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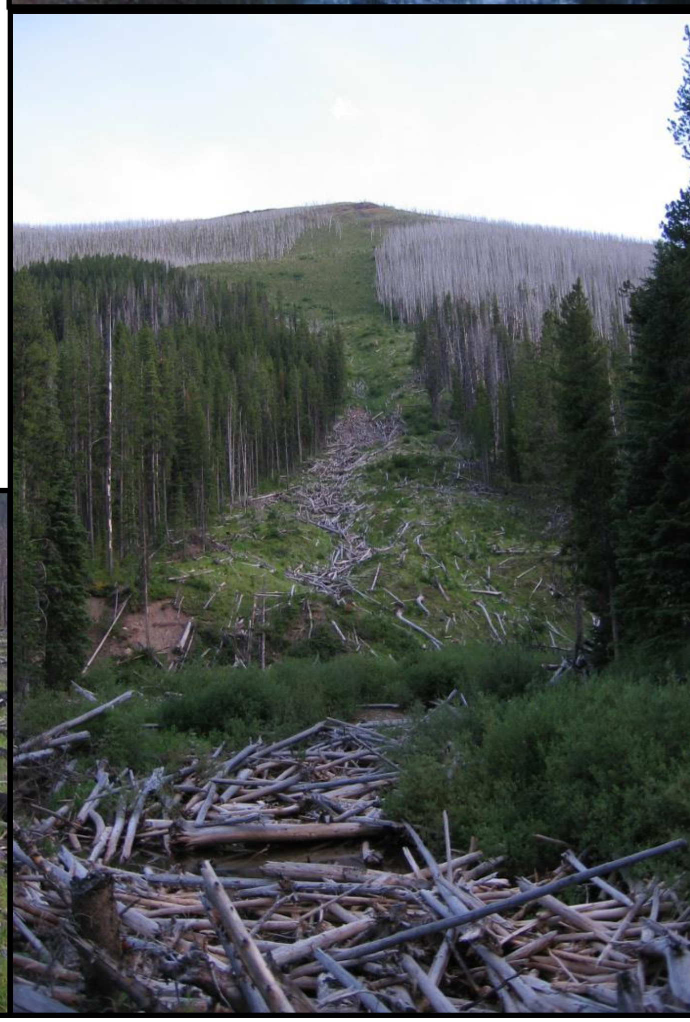
2005-2017

Montana Fish, Wildlife and Parks

Missoula, Montana

updated July 2017



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by

Ron Pierce, Craig Podner and Pat Saffel

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Acknowledgements

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Introduction and Summary

From 2005 to 2017, Montana Fish, Wildlife and Parks in cooperation with the United States Forest Service, Montana Natural Heritage Program, commercial wilderness outfitters and volunteers completed a series of fisheries-based investigations for 20 headwater streams and three fish-bearing mountain lakes in the upper North Fork of the Blackfoot River Basin (Figure 1). The remote study area, located upstream of the North Fork Falls, lies within a 110 mile^2 high-elevation basin and entirely within the Scapegoat Wilderness. The surveys represent the first comprehensive fisheries work in this remote area of the Blackfoot River Basin, which included genetic tests in all fish-bearing waters. Genetic tests identified the presence of *Oncorhynchus* hybrid trout with a predominately nonnative rainbow trout (*O. mykiss*) genetic contribution across all fish-bearing waters. The unexpected findings of highly hybrized trout triggered additional aquatic studies exploring the possible removal of nonnative hybrid trout followed by a possible translocation of native trout.

The North Fork of the Blackfoot River Basin can be separated into three major hydrogeographic areas that broadly influence communities of fishes. These units are 1) the North Fork Blackfoot River Basin upstream of the North Fork Falls (*described in this study*), 2) the Dry Creek Basin located in the upper North Fork Basin, and 3) the lower North Fork Blackfoot River Basin downstream of the Falls (Figure 1). The lower North Fork of the Blackfoot River downstream of the Falls and its tributaries support mixed communities of native and nonnative trout. Native trout in this subbasin include migratory westslope cutthroat trout (*O. clarkii lewisi)* along with one of the largest remaining sub-populations of migratory (fluvial) bull trout (*Salvelinus confluentus*) in western Montana (Swanberg 1997; USFWS 2010; Pierce et al 2013; Montana FWP bull trout redd count database). The lower portion of this subbasin also supports rainbow trout, brook trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*). The Dry Fork of the North Fork sub basin has an intermittent (seasonally dry) reach near the mouth (Figure 1). Upstream of this intermittent section, perennial streams support resident and migratory westslope cutthroat trout and bull trout in low abundance (Pierce et al. 2007, 2008). This area has no known bull trout reproduction based on telemetry studies and the absence of age 0 bull trout (Swanberg 1997; Pierce et al. 2008; Appendix A).

The Dry Fork Basin also supports an increasing presence of hybrid trout, which are deemed a threat to the genetic integrity of genetically pure westslope cutthroat trout (*see* Robb Leary report *in* Pierce et al. 2008; Appnedix D). These rainbow trout hybrids are likely ascending the intermittent reach of the Dry Fork in low numbers during high water and are thought to originate in the upper North Fork based on the near proximity to the Dry Fork drainage and of genetic characteristics of the hybrid trout.

In contrast to these two sub basins, the trout community upstream of the North Fork Falls contains *Oncorhynchus* hybrids only (i.e., rainbow trout x Yellowstone cutthroat trout (*O. c. bouvieri)* x westslope cutthroat trout). The presence of rainbow trout and Yellowstone cutthroat trout genes can be traced to broad-scale introductions that began upstream of the North Fork Falls began in the 1920's when state and federal hatcheries, sportsmans groups, outfitters, the USFS and the Montana Fish and Game introduced undifferentiated cutthroat trout and rainbow trout into waters upstream of the North Fork Falls (Results Part III).

The long-term (>90 years) persistence of nonnative trout in this high-country environment likely relates to three lakes that provide refugia, wintering areas and sources of (re)colonization to nearby waters following natural disturbance such as the 1988 Canyon Creek wildfire. Though genetic markers for westslope cutthroat trout are widespread upstream of the North Fork Falls, our surveys have not detected the presence of a genetically unaltered (i.e., 100% genetically pure) native westslope cutthroat trout populations upstream of the Falls in any of the fish-bearting streams or lakes.

In addition, our fish population surveys show surprisingly low abundance (Results Part I). Indeed, stream surveys in headwater areas of perennial streams identified many stream reaches as fishless. Our surveys estimate about 45 miles of fish-bearing stream and about 40 miles of fishless stream. The low abundance and trout distributions limited to the lower reaches clearly contrast with streams in adjacent drainages (e. g., Monture Creek and Copper Creek) where native trout (westslope cutthroat trout and bull trout) inhabit all headwater streams where they are found in much higher abundance (Pierce et al. 2008; Pierce and Podner 2013). Based on the long history of fish stocking, poor record-keeping of hatchery plants, extensive hybridization and widespread disturbance associated with wild fire (e.g., 1988 Canyon Creek Fire), recent survey data and historical records are currently inconclusive regarding the presence/absence of aboriginal westslope cutthroat trout upstream of the North Fork Falls.

In addition to fisheries inventories and genetic testing, related baseline data collections include 1) bathymetric mapping and other survey information for the three fish-bearing lakes in the subbasin (Results Part II), 3) water temperature monitoring (2013-2016) at 22 sites, 4) flow stream discharge measurements at 19 sites during the summer/fall of 2013, 2014 and 2016, 4) water chemistry readings (i.e., conductivity, total dissolved solids and pH) at most fish population survey sites.

Given the presence of a large natural barrier (North Fork Falls) and limited distribution and low abundance of hybrid trout upstream of the Falls, our study results identify the North Fork Blackfoot River upstream of the Falls as a potential future conservation/recovery area for imperiled native trout, including both westslope cutthroat trout and bull trout. The concept is further premised on 1) the imperiled status of these native trout, 2) the downvalley dispersion of rainbow trout hybrids into the Dry Fork, 3) the remote location of a large complex area of pristine aquatic habitat, 3) the high suitability of the area as native trout habitat based on nearby stream populations, 4) near-term climate models that predict the contraction of coldwater habitat at the lower elevations of the Blackfoot River Basin (Isaak et al. 2015), and 5) the successful completion of similar (large) restoration projects elsewhere in Western Montana.

To help develop this native trout conservation/recovery concept, we also 1) collected macroinvertebrate and amphibian samples taken at 21 sites, 2) completed the Leopold Wilderness

Research Institute decision guide to evaluate a native trout conservation proposal, and 5) a bull trout translocation feasibility assessment for the translocation of North Fork bull trout upstream of the North Fork Falls (Results Part III). With a potential future native trout conservation project now in the planning phases, fisheries data in this report report are intended to act as a pre-treatment baseline. Lastly, this report is considered a *living* document to be periodically updated as relevant information is generated until such a time that a native trout translocation/conservation project is fully developed.

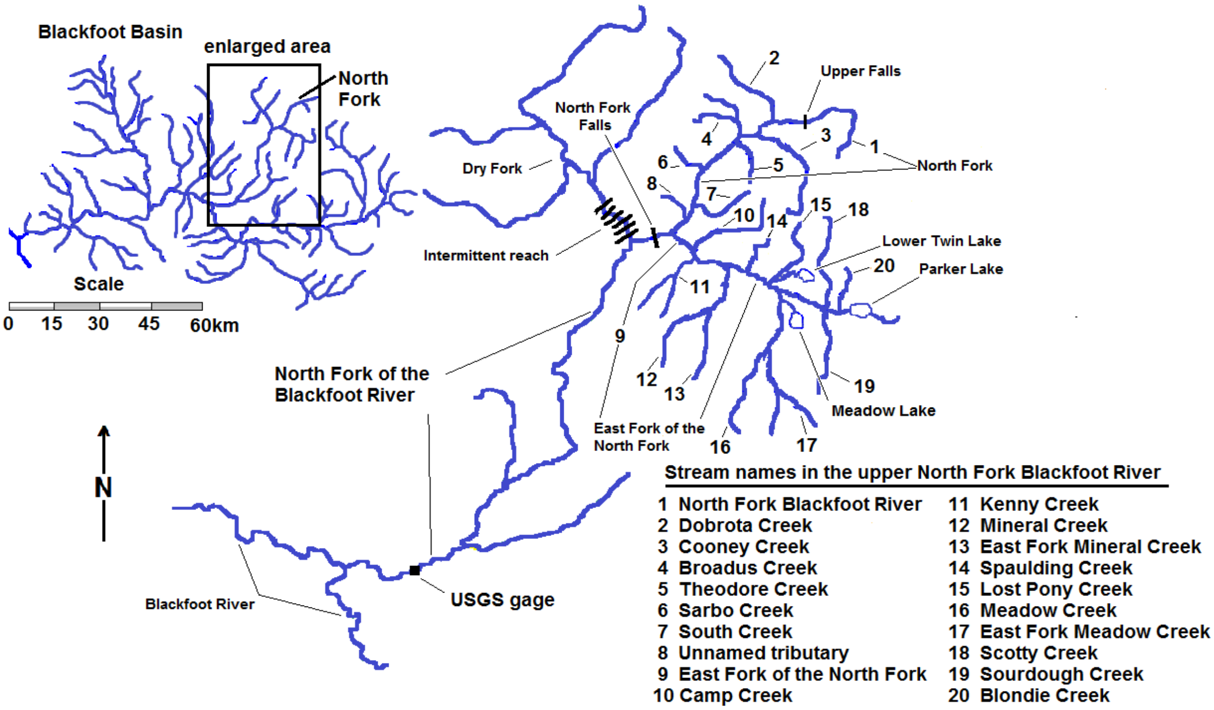


Figure 1. Location map of Blackfoot River Basin (left inset) and the North Fork of the Blackfoot River and tributaries upstream of the North Fork Falls. Numbers 1-20 relate to stream names on the right table. Three fish-bearing lakes are shown in the upper East Fork.

Study area and Methods

The North Fork of the Blackfoot River is the largest tributary to the Blackfoot River in terms of flow contribution (USGS gage 123238300). The study falls within a high glacial landscape in the northern-most portion of the Blackfoot Basin (Figure 1). This region represents the southern extension of a large contiguous wilderness complex that extends from Glacier National Park south through the Bob Marshall and Scapegoat wildernesses and adjacent roadless areas. This area of the North Fork borders the Dearborn drainage (Missouri River Basin) to the East and Flathead drainage (Columbia River Basin) to the North. Within the North Fork study area, twenty tributaries form the headwaters of the upper North Fork (Figure 1). This stream network supports about 85 miles of perennial stream, which generate a combined baseflow of approximately 40-60 cfs as measuresd upstream of the Falls (Appendix B). Tributary streams drain the highest mountain peaks of the Blackfoot Basin. Streams flow within alpine meadows, subalpine forest and montane woodlands and drain landforms ranging from glacial cirques, glacial trough and morainal valleys.

Upstream of the North Fork Falls, the study area spans a 110-square mile 4th-order drainage that includes the Lolo National Forest on the west portion of the drainage and the Helena National Forest on the eastern portion of the drainage. The entire study area falls within the Scapegoat Wilderness. From Crow Peak on the Continental Divide, the mainstem of the North Fork flows southwest 15.5 stream miles *(hereafter* sm), spills over the North Fork Falls at sm 26.0, exits the Scapegoat Wilderness at sm 22.0, and it enters the Blackfoot River at river mile 54.1 with a mean annual discharge of 385 cfs (USGS gage station #12338300, provisional data 1999-2012).

Downstream of the North Fork Falls, the lower North Fork of the Blackfoot River variably supports fluvial bull trout and westslope cutthroat trout, brown trout, rainbow trout and very low densities of brook trout depending on the specific stream reach. Bull trout occupy the entire North Fork mainstem downstream of the Falls and extend throughout the tributary system in lower abundance (Swanberg 1997**)**. The North Fork of the Blackfoot River downstream of the Falls is designated critical habitat for the recovery of bull trout (USFWS 2010). This primary reach of the North Fork supports the largest spawning run of migratory bull trout in the upper Clark Fork River drainage upstream of the Flathead River (FWP Region 2 bull trout redd count database). Like bull trout, native westslope cutthroat trout variable occupy the entire drainage downstream of the North Fork Falls (Pierce et al 2007; 2013).

The distribution of westslope cutthroat trout extends into the Dry Fork of the North Fork, as well as several tributaries in the lower North Fork drainage and includes both migratory and resident fish (Pierce et al. 2007). Brown trout and brook trout variously occupy the lower portions tributaries of the lower North Fork drainage. These nonnative species have not been detected in the North Fork basin upstream of Kleinschmidt Flat. Rainbow trout occupy the lower North Fork and reproduce in two spring creeks that enter the lower North Fork downstream of sm 6.2. However, hybrid rainbow trout x westslope cutthroat trout x Yellowstone cutthroat trout are incidentally present in the lower Dry Fork basin (Appendix D). Based on the proximity of the Dry Fork to the North Fork Falls, this presence is likely the result of fish spilling over the North Fork Falls. Hybrid trout have been observed trapped in pools of the intermittent reach of the Dry Fork (Figure 1) in July 2004 (Ron Pierce, personal observation).

Most the North Fork study falls within the perimeter Canyon Creek wildfire, which burned in 1988 during a record-setting drought. This 188,000-acre fire was one of the largest, fastest-moving and most intense wildfires ever documented in North American (Bushey 1991). The effects of this wildfire continue to exert a controlling influence on ecology of the stream system as well as the physical features of individual streams.

Stream Surveys

Beginning in 2006-2008 and continuing in 2013-2016, we established 40 fish population survey sites on 20 streams within the upper North Fork Blackfoot River drainage (Figure 2; Appendix A). These included six sites on the mainstem North Fork, four sites on the mainstem East Fork and 30 additional fish population survey sites on 19 smaller tributaries (Figure 2).

Electrofishing. – We used a backpack-mounted battery powered Smith-Root LR-20B electro-fishing unit to conduct intensive single-pass catch-per-unit effort (CPUE) fish population surveys to inventory fisheries. Surveys typically started at downstream riffle and proceeded upstream and targeted all fish and ended at an upstream pool/riffle break. Once captured, fish were sedated with MS-222 (tricane methansulfonate), phenotypically identified to species, measured for total length (mm) and weight (g). To confirm genetic composition of sampled trout, tissue samples were sub-sampled from individual fish as described below. Once data and fin clips were collected, fish were revived in fresh water and returned to the stream. To document the site, we measured the stream length (ft), identified the start and end of each survey using Garmin GPS receivers (decimal degrees) and photographed each site. We recorded observation of amphibians, stream type (Rosgen 1996) and noted riparian vegetation. To summarize fisheries field data (Results Part I), we separated age 0 from age 1 and older trout using length-frequency histograms and standardized CPUE samples as catch/100' for age I and older trout. Summaries of all catch and size statistics are in Appendix A.

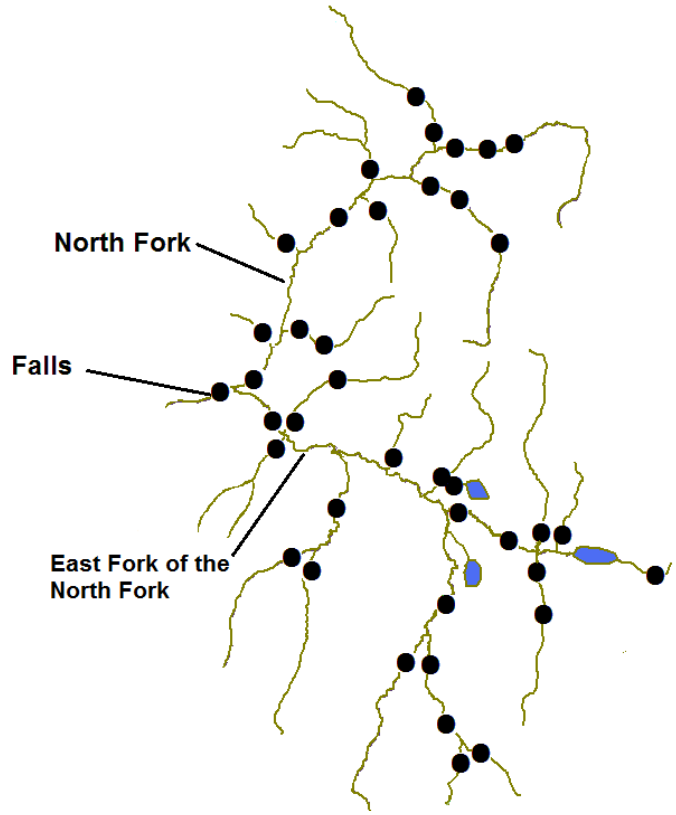


Figure 2. Fish population survey (electrofishing) sites in the North Fork of the Blackfoot Basin upstream of the North Fork Falls, 2006-2016.

<u>Lake Surveys</u>

Prior to lake surveys in 2005, fish-bearing lakes upstream of the North Fork Falls (Lower Twin Lake, Meadow Lake and Parker Lake) have not been sampled in over 20 years (Figure 1). The three lakes were variably subject to historical fish plants and subsequent gillnet surveys in the 1950's into the 1970's (Results Part III).

Gill net surveys. - We set experimental sinking overnight gillnet sets in the three fish-bearing lakes (Lower Twin Lake, Meadow Lake, and Parker Lake) upstream of the North Fork Falls. Where possible, we placed nets at historical survey locations (FWP Historical Lake Files). We used standardized net dimensions and mesh size (125'x 4'; 5 panels; 0.75", 1.00", 1.25", 1.5" and 2.0" bar) specified for alpine lake sampling in Montana. Nets were set for a single sampling period (minimum 10 hrs) usually beginning between 18:00 and 20:00 hours. We used a single gill net for the lakes in this study because of their small size. To compare the catch rates among lakes, catch results were standardized by net-hour. Following the collection of fish, we measured total length (mm), weight (g), collected scales and fin clips for genetic analyses and recorded observed diet items. From this information, we calculated catch rates, size distribution, growth, condition factor and *Oncorhynchus* genetic composition and food habits information (Pierce et al. 2008).

Lake Bathymetry. - To map lake bathymetric, we used Global Positioning Satellites (Garmin III GPS receivers) to identify latitude and longitude (decimal degrees) and sonic depth finders (Leila LPS-1 handheld digital depth sounder) to measure water depths. Both GPS location and depth data were taken simultaneously from multiple lake transects and at the 5' depth contour with the use of an inflatable 2-man kayak. We mapped lake perimeters by foot using GPS receivers. All lake locations and water depth values were entered into Excel spreadsheets and bathymetry was mapped using the GIS ArcView spatial analyst module at the FWP Technical Services Lab in Helena, Montana. In addition to lake bathymetry, we collected water chemistry (pH, total dissolved solids and conductivity) using an Oakton multi-parameter tester 35 series. While mapping lake perimeters, we recorded observations of juvenile fish, amphibians, macro-invertebrates, plant communities, notable wildlife and identified camping sites and trails in the immediate area.

Zooplankton - Zooplankton samples were collected from Parker Lake and Lower Twin Lake in summer 2015. Samples were taken using an inflatable float tube using a 50 ft rope with 1ft graduated markings and Wisconsin style vertical plankton net with a 4.875-inch mouth. A hand held electronic depth finder was used and three replicate vertical tows were completed from 1 ft above the bottom to the surface in the deepest areas of the lake. For each tow, zooplankton were concentrated in a collection jar (tow bucket) at the end of the net using a squirt bottle then deposited in 8 oz bottles of 95% ethanol for storage. A hand held electronic depth finder was used to measure water depth and GPS coordinates were recorded for each tow location sampled. Composite samples for the two lakes were then delivered to Rhithron Labratories for taxa identification, enumeration and biomass estimates.

Zooplankton samples were delivered to Rhithron's laboratory facility in Missoula, Montana on April 4, 2016. Both samples arrived in good condition. Upon arrival, samples were unpacked and examined, and an inventory was created. Zooplankton samples were analyzed using National Lakes Assessment protocols (U.S. EPA 2012). Samples were split (concentrated) as necessary to achieve a reasonable volume/density. Samples were concentrated by centrifuging a 50mL subsample. All concentration/dilution factors were recorded. Calibrated pipettes were used to transfer sufficient aliquots to Sedgewick Rafter counting cells. The entire Sedgewick Rafter cell was analyzed and counted for each sample. Organisms were identified to the lowest possible level, using a Leica DM2500 compound microscope at varying magnifications. Consistent with NLA protocols, the first 20 encounters per species, per sample were measured during identifications.

Genetic samples and analyses

To confirm field observations of trout genetic composition, *Oncorhynchus* genetic tests were performed for all fish-bearing lakes and streams sampled in the study area. For these tests, we collected tissue samples (fin clips) from individual *Oncorhynchus* trout, preserved tissue samples at streamside (or lakeside) in 95% ethanol, cataloged samples by survey location and date and delivered these samples to the Wild Salmon and Trout Genetics Laboratory at the University of Montana for genetic analyses. In most cases, samples sizes were small (<12 fish) due to low numbers of fish in stream surveys and the small sample size required to confirm field observations of hybridization. Dr. Robb Leary supervised all genetic tests and performed all genetic analyses. Genetic tests included the PINE, indel and SNPs techniques (*see* Robb Leary lab reports 2008-2016 for methods, references and all results). Summary excerpts from lab reports and lab identification reference numbers are in Appendix D.

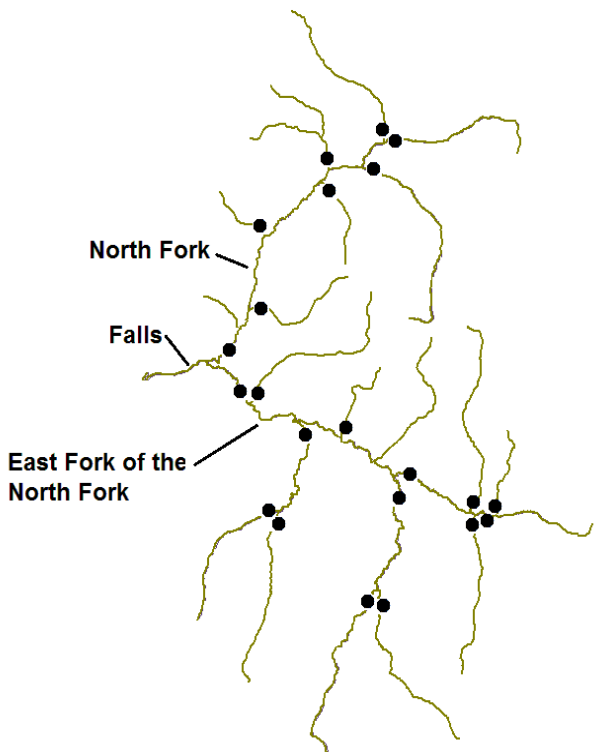


Figure 3. Stream temperature monitoring sites upstream of North Fork Falls.

Water temperature and stream discharge

Water temperature. - To gather baseline temperature data, we deployed continuous water temperature sensors (Onset Computer Corporation, Pocasset, Massachusetts; accuracy = 0.2°C) at 22 locations on 17 streams (Figure 3). These sensors, each with a 5-year battery life, were programmed at 50-minute intervals and deployed on July 8-10, 2013. For this report, all data were retrieved in September 2016. All raw data plots and a summary of monthly statistics for all sites during the monitoring period are shown in Appendix E.

Stream Discharge. - On September 23rd – 26th, 2013 and then again on August 25th-28th, 2014, a hydro-crew from Lolo National Forest packed upstream of the North Fork Falls to measure stream discharge at 19 locations on 17 streams (Figure 4). Discharge measurements were conducted within 0.2 miles of their confluences. Additionally, flows were measured near the headwaters of the East Fork and North Fork and low in their basins just upstream of their junction (Figure 4). Discharge measurements were taken in cross-sections with simple morphology (i.e., no undercut banks, trapezoidal geometry) and hydraulically unidirectional flow (i.e., no eddies or backwater). Areas where groundwater flux between tributaries could influence surface flow were avoided. A Garmin GPS unit documented the location of each survey site and a Marsh-McBirney Flo-Mate 2000 velocity meter calibrated prior to field work was used to measure discharge using standard techniques (Gallagher and Stevenson 1999). Efforts were made to measure velocity at points with a depth greater than 0.1ft; however, some of the tributaries were too shallow to conform to this protocol. Additionally, care is typically taken to ensure that no one discharge measurement exceeds 10% of the total discharge in a cross-section.

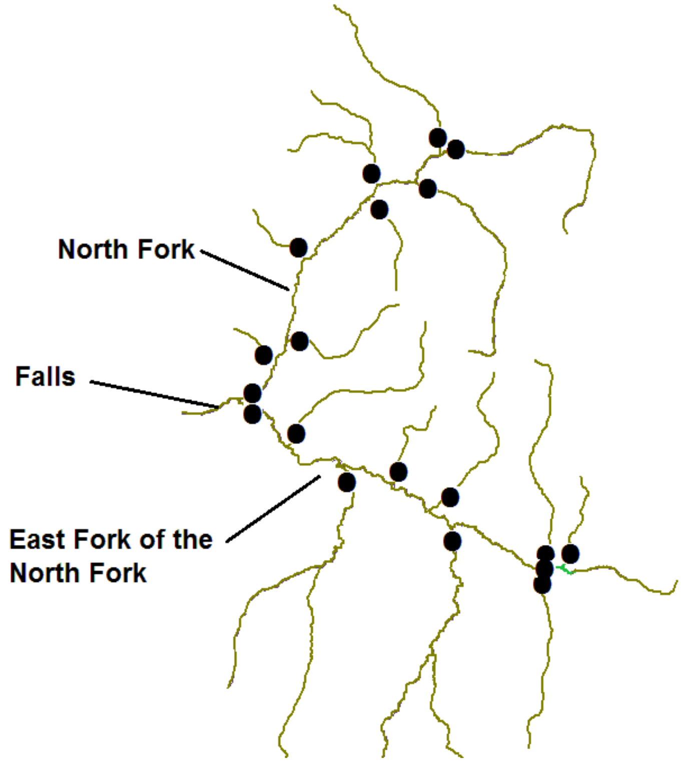


Figure 4. USFS stream discharge measuring sites at 19 locations in the upper North Fork of the Blackfoot River Basin, September 2013 and August 2014.

Water Chemistry

Water chemistry readings were taken with an Oakton multi-parameter tester 35 series meter which measured conductivity (uS), total dissolved solids (ppm) and pH (potential of hydrogen). Conductivity measures the ability of water to pass an electrical current, which reflects the presence of dissolved inorganic solids and thus the geology of the drainage area. Streams that run through areas of bedrock tend to have lower conductivity versus areas with clay soils tend to have higher conductivity because of the presence of materials that ionize when washed into the water. Total dissolved solids (TDS) relate to the combined content of all inorganic and organic soluble substances that provide an aggregate indicator of chemical constituents and/or contaminants. Certain naturally occurring total dissolved solids arise from the weathering and dissolution of rocks and soils. Whereas, pH is a measure of acidity and alkalinity of a solution that is a number on a scale of 0 to 14. A value of 7 represents neutrality; whereby, lower numbers indicate increasing acidity, higher numbers increasing alkalinity and each unit of change represents a tenfold change in acidity or alkalinity. These readings of basic water chemistry form the basis of water quality testing as well as chemical measures associated with biological attributes of water bodies.

Results Part I: Stream Inventories: Fisheries

Results Part I begins with a general description of each stream, including basin features, stream types, riparian vegetation and stream discharge, followed by summaries of fish population sampling results, genetic tests and related biological observations. All summary locations are referenced by stream mile (sm *hereafter*), which defines stream distance upstream from the confluence of the receiving waters (DNRC 1984). Stream summaries are organized first by the mainstem North Fork of the Blackfoot River and then by all known fish-bearing tributaries beginning with the uppermost headwater stream. We followed the same format to describe aquatic resources in the East Fork of the North Fork and its tributaries. More specific data are presented in the Appendices. These are **Appendix A:** Summary of catch and size statistics for all fish sampled in streams; **Appendix B:** Summary of stream discharge measurements for 17 streams; **Appendix C:** Summary of water chemistry readings; **Appendix D:** Genetic sampling sites and summary results; **Appendix E:** Summary of invertebrate sampling sites and results; **Appendix F:** Summary of water temperatures monitoring.

North Fork of the Blackfoot River

The North Fork of the Blackfoot River upstream of the North Fork Falls flows within heavily glaciated hanging river valley with an average gradient of 120’/mile (Figure 5). Tributaries to the upper North Fork from the headwaters down-valley are 1) Dobrota Creek (sm 34.6), 2) Cooney Creek (sm 33.7), 3) Broadus Creek (sm 33.0), 4) Theodore Creek (sm 32.5), 5) Sarbo Creek (sm 30.4), 6) South Creek (sm 28.6), 7) Un-named Creek (sm 27.8) and 8) the East Fork of the North Fork, which enters at the mainstem North Fork at sm 26.6. Upstream of the East Fork confluence, the North Fork flows through a glacial trough valley where the channel is confined in morainal and outwash deposits. Substrates type range from gravel and cobble to erratic glacial boulders with large areas of exposed bedrock. Downstream of the East Fork confluence, the North

Fork flows another 0.47 sm through a cascading bedrock channel before it spills about 50' vertically over the North Fork Falls. The North Fork channel classifies as Rosgen B1-B4 stream types, although stream types attenuate to an A1-A2 stream type in the very headwaters and near the North Fork Falls.

Upstream of the East Fork confluence, the mainstem of the North Fork drains a 47 miles^2 basin. Baseflow on the North Fork was measured at 1.1 cfs and 4.9 cfs near the headwaters at sm 34.7 (upstream of Dobrota Creek) and at 11.1 cfs and 28.7 cfs near the confluence with the East Fork at sm 26.8 in 2013 and 2014, respectively. (Figure 5; Appendix B). The combined flow of the North Fork and the East Fork of the North Fork was measured at 39.8 cfs in September 2013 (a low flow year) and 77.8 cfs in August 2014 (a high flow year). In 1988, the Canyon Creek wildfire swept through most of the upper North Fork watershed. This stand replacement wildfire led to fish kills (Jerry Burns, USFS retired, personal communication; Don Peters, FWP biologist retired, personal communication) and was especially intense in the headwaters as evidenced by slow recovery of conifers in many areas. Among the existing deadfall, a young riparian forest typically consists of lodgepole pine, Douglas fir, Englemann spruce and black cottonwood, as well as willow along the immediate streambanks. Over-hanging willow, large boulders, bedrock-formed pools and log-jams are primary instream habitat features. As the result of the Canyon Creek fire, the presence of coarse instream wood is generally very high within the channel.

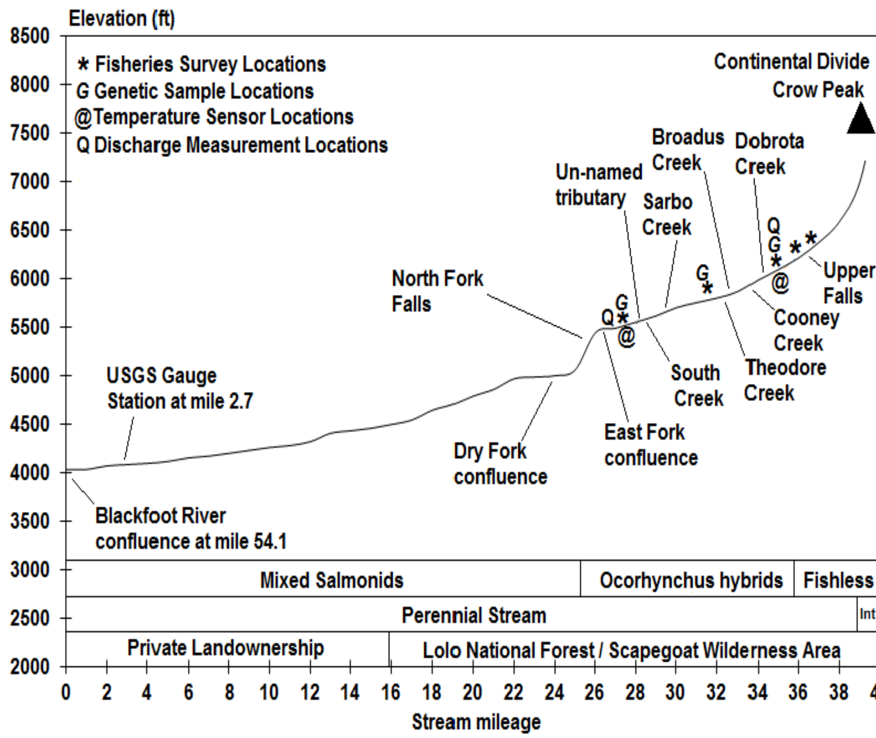


Figure 5. Longitudinal profile for North Fork Blackfoot River including names and locations of tributaries as well as data.

Fish populations and other data collections

The North Fork of the Blackfoot River was historically stocked with approximately >200,000 undifferentiated cutthroat trout and rainbow trout from 1926 to 1954 (Results Part III).

However, records are unclear regarding the specific genetic origin of stocked fish or the specific location of the actual fish plants relative to the North Fork Falls.

We conducted fish population surveys at five locations on the North Fork upstream of the Falls at stream miles 26.8, 32 and 34.7 in 2007 and at miles 36.4 and 36.9 above and below the upper falls in 2016 (Figure 5). Our 2007 surveys recorded low numbers of rainbow trout hybrids (CPUE = 0.2, 1.2 and 5.2, respectively) that increased in the upstream direction. Sampling above and below the upper falls recorded no fish. (Figure 6; Appendix A). Genetic tests from the three sample sites (n=12 fish total) showed hybrid rainbow trout x Yellowstone cutthroat trout x westslope cutthroat trout (Appendix D).

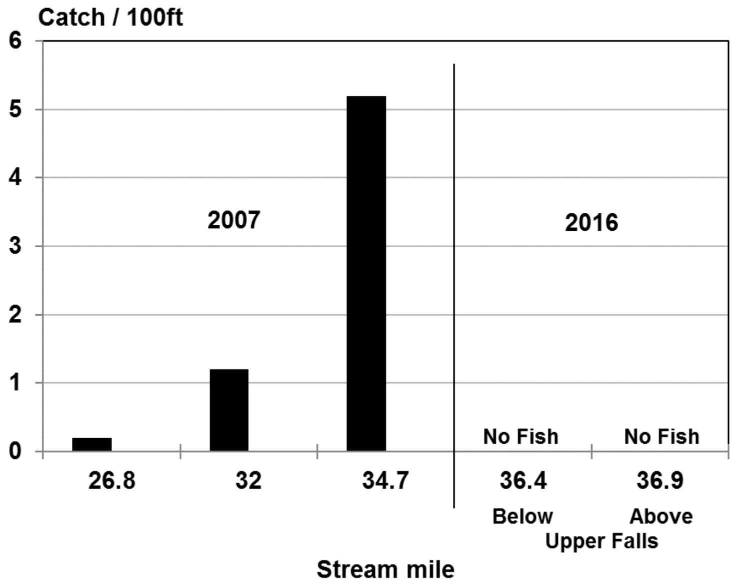


Figure 6. CPUE for rainbow trout hybrids at five locations on upper North Fork Blackfoot River, 2007 and 2016.

Water temperature logger were placed at two sites on the mainstem North Fork, one in the headwaters (sm 34.7) upstream of Dobrota Creek and one just upstream of the East Fork junction (sm 27.0). The upstream temperature sensor at (sm 34.7) revealed a range of maximum summer temperatures of 65.8-71.0^{o}F compared to 61.8-63.7 at the downstream (sm 27.0) sensor during the 2013-2016 monitoring period (Appendix F). The warmer water in the headwaters may relate to the southerly aspect of the drainage and the lack of forest cover (regeneration) in the uppermost portion of the basin where it appears the Canyon Creek fire burned the serotinous seedbed of the conifers, resulting in very slow recovery. The cooling effect in the downstream direction reflects the inflows of cooler tributary streams (Appendix F).

Water chemistry readings collected at these three fish population survey locations recorded conductivity increased in the downstream direction from 109uS to 157uS to 177uS at the three monitoring sites. Likewise, TDS increased in the downstream direction from 55ppm to 78ppm to 89ppm. We measured pH only at sm 27.2 at 8.8. In 2007, a Columbia spotted frog was observed during the fish population survey at mile 32 and a Rocky Mountain tailed frog during the mile 34.7 survey. During the 2016 upper North Fork surveys (sm 36.4 and 36.9) tailed froms (adults and larvae) were common. Macro-invertebrate surveys were conducted in 2014 at the three 2007 fish population survey locations on the mainstem North Fork, as well as six tributary streams (Broadus Creek, Cooney Creek, Dobrota Creek, Sarbo Creek, Theodore Creek and an unnamed stream) within 0.2 miles of their confluence with the North Fork. Complete macro-invertebrate inventory results are found in Results Part III and Appendix E.

Dobrota Creek

Dobrota Creek is a 1st order tributary to the upper North Fork. Dobrota Creek drains a small basin (5.5 mile^2) on the southern slopes of Scapegoat Mountain. Dobrota Creek flows southerly for about 4.0 miles and enters the North Fork at sm 34.6 with a baseflow measured at 2.5 cfs on September 24, 2013. Channel gradients range from 1,434'/mile in the upper 2.0 miles of stream to 192'/mile in the lower two miles of stream (Figure 7). Dobrota Creek classifies as a Rosgen B3 stream type with cobble-dominated substrate along with gravel, boulders mix with large areas of bedrock, which form wood-formed plunge and scour pools and boulder pocket water.

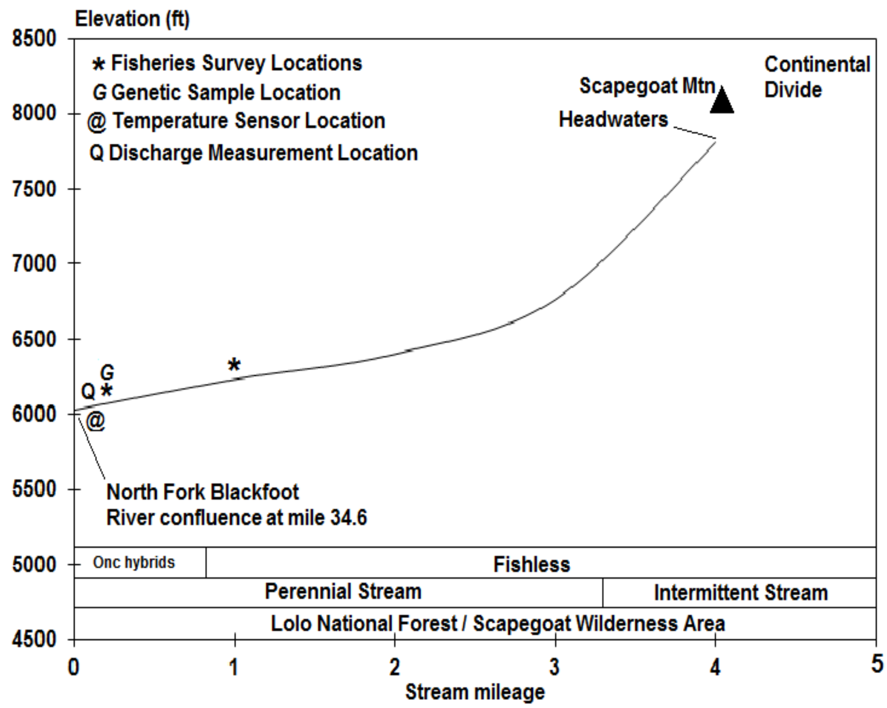


Figure 7. Longitudinal profile for Dobrota Creek.

