populations have either been extirpated or have become hybridized with rainbow or Yellowstone cutthroat trout. Further, many populations that are sympatric with non-native brook trout have dwindled to the point that long-term viability has become doubtful. The westslope cutthroat trout populations that appear to be the most viable were those present in stream upstream of natural or man-made fish barriers and lacked non-native fish.

Additional results of the inventory indicate that brook trout are virtually ubiquitous throughout the Big Hole drainage in small streams. Nearly all streams surveyed in this report contain brook trout populations; only those streams with impassible natural fish barriers (i.e., waterfalls or cascades) contained fish populations that where brook trout were absent. Rainbow and brown trout are also present in streams of the Big Hole drainage but were most common mostly in streams that have a close association with the Big Hole River downstream of Wise River.

Acknowledgements

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WATERS REFERRED TO:

American Creek
Bailey Creek
Bear Creek
Bear Wallow Creek
Beaver Creek
Berry Creek
Bryant Creek
Camp Creek
Cherry Creek
Clam Creek
Corral Creek
Delano Creek
Engeljard Creek
First Chance Gulch
Flume Creek
Fox Creek
French Creek
Governor Creek
Hamby Creek
Holland Creek
Indian Creek
Jerry Creek
Last Chance Gulch
Little Swamp Creek
Long Tom Creek
McVey Creek
Meadow Creek
Moose Creek (near Divide)
Moose Creek (trib to Deep Creek)
Moose Creek (trib to Swamp Cr near Wisdom)
Mudd Creek
Mule Creek
North Fork Divide Creek
North Fork Fox Creek
Old Tim Creek
Palisades Creek
Pattengail Creek
Peterson Creek (Short Creek)
Pine Creek
Pintler Creek
Reservoir Creek
Sappington Creek
Shultz Reservoir
Sixmile Creek
South Fork Divide Creek
South Fork Fox Creek
South Fork North Fork Divide Creek
Sullivan Creek
Tenmile Creek
Thayer Creek
Thompson Creek
Trapper Creek
Twelvemile Creek
West Fork Mudd Creek
West Fork Twelvemile Creek
Wickiup Creek
York Gulch

INTRODUCTION AND METHODS

Small streams are often important recreational fisheries. Not only do they usually provide crowd-free angling opportunities, they often can boast high densities of fish yielding high catch rates and high angler satisfaction. They also can be important spawning and rearing areas for fluvial fish migrating from larger river systems. Several of the small streams of the Big Hole harbor conservation populations of westslope cutthroat trout and populations of western pearlshell mussels, both of which are species of special concern in Montana. From 2008 through 2010 several small streams in the Big Hole drainage were sampled to determine the status of their fisheries. Many of the streams sampled were chosen because they historically harbored small populations of westslope cutthroat trout, but have not been surveyed in the past 5-10 years.

All streams were sampled using electrofishing or on rare occasions via visual survey from the stream bank. A 2- or 3-person crew used Smith-Root LR24 backpack electrofishing units for all fish collections. At times, in larger streams, two electrofishing units were used side-by-side. Single pass electrofishing was used to determine presence-absence, relative abundance and/or distribution of fish. Two- or 3-pass electrofishing was done to obtain depletion population estimates. In general when electrofishing was performed in association with a population estimate, fish were captured while sampling crews moved in an upstream direction with all habitats sampled within a given reach of stream. No block nets were used during electrofishing. In some streams sub-sampling of higher quality habitats was performed to maximize the likelihood in encountering fish. This technique is referred to as spot shocking in this report and was used primarily to determine the presence/absence of fish in a stream and to collect genetic samples from cutthroat trout. Dip nets with 1/8 in mesh size were used to capture fish. In general trout were targeted, but a representative number of all other species encountered were also captured. Captured fish were anesthetized with MS222, weighed (0.01 lb) and measured (0.1 in) prior to release. Genetic samples (i.e., fin clip) were collected from westslope cutthroat trout caught up to 30 fish sampled per stream. The presence or absence of amphibians and reptiles in electrofishing reaches was also noted. In streams that contained western pearlshell mussels, population information was gathered following the methods of Stagliano (2006).

Two-pass depletion population estimates were calculated using formula's set out in Leathe (1983). Three pass removal population estimates were calculated in FA+ (FWP 2009).

FINDINGS

Governor Creek

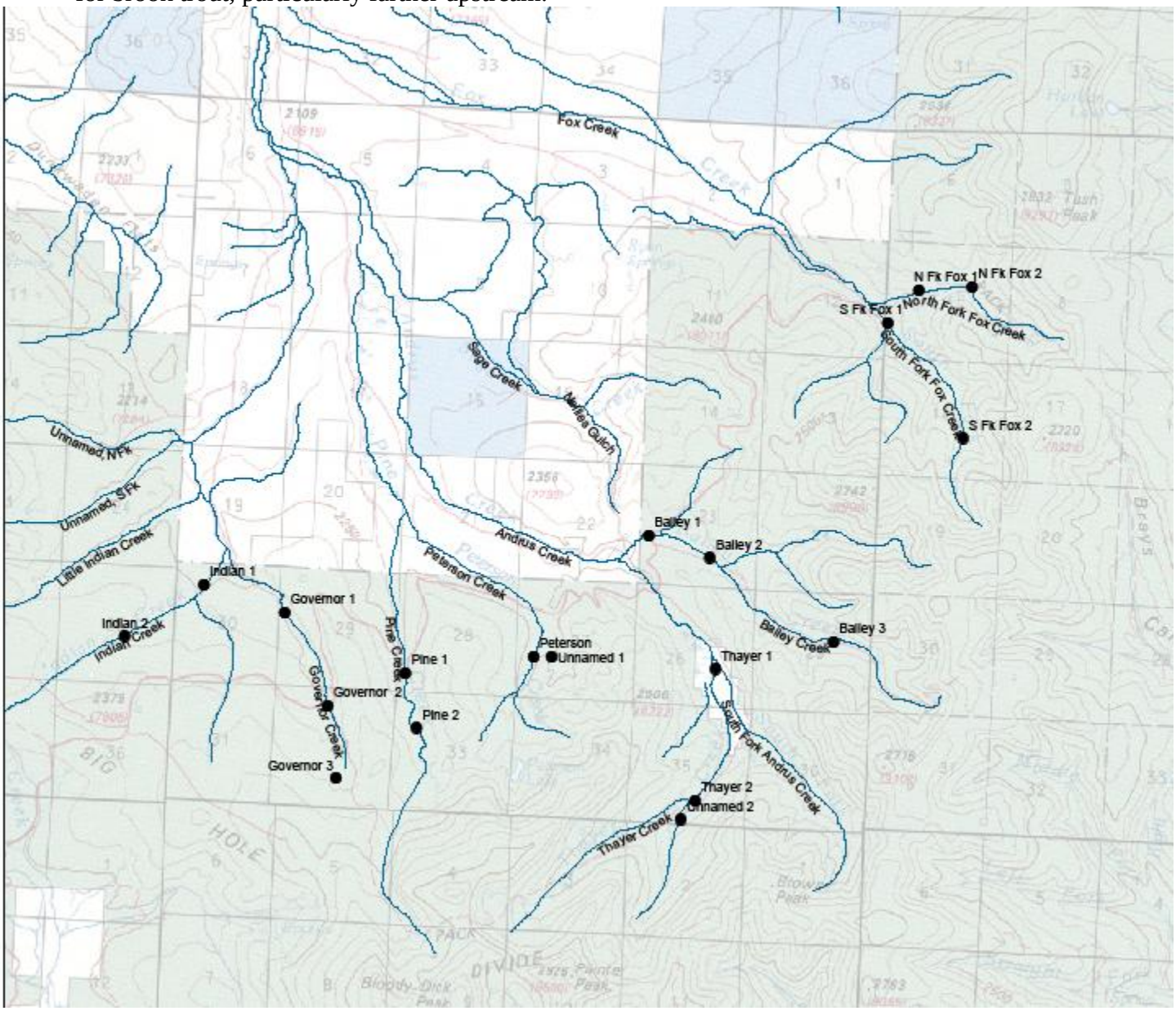
Governor Creek is a main tributary to the headwaters of the Big Hole River. It drains the southeast end of the Big Hole valley and much of the non-public land of the upper drainage is owned by 1 ranch (Hairpin Ranch). Governor Creek is an important system for westslope cutthroat trout. Many tributary streams including Andrus, Thayer, Bailey, Fox and Indian contain remnant populations of westslope cutthroat. The status of cutthroat trout on private lands in the mainstem and tributaries is unknown. Most of Governor Creek and its tributaries can be described as low to moderate gradient systems flowing through open meadows with some reaches flowing through lodgepole pine forests and others flowing through dense willow stands. Interestingly, despite being well connected to the Big Hole River (i.e., no fish migration barriers), rainbow trout or the presence of hybridized westslope cutthroat trout is rare in the drainage.

During 2008 and 2009 Governor Creek and many of its tributaries were sampled to determine the status of the fishery and to collect genetic samples from westslope cutthroat trout. All of the sampling occurred in areas of the Beaverhead Deerlodge National Forest (Map 1). In Governor Creek, no cutthroat trout were found (Table 1, Governor 1, 2 and 3). The stream on the National Forest is very small and in some reaches downstream of the main road crossing the channel is not well defined. Brook trout and Rocky Mountain sculpin were present at the two lower sites, but only brook trout were present at Governor 3. The 4 fish captured at Governor 3 were all at the beginning of the section where the stream enters a large meadow. Upstream of the meadow the gradient increases substantially and the stream appears as if it may go dry later in the summer. No fish were captured from the higher gradient section so it is likely that the distribution of fish in Governor Creek is restricted primarily to downstream of Governor 3. Much of the stream between Governor 2 and 3 was spot electrofished in pools to determine if any westslope cutthroat were present and none were found. In 1989, 4 non-hybridized westslope cutthroat were caught in Governor Creek in the vicinity of the locations sampled in 2008 and 2009.

Indian Creek

Indian Creek is a tributary to Governor Creek located west of the main stream (Map 1). Because of its drainage size and because it is near the headwaters, Indian Creek approximately doubles the flow of Governor Creek at its confluence. Little Indian Creek has also historically harbored a slightly hybridized population of westslope cutthroat trout but no cutthroat trout from Indian Creek have been collected and tested for hybridization. In 2009 Indian Creek was single pass electrofished in two locations (Table 1, Indian 1 and 2). At both locations a single westslope cutthroat was captured. Genetic samples were collected from captured cutthroat but have not been analyzed. No age-1 brook trout were captured at Indian 2 indicating limited reproduction in this reach of the stream, but age-1 fish were captured at Indian 1. At Indian 1, near the Forest Service boundary, the stream was difficult to electrofish because higher water conditions at the end of June

when it was sampled. For its small size, Indian Creek contains a relatively good fishery for brook trout, particularly farther upstream.



Map 1. Governor Creek and tributaries with black dots indicating locations of stream sampling events.

Pine Creek

Pine creek is located east of Governor Creek. This stream is unique relative to the other moderate size tributaries to Governor Creek (i.e., Fox or Andrus Creek) because it is characterized by reaches of moderate to high gradient with short sections of flat meadows. The riparian vegetation consists primarily of lodgepole pine trees. Two sections were surveyed in Pine Creek and only brook trout and mottled sculpin were

captured (Table 1, Pine 1 and 2). A high gradient cascade separates Pine 1 from the meadow located approximately 1/3 mi upstream (Map 1). A second cascade separates this downstream meadow from another meadow located farther upstream at Pine 2 (both meadows were surveyed and included in Pine 2). It appears that these cascades do not represent barriers to fish passage or it is possible that brook trout were transported and introduced upstream of the high gradient reaches. Evidence of the latter includes the lack of sculpin at Pine 2, which were abundant downstream at Pine 1.

Peterson Creek

Two locations were surveyed on Peterson Creek (also called Short Creek) and only brook trout were captured (Table 1, Peterson 1 and Unnamed 1). The stream habitat surveyed consisted of a low gradient, meandering channel with sedge and willow riparian vegetation. Peterson Lake at the headwaters of the drainage contains a self-sustaining population of rainbow trout sympatric with recently introduced westslope cutthroat. Near the headwaters, the stream is much higher gradient and forested, but this area was not surveyed.

Thayer Creek

Thayer Creek is a tributary to Andrus Creek, which is a tributary to Governor Creek. A Forest Service land acquisition project consolidated an isolated portion of private land on Andrus, South Fork Andrus and Thayer creeks into public ownership. The habitat in Thayer Creek consists primarily of a wide, open meadow system with a low gradient stream channel. Few willows are present, but well developed pools are common. In the upper reaches of the stream and the South Fork, the habitat is higher gradient and pools are less common. At Thayer 1, the brook and cutthroat trout were in excellent condition for the size of stream. Although brook trout greatly outnumber cutthroat, it does not appear that the stream is overpopulated with fish. Farther upstream the proportion of cutthroat in the stream increased (Table 1, Thayer 2 and Unnamed 2), but brook trout still greatly outnumbered cutthroat. Unlike farther downstream, evidence of successful cutthroat reproduction was present in the headwaters as several age-1 fish were captured. The South Fork was not sampled, but brook trout were observed in the stream at the road crossing and near the mouth at Thayer Cabin. In 1989, when the last cutthroat genetic samples were collected from the stream, results indicated the fish were non-hybridized. Genetic results collected from cutthroat caught during 2009 surveys indicate that fish in Thayer Creek are still non-hybridized (Leary 2010a). Additional samples were collected by Forest Service personnel in 2010, but results are not yet available.

Bailey Creek

Bailey Creek, similar to Thayer Creek, is also a tributary to Andrus Creek. Bailey Creek also flows through a wide, open meadow with very few willows or other woody riparian vegetation. High quality pools are more common in lower reaches of the stream near the Forest Service Boundary. Farther upstream few pools are present and the stream is dominated by long riffles and runs with predominantly gravel substrate. Three sections

of Bailey Creek were surveyed in late June 2009 and brook and westslope cutthroat were found at all sites. Sculpin and spotted frogs were present at Bailey 1 (Table 1, Bailey 1, 2 and 3). The proportion of brook trout to westslope cutthroat was the greatest at Bailey 2 where brook trout only outnumbered cutthroat 4:1. Evidence of cutthroat reproduction was present at Bailey 2 as most fish captured appeared to be age-1 fish. The habitat throughout Bailey 2 consisted of a small incised channel with abundant gravels and grassy banks. Pools were rare in this reach of stream and runs were common. Pools were mostly formed on outside meander bends. No population estimates were done in Bailey Creek because high water conditions at the end of June led to poor capture efficiency. Genetic samples collected from cutthroat trout in 1989 and 1999 indicated the fish were non-hybridized. Genetic samples collected in 2009 indicate the fish are likely non-hybridized. A single copy of the *281* allele, which is usually characteristic of rainbow trout, was detected in the 29 fish sample. This could indicate a small amount of hybridization with rainbow trout or it could be unusual westslope cutthroat trout genetic variation that is indistinguishable with the technique used from that usually characteristic of rainbow trout. Additional genetic testing is needed to determine if the Bailey Creek population is slightly hybridized.

Fox Creek

Habitat conditions in Fox Creek and the South Fork of Fox Creek are very similar to those in Bailey Creek. Only brook trout and sculpin were captured in the South Fork (Table 1, S Fk Fox 1). At the headwaters of the stream (S Fk Fox 2), no fish were found and when the stream was spot shocked between Fox 1 and Fox 2, only brook trout and sculpin were found. Sampling done in 2010 in Fox Creek downstream of the forks also yielded only brook trout and mottled sculpin. Formerly, slightly hybridized westslope cutthroat trout were present in Fox Creek, but it appears this population of fish may be extirpated.

In the North Fork of Fox Creek there is a high gradient section less than ½ mile from the confluence. Upstream of this high gradient reach the stream gradient lessens and willows are common. Westslope cutthroat, in low numbers, and brook trout were present in the North Fork (Table 1, N Fk Fox 1). Brook trout densities in the North Fork were similar to those found in the South Fork. The entire stream was electrofished between S Fk Fox 1 and S Fk Fox 2 and brook trout were found to outnumber cutthroat almost 50:1. Past genetic samples collected from the North Fork indicated the population of cutthroat trout was non-hybridized, but results from the 5 fish collected in 2009 were not available at the time this report was completed.

Table 1. Fisheries survey data from Governor Creek and tributaries during 2008 and 2009 where Length = the length of the section, L is fish length and W = fish weight. The fish species sampled were: EB = brook trout, WCT = westslope cutthroat trout and M Cot = mottled sculpin.

Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
Governor 1	45.19912	113.35730	1 Pass	EB (22)		6.6 (3.7-9.8)	0.14 (0.02-0.36)

(500)				M Cot (29)			
Governor 2 (1000)	45.18796	113.34900	1 Pass	EB (55) M Cot (3)		5.8 (2.9-10.6) 3.1 (2.4-4.5)	0.10 (0.01-0.53)
Governor 3 (300)	45.17902	113.34688	1 Pass	EB (4)			
Indian 1 (1260)	45.20203	113.37159	1 Pass	EB (9) WCT (1) M Cot (6)		6.8 (3.2-9.5) 6.8 2.9 (2.3-4.2)	0.12 (0.01-0.25)
Indian 2 (840)*	45.19522	113.38499	1 Pass	EB (24) WCT (1) M Cot (3)		7.7 (6.2-10.0) 7.8 3.9 (3.5-4.4)	0.19 (0.07-0.42) 0.10
Pine 1 (400)	45.19241	113.33569	1 Pass	EB (47) M Cot (10)		5.1 (3.5-6.5)	0.07 (0.02-0.14)
Pine 2 (1000)	45.19241	113.33576	1 Pass	EB (20+)			
Peterson (300)	45.19519	113.31350	1 Pass	EB (29)		4.6 (2.6-7.0)	
Unnamed 1 (200)	45.19526	113.31036	1 Pass	EB (6)		5.1 (3.0-5.6)	
Thayer 1 (500)	45.19472	113.28176	1 Pass	EB (67) WCT (2)		10.7 (10.4-10.9)	0.35 (0.34-0.35)
Thayer 2 (500)	45.17839	113.28416	1 Pass	EB (45) WCT (4)		4.2 (2.3-5.3)	0.03 (0.01-0.06)
Unnamed 2 (1000)	45.17600	113.28647	1 Pass	EB (32) WCT (7)		4.9 (2.8-8.4)	0.05 (0.01-0.15)
Bailey 1 (1160)**	45.21075	113.29446	1 Pass	EB (211) WCT (9) M Cot		8.2 (5.8-11.0)	0.19 (0.04-0.44)
Bailey 2 (2800)***	45.20839	113.28362	1 Pass	EB (86) WCT (26)		5.7 (4.2-8.9)	
Bailey 3 (1000)	45.19871	113.26135	1 Pass	EB (63) WCT (1)		5.2 (2.2-8.6) 9.1	0.05 (0.01-0.18) 0.22
S Fk Fox 1 (528)	45.23840	113.25456	3 Pass	EB (76) M Cot (28)	1030 (684-1375)	5.7 (1.5-8.8) 2.7	0.06 (0.01-0.21)
S Fk Fox 2 (200)	45.22459	113.24043	1 Pass	No Fish			
N Fk Fox 1 (401)	45.24253	113.24939	2 Pass	EB (67) WCT (2)	918 (853-982)	5.3 (2.6-7.8) 8.6 (7.8-9.3)	0.05 (0.01-0.21) 0.20 (0.14-0.25)
N Fk Fox 2 (2400)	45.24331	113.24011	1 Pass	EB (143) WCT (3)		8.8 (7.0-10.0)	

* GPS coordinate for Indian 2 was the downstream end of the 840 ft section

** Section extended downstream 1160 ft to FS boundary fence from given GPS point

*** Section extended upstream 2800 ft from the given GPS location

Berry Creek

Berry Creek is a moderately sized drainage that drains from the Beaverhead Mountains and parallels Hamby Creek to the north and Pioneer Creek to the south (Map 2). Berry and Timberline lakes are located at the headwaters of the drainage, both of which contain stocked populations of Yellowstone cutthroat trout. Within ½ mile downstream of Berry Lake, the gradient in Berry Creek increases and the habitat is dominated by cascades before reaching Moose Meadow where the gradient lessens. Downstream of Moose Meadow, the stream grade increases slightly and the riparian canopy is dominated by lodgepole pine trees with other deciduous woody vegetation. Downstream of this moderate gradient reach the stream enters Berry Meadows, an extensive low gradient section of stream with abundant willows and high quality fish habitat. Downstream of Berry Meadows the stream flows through a mix of low gradient and low to moderate gradient reaches and lodgepole pine forests. Closer the Forest Service boundary, Berry Creek flows through a low gradient area with many pothole lakes adjacent to the stream. Once the stream leaves the forest and enters private land on John Doolings property it splits into several channels. The willow riparian vegetation is dense and formed of older mature willows. There are few pools in this reach likely as a result of the highly braided nature of the channel.

Three reaches of Berry Creek were sampled in 2009. Only brook trout and mottled sculpin were captured in the farthest downstream reach on private land (Table 2, Berry 1). Farther upstream (Table 2, Berry 2), longnose suckers, in relatively high abundance, were also captured in addition to brook trout and sculpin. The habitat in Berry 2 could be characterized as low gradient, but with relatively large cobble and some boulder substrate. Pools were formed by meander bends and large woody debris in the stream channel. The riparian area consisted of willows and lodgepole pine. Spotted frogs were common in this reach of stream. In Berry Meadows, where the habitat appeared to be ideal for trout, the overall density of fish was low and only half that of Berry 2. Anecdotal evidence from local anglers indicated that Berry Meadows contained a high quality fishery at one time with larger, more abundant fish. Spotted frogs and chorus frogs were also present at the site. The habitat in Berry Meadows consists of a meandering stream channel and abundant willows. Pools were often greater than 3 ft deep. Gravels and granitic sand were the dominant substrate types. It is unclear why fish densities were not greater in Berry Creek given the high quality nature of the habitat.

Although not electrofished, fish visually observed in the stream at Moose Meadows appeared to be cutthroat trout rather than brook trout (it could not be determined if fish were Yellowstone or westslope cutthroat trout). Further sampling is warranted to determine the status of the fishery in this upper reach of stream. It is possible that there is a remnant population of westslope cutthroat in the headwaters of Berry Creek or it is possible that Yellowstone cutthroat trout have colonized the creek from the lakes farther upstream.

Table 2. Fisheries survey data from Berry Creek during 2009 where Length = the length of the section, L is fish length and W = fish weight. The fish species sampled were: EB = brook trout, M Cot = mottled sculpin and LSU = longnose sucker.