The Canyon Creek fire burned the Dobrota basin intensely in 1988, resulting in a stand-replacement of lodgepole pine forest. During the time of our surveys, high rates of erosion were still occurring in areas against steep hillsides where plant re-growth is slow. Dobrota Creek is now recruiting considerable amounts of large wood into the channel from the burn area. The riparian plant communities are composed of willow, alder, young lodgepole pine and a robust mixture of grasses and forbs that contributes to bank stability.

<u>Fish populations and other data collections</u>

A survey of fish populations at sm 0.1 in 2007 found low trout numbers (CPUE = 2.7). Genetic tests (n=5 fish) confirmed rainbow trout x westslope cutthroat trout x Yellowstone cutthroat trout hybrids with a predominant rainbow trout genetic contribution (Appendix D). Additionally, a survey conducted in 2016 on Dobrota Creek further upstream at sm 1.0 found no fish but noted the presence of tailed frogs. Water temperature monitoring at sm 0.1 during the 2013-2016 monitoring period recorded mean maximum summer high of 59.3°F, which is 8.3°F colder than mean maximum temperatures of the North Fork upstream of the Dobrota Creek confluence (Appendix F). Water chemistry recorded conductivity at 148uS and TDS at 74ppm. We did not record pH on Dobrota Creek at during the 2007 fish population survey but recorded a conductivity of 171uS in 2016 (Appendix C).

Cooney Creek

Cooney Creek is a 2nd order tributary stream to the upper North Fork. Cooney Creek drains a small (9.2 mile²) headwater basin on northern slopes of Olson Peak and Galusha Peak. Cooney Creek begins in a cirque basin, flows northerly for about 5.5 miles and enters the North Fork at sm 33.7 near the Carmichael Guard Station with a baseflow measured at 2.9 cfs on September 24, 2013. Stream gradient ranges from 617'/mile in upper Cooney Creek to 91'/mile near the mouth (Figure 8). Numerous spring seeps and ephemeral streams enter Cooney Creek throughout its entire length. Cooney Creek classifies as a Rosgen B3-B4 stream type with gravel, cobble, boulder and bedrock substrates. Alder, willow, forbs and grasses line the stream banks beneath a dense riparian forest of Englemann spruce and lodgepole pine in the headwaters of the basin. The headwaters of Cooney Creek support a mature forest although portions the surrounding mountain slopes burned during the 1988 Canyon Creek fire. Currently, the recruitment of wood is extremely high on lower Cooney Creek due in part to avalanche activity in the burn area.

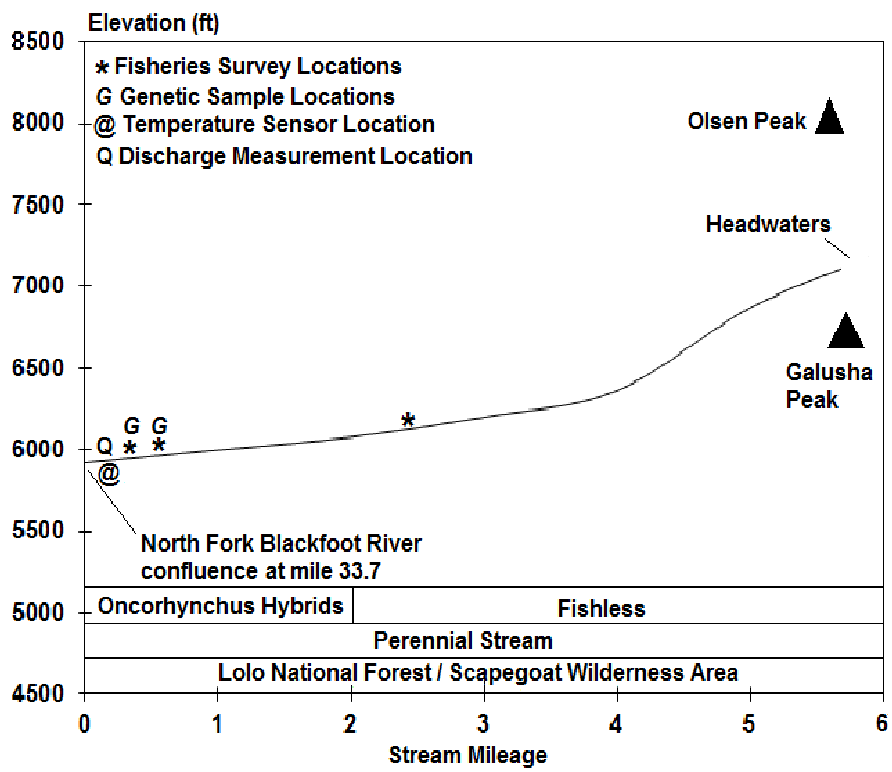


Figure 8. Longitudinal profile for Cooney Creek.

Fish populations and other data collections

Historical planting records show Cooney Creek was planted once in September 1941 with 20,160 rainbow trout and once in September 1950 with 3,600 undifferentiated cutthroat trout (Results Part III).

Cooney Creek was first surveyed in 2007 at sm 0.2. That survey captured only one fish (CPUE=0.2), and that fish tested as a non-hybridized westslope cutthroat trout (Appendix D). In 2013, we returned to Cooney Creek to collect additional samples for genetic testing and to identify the distribution of trout in Cooney Creek. We resurveyed the site at sm 0.2 and found very low fish numbers (CPUE=0.4). We also surveyed two additional upstream locations in 2013 at sm 0.4 and sm 2.4 (Figure 9). Sampling at sm 0.4 recorded similar low numbers trout (CPUE=0.3) and the sm 2.4 survey site was fishless (Appendix A). Results from genetic tests for the 2013 samples (n=8) showed hybrid rainbow trout x Yellowstone cutthroat trout x westslope cutthroat trout (Appendix D).

A temperature sensor at sm 0.2 identified cold summer temperatures recording a mean maximum annual water temperature of 53.4 ^{o} F, ranging between 51.9-54 ^{o} F during the 2013-2016 monitoring period, 5.9 ^{o}F lower than Dobrota Creek and 14.2^{o}F lower than the North Fork upstream of the Dobrota Creek confluence (Appendix F). Water chemistry readings taken in 2013 showed an increase in conductivity in the downstream direction (i. e., 185 uS at sm 2.4 versus 202 uS at sm 0.2). TDS ranged from 143-131 ppm and pH ranged from 8.5-8.7 (Appendix C).

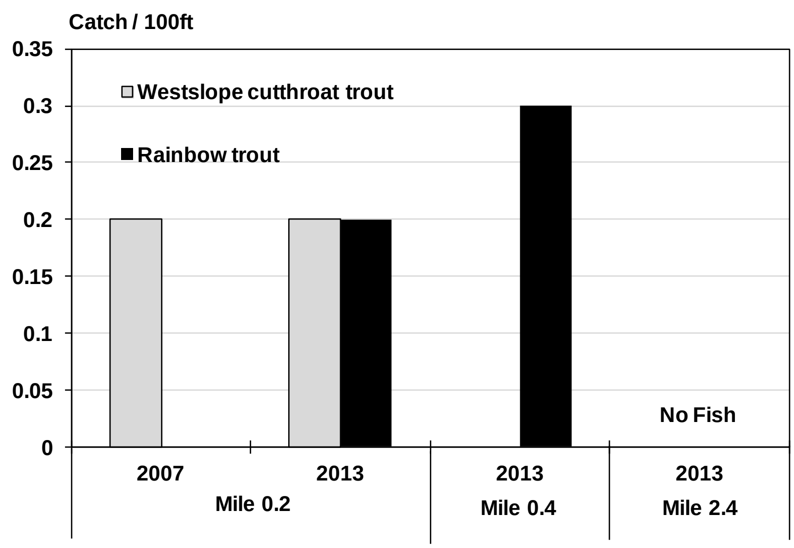


Figure 9. CPUE for three survey sections on Cooney Creek.

Broadus Creek

Broadus Creek, a 2nd order tributary to the North Fork, drains a small (3.3 mile^2) basin on the eastern slopes of Evans Peak. It flows east and south for 2.5 miles and enters the North Fork at sm 33.0 with a baseflow measured at 0.7 cfs on September 24, 2013. The upper mile of

Broadus Creek is intermittent and has a gradient of 1,200'/mile, whereas the lower 1.5 miles of stream is perennial and descends at 430'/mile and classifies as a Rosgen Aa2 stream type (Figure 10). This high gradient stream has a mix of boulder and bedrock substrates. Copious amounts of charred wood are currently entering the stream from the burn area, including steep surrounding cliffs. The banks are stable due to bedrock, but also allow for alder and a mixed community of grasses and forbs. The young riparian forest consists of lodgepole pine and Englemann spruce. Just upstream of the mouth a 12' waterfall acts as an upstream fish passage barrier based on electrofishing surveys.

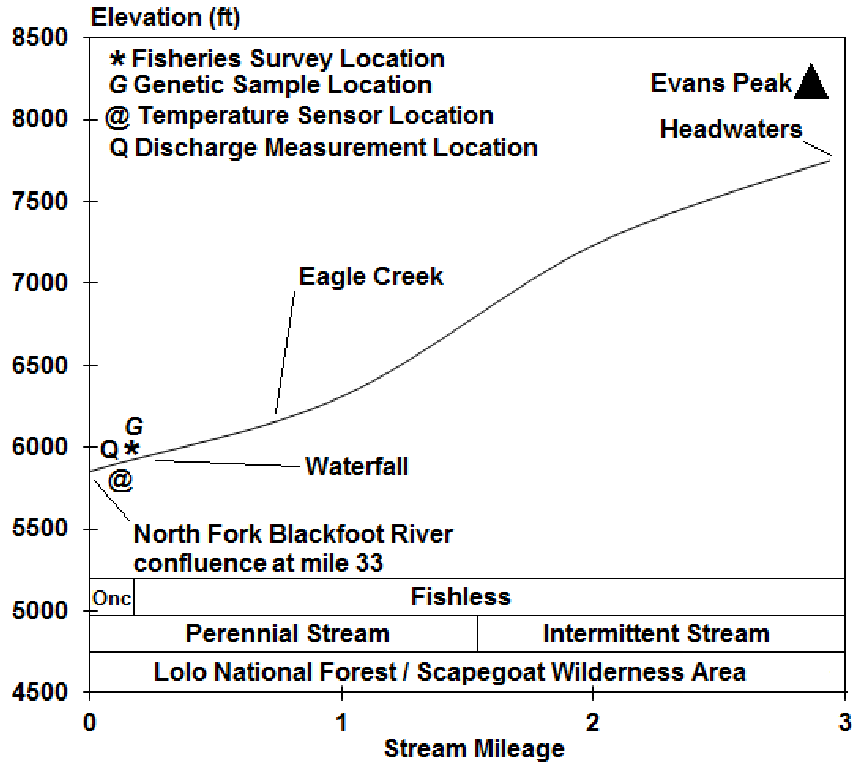


Figure 10. Longitudinal profile for Broadus Creek.

<u>Fish populations and other data collections</u>

We surveyed up- and downstream of the Broadus Creek Falls in July 2007. These surveys identified hybrid trout in low abundance (CPUE=1.4) downstream of the Broadus Falls versus no fish upstream of Broadus Falls. Genetic tests (n=4) confirmed hybridization between rainbow trout x westslope cutthroat with a predominant rainbow trout genetic contribution (Appendix D). No other fish species or amphibians were observed during the surveys. A temperature sensor at sm 0.1 on Broadus Creek for the 2013-2016 monitoring period recorded a mean maximum annual summer water temperature of 59.5°F that ranged between 58.5-60.9°F (Appendix F). Macroinvertebrate and amphibian survey results are in Results Part III. Water chemistry readings below Broadus Falls recorded conductivity at 197uS and TDS at 98ppm.

Theodore Creek

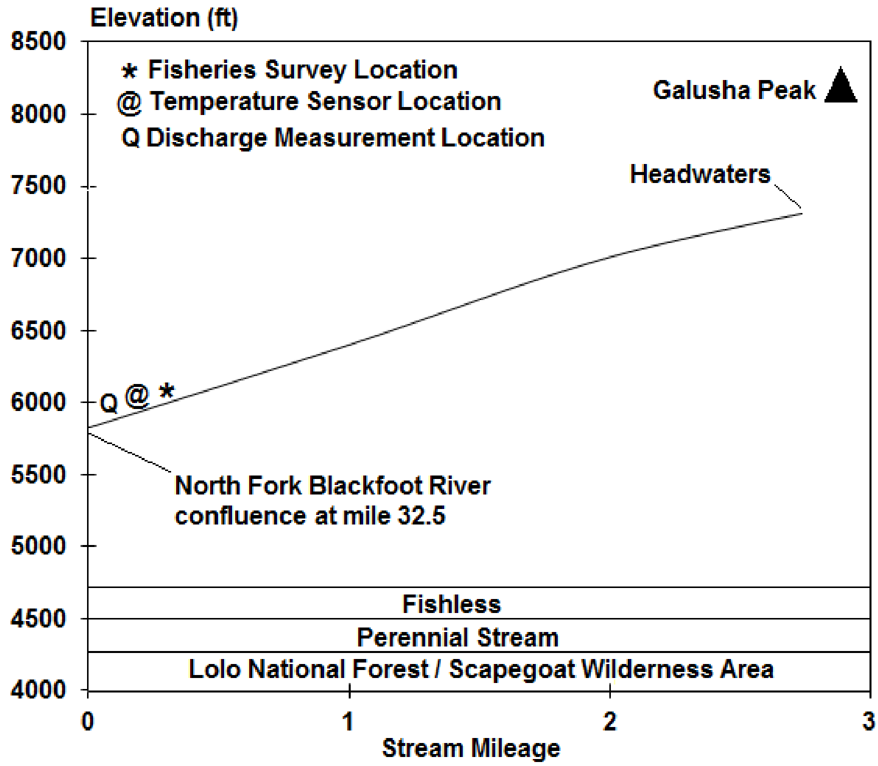


Figure 11. Longitudinal profile for Theodore Creek.

Theodore Creek is a small 1st order perennial tributary that flows northerly 2.4 miles before entering the upper North Fork at sm 32.5 with a baseflow measured at 0.1 cfs on September 24, 2013. This high-gradient stream (mean gradient=530'/mile) drains as small basin (1.6 mile^2) on the north-eastern slopes of Galusha Peak (Figure 11).

The 1988 Canyon Creek wildfire burned the riparian vegetation along Theodore Creek, which now consist of dense community of young lodgepole pine, Englemann spruce and black cottonwood, along with willows, forbs and grasses at the stream margins. The recruitment of large wood to the stream channel is high and overhanging shrubs contribute extensively to instream habitat features. The survey location on lower Theodore Creek classifies as a Rosgen C4 stream type with a predominately gravel substrate.

Fish populations and other data collections

A fish population survey at sm 0.2 in 2007 found no fish but Columbia spotted frogs were observed. Water chemistry measurements recorded conductivity at 166uS and TDS at 83ppm. We did not record pH in Theodore Creek. A thermograph at sm 0.1 recorded maximum annual high temperatures ranged between 55.7 and 59.5^{o}F for the 2013-2016 monitoring period (Appendix F).

Sarbo Creek

Sarbo Creek, a small 1st order tributary, drains 1.4 mile^2 basin on the southern slopes of Evans Peak, and flows 1.7 miles to its confluence with the North Fork at river mile 30.4. Stream gradient averages 545ft/mile for the upper 0.7 mile of stream decreasing to 128ft/mile in the middle reaches that increases to 332ft/mile near the mouth (Figure 12). Most of the Sarbo Creek drainage was not burned in 1988 Canyon Creek wildfire. Only the hillsides of the lower 0.2 miles burned; however, its riparian corridor remained untouched. A small confined stream, lower Sarbo Creek classifies as a Rosgen A1+ stream type beneath a riparian over-story of mature spruce and lodgepole pine above dense under-story of alder. Large wood recruitment to the stream channel is low to moderate. Most plunge and scour pools as well as pocket pools are created by large slabs of bedrock and instream boulders.

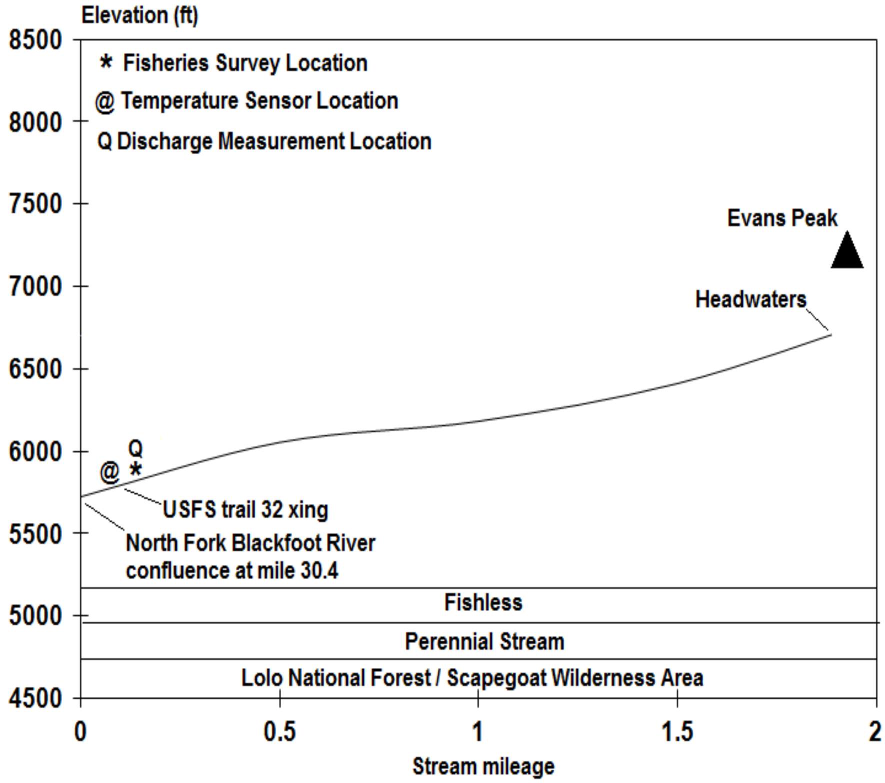


Figure 12. Longitudinal profile for Sarbo Creek.

Fish populations and other data collections

A fish population survey conducted in August 2014 at sm 0.1 on Sarbo Creek found no fish (Appendix A). Concurrent amphibian and macro-invertebrate surveys recorded no amphibians (Results Part III, Appendix E). Water chemistry reading recorded conductivity at 159uS, TDS of 80ppm and pH of 8.1 (Appendix C). In July 2013, we deployed a temperature sensor at sm 0.1 in Sarbo Creek. Temperature data shows a mean maximum summer temperature of 56 °F that ranged between 56.6 and 55.9°F during the 2013-2016 monitoring period (Appendix F).

South Creek

South Creek, a small 1st order tributary drains a 2.2 mile^2 basin on the northern slopes of Galusha Peak. South Creek flows northwesterly for approximately 3.0 miles and joins the North Fork at sm 29.3. Stream gradient averages 1,336ft/mile the upper mile and decrease to 346ft/mile in the lower two miles of stream (Figure 13). Large portions of lower South Creek and its surrounding foothills burned in the 1988 Canyon Creek wildfire; however, the upper 2.2 miles of its riparian corridor remained untouched. South Creek classifies as a Rosgen B2-B3 stream type at mile 1.2 and a B4-B5 near the mouth A small confined stable channel surrounded by a mature Englemann spruce and lodgepole pine over-story mixed with lodgepole pine above dense under-story of alder. Recruitment of large wood to the stream channel is low to moderate creating some plunge and scour pools along with pocket pools created by large instream boulders. However, observed during a July 2016 survey (sm 0.4), lower South Creek lacks an overstory a result of the wildfire but a very dense alder growth along the stream. The lack vegetation on areas of the adjacent hillside slopes in the burn area contributes elevated levels of sand and gravel to the stream. High concentrations of large wood recruited to the stream channel create complexity of plunge and scour pools.

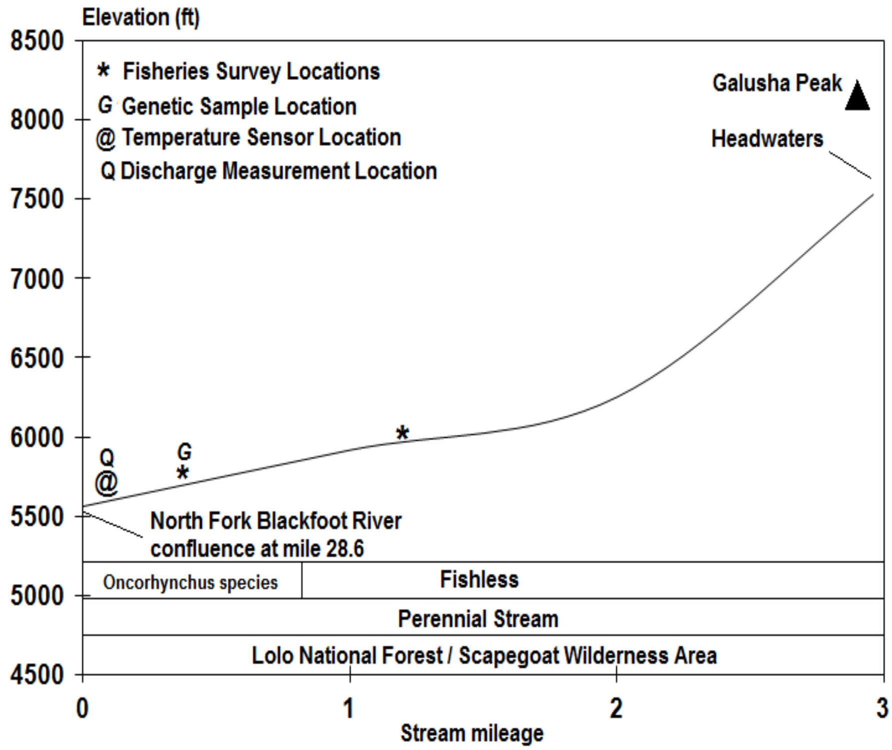


Figure 13. Longitudinal profile for South Creek.

<u>Fish populations and other data collections</u>

In September 2013, a fish population survey at sm 1.2 on South Creek found no fish but noted the presence of larval tailed frogs. A subsequent fish population survey in 2016 at stream mile 0.4 recorded a rainbow trout CPUE of 3.3fish/100ft (Appendix A). Genetic tests are pending. Discharge measurement results are found in Appendix B. Water chemistry reading 2013 recorded conductivity at 229uS, TDS of 163ppm and pH of 8.3, readings from 2016 are listed in (Appendix

C). A temperature sensor in South Creek at sm 0.1 recorded mean maximum annual water temperature of 58.1 ^{o}F for the monitoring period 2013-2016 and a range between 57.1-58.4^{o}F (Appendix F).

Un-named tributary

A small 1st order un-named stream drains a 1.3 miles^2 basin on the eastern slopes of Falls Point. The stream is 1.6 miles in length, and enters the North Fork at river mile 27.8 upstream of the East Fork confluence (Figure 14). Most of this un-named tributary's basin was untouched by the 1988 Canyon Creek wildfire. Only the hillsides of the lower reaches were burned.

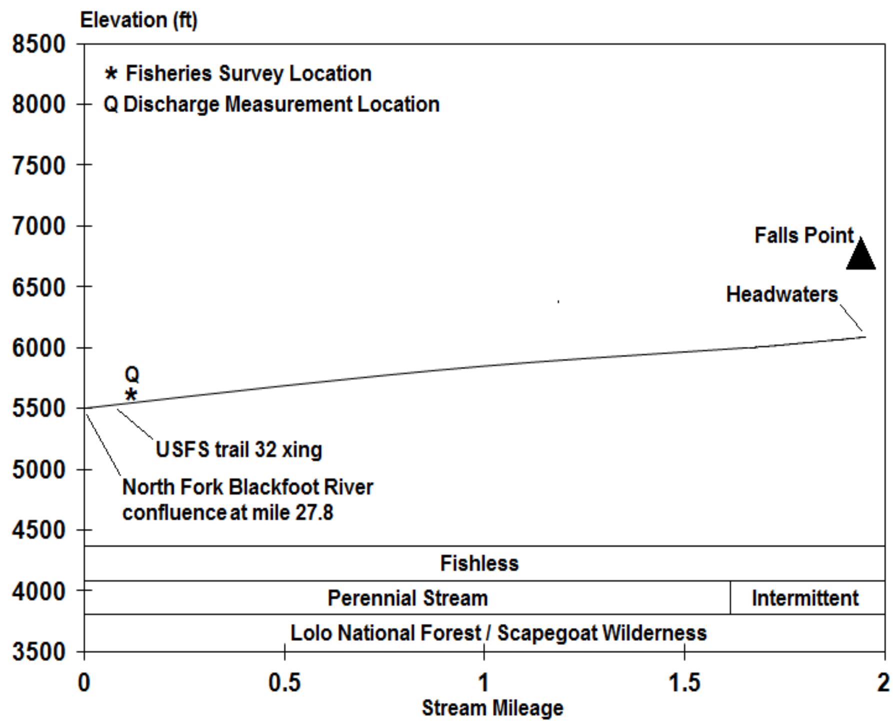


Figure 14. Longitudinal profile for an Un-named tributary to the upper North Fork Blackfoot River.

The tributary classifies as a Rosgen B3-B4 stream type and the channel is very stable with dense riparian vegetation, including an over-story of mature Englemann spruce and lodgepole pine above alder, willow, young black cottonwoods and streamside forbs and grasses. Large wood recruitment to the stream channel create plunge and scour pools as well as large boulders create pocket water and scour pools.

Fish populations and other data collections

A fish population survey conducted in August 2014 at sm 0.1 found no fish (Appendix A). Results from amphibian and macro-invertebrate surveys conducted are found in Results Part III. The USFS discharge measurements conducted in September 2013 and August 2014 measured baseflows at 1.6 cfs. Water chemistry reading recorded conductivity at 125uS, TDS of 60ppm and pH of 8.0 (Appendix C).

East Fork of the North Fork of the Blackfoot River

The East Fork of the North Fork is a large 3rd order stream that originates about 1.5 sm upstream of Parker Lake. From Parker Lake, downstream the East Fork flows northwest 10.1 sm through a glacial trough valley to its confluence with the North Fork at sm 26.6. Classified as Rosgen B3-C4 stream types, the East Fork drains a 65 mile^2 basin along with nine primary tributaries (Figure 15). From the headwaters, downstream these tributaries are 1) Blondie Creek (sm 10.0), 2) Sourdough Creek (sm 9.4), 3) Scotty Creek (sm 9.2), 4) Meadow Creek (sm 6.7), 5) Lost Pony Creek (sm 6.0), 6) Spaulding Creek (sm 4.7), 7) Mineral Creek (sm 3.3), 8) Kenny Creek (sm 1.8) and 9) Camp Creek (sm 1.7).

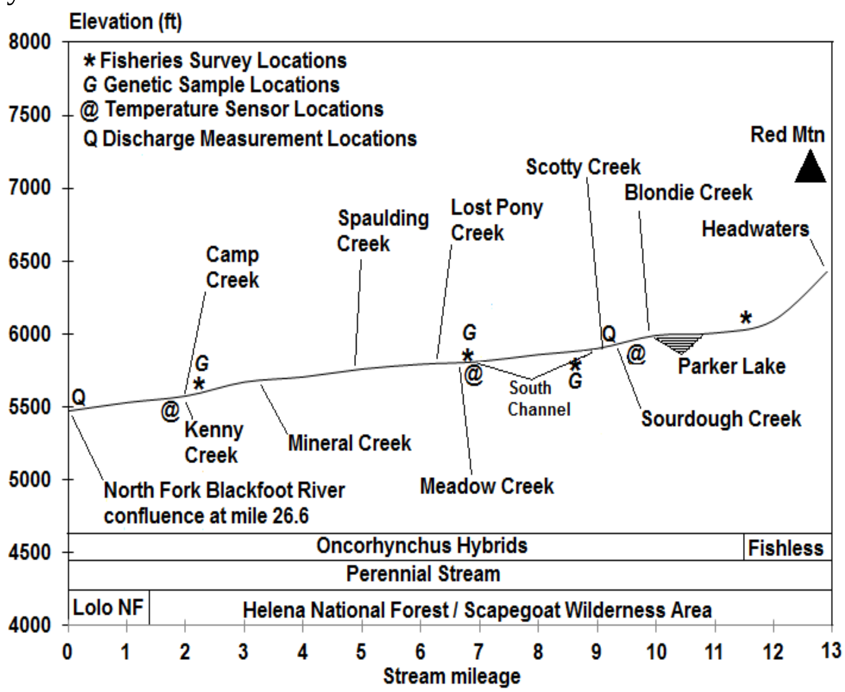


Figure 15. Longitudinal profile for East Fork of North Fork Blackfoot River.

Downstream of Parker Lake, the East Fork baseflow was measured at 4.0 cfs on September 23, 2013, compared to 28.7 cfs on September 25, 2013 just upstream of the East Fork confluence with the North Fork (Figure 15, Appendix B). The East Fork splits into two channels just downstream of the Scotty Creek confluence near sm 9.1. These channels flow in separate channels for about two miles before rejoining about 0.2 miles upstream of the Meadow Creek confluence (Figure 15).

The lower nine miles of the East Fork channel falls within the 1988 Canyon Creek burn area. Here, substantial amounts of wood are now entering the channel. A dense lodgepole pine forest has become reestablished in the riparian zone along with a corridor of willow and alder, forbs and various grasses. Upstream of the burn area, the East Fork a dense understory of alder and other shrubs, snowberry and various grasses line the stream beneath an over-story of mature lodgepole pine.

Fish populations and other data collections

The East Fork was historically stocked with approximately 41,000 "undifferentiated" cutthroat trout from 1940 to 1952 (Results Part III). In 2006, we surveyed fisheries in the East Fork for the first time. These surveys included one site upstream of Parker Lake (sm 11.7) and one site upstream of the Meadow Creek confluence (sm 7.0). In 2013, we resurveyed the sm 7.0 site and established two additional East Fork survey sites, one on the lower East Fork (sm 1.9) and one on the south channel (sm 9.0). Our survey upstream of Parker Lake found no fish despite the presence of trout in Parker Lake. The CPUE at the two downstream sites ranged from 4-9 fish/100' (Figure 16) (Appendix A). Genetic tests (n=5 fish) identified rainbow trout x Yellowstone cutthroat trout x westslope cutthroat trout hybrids with a predominant rainbow trout genetic contribution. (Appendix D). Amphibians (tailed frogs and Columbia spotted frogs) were variously observed throughout the East Fork samples (Results Part III).

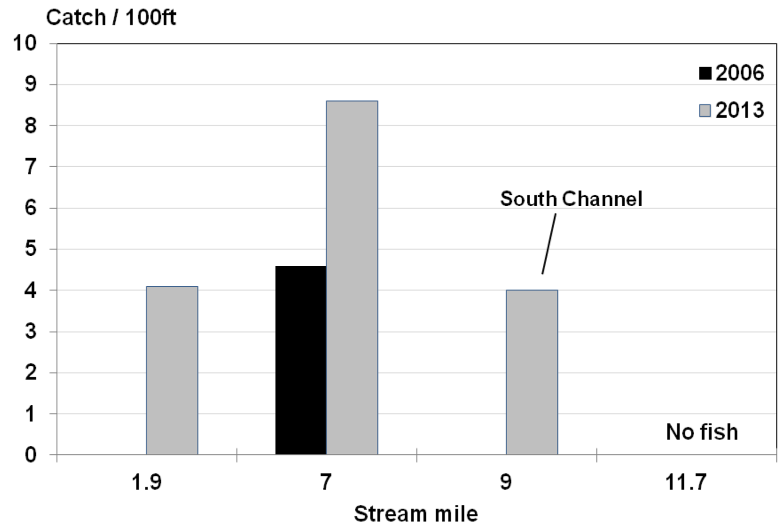


Figure 16. CPUE for hybrid trout at four sampling locations on East Fork of North Fork Blackfoot River, 2006 and 2013.

Temperature sensors were placed at three locations (sm 1.7, 7.0 and 9.4) on the East Fork in July 2013 (Figure 15). For the 2013-2016 monitoring period, maximum annual water temperatures ranged between 70.8 and 72.6 ^{o}F at sm 9.4. This compares to maximum annual temperature range between 62.5 and 63.6 ^{o}F at mile 7.0 and 55.5 and 63.5 ^{o}F at mile 1.7 for the 2013-2016 monitoring period (Appendix F). The warmer water in the upstream monitoring reflects the influence of Parker Lake; whereas, the cooling influence in the downstream direction reflect moderating influence of East Fork tributaries. Water chemistry readings were variable in the East Fork at three sampling locations (Appendix C).

Blondie Creek

Blondie Creek is a small 1st order tributary to the East Fork, entering at sm 10.0 just downstream of Parker Lake was measured at 0.2 cfs in August 2014. The small stream classifies as Rosgen B3 stream type, which drains a 1.1 miles^2 basin on the western slopes of Pyramid Peak with an average gradient of 458ft/mile over its 2.1-mile length (Figure 17). A dense understory of various grasses, shrubs and forbs line the stream banks beneath a dense riparian overstory of young lodgepole pine. At the site of our fish population survey, lower Blondie Creek was untouched by the 1988 Canyon Creek fire. The amount of instream wood was thereby much lower than the surrounding burn area. Majority of the fish habitat consists of small pocket pools formed by large boulders and undercut banks with moderate amounts of instream wood.

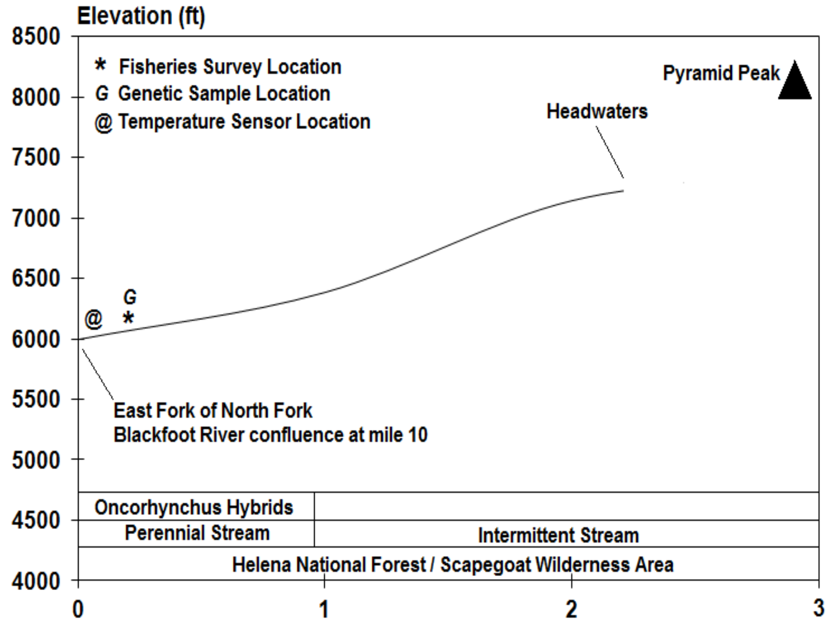


Figure 17. Longitudinal profile for Blondie Creek.

<u>Fish populations and other data collections</u>

In August 2013, sampling of fish populations at sm 0.2 recorded a CPUE of 6.9. We also noted the presence of tailed frogs, Columbia spotted frogs and western toads. Trout were phenotypically identified as rainbow trout in the field. Results of genetic analyses (n=10) showed rainbow trout x Yellowstone cutthroat trout x westslope cutthroat trout hybrids (Appendix D). A concurrent macroinvertebrate and amphibian survey was completed at the fish population survey site (Results Part III and Appendix E). Summer water temperature readings near the mouth of Blondie recorded at mean maximum annual temperature of 58.1°F that ranged between 55.2 and 59.2°F during the 2013-2016 monitoring period (Appendix F). Water chemistry readings were 138uS for conductivity, 78ppm for TDS and 8.1 for pH.

Sourdough Creek

Sourdough Creek, a 2nd order tributary, drains a small (5.1 mile^2) basin on the western slopes of Red Mountain. The stream begins in a small cirque lake, flows north 3.4 miles and joins the East Fork of the North Fork at sm 9.4 with a discharge of 1.1 cfs on September 25, 2013 (Figure 18). Stream gradients range from a high of 1,060'/mile between sm 2.0 - 3.0 to 185'/mile downstream of sm 2.0 (Figure 18). Sourdough classifies as Rosgen B3-C4 stream type in the lower survey sections.

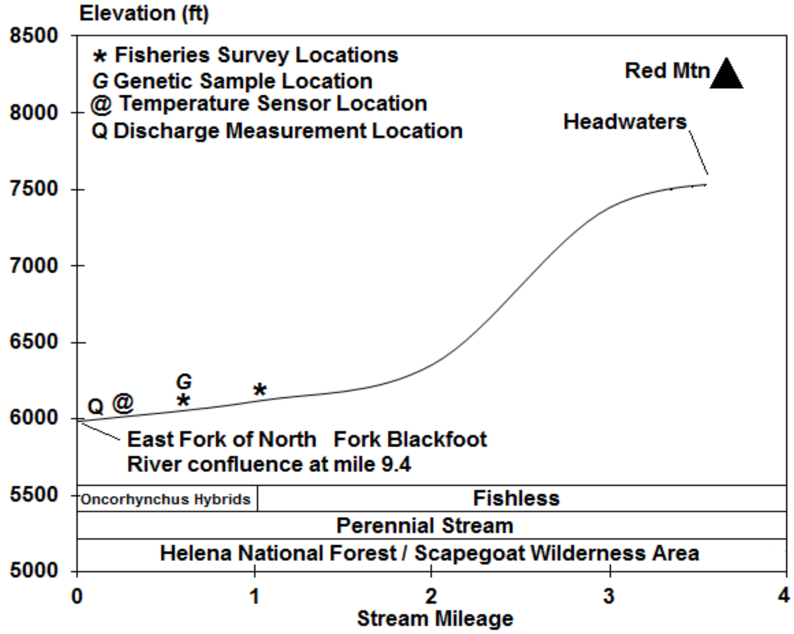


Figure 18. Longitudinal profile for Sourdough Creek.

Below a coniferous overstory, riparian vegetation consists of a dense shrub community (willow, alder and red-osier dogwood) with various forbs and grasses. Only the lower 0.1 mile of Sourdough Creek was affected by the 1988 Canyon Creek fire. Thus, most of drainage supports a mature lodgepole pine and subalpine fir forest. Channel features consist of overhanging vegetation, undercut streambanks and large boulder substrates. Larger woody debris recruitment to the stream channel is relatively low compared to streams in the nearby burn area.

Fish populations and other data collections

Fish population surveys conducted in 2006 and in 2013 at sm 0.6 identified trout in very low numbers (CPUE=0.5 both years). A 2013 survey conducted at sm 1.0 on Sourdough Creek found no fish. Genetic tests from the 2006 sample (n=3) identified rainbow trout x Yellowstone cutthroat trout x westslope cutthroat hybrid trout with a substantial rainbow and Yellowstone cutthroat trout genetic contribution and a minor contribution from westslope cutthroat trout. Concurrent macroinvertebrate and amphibian samples were collected at both sm 0.6 and sm 1.0 in 2013 (Results Part III and Appendix E). Water temperature recordings at sm 0.1 recorded cold summer temperatures with maximum annual temperatures ranging between 51.7 and 53.7 ^{o}F during the 2013-2016 monitoring period. The maximum recorded temperate of 53.7^{o}F is 18.9^{o}F lower than the highest temperature of the receiving waters of the East Fork downstream of Parker Lake (Appendix F). Water chemistry results collected during the 2013 surveys recorded slightly lower conductivity at the upper site (156 uS) versus the lower site (166uS) and slightly lower TDS at the upper site (76 ppm) versus the lower site (84ppm). Readings for pH ranged from 7.9-8.1.

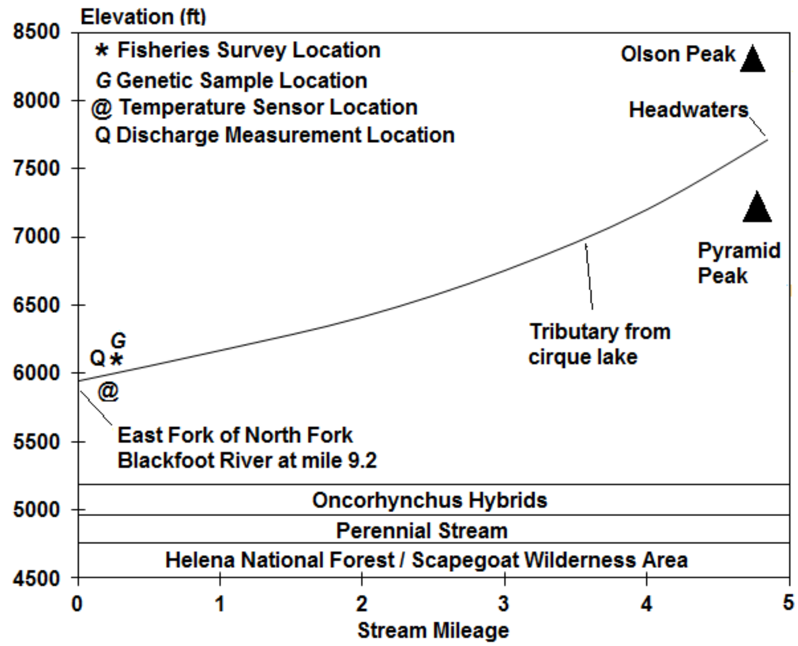


Figure 19. Longitudinal profile for Scotty Creek.