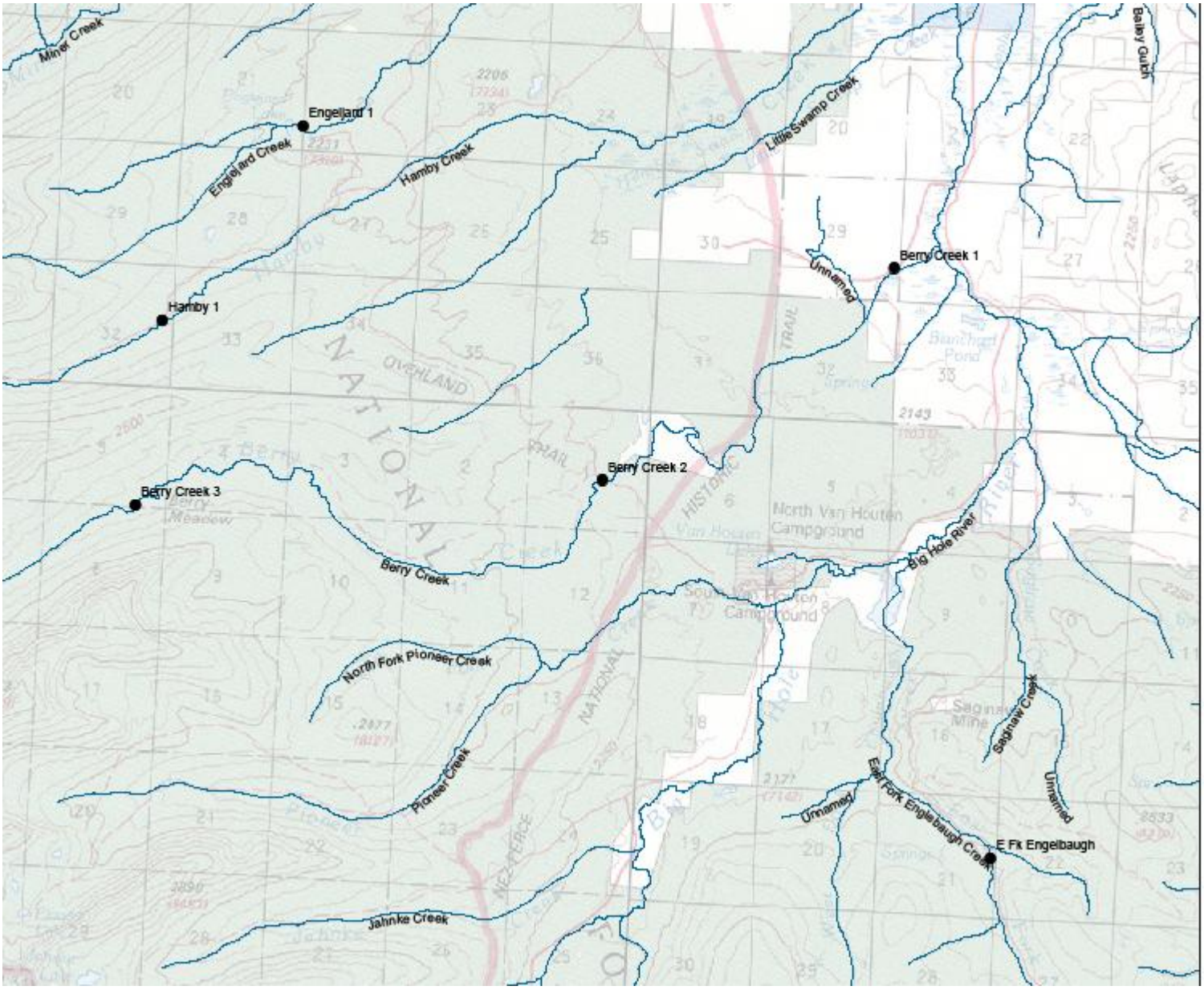
Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
Berry Creek 1 (300)	45.28097	113.45964	3 Pass	EB (13)	228 (217-270)	6.6 (2.0-11.5)	0.15 (0.01-0.63)
				M Cot (23)	440 (343-536)	2.8 (1.9-4.4)	
				LSU (1)		7.7	0.11
Berry Creek 2 (300)	45.25387	113.50719	3 Pass	EB (50)	968 (817-1118)	5.5 (1.5-9.3)	0.07 (0.01-0.30)
				M Cot (24)		2.6 (1.6-3.5)	
				LSU (20)	370 (300-438)	4.8 (3.7-5.9)	0.04 (0.02-0.10)
Berry Creek 3 (500)	45.24799	113.58591	3 Pass	EB (25)	285 (223-346)	6.5 (3.5-9.4)	0.11 (0.01-0.34)
				M Cot (3)		2.6 (1.8-3.1)	

Little Swamp

Little Swamp Creek is a small drainage located between Berry and Hamby creeks. It was surveyed in 2009 as part of the Arctic grayling monitoring program. The stream has a relatively small drainage area and likely receives water from nearby Hamby Creek either through groundwater exchange or through surface diversion. One section of the stream was surveyed and found only to contain brook trout and mottled sculpin (Table 3). The size of the brook trout was relatively large for the size of stream compared to other brook trout populations in similar habitats in the Big Hole. No amphibians or other fish species were observed at the site sampled.

Table 3. Fisheries survey data from Little Swamp Creek during 2009 where Length = the length of the section, L is fish length and W = fish weight. The fish species sampled were: EB = brook trout and M Cot = mottled sculpin.

Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
Little Swamp 1 (300)	45.29327	113.48734	2 Pass	EB (18)	318 (308-328)	8.0 (2.0-11.5)	0.28 (0.01-0.69)
				M Cot (9)		2.5 (1.6-4.2)	



Map 2. Berry, Hamby, Engeljard and East Fork of Englebaugh creeks with black dots indicating locations of stream sampling events.

Hamby Creek

Hamby Lake drains from the Beaverhead Mountains in the west Big Hole valley. At its headwaters are three lakes: Lake Geneva, an unnamed lake and Hamby Lake. Lake Geneva contains a self-sustaining population of Yellowstone cutthroat trout, the unnamed lake is fishless and Hamby Lake contains a mixed fishery of brook trout and Yellowstone cutthroat trout. At one time Hamby Lake also supported an Arctic grayling population. At the outlet of Hamby Lake, the stream has a moderate gradient for approximately 1

mile before the gradient lessens and the stream becomes very sinuous, flowing through broken meadows for the next 3 miles. Through this low gradient reach the stream is in excellent conditions with abundant willows and very clean, gravely substrate. From the meadow reach downstream to the forest service road crossing the stream gradient changes to moderate and the substrate is primarily boulders and cobble and the riparian vegetation consists of mainly lodgepole pine trees.

Hamby Creek was surveyed in only one section (Map 2) in the upper meadow reach. This section of stream contained high quality habitat with frequent, high-quality pools and abundant, clean gravels. The pools were primarily formed from meander scours, but some pools were also formed by woody debris. The riparian vegetation consisted of willows with some canopy cover of lodgepole pine trees. The stream banks were in excellent condition and stream habitat in general was excellent. Only brook trout and mottled sculpin were captured in the stream (Table 4). Brook trout density was quite high and substantially greater than that observed in Berry Meadows, which contained similar habitat. Also, recently emerged young of the year brook trout were captured, suggesting Hamby Creek is a very cold stream (stream was sampled on August 3rd). No potential fish barrier sites were observed in the Hamby Creek drainage, but a thorough inventory was not performed and no parts of the stream were surveyed downstream of the Forest Service road crossing. If a suitable barrier location can be identified, Hamby Creek would be an excellent candidate for westslope restoration because of the two self-sustaining lakes at the headwaters and the quality of habitat in the stream.

Table 4. Fisheries survey data from Hamby Creek during 2009 where Length = the length of the section, L is fish length and W = fish weight. The fish species sampled were: EB = brook trout and M Cot = mottled sculpin.

Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
Hamby 1 (520)	45.27023	113.58295	3 Pass	EB (103)	1157 (1031-1283)	6.4 (1.4-10.2)	0.11 (0.01-0.34)
				M Cot (27)	274 (267-281)	2.4 (1.1-3.5)	

Engeljard Creek

Engeljard Creek is a small tributary that runs parallel to Hamby Creek before the 2 streams merge near the confluence with the Big Hole River. Engeljard Creek drains from the face of the Beaverhead Mountains of the west Big Hole. The lower reaches of the stream on private land have been significantly altered by mainstem irrigation dams. Engeljard Lake, as is it appears on USGS topographic maps, no longer exists. Apparently a former dam on the stream has been breached resulting in the loss of the cloverleaf lake complex, leaving only one small standing water body, to the south of the stream. The stream and the lake are now isolated from one another.

Engeljard Creek was sampled to determine the status of the fishery in the vicinity of Engeljard Lake (Map 2). Downstream of the former Engeljard Lake complex only brook

trout and mottled sculpin were captured (Table 5). Only longnose suckers are present in the remaining standing water of Engeljard Lake. A more thorough inventory of the drainage would be warranted to determine the status of the fishery upstream and downstream of the location surveyed in 2009.

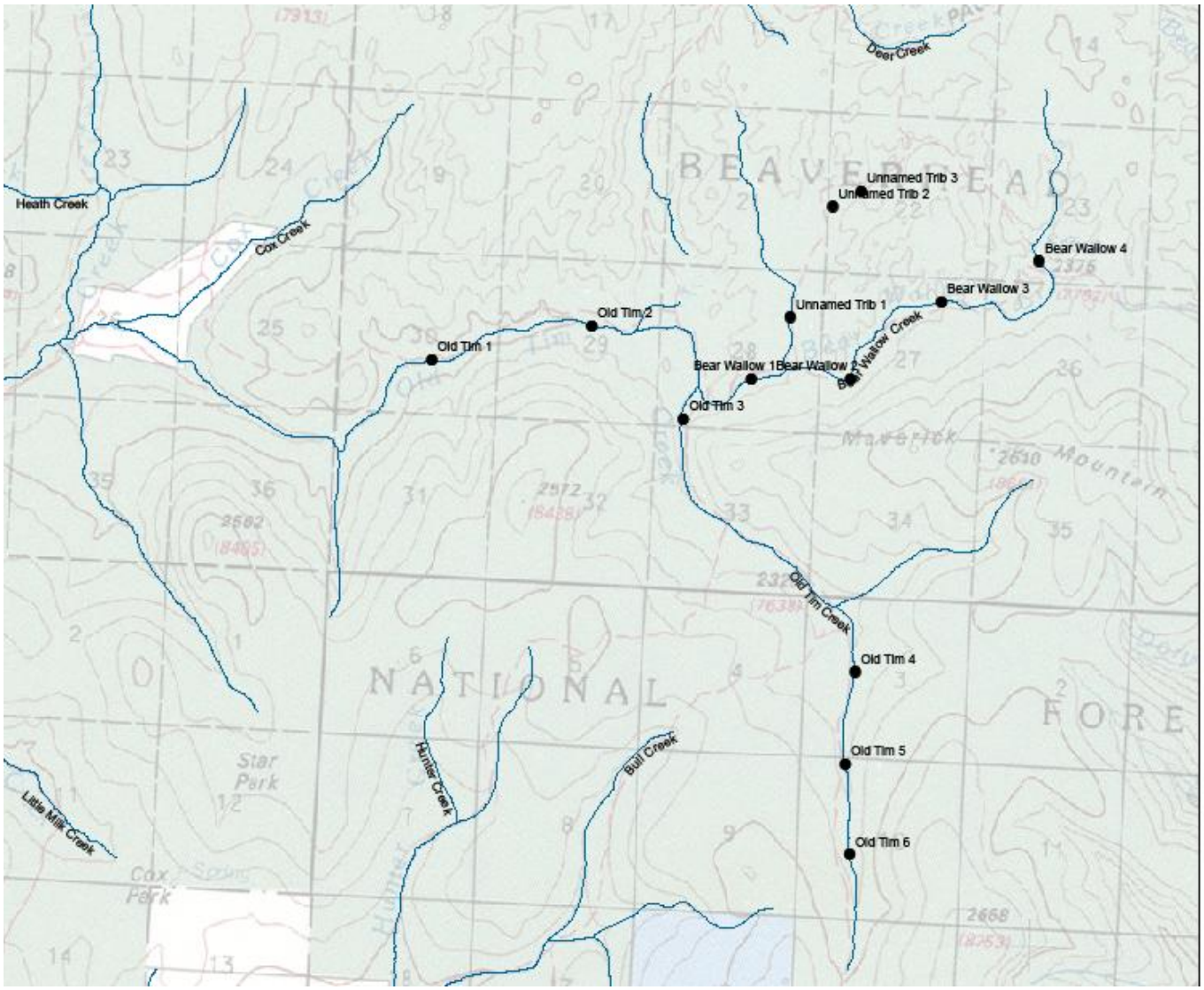
Table 5. Fisheries survey data from Engeljard Creek during 2009 where Length = the length of the section, L is fish length and W = fish weight. The fish species sampled were: EB = brook trout and M Cot = mottled sculpin.

Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
Engeljard 1 (250)	45.29440	113.56088	2 Pass	EB (31) M Cot (3)	716 (582-850)	4.3 (2.5-7.4) 3.1 (2.8-3.5)	0.04 (0.01-0.17)

Old Tim Creek

Old Tim Creek is the largest tributary to Warm Springs Creek in the West Pioneer Mountains east of the town of Jackson (Map 3). The stream drains moderate elevation mountains and therefore does not have the sustained snowmelt runoff typical of many of the other mountain streams in the Big Hole. The stream throughout much of its length is low gradient with a meandering stream channel and good to excellent fish habitat. Near the confluence with Warm Springs Creek the stream is low gradient with abundant willow riparian vegetation. Upstream of this location to the confluence with Bear Wallow Creek the stream is low gradient with a few sections of moderate gradient. In some reaches of the stream willows are common in the riparian area and in others they are sparse. However, for the most part the riparian condition throughout the stream is good, with stable banks and good cover for fish. Westslope cutthroat trout have not been documented in the Old Tim drainage, but a small isolated population is present in Warm Springs Creek.

In July of 2009 Old Tim and its main tributary, Bear Wallow Creek, were surveyed to determine the status of the fishery and aquatic habitat and to determine if a remnant westslope cutthroat population exists. Several reaches of Old Tim and Bear Wallow creeks were sampled (Map 3). Brook trout and mottled sculpin were the only fish species captured at all survey locations. Brook trout are very well distributed throughout the drainage—only in one location in an unnamed tributary to Bear Wallow Creek were brook trout not captured. Even in the headwaters of Bear Wallow Creek where there often was not a defined stream channel, brook trout were present. Very few willows were present in the riparian area of Old Tim Creek upstream of the confluence of Bear Wallow. Despite the lack of woody vegetation and the presence of livestock grazing, the stream banks are relatively stable. The greatest density of brook trout observed in Old Tim Creek was associated with the site with the greatest willow density (Table 6, Old Tim 2). The stream channel in Old Tim Creek, particularly upstream of Bear Wallow Creek, is highly susceptible to impacts from grazing and should be monitored closely in the future.



Map 3. Old Tim Creek and tributaries with black dots indicating locations of stream sampling events.

Similar to Old Tim Creek, few willows are present in the Bear Wallow drainage. The stream channel through several reaches of Bear Wallow Creek is quite unique. At Bear Wallow 1 and 2 and 3 the wetted width of the channel was often less than 2 ft and the depth was 2-3 ft. Because of the channel configuration and overhanging banks, capturing fish using electrofishing was difficult, hence many location were only sampled with a single pass and those where estimates were done often required 3 passes. Unlike many stream in the Big Hole drainage whose fisheries are overpopulated with brook trout, Old Tim and Bear Wallow creeks were in general not overpopulated. Average size of brook trout in Old Tim was greater than nearby streams of similar size with similar habitat. Old Tim Creek downstream of the confluence with Bear Wallow is an excellent brook trout fishery. It is unclear why the brook trout population appears to be self-regulating their recruitment in the stream versus similar nearby streams. Another interesting aspect of the fishery in Old Tim Creek was the abundance of mottled sculpin and large size of some

individuals. Spotted frogs were also common in the drainage and western toad adults and tadpoles were present.

Table 6. Fisheries survey data from Old Tim and Bear Wallow creeks during 2009 where Length = the length of the section, L is fish length and W = fish weight. The fish species sampled were: EB = brook trout and M Cot = mottled sculpin.

Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
Old Tim 1 (436)	45.45462	113.25269	3 Pass	EB (41) M Cot (17)	520 (464-576)	6.6 (3.4-10.0) 3.1 (1.9-5.0)	0.12 (0.02-0.35)
Old Tim 2 (520)	45.45834	113.23249	2 Pass	EB (93) M Cot (20)	953 (931-975)	7.6 (2.7-11.7) 2.8 (1.9-4.4)	0.18 (0.01-0.57)
Old Tim 3 (525)	45.45043	113.22023	3 Pass	EB () M Cot (26)	321 (231-412) 372 (115-629)	6.7 (3.9-9.1) 2.4 (1.0-5.0)	0.14 (0.02-0.35)
Old Tim 4 (300)	45.42848	113.19682	1 Pass	EB (13) M Cot (5)		5.5 (2.0-7.4) 3.1 (1.3-6.6)	0.07 (0.01-0.13)
Old Tim 5 (100)	45.42012	113.19758	1 Pass	EB (4) M Cot (5)		5.5 (5.0-6.1) 2.6 (2.2-34)	0.05 (0.03-0.08)
Old Tim 6 (150)	45.41207	113.19644	1 Pass	EB (2)		7.1	0.11 (0.09-0.13)
Bear Wallow 1 (400)	45.45430	113.21179	1 Pass	EB (26) M Cot (17)		7.6 (2.1-11.4) 2.2 (1.5-3.8)	0.19 (0.01-0.54)
Bear Wallow 2 (325)	45.45471	113.19918	2 Pass	EB (29) M Cot (15)	472 (465-478)	7.0 (1.9-10.5) 2.7 (1.4-3.8)	0.12 (0.01-0.42)
Bear Wallow 3 (300)	45.46203	113.18804	1 Pass	EB (23) M Cot (7)		6.0 (2.9-8.7) 2.8 (2.3-3.6)	0.09 (0.01-0.21)
Bear Wallow 4 (472)	45.46610	113.17584	1 Pass	EB (9)		7.4 (5.6-9.5)	0.18 (0.8-0.36)
Unnamed Trib 1 (265)	45.46001	113.20721	3 Pass	EB (20)	399 (358-439)	7.7 (5.5-9.7)	0.20 (0.08-0.40)
Unnamed Trib 2 ()	45.47013	113.20248	1 Pass	EB (2)		4.4 (3.7-5.6)	
Unnamed Trib 3 (200)	45.47160	113.19898	2 Pass	No Fish			

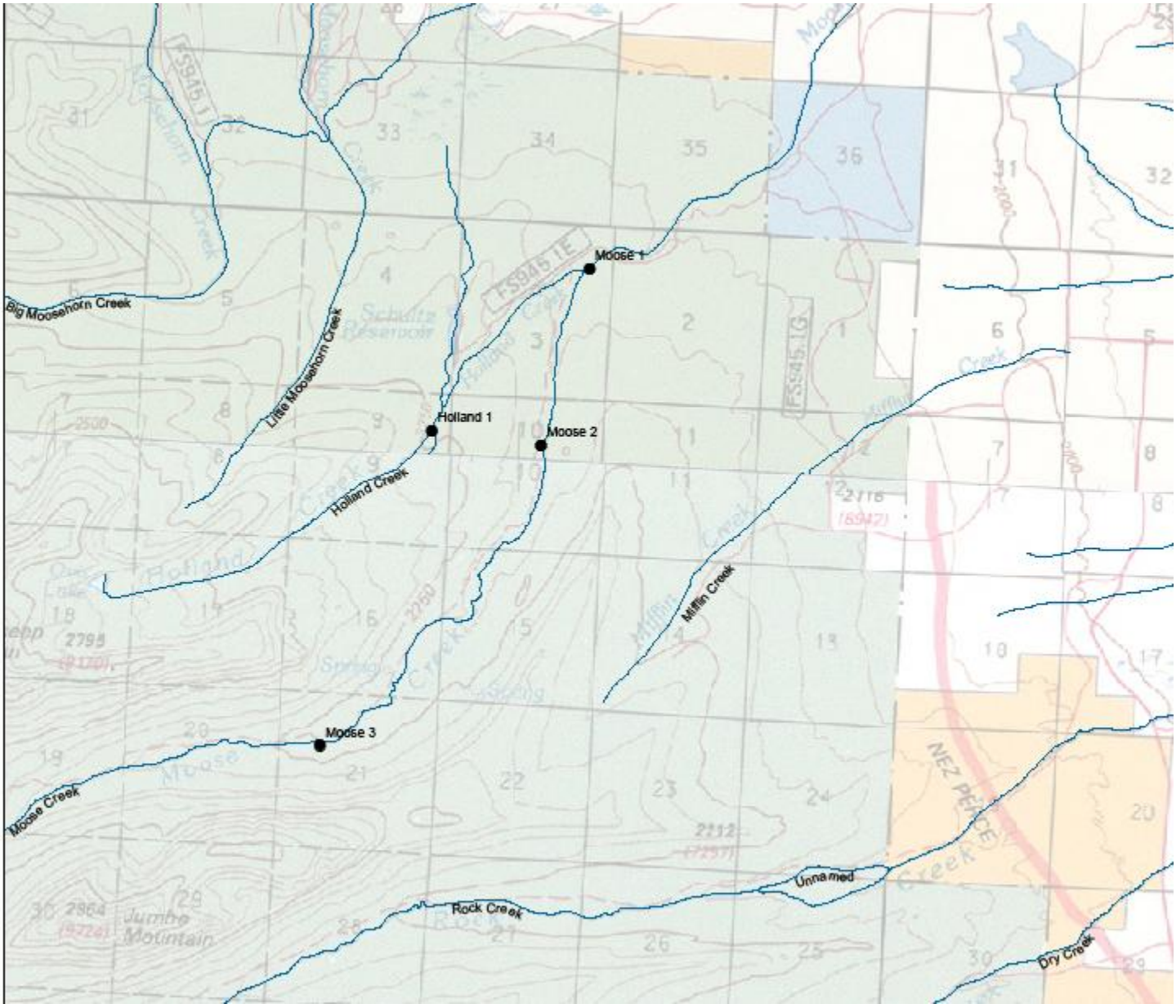
Moose Creek

Moose Creek is a tributary to Swamp Creek west of the town of Wisdom. It originates in the Beaverhead Mountains in the West Big Hole. The stream habitat in the upper reaches of Moose Creek (Map 4, Moose 3) consists of a low to moderate gradient channel flowing through primarily coniferous forest with cobble and gravel as the predominant substrate. Downstream of Moose 3, the stream gradient lessens and the channel meanders through a large willow meadow. From Moose 2 to Moose 3 the stream gradient increases slightly and the valley width decreases. The riparian area is a mix of willows and lodgepole pine. Holland Creek is a major tributary to Moose Creek and harbors a slightly hybridized (97.7%) westslope cutthroat population. Holland Creek is substantially altered near the lower reaches of the stream due to the diversion of the creek into Shultz Reservoir. Shultz Reservoir contains a self-sustaining population of westslope cutthroat sympatric with a small population of brook trout. The irrigation outlet of Shultz Reservoir is designed to flow to the north into Yank Swamp, which feeds Swamp Creek. The spillway is located adjacent to inflow at the south end of the reservoir. A fish migration barrier is present in the spillway channel leading back to Holland Creek. A similar fish migration barrier is present in Holland Creek at the water diversion to the reservoir. The effectiveness of these fish barriers has not been evaluated. Ovis Lake sits at the headwaters of Holland Creek and was stocked at one time with Yellowstone cutthroat trout, but was found to be fishless in 2009.

Moose Creek was electrofished in 3 different locations and 1 location was sampled in Holland Creek (Map 4, Table 7). The farthest downstream site sampled was below the confluence of Holland Creek (Moose 1) and the most upstream was at the end of the road and beginning of the foot trail leading up the drainage (Moose 3). Brook trout, westslope cutthroat and mottled sculpin were captured at all three sites. Brook trout greatly outnumber westslope cutthroat. The population of westslope cutthroat trout in Moose Creek has not been previously tested for hybridization. Genetic samples were collected from the fish captured, but have not yet been analyzed. The stream and riparian habitat through all of the reaches sampled was in excellent condition.

Brook trout are present in Shultz Reservoir at low density, but no brook trout were captured in Holland Creek upstream of the reservoir (Table 7, Holland 1). Therefore, it appears as though the fish barrier on Holland Creek is precluding upstream fish passage. In addition to Holland 1, the diversion channel from Holland Creek to Shultz Reservoir was sampled and no brook trout were captured in it. However, brook trout were captured in the outflow channel immediately downstream of the barrier structure. It is unclear how water management occurs in Shultz Reservoir and if the reservoir is commonly drained to the point where it affects the fishery. When surveyed in August of 2009, the reservoir was at full pool (note, 2009 was an average or slightly above average water year) and multiple age classes of cutthroat were captured up to 14 inches. Water management does not appear to be affecting the fish population in the reservoir at the time of this sampling, although the reservoir was drained in 2010 for repairs to the

irrigation outlet structure. Surveys done in June of 2008 indicated fish from the reservoir migrate into the inlet diversion channel to spawn. It is unclear why brook trout in the reservoir are at low density and do not appear to be reproducing. It is possible habitat conditions are not suitable for brook trout reproduction in the fall due to fluctuating water levels in the reservoir. It is also possible that that the barrier at the outflow of Shultz Reservoir is only a partial barrier to brook trout allowing a small amount of immigration.



Map 4. Moose Creek and tributaries with black dots indicating locations of stream sampling events.

Table 7. Fisheries survey data from Moose and Holland creeks during 2009 where Length = the length of the section, L is fish length and W = fish weight. The fish species sampled were: EB = brook trout, WCT = westslope cutthroat trout and M Cot = mottled sculpin.

Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
Moose 1 (400)	45.51811	113.68082	2 Pass	EB (30) WCT (3) M Cot (12)	406 (375-436)	5.0 (1.4-8.4) 6.2 (5.7-6.9) 3.2 (2.2-3.8)	0.06 (0.01-0.26) 0.08 (0.07-0.10)
Moose 2 (580)	45.50126	113.68596	1 Pass	EB (80) WCT (1) M Cot (6)		5.9 (3.0-9.6) 6.8	0.09 (0.02-0.41) 0.10
Moose 3 (305)	45.47197	113.71336	2 Pass	EB (52) WCT (3) M Cot (14)	923 (869-976) 69 (0-187)	4.7 (2.5-8.0) 7.4 (6.1-8.8) 3.2 (2.5-4.2)	0.05 (0.01-0.22) 0.14 (0.09-0.14)
Holland 1 (300)	45.50211	113.70067	2 Pass	WCT (10)	178 (163-194)	3.5 (3.0-3.9)	0.01 (0.01-0.02)

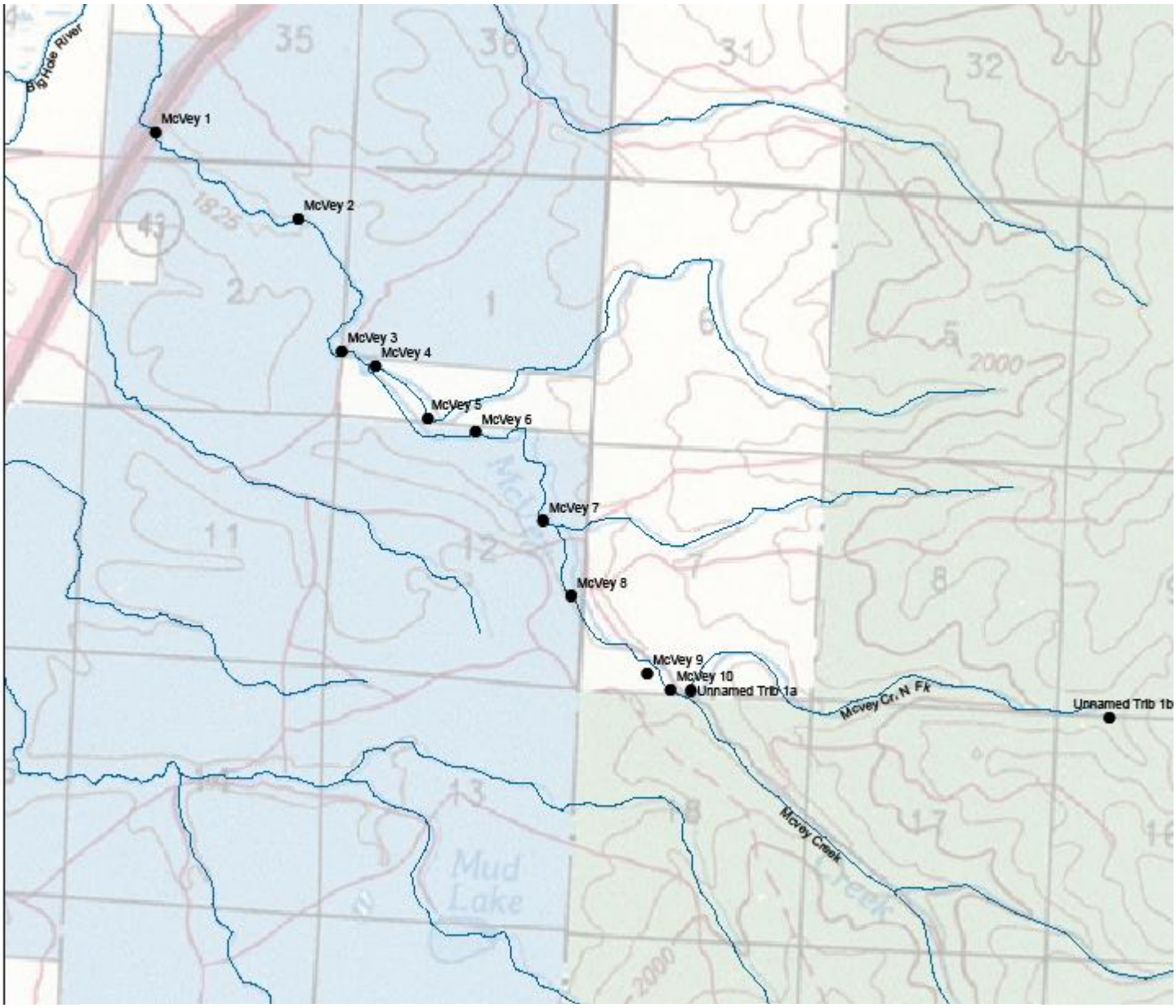
McVey Creek

McVey Creek originates in the West Pioneer Mountains northeast of Wisdom. It is a small stream that originates on the Beaverhead Deerlodge National Forest and flows northwest through lands managed by the DNRC. There are two small tracts of private land that intersect McVey Creek, but the majority of the stream is in public ownership. McVey Creek has historically harbored a non-hybridized population of westslope cutthroat trout residing primarily on the Forest. Habitat conditions in McVey Creek on the forest are good with abundant willows in the riparian area and stable banks. The stream is low gradient near the forest service boundary, but becomes moderate gradient and heavily forested farther upstream near the forks. Downstream on private and DNRC ground there are few willows and the stream banks are impacted by livestock grazing. The stream substrate in this area consists of primarily coarse granitic sand and some areas of gravel. There are two irrigation diversions on McVey Creek: one near the forest boundary and another approximately ¾ mi upstream of Highway 43. The lower of the two diversions captures the entire stream at base flows and the natural channel is dry for approximately ¼ mile. However, springs, which likely stem from the ditch, eventually returns flow to the stream and fish and amphibians are present. During 2008, 2009 and 2010 McVey Creek was surveyed to determine the current status of the fishery and to determine the distribution of westslope and cutthroat in the drainage (Map 5). Disease samples were collected from 60 brook trout in 2009 and analyzed and found to be disease free.

Brook trout were present throughout the stream (Table 8). The lower reaches of the stream (McVey 1) appear to be an important area for reproduction. High numbers of age-1 and age-0 fish were captured leading to a small average fish size (Table 8). Upstream

of this location (McVey 2) there appears to be little reproduction occurring in the stream resulting in a much larger average size. Upstream of McVey 2 average size was greater than McVey 1 and less than McVey 2 indicating a moderate amount of reproduction. Given the large numbers of juvenile fish in lower McVey Creek, it is possible that fish from the Big Hole River migrate into the stream to spawn. White suckers were found from near the mouth to downstream of the upper most diversion site (Table 8, McVey 9). Burbot, in low numbers, were also found in the stream from McVey 4 to the upper diversion site near the Forest Service Boundary. Spotted frogs were abundant downstream of the forest boundary and western toads were common. Backwaters and shallow inundated sedge fens were heavily populated by tadpoles. Westslope cutthroat trout were only captured on the National Forest (McVey 10) and despite recent mechanical removal efforts; brook trout still outnumber cutthroat 8:1.

The small unnamed tributary which converges with McVey Creek near the Forest Service boundary was also surveyed to determine fish species presence and distribution. Only



Map 5. McVey Creek and tributaries with black dots indicating locations of stream sampling events.

brook trout were captured in this tributary. Grazing impacts to the stream are moderate to severe near the confluence on private property, but approximately ½ mi upstream habitat conditions improve. Willows, which are lacking near the confluence, become abundant and although the stream is small it has high quality habitat and an abundant fish population (Table 8). Fish were found in the unnamed tributary to approximately 1.5 miles upstream of the confluence with McVey Creek. No fish were captured in the upper forks of the stream.

Table 8. Fisheries survey data from McVey Creek during 2008 and 2009 where Length = the length of the section, L is fish length and W = fish weight. The fish species sampled were: EB = brook trout, WCT = westslope cutthroat trout, LSU = longnose sucker, WSU = white sucker and BUR = burbot.

Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
McVey 1 (513)	45.69981	113.42392	2 Pass	EB (304) WSU (3)	3255 (3148-3362)	2.7 (1.0-8.5) 2.8 (2.3-4.4)	0.02 (.0.1-.025)
McVey 2 (1,900)	45.69513	113.41148	1 Pass	EB (50) LSU (1)			
McVey 3 (792)	45.68740	113.40726	1 Pass	EB (28) LSU (1)		5.8 (2.7-8.1) 4.9	0.10 (0.01-0.23) 0.03
McVey 4 (500)	45.68661	113.40433	1 Pass	EB (50) WSU (27) BUR (1)		3.6 (2.0-7.4) 6.0	0.08 (0.01-0.14) 0.04
McVey 5 (500)	45.68367	113.39969	1 Pass	EB (73) WSU (4)			
McVey 6 (504)	45.68300	113.39558	1 Pass	EB (19) WSU (1)			
McVey 7 (500)	45.67795	113.3895	2 Pass	EB (76) WSU (1) BUR (2)	940 (759-1120)	3.8 (2.0-8.5) 6.3 (5.7-6.7) 8.0 (7.4-8.5)	0.03 (0.01-.020) 0.09 (0.07-0.11) 0.09 (0.07-0.11)
McVey 8 (525)	45.67358	113.38681	1 Pass	EB (53) BUR (1)		3.6 (2.3-8.1) 7.3	0.03 (0.01-0.18) 0.08
McVey 9 (550)	45.66921	113.38007	1 Pass	EB (22)		4.3 (2.1-8.0)	0.05 (0.01-0.21)
McVey 10 (7200)	45.66829	113.37801	1 Pass	EB (688) WCT (86)			
Unnamed Trib 1a (525)	45.66833	113.37628	1 Pass	EB (33)		3.5 (2.3-6.7)	
Unnamed Trib 1b	45.66794	113.34081	1 Pass	No Fish			

Clam Creek

Clam Creek is a tributary to Thompson Creek in the Pintler Mountain Range. It is a small stream (average width 3 ft, flowing approximately 2-3 cfs), but despite its small size, Clam Creek harbors one of the largest remaining reproducing populations of pearlshell mussels in the Big Hole drainage. At the head of Clam Valley, a large warm spring introduces warm mineral rich waters to Clam Creek, which may be partly the reason for the high density of mussels (Munday, 2002). The stream flows through Clam Valley, a wide grassy meadow with a meandering "E" type channel with a hard silt bottom mixed with coarse granitic sand. Aquatic vegetation is also common in the stream through Clam Valley. A valley wide dam was present on Clam Creek near the downstream end of Clam Valley, but the dam has been breached. Downstream of Clam Valley the stream increases in gradient and the substrate characteristics change from sand and silt to cobble and boulders.

Clam Creek was surveyed in the summer of 2009 to determine the status of the fishery and to quantify the density of mussels in the stream. The mussel and fish survey occurred near the downstream end of Clam Valley (Map 7). This reach of stream is typical of an unimpacted meadow stream with an "E" type channel cross-section profile. The stream substrate consisted of a mix of hard-packed silt and granitic sand with large sand depositional areas on inside meander bends. The mussel survey consisted of a preliminary scan of the stream bottom using an aquascope. All mussels located were removed from the stream and placed in a bucked with water. After the initial visual survey, 0.25 m^2 quadrats were excavated in identified mussel beds and the material removed was inspected for mussels not visible from the surface. This quantitative method was used to determine the B-factor or the visual encounter rate and calculate a mussel density estimate. Pearlshell mussels were very common through this reach of stream (Table 9). Evidence of reproduction was found at the site as several mussels less than 1 inch were captured. Sixteen of the 117 live mussels sampled were found through excavating 9 quadrats in 5 mussel beds yielding a B-factor of 0.09 (i.e., 9% of mussels were buried and not visible from the surface). The overall mussel density in the reach of Clam Creek surveyed was 0.26 individuals/ft^2. This B-Factor is likely applicable to other beds in the Clam Valley reach where similar substrate is present. The mussels collected during this survey were relatively small compared to other mussel populations and to populations in Clam Creek farther downstream (see below).

Only brook trout and longnose suckers were found in Clam Creek (Table 9). Brook trout densities were high relative to the small size of the stream. No cutthroat were captured; however, a past survey in 1993 captured 1 highly hybridized cutthroat in Clam Creek. Pearlshell mussels are thought to be highly dependent on *Onychorhynchus* spp., and westslope cutthroat in particular, as host fish for the parasitic stage of their life cycle. However, it is clear that mussel reproduction is occurring in Clam Creek and cutthroat are either extirpated or at very low density. It is possible that the mussels are using either the native longnose suckers or the non-native brook trout as a host fish. Further study is needed to determine if this is the case and if so, why they are apparently successful in

Clam Creek versus the many other streams in the Big Hole valley where the native fishery has been replaced by brook trout.

Although not formally surveyed, Clam Creek was walked from Clam Valley to the confluence with Thompson Creek. The mussel density in this reach of stream appeared to be substantially greater than that found in Clam Valley. Dense mussel beds were common in runs and pools to the confluence with Thompson Creek. Mussel size appeared to be much greater in this reach with many individuals 3 inches and greater. Mussels were also present in Thompson Creek approximately ¼ mi upstream of the confluence with Clam Creek. This particular section of Thompson Creek is moderate gradient with primarily boulder substrate, which is may limit mussel populations in this reach.

Table 9. Fisheries and pearlshell mussel survey data from Clam Creek during 2009 where Length = the length of the section, L is shell or fish length and W = fish weight. The species sampled are: PRL = pearlshell mussel, EB = brook trout, and LSU = longnose sucker.

Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
Clam 1 (150)	45.80171	113.52563		PRL (117)		1.5 (0.4-2.8)	
Clam 2 (300)	45.80171	113.52563	2 Pass	EB (95)	1755 (1636-1875)	5.6 (2.2-8.5)	0.07 (0.01-0.20)
				LSU (4)	79 (27-131)	5.5 (4.7-6.5)	0.04 (0.02-0.10)

Pintler Creek

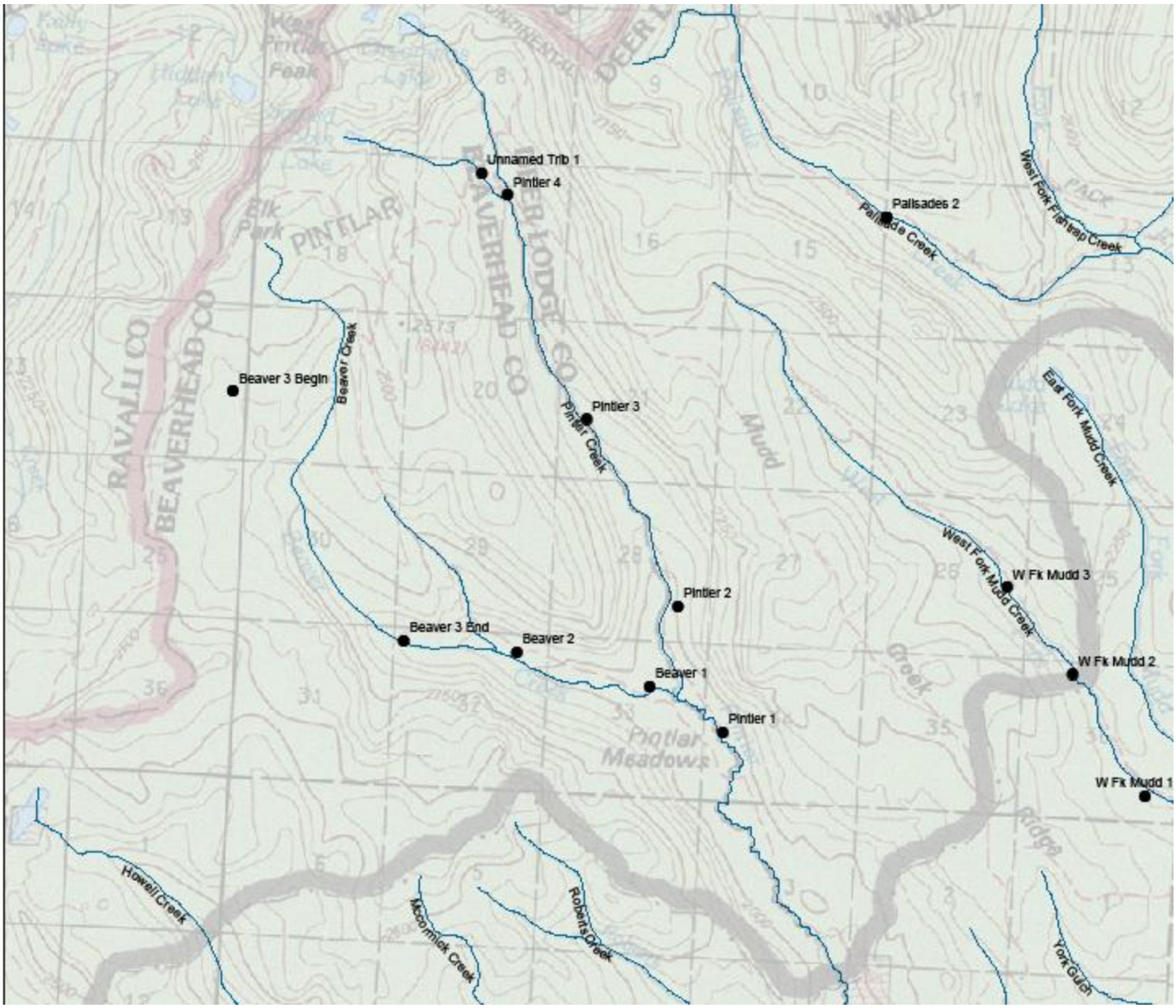
Pintler Creek drains from the Pintler Mountain Range north of Wisdom. Its headwaters are located in the Anaconda-Pintler Wilderness Area. Inventories performed in 2009 focused on the area of the drainage upstream of Pintler Falls. Pintler Falls (Figure 1) appear to be a barrier to fish migration; however, at higher flows a small channel becomes active on the east side of the creek and bypasses the falls. It is possible that fish from downstream could use this channel to circumvent the falls, but this possibility has not been thoroughly evaluated. The creek upstream of the falls flows through Pintler Meadows which contain a mix of habitat conditions from dense willows and relatively stable banks near the downstream end of the meadow to highly impacted and eroding banks in the mid and upper reaches. The substrate in the lower and mid reaches of the meadow is primarily decomposed granitic sand with some gravel. Near the upper meadow, gravels and some cobble are more common. Upstream of the meadows, the riparian area is dominated by spruce and other coniferous trees. The stream gradient is greater upstream of the meadow and the substrate is composed of cobble and boulders. Oreamnos Lake and an unnamed lake sit at the headwaters of the drainage. Oreamnos Lake is stocked on a 4-year rotation with westslope cutthroat trout but also contains a

self-sustaining population of rainbow/cutthroat hybrids. The lake upstream of Oreamnos along with all other lakes in the drainage is fishless.

Figure 1. Pintler Falls at high water flows in June of 2008.

Four sections of Pintler Creek were surveyed in 2009 (Map 6). In the upper reaches of Pintler Meadows, despite deep, frequent pools and some willow cover, very few fish were captured (Table 10, Pintler 1). The fish captured had traits that primarily resembled rainbow trout, but they appeared hybridized with cutthroat trout. Adult spotted frogs were abundant. Farther upstream, above the confluence of Beaver Creek (Pintler 2), the stream gradient is higher and the substrate is primarily cobble. Pools formed by boulder or woody debris jams were relatively common in this reach. Fish densities were much greater than those found farther downstream in the meadow, but overall fish size was smaller (Table 10). Tailed frog tadpoles were also present in the stream at Pinter 2. There were no differences in the fish present farther upstream in Pintler 3 and 4 (Table 10). At Pintler 3 the stream was moderate to high gradient with large boulders composing the dominant substrate type. At Pintler 4 the stream gradient was much less and gravels and cobbles were more common. The stream was also more sinuous and pools were formed by lateral meander scours and large woody debris. Only a small section was surveyed at this location to determine if fish were still present in the stream (Table 10). Only two fish were captured suggesting that other factors than habitat quality

(i.e., water quantity) may limit trout density in the upper reaches of the stream. An unnamed tributary stream (Table 10, Unnamed Trib 1) was sampled in the vicinity of Pintler 4. This stream is the outlet of Sawed Cabin Lake, which is fishless. The reach of stream surveyed was high gradient, but had high quality plunge pool habitat. No fish were captured, but tailed frog tadpoles and adults were abundant. At least two age classes of tadpoles were present in this reach of stream.



Map 6. Pintlar Creek and tributaries with black dots indicating locations of stream sampling events.

Table 10. Fisheries survey data from Pintler Creek during 2009 where Length = the length of the section, L is fish length and W = fish weight. The fish species sampled: RB = rainbow trout.

Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
Pintler 1 (550)	45.87838	113.45937	2 Pass	RB (8)	120 (0-320)	7.1 (4.4-10.2)	0.17 (0.02-0.43)
Pintler 2 (340)	45.88969	113.46617	2 Pass	RB (28)	447 (409-486)	5.8 (4.4-7.2)	0.07 (0.02-0.14)
Pintler 3 (254)	45.90646	113.47943	1 Pass	RB (12)		5.2 (3.7-8.3)	0.05 (0.02-0.15)
Pintler 4 (200)	45.92675	113.49135	1 Pass	RB (2)			
Unnamed Trib 1 (300)	45.92868	113.49492	1 Pass	No Fish			
Beaver 1 (525)	45.88224	113.46932	2 Pass	RB (22)	227 (206-248)	4.9 (3.1-8.5)	0.06 (0.01-0.21)
Beaver 2 (630)	45.88474	113.48703	2 Pass	RB (26)	239 (188-291)	5.4 (3.2-8.4)	0.07 (0.01-0.22)
Beaver 3 Begin Beaver 3 End	45.90741 45.88530	113.52622 113.50200	Spot Shock	No Fish RB (1)			

Beaver Creek

Beaver Creek is a major tributary to Pintler Creek whose confluence is at the head of Pinter Meadows. Beaver Creek flows primarily through dense spruce stands with some dogwood and willow on the immediate banks of the stream. The stream substrate is primarily cobble near the confluence but farther upstream is dominated by boulders. Bear Lake, a fishless lake, sits at the headwaters of the drainage. The upper part of the drainage near Bear Lake was recently burned in a forest fire. Two sections in the lower reaches of the stream (Beaver 1 and Beaver 2) were surveyed and population estimates were obtained (Map 6). At Beaver 1, the fishery was similar to that found in Pintler Creek. However, there were abundant age-1 fish, leading to smaller average fish length, therefore, the lower reaches Beaver Creek may be an important spawning and rearing area. Adult spotted frogs were also common in the riparian area of Beaver 1. Approximately 1 mile upstream, the fishery was similar to that of farther downstream, with the exception of fewer age-1 fish (Table 10, Beaver 2). To determine the distribution of fish in Beaver Creek, a large section of stream beginning at the headwaters was electrofished (Table 10, Beaver 3). No fish were captured in the upper reaches of the

stream, but juvenile and adult tailed frogs were common. The first fish captured was at Beaver 3 End. No distinct fish barriers were identified, but the stream is high gradient immediately upstream of Beaver 3 End with very large boulders. Adequate habitat to support fish is present upstream of this location, but colonization has not occurred.

York Gulch

Four distinct sections of York Gulch were electrofished from June through September of 2008. The first section began at the York Ranch bridge (Map 7) and extended upstream 1100 ft. A 2-pass population estimate was conducted in the first 500 ft of stream. Only 14 brook trout were captured (Table 11). White suckers, longnose suckers, longnose dace were the most abundant fish species encountered, but not all fish encountered were caught and tallied (Table 11). Arctic grayling, which were previously undocumented in York Gulch, were also captured at this site. The upstream extent of grayling captured is shown on Map 1. Only age-1 grayling were captured at the sampling site, but many age-0 grayling were subsequently caught in York Gulch downstream of the bridge to the confluence with the Big Hole River. The habitat through this reach of stream was in very good condition. The stream channel was well defined and had dimensions typical of a C-E type, meandering, meadow stream. The stream banks were mostly stable with grass and sedges vegetation and few willows. Qualitatively, the stream substrate consisted of a mixture of gravel and cobble with some areas of fine sand and silt. A thermograph that recorded stream temperature every 20 min was installed at the bridge site. The data collected (Figure 2) indicate the stream can get warm in the summer, but still remains within temperature tolerances of trout.

A second electrofishing section was sampled half way between the York bridge and the National Forest Boundary. The habitat in this reach of stream is in poor condition. The stream is not well defined and it flows through a very boggy area. There were very few pools and the channel was wider and shallower than farther downstream. The stream substrate was primarily gravel with some cobble and sand. Eight hundred and twenty feet of stream was electrofished (2 passes) and only 2 brook trout were captured. Longnose dace were abundant and longnose sucker were also present. The lack of adequate stream habitat and potential dewatering is likely the causal factor to the lack of fish observed in this section.

Table 11. Fisheries survey data from York Gulch during 2008 where Length = the length of the section, L is fish length and W = weight of the fish. The fish species sampled are: LL = brown trout, RB = rainbow trout, EB = brook trout, WCT = westslope cutthroat trout, M COT = mottled sculpin, LND = longnose dace, LSU = longnose sucker, WSU = white sucker and GR = grayling.

Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
York 1 (500)	45.81350	113.35629	2 Pass	EB (14)	160 (120-200)	7.3 (5.1-11.1)	0.20 (0.06-0.63)
				LL (1)		5.3	0.07
				GR (3)		5.9 (5.8-6.0)	0.06 (0.06-0.07)
				WSU (9)		5.7 (2.2-9.2)	0.14 (0.02-0.33)
				LSU (11)		5.7 (3.6-8.2)	0.10 (0.02-0.23)
				LND (5)		3.7 (2.6-4.2)	
York 2 (820)	45.82848	113.36136	2 Pass	EB (2)		6.8 (6.7-6.8)	
				WSU (1)		3.6	
				LSU (6)		6.4 (5.0-8.1)	
				LND (4)		4.4 (4.3-4.5)	
York 3 (500)	45.84269	113.34951	2 Pass	EB (3)		4.6 (3.5-6.6)	
York 4 (1000)	45.84618	113.36977	1 Pass	EB (10)		3.7 (2.4-5.3)	
				WCT (7)		4.7 (2.8-5.6)	

A third section was sampled at beginning at the Forest Service Boundary extending upstream 500 ft. Stream gradient in this reach was greater than the two reaches sampled farther downstream and the stream substrate was dominated by cobbles. There were very few pools in the reach of stream. The streambanks in this reach were less stable and the creek was wide and shallow. The channel was not well defined and had very easy access to the floodplain. From this point upstream the valley bottom is more confined and the surrounding hill slopes and the riparian area become more forested. Because of the lack of habitat, fish densities were also very low. Only 3 brook trout were sampled. Longnose dace were the only other fish species present.

The fourth section (Table 11, York 4) sampled began at the upper most diversion from York Gulch and extended upstream. This reach of stream flows through a mix of aspen and coniferous forest with grasses being the dominant streambank vegetation type. Stream enhancement has been performed in this reach by adding "V" shaped log structures across the channel to encourage pool development. In this reach of stream both westslope cutthroat and brook trout were captured (Table 11, York 4) in relatively equal numbers. Approximately ¼ mile upstream of the upper most York Ranch diversion (Map 6) the water diverted from West Fork Mudd Creek enters York Gulch. When the irrigation water is turned on, flows nearly double in York Gulch downstream. Historically this irrigation water has also introduced significant amounts of fine sediment to York Gulch as a result of large eroding scarp. This problem has been remedied by

piping irrigation water around the scarp. Upstream of the irrigation input in York the stream is very small and flows less than 1 cfs at normal summer flows.

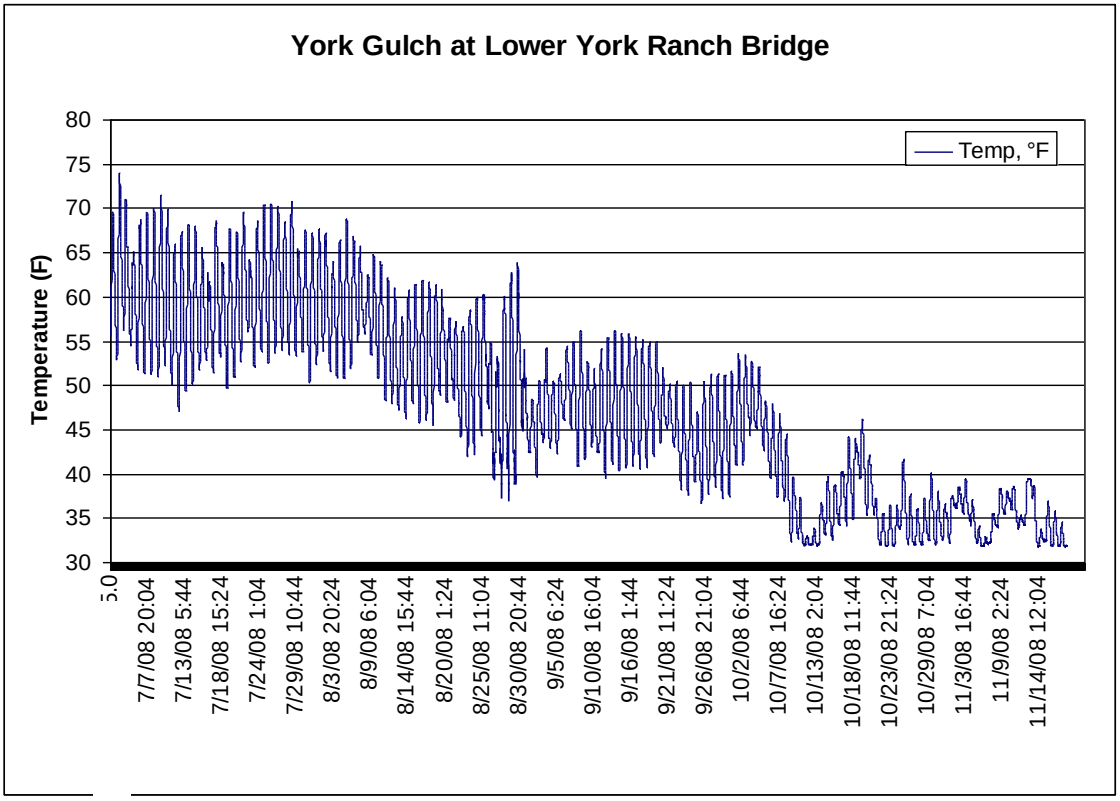
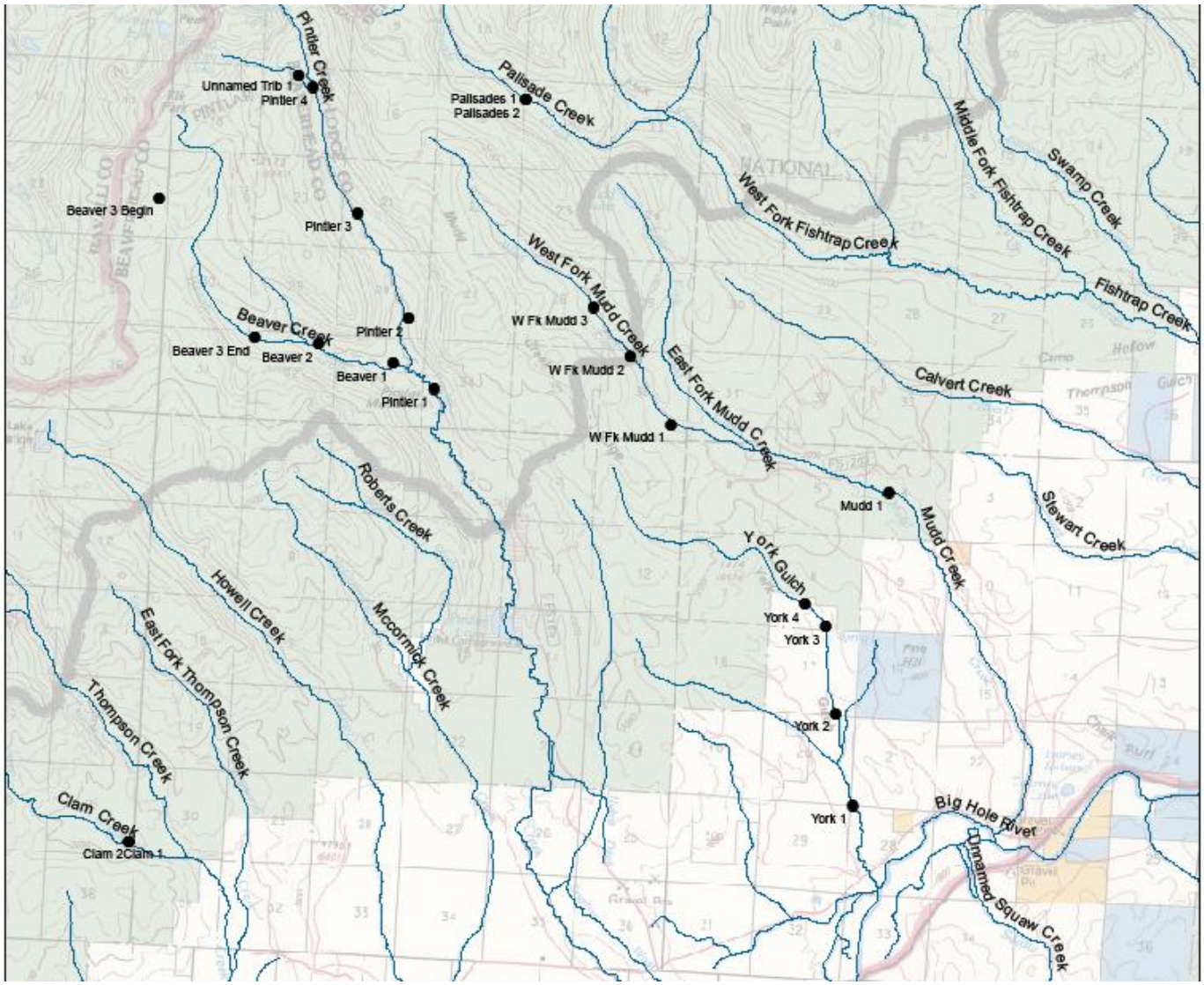


Figure 2. York Gulch stream temperature during summer and fall 2008.

The entire stream from the end of York 4 to near the headwaters was 1 pass electrofished to determine the extent of brook trout and westslope distribution in the system. The stream through this reach flows through coniferous forests with frequent open grassy areas. Near the headwaters the forest canopy is dense and the stream gradient is moderate to high. The channel is well defined in most reaches, but in some reaches near the headwaters it is undefined, flowing through boggy meadows. Brook trout and westslope cutthroat trout were the only fish species captured. A total of 27 westslope cutthroat and 97 brook trout were captured in this reach of stream. Both brook trout and westslope cutthroat extend upstream as far as the farthest Forest Service Road crossing (Map 6). It is unclear if fish are present upstream of the road crossing, but habitat is likely limited due to the lack of water and the high gradient of the stream. Approximately 100 yards of stream were electrofished upstream of the road crossing and no fish were captured. Similar to the rest of the stream, the overall trout density in this reach of stream was low. Water quantity and the associated lack of suitable habitat are the likely factors leading to low overall trout density. Genetic samples were taken from 33 cutthroat captured and results indicated the westslope cutthroat trout are non-hybridized (Leary 2009). Sixty brook trout collected were killed and analyzed for pathogens and results indicated the fish are free from pathogens.



Map 7. Clam Creek, York Gulch, West Fork of Mudd Creek, Mudd Creek and Palisades Creek and tributaries with black dots indicating locations of stream sampling events.

Mudd Creek

Because York Gulch is supplemented with water from the West Fork of Mudd Creek, the Mudd Creek drainage was also sampled to determine the fish species present and the current condition of the stream habitat. The goal of this sampling was to collect data to determine what the available options would be to include Mudd Creek in a westslope cutthroat restoration plan for York Gulch. Further, past sampling indicated that westslope cutthroat trout were present at very low density in Mudd Creek. We collected fisheries data from 1 section in Mudd Creek, 3 sections in the West Fork of Mudd Creek, Mudd Lake and Palisades Creek, which is diverted into Mudd Lake.

A potential fish barrier site was located on Mudd Creek near the National Forest Boundary (Map 6). A barrier at this location would isolate Mudd Creek upstream including the East and West Forks of Mudd Creek to the headwaters (which would include the York Diversion on West Fork Mudd Creek, Map 6). Therefore a fish barrier at this location, when included with non-native trout removal, would prevent brook trout from entering York Gulch through the irrigation diversion. The habitat in this reach consists of a relatively wide valley bottom with low to moderate gradient. The stream meanders through dense willows with well-developed and high quality pools. At the potential barrier location the valley bottom significantly narrows to roughly 100 ft wide. A 3-pass fish population estimate was performed immediately upstream of the potential barrier location in Mudd Creek (Table 12, Mudd 1). Only brook trout and mottled sculpin were captured. Despite the quality habitat, brook trout density was relatively low. No westslope cutthroat were captured. Several irrigation diversions are located upstream of the sampling site.

West Fork Mudd Creek

West Fork Mudd Creek was surveyed immediately upstream of the York diversion (Table 12, W Fk Mudd 1). Brook trout and mottled sculpin were the only fish species captured during the survey. Both juvenile and adult tailed frogs were captured. Approximately 1 mile upstream (W Fk Mudd 2), only brook trout and sculpin were captured. The habitat in this reach of stream is low gradient with frequent deep pools and abundant clean gravels. The density of brook trout in this reach was moderately high. A natural waterfall exists on West Fork Mudd Creek approximately 2 miles upstream of the York diversion. Upstream of this waterfall has historically been fishless. Surveys conducted in the fall of 2010 revealed that the cliff face adjacent to the waterfall barrier had collapsed and buried the 6 ft falls (Figure 3). The collapsed area still likely functions as a fish barrier because the water is flowing subsurface through the rubble. However, through time, it is likely that the spaces between the rocks will be filled with debris and water will flow over the surface and fish may be able to pass around the former falls. The stream was sampled downstream of the waterfall (W Fk Mudd 3) and only brook trout and sculpin were captured. Non-hybridized westslope cutthroat trout have been sampled in West Fork Mudd Creek, but this survey and others performed recently by the Forest Service have failed to document cutthroat in the stream. It is likely that this population of cutthroat has been extirpated.

Figure 3. West Fork of Mudd Creek collapsed barrier. Six ft high waterfall was present in center of photo, but collapse of adjacent cliff buried the falls.

Table 12. Fisheries survey data from Mudd Creek and tributaries during 2008 and 2010 where Length = the length of the section, L is fish length and W = weight of the fish. The fish species sampled are: EB = brook trout, M Cot = mottled sculpin.

Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
Mudd 1 (525)	45.86508	113.35137	3 Pass	EB (31)	342 (272-411)	6.3 (3.5-8.6)	0.15 (0.01-0.35)
W Fk Mudd 1 (500)	45.87442	113.40337	2 Pass	EB (27)	310 (250-371)	4.4 (2.1-6.6)	0.04 (0.01-0.09)
W Fk Mudd 2 (350)	45.88528	113.41369	2 Pass	EB (76) M Cot (32)	1220 (1109-1332) 524 (433-614)	4.2 (1.4-8.2) 2.6 (1.0-3.3)	0.04 (0.01-0.19)
W Fk Mudd 3 (700)	45.89299	113.42290	1 Pass	EB (54) M Cot			

Palisades Creek

Palisades Creek is a tributary to the West Fork of Fishtrap Creek (Map 6). It is located entirely within the Anaconda-Pintler Wilderness Area. The stream is listed as having a conservation population of westslope cutthroat trout, but it has never been genetically tested. It was sampled in the summer of 2008 because water is diverted from the stream through a ditch to Mudd Lake in the East Fork of Mudd Creek drainage. At the point of diversion all of the surface flows of Palisades Creek are diverted into the ditch; however, because of the large substrate, water flows through the rocks and within several hundred feet of the diversion there is flowing water again. Only brook trout (34) were captured in Palisades Creek both upstream (Table 13, Palisades 1) and downstream (Table 13, Palisades 2) of the diversion point. Tailed frog juveniles and adults were present in the stream. It is unknown if Palisades Creek is isolated from the West Fork of Fishtrap Creek by a natural barrier. A high-gradient reach exists on Palisades Creek within ½ mile from its confluence, but it is unknown if there is a barrier to fish passage in this reach.

Table 13. Fisheries survey data from Palisades Creek during 2008 where Length = the length of the section, L is fish length and W = weight of the fish. The fish species sampled was: EB = brook trout.

Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
Palisades 1 (600)	45.92651	113.44123	1 Pass	EB (26)		5.6 (3.7-8.0)	
Palisades 2 (500)	45.92651	113.44123	1 Pass	EB (8)		4.3 (2.7-6.6)	0.05 (0.02-0.11)

Deep Creek Tributaries

Sullivan Creek

Sullivan Creek is the southern most major tributary to Deep Creek before the confluence with French Creek originating from the Anaconda-Pintler range (Map 8). Sullivan Creek was surveyed on July 20th, 2010 approximately 3.9 miles upstream of the Forest Service Boundary (Table 14) and no fish were found. The stream habitat in the reach surveyed was moderate gradient with a very straight channel and few pools. The stream substrate was mostly large cobbles and small boulders. The area adjacent to the stream has been clear cut approximately 30-50 years ago. There was very little aquatic life present in the stream. The rocks lacked algae and were pale grey in color. Six invertebrate kick samples were taken into dip nets with 1/8 in mesh and only 1 mayfly was captured. The pH of the stream was 5.44, the most acidic stream surveyed in this report. Previous sampling in Sullivan Creek farther downstream on the Mount Haggin Game Range found a healthy brook trout fishery and a pH of 7.18 (Oswald 1981). The cause of the low pH in upper Sullivan Creek is unknown. There are no mapped mining areas in the drainage upstream of the location surveyed so it is unclear if the cause of the low pH is natural or man-made. Despite the cause, it is apparent that the low pH has substantial impacts on aquatic life in the stream. At the Dry Creek Road crossing within only a few miles downstream of the location surveyed the pH of the stream increases substantially and aquatic organisms are more typical of neighboring streams.

Twelvemile Creek

Twelve Mile Creek is the largest tributary to Deep Creek originating in the Anaconda Pintler range (Map 8). The stream was surveyed on July 21st and 28th, 2010 to determine the current fish species composition. Three locations were electrofished as part of the survey: the first was upstream of the main Forest Service Road Crossing (Twelvemile 1), the second was downstream of the Road 2492 crossing (Twelvemile 2) and the third was approximately 0.5 miles upstream of the Road 2492 crossing (Twelvemile 3). The stream habitat in Twelvemile 1 and 2 can be characterized by moderate to high gradient with primarily boulder and large boulder substrate. Pools are rare. Twelvemile 3 contains a mix of moderate and lower gradient habitat. Pools are more frequent and the stream meanders significantly more than downstream reaches. Only brook trout were captured at Twelvemile 1 (Table 14), but capture efficiency was low due to the large size of the stream and the velocity of the water. Tailed frog tadpoles were preset at all three electrofishing locations and 1 tailed frog adult was found at Twelvemile 2. Both brook trout and westslope cutthroat trout were captured at Twelvemile 2 and no fish were captured at Twelvemile 3. A large cascade (Figure 4) is an apparent fish passage barrier between Twelvemile 2 and 3. Flows at Twelvemile 3 were estimated to be between 5 and 10 cfs. It should be noted that male cutthroat captured at Twelvemile 2 were ripe and 1 female was captured that was also ripe. Genetic samples were collected from the cutthroat, and results indicate the fish are non-hybridized. Successful reproduction of westslope cutthroat trout is occurring in Twelvemile 2 as evidenced by the presence of age-1 fish. Upstream of the cascade, habitat conditions for trout are substantially

improved. The grade of the stream is much less and pools are much more frequent. Significant gravel deposits are present that could provide ideal spawning habitat. There is a little over 1 mile of creek upstream of the cascade that was surveyed and found to

Figure 4. Cascade fish barrier on Twelvemile Creek approximately 200 yards upstream of the FS Road 2492 crossing.