Scotty Creek

Scotty Creek is a 2nd order tributary that flows 4.8 miles south and joins the East Fork at sm 9.2 with a measured base flow of 0.6 cfs on September 25, 2013. Scotty Creek originates in a small cirque and drains a 4.2 mile^2 watershed on the western slopes of Olson and Pyramid Peaks. Stream gradients range from 710'/mile near the headwaters to 220'/mile near the mouth (Figure 19). Scotty Creek classifies as a Rosgen B3-B4 stream type with wood-formed step pool morphology. The Scotty Creek basin was severely burned during the 1988 Canyon Creek fire and is now recruiting high concentrations of wood into the stream. Riparian vegetation is very dense and consists of willows and grasses within a young lodgepole pine forest.

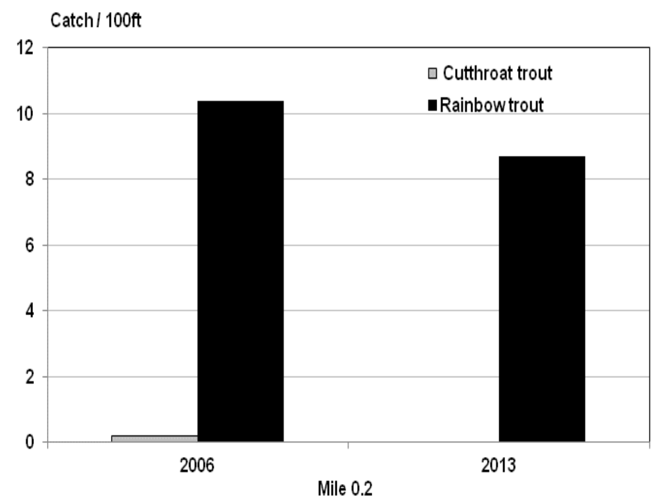


Figure 20. CPUE for rainbow trout hybrids and cutthroat trout on Scotty Creek, 2006 and 2013.

<u>Fish populations and other data collections</u>

Fish population surveys were conducted in 2006 and 2013 at sm 0.2. These surveys identified trout at higher catch-rates than most inventoried streams (i.e., CPUE=10.4 in 2006 and 8.7 in 2013) (Figure 20). Western toads and tailed frogs were observed during the 2006 and 2013 surveys. Genetic tests from 2006 trout (n=5) found hybrid rainbow trout x Yellowstone cutthroat trout x westslope cutthroat trout with a predominant rainbow trout genetic contribution. Macroinvertebrate and amphibian samples were collected concurrently with fish population surveys in 2013 (Results Part III and Appendix E). A water temperature sensor at sm 0.2 recorded maximum annual temperatures between 58.5 and 60.3^{o}F during the 2013-2016 monitoring period (Appendix F). Water chemistry readings collected during the 2013 survey were relatively low (conductivity=84uS, TDS=41ppm, and pH=7.7) compared to other tributaries to the East Fork (Appendix C).

Meadow Creek

Meadow Creek, a large 2^{nd} order stream enters the East Fork at sm 6.7 with a baseflow measured at 10.9 cfs at sm 0.1 in September 26, 2013. Flowing northerly for about 9.9 miles, Meadow Creek drains a 22.5 mile^2 watershed that includes the northern slopes of Daly Peak, Arrastra Mountain and Red Mountain. The East Fork of Meadow Creek enters the mainstem of Meadow Creek near sm 3.9. Stream gradients within the watershed range from an average of 324'/mile in the headwaters decreasing to 7'/mile downstream of the confluence of the East Fork of Meadow Creek (Figure 21).

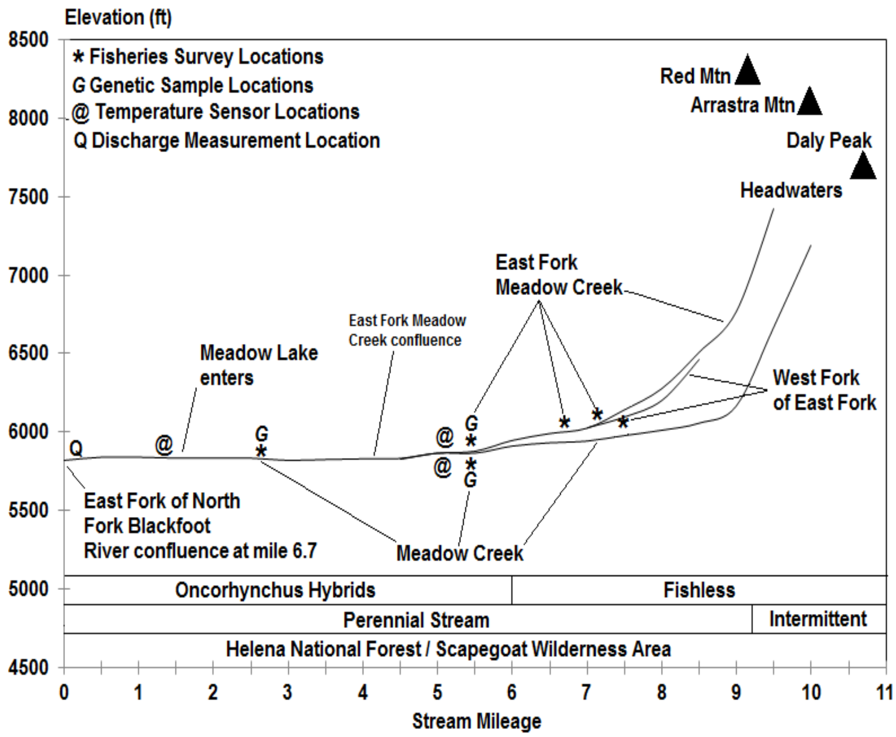


Figure 21. Longitudinal profile for Meadow Creek and its headwater tributaries.

Upper Meadow Creek and its headwater tributaries (East Fork of Meadow Creek, the West Fork of the East Fork) all classify as Rosgen B2-B3 stream types. The riparian plant communities in the upper reaches of Meadow Creek consist of subalpine fir and lodgepole pine above a dense under-story of rocky mountain maple mixed with willow, alders, young conifers and various shrubs and grasses. Fish habitat consists of under-cut banks, boulder pocket pools and wood-formed plunge pools. At about sm 7.0, Meadow Creek transitions from a forested confined channel to a broad alluvial stream valley (C4-E5 stream types) with a marsh wetland and riparian plant community comprised of willow and sedges. Here, fish habitat is composed primarily of deep under-cut banks beneath over-hanging willows with a substrate of sand, gravel and clay.

Recruitment of large wood to the channel is limited due to the transition from a coniferous forest to shrub plant community. Compared to most streams with coarse instream wood, small wood is variably present in lower Meadow Creek in the form of beaver dams. Downstream of the Meadow Lake outlet, the lower 1.4 miles of Meadow Creek transitions back to a confined channel. The lower reach Meadow Creek drainage burned in the 1988 Canyon Creek fire, resulting in the dense regeneration of an early seral lodgepole pine forest and moderate concentrations of instream wood.

Fish populations and other data collection

Planting records show Meadow Creek was planted in 1940, 1942 and 1943 with a total of 23,224 undifferentiated cutthroat trout. The East Fork of Meadow Creek was planted with an unspecified number of trout in 1940, then again in 1950 with two plants totaling 10,800 and in 1952 with two plants totaling 6,864 undifferentiated cutthroat trout (Results Part III).

In 2008, we establish six fish population surveys in the Meadow Creek drainage (Figure 21). These surveys determined upper reaches of both the West Fork of the East Fork of Meadow Creek were fishless and identified trout abundance increased in the downstream direction (Figure 22). In 2013, we resurveyed two sites originally surveyed in 2008 (Meadow Creek at sm 5.2 and East Fork of Meadow Creek at sm 0.8) and found low trout numbers with a CPUE of <1 fish/100ft (Figure 22). Genetic tests (n=12) identified hybridized rainbow trout x Yellowstone cutthroat trout x westslope cutthroat trout with a substantial rainbow trout genetic contribution (Appendix D). During fish population surveys, we observed tailed frogs, Columbia spotted frogs and western toads at various locations in the Meadow Creek drainage. In 2013, macroinvertebrate and amphibian surveys were conducted concurrent at the fish population resurvey locations on Meadow Creek at sm 2.6 and 5.2 and on the East Fork of Meadow Creek at sm 0.8 (Results Part III and Appendix E).

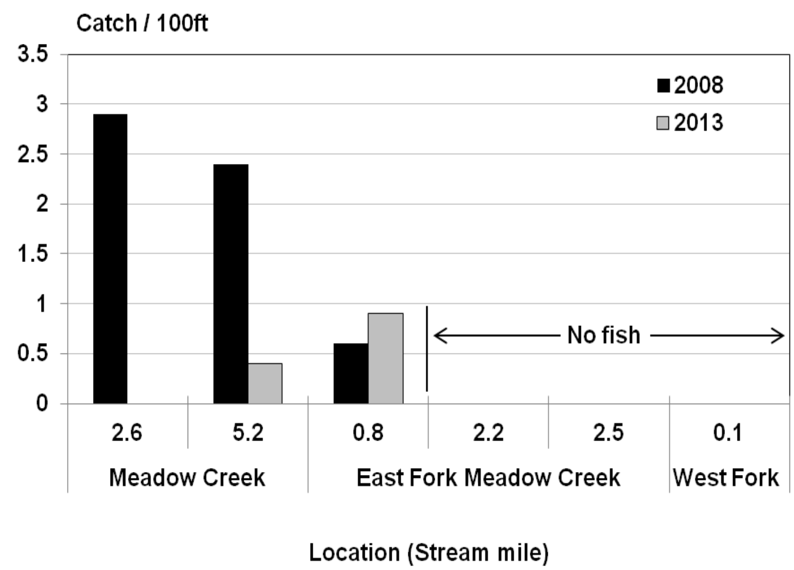


Figure 22. CPUE for rainbow trout hybrids in the Meadow Creek drainage, 2008 and 2013.

We placed two water temperature sensors in Meadow Creek (sm 1.4 and sm 4.7) and one in East Fork of Meadow Creek at sm 0.1 in July 2013. Water temperature monitoring at sm 1.4 identified a relatively warm summer temperatures with maximum annual highs ranging from 64.2-70.0^{o}F and low winter temperatures of $\leq$32.1^{o}F (Appendix E). Conversely, Meadow Creek at sm 4.7 had cooler maximum summer temperatures ($\leq$59.8^{o}F) and relatively warm winter flows, which likely indicate groundwater inflows. In August 2014, the sm 4.7 sensor was moved upstream to mile 5.3 and the East Fork's (sm 0.1) sensor was moved to sm 0.9. The mean maximum annual summer temperature for 2015-2016 period at sm 5.3 was 7.2^{o}F lower than temperatures at sm 1.4 for same monitoring period and unlike the sm 4.7 site, the sm 5.3 site showed no indication of groundwater influence during the winter of 2015-2016. Different from sm 0.1 where the East Fork's maximum summer temperatures remained <62^{o}F maximum summer temperatures at sm 0.9 averaged >62 ^{o}F during the 2015-2016 period (Appendix F). Water chemistry reading taken during the fish population surveys showed a general decrease in both conductivity and TDS in the upstream direction and pH ranging from 8.0-8.7 (Appendix C).

Lost Pony Creek

Lost Pony Creek is a 1st order tributary to the middle reaches of the East Fork of the North Fork. The outlet channel from Lower Twin Lakes enters the Lost Pony Creek stream valley near sm 0.8 (Figure 23). Lost Pony Creek drains a small 3.6 mile^2 basin on the southern slopes of Galusha Peak, and flows southerly 3.8 miles to its confluence with the East Fork at sm 6.0. Stream gradients range from 750'/mile in the upper reaches to 208'/mile near the mouth. The stream classifies as Rosgen B3-B4 stream type in lower reaches. Lost Pony Creek loses flow and goes intermittent between sm 0.2-0.5 during low flow periods. The stream banks of Lost Pony Creek generally support dense riparian vegetation composed of shrubs, sedges and grasses. Over hanging vegetation, dense amounts of coarse wood, alder roots and under-cut banks provide high quality fish habitat. The Lost Pony Creek drainage was intensely burned in the 1988 Canyon Creek

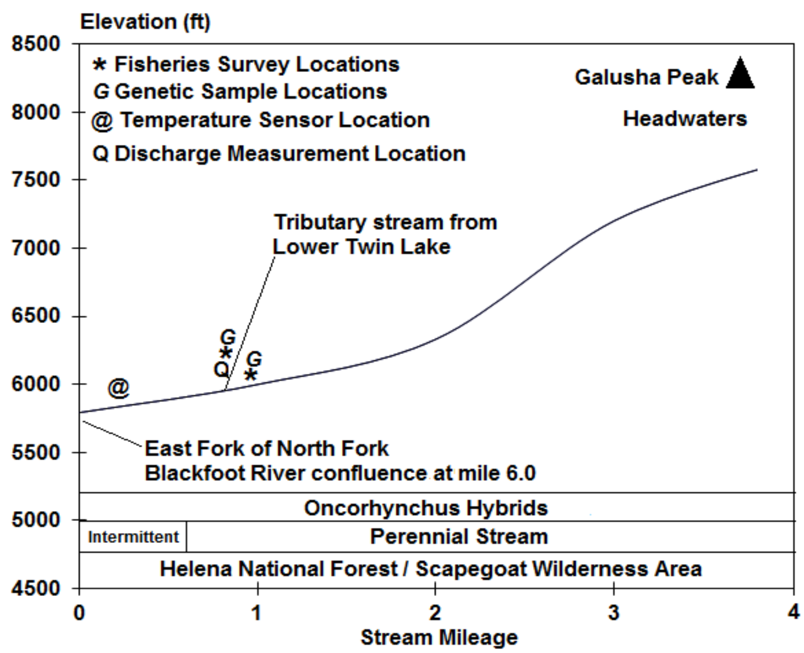


Figure 23. Longitudinal profile for Lost Pony Creek.

fire, resulting in the dense regeneration of the surrounding lodgepole pine forest and concentrated recruitment of large instream wood to the stream channel.

<u>Fish populations and other data collections</u>

A 2006 fish population survey of the outlet stream from lower Twin Lake (sm 0.8) found low numbers (CPUE=2.6) of hybrid trout. Genetic analyses (n=5 fish) from the outlet channel of Twin Lake identified hybridized rainbow trout x Yellowstone cutthroat x westslope cutthroat trout with a predominant rainbow trout genetic contribution. The mainstem of Lost Pony Creek near sm 0.8 was surveyed in 2013 and found relatively high numbers (CPUE=15.5) of trout (Appendix A). Genetic testing results from samples collected during the 2013 Lost Pony Creek identified a hybrid swarm among rainbow trout x Yellowstone cutthroat trout x westslope cutthroat with a predominant rainbow trout genetic contribution (Appendix D). We also observed Columbia spotted frogs, tailed frogs and western toads in both the 2006 and 2013. Concurrent macroinvertebrate and amphibian samples were taken at sm 0.8 during the 2013 survey (Results Part III and Appendix E).

Because of lower Lost Pony's mainstem flows going subsurface, summer water temperature monitoring in 2013 at sm 0.1 was limited to July 3 to August 14 period. During this brief period, the high summer water temperature was 64.9^{o}F (Appendix F). Water chemistry recorded moderate conductivity of 133uS, TDS of 66ppm and pH of 8.0. A discharge 0.4 cfs was measured in September 2013 at sm 0.1 on the outlet channel from lower Twin Lake (Appendix B).

Spaulding Creek

Spaulding Creek, a 1st order tributary, drains a small 1.1 mile^2 basin on the southern slopes of Galusha Peak (Figure 24). It flows southwest 2.1 miles before entering the East Fork at sm 4.7 with a baseflow measured at 0.1 cfs on September 25, 2013. The riparian area and adjacent hillsides were burned during the 1988 Canyon Creek fire. The vegetation now consists of an early seral lodgepole pine forest mixed with young Englemann spruce. The under-story along the stream margins consist of very dense vegetation including willows and other shrubs, forbs and grasses. The recruitment of large wood to the channel is very high, in addition to over-hanging vegetation contributes extensively to instream fish habitat features. Spaulding Creek classifies as a Rosgen A3-B3 stream type an average stream gradient of 484 ft/mile.

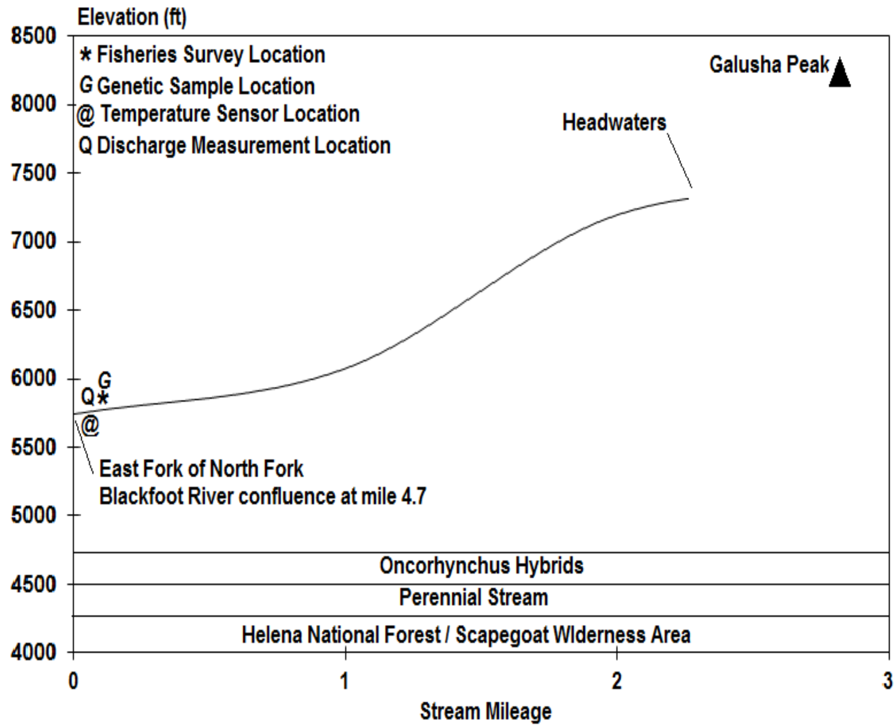


Figure 24. Longitudinal profile for Spaulding Creek.

Fish populations and other data collections

An August 2013 fish population survey on Spaulding Creek at sm 0.1 found very low numbers of trout (n=2, CPUE=0.7). Both fish were rainbow trout X Yellowstone cutthroat trout hybrids (Appendix D). We also identified tailed frogs during fisheries survey. Macroinvertebrate and amphibian were concurrently sampled at this site (Results Part III and Appendix E). A temperature sensor placed sm 0.1 identified high summer temperature ranging from 54-56.9^{o}F (Appendix F). Water chemistry readings identified a high conductivity 248uS, TDS at 123ppm and pH of 8.2.

Mineral Creek

Mineral Creek, a 2nd order stream, drains a 14.6 mile^2 watershed on the northeastern slopes of Arrastra Mountain and Iron Mountain. The mainstem Mineral Creek flows for 7.4 miles with gradients ranging from a high of 545 ft/mile in its upper reaches (sm 6-7) to a low of 18 ft/mile in the lower three miles of stream. Mineral Creek enters the East Fork of the North Fork at sm 3.3 (Figure 23) with a baseflow measured at 7.7 cfs on September 25, 2013. The East Fork of Mineral Creek is the largest tributary to Mineral Creek. It flows 3.8 miles in length and enters Mineral Creek near sm 3.1 (Figure 23). Mineral Creek classifies as a Rosgen B4-C4 stream type in the middle to lower reaches.

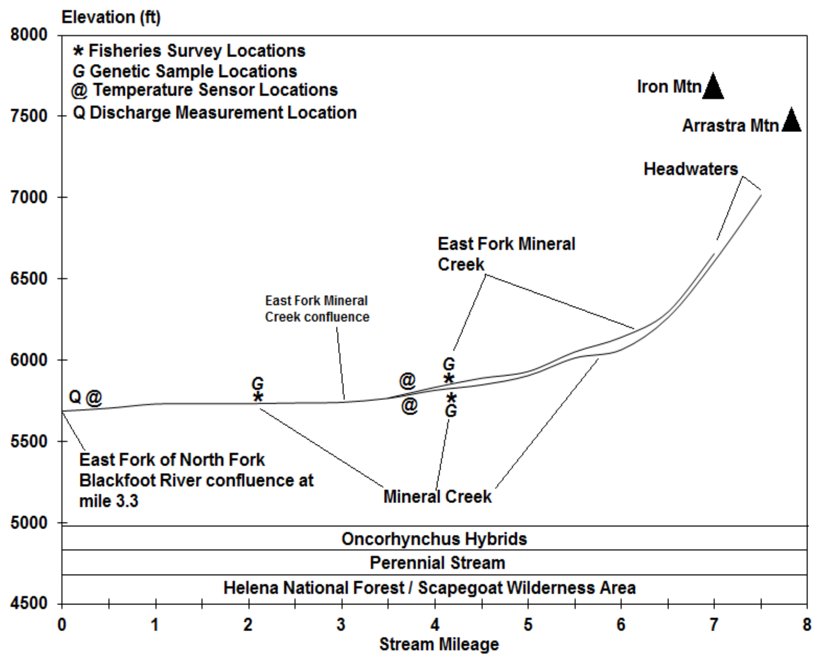


Figure 23. Longitudinal profile for Mineral Creek drainage.

Most of the Mineral Creek drainage was burned by the 1988 Canyon Creek wildfire. Thus, large amounts of wood are now entering the stream channel. A dense lodgepole pine forest is now reestablishing in the riparian zone along with a streamside corridor of willows and alders, forbs and various grasses.

<u>Fish populations and other data collections</u>

Fish population surveys were conducted at sm 2.1 and sm 4.2 on Mineral Creek and at sm 0.6 on East Fork of Mineral Creek in 2008 (Figure 24). These surveys recorded a CPUE ranging from 2-10 fish/100’

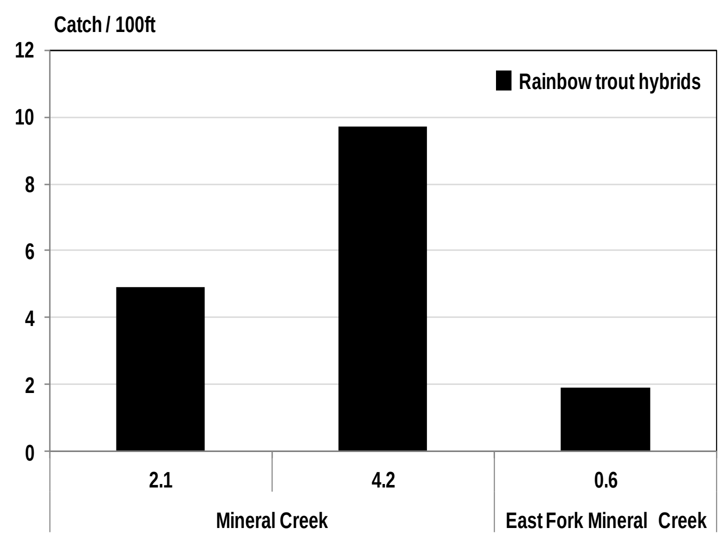


Figure 24. CPUE for rainbow trout hybrids at 3 locations in the Mineral Creek drainage, 2008.

(Figure 24; Appendix A). Genetic test (n=12 fish) identified the stream supports hybrid swarm of rainbow trout x Yellowstone cutthroat trout x westslope cutthroat trout with a predominant rainbow trout genetic contribution (Appendix D)

. We placed thermographs at three locations in the Mineral Creek drainage on July 2013. These locations were sm 0.3 and 3.5 on mainstem Mineral Creek and sm 0.1 on East Fork of Mineral Creek (Figure 23). Maximum summer water temperatures at sm 0.3 and sm 3.5 showed a very similar range (61.2-63.9^{o}F versus 61.0-63.6^{o}F, respectively) compared to the EF of Mineral Creek where maximum temperatures were <59^{o}F. Mineral Creek enters the East Fork of the North Fork at temperature about 5-6^{o}F colder than lower Meadow Creek during summer (Appendix F). Water chemistry reading showed an increase in conductivity (range 178-141uS) and TDS (range 72-91ppm) in the downstream direction and a pH ranging from 8.1-8.5.

Kenny Creek

Kenny Creek is a small 2nd order stream that drains a 1.7 mile^2 basin in the lower portion of the East Fork of the North Fork drainage. Draining the south-eastern and north-western slopes of two surrounding un-named mountains, Kenny Creek flows easterly 2.3 miles where it enters the East Fork at sm 1.7 directly opposite of the Camp Creek watershed. It has an average gradient of 750 ft/mile with an estimated visual base flow of 1.0-2.0cfs.

Kenny Creek classifies as a Rosgen B2-B3 stream type with pool-riffle features. Together with boulder pocket pools and undercut banks, high concentrations of large instream wood create scour and plunge pools providing very good cover and habitat for fish. The 1988 Canyon Creek wildfire burned a large portion of the upper basin; however, the riparian corridor in the lower watershed suffered little impacts from the wildfire and supports a dense mixed vegetation community of lodgepole pine, Douglas fir and young aspen above and understory of alders, willows, red osier dogwoods, forbs and grasses providing stream banks stability and abundant shade to the stream channel.

<u>Fish populations and other data collections</u>

In 2016 we conducted a fish population survey on lower Kenny Creek at sm 0.1. The survey recorded 3 fish visusally identified as rainbow trout. Genetic analysis is pending. Unfortunately, because of the dense riparian habitat hindering the fisheries electrofishing crew they were unable to produce a viable CPUE. Water temperature of Kenny Creek is not being monitored annually but was recorded during the survey at 50.5^{o}F; in addition to, water chemistry readings of pH 8.4, conductivity 275uS and a TDS of 137ppm (Appendix C).

Camp Creek

Camp Creek is a small 2nd order stream that flows westerly 4.7 miles and enters East Fork of North Fork at sm 1.7 with a baseflow measured at 0.6 cfs in September 2013. Camp Creek drains a 4.1 mile^2 watershed on the western slopes of Galusha Peak. Stream gradients range from 713'/mile in its upper 1.7 miles decreasing to 214'/mile in its lower 3.0 miles (Figure 25). The lower 2.5 miles of Camp Creek classify as a Rosgen B3-B4 stream type with pool-riffle features with large instream wood and under-cut streambanks. The riparian area of upper Camp Creek consists of a mature Englemann spruce forest above and understory of alder and willow, which create stable banks and a shaded channel. The riparian community attenuates to more aspen along with mixed willow, alder, forbs and grasses along lower Camp Creek

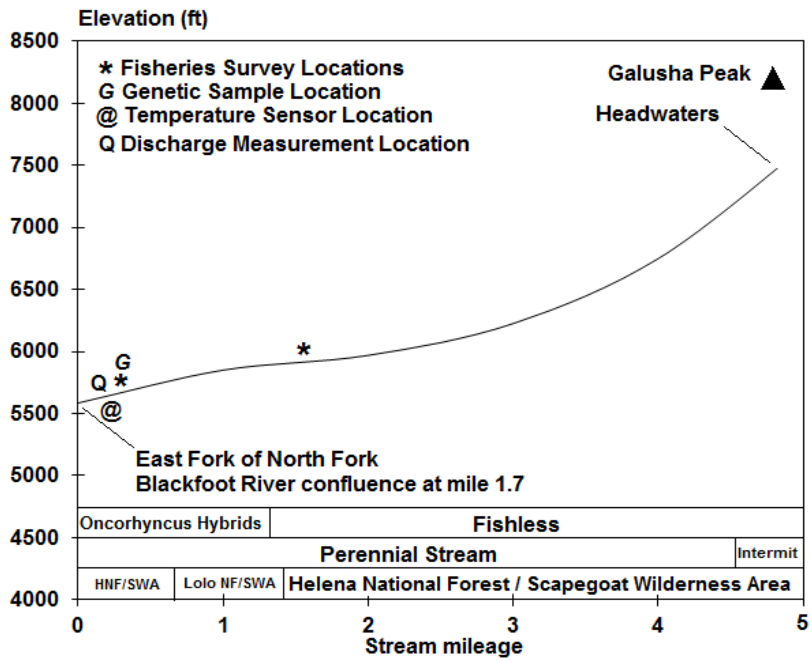


Figure 25. Longitudinal profile for Camp Creek.

Fish populations and other data collections

In 2013, we established two fish population survey sites (sm 0.1 and 1.6) on Camp Creek (Figure 26). These surveys identified the upper site as fishless; whereas, the lower site recorded low trout numbers (CPUE=3.0) with fish visually identified as rainbow trout. Genetic tests (n=10) identified a hybrid swarm between rainbow trout

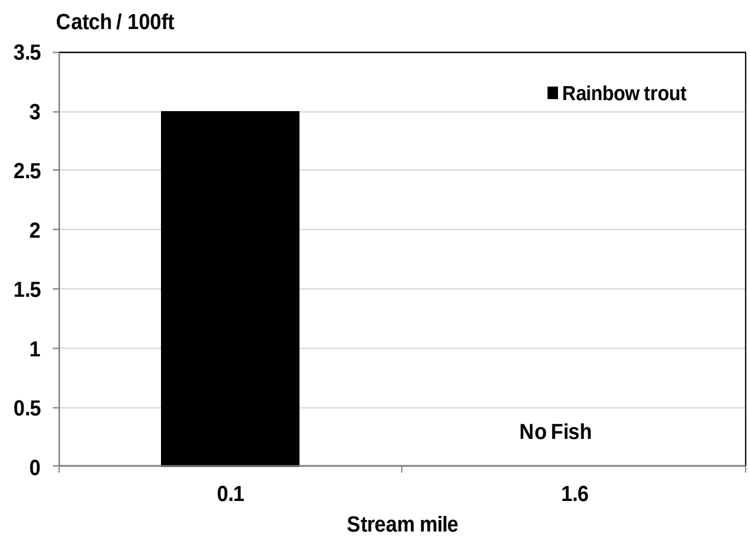


Figure 26. CPUE for rainbow trout at 2 locations on Camp Creek, 2013.

x Yellowstone cutthroat trout with a predominant rainbow trout genetic component (Appendix D). Tailed frogs were observed at both survey sites.

We placed a water temperature sensor at sm 0.1 in July 2013. This sensor identified a mean maximum summer temperatures of 55.8^{o}F that ranged between 55.4-56.1^{o}F over the 2013-2016 monitoring period Appendix F). Water chemistry measurements at the two surveys locations revealed relatively high conductivity and relatively high TDS compared to other streams (Appendix C). Conductivity increased in the downstream direction from 222 to 258uS. Likewise, TDS increased from 103ppm to 122ppm from sm 16.1 to sm 0.1. Readings of pH ranged from 8.5-8.7.

Results Part II: Lake Surveys

Parker Lake

Description: Parker Lake is an instream lake located on the upper mainstem of the East Fork of the North Fork. The lake is 24.7 acres in size, has a 6.5 ft maximum depth, and is located at 6,000 ft elevation. Most areas of the shoreline topography are brushy, heavily timbered and moderately steep; however, there are areas that lend well to shoreline angling. Angling Pressure is considered light.

Stocking History: Fish planting records indicate that Parker Lake was stocked with about 53,000 undifferentiated cutthroat trout between 1942 and 1952, after which time stocking ended.

Genetics: All fish in the sample (n=26) showed genetic characteristics for Yellowstone and westslope cutthroat trout and rainbow trout. Genetic analyses suggest that there maybe two somewhat reproductively isolated populations, both of which are hybridized (Appendix D).

Physical Information

Date Sampled: 7/20/2005 **Elevation:** 6000 ft **Surface Area:** 24.7 acres

Volume: 68.9 acre-ft **Max Depth:** 6.2 ft **pH**: 8.36

Conductivity: 291 uS **TDS:** 142 ppm **Water Code:** 04-7080

Fisheries Survey Information

Fish Species Present: Hybridized rainbow trout x Yellowstone cutthroat trout x westslope cutthroat trout

Sampling Methods: Sinking Gill Net

Size Range of Fish Captured: 5.9 – 14.9”

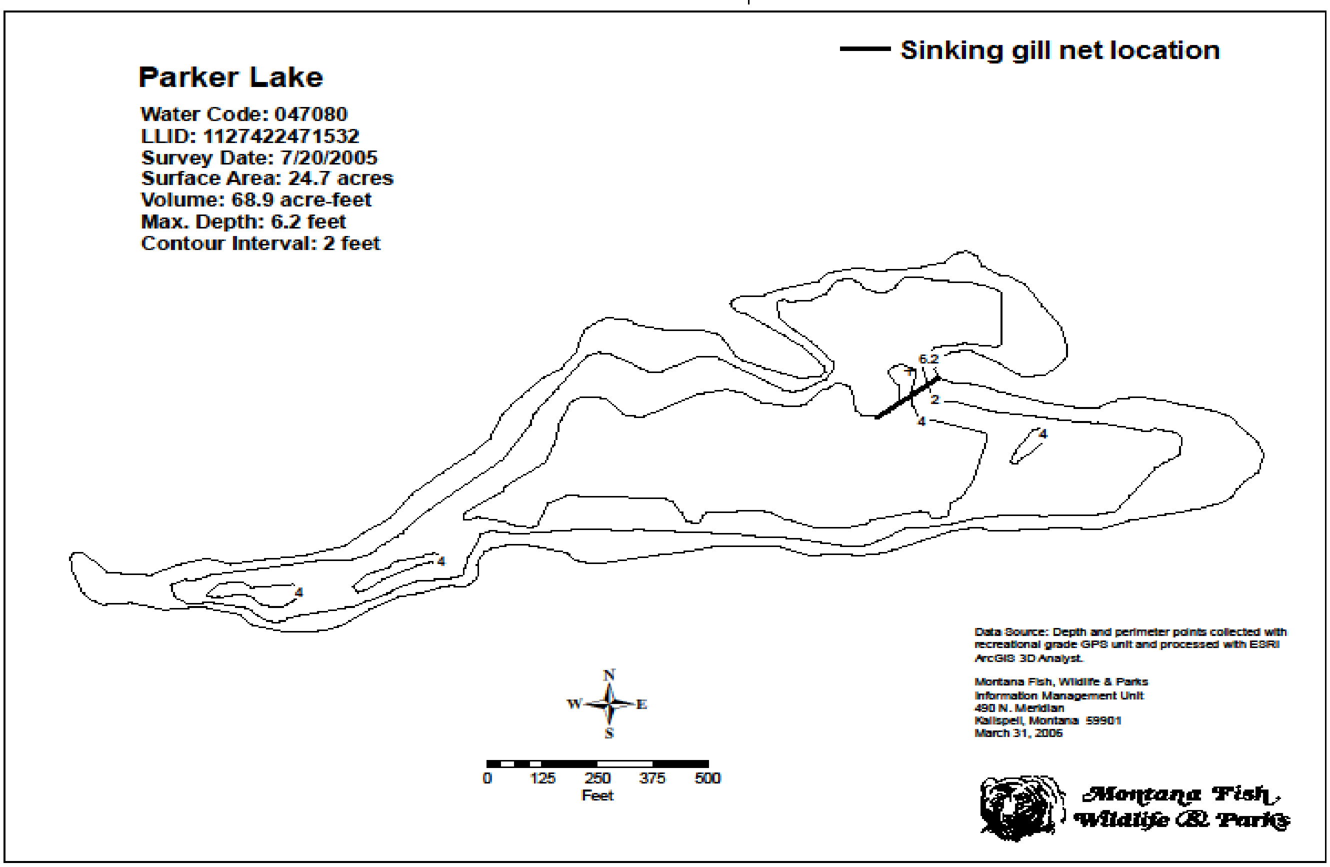
Gill Net Catch Rate: 3.0 trout/net hour
Trout Condition (Wr): 95 (range 63 -120)
Natural Recruitment: Present

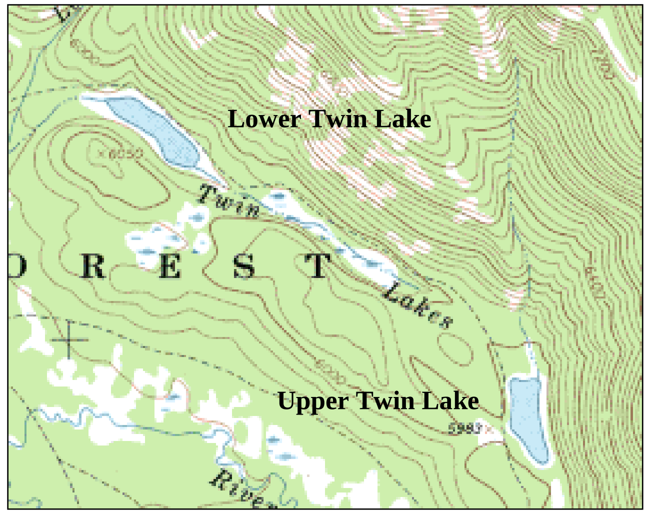
Amphibians Observed: Spotted Frogs, Western Toads

Zooplankton Surveys location and results: Sept 3, 2015

Tow #1: N47.15325, -W112.74017, Depth 3.3ft
Tow #2: N47.15319, - W112.73973, Depth 3.3ft
Tow #3: N47.15320, -W112.73966, Depth 3.3ft

Division	Taxon	Count	ave length (mm) individual	# per m3	est dry weight (µg) individual	µg per m3
Cladocera	*Daphnia*	34	976.86	11.52	4.26	49.13
Copepoda	Calanoida					
	Copepoda: nauplius	2	208.50	0.68	0.40	0.27
	Cyclopidae					
Rotifera	*Ascomorpha*	24	170.95	8.14	0.06	0.49
	Conochilus					
	Kellicottia longispina	110	167.71	37.29	0.01	0.54
	Keratella quadrata					
	Polyarthra	4	115.00	1.36	0.04	0.05
	TOTAL	174	1639.02	58.98	4.78	50.48





Lower Twin Lake

Description: Lower Twin Lake is a small (8.6 acres) glacial trough lake at 5,900 ft elevation located in the Lost Pony Creek basin. Angler pressure is considered light. Upper Twin Lake is shallow and fishless.

Stocking History: Fish planting records show Lower Twin Lake was planted between 1950 and 1952 with about 13,600 undifferentiated cutthroat trout.

Genetics composition: All fish in the sample (n=25) showed genetic characteristics for rainbow trout x Yellowstone cutthroat trout x westslope cutthroat trout. Pine markers suggest there maybe two somewhat reproductively isolated populations, both of which are hybridized (Appendix D).