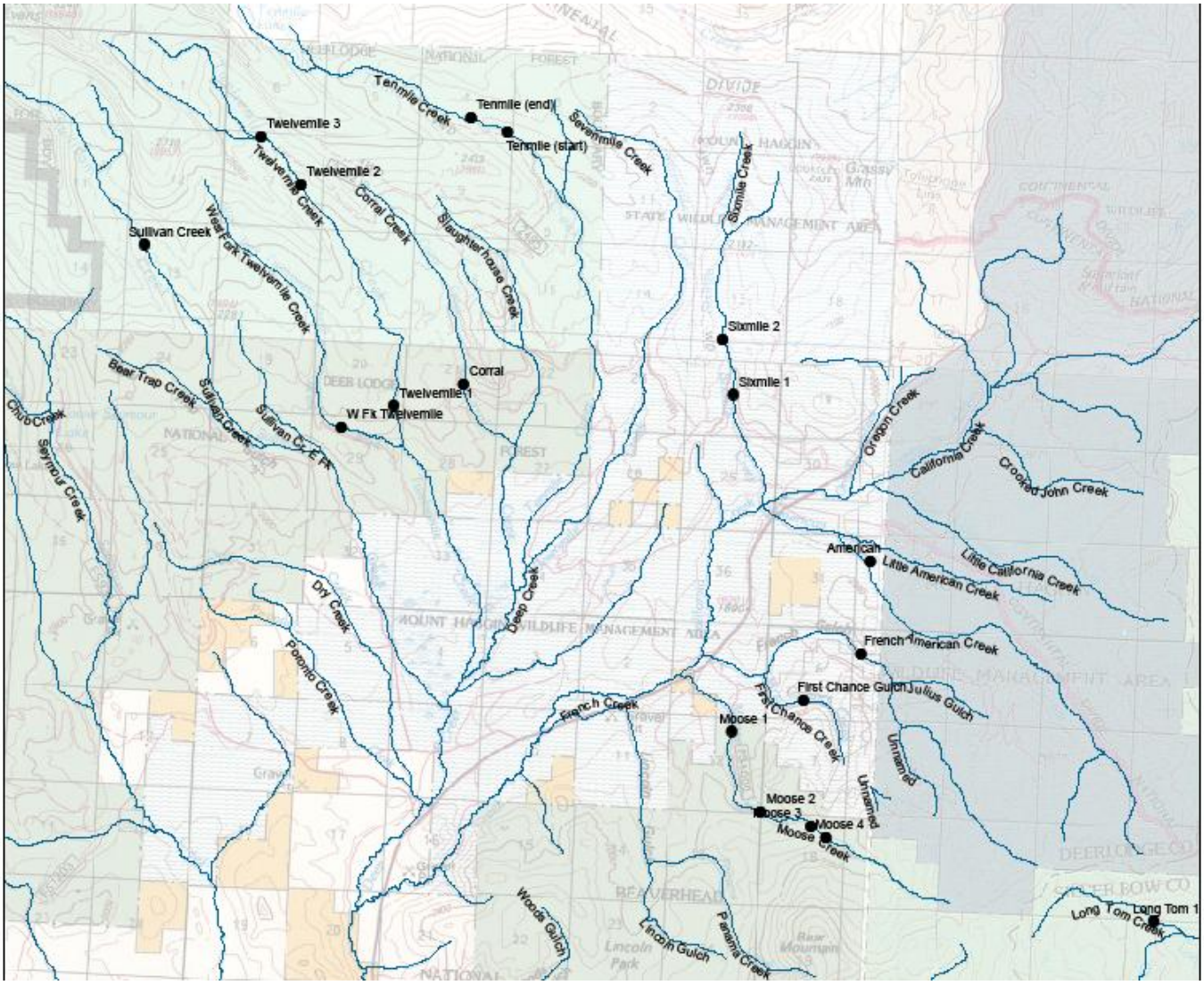
contain adequate flows and habitat to support fish.

West Fork Twelve Mile Creek

A single population estimate was done in the West Fork of Twelvemile Creek (Map 8). At this location, the West Fork of Twelvemile Creek is low gradient with abundant willow and alder stream bank vegetation. The area around the stream has been clear cut and it is possible that the trees on the streambanks were historically logged too. The stream substrate consisted of small gravel and abundant coarse granitic sand. There were also abundant mats of thick dark moss that covered the stream bottom and any debris in the channel. Only brook trout were captured in the section surveyed (Table 14).

Corral Creek

Corral Creek is a small tributary to Deep Creek but is important because it harbors one of the few remaining non-hybridized westslope cutthroat trout populations in the drainage. Corral Creek was sampled upstream of the main Forest Service Road crossing and only brook trout were captured (Map 8, Table 14). Despite its small size, Corral Creek appears to be an important spawning and rearing tributary stream. The numbers of young-of-the-year and 1-year old fish were very high yielding a small average fish size. The stream substrate was primarily small gravel and coarse granitic sand. The stream was low to moderate gradient in the reach sampled. The riparian habitat consisted of alder and birch mixed in among coniferous forest. Near the top of the section, the stream was becoming much more forested with large spruce trees. Mottled sculpin were present in the stream. Tailed frog tadpoles and a longtoed salamander were found at the site. Although no cutthroat were captured, it is possible that a population is still present farther upstream. The last genetics sample from Corral Creek was collected approximately 1.6 miles upstream. It will be important to further sample Corral Creek to determine if this population of cutthroat is still present.



Map 8. Deep Creek and tributaries with black dots indicating locations of stream sampling events.

Tenmile Creek

Ten Mile Creek forms the headwaters of Deep Creek (Map 8). It is the second largest tributary to Deep Creek and originates in the Anaconda Pintler Range. At the headwaters of the drainage are 3 lakes, the middle and lower of which contain self-sustaining populations of rainbow and rainbow/Yellowstone cutthroat hybrids; the upper lake is fishless. The stream downstream of the lakes historically has harbored slightly hybridized westslope cutthroat trout (90.1% westslope) near the Forest Service Boundary and non-hybridized fish farther upstream. Tenmile Creek was electrofish two different times during the summer of 2010 to collect genetic samples from westslope cutthroat trout. Prolonged higher water conditions in midsummer made sampling difficult and only 4 cutthroat were captured. A second effort was made on September 20th, 2010 and an additional 9 cutthroat were captured (Table 14). Although no population estimate was performed, the ratio of brook trout to cutthroat trout was more than 20:1. It should be noted that Tenmile 2 began just upstream of the end of a primitive logging road leading to an outfitter camp and ended at an old mining dam across the creek that has been breached. The habitat in this reach was moderate gradient with large boulder/cobble

substrate and few pools. One of the fish captured during the latter sampling appeared to be very highly hybridized. Genetic samples were collected from all cutthroat, including the apparent hybrid. Results from these samples indicate that cutthroat population in Tenmile Creek is very slightly hybridized (99.7% westslope), and that the one fish that phenotypically appeared hybridized was heavily hybridized. The presence of highly hybridized fish in the stream and self-sustaining populations of non-native rainbow and cutthroat trout in the lakes upstream put the Tenmile Creek population of westslope cutthroat trout in extreme peril. Conservation actions should be taken immediately to preserve the slightly hybridized fish before competition from brook trout and hybridization from rainbow trout lead to the loss of the population.

Sixmile Creek

Sixmile Creek along is a tributary to California Creek which enters French Creek before joining with Deep Creek (Map 8). Sixmile Creek lies entirely within the Mount Haggin Wildlife Management Area. Two locations on Sixmile Creek were electrofished to determine the status of the fishery. The first location sampled was immediately upstream of the main Forest Service Road culvert (Sixmile 1). At this location, brook trout, rainbow trout and mottled sculpin were present (Table 14, Sixmile 1). The stream habitat was low-moderate gradient with small cobble and gravel substrate and high quality, but infrequent pools. The stream channel through several sections had avulsed and was downcutting. It was unclear if these avulsion were related to past mining activities. The riparian vegetation was a mix of willows and alder. Upstream of Sixmile 1, the stream goes through ¼-mile, narrow, bedrock canyon. Within this canyon are several small waterfalls between 3 and 5 ft in height (Figure 5). It is unknown whether these falls represent barriers to fish passage, but they appear to have the capability of precluding upstream movement of fish. If the falls are barriers to fish passage, they would isolate at least 2 miles of habitat upstream. Sixmile 2 was located immediately upstream of this canyon. The habitat in this reach of stream consisted of an "E" type channel meandering through a sedge/willow bottom. There was no evidence of grazing impacts and the stream appeared to be in pristine condition. Pools were frequent and very high quality (some 3 ft deep). The stream substrate was sand and small gravel. Only brook trout in high abundance were captured in the stream (Table 14). The lack of sculpin and rainbow trout found downstream is another indication that the falls may represent barriers to fish passage. An interesting aspect of Sixmile Creek was the high conductivity of the water (220 µS) relative to any of the other tributaries to Deep Creek, which were all less than 100 µS.

Figure 5. Series of falls on Sixmile Creek. From left to right starting in the upper left is the lower most, middle two and upper falls. Dip net shown is 5 ft tall.

American Creek

American Creek is the largest tributary to California Creek. It and most of the other tributaries to California and French Creek have experienced significant historic mining activities within their watersheds. Most of the visible mining evidence on the surface is from placer and dredge mining. American Creek from its confluence to above the confluence with Little American Creek has extensive beaver activity with multiple large dams and a heavily inundated floodplain. American Creek was sampled approximately 0.45 miles upstream of the confluence with Little American Creek. At this location the stream was low to moderate gradient with abundant willows on the stream banks. The stream lacked well developed pools, which was unusual given the stream type and the absence of any visible mining activity. The stream substrate was mostly gravel with small cobble more abundant near the upstream portion of the section. Only brook trout and mottled sculpin were captured in the stream Table 14. Although no population estimate was made, the abundance of brook trout was low relative to the size of stream and quality of habitat. Spotted frog adults were also common.

French Creek

French Creek in French Gulch has been extensively placer and dredge mined. Large piles of spoils are present in the floodplain in the lower reaches of the stream and large cuts are present in adjacent hillsides. Despite the extensive mining history, the riparian area has recovered and abundant mature willows are present. The stream was electrofished in one location approximately 1 mile upstream from the highway crossing. At this location, willows were abundant and the stream gradient was low to moderate. The stream substrate was primarily gravel. The stream channel was very straight with few pools which was unusual given the valley width and slope which were more indicative of a meandering type stream channel. There were abundant seeps and springs in the area surveyed. Only brook trout and mottled sculpin were captured in the surveyed section of stream (Table 14). Spotted frogs were abundant in this reach of stream.

First Chance Gulch

First Chance Gulch is a tributary to French Creek and has experienced similar mining related impacts and riparian recovery as its parent stream. The valley width is much narrower and the stream channel is much more confined than in French Creek, exacerbating the impacts of floodplain dredge spoils. Despite the impacts, the stream contains a relatively abundant brook trout population (Table 14). No age-0 brook trout were captured in the reach sampled suggesting this area may lack adequate spawning habitat. No sculpins were captured in the surveyed reach, but spotted frogs were present.

Moose Creek

Moose Creek is a tributary of French Creek near the southeastern corner of the Mount Haggin Wildlife Management Area (Map 8). The stream historically harbored a non-hybridized population of westslope cutthroat trout. Unlike other French Creek tributaries, there is little evidence of past mining activities in Moose Creek. Four different sections were electrofished in Moose Creek on July 26th, 2010 to quantify the existing fish populations and determine if westslope cutthroat were still present in the drainage. Moose 1 (Table 14) was located near the Forest Service Boundary. The stream in this reach was low to moderate gradient with a abundant willow and birch riparian vegetation. There were abundant beaver dams downstream of the sampling section. The substrate was primarily small gravels. Only brook trout and mottled sculpin were captured. The density of fish appeared to be low in Moose Creek at this location relative to the quality of habitat present. Spotted frogs were present at Moose 1. Farther upstream at Moose 2, the stream gradient is moderate with primarily boulder and large cobble substrate. This reach is located upstream of the Forest Service Road 1000 stream crossing. The stream flows through a dense spruce forest and only brook trout were captured (Table 14). At Moose 3 and 4, the habitat was similar to Moose 2. Only brook trout were captured at Moose 3 and no fish were found at Moose 4. Either there is a barrier to fish passage between Moose 3 and Moose 4 or in dry years habitat may be limited.

Table 14. Fisheries survey data from Deep Creek tributaries during 2010 where Length = the length of the section, L is fish length and W = weight of the fish. The fish species sampled are: EB = brook trout, WCT = westslope cutthroat trout, RB = rainbow trout and M Cot = mottles sculpin.

Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
Sullivan Creek (1200 ft)	46.01333	113.16615	1 Pass	Fishless			
Twelvemile 1 (850 ft)	45.99038	113.10967	1 Pass	EB (10) M Cot (5)		4.6 (3.5-6.3) 2.7 (1.9-3.6)	0.05 (0.01-0.12)
Twelvemile 2 (2850 ft)	46.02372	113.13230	1 Pass	EB (56) WCT (26)		5.7 (3.5-7.7) 5.7 (2.2-8.0)	0.07 (0.02-0.16) 0.07 (0.01-0.17)
Twelvemile Barrier	46.03095	113.14338					
W Fk Twelvemile (300 ft)	45.98664	113.12092	2 Pass	EB (58) M Cot (8)	1136 (956-1316)	3.7 (1.2-5.7) 3.1 (2.4-4.0)	0.03 (0.00-0.09)
Tenmile (start) (2200 ft) (end)	46.03316 46.03508	113.08739 113.09550	1 Pass	EB (237) WCT (9)			
Corral (1000 ft)	45.99414	113.09440	1 Pass	EB (66) M Cot		3.7 (1.2-6.2)	0.04 (0.01-0.09)
Sixmile 1 (800 ft)	45.99446	113.03493	1 Pass	EB (48) RB (4) M Cot (14)		5.0 (1.8-8.1) 4.7 (3.5-7.3) 3.0 (1.5-4.5)	0.06(0.02-0.23) 0.04 (0.02-0.11)
Sixmile 2 (240 ft)	46.00285	113.03783	2 Pass	EB (135)	2559 (2497-2620)	3.6 (1.5-6.5)	
American (550 ft)	45.96974	113.00310	1 Pass	EB (36) M Cot (15)		3.5 (1.4-7.1) 2.8 (1.2-4.0)	0.04 (0.01-0.13)
French (450 ft)	45.95552	113.00427	2 Pass	EB (61) M Cot (11)	732 (695-770)	4.2 (1.1-6.5) 3.5 (2.6-4.3)	0.05 (0.01-0.12)
First Chance Gulch (300 ft)	45.94800	113.01640	2 Pass	EB (28)	500 (472-528)	5.7 (4.5-7.0)	0.07 (0.04-0.14)
Moose 1 (435)	45.94272	113.03188	2 Pass	EB (25) M Cot (21)	337 (257-417)	3.8 (1.0-7.0) 3.0 (2.0-4.2)	
Moose 2 (800)	45.93059	113.02475	1 Pass	EB (63)		4.4 (1.0-7.7)	0.06 (0.01-0.18)
Moose 3 (2000)	45.92876	113.01356	1 Pass	EB (70)			
Moose 4 (400 ft)	45.92707	113.01022	1 Pass	No Fish			

Bryant Creek

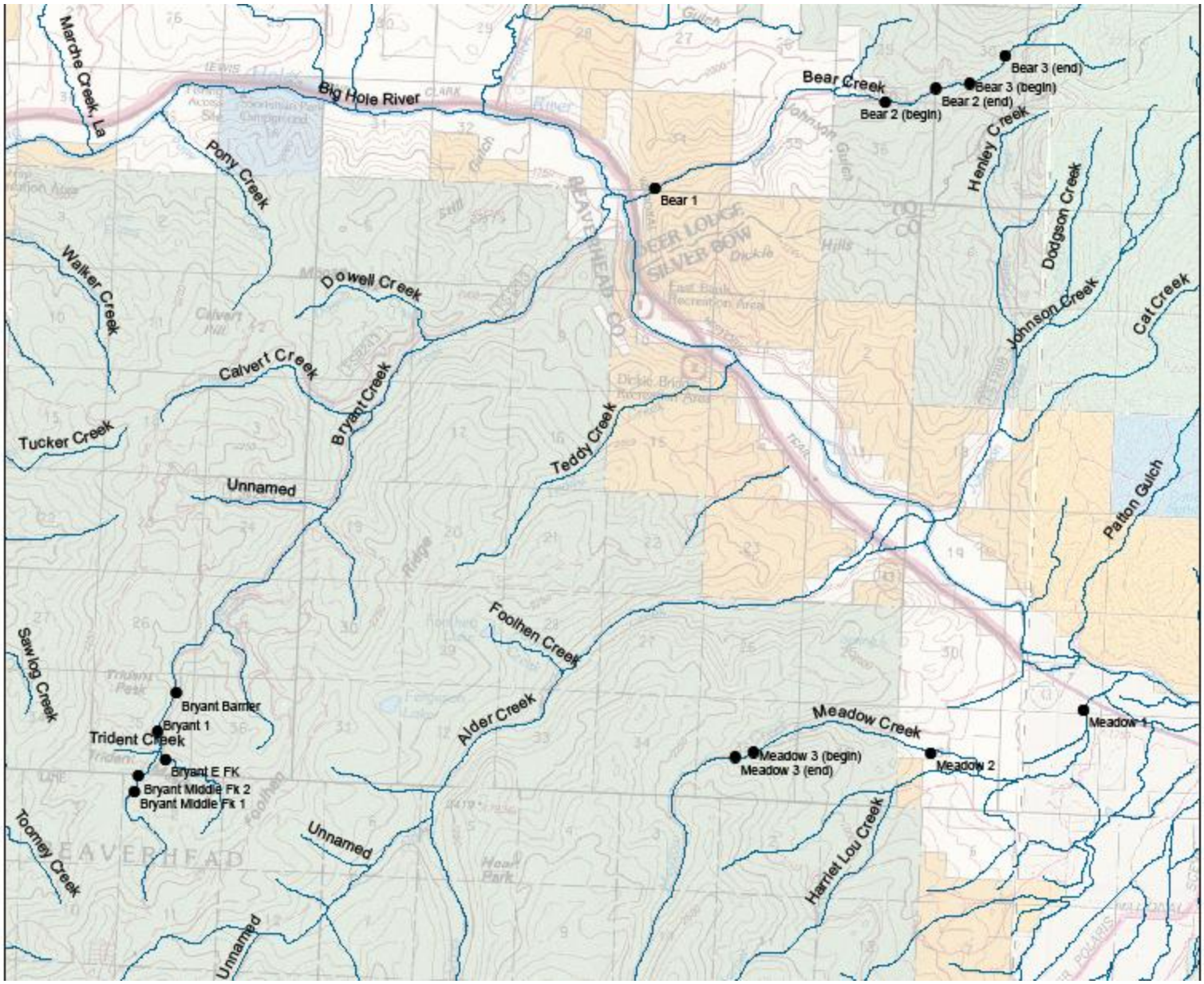
Bryant Creek originates in Trident Meadows, which is named from the 3 headwater forks that converge in the meadow to form Bryant Creek (Map 9). Trident Meadows is home to one of a few streams in the Big Hole drainage with a non hybridized population of westslope cutthroat trout upstream of a natural fish migration barrier where no non-native fish are present. The east and middle forks of the creek convey the majority of the water in the creek. The smaller west fork only has a defined channel for a short distance upstream of its confluence where it drains from a large wet meadow. All three forks of the stream and the area downstream of the meadows were surveyed on July 13th, 2010. The habitat in Trident Meadows is characterized by a wide grassy meadow with abundant, high-elevation willows. The stream substrate in the forks is primarily sand, while downstream of the forks there is abundant small gravel. The stream is narrow and deep ("E" type channel) in the forks with well developed pools and below the forks it is more typical of a "C" type channel. There was abundant dark moss on the streambed in the creek and the forks. Downstream of the forks (Bryant 1), a population estimate was performed and only westslope cutthroat trout were present (Table 15). Unfortunately the estimate has a wide confidence interval because of the poor efficiency in the large, frequent pools. However, it is clear that the cutthroat trout population in Byrant Creek appears small relative to the quality of habitat present. The east fork was surveyed beginning high in the meadow where the channel was less defined and working downstream. The first fish was encountered at the GPS location shown as Bryant E Fk 1 (Map 9), approximately 0.15 miles upstream of the confluence, but the stream was spot shocked beginning approximately ½ mile upstream of this location. The middle fork

Figure 6. Farthest downstream fish barrier identified on Byrant Creek downstream of Trident Meadows.

was fishless in the upper reaches. This reach of stream had slightly greater stream gradient and well developed pools with abundant gravel. One of the past genetic samples came from this reach of stream and past Forest Service surveys indicated that cutthroat were present in this reach of stream. It is unclear why it is fishless now because there appears to be adequate habitat to support a fishery. Downstream of this sampling location approximately 200 yards, there is a short reach of stream (100 yards) where the channel is undefined and flowing through a large fen. Immediately downstream a defined channel is present again and the first cutthroat trout was encountered in this reach (Table 15, Bryant Middle Fk). Bryant Creek was surveyed downstream of Trident Meadows to determine where potential fish barriers exist and the upstream extent of the brook trout population below. Three potential barrier sites were identified (from upstream to downstream: Barrier 1 = N 45.79606 W 113.17564, Barrier 2 = N 45.79719, W 113.17522, Barrier 3 = N 45.79737 W 113.17500). The most downstream barrier (Figure 6) appears to be the barrier precluding upstream passage because a brook trout was captured in the pool immediately downstream of the cascade and no brook trout were captured farther upstream. Brook trout were common downstream of this location. None of the barriers identified appear to be impassible to fish at all flows, so there exists the potential for Bryant Creek to be colonized by brook trout. One spotted frog tadpole was captured in the stream at the barrier site.

Table 15. Fisheries survey data from Byrant Creek and tributaries 2010 where (Length) is the length of the reach sampled in feet and Species are: EB = brook trout and WCT = westslope cutthroat trout.

Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
Bryant 1 (500 ft)	45.79172	113.17842	2 Pass	WCT (32)	466 (195-736)	4.5 (1.7-7.9)	0.05 (0.01-0.17)
Bryant E FK	45.78772	113.17654	1 Pass	WCT (12)		5.7 (3.9-7.1)	0.08 (0.03-0.15)
Bryant Middle Fk 1 (540 ft)	45.78301	113.18264	1 Pass	Fishless			
Bryant Middle Fk 2	45.78519	113.18192	1 Pass	WCT (4)		6.7 (5.2-7.2)	0.11 (0.10-0.12)
Bryant Barrier	45.79739	113.17500	1 Pass	EB (1)			



Map 9. Bryant, Bear and Meadow creek and tributaries with black dots indicating locations of stream sampling events.

Bear Creek

Bear Creek is a small tributary to the Big Hole River located immediately across the river to the northeast from Bryant Creek (Map 9). The stream is low to moderate gradient near its mouth upstream for approximately 2.5 miles. Willows and birch are the predominant woody riparian vegetation with some areas of coniferous forest. Landownership in the lower reaches is a mix of private and BLM. There are 2 sections of the stream in this reach which have multiple beaver dams, although there did not appear to be much recent beaver activity. The crossing under Highway 43 consists of a bottomless metal culvert

that appears to have been installed to facilitate fish passage. Immediately upstream of the culvert a large (3 ft) vertical drop is present where it appears fill was excavated during the highway construction. The drop is head cutting upstream and each year the grade of the drop lessens. Near the forest boundary the stream gradient increases and the stream is forested with large spruce trees. Pools are less frequent and the substrate is much larger than farther downstream. An irrigation diversion is present near the location where the main road crosses Bear Creek on the National Forest for the first time. At the time of this sampling the crossing (a log bridge) was closed because it was unsafe for vehicular travel. Bear Creek is home to a non-hybridized population of westslope cutthroat trout.