<u>**Physical Information**</u>

Date Sampled: 6/21/2005	**Water Code:** 04-6900	**Elevation:** 5900 ft
Surface Area: 8.6 acres	**Volume:**29.5acre-ft	**Max Depth:** 11.6 ft
pH: 8.70	**Conductivity:** 226 uS	**TDS:** 112 ppm

<u>**Fisheries Survey Information**</u>

Fish Species Present: Hybridized rainbow trout x Yellowstone cutthroat trout x westslope cutthroat trout
Sampling Methods: Sinking Gill Net
Size Range Captured: 145 - 600mm
Gill Net Catch Rate: 3.6 trout/net hour
Trout Condition Factor (Wr): 82 (range 25 – 111) (low)
Natural Recruitment: Present

Amphibians Observed: Spotted Frogs (adults), tadpoles and eggs present, Western Toad (adult

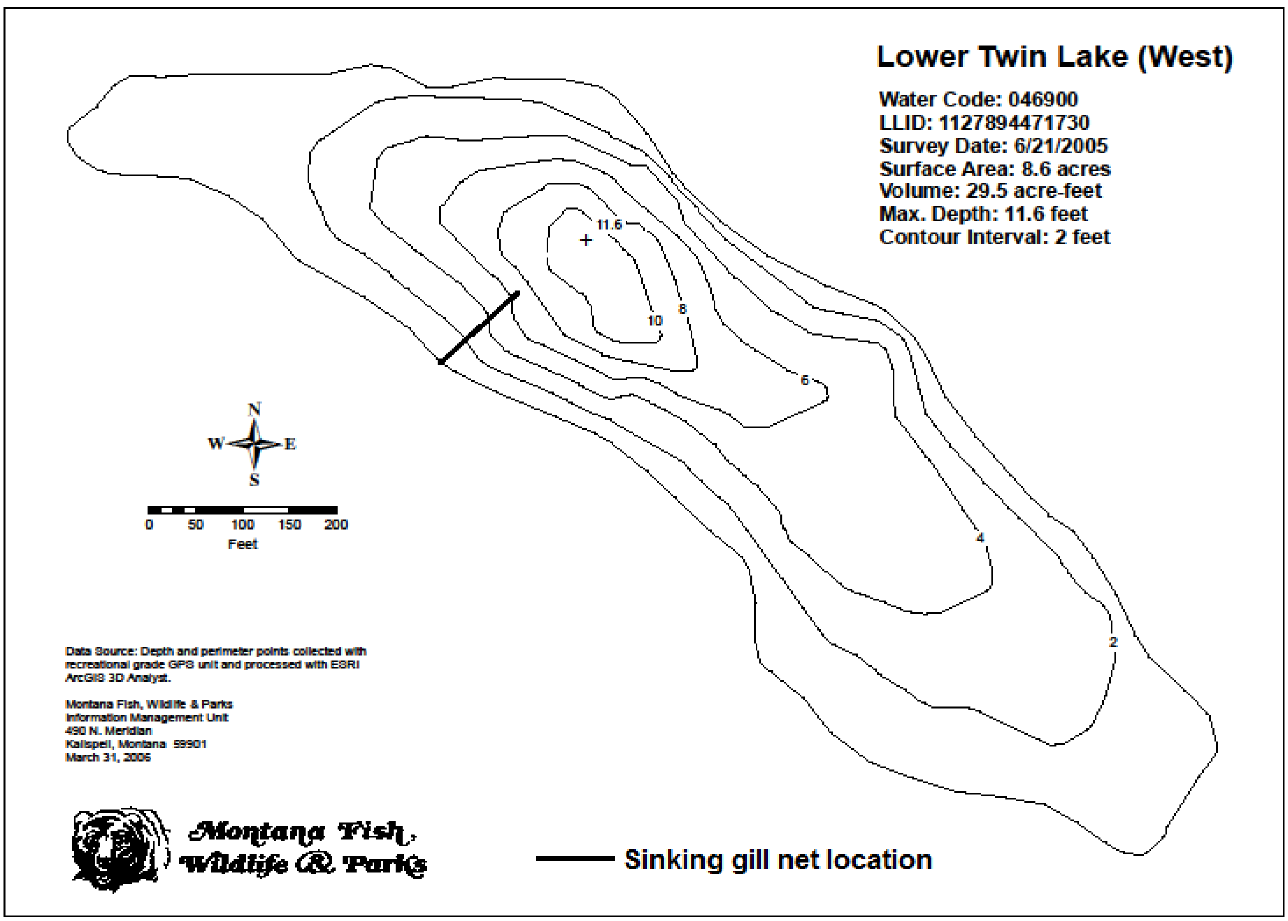
Zooplankton surveys locations and results: Sept 4, 2015

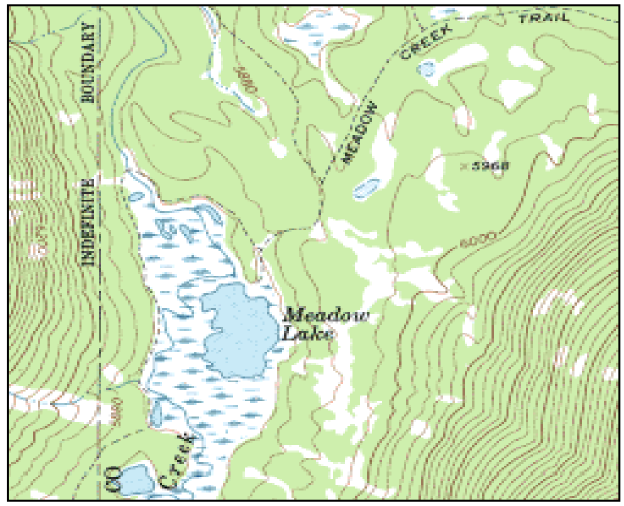
Tow #1: N47.17324, -W112.78905, Depth 7.2ft

Tow #2: N47.17333, - W112.78917, Depth 8.5ft

Tow #3: N47.17336, -W112.78926, Depth 9.1ft

Division	Taxon	Count	ave length (mm) individual	# per m3	est dry weight (µg) individual	µg per m3
Cladocera	*Daphnia*	42	1158.75	16.59	6.60	109.48
Copepoda	Calanoida	4	575.50	1.58	0.40	0.63
	Copepoda: nauplius	9	159.00	3.55	0.40	1.42
	Cyclopidae	1	850.00	0.39	0.40	0.16
Rotifera	*Ascomorpha*	1	130.00	0.39	0.03	0.01
	Conochilus	30	150.00	11.85	0.09	1.04
	Kellicottia longispina	13	157.15	5.13	0.01	0.06
	Keratella quadrata	7	152.86	2.76	0.08	0.23
	Polyarthra	8	117.50	3.16	0.04	0.13
	TOTAL	115	3450.76	45.41	8.05	113.16





Meadow Lake

Description: Meadow Lake is a small (8.5 acres) shallow (<4 ft) lake, at 5,800 ft elevation and located in the lower Meadow Creek watershed.

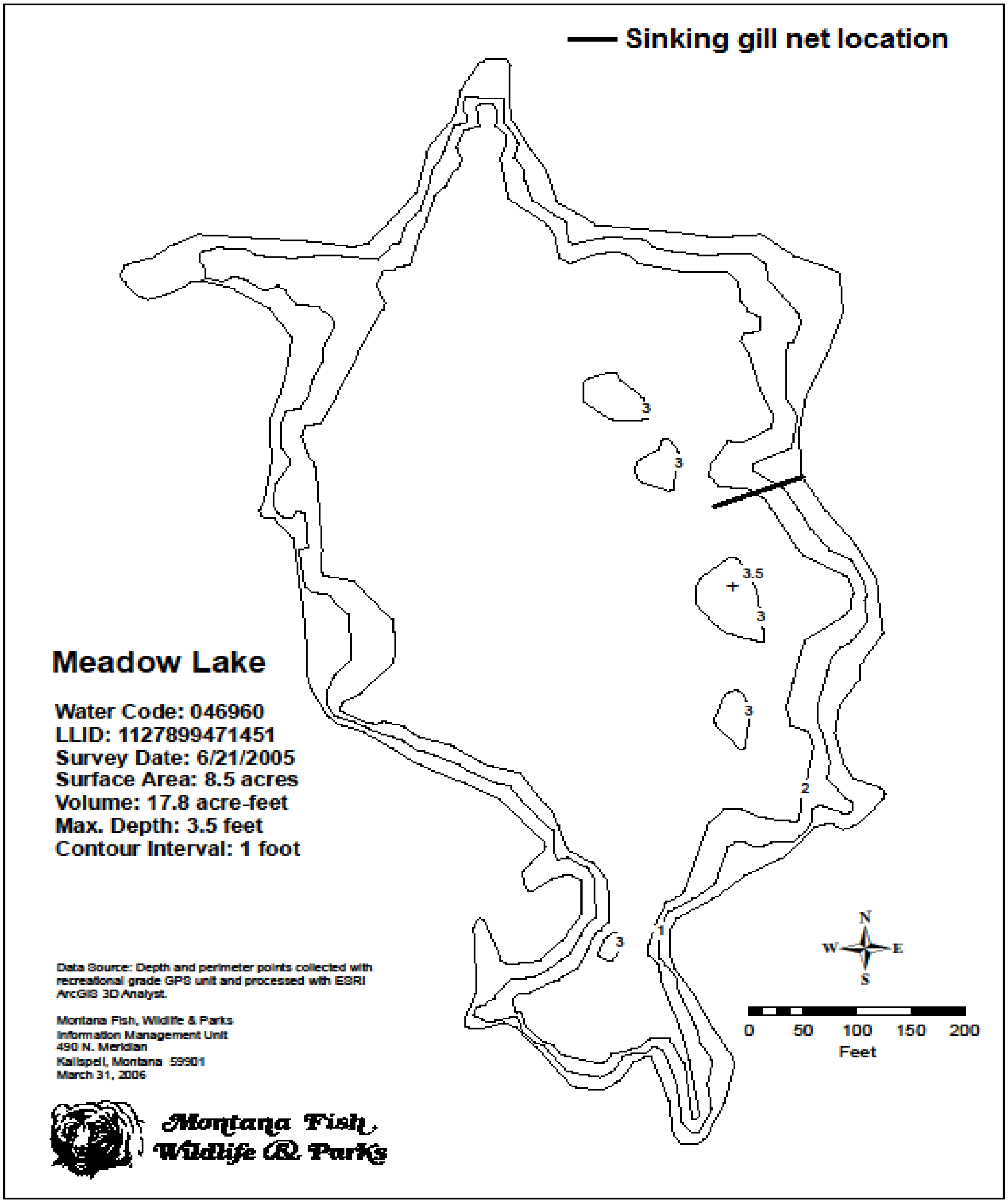
Stocking history: There are no fish planting records for Meadow Lake. Outfitters in the 1940's and 1950's planted the lake with fish brought up from the North Fork below the North Fork Falls (Smoke Elser, personal communication).

Physical Information

Water Code: 04-6960 **Elevation:** 5800 ft **Surface Area:** 8.5 acres
Volume: 17.8 acre-ft **Max Depth:** 3.5 ft **pH**: 8.03
Conductivity: 181 uS **TDS:** 91 ppm

Fisheries Survey Information

Date Sampled: 6/21-22/2005
Fish Species Present: Rainbow trout and westslope cutthroat trout hybrids
Sampling Methods: Sinking Gill Net
Size Range Captured: 8.1 – 14.5 inches
Gill Net Catch Rate: 0.13 trout/net hour
Trout Condition (Wr): 83 (range 71 – 98)
Natural Recruitment: Present but limited
Amphibians Observed: Spotted Frogs (adults)


Sinking gill net location
Meadow Lake
Water Code: 046960
LLID: 1127899471451
Survey Date: 6/21/2005
Surface Area: 8.5 acres
Volume: 17.8 acre-feet
Max. Depth: 3.5 feet
Contour Interval: 1 foot
Data Source: Depth and perimeter points collected with recreational grade GPS unit and processed with ESRI ArcGIS 3D Analyst.
Montana Fish, Wildlife & Parks
Information Management Unit
490 N. Meridian
Kalispell, Montana 59901
March 31, 2006
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Results Part III: Special Studies

Macroinvertebrate and Amphibian Surveys upstream of the North Fork Falls

by
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Montana Natural History Program
and
Lindsey Gilstrap and Trevor Selch
Montana Fish, Wildlife and Parks

We conducted a series of macroinvertebrate and amphibian surveys to thoroughly inventory aquatic communities. These surveys overlapped with fisheries survey sites and relied on methodologies developed with Montana Natural Heritage Program (amphibians) and Environmental Protection Agency (macroinvertebrates and habitat assessments).

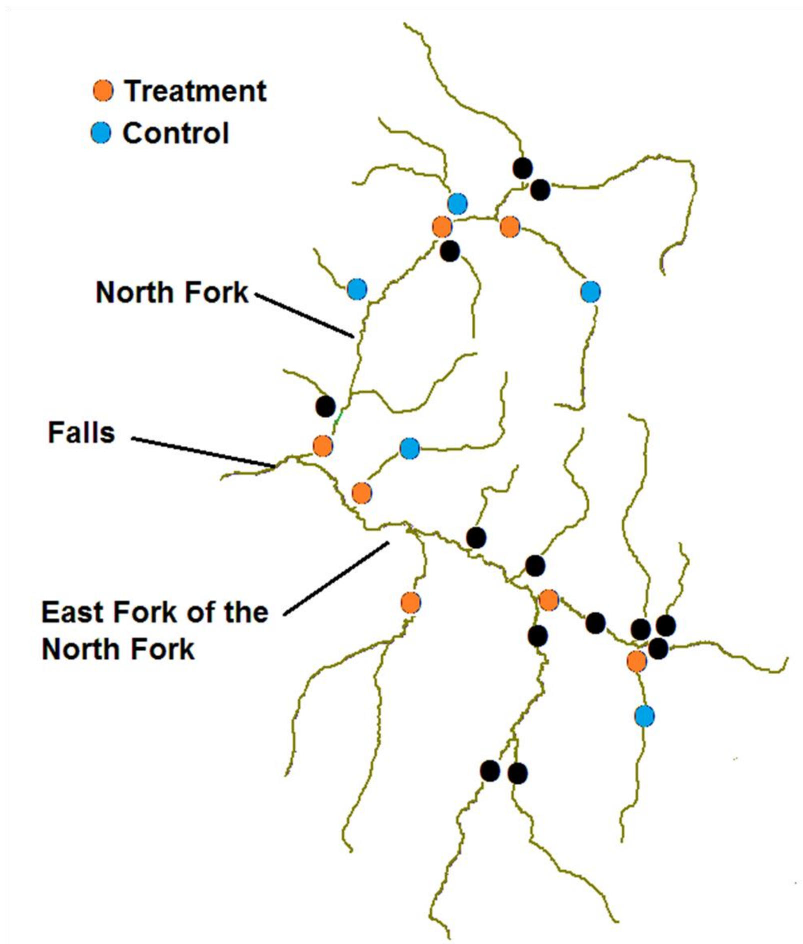

Figure 1. Location map showing the 25 macroinvertebrate and amphibian survey sites. The blue dots show possible controls sites (non fish-bearing streams) and the red dots show treatment sites (fish bearing streams) associated with monitoring.

Study Area and Methods

Aquatic communities (amphibians and macroinvertebrates) were inventoried and assessed upstream of the North Fork Falls in 2013, 2014 and 2015 (Figure 1) using a combination of MT Natural Heritage Program (amphibians), MT Department of Environmental Quality and Environmental Protection Agency (macroinvertebrates and habitat assessments) protocols and methodology. In addition to inventories, data were collected in a manner that enables a BACI and

Photo 1. David Stagliano collecting macroinvertebrates with a Surber sampler, September 2013.

upstream/downstream comparision that could apply to a possible rotentone treatment (Figure 1).

Amphibian Surveys

We conducted opportunistic, visual encounter surveys (VES) along at least 75 meters of the riparian area of the banks of each stream reach visited. This involved walking the high-water mark of the banks flipping over cover objects (trees, flat rocks) and visually identifying and counting the species observed. Rocky mountain tailed frog, *Ascaphus montanus* (ASMO) larvae and adults were collected with the macroinvertebrate net during the riffle sampling or reported during the electrofishing surveys. When collected in the macroinvertebrate surber sampler, ASMO densities were calculated to individuals per m^2. ASMO were counted and released before sample preservation, except one voucher specimen per stream kept in 95% ETOH for DNA analysis.

Macroinvertebrate Collection and Analysis

A semi-quantitative, standardized macroinvertebrate sampling method was used for collecting aquatic benthic communities within the North Fork Blackfoot River study area. The EPA EMAP Targeted Riffle Protocol (8 composited Surber samples, area sampled = 0.744 square meter) was used to sample three riffle habitat areas within the designated sampling reach (Lazorchak 1998, Peck et al. 2003) (Figure 1). To reduce seasonal macroinvertebrate variation, these samples were collected within the MDEQ recommended summer sampling time frame (June 21 to October 1) (Richards 1996). Samples are preserved with 95% ethanol in 1 liter Nalgene bottles and processed (sorting, identification and data analysis) at the Helena Stag Benthics laboratory following standardized protocols (MDEQ 2012). Macroinvertebrates were identified to the genus/species taxonomic level, counted and entered into spreadsheets and database forms. Data analysis included computation of indices of community structure, such as the total number and proportion of EPT taxa (Ephemeroptera, Plecoptera and Trichoptera) in the sample and other biological metrics used in calculating the MDEQ multimetric indices (MMI) (Jessup et al. 2005, Feldman 2006). Metric results were then scored using the MT DEQ bioassessment criteria and each sample categorized as non-impaired or impaired according to mountain stream threshold values of >63

(Table 3). The macroinvertebrate MMI score is based upon a series of metrics that measure attributes of benthic macroinvertebrate communities regarding condition changes to a stream system (in the form of pollution or pollutants). The index score represents the condition of the macroinvertebrate community at the time the sample was collected within that past year. If the index score is below the impairment threshold, the individual metrics can be used to provide insight as to why the communities are different from the reference condition (Barbour et. al 1999, Jessup et. al. 2005). We calculated Shannon's Diversity Index (H') for each sample as a measure of initial species diversity at a site prior to piscicide treatment. According to some studies, high diversity at a site have H' values >2.5 to >3 (Hill 1973, Jost 2006). We analyzed metrics of the macroinvertebrate data using a one-way ANOVA and the Percent Similarity Index as the comparison of macroinvertebrate communities, taxa richness and tolerance values between years and control or treatments (Appendix E). Differences were considered significant at p values less than 0.05.

RESULTS

Amphibian Results Summary

We documented the presence of three amphibian species across the 25 stream sites. In order of frequency of occurrence; the Rocky Mountain Tailed Frog, *Ascaphus montanus* (ASMO) was detected during 63% of site visits, Columbia Spotted Frog, *Rana luteiventris* (RALU) detected at 20% of site visits overall (45% at 2013 sites, one reported in 2014), and the Western Toad, *Anaxyrus boreas* (BUBO) detected at 6% of sites (18% of 2013 sites, none reported in 2014) (Pierce et al. 2015). Only adults of the spotted frog and western toad were observed in the stream surveys. The western toad is a MT SOC and a USFS sensitive species with a substantial confirmed breeding area at Lower Twin Lake and potentially at Meadow and Parker Lakes (Pierce et al. 2015). These lakes also provide Columbia Spotted frog breeding habitats within the EF NF Blackfoot River sub-basin. A wetland complex in upper Sarbo Creek and South Creek may provide some of the only amphibian breeding habitat in the NF Blackfoot basin. The number of amphibian species and the densities of ASMO larvae/adults were higher at sites in south facing drainages compared to the northerly facing drainages (Pierce et al. 2015). We observed significantly higher densities of ASMO in the treatment stream reaches (average ~3 per m^2, n=25) compared to the control stream sites (average 0.9 per m^2, n=7) (ANOVA, p=0.04). Four of the treatment streams (Blondie, Dobrota, Lost Pony and Scotty Creeks) had very high densities of ASMO, averaging 9.3 per m^2. We incidentally observed Long-toed salamander larvae, *Ambystoma macrodactylum* in the outlet wetland area of Lower Twin Lake in 2013 indicating a breeding area.

Macroinvertebrate Communities Summary

Overall, 124 unique invertebrate taxa were reported from 32 EMAP Targeted-riffle samples collected from 25 sites in 18 streams in 2013, 2014 and 2015 (Appendix E). No Montana invertebrate species of concern (SOC) were documented within the NF Blackfoot River basin, although some stonefly taxa which can only be identified to genus (*Suwallia* and *Isoperla)* or species group *(Zapada oregonensis gr.*), without examining the adults, have the potential to contain SOC species (Appendix E). The Nemourid stonefly, *Zapada frigida*, is a rarely-collected, but not state-listed, taxa that was documented at five sites, Cooney (Upper and Lower), Dobrota, East Fork Meadow and Spaulding Creeks (Appendix A). In 2013, the East Fork North Fork Blackfoot reported a rare and recently described (Zloty et al. 2005) dipteran species, *Oreolepsis torrenticola*. Macroinvertebrate taxa richness per site averaged 31.6 taxa in 2013, 37.2 in 2014 and 37.3 in 2015, which is lower than expected for reference condition streams in the Rocky Mountain ecoregion (40 taxa; Whittier et al. 2006), although previous MT studies have placed this threshold at >28 taxa (Bukantis 1996). EPT taxa richness per sample averaged 20.6 (2013), 23.4 (2014) and 25.3 (2015); this is slightly above the threshold expected for non-impacted, mountain streams (>19 taxa; Bukantis 1996), but lower than other least disturbed mountain streams (26 EPT taxa; Whittier et al. 2006) (Table 1). When samples from multiple years were collected from the same site, the cumulative EPT richness was always at or above the 26-taxon threshold, except at the Sourdough treatment site (Table 1). Average % EPT across sites (74.1%, 2013; 77.9% in 2014 and 78.1% in 2015) is above reference condition threshold values (>70%, Bukantis 1996) and therefore, stream assemblages are considered un-impaired.

Table 1. Macroinvertebrate density, richness and diversity metrics for the North Fork Blackfoot Treatment and Control sites from 2013-2015. Total Ind. = total individuals in the sample, Total Taxa=total taxa richness and cumulative total (T), EPT= total Ephemeroptera, Plecoptera and Trichoptera taxa, %EPT, H'=Shannon's Diversity, MMI=MT DEQ's Multimetric Index. ASMO per m^2 =Tailed Frog, *Ascaphus montanus* densities.

Stream	River Mile	BACI Treatment	BACI Control	Drain Aspect	Total Ind. sample	Number per m^2	Total Taxa	EPT Taxa	H'	MMI	% EPT	ASMO per m^2
Blondie Creek	0.2	08/05/13		S	664	883	25	16	2.72	79.6	63.9	8.0
Broadus Creek	0.1	08/28/14		S	772	1027	26	21	2.75	85.9	91.7	2.7
Broadus Creek U/S falls	0.15		09/30/15	S	804	1005	29	25	2.83	92.7	97.1	4.0
Camp Creek	0.1	09/05/15		W	2704	3380	39	25	2.74	86.8	81.9	0.0
Camp Creek	1.6		09/05/15	W	840	1050	35	25	3.13	90.1	83.0	1.3
Cooney Creek	0.2	08/27/14		N	1216	1617	40	23	3.13	78.5	75.0	2.7
	0.2	10/01/15		N	1136	1420	38	24	3.27	85.3	78.9	1.3
				avg.	**1176**	**1519**	**46(T)**	**29(T)**	**3.20**	**81.9**	**77.0**	**2.0**
Cooney Creek	2.4		09/30/15	N	1416	1770	29	23	2.78	92.9	83.5	1.3
Dobrota Creek	0.1	08/28/14		S	2008	2671	50	31	3.01	82.3	79.3	9.3
EF NF Blackfoot River	7	08/08/13		EW	920	1224	33	19	2.86	69.6	49.8	4.0
	7	09/04/15		EW	1236	1545	39	26	2.97	84.8	68.2	1.3
				avg.	**1078**	**1385**	**49(T)**	**27(T)**	**2.92**	**77.2**	**59.0**	**2.7**
EF NF Blackfoot River	9	08/06/13		EW	876	1165	28	19	2.71	83.9	75.3	2.7
Lost Pony Creek	0.8	08/08/13		S	1476	1963	32	24	3.06	85.5	73.2	9.3
Meadow Creek	2	08/07/13		N	1564	2080	34	15	2.76	75.5	61.4	0.0
Meadow Creek	5.2	08/07/13		N	668	888	31	22	2.72	81.2	85.6	5.3
Meadow Creek (EFork)	0.8	08/07/13		N	992	1319	34	26	2.73	89.3	92.3	6.7
Mineral Creek	2.1	09/05/15		NE	2406	3008	44	28	2.99	82.1	70.4	0.0
NF Blackfoot River	27	08/27/14		EW	968	1287	42	25	3.13	70.2	50.8	1.3
	27	09/06/15		EW	1392	1740	49	31	3.23	86.7	66.8	0.0
				avg.	**1180**	**1514**	**51 (T)**	**32(T)**	**3.18**	**78.45**	**58.8**	**0.7**
NF Blackfoot River	32	08/28/14		EW	3096	4118	49	29	3.16	86.9	80.4	1.3
	32	09/30/15		EW	2512	3140	47	31	3.44	88.5	68.5	0.0
				avg.	**2804**	**3629**	**66 (T)**	**40(T)**	**3.30**	**87.7**	**74.5**	**0.7**
NF Blackfoot River	34.7	08/28/14		EW	4016	5341	39	25	1.86	86.2	80.7	0.0
Sarbo Creek	0.1		08/27/14	S	2012	2676	37	23	3.06	82.3	75.4	0.0
	0.1		09/30/15	S	1608	2010	39	24	3.21	84.6	79.4	0.0
				avg.	**1810**	**2343**	**43 (T)**	**26(T)**	**3.14**	**83.45**	**77.4**	**0.0**
Scotty Creek	0.2	08/06/13		S	2176	2894	34	18	3.15	76.3	51.1	10.6
Sourdough Creek	0.6	08/06/13		N	1488	1979	35	21	2.41	84.3	94.1	0.0
	0.6	09/03/15		N	1398	1748	30	25	2.53	83.3	91.8	1.3
				avg.	**1443**	**1863**	**37 (T)**	**26(T)**	**2.47**	**83.8**	**93.0**	**0.7**
Sourdough Creek	1		08/05/13	N	784	1043	30	19	2.36	77.4	80.9	0.0
	1		09/30/15	N	1040	1300	29	18	2.59	71.6	68.1	0.0
				avg.	**912**	**1172**	**33 (T)**	**20(T)**	**2.48**	**74.5**	**74.5**	**0.0**
Spaulding Creek	0.1	08/08/13		S	2124	2825	37	28	2.98	84.7	87.9	5.3
Theodore Creek	0.1	08/28/14		N	1024	1362	33	21	2.89	76.7	73.1	1.3
NFBLKFT unnamed trib.	0.1	08/27/14		S	964	1282	20	13	1.82	73.4	95.0	0.0

Only Blondie Creek, EF NF Blackfoot and the North Fork Blackfoot samples reported % EPT scores below this 70% impairment threshold, but were still ranked unimpaired with the DEQ MMI scores (Table 1). Macroinvertebrate densities (number per m^2) were similar among most sites in the NF Blackfoot basin, averaging ~1,000-2,000 individuals per m^2, but some sites in the NF Blackfoot mainstem and lower Camp Creek had significantly higher densities >3,000-5,000 ind. per m^2 (Table 1). Average Shannon's Diversity, MT DEQ MMI index and %EPT were very similar between sites in both basins (Table 1). All samples were ranked unimpaired with the MT DEQ MMI (scores >63 threshold) and, in fact, all samples have scores greater than 70, and 75% of the samples have very high scores >80 (Table 1, Appendix E). Most sites ranked high in diversity with Shannon's (H') >2.7, except Sourdough Creek (H'=2.5), and one site on the NF Blackfoot River (Table 1). The most diverse communities measured with Shannon's Index (H') were NF Blackfoot River sites (RM 27 and 32), Cooney and Sarbo Creeks with scores ≥ 3.2 (Table 1). Highest taxa richness reported from a single sample was at Dobrota Creek with 50 taxa, followed by the NF Blackfoot River sites at RM32 and RM27 with 49 unique taxa each, but the cumulative taxa richness from 2 years of sample data at these NF Blackfoot mainstem sites was 66 and 51 total taxa, respectively (Table 1). Interestingly, despite the NF Blackfoot River RM32 site gaining 17 additional taxa with the 2015 sample, only nine additional taxa were added with the second sample at the NF Blackfoot River RM27 (Table 1). EF North Fork Blackfoot River RM 7 site also gained 10 additional taxa with the second sample taken in 2015.

Macroinvertebrate Community Similarity

Percent taxa similarity between control and treatment sites (n=5 pairs) averaged 64.5% (47.5-80.6%), while taxa similarity between years at the same site (n=7 pairs) was only slightly higher at 68% (49-78.8%) (Table 2, Appendix E). There is no difference between taxa similarity at control vs. treatment sites compared to between years at the same site (ANOVA, p=0.32). Between year average % taxa similarity at the sites (n=7) was lowered because of the low taxa numbers shared between samples from the EF NF Blackfoot and NF Blackfoot Rivers (Table 2, Appendix E). These mainstem sites continued to add large numbers of new taxa to the site's assemblage list with a second sample from 2015. Percent whole community similarity between control and treatment was lower at 52.6% (40.5-69.9%) compared to a between year similarity of 62.4% (53.1-70%) (Table 2); this was significantly different (ANOVA, p=0.03).

Table 2. Percent taxa similarity and macroinvertebrate community similarity indices between years and Control vs. Treatment sites.

Stream	River Mile	Treatment	Control	% Taxa Similarity	% Commun. Similarity
Broadus Creek	0.1	08/28/14		80.6	49.6
Broadus Creek U/S falls	0.15		09/30/15		
Camp Creek	0.1	09/05/15		80.5	65.4
Camp Creek	1.6		09/05/15		
Cooney Creek	0.2	08/27/14		69.6	69.9
Cooney Creek	0.2	10/01/15			
Cooney Creek	2.4		09/30/15	60.0	52.1
EF NF Blackfoot River	7	08/08/13		49.0	57.9
EF NF Blackfoot River	7	09/04/15			
NF Blackfoot River	27	08/27/14		76.5	53.1
NF Blackfoot River	27	09/06/15			
NF Blackfoot River	32	08/28/14		50.0	55.9
NF Blackfoot River	32	09/30/15			
Sarbo Creek	0.1		08/27/14	76.7	67.7
Sarbo Creek	0.1		09/30/15		
Sourdough Creek	0.6	08/06/13		75.7	70.0
Sourdough Creek	0.6	09/03/15			
Sourdough Creek	1		08/05/13	78.8	62.4
Sourdough Creek	1		09/30/15		
Sourdough Creek		2015 Treat x Control		52.4	55.5
Sourdough Creek		2013 Treat x Control		47.5	40.5

Conclusions

We documented macroinvertebrate communities high in diversity and biological integrity in 18 streams across both sub-basins of the NF Blackfoot River study. With the 2015 sampling revisits at 7 sites, we continued to add substantial numbers of taxa to the cumulative taxa richness (up to 17 additional spp. per site for the NF Blackfoot River). We can conclude that for the mainstem North Fork Blackfoot River and the East Fork NF Blackfoot sites, we are not close to approaching the asymptote for total macroinvertebrate species richness documented at a site with only 2 years of data. No Montana invertebrate species of concern (SOC) were documented over the three years of sampling within the NF Blackfoot River basin. Although, we did collect some stonefly taxa (*Isoperla* and *Zapada*) which can only be identified to genus (without examining the adults) that have the potential to contain SOC species. Many fishless control streams with similar macroinvertebrate taxa will remain in the basin that could provide a means for macroinvertebrate populations to recolonize rotenoned stream sections. Most control reaches shared, on average, ~65% of the taxa present in the treatment reaches resembling the % taxa similarity between yearly samples taken at the same site. Surprisingly though, the control and treatment reaches of

Sourdough Creek are less than a ½ mile apart, but had the most dis-similar macroinvertebrate assemblages, sharing only about 50% of the taxa between the sites. In addition, we observed no tailed-frog larvae in the control reach of Sourdough, while in the treatment reach ASMO larvae averaged 0.7 individuals per m^2.

Following minimum recommended rotenone dosing and treatment duration has been shown to have minimal long-term effects on benthic macroinvertebrate densities or assemblage structure (Vinson et al 2010). Macroinvertebrate communities have recovered up to 90% of the documented pre-treatment common taxa after just one year post-rotenone treatment; though rare taxa may take multiple years to recover (Vinson et al 2010). Therefore, the judicious use of rotenone throughout the basin will not likely have long-term adverse effects on the macroinvertebrate communities. The western toad, a MT SOC and USFS sensitive species, was reported in good numbers at two sites within the East Fork NF Blackfoot Basin and is likely breeding in the fringe wetland areas of Lower Twin Lake, Meadow and Parker Lakes. Fewer amphibian breeding areas exist in the NF Blackfoot Sub-basin, barring a couple of higher elevation wetland areas of Sarbo and South Creeks, where we did not report any additional amphibian species in 2014. Treatment streams proposed for piscicide in this study have higher densities of the Rocky Mountain tailed-frog than the control stream sites. Therefore, the use of rotenone throughout the basin will likely have an adverse effect on the Rocky Mountain tailed frog populations occurring in fish-bearing streams. Since the western toad and Columbia spotted frog are largely using streams for feeding and dispersal (Maxell 2000), proposed treatment will only have an effect on these amphibian populations if those previously mentioned lakes are treated with the piscicide during the breeding season. A late-summer, early fall piscicide treatment to the lakes will avoid the amphibian breeding window. Western toad tadpoles' metamorphosis to toadlets from mid-July-September (Black and Brunson 1971, Maxell et al 2002); at this point they are able to avoid the lake areas being treated. Obviously, continued monitoring across these established sites will occur post-treatment to document recovery of the macroinvertebrate communities and Rocky Mountian tailed-frog populations.

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Environmental DNA sampling for detection of rainbow trout in the North Fork of the Blackfoot River by Montana Fish, Wildlife and Parks

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Introduction

Environmental DNA (eDNA) is DNA extracted from an environmental sample, such as soil, water, or air, without directly sampling the target organism (Lodge et al. 2012; Taberlet et al. 2012). Researchers have demonstrated that detection of target organisms using eDNA can be more sensitive, efficient, and cost-effective than traditional sampling methods, particularly when the organism of interest has a limited distribution or is rare (Dejean et al. 2012). For example, the eDNA-based detection probability of a single trout in 100 m of stream is ~0.85, substantially greater than that of electrofishing (Wilcox et al. *in review*). As a result, eDNA sampling has received a great deal of attention for its potential to detect early invasions of nonnative species (Darling and Blum 2007; Dejean et al. 2012; Ficetola et al. 2008; Goldberg et al. 2013; Jerde et al. 2011) and the presence and distribution of rare native species (Goldberg et al. 2011; Olson et al. 2012; Thomsen et al. 2012; McKelvey et al. in press) such as species currently listed under the U.S. Endangered Species Act. In addition, it also shows promise for detecting individuals of nonnative species that may remain after chemical or mechanical treatments to remove them.

Rainbow trout (*Oncorhynchus mykiss*) are native to the western half of North America from California to Alaska, and inland to Idaho, Oregon, Washington, and a small portion of Montana. This species has also been widely introduced outside its native range. Where rainbow trout and inland cutthroat trout (*O. clarkii)* co-occur, hybridization is often observed. Hybridization with introduced rainbow trout has led to population decline and loss for several subspecies of cutthroat trout. As a result, managers wishing to establish genetically pure populations of cutthroat trout in a stream may start by attempting to eradicate rainbow trout and hybrid fish. Determining when eradication has been successful, however, is difficult and often relies on repeating the removal effort. Because chemical or mechanical treatments are expensive and time-consuming, an alternative method for determining the success of removal efforts is desirable. We hypothesize that eDNA sampling could be that alternative.

Methods

Supplies and equipment for eDNA sample collection were delivered to Montana Fish, Wildlife and Parks on 2 September 2015. Samples were collected by Montana Fish Wildlife and Parks between 3 September and 1 October 2015 (Table 1) to evaluate the presence of rainbow trout in the North Fork of the Blackfoot River drainge, Montana. Samples were collected by pumping 5 L of stream water through a glass filter (GE HealthCare) using a peristaltic pump (GeoTech Environmental Equipment, Inc.) following the protocol developed by Carim et al. (2015). Used filters were placed in plastic bags with silica desiccant and packaged in individual envelopes labeled with field information (e.g., date and sampling location).

Upon receipt of samples at the National Genomics Center for Wildlife and Fish Conservation (NGCWFC), sampling data were catalogued and samples were stored at -20 °C until analyzed. We extracted DNA from half of the sample filter using the Qiagen DNEasy® Blood and Tissue Kit with a modified protocol adapted from Goldberg et al. (2011). The other half of the sample filter was stored at -20 °C and retained for future analysis.

Samples were analyzed for the presence of rainbow trout using the *RBT* quantitative PCR (qPCR) assay developed at the NGCWFC (Wilcox et al. 2015). Each sample was analyzed in triplicate with a qPCR instrument. A sample was considered positive for the presence of rainbow trout if at least one of the three PCR reactions amplified rainbow trout DNA (see supplement below). The number of triplicate PCR reactions for each sample that amplified was used as a rough estimate of relative DNA concentration i.e., samples with amplification in all three reactions usually have more DNA than those with amplification in only one reaction.

All reactions included an internal positive control to ensure that the reaction was effective and sensitive to detection of rainbow trout DNA. If the internal positive control was inhibited i.e., DNA amplification was delayed or suppressed (Figure S2), we treated the sample with an inhibitor removal kit (Zymo Research) and re-analyzed the sample in triplicate.

All laboratory experiments were conducted with negative controls to ensure that there was no contamination during DNA extraction or qPCR setup.

	Stream	Collection date	Latitude	Longitude	Rainbow detected electrofishing?	Rainbow eDNA detected?	# Rainbow positive reactions
1	Broadus Creek	9/30/2015	47.25840	-112.83279	N	N	0
2	Camp Creek	9/5/2015	47.19995	-112.84816	N	**Y**	**3**
3	Camp Creek	9/5/2015	47.18434	-112.86488	Y	**Y**	**3**
4	Cooney Creek	9/30/2015	47.24381	-112.78121	N	**Y**	**1**
5	Cooney Creek	10/1/2015	47.25840	-112.81465	Y	**Y**	**3**
6	Dobrota Creek	9/30/2015	47.26740	-112.80672	Y	**Y**	**3**
7	E. F. North Fork Blackfoot River	9/5/2015	47.18321	-112.86454	Y	**Y**	**3**
8	E. F. North Fork Blackfoot River	9/4/2015	47.16347	-112.79491	Y	**Y**	**3**
9	Meadow Creek	9/4/2015	47.13887	-112.79452	Y	**Y**	**3**
10	Mineral Creek	9/5/2015	47.15880	-112.84092	N	**Y**	**3**
11	North Fork Blackfoot River	9/6/2015	47.19629	-112.88811	Y	**Y**	**3**
12	North Fork Blackfoot River	9/6/2015	47.19739	-112.88104	Y	**Y**	**3**
13	North Fork Blackfoot River	9/30/2015	47.24827	-112.84164	Y	**Y**	**3**
14	North Fork Blackfoot River	9/30/2015	47.26690	-112.80636	Y	**Y**	**3**
15	Sarbo Creek	9/30/2015	47.23647	-112.86195	N	N	0
16	Scotty Creek	9/3/2015	47.15455	-112.75713	Y	**Y**	**3**
17	Sourdough Creek	9/3/2015	47.14083	-112.75302	N	N	0
18	Sourdough Creek	9/3/2015	47.14688	-112.75656	Y	**Y**	**2**
19	Theodore Creek	9/30/2015	47.25372	-112.83504	N	**Y**	**3**
20	Un-named tributary	9/30/2015	47.20696	-112.87268	N	N	0

Table 1. Results from eDNA samples analyzed for presence of rainbow trout in the North Fork of the Blackfoot River drainage. Map ID corresponds to numbers in Figure 1b – 1c. **Map ID**

Results and discussion

No samples showed evidence of inhibition during qPCR analysis. Rainbow trout DNA was detected in 16 of 20 field samples (Figure 1b-c and Table 1). Additionally, rainbow trout eDNA was detected at all 12 locations where the species has been observed during previous electrofishing surveys and an additional four locations in Camp, Cooney, Mineral and Theodore Creeks where they had not been previously observed.

Although eDNA detection is generally more sensitive than traditional methods, it may still fail to detect an organism that is present. A variety of factors influence the detection and abundance of DNA in an environmental sample. For example, greater animal abundance and sampling proximity may increase probability of detection. Furthermore, eDNA production rate may vary with life history stage (e.g., high production during the breeding season; McKelvey et al. in press; Turner et al. 2014). Environmental DNA degradation is also influenced by factors such as water temperature and UV exposure (Pilliod et al. 2014). Additionally, some types of chemical compounds naturally found in streams may inhibit laboratory detection of eDNA (Jane et al. 2014). Field and laboratory methods can also influence eDNA detection (Renshaw et al. 2014).

Because eDNA techniques detect an organism's DNA and not the organism itself, the precise nature of what is being detected must be inferred. A single migrant, for example, can produce a positive detection. This, along with occurrence of false negative detections, can be resolved through repeated sampling. The probability of receiving a false negative result will decline exponentially with multiple sampling visits across time. Furthermore, populations will produce repeated, positive detections in a basin, whereas individual migrants produce local and ephemeral detections.

Conclusion

Given the present methods, our interpretation of these results is that one or more rainbow trout were present upstream from those locations with positive detections. Locations in which rainbow trout eDNA was not detected may have lacked rainbow trout, or this species may have been present in very low numbers or at some distance upstream from the sampling point. If you have any questions about the results or wish for help interpreting these data, please contact us. We look forward to working with you in the future.

Figure 1. Sampling location for eDNA detection of rainbow trout in North Fork of the Blackfoot River drainage, Montana. Numbers in Figures 1b and 1c correspond to the "Map ID" column in Table 1.

Figure 1a.

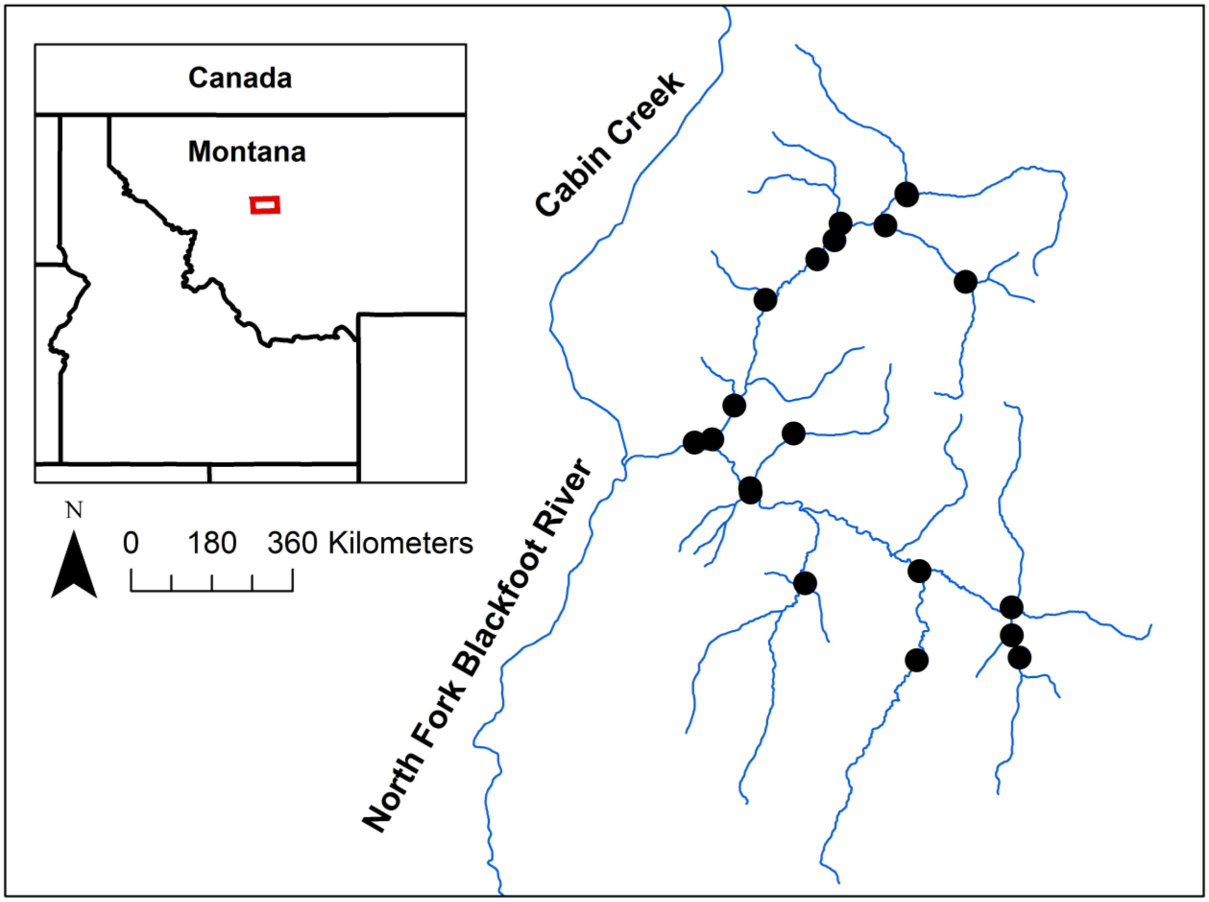
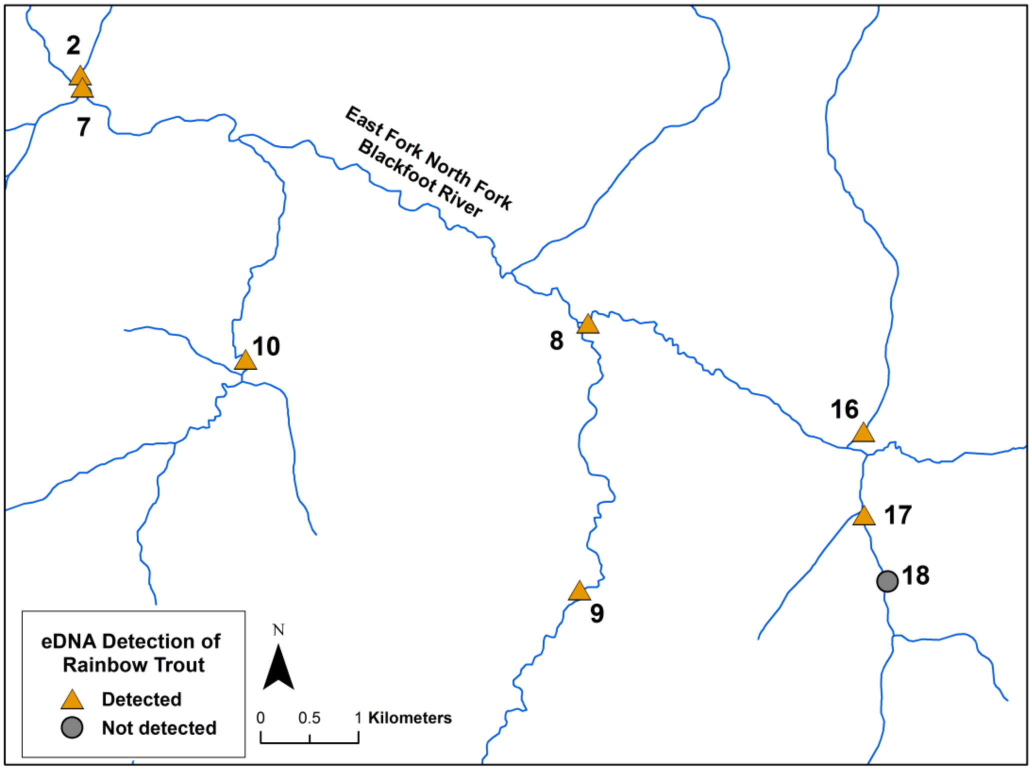
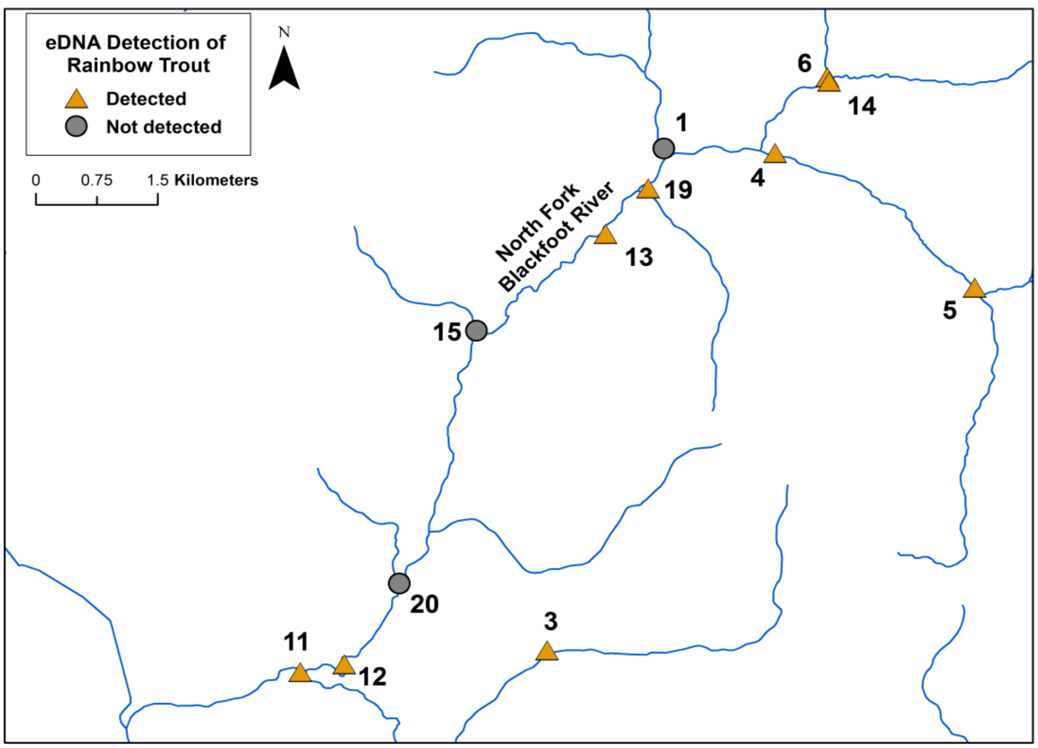


Figure 1b (top) and Figure 1c (bottom).





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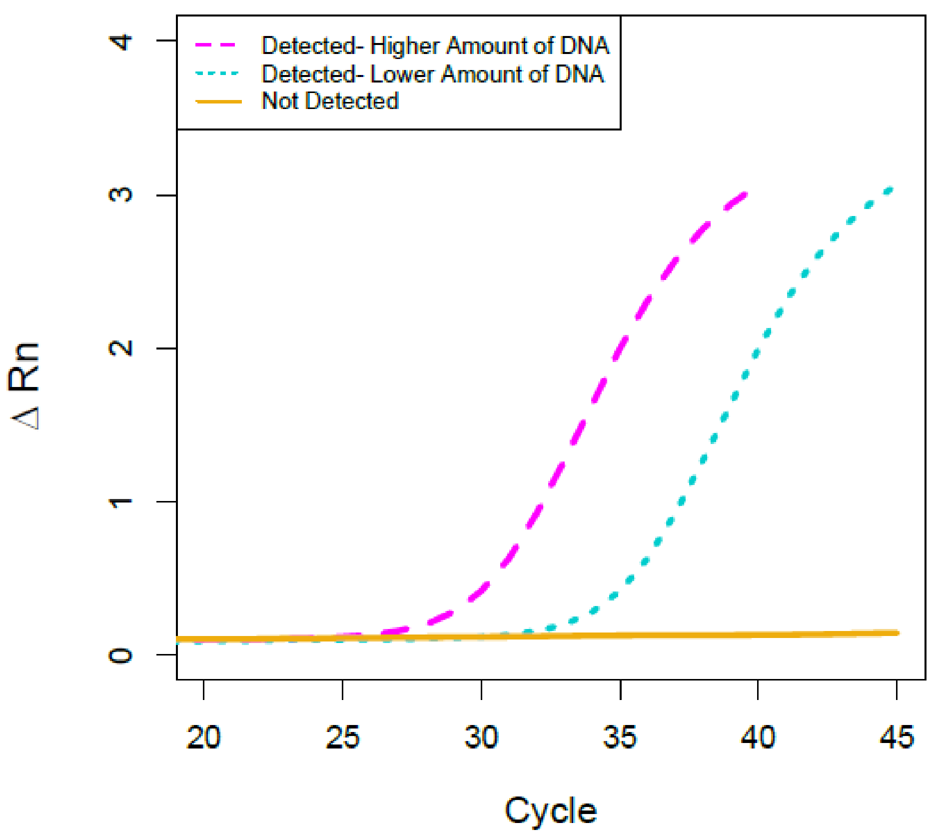
Supplement

In a quantitative PCR reaction, light is emitted when DNA from a target species is present. This light is captured by the PCR instrument and plotted on a figure to help visualize the amount of DNA present in a sample (Figure S1). PCR is performed in cycles, wherein the amount target DNA (and thus fluorescence) is doubled with each cycle. Fluorescence will occur at an earlier cycle when there is more DNA present in a sample. If target DNA is not present in a sample, there will be no fluorescent light emitted during the qPCR reaction. 20 25 30 35 40 45 0 1 2 3 4 Cycle DRn Detected- Higher Amount of DNA Detected- Lower Amount of DNA Not Detected

Figure S1. Amplification plot showing the change in normalized fluorescence (ΔRn) versus PCR cycle. When DNA from the target species is present, there is an increase in the amount of fluorescence (pink and blue dashed lines). Conversely, when there is no target DNA present in the sample, there is no increase in fluorescence above background levels (solid yellow line).

Each sample is also run with an internal positive control (IPC). The IPC is a separate, smaller reaction that is added to each sample, and used to determine if inhibitors are present in the sample that might alter our ability to detect DNA from the target species. In water samples, these inhibitors may be tannins or other compounds that lower the pH of water. If inhibition is detected in a sample (Figure S2), it is treated to remove inhibitors and re-analyzed with qPCR.



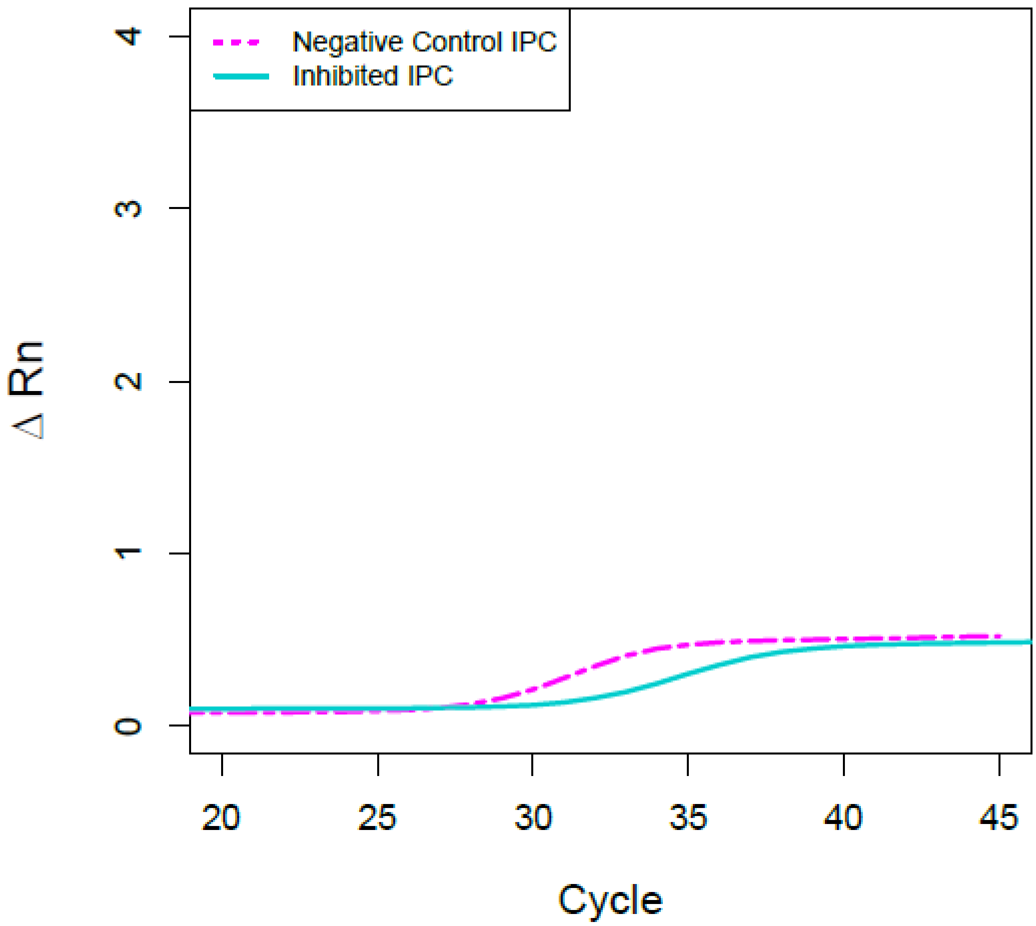


Figure S2. Amplification plot showing the change in normalized fluorescence (ΔRn) versus PCR cycle for the IPC reaction. When inhibitors are present in a sample, the IPC curve will be shifted compared to the negative control.

Historical Review of Fisheries and Fish Plants Upstream of the North Fork Falls

by

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Summary

We researched historical files to investigate the possible presence of aboriginal fish and to document past fish stocking practices upstream of the North Fork Falls. We reviewed historical files (newspapers, agency records) from the Montana Historical Society, archives in the Mansfield Library as well as all known relevant records housed in 1) Missoula Montana Fish, Wildlife and Parks (FWP) Regional Headquarters, 2) FWP Helena internal database, 3) FWP Fisheries Library, 4) Washoe Park Trout Hatchery (WPTH), as well as 5) written histories of the Montana Fisheries Division (Alvord 1975, 1991; Zackheim 2005). The WPTH. Montana's first state hatchery, was specifically researched because it provided fish and eggs to waters throughout western Montana, including the Blackfoot Basin.

Our searches of FWP historical files made no mention of the presence/absence of aboriginal fish upstream of the North Fork Falls prior to fish stocking. This lack of documentation may not be surprising given the first formal FWP fish population surveys upstream of the North Fork Falls were completed several decades after fish stocking began. The first documented fish plant occurred in 1926 (Helena Daily Independent, September 15, 1926); whereas, the first lake surveys were completed in 1959 (FWP historical files), and the first stream surveys were completed in 2006 (Appendix A). Like FWP historical records, searches at the Mansfield Library archives found no records of aboriginal fish or early fishing reports from upstream of the North Fork Falls. This Mansfield Library search included collections, catalogs, dissertations and oral stories between 1910 and 1960. Likewise, searches of Montana Historical Society and scanned newspapers made no mention of fish or fishing prior to stocking programs upstream of the North Fork Falls.

Though records are generally incomplete, historical hatchery records revealed cutthroat trout eggs from Ashley Lake (Flathead drainage), Yellowstone Lake, Lake Tahoe and Lahontan, as well as rainbow trout were at the WPTH between 1908 and 1983. In the early years, the WPTH also produced brook trout, Chinook salmon and grayling. In 1911 alone, the WPTH released >2.6 million *blackspotted cutthroat trout* fry (coded 02, cutthroat trout *undesignated*) from eggs supplied by Yellowstone National Park courtesy of the U. S. Bureau of Fisheries. Fore decades thereafter, the blackspotted cutthroat trout were often referred to as *natives* in both hatchery records and newpaper accounts. Within a few years of the construction of the WPTH, millions of blackspotted cutthroat trout (eggs and fry) and rainbow trout were widely distributed throughout Montana, including Georgetown Lake, which was a future source of eggs for the WPTH.

Eggs for WPTH were taken from Georgetown Lake cutthroat trout beginning in 1919 and Flint Creek beginning in 1922. During the 1920s and 1930s, an estimated 20 million eggs per year were taken from Georgetown Lake alone. With prior hatchery plant of various strains of cutthroat and rainbow into Georgetown Lake, many of eggs brought into WPTH, and subsequently stocked into streams and lakes, were likely species other than genetically pure westslope cutthroat trout, including Yellowstone Cutthroat trout, rainbow trout and hybrids of all.

The WPTH supplied eggs to the Ovando State Hatchery, which operated during summers from 1921 to 1964; both hatcheries stocked fish (rainbow trout and cutthroat trout) upstream of the North Fork Falls. We found no hatchery records that identify where the Ovando State Hatchery stocked fish between 1921 and 1932, though one article in the Helena Daily Independent (September 15, 1926) reported the Helena Rod and Gun planted 10,000 blackspotted trout in Meadow Creek, Twin Lakes and the North Fork Blackfoot River. Likewise, we found no specific records that identify the subspecies of cutthroat trout that entered the Ovando State Hatchery. However, the WPTH supplied eggs to the Ovando hatchery in years when Yellowstone cutthroat trout eggs were available. In some years, these egg transfers coincide with fish stocking in waters upstream of the North Fork Falls.

In addition to stocking programs promoted by state and federal hatcheries, the USFS promoted the widespread stocking on the Lincoln Ranger District with the assistance of sportsmans groups (Helena Daily Independent, 11-3-1937). Regardless of pre-existing fisheries, most of the larger streams within the District were stocked, including the North Fork Blackfoot River.

The first documented pure westslope cutthroat trout used in the hatchery system were collected in the Flathead Basin in 1965 - 1967. These fish were held at the Jocko River State Hatchery (Arlee, MT) until 1980, and likely had little bearing on the North Fork because there are records of egg transfers from the Jocho River4 State Hatchery to the WPTH. In 1983, the WPTH developed a genetically unaltered westslope cutthroat trout broodstock, derived from tributaries of the South Fork Flathead River. The only documented plant of genetically unaltered westslope cutthroat trout stocked upstream of the North Fork Falls occurred in upper Twin Lake in 1988. Fish from this plant did not persist as determined by a 2005 gill net survey that reported upper Twin Lake as fishless.

How fish were planted was also poorly documented, though records show both aircraft and livestock (horses and pack mules) were used to plant fish and to survey lakes upstream of the North Fork Falls. Planes planted fish beginning in 1951 and helicopter plants began in 1960 in western Montana. According to *Fish Stocking and Management Policy of the Fish and Game Department, State of Montana of 1959*, “specific plants in specific waters by airplane shall be allowed when accomplished under the direction of the conservation personnel responsible for the fishery management wherein the fish are to be planted and with the written approval of the Superintendent of Fisheries and the Chief Fisheries Management Biologist of the Montana Fish and Game Department”. Though written approvals were not located in our searches, it is possible undocumented aircraft stocking occurred between 1951 and 1959.

Recent genetic tests (2006-2014) of *Oncorhynchus* trout confirm a history of stocking both nonnative rainbow trout and nonnative Yellowstone cutthroat trout upstream of the North Fork Falls. Genetic tests also confirm the widespread presence of westslope cutthroat trout genes upstream of the North Fork Falls. Yet, our review of the historical record remains inconclusive regarding whether the presence of westslope cutthroat trout genes relate to aboriginal fish, hatchery westslope cutthroat trout (hybrids), or both. One sculpin (species unknown) was identified in a survey at mile 26.8 on July 11, 2007 the North Fork upstream of the Falls near the junction with the East Fork. This single sculpin suggests the North Fork upstream of the Falls may not have been historically fishless.

A more detailed summary of all documented histories of fish planting and fish population surveys individual water bodies upstream of the North Fork Falls are described below.

Lower Twin Lake

The Helena Independent Record reported planting of blackspotted cutthroat trout in Twin Lakes in 1926 and 1940. Planting records show lake plants between 1950 and 1952 with 13,584 undifferentiated cutthroat trout from WPTH. There were no comments in historical records confirming how the fish were transported to stock the lake.

Documented in a May 15, 1962 FWP D-J Job Completion Report, Project #: F-12-R-8, Job1. A survey crew packed in by White-Tail Ranch outfitters of Ovando conducted an overnight gill net survey on Lower Twin Lake July 17-18, 1962. Gill net results recorded 7 undifferentiated cutthroat trout caught averaging 11.1 inches in length.

Helicopter survey conducted by FWP biologist Liter Spence on July12, 1968 conducted a 21.5-hour gill net survey caught 54 Yellowstone cutthroat trout averaging 9.3 inches in length and 1 Yellowstone cutthroat trout/ rainbow trout hybrid (13.4 inches in length). Additional comments documented a small inlet spring with spawning potential.

An FWP fisheries survey crew packed in with horses and conducted a 6.5-hour gill net survey July 21, 2005. Gill net results recorded 25 undifferentiated cutthroat trout averaging 12.3 inches in length. Genetic tests (n=25) revealed Yellowstone trout x westslope cutthroat trout x rainbow trout hybrids.

Upper Twin Lake

The Helena Independent Record reported planting of blackspotted cutthroat trout in Twin Lakes in 1926 and 1940.

Documented in a May 15, 1962 FWP D-J Job Completion Report, Project #: F-12-R-8, Job I. A survey crew packed in by White-Tail Ranch outfitters of Ovando, conducted an overnight gill net survey on Upper Twin Lake July 17-18, 1962. Gill net results recorded 17 undifferentiated cutthroat trout caught averaging 15 inches in length.

Helicopter survey conducted by FWP biologist Liter Spence on July 12, 1968 conducted a 21-hour gill net survey caught no fish. Additional comments documented that a winter kill was observed by Warren Ensign District Ranger in Lincoln, MT as reported by Cecil Garland.

"Pre-wilderness stocking aerial stocking precedents for wilderness lakes in Montana" documented that Upper Twin Lake, lake adjacent to Lower Twin Lake, in 1969 was stocked by aircraft with 990 Yellowstone cutthroat trout from the Yellowstone River Trout Hatchery.

FWP regional fish planting report for 1988 and 1989 recorded Upper Twin Lake being planted, as a requested FWP biologist Wayne Hadley, with 3,990 westslope cutthroat trout in 1988 and 4,000 in 1989 from the Washoe Park Trout Hatchery. Lake stocking was completed using horses.

An FWP fisheries crew packed in with horses and conducted a gill neet survey on June 20-21, 2005. The survey found no fish in upper Twin Lake.

Meadow Lake

There are no fish planting records for Meadow Lake. However, the Helena Rod and Gun Club planted Meadow Creek as early as the 1920's (Helena Daily Independent 9-26-1926) and outfitters planted the Meadow Lake with fish brought up from below the North Fork Falls into Meadow Creek in the 1940's and 1950's (Smoke Elser, wilderness outfitter, personal communication). Because Meadow Lake connects with Meadow Creek, past stocking of Meadow Creek likely influenced Meadow Lake (*see* Meadow Creek section).

Documented in a May 15, 1962 FWP D-J Job Completion Report, Project # F-12-R-8, Job 1, Ralph W. Boland and a survey crew packed in by White-Tail Ranch outfitters of Ovando, MT conducted an overnight gill net survey on Meadow Lake July 15-16, 1962. Gill net results recorded 17 rainbow trout (*Salmo gairdneri*) caught averaging 10.9 inches in length.

Helicopter survey conducted by FWP biologist Liter Spence on July 12, 1968 conducted a 12.5-hour gill net survey recorded a sample size of 32 fish, 30 fish showed characteristics of Yellowstone cutthroat trout x rainbow trout hybrids. These fish averaged 11.2 inches in length.

A gill net survey of Meadow Lake conducted by FWP biologist Wayne Hadley Aug 19-20, 1986 found no fish.

An FWP fisheries crew packed in with horses, conducted a gill net survey on June 21-22, 2005 and recorded no fish. However, the same survey crew caught three fish by angling. Genetic tests identified these three fish as westslope cutthroat trout x rainbow trout hybrids.

A Meadow Lake creel census conducted on five fishermen in 1963 reported 25 undifferentiated cutthroat trout averaging 10 inches in length over a period of 65 hours of angling.

<u>Parker Lake</u>

Fish planting records show that the only time Parker Lake was stocked was between 1942 and 1952 with 53,157 undifferentiated cutthroat trout from the Ovando Trout Hatchery during the 1940's and Washoe Park Trout Hatchery in the 1950s. Fish planting records do not comment on how the fish were taken to the lake.

A gill net survey was conducted by A. N. Whitney; Aug 20-21, 1959 recorded sample size of 58 cutthroat trout with an average length of 11 inches. Helicopter survey conducted by FWP biologist Liter Spence on July13, 1968 conducted a 20.5-hour gill net survey caught 58 Yellowstone cutthroat trout averaging 9.1 inches in length. FWP biologist Wayne Hadley conducted a gillnet survey August 18-19, 1986 recorded a sample of 19 Yellowstone cutthroat trout averaging 9.2 in length.

An FWP fisheries crew packed in with horses and conducted an 18hr gill net survey July 20-21, 2005. Gill net results recorded 46 Yellowstone cutthroat trout averaging 10.6 inches in length. Genetic test (n=26) identified Yellowstone trout x westslope cutthroat trout x rainbow trout hybrids.

Three different creel censuses were conducted on Parker Lake in 1949, 1958 and 1962. A 1949 census of four fishermen recorded two rainbow trout averaging 18 inches in length over 12 hours of angling produced a catch rate of 0.17fish/hour. A 1958 census recorded two fishermen caught five undifferentiated cutthroat trout averaging 9.0 inches in length during the hours of angling producing a catch rate 1.7fish/hour. A 1962 creel census conducted on one fishermen angling for 0.5 hours recording no catch.

The only Statewide angling pressure estimates documented in the entire the upper North Fork Blackfoot River upstream of the North Fork Falls between 2005 and 2013 occurred on Parker Lake in 2007. Results from 2007 estimate total pressure of 115 ± 115 angler days over two trips and an angler satisfaction rating of 4 on a scale of 1 (poor) to 5 (excellent).

<u>North Fork Blackfoot River upstream of the North Fork Falls</u>

No agency fish planting records were found for the upper North Fork Blackfoot River upstream of the North Fork Falls. However, the Helena Daily Independent Record on 9-15-1926 reported the planting of 10,000 *blackspotted cutthroat trout* by the Helena Rod and Gun Club in Meadow Creek, Twin Creek and the North Fork of the Blackfoot River. The Helena Daily Independent Record also reported the U.S. Forest Service, Lincoln Ranger Disctrict planted 35,000 natives in the North Fork Blackfoot River in conjunction with other Lincoln District plants. All Fish and Game historical files (1932-1992) show that all fish planting only occurred on the lower North Fork Blackfoot River downstream of the Falls, though the exact locations where fish were released were not documented.

In 2007, FWP surveyed fish populations in the North Fork Blackfoot River upstream of the Falls for the fist time. These surveys were completed at stream miles 26.8, 32.0 and 34.7. Genetic test from 12 of 64 *Oncorhynchus* trout collected from these locations identify these fish as rainbow trout x Yellowstone cutthroat trout x westslope cutthroat trout hybrids.

One sculpin (species unknown) was identified in a survey at mile 26.8 on July 11, 2007. The fish suggest the North Fork upstream of the Falls was not historically fishless. Additional survey targeting sculpins in 2015 and 2016 failed to collect sculpins.

Creel censuses were conducted on the North Fork Blackfoot River in 1948-1949, 1953, 1956-1964; however, census locations were not specific enough to determine if any censuses were conducted upstream of the North Fork Falls.

Meadow Creek

Stocking history and surveys

Meadow Creek was stocked every two years between 1932 and 1952 with undifferentiated cutthroat trout. Over this 20-year period, records indicate a total of 405,654 cutthroat trout from Ovando Hatchery and 160,906 cutthroat trout from Washoe Park Hatchery were stocked in Meadow Creek. In 1937 and 1945, a total of 29,280 rainbow trout were also planted. Historical records do not mention how fish were transported to Meadow Creek. In addition, the Helena Daily Independent (9-29-1940) mentioned the Helena Fish and Game Association planted the East Fork of Meadow Creek with an unidentified number of “natives” in the summer of 1940.

Three different creel censuses were conducted on Meadow Creek in 1949, 1956 and 1964. Two separate censuses conducted from August 10 – 13, 1949 and August 22 – 25, 1949 recorded a total of seven fishermen angling for 43 hours caught 18 rainbow trout averaging 15 inches in length, plus 52 undifferentiated cutthroat trout averaging 14.2 inches in length. A 1956 census reported four fishermen caught 16 rainbow trout averaging 12.5 inches in length and 12 undifferentiated cutthroat trout averaging 11.7 inches in length during six hours of angling. A 1964 creel census on Meadow Creek recorded one fisherman angling for two hours caught eight undifferentiated cutthroat trout averaging 7.0 inches in length.

In 2008, FWP, for the first time, conducted fish population surveys throughout the Meadow Creek drainage and resurveyed two locations again in 2013. Genetic testing in 2008 (n=12 fish) and 2013 (n=9 fish) identified rainbow trout x Yellowstone cutthroat trout x westslope cutthroat trout hybrids with a substantial genetic contribution from rainbow trout.

East Fork of North Fork Blackfoot River

Stocking history and surveys

Planting records show the East Fork was planted in 1940, 1942 and 1943 with a total of 23,224 undifferentiated cutthroat trout from the Ovando Trout Hatchery. The Helena Independent Record noted in 1940 alone that 22,000 “natives” were planted on the East Fork. Agency records fish plants occurred again in 1950 with two plants totaling 10,800 and in1952 with two plants totaling 6,864 undifferentiated cutthroat trout from Washoe Park Hatchery. No comments in historical records describe how the fish were transported into the East Fork of the North Fork.

Historical records show a creel census in 1956 reported two anglers fishing the East Fork caught three rainbow trout averaging 7 inches in length and six cutthroat trout averaging 7 inches in length during one hour of angling.

FWP fish population surveys were conducted on the East Fork at four locations (stream miles 1.9, 7.0, 9.0 and 11.7) in 2006 and 2013. Survey at stream mile 11.7 produced no fish. Genetic samples collected in 2006 at mile 7.0 (n=4) and from 2013 survey at miles 1.9 and 9.0 (n=20) identified rainbow trout x Yellowstone cutthroat trout x westslope cutthroat trout hybrids.

Cooney Creek

Stocking history and surveys

Historical planting records show Cooney Creek was planted once in September 1941 with 20,160 rainbow trout from the Ovando Trout Hatchery and once in September 1950 with 3,600 undifferentiated cutthroat trout from the Washoe Park Trout Hatchery. Records do not identify how these fish were transported to Cooney Creek.

No historical records were found regarding creel census work or fish population surveys on Cooney Creek prior to 2007.

In 2007, FWP conducted a fish population survey at stream mile 0.2 on Cooney Creek. Only one fish was found. Genetic testing identified that fish as a non-hybridized westslope cutthroat trout. In 2013 additional surveys conducted at miles 0.2, 0.4 and 2.4 collected genetic samples from eight additional fish. Genetic testing (n=8) identified these fish as rainbow trout x Yellowstone cutthroat trout x westslope cutthroat trout hybrids.

Scotty Creek

Stocking history and surveys

Historical planting records show Scotty Creek was planted September 12, 1943 with 3,000 undifferentiated cutthroat trout and again on August 20, 1948 with 2,000 undifferentiated cutthroat trout from the Ovando Trout Hatchery. No additional comments from the historical records identify how the fish were transported to Scotty Creek.

FWP conducted the first fish population survey on Scotty Creek at mile 0.2 in 2006. This sample phenotypically identified 42 rainbow trout and 1 cutthroat trout. Genetic testing (n=5) showed rainbow trout x Yellowstone cutthroat trout x westslope cutthroat trout hybrids. In 2013 a re-survey at stream 0.2 was conducted on Scotty Creek. This survey collected additional genetic samples (n=35) that are currently stored at the FWP Missoula office.

There are no records of historical creel surveys for Scotty Creek.

Historical Reports

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Supplement to Minimum Requirements Analysis/Decision Guide (MRA/MRDG): Evaluating Proposals for Ecological Intervention in Wilderness

Beth Hahn and Peter Landres, Aldo Leopold Wilderness Research Institute
June 2016

The purpose of this supplement is to provide support to agency staff in completing an MRA or MRDG for proposals that involve ecological intervention in wilderness, including projects related to the preservation of cultural resources. This supplement is needed because ecological intervention proposals commonly entail complex legal, scientific, and ethical questions that may be beyond the realm of a typical MRA or MRDG. By explicitly raising these questions related to ecological interventions early in the MRA or MRDG process, this supplement is intended to help agency staff identify issues that need to be resolved before moving forward with the MRA or MRDG, as well as identify early on whether the goal of the intervention is legally appropriate. This supplement may also be useful in building the administrative record of the project.

The below responses to this Leopold Intervention Framework were authored and/or reviewed by an interagency core team [Ron Pierce and Carol Endicott (FWP), Scott Spaulding, Josh Lattin, Jimmy Gaudry, Shane Hendrickson and George Liknes (USFS) and Wade Fredenberg (USFWS)] with assistance from other agency managers and under the guidance of Beth Hahn at the Aldo Leopold Wilderness Research Institute. The questionnaire was deemed 'adequately answered' by a 94% (range 88-100 for the 16 individual questions) consensus of the core team on January 11th, 2017.

Does the proposal contain essential information for evaluating the MRA/MRDG Step 1 question "Is Action Necessary?"

A. Is there an ecological issue or degradation that is prompting the proposed ecological intervention?

The questions in this section help ensure that the proposal adequately provides a "Description of the Situation" as required in the MRA or MRDG. Note that these questions expand on what is presented in this section of the MRDG because a proposed ecological intervention may have an extraordinarily complex background and context that needs to be described.

	ADEQUATE	NOT ADEQUATE	NOT APPLICABLE
1. Does the proposal describe the background and context for the ecological degradation and the intervention? Consider: • Historic information about the ecological degradation, including the source of the degradation, its distribution and rate of spread, and the resulting ecological threats and risks. • Current information about the ecological degradation, especially the known or potential ecological threats and risks. • Whether the intervention intends to restore to a historic condition, or facilitate adaptation to a new condition.	X	☐	☐
2. Does the proposal describe how the ecological intervention will provide long-term adaptation or mitigation to the effects of climate change? Consider: • If climate-driven ecological changes will lead to an irreversible loss of a resource. • If data trends indicate that systems are nearing thresholds outside the historical range of variability that could lead to ecological tipping points. • If there is precedence for ecosystems shifting across the landscape, and indications of significant expansions and contractions of range in response to historic climatic trends and / or disturbances.	X	☐	☐
3. Does the proposal describe why action is more important than inaction to preserve wilderness character? Consider:	X	☐	☐

- If the issue is caused by contemporary human actions or legacy land use impacts, or reflects variation in species occurrences or ecological processes.
- If the intervention will lead to resilient outcomes without requiring repeated interventions.
- If the ecological system will degrade as a result of inaction, and whether this degradation will likely lead to further cascading changes to the ecological system.
- If non-intervention will allow the system to self-sort and reorganize.
- Given the scientific value of wilderness as an untrammeled baseline, intervention actions will diminish the potential for future wilderness research.

4. Does the proposal describe the intervention in terms of preserving the natural quality of wilderness character? Consider: • Spatial scale of the action and its intended outcomes. • Temporal scale of the action, including frequency and seasonality of implementation, and its intended outcomes. • Potential effects (including non-target effects) of activities on ecosystem composition, struture and processes, such as predator-prey relations, disturbance processes, and other effects that cascade throughout the ecological system.	X	☐	☐
5. Does the proposal describe the likelihood of accomplishing the stated objective, and specific plans to address uncertainties? Consider: • Whether this type of intervention has been successful elsewhere, and if so, whether these results apply to this proposal. • Whether follow-up monitoring will be conducted to assess the effectiveness of the intervention, as well as the impacts and benefits of monitoring on wilderness character.[1] • For long-term or repeat interventions, thresholds have been established that will trigger re-evaluation of the ecological intervention.	X	☐	☐
If all rows are ADEQUATE or NOT APPLICABLE, continue the evaluation; if any rows are NOT ADEQUATE, deny proposal and return for potential revision.			

A1. Does the proposal describe the background and context for the ecological degradation and the intervention?

Yes. The proposal[1] and the baseline study[27] describe the background and context for the ecological degradation and the need for intervention. This evaluation framework provides further context.

Factors related to the types and causes of ecological degradation and proposed intervention are the result of a long history of stocking nonnative fishes within the project area, the possible elimination of a historically pure population of native westslope cutthroat trout, and the risks this legacy of fish introductions pose to native fish (downstream) outside of the project area. Though the pre-1920 presence of native trout upstream of the North Fork Falls has never been documented[27], the existing fishery is nonetheless drastically altered from the historical (pre-1920) condition. Field surveys from 2004 through 2016 found predominantly *Oncorhynchus* hybrid trout, as an admixture of primarily rainbow trout (*Oncorhynchus mykiss*) genes, with contributions from westslope cutthroat trout (*O. clarkii lewisi*) and Yellowstone cutthroat trout (*O. c. bouvieri*). These fish are widespread within the project area, which is upstream of a barrier falls on the North Fork Blackfoot River (Figure 1). Decades of hatchery plants that began in the 1920s are responsible for the compromised genetic status of the existing population[27]. No data or observations on the native fish assemblage present before fish stocking are available; however, the wide-spread distribution of westslope cutthroat trout genes, and their usual presence upstream of other barrier falls in the Blackfoot River watershed suggest the project area possibly provided historical habitat over thousands of years for native westslope cutthroat trout. The existing fishery has little recreational or conservation value. Because of low abundance and a limited distribution, these hybrid trout appear to be poorly suited to cold, high elevation streams[19,27] and thus offer low ecological value to other species such as fish-

[1] If monitoring will not be conducted, provide rationale (e.g., for some actions, there may be sufficient evidence about intervention outcomes to suggest that monitoring is unnecessary).

eating birds and mammals. Perhaps even more importantly, this fishery is a headwater source of hybridization to down valley stocks of nonhybridized native westslope cutthroat trout[27]. The proposal to replace these hybrid trout with native westslope cutthroat trout and native bull trout would reduce hybridization risks, while contributing significantly to ecological function and the conservation of imperiled native trout, especially bull trout.

Westslope cutthroat trout and bull trout are typically sympatric throughout their overlapping range and together they reflect the native trout assemblage to the Montana wilderness landscape west of the Continental Divide. Both are present in the Scapegoat Wilderness immediately downstream of the project area, which includes a four-mile reach of the mainstem North Fork, in addition to about 10 miles of stream in the Dry Fork. Bull trout in the Dry Fork drainage have been surveyed in the mainstem of the Dry Fork, Canyon Creek and Cabin Creek. Both native species broadly occupy neighboring wilderness streams within the Blackfoot River and Flathead River basins. Because these native trout are specifically coadapted to the mountainous streams of western Montana, replacing hybrid trout with drainage-specific stocks of native westslope cutthroat trout and bull trout from neighboring streams would result in a more natural wilderness condition compared to the existing fishery. The headwaters of the adjoining Flathead River Basin (Great Bear and Bob Marshall Wilderness) represent the largest patch of uncompromised native fish habitat in western Montana.