Bear Creek was surveyed to determine if rainbow or brown trout were present in the lower reaches of the stream (indicating fish passage from the Big Hole River past Highway 43) and to determine the status of the fishery in the rest of the stream. Bear Creek was surveyed on July 19th, 2010. Upstream of Highway 43 (Bear 1), only brook trout and mottled sculpin were captured (Table 16). No brook trout were captured on the second electrofishing pass so confidence intervals were not generated. The habitat in this reach was very good with a meandering stream channel, well developed pools and abundant, clean gravels. It is unclear why the density of brook trout was so low relative to the high quality of habitat present. Farther upstream near the Forest Service Boundary (Bear 2), westslope cutthroat trout and brook trout were captured but no sculpin were present (sampling occurred on 2 dates: 7/19/10 and 8/24/10). Interestingly, at this location, cutthroat trout outnumbered brook trout. Farther upstream (Table 16, Bear 3) only brook trout were captured. Brook trout were present in Bear Creek to the end of Bear 3 so the upstream distribution of fish in the stream remains unknown. It should be noted that the abundance of fish near the end of Bear 3 was very low.

Table 16. Fisheries survey data from Bear Creek and tributaries during 2010 where (Length) is the length of the reach sampled in feet and Species are: EB = brook trout, WCT = westslope cutthroat trout, M Cot = mottled sculpin.

Section (Length)		Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
Bear 1 (600 ft)		45.87327	113.08112	2 Pass	EB (9) M Cot (15)	80	5.7 (3.7-7.7) 3.1 (1.5-3.9)	0.09 (0.02-0.20)
Bear 2 (2600 ft)	(begin) (end)	45.88723 45.88947	113.03441 113.02409	1 Pass	EB (14) WCT (26)		5.2 (4.1-8.1) 5.2 (4.0-6.1)	.011 (0.02-0.25) 0.06 (0.02-0.10)
Bear 3 (2500 ft)	(begin) (end)	45.89040 45.89473	113.01719 113.01010	1 Pass	EB (23)			

Meadow Creek

Meadow Creek is a small tributary to the Big Hole River west of the town of Wise River (Map 9). It originates in the West Pioneer Mountains and flows north then turns east where it is joined by Harriet Lou Creek. The upper reaches of the stream on National Forest can be characterized by moderate to high gradient with boulder and large cobble stream substrate. The riparian plant community consists of primarily large mature spruce

trees. Downstream of the Forest Service boundary the gradient of the stream lessens and the substrate size decreases. Deciduous woody plants, primarily aspen near the Forest Service Boundary and willows farther downstream, form the riparian canopy downstream to near the confluence with Hariet Lou Creek. Downstream of Harriet Lou Creek the stream flows through irrigated pasture lands with very few willows. The banks are grassy and relative stable in the lower reaches of the stream. Meadow Creek is home to a slightly hybridized (99.2%) population of westslope cutthroat trout.

Meadow Creek was sampled in 3 locations on September 23rd, 2010 to determine the status of the fishery. The first location sampled was immediately upstream of Highway 43 (Table 17, Meadow 1). At this location a 2-pass estimate was performed, but only mottled sculpin were captured on the second pass so reliable estimates were not produced. In addition to sculpin, brown, rainbow and brook trout were captured in the stream along with mountain whitefish. The fish community in the lower reaches of Meadow Creek closely resembles that of the Big Hole River and it appears that the stream may be an important spawning and rearing stream for fluvial fish. Farther upstream (Meadow 2), only brook trout were captured in high abundance. The location of Meadow 3 was a historic beaver dam complex that used to impound a large area. There was no evidence of active beavers in the areas and the dam is decadent and has been breached. Reaches of the stream downstream of Meadow 3 have been diverted from their historic channels to facilitate flood irrigation. On the forest (Table 17, Meadow 3) only westslope cutthroat trout were captured at very low abundance. Genetic samples were collected from the cutthroat captured, and suggest a very low hybridization rate with Yellowstone cutthroat trout (97.3% westslope). It is unclear why brook trout were not present at Meadow 3 when they were abundant at Meadow 2 approximately 1.8 miles downstream. The presence of rainbow trout in the lower stream pose an immediate and substantial threat to the population of native westslope cutthroat in Meadow Creek. No rainbow trout hybridization has occurred in Meadow Creek and there are no barriers between Meadow 1 and Meadow 3.

Table 17. Fisheries survey data from Meadow Creek during 2010 where (Length) is the length of the reach sampled in feet and Species are: EB = brook trout, WCT = westslope cutthroat trout, RB = rainbow trout, LL = brown trout, MWF = mountain whitefish and M Cot = mottled sculpin.

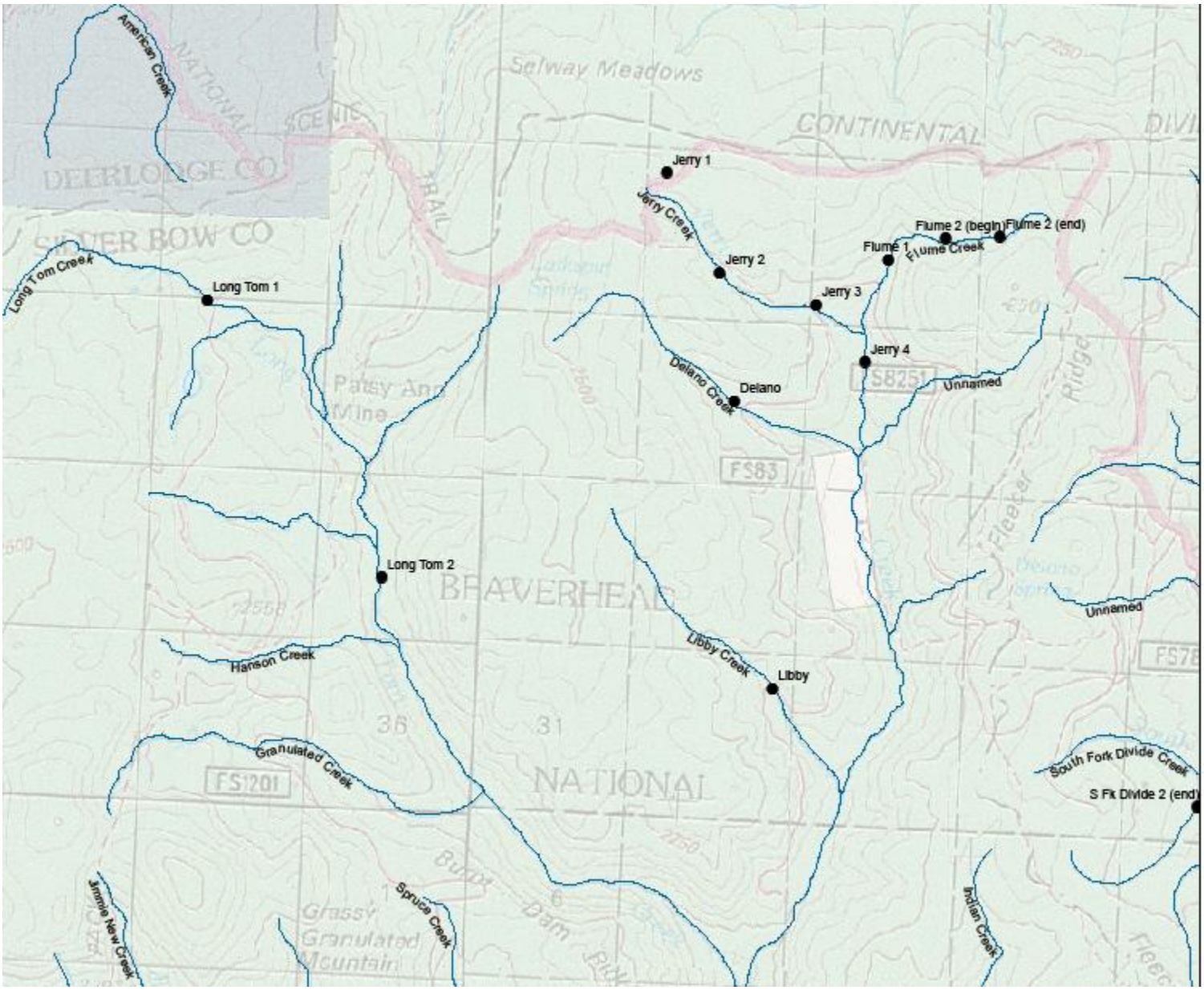
Section (Length)		Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
Meadow 1 (300 ft)		45.80089	112.98801	2 Pass	EB (6)		7.8 (4.4-10.8)	0.21 (0.03-0.50)
					RB (2)		5.2 (3.1-7.3)	0.09 (0.02-0.16)
					LL (2)		10.5 (3.5-17.5)	
					MWF (10)		5.0 (4.2-9.6)	0.05 (0.02-0.30)
					M Cot (15)		3.7 (2.9-5.3)	
Meadow 2 (300ft)		45.79373	113.01907	2 Pass	EB (125)	2379 (2057-2701)	3.3 (1.6-9.6)	
Meadow 3 (1040 ft)	(begin)	45.79266	113.05547	1 Pass	WCT (7)		6.5 (3.7-8.1)	0.11 (0.02-0.19)
	(end)	45.79185	113.05922					

Jerry Creek

Jerry Creek is a moderate size tributary to the Big Hole and is the largest stream draining from the Fleecer Mountain area (Map 10). The stream habitat in Jerry Creek consists of primarily moderate gradient "B" type channel from its confluence to approximately ½ mile downstream of Long Tom Creek, the largest tributary to Jerry Creek. Pools through this reach of stream are rare and the substrate consists of primarily large cobbles and boulders. Approximately ½ mile downstream of the confluence of Long Tom Creek the stream gradient increases and the valley width decreases dramatically. Large boulders are the primary stream substrate and the stream cascades in several reaches. Upstream of this cascading reach to near the confluence of Long Tom Creek the stream meanders through a short meadow. The channel type though the meadow would likely be considered a "C" type channel with frequent meander scour pools. The substrate is primarily gravel and willows, which are rare farther downstream, are common. Upstream of the confluence of Long Tom Creek, the stream is moderate gradient until approximately ½ mile upstream of the confluence of Libby Creek where the stream gradient lessens again and the stream flows through a large meadow complex. The meadows appear to have active beaver dams, but the area has not been recently surveyed. The meadows are also home to a private inholding known as the Delano Place. Upstream of the meadows the stream gradient increases again and is moderate gradient to the headwaters. The Forest Service Road that circumnavigates the upper drainage has several culvert stream crossings that form fish barrier. Jerry Creek, Delano Creek and Libby Creek crossings appear to be complete barriers to fish passage (i.e., no brook trout present upstream), while Flume Creek appear to still allow some fish passage. Jerry Creek is home to slightly hybridized and non-hybridized conservation populations of westslope cutthroat trout. Non hybridized populations, with the exception of Spruce Creek, are limited to the headwater upstream of perched culverts, but cutthroat trout are common throughout the drainage. Cutthroat trout in Jerry Creek downstream of the perched culverts are hybridized with hybridization levels increasing toward the mouth.

Jerry Creek and several of its tributaries were sampled in early July 6th and 7th, 2010 to determine the present status of the fishery and to collect genetic samples from cutthroat trout. Jerry Creek was surveyed in 3 locations (Map 10, Table 18). Only westslope cutthroat trout were captured upstream of the Forest Service Road Crossing (Table 18, Jerry 1 and Jerry 2). Reproduction is still occurring in the isolate population of cutthroat trout upstream of the culvert crossing as evidenced by the presence of age-1 fish, but the population size is limited by available habitat (approx 1.3 miles). Immediately downstream of the culvert crossing brook trout are present in the stream, but at relatively low density compared to cutthroat (Table 18, Jerry 3). No brook trout were captured on the second pass at Jerry 3, so no confidence intervals are available for the estimate. The cutthroat density in Jerry 3 was more than double that of Jerry 2. Downstream of the confluence of Flume Creek (Jerry 4) the stream is much larger. Although only one electrofishing pass was made, assuming an 85% capture efficiency (efficiency at Jerry 3, actual efficiency was likely lower due to larger stream size) the population estimate would be near 750 cutthroat and 350 brook trout per mile. The density of fish again

doubled from Jerry 3 to Jerry 4. It should be noted that cutthroat trout were observed actively spawning in Jerry 3 and Jerry 4.



Map 10. Jerry Creek and tributaries with black dots indicating locations of stream sampling events.

Flume Creek

Flume Creek is a tributary to Jerry Creek near its headwaters. A semi-perched culvert acts as a deterrent to fish passage. Most of Flume Creek is moderate gradient with a semi-open canopy, grassy banks and lodgepole pine over story. The substrate is large consisting mostly of cobbles and small boulders with pockets of limited gravels. Flume Creek was electrofished at 2 locations (Table 18, Flume 1, 2). Flume 1 was located

immediately upstream of the road culvert and Flume 2 was located approximately ½ mile upstream. Brook trout and cutthroat trout were present at Flume 1 indicating that the culvert is likely passable to fish at certain flows. However, farther upstream, only westslope cutthroat trout at low density were captured. A long cascade on Flume Creek (N45.92495, W112.83884) appears to form a fish barrier and no fish were captured upstream of this barrier. Habitat conditions upstream of the barrier may be limiting for fish survival because of low water in dry years or during winter. Genetic samples were collected from all cutthroat captured, but results are not available.

Delano Creek

Delano Creek, similar to upper Jerry Creek, harbors one of only a few remaining non-hybridized populations of westslope cutthroat trout with no other non-native species present. The reason for the lack of non-native species is the presence of a perched road culvert that is an apparent fish barrier. Delano Creek was electrofished to collect genetic samples from cutthroat trout and determine the population status. Only westslope cutthroat were captured at moderate abundance (Table 18). However, results of genetic samples collected indicate the fish population in Delano Creek has become hybridized. Of the 25 fish sampled 15 appeared to be non-hybridized westslope cutthroat trout and the other 10 appeared to be a hybrid swarm between westslope cutthroat and rainbow trout with a predominant (0.873) westslope cutthroat trout genetic contribution.

Libby Creek

Libby Creek is a small tributary to Jerry Creek downstream of Delano Creek. Similar to other Jerry Creek tributaries, the road crossing culvert is perched creating what appears to be a fish barrier. Libby Creek was electrofished immediately upstream of the culvert and 1 westslope cutthroat trout was captured (Table 18). Time constraints prevented further survey of the stream, but to the best of our knowledge this is the first time fish have been documented in the stream upstream of the road crossing. Further surveys are needed to determine if there is a viable population of cutthroat trout in the stream.

Long Tom Creek

Long Tom Creek is the largest tributary to Jerry Creek and it nearly doubles the flow of the stream at its confluence. Fish Lake is located at the headwaters of the drainage but no trout are present in the lake. Although no stocking records exist for the lake, anecdotal evidence from local landowners indicate that the lake was stocked several times in the past but would experience periodic die offs of stocked trout. Longnose suckers are the only fish present in the lake and they were likely introduced. Long Tom Creek was electrofished at 2 locations on 7/8/10. Near the headwaters and downstream of Fish Lake, Long Tom Creek was fishless (Table 18, Long Tom 1). Farther downstream only westslope cutthroat trout and 1 longnose sucker was captured. Interestingly, no brook trout were captured in the stream; however flows were relatively high at the time of sampling and efficiency was low, therefore, it is difficult to rule out the potential presence of brook trout at low density in the stream. There are no known barriers in

Long Tom Creek, but the lower reaches of the stream have not been adequately surveyed. Genetic samples were collected from captured cutthroat trout, but results are not yet available. Past genetic samples collected from the stream indicate the fish are slightly hybridized (96% westslope).

Table 18. Fisheries survey data from Jerry Creek and tributaries during 2010 where (Length) is the length of the reach sampled in feet and Species are: EB = brook trout, WCT = westslope cutthroat trout and LSU = Longnose sucker.

Section (Length)		Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
Jerry 1 (1200 ft)		45.92926	112.88066	1 Pass	WCT (23)		4.0 (1.5-6.9)	0.04 (0.01-0.10)
Jerry 2 (500 ft)		45.92071	112.87353	2 Pass	WCT (16)	178 (149-211)	4.8 (2.9-6.7)	
Jerry 3 (500 ft)		45.91831	112.86133	2 Pass	WCT (39) EB (8)	421 (329-447) 84	5.0 (2.8-7.8) 5.0 (1.7-6.0)	
Jerry 4 (550 ft)		45.91358	112.85498	1 Pass	WCT (66) EB (28)		5.7 (1.6-8.4) 5.7 (1.6-8.1)	0.09 (0.01-0.20) 0.11 (0.03-0.19)
Flume 1 (500 ft)		45.92253	112.85262	2 Pass	WCT (15) EB (26)	183 (111-255) 279 (261-298)	4.5 (2.5-8.8) 3.9 (1.8-6.0)	0.08 (0.01-0.22) 0.04 (0.01-0.08)
Flume 2 (1600 ft)	(begin) (end)	45.92461 45.92495	112.84561 112.83884	1 Pass	WCT (18)		5.4 (2.5-7.3)	
Delano (300)		45.90964	112.87106	2 Pass	WCT (25)	423 (425-461)	4.5 (2.0-5.7)	0.04 (0.01.06)
Libby (200)		45.88487	112.86474	1 Pass	WCT (1)			
Long Tom 1 (200)		45.91644	112.93722	1 Pass	No Fish			
Long Tom 2 (1300)		45.89304	112.91401	1 Pass	WCT (25) LSU (1)		7.3 (4.0-10.9) 2.3	0.16 (0.03-0.45) 0.01

Divide Creek

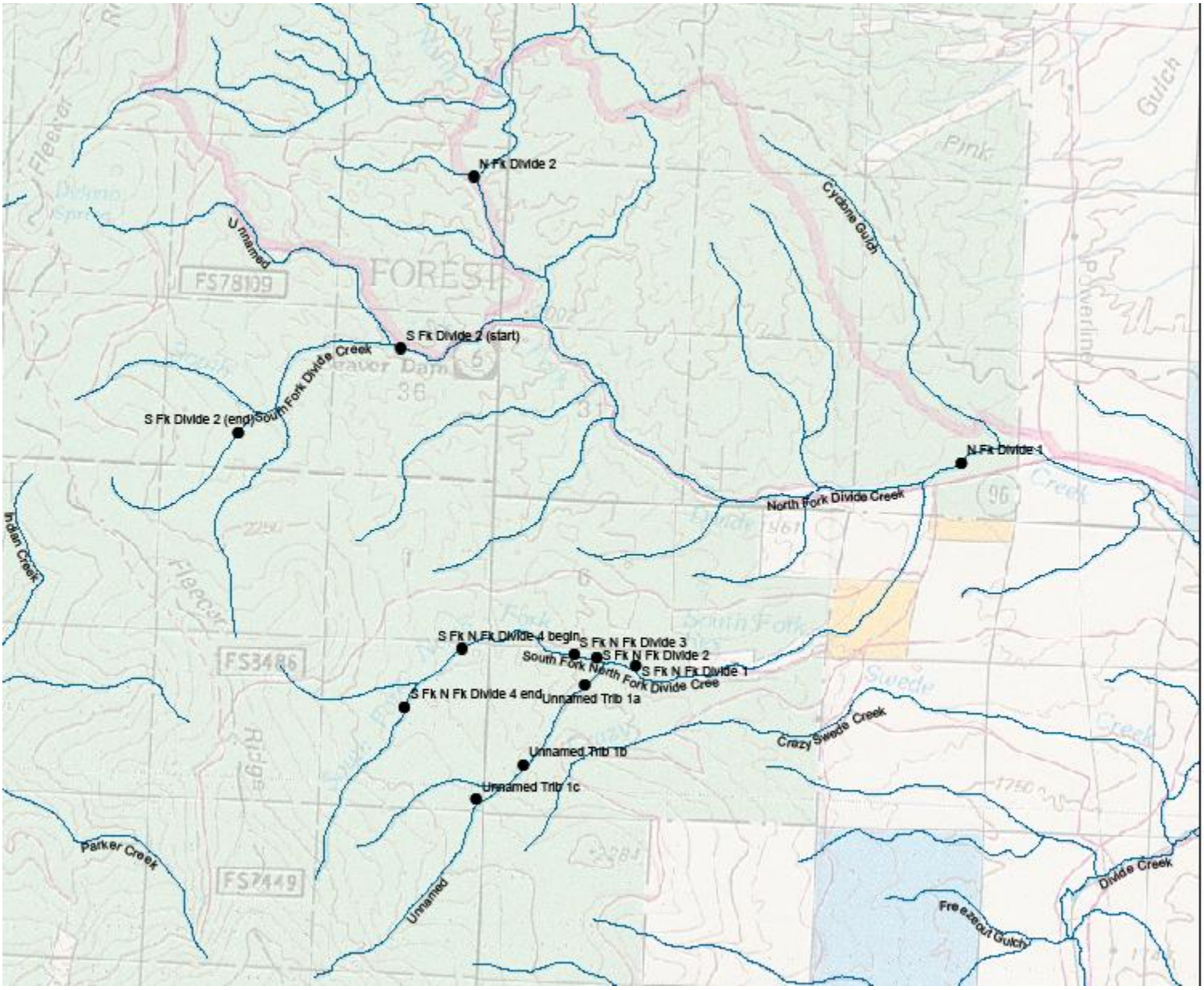
The North Fork Divide Creek drains from the north slopes Fleecer Mountain and the East Fork of Divide Creek drains from the Highland Mountains (Map 11). The East Fork is a small stream, while the North Fork is the source of the majority of the water in the stream. The South Fork of the North Fork of Divide Creek is part of the Butte-Silverbow drinking water supply. A small reservoir is present on this stream near the forest boundary and water is piped from the reservoir to the main line from the Big Hole River and into the water treatment plant at Feeley, MT. The North Fork of Divide Creek and several of its tributaries are home to conservation populations of westslope cutthroat trout. Genetic samples collected in the past indicate that non-hybridized fish are present in the upper North Fork, in upper reaches of the South Fork and in the South Fork of the

North Fork of Divide Creek. In 2008 -2010 the North Fork of Divide Creek, its tributaries and South Fork Reservoir were sampled to determine the status of the fisheries. Two sections were sampled on the North Fork, 3 sections on the South Fork and extensive sampling was performed in the South Fork of the North Fork of Divide Creek to determine the distribution of westslope cutthroat trout and brook trout in the stream (Map 11). Genetic samples were taken from all cutthroat trout captured (up to 30 fish), except those captured in gill nets in South Fork Reservoir.

Only brook trout were captured in the lower (Table 19, N Fk Divide 1) and mid reaches (Table 19, N Fk Divide 2) of the North Fork of Divide Creek (Table 19). In the past 100% pure westslope cutthroat were present in the North Fork below Bull Ranch near N Fk Divide 2, but none were captured during this survey. It is possible that cutthroat may still be present in the North Fork of Divide Creek but this survey would suggest they are either isolated in headwater tributaries or at very low density (i.e., less than 100:1). In 2010 a potential barrier location was identified in the North Fork of Divide Creek upstream of the Forest Service boundary. The stream in this reach highly confined and moderate gradient with very large boulders. At one location the stream flows over a single 3 ft fall into a large plunge pool (Figure7). To determine if this falls currently functioned as a fish barrier 110 brook trout ranging in size from 2.0-10.0 in were captured upstream of falls, adipose fin clipped and released in the pool immediately below the falls. Two weeks later the reach upstream of the falls was electrofished again and adipose fin clipped fish were present indicating the falls was not a fish passage barrier. The site was evaluated to determine if it were possible to modify this location to make a fish barrier. Survey of the site indicated that a 5 ft drop could be created if the streambed downstream of the falls could be excavated to the existing maximum depth of the pool immediately below the falls. Given the large rock size, it may not be possible to excavate the streambed downstream of the falls so a second alternative was developed that included diverting the stream upstream of the falls over a different boulder cascade. It is unclear which alternative would be the most practicable for this site. In either case, a barrier at

Figure 7. North Fork of Divide Creek falls with the potential to be developed into a fish barrier.

this location would isolate the North and South forks of Divide Creek and approximately 9 miles of stream.



Map 11. Divide Creek and tributaries with black dots indicating locations of stream sampling events.

The South Fork of Divide Creek also contains a population of brook and westslope cutthroat trout. Past genetic results suggest there is a mix of unhybridized and slightly hybridized (> 95 %) westslope cutthroat in the stream. In 2008 and 2009, the stream was sampled to determine the distribution and relative abundance of westslope and brook trout in the drainage. Only brook trout were captured in the lower reaches of the stream upstream of Beaver Dam Campground, but a mix of brook trout and westslope cutthroat were captured immediately upstream of this location. Brook trout extend to the

headwaters of the stream, and near the headwaters brook trout and cutthroat are relatively equal in numbers. Fin clips were taken from all westslope captured but genetic testing results were not available at the time this report was completed.

Table 19. Fisheries survey data from North Fork Divide Creek and tributaries during 2008 - 2010 where (Length) is the length of the reach sampled in feet and Species are: EB = brook trout and WCT = westslope cutthroat trout.

Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
N Fk Divide 1 (400)	45.8761	112.72111	2 pass	EB (71)	855 (587-1124)	4.3 (1.5-9.4)	0.07 (0.01-0.45)
N Fk Divide 2 (475)	45.89923	112.78325	2 pass	EB (121)	1526 (1334-1718)	4.4 (1.6-7.9)	0.06 (0.02-0.19)
S Fk Divide 2 (sta)	45.88404	112.79150	Spot shock	EB (26)			
(end)	45.87615	112.81129		WCT (14)			
S Fk N Fk Divide 1	45.85733	112.76056	1 pass	EB (51)		4.4 (2.1-7.2)	0.05 (0.01-0.16)
				WCT (2)		6.1 (4.6-7.6)	0.09 (0.03-0.16)
S Fk N Fk Divide 2 (450)	45.85791	112.76548	1 pass	EB (7)		5.5 (3.9-7.2)	
				WCT (11)		6.1 (1.9-9.0)	0.10 (0.01-0.23)
S Fk N Fk Divide 3 (950)	45.85807	112.76831	1 pass	WCT (18)		4.2 (2.2-8.0)	0.04 (0.01-0.13)
S Fk N Fk Divide 4	45.85820	112.78229	Spot shock	WCT (21)			
	45.85289	112.78915		No Fish			
Unnamed Trib 1a	45.85548	112.76680		WCT (25)			
				EB (18)			
Unnamed Trib 1b	45.84830	112.77404	Spot shock	WCT (2)			
Unnamed Trib 1c	45.84517	112.77974	Spot shock	No Fish			

The South Fork of the North Fork of Divide Creek upstream of the South Fork Reservoir contains brook trout and westslope cutthroat trout. The South Fork Reservoir dam and outlet structures are fish barriers. At base flows in dry years (2008), all of the water entering the reservoir is used for the municipal water supply and the outlet is dry. In wet years, like 2009 and 2010 the reservoir remains full and water spills down a cascade spillway to the stream below the dam. Westslope cutthroat extend from the reservoir to near the headwaters of the stream (Map 11). Brook trout, however, do not extend very far upstream of the reservoir. No brook trout were found above a small high gradient reach located approximately ¾ mi upstream of the reservoir (S Fk N Fk Divide 3). Brook trout and westslope cutthroat trout are present the unnamed tributary to the south, but similar to the mainstem, brook trout are only present a short distance upstream from the confluence (1/3 mi). Westslope cutthroat were present upstream to Unnamed Trib 1b

(Map 11) where the stream gradient greatly increases. This high gradient reach appears to be a fish barrier because no fish were present upstream (Table 19, Unnamed Trib 1c). Suitable fishless habitat appears to be present upstream of the high gradient reach and it could be a candidate stream for expansion of the existing cutthroat population. Thirty-one genetic samples were collected and analyzed from westslope cutthroat upstream of the reservoir and the results indicate the fish are non-hybridized (Leary 2009), similar to past results. An additional 25 samples were collected from the unnamed tributary, and results also indicate the fish were non-hybridized. Past samples collected from this tributary indicate very low levels of hybridization (99% westslope), but the reliability of these results was questionable.

Moose Creek (Highlands)

Moose Creek drains from the Highland Mountain Range to the Big Hole River south of the town of Divide (Map 12). The stream was surveyed from its headwaters to the I-15 culvert to determine the current status of the fishery and the current habitat conditions of the stream. Moose Creek flows primarily through public lands managed by the BLM with a mix of private and US Forest Service ownership through the upper reaches of the stream. Through its middle reaches it flows through a BLM wilderness Study Area. Many of the private land sections in the upper watershed are historic mining areas. The habitat of the stream consists of low gradient meadows near the I-15 crossing with healthy riparian willows and other plants and some evidence of beaver activity. The crossing of I-15 consists of twin 4 ft culverts that are at least 100 yards long and could represent a fish migration barrier. Farther upstream on BLM managed lands the stream is higher gradient and has fewer meanders; however, habitat is in very good condition with very stable banks and heavy riparian vegetation dominated by willow, alder, birch and dogwood. Upstream in Section 13 of the Wilderness Study Area where Moose Creek makes a bend to the south, a fish migration barrier was identified. This reach of stream is very high gradient with common cascades. A single 5 ft cascade (Figure 8) was identified near the upstream extent of the high gradient reach as being a potential fish migration barrier. Upstream of this fish barrier the stream gradient is substantially less and the valley bottom begins to widen. There is abundant evidence of historic beaver activity, but little evidence of current beaver activity through this reach. The upper reaches of the stream fork into several small tributaries.

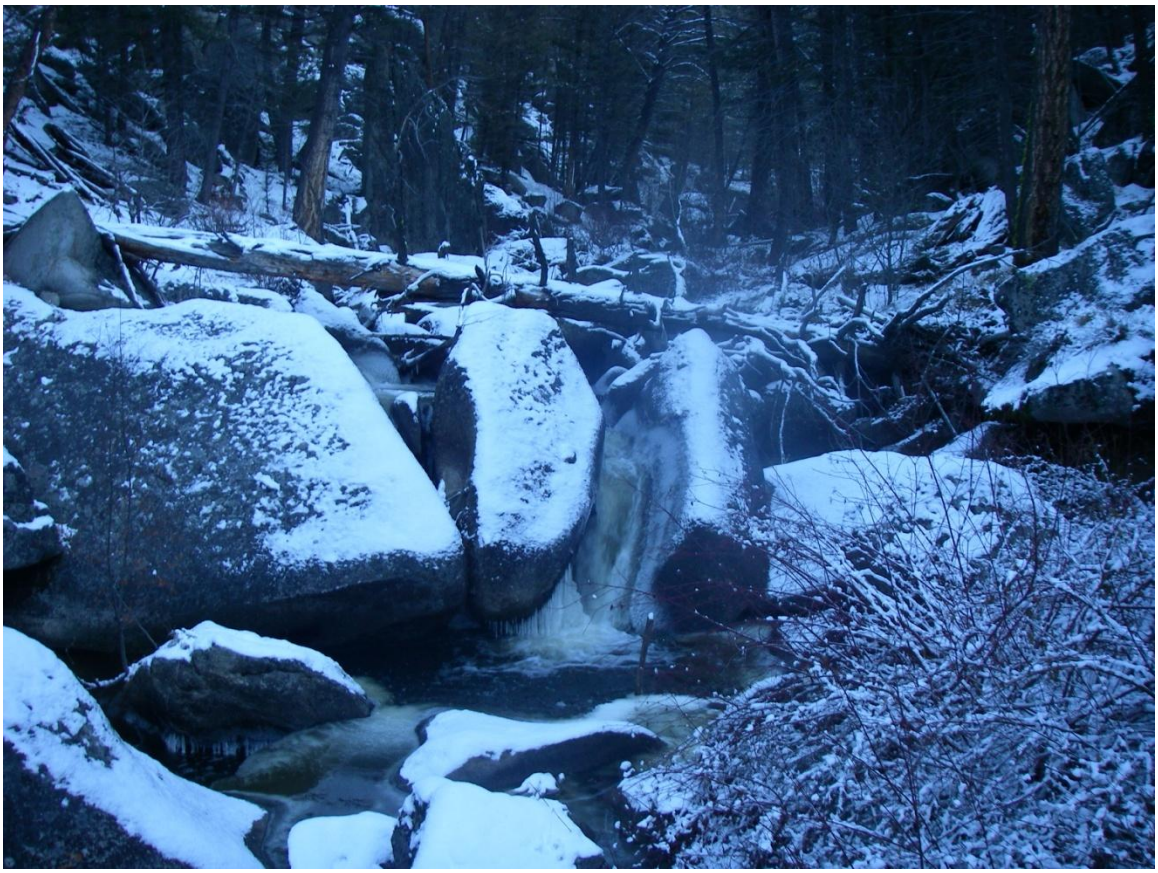


Figure 8. Cascade barrier on Moose Creek

Seven sections of Moose Creek were sampled in July of 2008 (Map 12). In 2 of the 7 sections population estimates obtained. The lower reaches of the stream contained brown, rainbow and brook trout. Mottled sculpin were also present at this site (Table 20, Moose Cr 1). Upstream of the barrier waterfall, only Yellowstone cutthroat trout were captured in the main creek and all tributaries sampled. At site 3, in the upper meadows of the main creek, the fish density was very high (Table 20). There was evidence of abundant historic beaver dams throughout this reach, but only in one location was any recent beaver activity was noted. At site 7 on Moose Creek there were also abundant historic beaver dams, many of which were now only represented by grassy, valley wide mounds; none of the remnant dams impounded any water because they had either been breached by the stream or had filled with sediment and become vegetated with sedges. Genetic samples collected from the North Fork of Moose Creek in 1995 indicated that there were 90% pure westslope cutthroat trout in the stream. However, in the same year samples were collected about 2 miles farther downstream in Moose Creek and found to be only to be 13% westslope and 87% Yellowstone cutthroat. There is no barrier between these two locations and the stream is low gradient so it is unclear why the two samples would produce results so different. Unspecified cutthroat trout were stocked in Moose Creek in 1947 and 1949 and it is likely they were Yellowstone cutthroat. Although highly hybridized, the presence of westslope genes in the current fish population suggests that westslope were native to Moose Creek prior to Yellowstone

cutthroat introduction. Evidence of Pearlshell mussels has been found in the lower reaches of the stream, but no additional surveys for mussels were done as a part of this survey.

Table 20. Fisheries survey data from Moose Creek and tributaries during 2008 where Sect. L is the length of the reach sampled and Species are: LL = brown trout, RB = rainbow trout, EB = brook trout, WCT = westslope cutthroat trout, YCT = Yellowstone cutthroat trout, M COT = mottled sculpin.

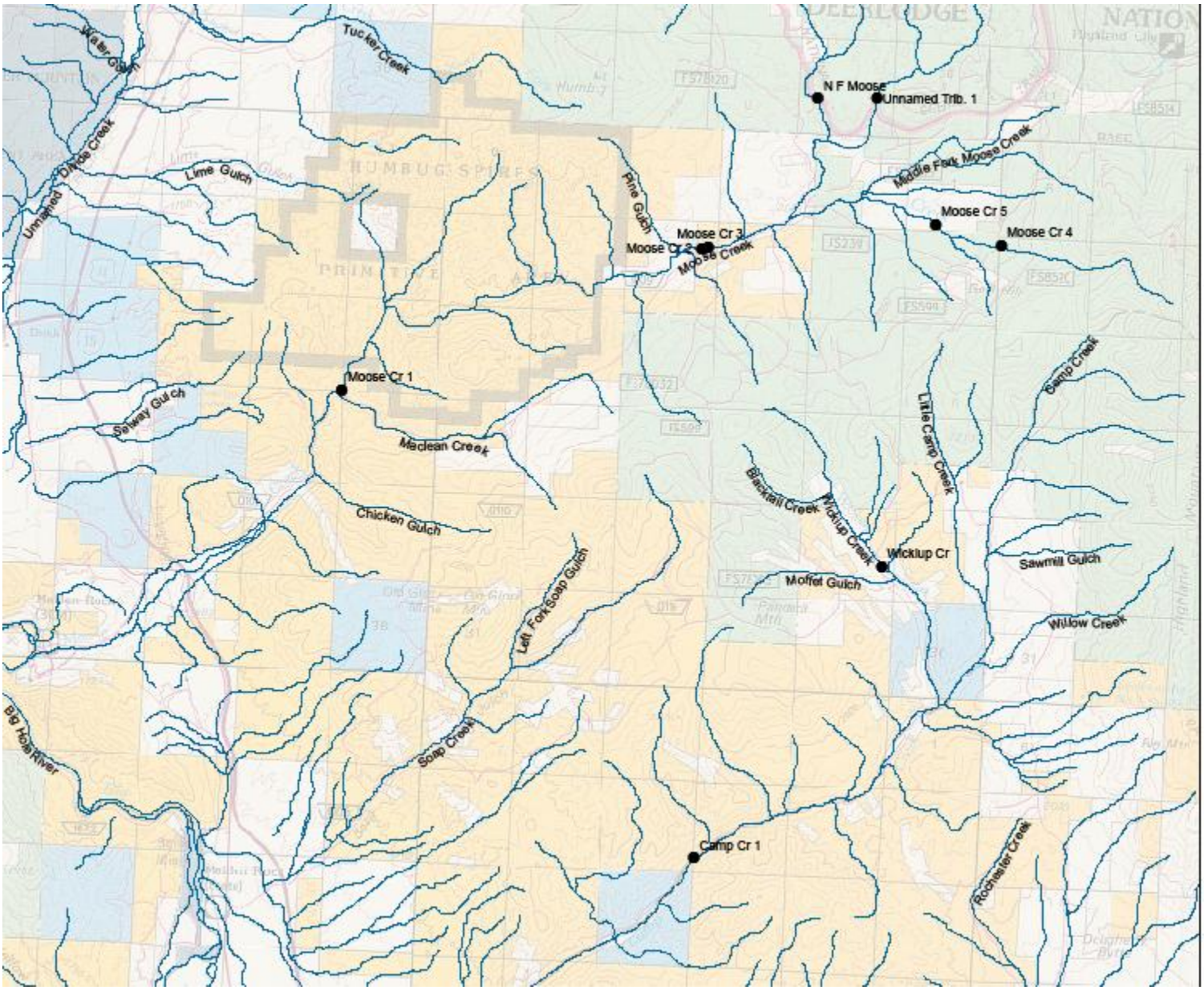
Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
Moose Cr 1 (500 ft)	45.74335	112.67031	2-Pass	LL (31)	358 (291-425)	5.3 (3.5-12.7)	0.11(0.02-0.70)
				RB (27)	310 (259-371)	5.7 (1.7-6.9)	0.11(0.01-0.16)
				EB (12)	128 (120-136)	4.5 (1.7-6.9)	0.05(0.01-0.12)
				M COT (4)		3.2 (2.9-4.2)	0.02(0.01-0.03)
Moose Cr 2 (185 ft)	45.76745	112.59161	1-Pass	YCT (51)		6.6 (2.6-10.1)	0.12(0.01-0.26)
Moose Cr 3 (600 ft)	45.76778	112.59020	3-Pass	YCT (222)	2191 (2013-2369)	6.3 (2.7-10.5)	0.11(0.03-0.28)
N F Moose (500 ft)	45.79151	112.56711	1-Pass	YCT (13)		6.5 (3.8-8.3)	0.11(0.03-0.21)
Moose Cr 4 (500 ft)	45.76972	112.52510	1-Pass	No fish			
Unnamed Trib 1	45.71994	112.55421	1-Pass	YCT (7)		4.3 (3.2-6.5)	0.04(0.02-0.10)
Moose Cr 5 (500 ft)	45.77251	112.53989	1-Pass	YCT (10)		4.9 (3.2-6.7)	0.05(0.01-0.11)

Camp Creek

Camp Creek, similar to Moose Creek, drains from the Highland Mountain Range to the Big Hole River at Melrose (Map 12). It flows through a mix of private and federal ground with a majority of the land being managed by the BLM. A small irrigation reservoir is present on the stream approximately 3.7 miles upstream from the mouth. The dam on the stream is approximately 30 ft high and impounds a reservoir of approximately 5 surface acres. It is unclear how the dam outlet works operate but there appears to be very little recent fluctuations in reservoir levels during the summer. The dam is most likely a barrier to fish passage, although passage may be possible through the large spillway structure on the south side of the dam during high flows.

Camp Creek was electrofished approximately 3 miles upstream of the reservoir (Table 21, Camp 1) on 9/11/08. At this location, as with much of Camp Creek from the Reservoir to the confluence with Wickiup Creek, there is a healthy riparian area of willows, alder, birch and cottonwoods. In many locations along the stream, particularly immediately upstream of the reservoir, the stream is choked with woody vegetation

making access to the water difficult. At the location where fish were sampled, brook and rainbow trout were captured along with 14 mottled sculpin. No weights were taken on fish captured, but the condition of the rainbow trout was excellent and average for brook trout. The brook trout catch was dominated (35 fish) by age-1 fish, less than 3.5 in long. Wickiup Creek, at tributary to Camp Creek, was also surveyed and found to only contain brook trout (Table 21). Downstream of the reach surveyed, Wickiup Creek has several reaches of decadent beaver dams, most of which have mostly filled with sediment.



Map 12. Moose and Camp creeks and tributaries with black dots indicating locations of stream sampling events.

Table 21. Fisheries survey data from Camp Creek and tributaries during 2008 where Sect. L is the length of the reach sampled and Species are: LL = brown trout, RB = rainbow trout, EB = brook trout, WCT = westslope cutthroat trout, YCT = Yellowstone cutthroat trout, M COT = mottled sculpin.

Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in)	L Range (in)	Avg W (lbs)	W Range (lbs)
Camp 1 (420 ft)	45.67279	112.58801	2-Pass	RB (34) EB (86) M COT (14)	441 (477-404) 1190 (1048-1333)	5.2 4.2	2.0-9.3 2.1-9.0		
Wickiup (250 ft)	45.71911	112.54886	1-Pass	EB (24)		3.2	2.3-6.4		

Trapper Creek

Trapper Creek drains from the east Pioneer Mountains and flows to the Big Hole River west of Melrose (Map 13). Near its headwaters there have been extensive historic mining activities. Trapper Lake sits near the head of the drainage and contains a self-sustaining fishery of hybridized westslope cutthroat trout. The upper reaches of the stream on the National Forest contain excellent habitat with a mix of low gradient willowy reaches and higher gradient faster sections. Farther downstream on private ground the stream is also in primarily good condition with abundant riparian willows. There are some areas of localized grazing and agricultural impacts to streambanks downstream of the town of Glendale, but overall the stream is in very good condition. Diversions irrigate several pastures that parallel the stream and also a portion of land to the south of the valley bottom. A ditch from Canyon Creek to the north delivers additional water to the stream near the town of Glendale. Trapper Creek and Sappington Creek contain conservation populations of westslope cutthroat trout. Trapper Creek and several of its tributaries were sampled in 2008 and 2009 to determine the current status of their fisheries and to collect genetic samples from westslope cutthroat trout.

Five sections were sampled in Trapper Creek, 2 in Sappington Creek, 2 in Sucker Creek (Map 13) and one in an unnamed tributary to Trapper Creek. Trapper Lake was also sampled. In the lower reaches of the stream (Table 22, Trapper 1) brown and brook trout were present along with mottled sculpin. Trout densities were low through the reach sampled, but it is possible that the reach sampled was not representative of the habitat in the lower stream. The stream channel was narrow and deep with silt substrate in deep slow runs and few riffles. The section was located in a hay meadow and there were few willows. Much of the rest of the stream is heavily willowed and has more gravel/cobble substrate. Approximately 1 mile of stream downstream of the forest boundary was sampled to collect westslope cutthroat trout genetic samples (Trapper 2). This reach was characterized by moderate gradient with dense alder-birch canopy. Brook trout outnumber cutthroat approximately 3:1 (Table 22). A potential location to construct a fish migration barrier in Trapper Creek was identified on lands administered by the BLM between Trapper 1 and Trapper 2 at N45.64210 W112.79259. This is a narrow section of stream bounded by high banks on the south and north sides of the stream.

Table 22. Fisheries survey data from Trapper Creek and tributaries during 2008 and 2009 where Length = the length of the section, L is fish length and W = weight of the fish. The fish species sampled are: LL = brown trout, RB = rainbow trout, EB = brook trout, WCT = westslope cutthroat trout, YCT = Yellowstone cutthroat trout, M COT = mottled sculpin.

Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
Trapper 1 (500 ft)	45.63950	112.77111	2 Pass	LL (6)	66 (50-82)	9.9 (7.5 -14.5)	0.40 (0.13-1.06)
				EB (7)	76 (63-89)	5.1 (2.0-8.7)	0.10 (0.01-0.26)
				M Cot (16)		2.9 (2.1-4.0)	
Trapper 2	45.64808	112.83868	Spot shock	EB (27)			
				WCT (11)		9.4 (6.0-12.2)	0.29 (0.06-0.54)
Trapper 3 (500)	45.64935	112.84536	1 Pass	EB (19)		6 .0 (2.7-9.0)	0.12 (0.02-0.35)
				WCT (2)		10.7 (9.4-12.0)	0.42 (0.29-0.56)
Trapper 4 (500)	45.64243	112.87096	2 Pass	EB (91)	1230 (904-1556)	5.0 (2.0-8.1)	0.10 (0.01-0.18)
				WCT (1)		3.5	0.01
				LL (1)		14.6	1.03
Trapper 5 (314)	45.60888	112.88284	1 Pass	EB (17)		4.3 (2.1-7.5)	0.10 (0.01-0.18)
				WCT (2)		5.4 (4.0-6.7)	0.06 (0.02-0.10)
Trapper 6 (200)	45.58274	112.92997	1 Pass	No Fish			
Sucker 1 (500)	45.6427	112.80739	1 Pass	EB (1)		6.3	
				WCT (16)		4.3 (2.8-6.9)	
				LL (1)		4.6	
Sucker 2 (1000)	45.63571	112.81632	1 Pass	WCT (31)		4.8 (2.5-8.5)	
Sappington 1	45.59993	112.90392	1 Pass	EB (9)			
				WCT (14)		5.1 (3.5-8.0)	0.05 (0.02-0.16)
Sappington 2	45.59914	112.91619	1 Pass	WCT (33)		5.6 (3.3-7.5)	0.10 (0.01-0.14)

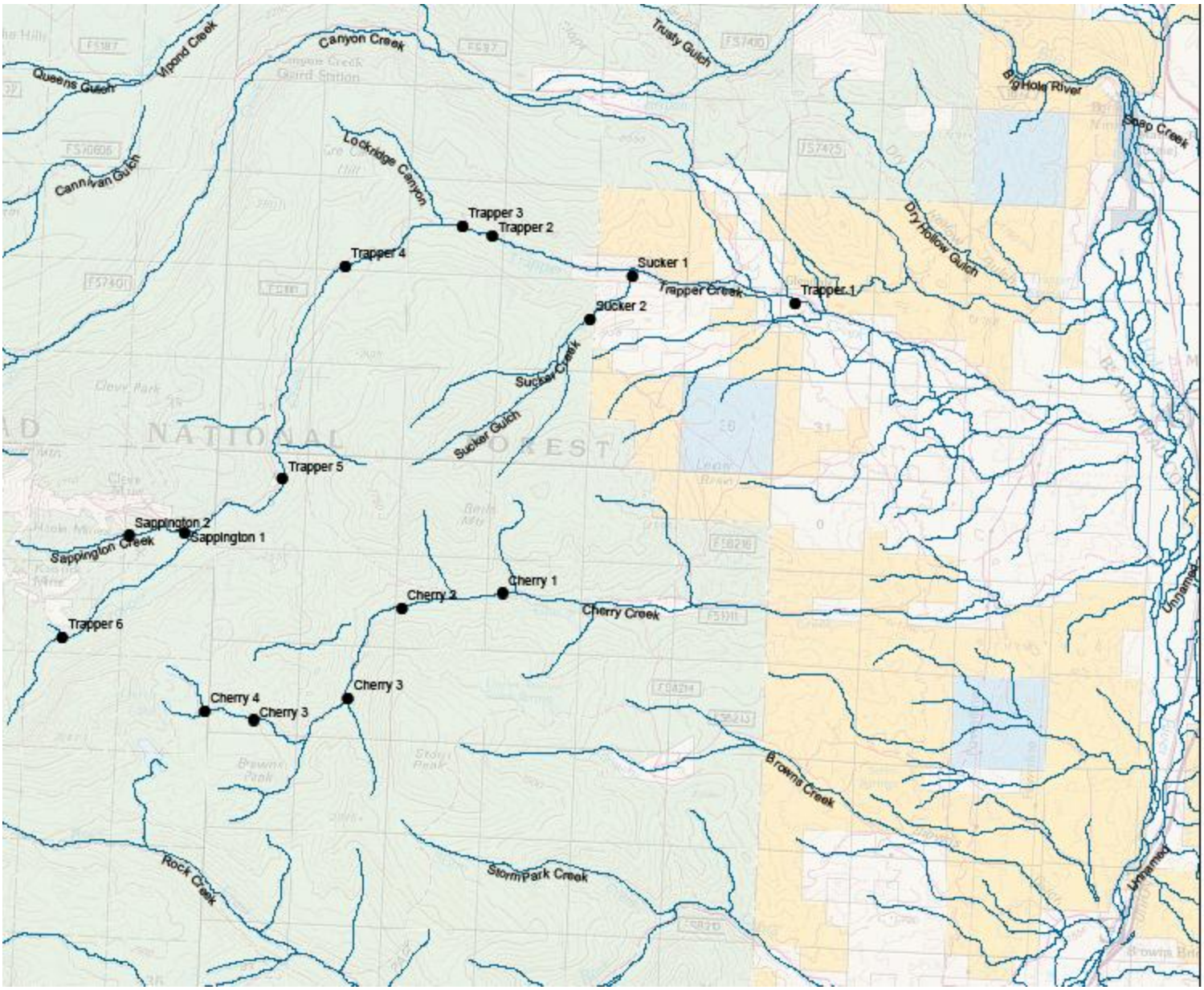
On public lands, 4 sections of Trapper Creek were surveyed. Immediately upstream of the Forest Service boundary the stream is high gradient with cascades common (Table 22, Trapper 3). No barriers were identified in this section and only brook trout and westslope cutthroat were captured (Table 22). Farther upstream the gradient lessens and large meadows are present. In this reach (Trapper 4) brook trout were very abundant (Table 22). Additionally, a brown trout was captured in this reach suggesting there is no barrier between lower reaches of the stream and those above the high gradient reach at the Forest Service boundary. Farther upstream brook trout still dominate the fishery (Trapper 5). Upstream of the confluence of Sappington Creek no brook trout were captured while sampling approximately ½ mile of stream; however brook trout are present in lower Sappington Creek. One additional section was surveyed on Trapper Creek upstream of the confluence with the outlet of Trapper Lake (Table 22, Trapper 6). No fish were

present in this reach of stream. Trapper Lake is a source of hybridized cutthroat trout. Genetic samples collected in the past from the stream downstream of the lake indicated a relatively high rate of introgression between Yellowstone cutthroat and rainbow trout (69% westslope).

Figure 9. Headcut partial barrier on Sucker Creek.

Sucker Creek

Sucker Creek is a tributary to Trapper Creek whose confluence is approximately 0.5 miles downstream of the Forest Service Boundary (Map 13). Near the confluence with Trapper Creek, there is a substantial head cut in the stream bed forming a partial barrier (Figure 9). It is likely that at low flows the drop functions as a fish barrier, but at high flows the water can bypass the drop and potentially allow fish access to the upper reaches of the stream. Two sections were electrofished on Sucker Creek to determine the current status of the fishery and to collect genetic samples from westslope cutthroat trout. In the lower section immediately upstream of the partial barrier (Table 22, Sucker 1) westslope cutthroat trout were captured and 1 brook and brown trout were also captured, verifying the partial nature of the barrier. Farther upstream (Sucker 2), only westslope cutthroat trout were captured. The stream habitat consists of moderate gradient with moderate pool frequency and very thick riparian willows and alder vegetation. Genetic results obtained from cutthroat sampled in Sucker Creek indicate the fish are slightly hybridized with rainbow trout (98.2% westslope, Leary 2009).



Map 14. Trapper and Cherry creek and tributaries with black dots indicating locations of stream sampling events.

Sappington Creek

Sappington Creek is a major tributary to Trapper Creek that has had extensive past mining within the drainage. The geology in the Sappington Creek drainage results in much higher conductivity water (233 µS) than that found in Trapper Creek upstream of the confluence (33 µS). Sappington Creek and an unnamed tributary are home to conservation populations of westslope cutthroat trout that have been historically non-hybridized. Surveys were conducted in Sappington Creek to determine if brook trout are present in the stream and to collect current genetic samples.

Two sections were electrofished in Sappington Creek. Near the confluence with Trapper Creek both brook trout and westslope were captured (Table 22, Sappington1), but westslope outnumbered brook trout 1.5:1. Farther upstream (Sappington 2), only westslope were captured. The stream was surveyed from the ending of Sappington 1 section to a high gradient reach (N45.60037, W112.90733) that appears to be a barrier to brook trout because upstream of this point no brook trout were captured. Genetic samples were collected from Sappington 2 and results of testing indicate the cutthroat trout are non-hybridized (Leary 2010b).

Cherry Creek

Cherry Creek drains from the East Pioneer Mountains and converges with the Big Hole River near Melrose. The stream from a fisheries perspective can be divided into 3 distinct reaches. From the mouth upstream approximately 10 miles the fishery is dominated by brook trout with a few westslope cutthroat trout. The westslope cutthroat in this reach have historically been non-hybridized. The habitat in this reach is dominated by dense willow and cottonwood riparian vegetation with gravelly substrate. There is some beaver activity in the lower reaches of the stream. The second reach begins at a non-descript high gradient reach located near the confluence of Bear Gulch (Map 13) which apparently precludes upstream migration of brook trout and only westslope cutthroat are present upstream of this location. The habitat in this reach is moderate gradient with large cobble and boulder substrate. This section of stream is divided from the headwaters by a high gradient cascade that appears to be a fish passage barrier approximately 1.5 miles downstream of Cherry Lake. The headwater reach of the stream is formed from the outlet streams of two headwater lakes (Cherry and Granite). These streams converge approximately 0.5 mi downstream of the lakes to form Cherry Creek. The lakes also harbor hybridized populations of westslope cutthroat trout, with Cherry Lake being significantly more hybridized (81.6% westslope) than Granite (91% westslope).

Cherry Creek was sampled in 2008 and 2009 in preparation for a westslope cutthroat restoration project. A suitable location for construction of a fish migration barrier was previously identified approximately 1.5 mi upstream of the confluence with the Big Hole River (N45. 45.59425 W 112.71763). Several sections were sampled to verify the distribution and density of both fish species and genetic samples were collected. In the downstream reaches, approximately 3 miles of stream was sampled through BLM and onto the National Forest. In these lower reaches brook trout outnumber cutthroat more than 25:1. Genetic samples were collected from all cutthroat captured in these lower reaches and sent in for analysis. Results indicate that the once pure fish in this reach of stream have become slightly hybridized (95.8% westslope, Leary 2009). Farther upstream (Table 23, Cherry 1), westslope cutthroat are more common and brook trout only outnumber cutthroat by a ratio of 5:1. No brook trout were captured upstream of the high gradient reach near Bear Gulch (Table 23, Cherry 2, 3, 4). Although the stream is high gradient within this reach, there is no distinct fish barrier and it is unclear why brook trout have not colonized upstream of this location. Immediately upstream of Bear Gulch,

the density of cutthroat greatly increases (Table 23, Cherry 2) and is greater than the density of brook trout found downstream.

Table 23. Fisheries survey data from Cherry Creek during 2008 and 2009 where Length = the length of the section, L is fish length and W = weight of the fish. The fish species sampled are: EB = brook trout and WCT = westslope cutthroat trout.

Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
Cherry 1 (500)	45.59266	112.83306	2 Pass	EB (22) WCT (5)	254 (197-312) 55	4.7 (2.9-7.2) 5.0 (3.7-6.0)	0.06 (0.01-0.15) 0.06 (0.03-0.09)
Cherry 2 (300)	45.58966	112.85526	2 Pass	WCT (21)	374 (353-395)	4.8 (3.2-6.5)	0.05 (0.01-0.11)
Cherry 3 (525)	45.57525	112.86626	1 Pass	WCT (20)		5.1 (3.1-7.5)	0.04 (0.02-0.14)
Cherry 3 (300)	45.57124	112.88691	2 Pass	WCT (32)	575 (537-613)	4.6 (2.2-6.4)	0.03 (0.01-0.08)
Cherry 4 (400)	45.5723	112.89779	1 Pass	WCT (22)		3.9 (2.0-12.3)	0.07 (0.01-0.64)

OTHER STREAMS SURVEYED

Several other streams were briefly surveyed and not thoroughly inventoried. Results of these brief surveys are listed in Table 24.

Table 24. Fisheries survey data from several creeks from 2008-2010 where Length = the length of the section, L is fish length and W = fish weight. The fish species sampled were: EB = brook trout, RB = rainbow trout, WCT = westslope cutthroat trout, LND = longnose dace, BUR is burbot and M Cot = mottled sculpin.

Section (Length)	Latitude	Longitude	Survey Type	Species (# sampled)	Pop Est/mi (95% CI)	Avg L (in) (range)	Avg W (lbs) (range)
Pattengail Creek (200)	45.67219	113.16664	1 Pass	RB*(6) EB (2) BUR (8) LND M Cot		7.5 (6.8-9.8) 10.1 (9.6-10.5) 8.8 (5.8-16.6)	0.18 (0.07-0.33)
Reservoir Creek (500)	45.66669	113.13017	1 Pass	EB (13) WCT (13)		5.7 (1.5 -8.0) 4.0 (2.4-6.5)	0.10 (0.01-0.22) 0.04 (.0.1-0.10)
E Fk Englebaugh Cr (240)	45.21104	113.43833	1 Pass	EB (52) M Cot (11)		4.2 (1.4-8.0) 2.1 (1.2-3.0)	

*****RB captured in Pattengail Creek appeared to be highly hybridized with cutthroat trout.

MANAGEMENT RECOMMENDATIONS

Governor Creek

Because Governor Creek and its tributaries harbor non-hybridized and slightly hybridized populations of westslope cutthroat trout, conservation of these populations should be a high priority. However, no suitable barrier sites have been identified on public ground that could isolate the streams. Ideally a barrier site on private ground downstream of the confluence of Fox Creek would isolate the entire upper watershed and brook trout could be removed from upstream of the barrier site. This would protect the Governor Creek metapopulation from potential invasion by rainbow trout and recolonization by brook trout. It is unlikely given the geomorphology of the lower drainage that such a suitable site exists. In the short term, it may be prudent to replicate the populations in Thayer, Andrus and Bailey creeks into fishless waters to conserve these populations of fish. A barrier in Andrus Creek would isolate Bailey and Thayer creeks, which are home to the best cutthroat numbers in the Governor Creek drainage, but such a barrier would have to be located on private property.

Berry Creek

No management changes are currently recommended for Berry Creek. Further sampling in the headwaters of the stream is necessary to determine if cutthroat trout are present in the drainage. As no potential barrier sites have been identified in the drainage, there is little potential for westslope cutthroat trout restoration at this time. Management of the lakes at the headwaters of the drainage has changed from stocking Yellowstone cutthroat trout to westslope and the frequency of stocking in Timberline Lake was changed from 4 years to 6 years.

Little Swamp Creek

No management changes are recommended.

Hamby Creek

No management changes are recommended for Hamby Creek. It provides a moderate quality brook trout fishery with high densities of fish. If a suitable barrier site were identified, Berry Creek would be an excellent candidate for westslope cutthroat restoration because of the high quality stream habitat, but such a site has not been identified.

Engeljard Creek

No current management changes are recommended for Engeljard Creek. The stream is small and does not likely provide much of recreational fishery. However, there may be

an opportunity to reconstruct the dam at the breach site and reform Engeljard Lake. Only a small portion of the historic dam has been removed and could conceivably be reconstructed with a spillway that would be impassible to fish. Upstream of the dam, westslope cutthroat could be restored to the watershed. This project would likely be low priority because of the small size of the stream, relatively few stream miles protected and the difficulty of access to the site to reconstruct the dam and spillway.

Old Tim Creek

No management changes are recommended for Old Tim Creek. It provides a quality brook trout fishery for its size. There is some potential for constructing a barrier upstream of the confluence with Warm Springs Creek, but the location is not ideal and access to the site with equipment would be difficult. Grazing monitoring should be periodically done in the drainage to ensure that grazing practices are not negatively impacting the stability of the stream banks or the health of riparian areas. Significant grazing impacts were noted on trails and in some localized areas of the stream banks. Expanding the existing willow population in the drainage may also benefit riparian health and the health of the fishery.

Moose Creek (west of Wisdom)

Moose Creek is another candidate for westslope cutthroat trout restoration. The habitat conditions in Moose Creek are pristine, but a suitable barrier site has not been identified. Potential barrier sites should be explored downstream of the confluence of Holland Creek to maximize the number of miles restored upstream. Holland Creek and Shultz Reservoir should be managed as the stronghold for cutthroat trout in the drainage until a suitable barrier site is identified and restoration upstream of that point can occur.

McVey Creek

An EA has been prepared for the removal of brook trout from McVey and establishing a barrier at the Highway 43 crossing. This project would secure the McVey Creek cutthroat population and allow for significant population expansion.

Clam Creek

No fisheries or land management changes are necessary in Clam Creek at the present time. Pearlshell mussels appear to be thriving, despite the lack of cutthroat trout in the stream, and the riparian area is in excellent condition. To protect the mussel population, this area should be monitored closely for potential grazing impacts. Further inventories should be done to quantify the density of mussels in the lower reaches of the stream downstream of Clam Valley. The stream should be periodically monitored (i.e., 5-10 year frequency) to verify mussel reproduction and potential population changes. The site should also be considered as a potential donor source for future cutthroat restoration projects that include a pearlshell mussel component.

Pintler Creek

Pintler Creek and Beaver Creek should be restored to westslope cutthroat trout upstream of Pintler Falls. The falls likely form a natural barrier to fish migration, but the completeness of the barrier should be verified at high flows. Land management changes are warranted in the mid and upper reaches of the riparian area of Pintler Meadows to protect the stream from grazing impacts and allow woody and non-woody vegetation to become established. Willow plantings may be warranted to facilitate riparian regeneration. To remove the rainbow trout population upstream of the falls would require a chemical treatment of the stream and Oreamnos Lake. Because Pinter Creek is within the Anaconda-Pintler Wilderness Area, such a project would have to be closely coordinated with the Forest Service. Further, it would likely require a temporary exemption of wilderness policy to allow for minor motorized use within the wilderness to transport (via helicopter) and apply (motorized boat) fish toxicant to Oreamnos Lake.

York Gulch

Brook trout should be removed from York Gulch to increase the distribution and abundance of native westslope cutthroat trout. Several options are available to accomplish this, the simplest being to modify the existing irrigation diversion on the West Fork Mudd Creek to York Gulch to preclude upstream fish passage. Also a fish barrier should be established in York Gulch somewhere between York 2 and York 3 (see Map 7) to prevent brook trout from the Big Hole River from recolonizing the stream. A barrier in this location would not affect migratory grayling that use the lower reaches of the stream. Brook trout could then be removed from the West Fork of Mudd Creek using rotenone and from York Gulch using electrofishing. Cutthroat from York Gulch and potentially another nearby source could be used to recolonize the West Fork of Mudd Creek upstream of the fish barrier.

Sullivan Creek

No management changes are recommended for Sullivan Creek, but the cause of the low pH in the stream should be further investigated. If found and mitigated, it could be possible to restore westslope cutthroat trout to the upper reaches of the stream.

Twelvemile Creek

Westslope cutthroat trout should be moved to the fishless upper reaches of Twelvemile Creek. It is clear from the data collected in 2010 that reproduction of cutthroat trout is occurring in the stream immediately downstream of the cascade barrier and therefore reproduction would likely occur upstream. There are more frequent and higher quality pools and more abundant spawning gravels upstream of the cascade than downstream. Further investigation of a high gradient reach upstream of the Dry Creek Forest Service Road located farther downstream is warranted to determine if a fish passage barrier is present in this area. If a barrier is present, brook trout could be removed from the stream

downstream to this barrier significantly expanding available habitat for westslope cutthroat trout.

Tenmile Creek

Because of the complexity associated with restoring them in their native habitat (i.e., no suitable location has been identified for constructing a fish barrier) and the immediate threat of hybridization from upstream and downstream, the most effective course of action to conserve cutthroat trout in this stream may be to capture an relocate any remaining cutthroat trout to a nearby fishless stream (i.e., Sixmile Creek).

Sixmile Creek

A fish passage evaluation should take place on Sixmile Creek to determine if fish can pass the narrow falls reach of the stream. If fish passage is present, a project should be initiated to modify one of the existing falls to preclude fish passage. If the falls reach is a barrier to fish passage or if the falls are modified to become a fish barrier, then brook trout should be removed upstream and westslope cutthroat trout restored. Potential sources of fish to refound Sixmile Creek could include Tenmile, Twelvemile and Corral creeks.

American Creek

No management changes are recommended for American Creek at this time. The lack of a fish barrier and the extensive beaver activity in the drainage would make westslope cutthroat trout restoration very difficult. Additional surveys should be done farther upstream near the headwaters.

French Gulch

Working cooperatively with the Montana Department of Transportation (MDT) and their reconstruction of the Anaconda cutoff road, a fish barrier could be constructed on French Gulch. If such a barrier is constructed, westslope cutthroat trout could be restored upstream. Additionally, a plan should be developed to restore habitat in the stream that has been impacted by mining activities.

Moose Creek

Similar to French Gulch, working cooperatively with MDT and the reconstruction of the highway, a fish migration barrier could be constructed and westslope cutthroat trout could be restore upstream.

Bryant Creek

No management changes are recommended at this time for Bryant Creek. The population of westslope cutthroat trout will serve as a donor source for refounding the Cherry Creek

population of cutthroat. The population should be regularly monitored for the presence of brook trout because of the proximity and potential incomplete nature of the fish barrier downstream of Trident Meadows.

Bear Creek

An opportunity exists to conserve westslope cutthroat in Bear Creek by creating a fish migration barrier at the Highway 43 crossing. The headcut located immediately upstream of the culvert crossing could be modified to create a fish barrier and westslope cutthroat could be restored upstream. Such a project would be logistically challenging because of the large tracts of private property on the stream and the abundance of beaver dams present.

Meadow Creek

Habitat management in the lower reaches of the stream should emphasize protection of instream flows and spawning and rearing habitat for fluvial fish from the Big Hole River. Conserving the westslope cutthroat population in Meadow Creek will be difficult because no suitable fish barrier sites have been identified. However, data collected by the US Forest Service indicates that the reach of stream sampled immediately upstream of the reach sampled in 2010 is fishless but has habitat that could support a fishery. Therefore, it may be possible to introduce fish from below in an attempt to expand the existing population. An alternative conservation measure may include relocating the population to other nearby fishless waters.

Jerry Creek

Jerry Creek should be a high priority stream for westslope cutthroat trout restoration. Given the presence of nonhybridized cutthroat and the high quality habitat in the drainage, it would make an excellent candidate for restoration. A potential site for barrier construction exists ½ mile downstream of the confluence of Long Tom Creek. This area is remote, which would likely make barrier construction difficult. However, it is the most suitable location identified in the drainage. Immediate action in Delano Creek is warranted to conserve the remaining non-hybridized westslope cutthroat trout in the stream. The recent invasion of hybridized fish into the stream pose a major threat to this non-hybridized population of fish. Further sampling in the Long Tom Creek drainage is also warranted to determine brook trout distribution and the status of the fisheries in tributary streams.

Divide Creek

The North Fork of Divide Creek could be restored to westslope cutthroat trout if a fish barrier could be constructed near the forest service boundary. Once brook trout are removed from the stream, westslope cutthroat trout from the South Fork of the North Fork of Divide Creek could be used to refound the cutthroat population in the stream. The South Fork of the North Fork of Divide Creek also has excellent potential for

westslope cutthroat trout restoration. With an existing fish barrier in place (South Fork Reservoir), and limited brook trout distribution, a small chemical project could be performed to remove brook trout from the drainage. Improvements could be made to the reservoir inlet to facilitate fish passage and increase spawning potential immediately upstream of the reservoir.

Moose Creek (Highlands)

Moose Creek in the highlands presents a good opportunity to restore westslope cutthroat trout. With a natural fish migration barrier present, the current lack of beaver activity, and the excellent condition of the habitat in the upper reaches make this stream a prime candidate for restoration to westslope cutthroat trout. In concert with cutthroat restoration, Moose Creek may also pose an opportunity to reintroduce native pearlshell mussels. It is recommended that coordination with the landowners in the drainage occur as soon as possible and a toxicant project be planned to remove non-native Yellowstone cutthroat trout down to the natural fish barrier and restore westslope cutthroat trout to the drainage. It is also recommended that a more in depth survey be performed for Pearlshell mussels in the drainage.

Camp Creek

Additional data collection in the Camp Creek drainage is warranted. The reservoir should be netted and the upper reaches of Camp Creek including several of its tributaries should be sampled. Camp Creek would be an ideal candidate stream for westslope cutthroat restoration because an existing fish barrier is present in the system and there is good quality habitat present.

Trapper Creek

Trapper Creek presents a very good opportunity for westslope cutthroat trout and preserving the existing unhybridized fish in Sappington Creek and the slightly hybridized fish in Sucker Creek. A fish migration barrier would have to be constructed and the brook and brown trout removed from the stream upstream of this location, including Trapper Lake. An interim step to restoring the drainage could include the removal of fish from Trapper Lake and restocking it with fish from Sappington Creek. Also, westslope cutthroat trout from Sappington Creek could be introduced into the fishless reaches of upper Trapper Creek.

Cherry Creek

An environmental assessment has been prepared to construct a fish migration barrier in Cherry Creek approximately 1.5 miles upstream of the confluence at the location previously identified and to remove brook trout and hybridized cutthroat upstream of this location. Also included in this project will be the replacement of the hybridized populations of westslope cutthroat trout in Cherry and Granite lakes with unhybridized cutthroat from local sources within the Big Hole drainage.

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