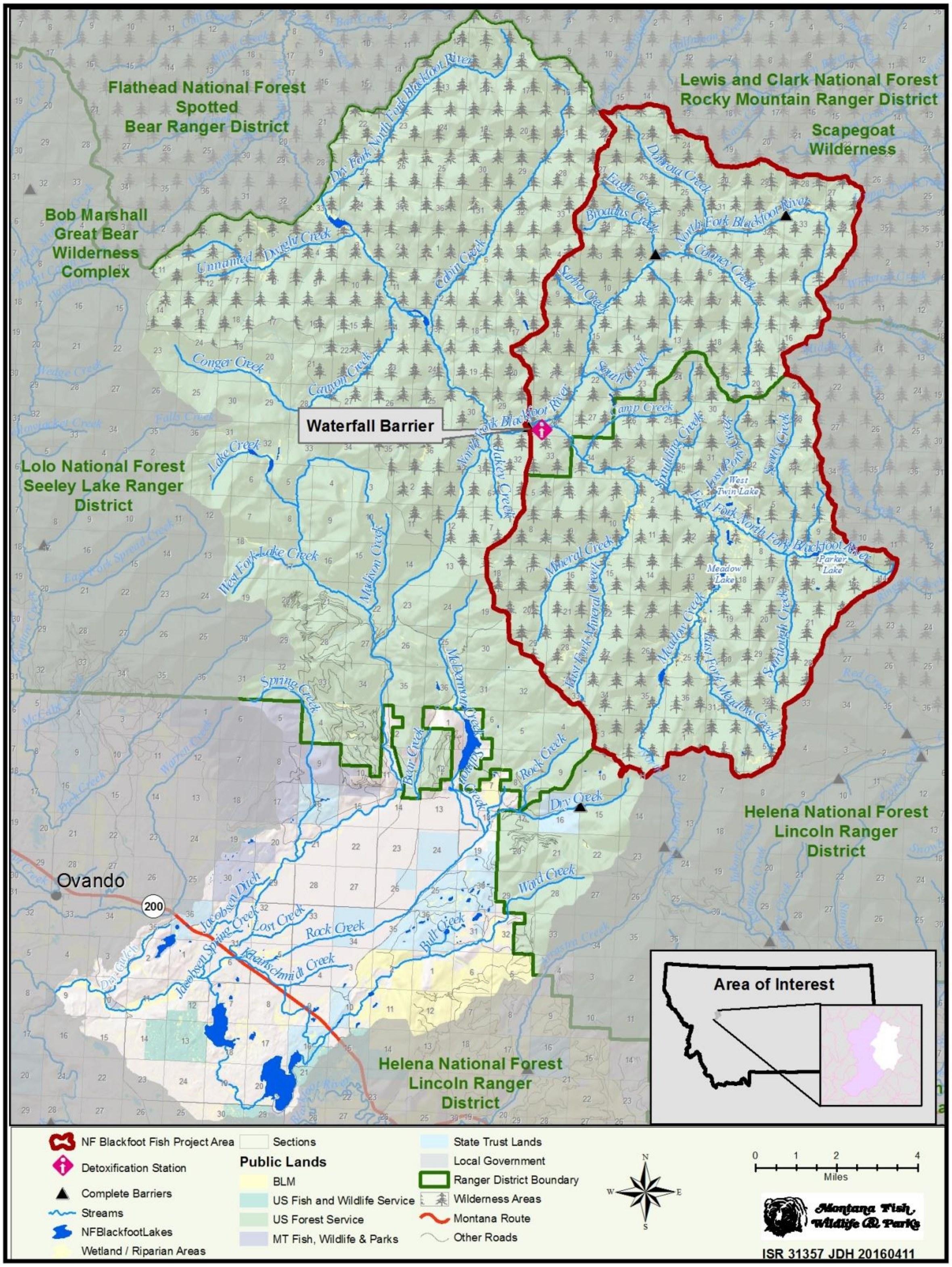

Figure 1. North Fork Blackfoot River watershed with location of project area.

The third bullet under question A1 asks whether the intervention intends to restore the resource to a historical condition, or facilitate adaptation to a new condition. Decades of stocking of nonnative rainbow trout and Yellowstone cutthroat trout resulted in the loss of the historical condition by the time of wilderness designation in 1972. Likewise, stocking nonnatives has further altered ecological function[27]. Meanwhile, these high elevation waters provide highly suitable habitat for native trout that are less susceptible to warming, and protected by the wilderness and the barrier falls from invasion of nonnative species[18,27,41]. As westslope cutthroat trout were possibly present historically, returning this species could return the project area to the historical condition. Compared to westslope cutthroat, the historical presence of bull trout in the project area is less certain. With no evidence of historical bull trout presence, translocating bull trout upstream of the barrier falls would likely facilitate adaptation to a new but natural condition representative of the historical condition of most watersheds west of the Continental Divide in Montana. Therefore, while the condition may be new to the project area, it reflects the native fish assemblage of much of the Clark Fork River drainage and western Montana. Acknowledgment of the need to adapt to a new, more natural condition is a progressive step towards native species conservation, while correcting a legacy of biologically adverse nonnative trout introductions in this wilderness landscape.

The project area was designated wilderness in 1972. The Wilderness Act recognized the role of state jurisdiction and responsibilities related to wildlife and fish in the national forests[40]. Forest Service Manual (FSM) 2323.3[43] further defines United States Forest Service (USFS) policy regarding fish stocking in wilderness and provides guidance as to when and where stocking should occur. This USFS policy is intended to: 1) provide an environment where the forces of natural selection and survival rather than human actions determine which and what numbers of wildlife species will exist; 2) protect wildlife and fish indigenous to the area from human caused conditions that could lead to Federal listing as threatened or endangered, and 3) provide protection for known populations and aid recovery in areas of previous habitation, of federally listed threatened or endangered species and their habitats. Furthermore, the FSM defines indigenous species as "any species of flora or fauna that naturally occurs in a wilderness area and that was not introduced by man." Westslope cutthroat and bull trout fit this description. The USFS Policy also recognize State jurisdiction and responsibilities for the protection and management of wildlife and fish populations in wilderness and emphasizes close working relationships with State authorities to help resolve wilderness issues. The FSM also provides guidelines for State and USFS wilderness cooperative agreements. Cooperative agreements between the USFS and Montana Fish, Wildlife and Parks (FWP) that guide fisheries management are now in place for western Montana wilderness areas[20,25,37]. These agreements basically affirm State jurisdiction over stocking of waters that were stocked before wilderness designation and provide specific guidance for correcting the ecological degradation by managing for indigenous (native) trout.

Not all waters within the project area will be stocked with westslope cutthroat trout and bull trout, and these areas will remain in their likely historical, fishless condition. Pre-wilderness stocking included, but was not necessarily limited to, four lakes (Parker Lake, Lower and Upper Twin lakes and Meadow Lake) various sections of the East Fork North Fork Blackfoot River, the North Fork Blackfoot River, Meadow Creek, the East Fork of Meadow Creek, Twin Creek, Cooney Creek and Scotty Creek[27]. Under the current proposal, fish stocking would not occur in fishless lakes or fishless streams segments upstream of the barrier falls on Broadus Creek or the barrier falls located on the North Fork Blackfoot River upstream of Dobrota Creek[27]. Therefore, these waters would remain in their historical condition.

A2. Does the proposal describe how the ecological intervention will provide long-term adaptation or mitigation to the effects of climate change?

Yes. This project addresses all bullet items under A2, which focus on adaption to, or mitigation for, the effects of climate change, which are major considerations for bull trout and westslope cutthroat trout recovery planning. Long-term National Weather Service data, from 1948 to the present, show current local warming trends along with corresponding reductions in snowpack over the past several decades[38,39]. In addition, climate projections indicate future warming and the continued regional contraction of cold-water habitat[18,41]. Although climate projections do not adequately account for groundwater or lake environments, these models clearly predict an up-valley contraction of thermally suitable spawning and rearing habitat for bull trout by 2040, throughout western Montana. This contraction is ongoing in western Montana[12].

The proposed project area is an excellent candidate for conservation of these thermally sensitive species, as climate models indicate suitable thermal habitat for bull trout and westslope cutthroat in the project area into the foreseeable future[18]. Bull trout are obligate coldwater species[21], and they are especially at risk in a warming climate[12,18]. Consistent with local and regional warming trends and other anthropogenic stressors[18,28,38,39], bull trout populations are currently in decline at the low elevations of the Clark Fork River basin, including all spawning streams in lower Blackfoot River basin[28]. Climate models further project the loss of the loss of cold water needed for bull trout spawning and rearing in the mainstem North Fork. Because bull trout show genetic and life history variation among tributaries in the Blackfoot River basin[28,34], including the North Fork, continued declines point to the short-term, irreversible loss of landscape-adapted stocks for those streams prone to continued warming[18,28].

Though bull trout recovery actions are occurring in all occupied habitat on private lands in the Blackfoot Basin[28], including the North Fork, future options for bull trout conservation in the face of climate warming are increasingly limited to higher elevation streams[18]. The headwaters of Keep Cool/Beaver Creek drainage, which spans public and private lands and adjoins the project area, is projected to have thermally suitable habitat into at least 2040[18]; however, this drainage is widely subjected to anthropogenic disturbance, including dewatering and riparian livestock damage[28]. Furthermore, nonnative brook trout and brown trout are present, and the area lacks the private land support needed to reverse habitat problems afflicting bull trout. None of these conditions exist within the project area as it is designated Wilderness. The projected low-elevation loss of suitable bull trout habitat includes in the main stem North Fork Blackfoot River downstream of the barrier falls[18]. This loss could further imperil the persistence of bull trout, which are listed as threatened under the Endangered Species Act (ESA). Projects such as this are critical in preventing further reductions in occupied habitat or other populations trends that point to the local extirpation of bull trout[18,27]. Such projects are specifically identified and supported in the Bull Trout Recovery Plan for the Columbia Headwaters Recovery Unit[36].

Westslope cutthroat trout show similar climate-induced up-valley contractions of suitable cold-water habitat[18]. As warming continues, hybrid zones will also shift up-valley in many larger streams[41], especially in those streams with headwater populations of naturalized rainbow trout[27,41]. Thus, by replacing a headwater population of hybrid trout with westslope cutthroat trout, the proposed project would offset projected contractions in the range of westslope cutthroat trout, while eliminating a source of nonnative genes to the watershed downstream of the project area.

A3. Does the proposal describe why action is more important than inaction to preserve wilderness character?

Yes. Inaction would result in a continued altered ecological condition upstream of the barrier falls and would lead to irreversible and likely perpetual ecological damage to native trout downstream of the barrier falls. Failure to correct these threats when we have the capacity to do so would be irresponsible, given FWP, USFWS and USFS current understanding of the threats. Threats posed by nonnative hybrid trout and climate warming for at least this drainage can be largely offset by the proposed project.

The presence of a highly genetically altered population of fish, with nonnative rainbow trout providing the predominant genetic contribution, is fundamentally inconsistent with wilderness character, and is the result of long abandoned stocking programs that have placed native salmonids at risk. The goal of the project is to remove nonnative hybrid trout upstream of the barrier waterfall on North Fork Blackfoot River, and replace these fish with self-sustaining populations of native westslope cutthroat trout and bull trout, both of which are indigenous to the Scapegoat Wilderness. Project objectives are: 1) Treat all known fish-bearing stream reaches upstream of the North Fork Falls with piscicide (rotenone) to eradicate nonnative trout to the full degree feasible; 2) Minimize impacts to non-target species by utilizing appropriate chemical treatments (piscicides), project timing (fall) and geographic scale, including neutralizing piscicides near the North Fork Falls to eliminate risk to fish and aquatic organisms downstream of the project area; 3) Establish self-sustaining westslope cutthroat (<2% introgression) using drainage-specific stock(s), and ensure the persistence of the North Fork bull trout by translocating bull trout or their progeny from downstream of the North Fork Falls to upstream of the North Fork Falls, and to; 4) Monitor the effectiveness of the trout translocation for up to 10 years post-treatment and the recovery of macroinvertebrates and amphibian communities using existing information as the baseline for monitoring[27].

Reestablishment or establishment of a native trout assemblage is a reversal of the existing condition that is the result of human manipulation, and elimination of the preexisting aquatic community that was altered by human interference prior to wilderness designation. Although proposed actions temporarily increase presence by humans, and introduce a chemical disturbance, the quick outcome would be a native westslope cutthroat trout population, which has high conservation and wilderness value. Because bull trout were not known to be present historically upstream of the barrier falls, the establishment of a population of bull trout in the project area would likely not preserve wilderness character, but would contribute considerably to conservation of this ESA threatened species, carry out an ESA recovery action, and provide a future refuge for the native fish assemblage in a protected, wilderness setting within its historical range. It is noteworthy that the post-Wisconsin glacial biogeographical distribution of bull trout and westslope cutthroat trout has largely been in existence for roughly 10,000 years, but has only been influenced and documented by European humans in Montana for about the last 150 years. Consequently, the recorded history of native assemblages reflects only a tiny fraction (the most recent 1.5%) of the historical distribution. Whether westslope cutthroat trout and bull trout were native upstream of North Fork Falls cannot be ascertained at this time with any degree of certainty.

Agency partners have considerable experience in fish removal projects, and have developed protocols to minimize effects on non-target organisms, and limit the number of treatments required to achieve the project objective of < 2% hybridization. Removal of the existing fishery would require the use of rotenone, a plant-derived piscicide that is lethal to fish, some aquatic invertebrates, and gilled amphibians. Piscicide would be applied to all fish-bearing waters within the project area to remove nonnative trout to the greatest extent possible, with the acknowledgment that habitat complexity could prevent full removal given the existence of spring-fed refugial pockets and other features. Some areas may require more than one treatment. A combination of electrofishing and monitoring with environmental DNA (eDNA) would allow assessment of the success of piscicide treatment and identify discrete areas where fish have persisted, and additional treatments would be limited to those areas. The long-term monitoring plan calls for up to 10 years of post-treatment data collection to evaluate the project. Monitoring would include fisheries, aquatic invertebrates and amphibians to evaluate the response of these taxa to the project.

Compared to the existing condition, restocking with locally-adapted indigenous fish from streams would contribute to preserving wilderness character. Gametes from westslope cutthroat trout would be obtained from yet to be determined neighboring streams, and bull trout or their gametes would be obtained from the North Fork Blackfoot River immediately downstream of the project area. These locally adapted donor stocks would likely have a greater potential for persistence within the project area compared to fish obtained from other areas or solely from hatchery stock. Additionally, the barrier falls and remoteness of the project area are key features that enable the project, and prevent repeated interventions. Following the treatment and restocking with native trout, nonnative fish have no way to naturally access the project area because of the barrier falls. The remoteness of the project area would discourage illegal introductions of nonnative fish.

Compared to westslope cutthroat trout, the likelihood of success is less certain for bull trout. The physical habitat appears highly suitable for bull trout. The large patch size, cold water refugia, groundwater inflows and complex habitat features are all favor potential bull trout establishment[27]. However, donor stock from a population downstream of the falls with established migratory (fluvial) behavior involving the North Fork Blackfoot River, the Blackfoot River and the Clark Fork River and many connected secondary streams may, or may not, successfully residualize[34]. The uncertain success of bull trout translocation is in large measure reflective of very limited experience in similar type projects, though pioneering efforts in that regard are underway in other locations and are meeting with some initial success[4,5,11]. To investigate the feasibility of the bull trout translocation in the North Fork, a suitability assessment was completed for the North Fork project[11,46]. The assessment recorded a positive score of 0.81 on a scale of -1.0 to +1.0, indicating a high potential for the recipient habitat for supporting bull trout. To monitor a possible bull trout translocation, post-translocation data collections may include 1) eDNA to identify distribution, 2) electrofishing to identify abundance, size structure and reproduction, and 3) redd counts to identify adult population size should the translocation prove successful. In addition, water temperature data at 22 monitoring sites would allow for an assessment of bull trout habitat use.

The spatial scope of establishment of a native species assemblage within the project area would bring considerable conservation benefit to westslope cutthroat trout and bull trout, given the extent and diversity of available habitat. Both species are landscape adapted and widespread across adjoining wilderness and both represent the natural trout species assemblage for the North Fork immediately downstream of the barrier falls. Thus, this native trout assemblage better represents wilderness character than the existing condition upstream of the barrier falls. *Oncorhynchus* hybrids are now established in about 45 miles of stream in the North Fork Blackfoot River basin upstream of the barrier falls on the North Fork Blackfoot River[27]. The proposed project would replace these hybrid trout with native westslope cutthroat trout and native bull trout. Moreover, the project would promote the long-term conservation of both native trout within a headwater basin that offers outstanding native trout habitat, as well as long-term protection within a remote wilderness setting. Inaction would bring no ecological benefit to native species upstream of the falls, perpetuate hybridization in downstream waters, and fail to offset projected habitat loss to downstream populations relating to climate change. The project would protect wilderness character by preventing the potential permanent loss of bull trout from Scapegoat wilderness, while (re)establishing native cutthroat in a protected wilderness setting.

Inaction would contribute to further degradation of the ecological system. Importantly, inaction would further imperil westslope cutthroat trout downstream of the project area, as the existing hybrids would be a perpetual source of nonnative genes. Increased downstream hybridization would also reduce the genetic integrity of the westslope cutthroat trout metapopulation in the middle Blackfoot River because the Dry Fork provides recruitment of genetically pure fish to the Blackfoot River[44]. Restoration cooperators have worked for three decades in efforts to improve native westslope populations in the Blackfoot Basin, which includes the screening of all irrigation diversions on the North Fork and the restoration of all tributaries to the North Fork to improve metapopulation function[27,28]. The presence of hybrid trout and continued hybridization of the headwater populations in the North Fork would ultimately negate some of these improvements to the Blackfoot River metapopulation.

Because of population declines across western Montana and elsewhere, Montana Natural Heritage Program and FWP, and other agencies, list bull trout and westslope cutthroat trout as species of concern [21,22,23,30]. Montana lists these species as S2 species, which applies to species that are at risk because of “very limited and/or potentially declining population numbers, range, or habitat, which make it vulnerable to extirpation in the state. Declines in westslope cutthroat trout are especially pronounced east of the Continental Divide where populations typically occupy very small (<10km) isolates upstream of barrier falls[30]. West of the Continental Divide, westslope cutthroat trout populations have also declined significantly; however, populations are more widely distributed, present in greater abundance, and possess higher levels of life history and genetic diversity[10,14,30]. Bull trout, a federally listed threatened species under the ESA[13,36], is a keystone species for the Bob Marshall Wilderness Complex, which includes the Scapegoat Wilderness. A warming climate, loss of connectivity, habitat degradation, and nonnative species are the primary threats to bull trout[21,36]. The project area provides a rare opportunity to establish a secure population of bull trout.

Both grizzly bear and bull trout are key ecological components of the Bob Marshall Wilderness Complex. It is important to note that the wilderness managers from around the complex decided to choose bull trout as one of two priority indigenous species that managers would seek to conserve and/or recover in the Scapegoat Wilderness. This conservation strategy relates directly to bull trout in the North Fork. The implementation of management actions to conserve, recover, and monitor the health of bull trout is a measurable standard to which wilderness managers will be held accountable through the Wilderness Stewardship Performance program. Past intervention, such as stocking of non-native trout, though pre-wilderness designation, has ecologically altered this environment to the detriment of native trout. Climate change is contemporaneous, and could lead to a cascade of events in and around this portion of the wilderness, which could erode the natural quality and potentially lead to continued loss of bull trout in the both the Scapegoat Wilderness and non-wilderness portion of the upper Blackfoot River watershed. As part of the Wilderness Stewardship Performance documentation for the Bob Marshall Complex, bull trout and grizzly bear are wilderness character elements, and require continued monitoring as elements of tracking wilderness character.

The 4th bullet under question A3 asks if nonintervention would allow the system to self-sort and reorganize. Because of repeated stocking of nonnative species within the project area, inaction would result in continuation of the existing irreversible alterations in the fish community. Without removal of the existing fishery, self-sorting or reorganization to the historical condition is impossible.

The last A3 bullet addresses whether the existing condition represents the untrammeled baseline, and if intervention would diminish the potential for future wilderness research. The existing condition is a highly-altered population of hybridized fish, with nonnative rainbow trout genes being predominant. Therefore, this project would not diminish the potential for research evaluating an untrammeled ecosystem. Conversely, the project would provide an opportunity to research the effect of (re)establishment of a native trout on aquatic communities. Comprehensive pre-treatment aquatic investigations have been completed for all lakes and tributaries upstream of the barrier falls. Data were collected by USFS and FWP and all data has been shared among cooperators[27]. These baseline investigations point to a range of potential post-treatment wilderness research opportunities, such as evaluation of trophic interactions among diverse taxa, and persistence of native trout in the face of climate change.

Projects restoring westslope cutthroat trout are common, and have been documented to be effective in achieving their goals[6], so the project would not present a novel research need. The addition of bull trout would provide a much-needed example of a successful translocation as a recovery action for this ESA threatened species.

A4. Does the proposal describe the intervention in terms of preserving the natural quality of wilderness character?

Yes. The goals and objectives of the project were developed with wilderness character in mind[25]. For cold-water salmonids, indigenous to the greater landscape, within and outside of wilderness, this project would help restore a more natural wilderness character compared to the existing condition. The spatial scale of the proposed rotenone application and restocking would include all fish-bearing waters. Fish stocking would not occur in currently fishless lakes and fishless streams upstream of barrier falls on Broadus Creek and the upper North Fork Blackfoot River upstream of Dobrota Creek. Considering these exceptions, the spatial extent of available habitat is substantial with about 85 miles of stream and three lakes.

The temporal scale of the treatment would begin with a primary rotenone treatment in the fall of 2019, followed by seven years of restocking by drainage-specific landscape-adapted genetically pure native fish. The project would include reach-scale genetic swamping for westslope cutthroat (i.e., overstocking with pure westslope cutthroat to rapidly dilute the remaining nonnative rainbow gene pool), as needed, to help meet the project objective of < 2% introgression[1]. Monitoring fish, aquatic invertebrates, and amphibians would result in a minimal presence of fieldworkers, which would be a short-term periodic disturbance of the natural quality of wilderness character. These efforts would add to the presence of fieldworkers maintaining trails and controlling weeds.

Timing the piscicide treatment for fall would reduce mortality of nontarget organisms, as most would not be in a vulnerable life history stage[42]. Some invertebrates and gilled amphibians would die; however, natural recovery would allow these taxa to rebound rapidly, especially in the presence of few larger fish. Fishless headwater reaches would not be treated and thereby provide an immediate source of invertebrate recolonization. The proposal includes a white paper literature review of the effects of rotenone on macroinvertebrates and amphibians[42] along with studies repeatedly show either a lack of vulnerability, or rapid recolonization and recovery of macroinvertebrates and amphibians.

Within a context of treatment objectives, short-term implementation ($\leq$ 3 years) and long-term effectiveness monitoring (up to 10 years) will both examine effects to target and non-target aquatic species. Monitoring will rely on pre-treatment inventories of invertebrates, amphibians and fishes[27], as well as similar large-scale treatments in western Montana (e. g., South Fork Flathead[6] and Cherry Creek[7]), and perhaps other research results emphasizing similar wilderness-related actions[16]. The westslope cutthroat trout component focuses on the elimination of existing hybrids. For westslope cutthroat trout, this is largely mechanical and highly likely to succeed because similar treatments have been broadly applied across Montana. The outcome to bull trout component is less certain because of the low number of existing translocation projects as guidance. The proposal calls for translocating juvenile bull trout (fry) that are captively reared from eggs and milt taken from adults within the North Fork population. Based on the 2016 North Fork redd count of 118 redds, we estimate about 375 adults within the North Fork spawning population. Spawning female fish are typically large (20-36 inches) and depending on size, bull trout can produce between 3,000-15,000 eggs (roughly 1,000 eggs per pound of female). Though the number of eggs to be incubated has yet to be determined, it is expected to be a negligible impact to the donor population, given the current size and fecundity of the spawning population. The translocation of bull trout will focus on maximizing genetic diversity rather than numbers[29], with the expectation that the population would naturally build toward equilibrium over the course of several generations if the habitat remains suitable.

A5. Does the proposal describe the likelihood of accomplishing the stated objective, and specific plans to address uncertainties?

Yes. The use of rotenone in fisheries management and native fish conservation projects has been tested world-wide for decades across hundreds, perhaps thousands, of individual projects. Indeed, similar treatments have been widely employed for the recovery on native trout in wilderness areas of the American West, including Montana. Based on similar large-scale treatments in western Montana, the goals and objectives of this project are highly attainable for westslope cutthroat trout[18]. In western Montana, ongoing monitoring on similar large-scale treatments in the South Fork Flathead River and the Cherry Creek watersheds indicate success[6,7,31], while also providing technical and biological insight into possible future projects[2,3].

Following a primary rotenone treatment, short-term implementation monitoring of three years or less, using electrofishing and eDNA, would dictate localized reach scale follow-up rotenone treatments. Based on early monitoring, genetic swamping will be used as needed on a local scale. Long-term effectiveness monitoring would extend up to 10 years, and would include repeat surveys of trout abundance, species composition and genetics, and would help ensure the project meets intended outcomes[1]. Input from experts in genetics, ecology, fisheries, conservation biology and climate change would help develop, implement and monitor the project. USFS wilderness staff and other planners would help design the monitoring effort to minimize trammeling and qualified field staff from FWP, U.S. Fish and Wildlife Service (USFWS) and USFS would oversee implementation of the project to help ensure success. Once the project is completed over approximately a decade, meeting the objectives of self-sustaining populations of westslope cutthroat trout with less than 2% introgression, and establishment of a naturally reproducing population of bull trout, there should be no need for further ecological intervention.

Compared to westslope cutthroat trout, the likelihood of establishing a self-sustaining population of bull trout is less certain. Despite being listed as threatened under the ESA since 1998, introduction or reintroduction of bull trout within their historic range has been rare, though not unprecedented. Translocation of bull trout obtained from the Metolius River watershed into the Clackamas River watershed in Oregon entailed reintroduction beginning in 2011 of various life stages, from eggs to subadults[4,5]. Spawning has been observed since 2014, though continued monitoring is needed to confirm successful reproduction. A second restoration action involved the recolonization of bull trout upstream of a barrier occurred in Snowbank Creek[28], a stream near the North Fork Blackfoot River project. Here, bull trout were absent from the stream before restoring habitat connectivity. Following restoration of in-stream flows and the removal of a migration barrier, bull trout from Copper Creek recolonized the stream within two years. Currently, spawning and the presence of multiple year classes (age 0-adult) bull trout are now present in Snowbank Creek[28]. Recently bull trout were translocated above a barrier falls into a small stream-lake complex in Glacier National Park[35], but it's too soon to judge success of that project. Although these projects differ from the North Fork Blackfoot River project in various ways (e. g., wilderness versus non-wilderness, anthropogenic versus natural barriers), the Clackamas and Snowbank case studies show that bull trout can spawn, rear and reoccupy streams where populations have been lost due to barriers. These case studies plus a 0.81 positive score on a feasibility assessment for the bull trout translocation elevate the prospects of a successful outcome[46].

B. Does the proposed intervention need to occur here and now? Yes *The questions in this section help ensure that the proposal adequately considers "Options Outside of Wilderness" as required in the MRA or MRDG. Note that these questions expand on what is presented in this section of the MRDG by asking for a preliminary consideration of the effects of the proposed intervention.*	ADEQUATE	NOT ADEQUATE	NOT APPLICABLE
1. Does the proposal describe why the intervention needs to occur in <u>this</u> wilderness? Consider: • If surrounding non-wilderness lands and waters would be suitable for the action (e.g., other types of protected areas, state/local public lands, or private lands).	X	☐	☐
2. Does the proposal describe why the intervention needs to occur <u>now</u> in this wilderness? Consider: • The likely consequences if action is taken now. • The likely consequences if no action is taken now.	X	☐	☐
3. Does the proposal describe if intervention will set a national precedent in wilderness?[2] Consider: • If the action has heretofore occurred in any other wilderness. • If the action is experimental.	X	☐	☐
4. Does the proposal describe potential effects—positive, negative, neutral—of the intervention on wilderness character, including strength of evidence? Consider: • Short term effects of the action on each quality of wilderness character. • Long term effects of the action on each quality of wilderness character.	X	☐	☐
5. Does the proposal describe potential cumulative effects—positive, negative, neutral—of the intervention? Consider:	X	☐	☐

[2] If the appropriate response is "Unknown" check the "Not Adequate" box.

- Cumulative effects over time on each quality of wilderness character.
- Cumulative effects of the proposed intervention when combined with other administrative, scientific, commercial, and visitor activities.

If all rows are ADEQUATE or NOT APPLICABLE, continue the evaluation; if any rows are NOT ADEQUATE, deny proposal and return for potential revision.

B1. Does the proposal describe why the intervention needs to occur in this wilderness?

Yes. As described above, the North Fork Blackfoot River within the Scapegoat Wilderness was selected because of ongoing threats and ecological degradation that are both project area-specific and regionally-specific. Climate modeling projects that the project area is remain suitable for bull trout by 2040 (Isaak et al. 2015). These "climate shields" occur at high elevation, and are often in designated wilderness. Thermal regime for most of the rest of the Blackfoot River watershed will be too warm for bull trout. Therefore, the Scapegoat Wilderness provide a rare opportunity to protect this cold-water obligate species in markedly dwindling habitat. In addition to correcting ecological damage and threats to native trout, the project area is among the rare opportunities to provide many connected stream miles, and access to lakes, and has among the highest potential for significant native trout conservation and protection in western Montana. Watersheds of this scope and magnitude, with these desirable attributes and primed for restoration are rare. The result of coordination and planning sessions confirmed the potential for this to have a high probability of success. The proposal has been under development for over 10 years, relies on comprehensive field investigations, and considers the present and future risks to native trout in headwater areas prone to climate warming, both within and outside western Montana wilderness areas. The project would protect bull trout by creating a headwater refugia population within a large protected area that is less prone to low-elevation habitat loss from climate warming. The North Fork Blackfoot River upstream of the barrier falls is further isolated from illegal fish introductions because of its remote location. Without this intervention, wilderness values relating to indigenous fish of the North Fork Blackfoot River watershed will decline[18,28,41].

Like the North Fork, there are at least two additional large wilderness areas in western Montana upstream of barrier waterfalls with similar potential for bull trout translocations. These include the Spotted Bear River of the South Fork Flathead drainage (Bob Marshall Wilderness) upstream of Spotted Bear Falls and the Landers Fork in the upper Blackfoot Basin (Scapegoat Wilderness) upstream of Silver King Falls.

The South Fork Flathead River already supports the largest metapopulation of bull trout in the Bob Marshall Complex with twelve known spawning streams. The habitat is intact and the area is secure for bull trout because Hungry Horse dam on the lower river is a barrier to invasions of unwanted aquatic organisms. Hungry Horse Reservoir further provides foraging and overwintering habitat for migratory (adfluvial) bull trout. In addition, the South Fork of the Flathead basin is modeled to be less prone to climate-induced warming than the mainstem North Fork Blackfoot River because spawning and rearing sites are widely distributed across the South Fork Flathead Basin[18]. Thus, while the upper Spotted Bear River might be considered as a future bull trout refugium (especially considering the outcome of the North Fork Blackfoot introduction), there is less urgency to accomplish that action.

The headwaters of the Landers Fork offer another opportunity, but is not currently being proposed for a bull trout translocation site because all spawning and most of the rearing habitat occurs in an accessible tributary, Copper Creek. Copper Creek is the upstream-most spawning population in the Blackfoot Basin. Unlike spawning tributaries to the lower Blackfoot River, the Copper Creek bull trout population is stable, and summer water temperatures are the coldest of all bull trout streams in the Blackfoot Basin[28]. Additionally, there are no competing or hybridizing species present, and spawning and rearing areas in the headwaters of Copper Creek are projected to remain thermally suitable through at least 2040[18]. Lastly, there is currently very little biological information for the watersheds upstream of the Spotted Bear Falls or Silver King Falls to support bull trout translocations. Depending on the outcome of the North Fork project, those sites could be further evaluated over time. There is also additional urgency because the heavily hybridized North Fork salmonid population represents a known threat to downstream native trout, whereas those others do not have similar concerns.

B2. Does the proposal describe why the intervention needs to occur now in this wilderness?

Yes. The headwater source of hybridization threatens the genetic integrity of westslope cutthroat at multiple spatial scales. Climate change models projected through at least 2040 further suggest delays and inaction would fail to offset the ongoing and predicted regional contraction and loss of suitable habitat for both westslope cutthroat trout and bull trout.

Genetic testing indicates project delays would exacerbate hybridization risk to down valley westslope cutthroat trout, such as the Dry Fork population, from hybrid fish upstream of the barrier falls[27]. The Dry Fork supports cutthroat trout spawning and exhibits the complex migratory behavior by these genetically pure cutthroat trout, that mature in the middle Blackfoot River[44]. Thus, continued hybridization will diminish the genetic integrity of the westslope cutthroat metapopulation in the middle Blackfoot River. Indeed, the number of hybrid westslope cutthroat trout in the lower Dry Fork drainage increased from 4% in 2004[27] to 31% in 2016 (Sally Painter, Wild trout and Salmon Genetics Lab, personal communication) in samples taken within 1 mile of each other. Though the project would greatly reduce or eliminate one source of hybrid fish entering the Dry Fork, the North Fork Blackfoot River project may not eliminate possible future downstream sources of hybridization (e. g., rainbow trout from the Blackfoot River), which could extend upstream in the presence of continued warming[26,41]. Currently, the upstream-most known migratory rainbow trout from the Blackfoot River reproduces in a spring creek 18.7 river miles downstream of the confluence of the Dry Fork. The possible upstream expansion of downstream rainbow trout[41] further elevates the importance of a secure conservation population of westslope cutthroat trout upstream of the North Fork Falls.

Bull trout are currently undergoing regional (low-elevation) population declines[12], which include dramatic declines all lower elevation bull trout stream in the Blackfoot Basin during the last 20 years[28]. Future contractions potentially include the projected loss of spawning and rearing habitat for the North Fork Blackfoot River population of bull trout located downstream of the barrier falls[18]. The North Fork Blackfoot River currently supports the largest run of migratory bull trout in the Blackfoot Basin. This stock differs genetically from other stocks[28]. Additionally, on the current course this stock and many others appear to be in jeopardy within the next 25 years[18]. Per the proposed timeline, the years 2020-2022 would be the earliest age 0 fish could be translocated[1]. The success of the translocation would not be known until 2026-2028, which is earliest time that translocated bull trout could successfully reproduce. With this timeframe in mind, the "why now" question relates to minimum 10-year window. Per USFS climate projections, this 10-year period will begin to approach the time that bull trout habitat in the North Fork will be compromised[18].

The USFWS supports the project because of the potential benefits to bull trout recovery. Section 7 (a)(1) of the ESA requires that federal agencies use their authorities and resources to advance endangered species recovery. This recovery action use current science, agency coopearation, and available funding to expand and secure a bull trout population in a portion of the Blackfoot River watershed that appears suitable to the long-term survival of the species. This recovery action is specifically described in the Recovery Unit Implementation Plan[36] for the Columbia headwaters. Lastly, the project has been funded by the USFS, Natural Resources Damage Program (NRDP) and FWP. The NRDP provides most the funding. This funding is specifically tied to both cutthroat trout and bull trout recovery as mitigation to replace mining-related native trout losses in the upper Clark Fork Basin[45]. Because of its high resource value, the State of Montana, federal partners and other cooperating stakeholders are prepared to advance the proposed action.

B3. Does the proposal describe if intervention will set a national precedent in wilderness?

Yes. Translocations or other methods of stocking native trout into historically fishless wilderness waters that are within their historic range have occurred throughout the American West. These actions were typically led by State agencies with primary jurisdictions over fish and wildlife management under the Wilderness Act[40] and State/USFS management agreements and/or American Fisheries Society stocking policies, most of which are recovery/conservation actions. It is important to point out that because many similar native trout conservation projects have been undertaken elsewhere, the North Fork Blackfoot River project would not set a national USFS or wilderness precedent. Examples of similar wilderness native trout projects include the following: 1) introduction of westslope cutthroat trout into 11 historically fishless lakes in the South Fork of the Flathead River drainage in the Bob Marshall Wilderness[32]; 2) introduction of Arctic grayling (*Thymallus arcticus*) into historically fishless waters the North and South Fork of Sun River in the Bob Marshall Wilderness[15]; 3) introduction of westslope cutthroat into historically fishless Cherry Creek in the Metcalf Wilderness[7]; 4) introduction of Yellowstone cutthroat trout into historically fishless waters in Dead Indian Creek in the North Absaroka Wilderness[8] and Mystery and Dime Lakes in the Teton Wilderness[9]. Colorado also has an extensive record of translocating ESA-listed native fishes into historically fishless waters within wilderness (Table 1).

Table 1. Projects in Colorado where native cutthroat trout were translocated into designated wilderness or national park, including historically fishless waters (Kevin Rogers, Colorado Division of Wildlife, personal communication).

Wilderness Area	*Waters*	*Species*
Lizard Head Wilderness	Woods Lake, Fall Creek, Muddy Creek	Colorado river cutthroat trout
Flat Tops Wilderness	Big Cow Lake	Colorado river cutthroat trout
Holy Cross Wilderness	Timberline Lake, Lake Fork of the Arkansas River	Greenback cutthroat trout
Mount Massive Wilderness	Rock Creek watershed	Greenback cutthroat trout
Rocky Mountain National Park	Big Thompson watershed	Greenback cutthroat trout
Sangre de Cristo Wilderness	South Prong Hayden Creek	Greenback cutthroat trout
Lost Creek Wilderness	Rock Creek	Greenback cutthroat trout
Weminuche Wilderness	Roaring Fork watershed	Greenback cutthroat trout
Greenhorn Mountain Wilderness	Graneros Creek	Greenback cutthroat trout
Sangre de Cristo Wilderness	Sand Creek watershed	Rio Grande cutthroat trout (planned)

Furthermore, the Idaho Fish and Game has stocked bull trout in historically fishless lakes in the Frank Church-River of No Return Wilderness in Idaho to control brook trout (Dave Parris, IDFG, personal communication). The Boise National Forest has translocated bull trout from the North Fork of the Boise River (Sawtooth Wilderness) to Bear Creek, a non wilderness, historically fishless tributary to the North Fork of the Boise River (Bruce Reiman and Tammy Hoem Neher, personal communication).

Because bull trout reintroductions or translocations are relatively uncommon, owing in part to their need for larger scale habitats and their reputation as a less desirable sport fish, monitoring data is limited compared to westslope cutthroat trout translocations. Examples of other bull trout (re)introductions or translocations include the Clackamas project[4], introduction into Grace Lake in Glacier National Park[35], and Snowbank Creek, which is also in the Blackfoot River watershed. Planned or potential bull trout translocation projects are either being planned or proposed in the lower Clark Fork River watershed and the Pend Oreille watershed of Idaho and Washington.

Specific to the North Fork Blackfoot River project area, the relatively large scale (85 miles of stream of variable size and habitat features that include the presence of interconnected lakes), presence of groundwater inflows, cold-water refugia, and the resulting model projections that water temperatures will remain suitable make this a highly desirable project. The lack of human disturbance and relative security of the wilderness habitat going forward further makes this an ideal location for attempting a bull trout translocation as part of the larger project. A comprehensive pre-treatment inventory of aquatic species and conditions has been completed. An initial bull trout feasibility assessement[46] has been completed, and a ten-year post-treatment monitoring program is planned and has been funded.

Stocking actions associated with the recovery the ESA listed species, like bull trout, are specifically allowed under current USFS policy[43] and USFS/FWP wilderness management agreements[25,37]. Indeed, the USFS and FWP management framework for the Bob Marshall Wilderness complex[37] specifically states that "chemical treatment may be necessary to prepare water for the reestablishment of indigenous species to protect or recovery Federally listed Threatened and Endangered species or to correct undesirable conditions resulting from the influence of humans (e.g., the establishment of and exotic fish population that threatens a native gene pool)". The action must be necessary to maintain wilderness values ***or to recover a Threatened or Endangered species***." Given this background, denial of permission to stock indigenous or ESA listed fish, or other imperiled native trout, into a wilderness setting with a prior (pre-wilderness) history of fish stocking could potentially set an adverse precedent in its' own right.

B4. Does the proposal describe potential effects—positive, negative, neutral—of the intervention on wilderness character, including strength of evidence?

Yes. The proposal and subsequent analyses will detail the range of potential effects on wilderness character. Short-term presence of fieldworkers, and the use of rotenone would temporarily alter wilderness character. Rotenone, an organic compound originally discovered by natives in South America to have properties allowing them to harvest fish, has a short life and readily breaks down. Restoration of native westslope cutthroat trout would improve the wilderness character and naturalness by restocking native fish to these waters. As an indigenous species to the Scapegoat Wilderness, bull trout also improve character over the status quo and buffer potential down-valley population declines in the Scapegoat Wilderness as currently projected[18]. Piscicide application would have short-term negative effects on some aquatic invertebrates and gill-bearing Rocky Mountain tailed frogs (*Ascaphus montanus*). These populations would rebound quickly through natural mechanisms of recovery because the headwaters of most streams would not be treated and the fall timing of the project would coincide with the period of least impact.

Implementation of the short-term and long-term monitoring plan, and comparison to the baseline data on invertebrate and amphibian communities, trout abundance, species distributions, genetics and trophic structuring would allow evaluation of effects of the project on wilderness character. A comprehensive pre-treatment water temperature dataset is available as a basis for monitoring biotic relationships under present and future climate change scenarios. There are several negative effects to Wilderness Character that are expected with this proposal. There is no question that this action will negatively impact Wilderness Character in the short term. The project constitutes an intentional manipulation of the existing biophysical environment and is therefore a trammeling action. In addition, while in its main implementation stage (1-3 years) there will be significant impacts to Solitude of the area.

The Scapegoat Wilderness operates under the Bob Marshall Great Bear Scapegoat Recreation Management Direction that was signed in 1987 for the entire Bob Marshall Wilderness Complex[33]. Under this direction, the Scapegoat Wilderness utilizes the Limits of Acceptable Change system which "requires managers to define desired wilderness conditions and to undertake actions to maintain or achieve these conditions. A variety of influences affect these desired conditions, including recreation, fire control, grazing, and mining"[33]**.** These desired wilderness conditions have set standards along four Opportunity Classes within the Scapegoat. All four Opportunity Classes are present within the proposed project area. It is expected that as personnel, supplies, and equipment are mobilized; use levels, campsite impacts, and motorized intrusions will temporarily exceed standards set for Solitude and Undeveloped character. In addition, there will be a temporary reduction in the natural abundance of aquatic species found within the project area, thus reducing the Natural Character of the area. These effects of the proposal are expected to be short-term (1-3 years) and the proposal itself should not affect other aspects of Wilderness Character such as Primitive and Unconfined Recreation or other features of value such as integral cultural or geological features.

If completed, the project will create an increase in natural character in the long term (5 years and beyond) by replacing the non-indigenous fish species with indigenous species. The short-term loss to wilderness character will lead to an improvement of wilderness character in the long term.

B5. Does the proposal describe potential cumulative effects—positive, negative, neutral—of the intervention?

Yes. As the project advances, it will be vetted through the Montana Environmental Policy Act, which will involve 1) an extensive assessment of the potential cumulative effects on the natural and human environments, 2) public review, and 3) a thorough review of the scientific literature on piscicide projects relative to the proposed project. Moreover, questions of cumulative effects to the aquatic community would be monitored up to 10 years post-treatment[1]. A before-after control-impact monitoring design is planned for aquatic invertebrates and amphibians, and an extensive dataset of baseline data on aquatic invertebrates, amphibians, and fish has been collected. These data would provide a basis for response monitoring. Treatment and control comparisons of community structure and composition could also be made with data from adjoining roadless/wilderness drainages that support both cutthroat trout and bull trout (e.g., headwaters of Monture Creek) and from other large-scale wilderness treatments (e.g., South Fork Flathead[6]) and/or other studies[16].

The cumulative effects of this action to wilderness character when viewed at a temporal scale are expected to have no long-term effect to the undeveloped character or the values of primitive and unconfined recreation or other features of value. If the project is successful in its establishment of a healthy cold water native fishery, long term impacts to the solitude of the area could occur with an increase in angling pressure. Nonetheless, this is speculative, and adjacent drainages with healthy fisheries in the Scapegoat Wilderness do not currently show unacceptable degradations of solitude due to angler use. Future FWP angler pressure estimates, which have been ongoing for decades, offer one method to help determine changes in angler use patterns. The current USFS and FWP management framework for the Bob Marshall Wilderness compex[37] outlines mechanisms to protect wilderness resources should visitor use lead to excessive disturbance or overuse.

The Wilderness Act directs managers to retain areas with "primeval character" which suggests managing the landscape to retain the qualities that were present at a set point in time, before the influence of modern man[37,40]. The Act also directs managers to protect the land in "its natural condition"[40]. While there is some debate to the meaning of the term natural, this action would manipulate the ecosystem of the project area to be more consistent with surrounding ecosystems in the Scapegoat Wilderness and adjacent ecosystems in the Great Bear-Bob Marshall complex, and replace non-indigenous species with indigenous genetic stocks. Despite uncertainty of what the aquatic ecosystem of the project area consisted of prior to anthropogenic influences, it seems reasonable to assume that by replacing nonnative species with native species, while undoubtedly trammeling and altering the existing state of the wilderness in the short term, would move the area closer to a natural state than its current condition in the longer term, which would be a positive outcome.

Within the project area, several other management activities will negatively affect wilderness character that also need to be accounted for. Most of these actions are reoccurring maintenance or permitted commercial use that would take place regardless of this proposal, but it is worth considering the cumulative effect to wilderness character that would occur with these actions in concert with the proposal. There are five permitted outfitter and guide camps in the project area that are particularly busy during the fall hunting season, and there are several permits that do not have permitted camps in the project area, but do allow for summer roving trips. The USFS maintains a network of trails in the area, and has crews assigned to clear them annually throughout the duration of the project. The USFS is also actively treating invasive weeds species in the project area to increase the naturalness of the area, and reduce the alteration of natural ecosystem processes. The USFS maintains one administrative use cabin within the project area, and 2 more are nearby within the Scapegoat Wilderness. The USFS may also be replacing a bridge along the North Fork of the Blackfoot River that is outside of the project area. Nevertheless, this action will still affect a visitor's wilderness experience when accessing the area from the North Fork Blackfoot River trailhead. The cumulative affects to wilderness character in the project area can be mitigated by ensuring that no major trail work, invasive weeds work, or campsite restoration work occurs in the same time frame as the proposal, and that the timing of the treatment actions from this proposal do not coincide with periods of heavy use from permitted outfitter and guide companies.

C. What are the legal and administrative considerations that apply to the proposed intervention? Yes

The questions in this section help ensure that the proposal adequately considers the "Criteria for Determining Necessity" as required in the MRA or MRDG. Note that these questions expand on the legal and administrative aspects of what is presented in this section of the MRDG.

	ADEQUATE	NOT ADEQUATE	NOT APPLICABLE
1. Does the proposal describe if there is legal direction that permits the proposed intervention? Consider: • If the action is necessary to meet the Wilderness Act mandate to preserve one or more of the qualities of wilderness character. • If the action is necessary to satisfy valid existing rights or a special provision in wilderness legislation (the Wilderness Act of 1964 or subsequent wilderness laws). • If the action is necessary to meet the requirements of other federal laws (e.g., ESA, ARPA, NHPA, Dam Safety Act, Clean Air Act).	X	☐	☐
2. Does the proposal describe if there is administrative direction that affects whether to allow the proposed intervention? Consider: • If the appropriate administrative jurisdiction and the decisionmaker(s) have been identified. • If formal consultation or permits (e.g., for ESA issues) are needed prior to the proposed action.	X	☐	☐
3. Does the proposal describe if potential legal and administrative conflicts and uncertainties have been resolved? Consider: • If there are conflicts or uncertainties in regulations that influence the proposal decision. • If there are conflicts or uncertainties in policies that influence the proposal decision. • If there is other administrative direction, such as management plans or special orders (e.g., Executive Orders), that influence the proposal decision. • If there is guidance from partners that influence the proposal decision (e.g., state wildlife action plans, climate change adaptation strategies).	X	☐	☐

If all rows are ADEQUATE or NOT APPLICABLE, continue the evaluation; if any rows are NOT ADEQUATE, deny proposal and return for potential revision.

C1. Does the proposal describe if there is legal direction that permits the proposed intervention?

Yes. The project agrees with several existing laws, USFS Policy and guidelines, and management plans[13,20,21,24,36,40,43]. There are also two current USFS and FWP cooperative agreements that stipulate that making changes in fish species stocked in areas where stocking was established prior to wilderness desigation is fundamentally a State action and the responsibility of FWP[25,37]. With these laws, regulations, management plans and cooperative agreements all in place, we anticipate a cooperative interagency process, as described in wildernsess policy, whereby FWP, USFWS together with USFS biologists and wilderness staff and other stakeholders all work to identify and minimize wilderness issues associated with trammelling and to improve naturalness.

C2. Does the proposal describe if there is administrative direction that affects whether to allow the proposed intervention?

Yes. Administrative guidance is established through The Wilderness Act[40], USFS policy[43], as well as various cooperative agreements between the USFS and FWP[20,25,37]. The Wilderness Act specifically mentions that "nothing in the act shall be construed as affecting the jurisdictions and responsibilities of the several states with respect to wildlife and fish in the national forests (16 USC 1133)". The USFS Policy Manual[43] identifies the order of preference for stocking fish species in Wilderness is: 1) Federally listed Threatened or Endangered Species; 2) Indigenous species, and 3) Threatened or Endangered native species if species is likely to survive and spawn successfully. Indigenous species under this USFS policy are defined as "any species of flora or fauna that naturally occurs in a wilderness area and that was not introduced by man." Furthermore, the 2008 cooperative agreement for fish, wildlife and habitat management of national forest wilderness lands in Montana[25], mentions that "The State has the responsibility to make the determination as to which wildlife and fish are indigenous." Because both westslope cutthroat trout and bull trout naturally occur in the Scapegoat Wilderness and the North Fork Blackfoot River as a coadapted and sympatric assemblage, FWP considers both appropriate the proposed action. In support of this determination, the Fish, Wildlife, and Management Framework for the Bob Marshall Wilderness Complex[37] specifically permits fish FWP to stock fish in order to "maintain an indigenous species adversely affected by human influence". This involves maintaining genetic refuges in high quality aquatic habitats, and improving genetics of native, sensitive species like westslope cutthroat trout and to perpetuate or recover a threatened and endangered species.

With or without a bull trout component to the project, ESA consultaton would need to occur. Without bull trout, the focus would be on potential impacts downstream of North Fork Falls. With the inclusion of bull trout, the USFWS would complete the Section 7 consultation on behalf of the project including the introduction area, and would permit the translocation of bull trout through a Section 10 Recovery Permit. The USFWS, through their Creston National Fish Hatchery located near Kalispell, would assist as needed with: 1) the collection of eggs and milt, 2) incubation of embryos at the Creston Hatchery, and 3) the stocking of bull trout fry into suitable streams. Since the mid-1990s, the USFWS has experimentally reared bull trout at Creston National Fish Hatchery with great success, and is one of a very few facilities with a cold water supply and isolation facilities prepared to handle this task. They are currently conducting a similar operation for Glacier National Park Logging and Grace Lakes translocation project.

C3. Does the proposal describe if potential legal and administrative conflicts and uncertainties have been resolved?

Yes. There are no known direct legal or adminstrative conflicts with the goals and objectives or implementation tasks associated with the proposal. To the contrary, various laws, policys, managment plans and cooperative agreeements are intended to support and guide this type of project[13,20,21,24,25,36,37,40,43] and thereby help resolve philosphical or administrative conflicts and uncertaintees. An example of a cooperative agreement is the Montana Cutthroat Trout Conservation Agreement[20], signed by both FWP and USFS. One objective under this agreement is to seek opportunities to "restore and/or expand populations of each cutthroat trout subspecies into selected habitats within their respective historical ranges." This objective can apply directly to the westslope cutthroat trout component to the North Fork project. Further clarity regarding bull trout is outlined in the Cooperative Agreement for Fish, Wildlife and Habitat

Management on National Forest Wilderness Lands in Montana[25]. This agreement focuses on maintaining genetic refuges in high quality aquatic habitats, improving genetics of native, sensitive species like westslope cutthroat trout, and perpetuating or recovering Threatened and Endangered species, while providing guidance on stocking approval policies.

Because conflicting views of naturalness are inherent to wilderness fisheries management, differences are typically resolved with administrative guidance as specifically outlined in the Wilderness Act[40], the USFS Policy Manual[43] and two USFS/FWP cooperative agreements that identify decision authority[25,37]. Using these and other guiding documents, the USFS, USFWS, and FWP fisheries staff are engaging USFS wilderness staff to minimize short-term trammeling, and to ultimately improve long-term naturalness consistent with the goals and objectives of the project. This engagement begins with this *Leopold Center Decision Guide for Evaluating Proposals for Ecological Intervention in Wilderness* and a feasibility matrix that showed positive potential for a successful bull trout translocation[46]. The project will be further vetted through the MRDG process, as well as public review processes (MEPA/NEPA), which will include various alternatives (e. g., no action, no bull trout) to the proposed action.

Does the proposal contain essential information for comparing alternatives in Step 2 of the MRA/MRDG "Determine the Minimum Activity"?

D. Have essential issues related to stakeholders, values, and implementation been considered in developing a range of alternatives? Yes

The questions in this section help ensure that the proposal adequately considers issues that may be of particular importance in developing and considering alternatives if ecological intervention is deemed necessary from Step 1 of the MRA or MRDG.	ADEQUATE	NOT ADEQUATE	NOT APPLICABLE
1. Have different potential stakeholders and their values contributed to the development of alternatives?	X	☐	☐
2. Have national and local (e.g., site-specific, traditional knowledge[3]) values and perspectives contributed to the development of alternatives?			
3. Have agency and/or external resources that are necessary to implement the intervention and monitor effects contributed to the development of alternatives?	X	☐	☐

If all rows are ADEQUATE or NOT APPLICABLE, proceed with Step 2 of the MRA or MRDG; if any rows are NOT ADEQUATE, deny proposal and return for potential revision.

D1. Have different potential stakeholders and their values contributed to the development of alternatives?

Yes. The problems and proposed actions have been presented to stakeholder groups throughout western Montana and based on feedback received the concept appears to have broad public support. These communication will advance as the project goes through more formal public comment periods. Ultimately, broad stakeholder support will be needed to implement a project of this scale. Volunteers from many organizations have helped with backcountry data collections and have offered further assistance. The project has statewide importance, which includes support from FWP Fisheries Divisioin and the Governor's office.

D2. Have national and local (e.g., site-specific, traditional knowledge4) values and perspectives contributed to the development of alternatives?

Historical fisheries conditions have been researched through interviews, historical archives, oral histories and agency records[27]. To date, these investigations have identified no historical fisheries information upstream of the North Fork Falls prior to stocking of nonnative trout in the 1920s. However, as previously noted, the recorded history is a small fraction of the ecological history of these species in western Montana. The proposed project has been communicated to resource managers and tribal leaders with the Confederated Salish and Kootenai Tribes. These early communications tend to support the basic project concepts including the bull trout component of the project. Alternatives will be vetted during MEPA/NEPA.

D3. Have agency and/or external resources that are necessary to implement the intervention and monitor effects contributed to the development of alternatives?

Yes. Agency cooperators on the project include the USFS, USFWS, FWP and the Natural Resource Damage Program. The Montana DEQ will be involved as the project moves towards implementation. Following the Fish, Wildlife and Habitat Management Framework for the Bob Marshall Wilderness Complex[37], the project has been presented to, and discussed with, commercial outfitters and other stakeholders at the Bob Marshall Wilderness Complex Managers Meeting for the last three years. Various conservation and user groups (e. g., Trout Unlimited, The Backcountry Horsemen of Missoula, The Nature Conservancy, Professional Wilderness Outfitters Association, Helena Hunters and Anglers) have voiced initial support for the project. The Big Blackfoot Chapter to Trout Unlimited has an account established to help fund the project. Subsequent MRDG processes will be undertaken, and alternatives will likely be refined and potentially modified.

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Assessment of bull trout translocation feasibility upstream of the North Fork Falls, Blackfoot Basin, Montana

by

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Introduction

Bull trout (*Salvelinus confluentus*), *a threatened* species under the Endangered Species Act (USFWS 2010), is an obligate coldwater charr native to high country of western North America. Though actions to recover bull trout have been ongoing for over two decades, many populations continue to decline, including spawning populations in the lower Blackfoot River Basin (Pierce et al. 2016). In addition to a legacy of ongoing impacts such as overgrazing, excessive timber harvest and road building, future threats now involve climate warming and the projected up-valley contraction of bull trout habitat as a routine outcome of warmer stream temperatures and modified runoff regimes (Isaak et al. 2015). Corresponding with this warming, and already documented as underway, is the range expansion of exotic competitors such as brown trout (Al-Chokhachy et al. 2015). With current declines and future threats in mind, meaningful opportunities to recover bull trout are becoming increasingly rare and urgent, and are generally limited to the higher elevations where summer water temperatures are projected to remain cold and suitable for bull trout into the foreseeable future (Isaak et al. 2015).

Translocations are a common activity in species conservation (Seddon et al. 2007), though few examples of translocations are documented for bull trout as the prioritization on recovery of this species by fisheries managers has been very recent (Barry et al. 2014). Even fewer, if any, translocations with successful reproduction have been documented. To improve the chances for successful bull trout translocation Dunham et al. (2011) developed a simple and transparent framework for assessing the feasibility of proposed bull trout translocation projects based on a case study in the Clackamas River. This tiered framework qualitatively scores potential projects on an overall scale between +1.0 and -1.0 and relies heavily on the presence and persistence of suitable coldwater habitat for spawning and rearing. In this study, we applied the Dunham et al. (2011) methodology (*hereafter* Clackamas framework) to assess the feasibility of a successful bull trout translocation in the North Fork Blackfoot River upstream of the Falls, using bull trout from below the Falls as a potential donor population.

Study area

The study area upstream of the North Fork Falls spans a 110 mile^2 4th order drainage, which includes portions of the Lolo National Forest on the western side of the drainage and the Helena National Forest on the eastern side of the drainage. The entire study area falls within the Scapegoat Wilderness.

In addition to the mainstem of North Fork Blackfoot River and the mainstem East Fork of the North Fork, there are sixteen additional (smaller) headwater tributaries upstream of the North Fork Falls, which together form about an 85-mile network of perennial streams (Figure 1). These streams drain the highest mountain peaks of the Blackfoot Basin and flow though alpine meadows, subalpine forest and montane woodlands, while coursing through landforms ranging from glacial cirques to glacial trough and morainal valleys. Though the proposed project area is prone to natural disturbance (wildfire), there are minimal anthropogenic habitat disturbances. In addition, these headwater streams are considered less prone to thermal enrichment because of climate warming (Isaak et al. 2015), which more directly threatens the low-elevation bull trout stocks throughout the Blackfoot River basin. These predicted losses of major portions of suitable habitat for the North Fork bull trout by 2040 (Isaak et al. 2015) and the expected ongoing decline in down-valley bull populations in the Blackfoot River core area provide strong biological justification for the proposed translocation concept.

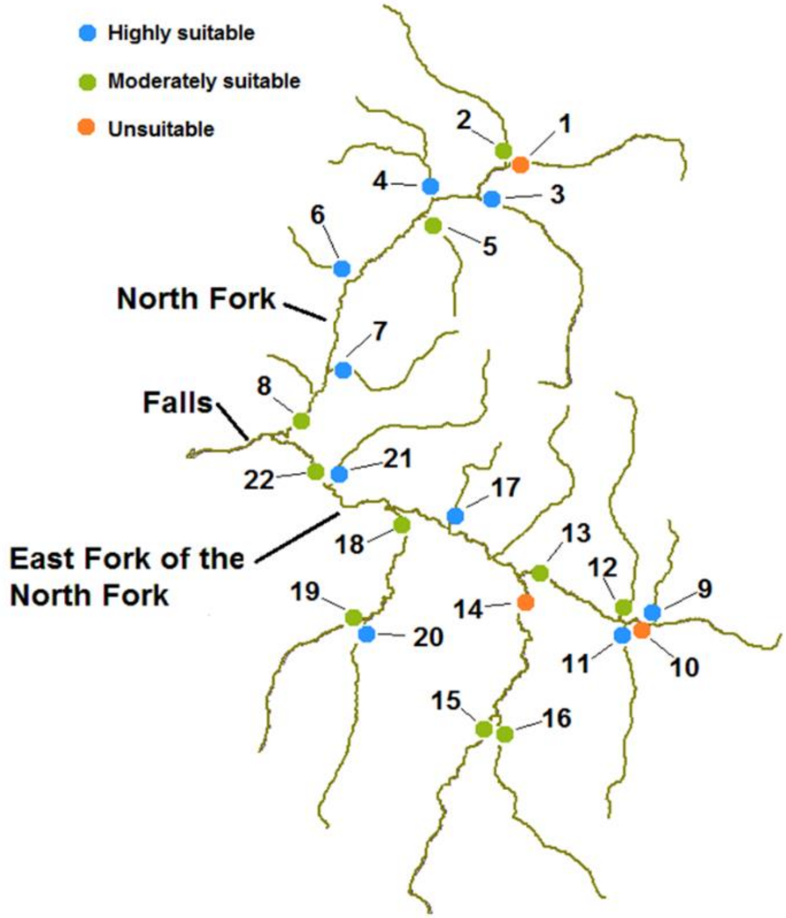

Figure 1: Study area showing temperature monitoring sites and the classification of temperature-related habitat suitability. Numbered monitoring sites reference temperature results in Table 1.

The stream system upstream of the North Fork Falls currently supports *Oncorhynchus* hybrid trout as the only salmonid along with the incidental presence of an unidentified species of sculpin. The stream system contains no other competing salmonid species (e.g., brook or brown trout). Fish-bearing streams and lakes throughout the project area are being considered for a possible rotenone treatment to eliminate the hybrid trout, followed by restocking with nearby sourced native westslope cutthroat trout and bull trout. Both are coadapted, sympatric and widespread within the adjacent Bob Marshall Wilderness Complex (South Fork Flathead), and in the Blackfoot River watershed, including waters downstream of the North Fork Falls. Though bull trout are present and relatively abundant downstream of the Falls, fish populations surveys have failed to detect bull trout upstream of the North Fork Falls. Furthermore, there is no current evidence bull trout were historically present upstream of the Falls.

Methods

To assess the feasibility of a possible bull trout translocation, we identified 1) the potential of the recipient habitat, and 2) the potential of an available donor population for a successful bull trout translocation following the Clackamas framework. To assess the recipient habitat, we generated 5 types of tiered information in response to feasibility questions. These questions are: 1) Was the recipient habitat historically occupied? 2) Are bull trout unlikely to be present now in the recipient habitat? 3) Is the recipient habitat suitable for bull trout spawning and rearing? 4) Have past, present and potential future threats in the recipient habitat been sufficiently mitigated? and 5) Is (re)colonization unlikely to occur in the short-term? In addition, two donor population questions were answered: 1) Is there a donor stock that is an evolutionary match for the recipient habitat? And, if so, 2) Are there enough propagules available without risking the health of the donor population? To identify a cumulative feasibility score under the Clackamas framework, most responses are scored on a scale between +1.0 and -1.0. Scores for each question under the recipient habitat and donor population were averaged for a tier 2 score. The two scores were then averaged to generate a final tier 3 feasibility score.

Four of the five questions associated with the recipient habitat (1,2,4,5) are generally qualitative and easily answered from baseline fisheries studies or study area characteristics (Pierce et al. 2017). The two donor population questions were answered by genetic and life history studies of the North Fork bull trout population (Pierce et al 2016; Swanberg 1996). Thus, the primary quantitative exercise of this feasibility study was to examine habitat suitability with water temperature data specific to the study area.

To identify suitability of the recipient habitat with water temperature (question #3), we compiled water temperature data for all 22 monitoring sites in the proposed project area (Figure 1). Data were derived from continuous water temperature sensors (Onset Computer Corporation, Pocasset, Massachusetts; accuracy = 0.2^{o}C), programmed at 50-minute intervals, and deployed between 10 July 2013 and 9 September 2016. Following the Clackamas framework, we calculated instantaneous daily maximum water temperatures for the known bull trout spawning period (10 September to 30 September 2013, 2014 and 2015), as well as summer rearing period (1 July through 31 August 2013, 2014 and 2015). We did not include 2016 temperature data because we did not have comparative September data for the July/August dataset.

For identification of spawning and rearing suitability, we classified the temperature data into three suitability classes (highly suitable, moderately suitable and unsuitable) as a function of temperature thresholds specific to bull trout as reported in the Clackamas framework. Threshold values for the spawning season were maximum daily water temperatures of $\leq$ or > 9^{o}C. Threshold values for summer rearing temperatures were classified by $\leq$ and > 16^{o}C. To calculate spawning season suitability and summer rearing suitability over the three-year data collection period, we first calculated mean daily maximum water temperatures (and range) for 2013, 2014 and 2015 spawning and rearing periods respectively, then calculated a grand mean for all three years of data. Grand mean values were used to group the data into the three classes of habitat suitability, whereby 1) highly suitable spawning habitat had maximum daily temperatures $\leq$9^{o}C and rearing temperatures $\leq$16^{o}C, 2) moderately suitability temperatures had >9^{o}C spawning season temperatures and $\leq$16^{o}C summer rearing temperatures, and 3) unsuitable temperatures had summer rearing temperatures >16^{o}C.

Results/Discussion

Tier 1 framework scoring – To assess the recipient habitat and donor populations, we scored a total of seven feasibility questions. The five questions, scores and rationale related to the recipient habitat are as follows:

1) *Was the recipient habitat historically occupied*? Fish populations surveys at 43 sites upstream of the North Fork Falls failed to identify presence of bull trout. Likewise, fish populations surveys in adjoining drainages upstream of similar barrier falls (Monture and the Landers Fork) reveal no evidence of bull trout presence. Lacking evidence of bull trout presence and absent historical information, following the Clackamas framework we provided a score of 0.

2) *Are bull trout unlikely to be present now in the recipient habitat*? Because the Clackamas framework asserts that a translocation should not proceed if there is reasonable certainty that the species in question is already present in the recipient habitat, we provided a score +1.0. This positive score reflects reasonable certainty no bull trout occur upstream of the Falls, and that no existing bull trout population will be adversely affected by a translocation.

3) *Is the recipient habitat suitable for bull trout spawning and rearing?* For this question, we compiled temperature data and developed thermal habitat suitability classification for all streams in the proposed project area (Figure 1, Table 1). This exercise identified 19 off 22 sites (86%) with moderate (n=10) to high (n=9) suitability for bull trout, and only three sites thermally unsuitable during the spawning and rearing periods. Interestingly, two of three unsuitable location were among the highest sites in terms of elevation. One site on the East Fork (#10 on Figure 1) is located downstream of Parker Lake, which drains warm water from the lake surface during the summer rearing period. One site on the upper North Fork (#1) has very little up-valley vegetative cover due to intensity of past wildfire. The third site on lower Meadow Creek (#14) is in a wide and shallow, low gradient channel downstream of beaver/wetland complex. Given the overall thermal suitability and interconnected status of the recipient habitat, we gave the recipient habitat a score of +0.75.

4) *Have past, present and potential future threats in the recipient habitat been sufficiently mitigated?* As designated Wilderness, there are no immediate anthropogenic habitat limitations that can be mitigated on site. Climate change is considered a broadscale long-term threat; however, climate projections point to the persistence of large patches of thermally suitable habitat upstream of the North Fork Falls in 2040 and beyond (Isaak et al. 2015). The Clackamas framework makes no mention of climate change threats, but emphasizes the presence of cold water. Consistent with this framework, we scored the question with a value of +1.0 because the threats to bull trout based on climate projections are not unique or specific to this landscape (Isaak et al. 2015). Indeed, this protected region is projected to be one of the more resilient landscapes within the range of the species in the Columbia Headwaters Recovery Unit.

5) *Is (re)colonization unlikely to occur in the short-term?* Under the Clackamas framework, if natural recolonization is likely to occur for a recipient habitat, then a reintroduction effort may not be warranted. Because the North Fork Falls makes (re)colonization impossible, we gave this a score of +1.0.

		July 1 to August 31: bull trout summer rearing period				September 10 to September 30: bull trout spawning period				Recipient habitat suitability		
Stream name	Stream ID	2013	2014	2015	Grand mean summer	2013	2014	2015	Grand mean spawning	Highly suitable (≤9 and ≤16)	Moderately suitable (>9 and ≤16)	Unsuitable (>16 summer)
North Fork Streams		mean (range)°C				mean (range)°C						
NF Blackfoot River (Mile 34.7)	1	19(13 - 22)	15(9 - 19)	17(13 - 20)	17	11(4 - 17)	10(7 - 13)	11(8 - 14)	10.7			Unsuitable
Dobrota Creek	2	13(7 - 16)	11(7 -13)	12(8 - 16)	12	9(4 - 15)	9(6 - 12)	11(7 - 13)	9.7		y	
Cooney Creek	3	11(9 - 12)	10(7 - 11)	11(8 - 13)	10.7	8(4 - 10)	7(5 - 8)	8(6 - 9)	7.7	y		
Broadus Creek (mile 0.1)	4	13(10 - 15)	12(8 - 15)	13(10 - 16)	12.7	9(4 - 13)	8(5 - 11)	9(6 - 11)	8.7	y		
Theodore Creek (Mile 0.1)	5	13(10 - 15)	11(8 - 13)	12(10 - 15)	12	9(4 - 14)	8(5 - 11)	9(7 - 11)	9.6		y	
Sarbo Creek (Mile 0.1)	6	12(9 - 14)	11(7 - 13)	11(9 - 13)	11.3	8(4 - 12)	8(5 - 10)	8(6 - 10)	8	Y		
South Creek (Mile 0.1)	7	13(11 - 15)	12(9 - 14)	12(11 - 15)	12.3	9(5 - 13)	8(6 - 11)	9(8 - 11)	8.7	Y		
NF Blackfoot River (Mile 27)	8	16(11 - 18)	13(9 - 17)	15(11 - 18)	14.7	10(5 - 15)	10(7 - 13)	11(8 - 14)	10.3		y	
East Fork of the North Fork Streams												
Blondie Creek (mile 0.1)	9	13(11 -15)	11(8 - 13)	13(10 - 15)	12.3	9(5 - 13)	9(6 - 11)	10(7 - 12)	9.3	Y		
EF of NF Blackfoot River (mile 9.4)	10	20(15 - 23)	19(11 - 22)	17(13 - 23)	18.7	11(5 - 17)	12(8 - 15)	11(8 - 14)	11.3			Unsuitable
Sourdough Creek (Mile 0.1)	11	11(8 - 12)	9(7 - 11)	10(7 - 12)	10	9(5 - 11)	9(6 - 10)	9(7 - 11)	9	Y		
Scotty Creek (Mile 0.2)	12	14(11 - 16)	13(9 - 16)	13(11 - 16)	13.3	10(6 - 13)	9(7 - 11)	10(8 - 12)	9.7		y	
EF of NF Blackfoot River (mile 7.0)	13	16(11 - 18)	14(10 - 17)	15(12 - 18)	15	11(7 - 15)	11(7 - 13)	12(8 - 14)	11.3		y	
Meadow Creek (Mile 1.4)	14	18(13 - 21)	15(10 - 18)	18(13 - 21)	17	13(5 - 19)	13(8 - 16)	15(10 - 18)	13.7			Unsuitable
Meadow Creek (Mile 4.7)(Mile 5.3)	15	**14(10 - 16)**	**10(8 - 11)**	14(10 - 17)	12.7	11(8 - 15)	9(6 - 11)	10(7 - 12)	10		y	
EF Meadow Creek (Mile 0.1)(Mile 0.9	16	**13(10 - 17)**	**10(7 - 12)**	16(10 - 21)	13	**8(5 - 12)**	10(6 - 14)	12(7 - 14)	10		y	
Spaulding Creek (Mile 0.1)	17	12(9 - 14)	11(8 - 13)	12(10 - 14)	11.7	8(5 - 11)	8(7 - 10)	8(7 - 10)	8	Y		
Mineral Creek (Mile 0.3)	18	16(11 - 17)	14(9 - 13)	15(11 - 18)	15	11(7 - 15)	11(7 - 13)	12(8 - 15)	11.3		y	
Mineral Creek (Mile 3.5)	19	16(12 - 18)	14(10 - 16)	14(10 - 17)	14.7	10(5 - 15)	10(7 - 13)	9(7 - 11)	9.6		y	
EF Mineral Creek (mile 0.1)	20	13(10 - 15)	10(4 - 13)	13(10 - 15)	12	9(4 - 13)	9(7 - 11)	9(7 - 13)(	9	Y		
Camp Creek (mile 0.1)	21	12(10 - 13)	11(8 -13)	12(9 - 130	11.7	9(5 - 12)	9(7 - 11)	9(7 - 11)	9	y		
EF of NF Blackfoot River (mile 1.7)	22	16(12 - 18)	12(9 - 15)	12(10 - 13)	13.3	10(6 - 14)	10(7 - 12)	10(8 - 12)	10		y	

Table 1. Temperature summary for the 2013-2015 spawning and rearing periods and related habitat suitability classifications for 22 temperature data collection sites. Classifications are colored by high suitability (blue), moderate suitability (green) and unsuitable (orange). Stream ID relates to monitoring sites and classification mapping on Figure 1.

To specifically assess the donor population, we scored two feasibility questions. The questions, scores and related rational are as follows:

1) I*s there a donor stock that is an evolutionary match for the recipient habitat?* Genetic studies have determined the North Fork bull trout population downstream of the Falls can be differentiated genetically from other bull trout stocks in the Blackfoot Basin (*see* Robb Leary Report *in* Pierce et al. 2016). The selection of the existing North Fork stock is the ideal donor because it is genetically consistent with the existing North Fork stock should any downstream emigrants traverse the Falls. Furthermore, part of the rationale for this translocation is to provide a genetic refugium to ensure that the North Fork stock is perpetuated, should the bull trout population downstream of the Falls eventually fail (Isaak et al. 2015). Though the North Fork stock has a known migratory behavioral trait (Pierce et al. 2016; Swanberg 1997), the 85 miles of available connected and complex habitat appears to be ample space for the replication of the migratory life history form in a somewhat more limited basin. While we acknowledge some inherent uncertainty, it is difficult to provide a better evolutionary match than a donor stock from the same watershed. Because the project would use the exact evolutionary lineage, we scored this a +1.0.

2) *Are there enough propagules available without risking the health of the donor population?* In this case, our scoring methods differed from that of Dunham et al. (2011). The Clackamas framework subjectively provided only two class values (+1.0 and -1.0) with unrealistically high numbers adult fish (<1000 and >1000) from which to gage adverse donor effects. That is because the Clackamas framework was designed to apply at a more metapopulation and watershed-based scale (e.g., transfer from the Metolius River to the Clackamas River).

Based on a North Fork redd count of 118 in 2016, the North adult spawning population was estimated 375 fish (i. e., 3.2 fish/redd), which does not include non-spawning adults or subadult bull trout. This is one of the more robust populations within the range of the Columbia Headwaters Recovery Unit. Though the number of propagules for the project has yet to be determined, the project currently plans to collect eggs and milt from wild fish and outplant the progeny, versus transfer live fish from the North Fork. This further reduces the potential for unwanted transfer of nontarget organisms and increases the availability of larger numbers.

The project anticipates collecting fewer than 10,000 eggs per year from a handful of females, for a period of up to three years. This number of eggs roughly equals the production of two typical 5 lb adult fluvial female fish (calculated from 1,000 eggs per pound of fish). That equates to about 1-2% of the estimated annual female egg production for the North Fork. With current experience and based on existing incubation success using wild fish at Creston National Fish Hatchery, we anticipate very high (>90%) egg survival. This compares to much lower average survival at emergence (<36%) in spawning tributaries of the Blackfoot River due to natural sediment-induced mortality (Pierce and Podner 2006) or other factors such as incomplete fertilization, which can create less than ideal outcomes for wild fish. The anticipated methods are intended to temporarily boost survival in a controlled incubation environment over the short term to maximize numbers and to foster natural selection by quickly outplanting age 0 progeny into the wild. Thus, we conclude the North Fork Project would minimize impacts to the donor population. Based on these methods, calculated risks to the donor population are considered biologically insignificant. Because some impact is arguably possible, we conservatively scored this question at +0.75.

For this feasibility study, the tier 1 scoring generated an average tier 2 score of +0.75 for the recipient habitat and an average score of +0.87 for the donor population. Thus, the final tier 3 feasibility score was +0.81 (Figure 2). This overall positive score indicates a high likelihood of success if the project is implemented as envisioned.

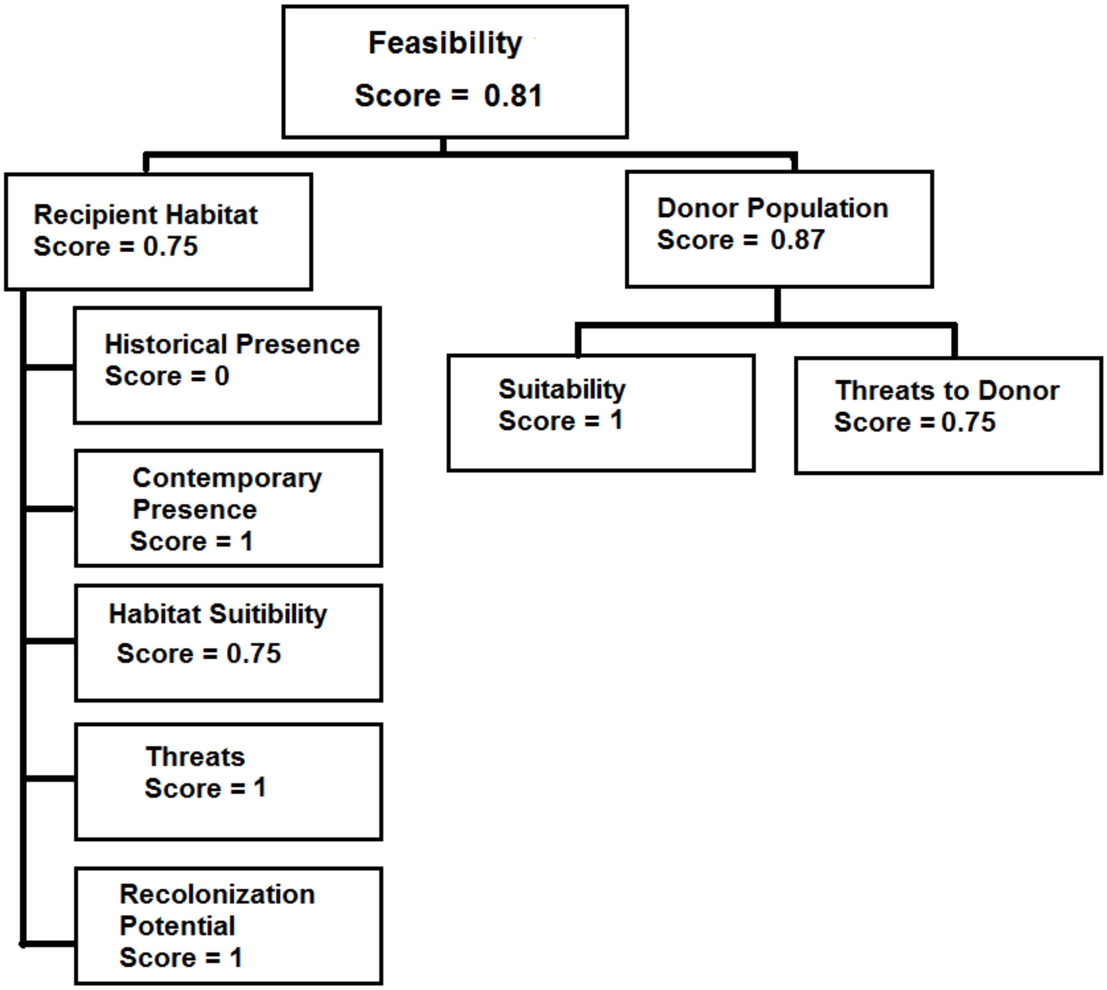

Figure 2. North Fork flowchart showing the scoring for three tiers of the feasibility assessment. The final feasibility score of 0.81 indicate a high level of potential success for a possible bull trout translocation.

In the case of the North Fork upstream of the Falls, it is important to again note the Clackamas framework and the final feasibility score is based largely on metapopulation structure and does not wholly reflect conditions relative to successful bull trout translocation at a smaller scale. For example, the large patch of suitable habitat upstream of the North Fork Falls (110 mile^2 drainage) is larger than watersheds occupied by local populations of bull trout elsewhere in the Blackfoot Core area, in Copper Creek (41 mile^2 drainage), Poorman Creek (43 mile^2 drainage), Gold Creek (63 mile^2 drainage) and Belmont Creek (30 mile^2 drainage), each of which are considered occupied bull trout patches with a known history of ostensibly thousands of years of successful reproduction. Additional key habitat features incorporate major elements of habitat diversity; including groundwater upwelling in potential spawning areas, cold areas providing summer refugia, seasonally productive (warmer water) lakes, beaver complexes generating suitable winter conditions, thermal refugia from drought, and areas of more concentrated seasonal forage. Lastly, the absence of competing nonnative fish species greatly elevate the suitability of upper North Fork for a successful translocation.

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Appendices

Appendix A: Summary of catch and size statistics for fish samples, 2006 - 2016

Appendix B: Summary of stream discharge measurements, 2013 - 2016

Appendix C: Summary of water chemistry readings, 2007 - 2016

Appendix D: Summary of genetic sampling sites and test results, 2005-2016

Appendix E: Summary of invertebrate sampling sites and results, 2013-2014

Appendix F: Summary of water temperatures readings, July 2013 to September 2016

Appendix A: Catch and size statistics for the Upper North Fork Blackfoot River drainage. 2006-2016.

Stream	River Mile	Location (T, R, S)	Date Sampled	Section Length (ft)	Species	Total Number Captured	Number Captured 1st Pass	YOY Captured 1st Pass	Range of Lengths (in)	Mean Length (in)	CPUE (#/100') in 1st Pass	YOY CPUE (#/100') in 1st Pass
Blondie Creek	0.2	16N,9W,9C	5-Aug-13	405	RB*	28	28	0	2.2 - 5.0	3.1	6.9	0.0
					Tailed frogs	common	Spotted frogs &	Western toads	present			
Broadus Creek	0.1	17N,10W,2A	12-Jul-07	280	RB*	4	4	0	5.6 - 8.7	6.8	1.4	0.0
Camp Creek	0.1	17N,10W,34B	4-Sep-13	330	RB*	10	10	6	1.2 - 6.9	2.8	3.0	1.8
	1.6	17N,10W,26B	4-Sep-13	562	No fish found							
					Tailed frogs present							
Cooney Creek	0.2	17N,10W,1A	12-Jul-07	639	CT	1	1	0	7.9	7.9	0.2	0.0
			5-Sep-13	1155	CT*	2	2	0	6.2 - 6.4	6.3	0.2	0.0
					RB*	2	2	0	5.9 - 6.2	6.1	0.2	0.0
	0.4	17N,10W,1A	6-Sep-13	1200	RB*	4	4	0	5.1 - 9.8	6.8	0.3	0.0
	2.4	17N,9W,8B	6-Sep-13	770	No fish found							
Dobrota Creek	0.1	18N,9W,31C	13-Jul-07	1044	RB*	28	28	0	4.6 - 10.7	7.7	2.7	0.0
	1	18N,10W,25D	20-Jul-16	328	No fish	found	tadpoles	observed				
Dry Fork of North Fork Blackfoot River	3	17N,11W,24A	20-Jul-16	1000	DV	1	1	0	4.7	4.7	0.1	0.0
					CT*	21	21	0	3.3 - 6.2	4.3	2.1	0.0
East Fork of North Fork Blackfoot River	0.1	17N,10W,28C	18-Jul-16	187	Sculpin survey	No sculpins	found					
	1.9	17N,10W,34C	4-Sep-13	490	RB*	20	20	0	3.7 - 8.9	5.4	4.1	0.0
	7	16N,9W,7B	11-Jul-06	689	RB*	32	32	21	2.0 - 9.1	4.0	4.6	3.0
					Western toads present							
			8-Aug-13	690	RB*	59	59	0	2.8 - 9.2	4.5	8.6	0.0
"south channel"	9	16N,9W,8C	6-Aug-13	630	RB*	25	25	0	2.9 - 8.2	4.8	4.0	0.0
	11.7	16N,9W,10D	10-Jul-06	330	No fish found							
Kenny Creek	0.1	17N,10W,34C	18-Jul-16	360	RB*	3	3		4.4 -6.3	5.6		
Spot shocked, No CPUE generated												
Lost Pony Creek	0.85	16N,9W,6B	8-Aug-13	251	RB*	39	39	16	2.1 - 6.6	3.7	15.5	6.4
"Effluent channel from "Lower Twin Lake"	0.8	16N,9W,6B	11-Jul-06	540	RB*	14	14	8	1.3 - 6.3	3.5	2.6	1.5
					Columbia spotted frog present							
Meadow Creek	2.6	16N,9W,18A	6-Sep-08	1025	RB*	30	30	3	2.8 - 9.1	4.2	2.9	0.3
					Western toads present							
	5.2	16N,10W,24D	7-Sep-08	986	RB*	24	24	9	2.6 - 6.5	4.3	2.4	0.9
					Tailed frogs present							
			7-Aug-13	986	RB*	4	4	0	5.8 - 8.1	6.9	0.4	0.0
East Fork Meadow Creek	0.8	16N,10W,25A	7-Sep-08	1026	RB*	6	6	1	3.0 - 8.2	5.7	0.6	0.1
			7-Aug-13	1026	RB*	9	9	0	4.7 - 8.7	6.3	0.9	0.0
	2.2	16N,9W	7-Sep-08	500	No fish found							
	2.5	16N,9W	7-Sep-08	354	No fish found							
West Fork of East Fork Meadow Creek	0.1	16N,9W	7-Sep-08	347	No fish found							
					Tailed frogs present							

All CPUE based on year class sizes
CT = Cutthroat trout
DV = Bull trout
RB = Rainbow trout
ONC = Oncorhynchus species

* Sample may include rainbow trout / cutthroat trout hybrids

Appendix A: Catch and size statistics for the Upper North Fork Blackfoot River drainage. 2006-2016 cont'd.

Stream	River Mile	Location (T, R, S)	Date Sampled	Section Length (ft)	Species	Total Number Captured	Number Captured 1st Pass	YOY Captured 1st Pass	Range of Lengths (in)	Mean Length (in)	CPUE (#/100') in 1st Pass	YOY CPUE (#/100') in 1st Pass
Mineral Creek	2.1	16N,10W,10C	8-Sep-08	669	RB*	33	33	15	3.4 - 10.3	5.1	4.9	2.2
	4.2	16N,10W,10C	8-Sep-08	310	RB*	30	30	14	2.8 - 7.5	4.8	9.7	4.5
East Fork Mineral Creek	0.6	16N,10W,10C	8-Sep-08	516	RB*	10	10	0	4.7 - 9.4	6.6	1.9	0.0
North Fork Blackfoot River												
Below North Fork Falls, survey conducted to determine the presence of sculpins	25.2	17N,10W,29C	18-Jul-16	150	Sculpins	8	4	4	2.3 - 3.2	2.7	2.7	2.7
Above North Fork Falls, survey conducted to determine the presence of sculpins	26.4	17N,10W,28C	18-Jul-16	1500	No Sculpins	found						
	26.8	17N,10W,28C	11-Jul-07	858	RB*	2	2	0	7.8 - 11.9	9.8	0.2	0.0
					Sculpin	1	1	0	3.0	3.0	0.1	0.0
Survey conducted to determine the presence of sculpins	27.2	17N,10W,28D	27-Aug-14	1182	RB	3	3	0	8.0	8.0	0.3	0.0
					No Sculpins	found						
	32	17N,10W,2C	12-Jul-07	2400	RB*	28	28	0	5.5 - 13.2	8.6	1.2	0.0
					Columbia spotted frogs present							
	34.7	18N,9W,31C	13-Jul-07	660	RB*	34	34	8	2.5 - 8.7	5.4	5.2	1.2
downstream of upper falls	36.4	18N,9W,32D	19-Jul-16	360	No fish	adult tailed frogs	common	tadpoles	abundant			
upstream of upper falls	36.9	18N,9W,33B	19-Jul-16	328	No fish	adult tailed frogs	common	tadpoles	abundant			
Sarbo Creek	0.1	17N,10W,10C	27-Aug-14	114	No fish found							
Scotty Creek	0.2	16N,9W,8D	12-Jul-06	403	RB*	42	42	20	2.1 - 8.1	4.2	10.4	5.0
					CT*	1	1	0	8.9	8.9	0.2	0.0
					Western toads present							
			6-Aug-13	403	RB*	35	35	0	3.1 - 7.6	4.7	8.7	0.0
					Tailed frogs present							
Sourdough Creek	0.6	16N,9W,17A,D	12-Jul-06	651	RB*	3	3	0	5.4 - 9.4	7.2	0.5	0.0
			6-Aug-13	650	RB*	3	3	0	6.0 - 7.3	6.8	0.5	0.0
	1	16N,9W,17D	5-Aug-13	600	No fish found							
South Creek	0.1	17N,10W,22B	27-Aug-14		YOY oncorhynchus species observed							
	0.4	17N,10W,22B	20-Jul-16	300	ONC	10	10	3	2.6 - 6.9	4.4	3.3	1.0
	1.2	17N,10W,23C	4-Sep-13	310	No fish found, Tailed frogs present							
Spaulding Creek	0.1	16N,10W,2A	7-Aug-13	275	RB*	2	2	0	5.1 - 5.2	5.1	0.7	0.0
Theodore Creek	0.2	17N,10W,2D	12-Jul-07	450	No fish found							
					Columbia spotted frog present							
Un-named tributary stream entering North Fork Blackfoot River near stream mile 27.8	0.1	17N,10W,21D	27-Aug-14	240	No fish found							

All CPUE based on year class sizes
CT = Cutthroat trout
RB = Rainbow trout
ONC = Oncorhynchus species

* Sample may include rainbow trout / cutthroat trout hybrids

Appendix A: Catch and size statistics for the Landers Fork drainage. 2015.

Stream	River Mile	Location (T, R, S)	Date Sampled	Section Length (ft)	Species	Total Number Captured	Number Captured 1st Pass	YOY Captured 1st Pass	Range of Lengths (in)	Mean Length (in)	CPUE (#/100') in 1st Pass	YOY CPUE (#/100') in 1st Pass
Bighorn Creek	0.45	16N,8W,8C	10-Aug-15	300	CT*	43	43	0	2.1 - 9.4	4.1	14.3	0.0
					Tailed frog &	Spotted frogs	observed					
Falls Creek	0.2	16N,8W,35A	12-Aug-15	578	CT*	21	21	0	2.5 - 7.1	4.7	3.6	0.0
					Western toad	observed						
Fickler Creek	0.4	16N,8W,22A	11-Aug-15	300	No fish	found	No amphibians	observed				
Indian Meadows Creek	0.4	15N,8W,12B	5-Jun-14	450	CT	34	34	14	2.2 - 6.0	3.5	7.6	3.1
Landers Fork	11.2	16N,8W,35D	12-Aug-15	1260	CT	21	21	0	2.9 - 15	6.6	1.7	0.0
					Sculpins	present						
	18.1	16N,8W,8C	10-Aug-15	300	CT	34	34	3	1.6 - 10.6	4.8	11.3	1.0
					Sculpins	common						
Lookout Creek	0.9	16N,8W,16B	11-Aug-15	405	No fish found	No amphibians	observed					

All CPUE based on year class sizes

CT = Cutthroat trout

* Sample may include rainbow trout / cutthroat trout hybrids

Appendix B. USFS stream discharge measurements upstream of the North Fork Falls, 2013 - 2016.

Stream	Location			September 23-26, 2013 discharge (cfs)	August 25-28, 2014 discharge (cfs)	September 8-10, 2016 discharge (cfs)	Drainage area above sensor ($mile^2$)
	Stream mile	Latitude	Longitude				
Blondie Creek	0.1	47.15448	-112.74642		0.2		1.1
Broadus Creek	0.1	47.25802	-112.83232	0.7	1.5		3.3
Camp Creek	0.1	47.18436	-112.86495	0.6	1.4		4.1
Cooney Creek	0.2	47.25838	-112.81576	2.9	6.3		9.2
Dobrota Creek	0.1	47.26740	-112.80669	2.5	6.6		5.5
East Fork North Fork Blackfoot River	0.1	47.19614	-112.88720	28.7	49.1	25.9	65.1
East Fork North Fork Blackfoot River	9.5	47.15280	-112.75679	4.0	7.2		9.0
Effluent channel from Twin Lake (Lost Pony Drainage)	0.1	47.16992	-112.80357	0.3			
Meadow Creek	0.1	47.16247	-112.79532	10.9	17.4		18.8
Mineral Creek	0.3	47.17613	-112.83837	7.7	11.7		14.6
North Fork Blackfoot River	26.8	47.19652	-112.88673	11.1	28.7	12.4*	39.9
North Fork Blackfoot River	34.7	47.26707	-112.80610	1.1	4.9		7.1
Sarbo Creek	0.1	47.23632	-112.86205	0.3	0.6		1.5
Scotty Creek	0.2	47.15450	-112.75726	0.6	2.0		4.2
Sourdough Creek	0.1	47.15248	-112.75678	1.1	2.6		5.0
South Creek	0.1	47.21288	-112.86847		0.4		2.2
Spaulding Creek	0.1	47.17594	-112.82015	0.1	0.2		1.1
Theodore Creek	0.1	47.25334	-112.83464	0.1	0.3		0.9
Un-named trib entering NFBLKFT at mile 27.8	0.1	47.20767	-112.87333	1.6	1.6		1.3

*** Discharge based on an FWP estimate**

Appendix C: Summary of water chemistry readings for Upper North Fork Blackfoot River drainage 2007-2016.

Stream name	Date	Stream Mile	Lat	Long	pH	Conductivity (uS)	TDS (ppm)
Blondie Creek	5-Aug-13	0.2	47.15471	112.7463	8.1	138	78
Broadus Creek	12-Jul-07	0.1	47.25801	112.83223		197	98
	28-Aug-14		47.25772	112.83198	8.1	165	82
Camp Creek	4-Sep-13	0.1	47.18376	112.86497	8.6	258	122
	4-Sep-13	1.6	47.19994	112.84849	8.5	222	103
Cooney Creek	5-Sep-13	0.2	47.25793	112.81074	8.5	202	143
	27-Aug-14		47.25832	112.81521	7.9	133	68
	6-Sep-13	2.4	47.24397	112.78135	8.7	185	131
Dobrota Creek	13-Jul-07	0.1	47.26928	112.80687		148	74
	28-Aug-14		47.26723	112.80679	7.9	127	63
	20-Jul-16	1	47.27949	112.80953		171	
Dry Fork of the North Fork Blackfoot River	20-Jul-16	3	47.2143	112.93836	8.3	201	104
Kenny Creek	18-Jul-16	0.1	47.18263	112.86499	8.4	275	137
Lost Pony Creek	8-Aug-13	0.8	47.17528	112.79342	8	133	66
Meadow Creek	6-Sep-08	2.6	47.13887	112.79452	8.5	152	78
	7-Aug-13	5.2	47.11842	112.81139	8	138	78
East Fork Meadow Creek	7-Aug-13	0.8	47.11831	112.79995	8.1	108	54
	7-Sep-08	2.5	47.10084	112.7918	8.7	95	50
West Fork of East Fork Meadow Creek	7-Sep-08	0.1	47.10002	112.79225	8.1	57	30
Mineral Creek	8-Sep-08	2.1	47.1588	112.84092	8.1	178	91
	8-Sep-08	4.2	47.14819	112.86125	8.4	141	72
East Fork Mineral Creek	8-Sep-08	0.6	47.14387	112.85385	8.5	147	74
North Fork Blackfoot River	18-Jul-16	25.2	47.19194	112.90872	8.5	198	
	18-Jul-16	26.4	47.19658	112.8907		200	
	11-Jul-07	26.8	47.19729	112.88304	8.8	177	89
	27-Aug-14	27.2	47.19725	112.88096	8.1	142	74
	12-Jul-07	32	47.24827	112.84164		157	78
	28-Aug-14		47.25443	112.83547	8.2	142	74
	13-Jul-07	34.7	47.2675	112.80538		109	55
	28-Aug-14		47.26689	112.80644	7.8	85	42
	19-Jul-16	36.9	47.27545	112.76192		97	
East Fork of North Fork Blackfoot River	4-Sep-13	1.9	47.18352	112.86468	8.6	244	173
	8-Aug-13	7	47.16366	112.79526	8.1	175	87
	6-Aug-13	9	47.15443	112.76804	8.2	205	102
Sarbo Creek	27-Aug-14	0.1	47.23628	112.86194	8.1	159	80
Scotty Creek	6-Aug-13	0.2	47.15457	112.75702	7.7	84	41
Sourdough Creek	6-Aug-13	0.6	47.14685	112.75656	7.9	166	84
	5-Aug-13	1	47.14014	112.75302	8.1	156	76
South Creek	20-Jul-16	0.4	47.21439	112.86357	7.7	216	
	4-Sep-13	1.2	47.20865	112.84927	8.3	229	163
Spaulding Creek	8-Aug-13	0.1	47.17591	112.8201	8.2	249	123
Theodore Creek	12-Jul-07	0.2	47.25377	112.83523		166	83
	28-Aug-14		47.25364	112.83527	8.1	125	66
Un-named tributary stream entering North Fork Blackfoot River near stream mile 27.8	27-Aug-14	0.1	47.2075	112.87346	8	125	60

Appendix D: Upper North Fork Blackfoot River drainage genetic sample summary, 2004 - 2016.

Stream / Lake name	Date collected	Stream mile	Location T,R,S	Lat	Long	Species	Sample number	# of genetic samples collected	genetic samples tested	Taxa ID*
Blondie Creek	5-Aug-13	0.2	16N,9W,9C	47.15471	112.74631	Hyb	4763	20	10	RBT x YCT x WCT
Broadus Creek	12-Jul-07	0.1	17N,10W,2A	47.25801	112.83223	Hyb	3505	4	4	RBTx WCT
Cabin Creek (Tributary to Dry Fork of the North Fork Blackfoot River)	13-Jul-04	0.5	17N,11W,13B	47.23086	112.94829	Hyb	2977	29	26	WCT x RBT
Camp Creek	4-Sep-13	0.1	17N,10W,34C	47.18376	112.86497	Hyb	4770	10	10	RBT x YCT
Canyon Creek (Tributary to Dry Fork of the North Fork Blackfoot River)	14-Jul-07	1.5	17N,11W,14C	47.21952	112.97434	WCT	3508	30	25	WCT
Cooney Creek	12-Jul-07	0.2	17N,10W,1A	47.25836	112.81499	WCT	3510	1	1	WCT
Cooney Creek	5-Aug-13	0.2-0.4	17N,10W,1A	47.25836	112.81499	Hyb	4764	8	8	RBT x YCT
Dobrota Creek	13-Jul-07	0.1	18N,9W,31C	47.26928	112.80687	Hyb	3511	28	5	RBT x WCT x YCT
Dry Fork of the North Fork Blackfoot River	20-Jul-16	3	17N,11W24A	47.2143	112.93836	HYb		22	16	WCT x RBT
Effluent channel from Lower Twin Lake, (Lost Pony Creek drainage)	11-Jul-06	0.8	16N,9W,6B	47.17254	112.79581	Hyb	3363	10	5	RBT x YCT x WCT
Kenny Creek	18-Jul-16	0.1	17N,10W,34C	47.18263	112.86499	RBT		3		
Lost Pony Creek	8-Aug-13	0.8	16N,9W,6B	47.1752811	112.79342	Hyb	4766	24	10	RBT x YCT x WCT
Meadow Creek	6-Sep-08	2.6	16N,9W,18	47.13887	112.79452	Hyb	3856	28	4	RBT x YCT x WCT
Meadow Creek	7-Sep-08	5.2	16N,10W,24D	47.11841	112.81139	Hyb	3857	15	4	RBT x YCT x WCT
East Fork Meadow Creek	7-Sep-08	0.8	16N,10W,25A	47.11820	112.80013	Hyb	3858	6	4	RBT x YCT x WCT
East Fork Meadow Creek	7-Aug-13	0.8	16N,10W,25A	47.1183065	112.79995	Hyb	4765	9	9	RBT x YCT x WCT
Mineral Creek	8-Sep-08	2.1	16N,10W,10A	47.1588	112.84092	Hyb	3863	28	8	RBT x YCT x WCT
Mineral Cr above E.F Mineral	8-Sep-08	4.2	16N,10W,10C	47.14819	112.86125	Hyb		28		
East Fork Mineral Creek	8-Sep-08	0.6	16N,10W,15B	47.14387	112.85385	Hyb	3864	10	5	RBT x YCT x WCT
North Fork Blackfoot River (below South Cr)	11-Jul-07	26.8	17N,10W,28C	47.19729	112.88304	Hyb	3522	2	2	RBT x YCT x WCT
North Fork Blackfoot River (below Theodore Cr)	12-Jul-07	32	17N,10W,2C	47.24827	112.84461	Hyb	3523	28	5	RBT x YCT x WCT
North Fork Blackfoot River (above Dobrota Cr)	13-Jul-07	34.7	18N,9W,31C	47.2675	112.80538	Hyb	3521	30	5	RBT x YCT x WCT
East Fork of NFBLKFT	4-Sep-13	1.9	17N,10W,34C	47.18352	112.86468	Hyb	4762	10	10	RBT x YCT x WCT
East Fork of NFBLKFT	11-Jul-06	7	16N,9W,7B	47.16365	112.7952	Hyb	3360	28	5	RBT x YCT x WCT
East Fork of NFBLKFT (South Channel)	6-Aug-13	9	16N,9W8C	47.15493	112.76985	Hyb	4762	22	22	RBT x YCT x WCT
Scotty Creek	12-Jul-06	0.2	16N,9W,8D	47.1545	112.75689	Hyb	3362	29	5	RBT x YCT x WCT
Sourdough Creek	12-Jul-06	0.6	16N,9W,17A	47.14685	112.75656	Hyb	3361	3	3	RBT x YCT x WCT
South Creek	20-Jul-16	0.4	17,10W,22B	47.21439	112.86357	ONC		10		
Spaulding Creek	7-Aug-13	0.1	16N,10W,2A	47.1759062	112.8201	Hyb	4767	2	2	RBT x YCT
Lower Twin Lake	21-Jun-05		16N,9W,6C	47.1732	112.78976	Hyb	3099	25	25	RBT x YCT x WCT
Meadow Lake	22-Jun-05		16N,9W,18B	47.14576	112.78877	Hyb	3279	3	3	RBT x WCT
Parker Lake	20-Jul-05		16N,9W,9D	47.15379	112.73933	Hyb	3098	28	26	YCT x RBT x WCT

RBT = Rainbow trout
WCT = Westslope cutthroat trout
YCT = Yellowstone cutthroat trout
ONC = Oncorhynchus species
Hyb = Hybrid

* All taxa ID in order of predominant genetic contribution

Summary of *Oncorhynchus* Genetic Tests

summaries of all genetic analyses are from genetic samples collected from the North Fork Blackfoot River and its tributaries upstream of the North Fork falls and two samples from the Dry Fork of the North Fork drainage (Dry Fork and Cabin Creek). All *Oncorhynchus* genetic analyses are organized below in alphabetical order. The summaries include the genetic sample lot number as well as the individual sample size. These analyses were conducted at the University of Montana Conservation Genetics Laboratory and were written by Dr. Robb Leary. All other information related to genetic samples can be obtained from Montana Fish, Wildife and Parks by referencing the sample # ID.

Blondie Creek: Sample # 4763 (n=10)

In the sample from Blondie Creek, alleles characteristic of rainbow trout were detected at all of the rainbow markers, alleles characteristic of westslope cutthroat trout were detected at only four of the westslope markers, and alleles characteristic of Yellowstone cutthroat trout were detected at all of the Yellowstone markers. This sample, therefore, provided conclusive evidence of hybridization among westslope cutthroat, rainbow, and Yellowstone cutthroat trout. The Yellowstone cutthroat (X^2_{19}=31.561, P<0.05) and rainbow trout (X^2_{18}=65.332, P<0.001) allele frequencies were statistically heterogeneous among the respective markers and the alleles were clearly not randomly distributed among the fish in the sample (Figures 3 and 4). All the fish in the sample, however, were definitely of hybrid origin among all three taxa. The trout in Blondie Creek, therefore, should simply be considered to be hybrids among rainbow, Yellowstone cutthroat, and westslope cutthroat trout with a major rainbow (about 50 percent) and Yellowstone cutthroat (about 48 percent) and minor westslope cutthroat trout (about two percent) genetic contribution.

Broadus Creek: Sample #3505 (n=4)

Alleles characteristic of both westslope cutthroat and rainbow trout were detected at seven of the 13 diagnostic loci between these species that were analyzed in the sample from Broadus Creek. The allele frequencies were statistically homogeneous (X^2_{12}=7.448; P>0.05) among the diagnostic loci and the rainbow trout alleles appeared to be randomly distributed (X^2_{3}=2.879; P>0.10) among the fish in the sample. This sample, therefore, appears to have come from a hybrid swarm between westslope cutthroat and rainbow trout with a predominant (0.93) rainbow trout genetic contribution.

Cabin Creek: Tributary to Dry Fork of the North Fork Blackfoot River sample # 2977 (n=26)

PINE fragments characteristic of westslope cutthroat and rainbow trout were detected at three of the six diagnostic markers between these fishes that wrer analyzed in the sample. Although the frequency of rainbow trout alleles among the marker loci was statistically homogeneous (P>0.50), the markers characteristic of rainbow trout was not randomly distributed (P<0.001) among the fish in the sample. In contrast, all the rainbow markers were detected in only one fish. All the other fish possessed markers characteristic of only westslope cutthroat trout. These results suggest this population is a mixture of hybridized and non-hybridized westslope cutthroat trout. The vast predominance of what appears to be non-hybridized westslope cutthroat trout in the sample and the relatively high frequency of rainbow fragments (0.30) in the fish definitely of hybrid origin suggest the latter is a recent migrant into the population. Thus, interbreeding between non-hybridized westslope cutthroat trout and fish of hybrid origin may not have begun at the time of sampling. The presence if fish of hybrid origin in the population seriously threatens the continued genetic integrity of the non-hybridized fish.

Camp Creek: Sample #4770 (n=10)

Alleles characteristic of rainbow trout were detected at all of the rainbow markers, no alleles characteristic of westslope cutthroat trout were detected at the westslope markers, and alleles characteristic of Yellowstone cutthroat trout were detected at six of the Yellowstone markers in the sample from Camp Creek. This sample, therefore, provided conclusive evidence of hybridization between rainbow and Yellowstone cutthroat trout. Although the Yellowstone cutthroat trout allele frequencies were statistically heterogeneous (X^2_{38}=148.388, P<0.001) among the rainbow and Yellowstone markers, the Yellowstone cutthroat trout alleles appeared to be randomly distributed (X^2_{10}=6.338, P>0.50) among the fish in the sample. Furthermore, all of the fish in the sample were definitely of hybrid origin (Figure 8). Camp Creek, therefore, appears to contain a hybrid swarm between rainbow and Yellowstone cutthroat trout with a predominant (0.932) rainbow trout genetic component.

Canyon Creek: Tributary to Dry Fork of the North Fork Blackfoot River Sample #3508 (n=25)

Alleles characteristic of only westslope cutthroat trout were detected at all the loci analyzed in the sample from Canyon Creek (Table 5). With the sample size of 25, we have better than a 99% chance of detecting as little as a one percent rainbow trout and better than a 98% chance of detecting as little as a one percent Yellowstone cutthroat trout genetic contribution to a hybrid swarm that once was non-hybridized westslope cutthroat trout. Canyon Creek, therefore, very likely contains a non-hybridized westslope cutthroat trout population.

Cooney Creek: Sample #3510 (n=1)
A single fish believed to be a rainbow trout was collected from Cooney Creek. In contrast to the expectation, alleles characteristic of only westslope cutthroat trout were detected at all the loci analyzed in this fish. This fish, therefore, was undoubtedly not a rainbow trout and in fact may possibly have been a non-hybridized westslope cutthroat trout.

Cooney Creek: Sample #4764 (n=8)
Alleles characteristic of rainbow trout were detected at all of the rainbow markers, no alleles characteristic of westslope cutthroat trout were detected at the westslope markers, and alleles characteristic of Yellowstone cutthroat trout were detected at 13 of the Yellowstone markers in the sample from Cooney Creek. Thus, this sample provided good evidence of hybridization between rainbow and Yellowstone cutthroat trout. Although the Yellowstone cutthroat and rainbow trout allele frequencies were statistically heterogeneous (X^2_{38}=71.423, P<0.001) among the markers all fish in the sample were definitely of hybrid origin (Figure 5). The fish in Cooney Creek, therefore, should simply be considered to be hybrids between rainbow and Yellowstone cutthroat trout with a major rainbow trout (about 88 percent) genetic contribution.

The above results are in stark contrast to those obtained from an indel/microsatellite analysis of a single trout collected from Cooney Creek (#3510, col. 7/12/07, 47.258 112.81). This fish was believed to be a rainbow trout but, the results suggested it was a non-hybridized westslope cutthroat trout. If such fish still persist in Cooney Creek, the recent results suggest that they are relatively uncommon.

Dobrota Creek: Sample #3511 (n=5)
Alleles characteristic of rainbow, Yellowstone cutthroat, and westslope cutthroat trout were detected in the sample collected from Dobrota Creek. The westslope cutthroat (X^2_6=19.027; P<0.01) and Yellowstone cutthroat trout (X^2_7=23.563; P<0.01) allele frequencies were statistically heterogeneous among the diagnostic loci and

they were not randomly distributed (X^2_{11}=123.008; P<0.001) among the fish in the sample. Although Dobrota Creek does not appear to contain a hybrid swarm, all the fish in the sample were definitely of hybrid origin. From a management perspective, therefore, Dobrota Creek should simply be considered to contain hybrids among westslope cutthroat, Yellowstone cutthroat, and rainbow trout with a predominant rainbow trout genetic contribution.

Dry Fork of the North Fork Blackfoot River: Sample #   (n=22)

Alleles characteristic of rainbow trout were detected at 17 of the rainbow markers and 19 of the westslope markers were polymorphic in the sample from Dry Fork. In the sample, all of the Yellowstone markers possessed alleles characteristic of rainbow or westslope cutthroat trout except at *OclYGD106457_Garza*. The allele usually characteristic of Yellowstone cutthroat trout at *OclYGD106457-Garza* could indicate a small amount of hybridization with Yellowstone cutthroat trout or a westslope cutthroat trout polymorphism This locus has been found to be polymorphic in numerous other samples we have analyzed that otherwise appeared to be non-hybridized westslope cutthroat trout (Table 3). In this case, therefore, we strongly favor the westslope cutthroat trout polymorphism interpretation for the presence of variation at *OclYGD106457_Garza* in the sample. Thus, this sample contained conclusive evidence of hybridization only between westslope cutthroat and rainbow trout.

Lost Pony Creek drainage (Twin Lake Outlet Channel): Sample #3363 (n=5)

Alleles characteristic of both rainbow and Yellowstone cutthroat trout were detected at eight of the 14 diagnostic loci between these fishes that were analyzed in the sample from effluent channel from Twin Lake in the Lost Pony Creek drainage. The allele frequencies were statistically heterogeneous (X2 13=36.252; P<0.001) among the diagnostic loci but, the Yellowstone cutthroat trout alleles appeared to be randomly distributed (X 27=3.228; P>0.50) among the fish in the sample. At Ssa408* and Omm1037-1*, alleles characteristic of westslope cutthroat trout were detected in the 368 sample. Although, the allele frequencies were statistically heterogeneous (X2 12=77.509; P<0.001) among the diagnostic loci, the westslope cutthroat trout alleles appeared to be randomly distributed (X2 3=2.486; P>0.10) among the fish in the sample. Considering all the data, therefore, the sample from the effluent channel of Twin Lake appears to contain a hybrid swarm among rainbow, Yellowstone cutthroat, and westslope cutthroat trout with a predominant (0.839) rainbow trout genetic contribution.

Lost Pony Creek: Sample #4766 (n=10)

Alleles characteristic of rainbow trout were detected at all of the rainbow markers, alleles characteristic of westslope cutthroat trout were detected at seven of the westslope markers, and alleles characteristic of Yellowstone cutthroat trout were detected at ten of the Yellowstone markers in the sample from Lost Pony Creek. This sample, therefore, provided good evidence of hybridization among rainbow, Yellowstone cutthroat, and westslope cutthroat trout. Disregarding the small (0.025) westslope cutthroat trout genetic component, the Yellowstone cutthroat trout allele frequencies were statistically heterogeneous (X^2_{38}=89.392, P<0.001) among the rainbow and Yellowstone markers. All fish in the sample, however, were definitely of hybrid origin (Figure 7). Thus, Lost Pony Creek should simply be considered to contain hybrids among rainbow, Yellowstone cutthroat, and westslope cutthroat trout with a substantial rainbow (about 88 percent) and minor Yellowstone (about 9.5 percent) and westslope cutthroat trout genetic contribution.

The above results are highly concordant with those obtained from a previous indel/microsatellite analysis of a sample of trout collected from Lost Pony Creek (#3363, col. 7/11/06, T16N R10W S1 47.173 112. 796, N=5). This analysis also indicated the creek contained hybrids among rainbow, Yellowstone cutthroat, and westslope cutthroat trout with a substantial rainbow and minor Yellowstone and westslope cutthroat trout genetic component.

Meadow Creek combined (n=12)

Samples were collected from two reaches of Meadow Creek. Evidence of hybridization with rainbow and Yellowstone cutthroat trout was detected in both samples. Because of the small sample sizes, we increased statistical power to detect evidence of genetic differences by comparing the frequency of westslope cutthroat, Yellowstone cutthroat, and rainbow trout alleles averaged over all the diagnostic loci between the samples. Contingency table chi-square analysis indicates that the average frequency of westslope cutthroat and rainbow trout alleles was statistically heterogeneous (X^2_1=4.020, P<0.05) between the samples but, the average frequency of Yellowstone cutthroat trout alleles was statistically homogeneous (X^2_1=2.798, P>0.05). Because of the former difference, the samples were treated separately for further analysis.

Meadow Creek (lower): Sample #3856 (n=4)

Alleles characteristic of westslope cutthroat trout were detected at one of the diagnostic loci for this fish that were analyzed in the sample from upper Meadow Creek. In the sample, alleles characteristic of Yellowstone cutthroat trout were detected at two diagnostic loci for this fish that were analyzed. At 12 loci analyzed, alleles characteristic of only rainbow trout were detected. Normally, we would be uncertain whether the apparent westslope and Yellowstone cutthroat trout alleles represented evidence of hybridization or if they were simply rainbow trout genetic variation. In this situation, however, we favor the hybridization interpretation because fish lower in the drainage clearly appear to be hybrids among rainbow, westslope cutthroat, and Yellowstone cutthroat trout (see #3857). The rainbow and Yellowstone cutthroat trout allele frequencies were statistically homogeneous (X^2_{12}=19.283, P>0.05 and X^2_7=7.404, P>0.10, respectively) among the diagnostic loci and the alleles appeared to be randomly distributed (rainbow X^2_2=0.693, P>0.50, Yellowstone X^2_1=0.148, P>0.50) among the fish in the sample. Thus, this reach of Meadow Creek appears to contain a hybrid swarm among rainbow, westslope cutthroat, and Yellowstone cutthroat trout with a predominant (0.971) rainbow trout genetic contribution.

Meadow Creek (upper): Sample #3857 (n=4)

In the sample from lower Meadow Creek, alleles characteristic of westslope cutthroat trout were detected at four diagnostic loci for this fish that were analyzed. Also, alleles characteristic of Yellowstone cutthroat trout were detected at four of the diagnostic loci for this fish that were analyzed. At six loci analyzed alleles characteristic of only rainbow trout were detected. The rainbow and Yellowstone cutthroat trout allele frequencies were statistically homogeneous (X^2_{12}=9.065, P>0.50 and X^2_7=6.776, P>0.10, respectively) among the diagnostic loci and the alleles appeared to be randomly distributed (rainbow X^2_3=5.953, P>0.10, Yellowstone X^2_2=1.803, P>0.10) among the fish in the sample. Thus, lower Meadow Creek appears to contain a hybrid swarm among rainbow, westslope cutthroat, and Yellowstone cutthroat trout with a predominant (0.904) rainbow trout genetic component.

East Fork Meadow Creek: Sample #3858 (n=4)

Alleles characteristic of westslope cutthroat trout were detected at nine of the diagnostic loci for this fish that were analyzed in the sample from East Fork Meadow Creek. In the sample, alleles characteristic of Yellowstone cutthroat trout were detected at five diagnostic loci for this fish that were analyzed. At two loci analyzed, alleles characteristic of only rainbow trout were detected (Tables 2 and 4). The rainbow and Yellowstone cutthroat trout allele frequencies were statistically homogeneous (X^2_{12}=10.437, P>0.50 and X^2_{7}=6.858, P>0.10, respectively) among the diagnostic loci and the alleles appeared to be randomly distributed (rainbow X^2_{6}=4.549, P>0.50, Yellowstone X^2_{3}=2.276, P>0.10) among the fish in the sample. East Fork Meadow Creek, therefore, appears to contain a hybrid swarm among rainbow, westslope cutthroat, and Yellowstone cutthroat trout with a substantial (0.788) rainbow trout genetic contribution.

East Fork Meadow Creek: Sample #4765 (n=9)

In the sample from East Fork Meadow Creek, alleles characteristic of rainbow trout were detected at all of the rainbow markers, alleles characteristic of westslope cutthroat trout were detected at only two of the westslope markers, and alleles characteristic of Yellowstone cutthroat trout were detected at 18 of the Yellowstone markers. This sample, therefore, provided evidence of hybridization among westslope cutthroat, rainbow, and Yellowstone cutthroat trout. Ignoring the very small (0.009) westslope cutthroat trout genetic component, the Yellowstone cutthroat trout allele frequencies were statistically homogeneous (X^2_{38}=51.216, P>0.05) among the rainbow and Yellowstone markers and all the fish in the sample were definitely of hybrid origin (Figure 6). East Fork Meadow Creek, therefore, should be considered to contain hybrids among rainbow, Yellowstone cutthroat, and westslope cutthroat trout with a substantial rainbow (about 88 percent) and minor Yellowstone (about 11 percent) and westslope cutthroat trout genetic contribution.

The above results are highly concordant with those obtained from a previous indel/microsatellite analysis of a sample of trout collected from East Fork Meadow Creek (#3858, col. 9/7/08, 47.11820 112. 80013, N=4). This analysis also indicated the creek contained hybrids among rainbow, Yellowstone cutthroat, and westslope cutthroat trout with a substantial rainbow and minor Yellowstone and westslope cutthroat trout genetic component.

Mineral Creek: Sample #3863 (n=8)

Samples were collected from two reaches of Mineral Creek. Evidence of hybridization with rainbow and Yellowstone cutthroat trout was detected in both samples. Because of the small sample sizes, we increased statistical power to detect evidence of genetic differences by comparing the frequency of westslope cutthroat, Yellowstone cutthroat, and rainbow trout alleles averaged over all the diagnostic loci between the samples. Contingency table chi-square analysis indicates that the average frequency of westslope cutthroat and rainbow trout alleles (X^2_{1}=0.753, P>0.50) and the average frequency of westslope and Yellowstone cutthroat trout alleles (X^2_{1}=0.000, P>0.99) were statistically homogeneous between the samples. Thus, the samples were combined for further analysis.

Alleles characteristic of westslope cutthroat trout were detected at five of the diagnostic loci for this fish that were analyzed in the sample from Mineral Creek. In the sample, alleles characteristic of Yellowstone cutthroat trout were detected at eight diagnostic loci for this fish that were analyzed. At two loci analyzed, alleles characteristic of only rainbow trout were detected. The rainbow and Yellowstone cutthroat trout allele frequencies were statistically homogeneous (X^2_{12}=10.856, P>0.50 and X^2_7=2.604, P>0.90, respectively) among the diagnostic loci and the alleles appeared to be randomly distributed (rainbow X^2_6=4.185, P>0.50, Yellowstone X^2_5=8.779, P>0.10) among the fish in the sample. Mineral Creek, therefore, appears to contain a hybrid swarm among westslope cutthroat, Yellowstone cutthroat, and rainbow trout with a predominant (0.885) rainbow trout genetic contribution.

East Fork Mineral Creek: Sample #3864 (n=5)

Alleles characteristic of westslope cutthroat trout were detected at nine of the diagnostic loci for this fish that were analyzed in the sample from East Fork Mineral Creek. In the sample, alleles characteristic of Yellowstone cutthroat trout were detected at seven diagnostic loci for this fish that were analyzed. The rainbow trout allele frequencies were statistically heterogeneous (X^2_{12}=21.902, P<0.05) among the diagnostic loci but, the Yellowstone cutthroat trout allele frequencies were statistically homogeneous (X^2_7=11.178, P>0.10) among the diagnostic loci. The rainbow trout alleles were not randomly distributed (X^2_8=16.453, P<0.05) among the fish in the sample but the Yellowstone cutthroat trout alleles were (X^2_7=11.005, P>0.10). The distribution of rainbow trout hybrid indices was highly variable among the fish (Figure 18) resulting in the non-random distribution. Despite this, all the fish in the sample were definitely of hybrid origin and the Yellowstone cutthroat trout alleles were randomly distributed among the fish. From a management perspective, therefore, the simplest approach would be to consider East Fork Mineral Creek to contain a hybrid swarm among westslope cutthroat, Yellowstone cutthroat, and rainbow trout with a substantial (0.700) rainbow trout genetic component.

North Fork Blackfoot River upstream of Dobrota Creek: Sample #3521 (n=5)

Alleles characteristic of rainbow, Yellowstone cutthroat, and westslope cutthroat trout were detected in the sample collected from the North Fork Blackfoot River above Dobrota Creek. The westslope cutthroat (X^2_6=8.805; P>0.10) and Yellowstone cutthroat trout (X^2_7=10.051; P>0.10) allele frequencies were statistically homogeneous among the diagnostic loci but the alleles did not appear to be randomly distributed (X^2_5=9.327; P<0.05) among the fish in the sample. Thus, this sample clearly contained hybrids among rainbow, westslope cutthroat, and Yellowstone cutthroat trout with a predominant rainbow trout genetic contribution but it does not appear to have come from a hybrid swarm.

North Fork Blackfoot River downstream of South Creek: Sample #3522 (n=2)

This sample also contained alleles characteristic of rainbow, Yellowstone cutthroat, and westslope cutthroat trout. The westslope cutthroat (X^2_6=5.897; P>0.10) and Yellowstone cutthroat trout (X^2_7=6.731; P>0.10) allele frequencies were statistically homogeneous among the diagnostic loci but the alleles did not appear to be randomly distributed (X^2_1=4.564; P<0.05) among the fish in the sample. Thus, this sample also clearly contained hybrids among rainbow, westslope cutthroat, and Yellowstone cutthroat trout with a predominant rainbow trout genetic contribution but it does not appear to have come from a hybrid swarm.

North Fork Blackfoot River downstream of Theodore Creek: Sample #3523 (n=5)

This sample also contained alleles characteristic of rainbow, Yellowstone cutthroat, and westslope cutthroat trout. In this sample, the westslope cutthroat trout (X^2_6=28.561; P<0.001) alleles were not statistically homogeneous among the diagnostic loci but, the Yellowstone cutthroat trout allele frequencies were (X^2_7=12.276; P>0.05). Also, the westslope and Yellowstone cutthroat trout alleles did not appear to be randomly distributed (X^2_6=19.020; P<0.01) among the fish in the sample. Thus, this sample also clearly contained hybrids among rainbow, westslope cutthroat, and Yellowstone cutthroat trout with a predominant rainbow trout genetic contribution but it does not appear to have come from a hybrid swarm.

North Fork Blackfoot River combined (n=12)

The average rainbow, westslope cutthroat, and Yellowstone cutthroat trout allele frequencies did not statistically differ among the three North Fork Blackfoot River samples. Thus, they were combined into a single sample for further analysis. In the combined sample, the westslope cutthroat trout (X^2_6=35.289; P<0.001) alleles were not statistically homogeneous among the diagnostic loci but, the Yellowstone cutthroat trout allele frequencies were (X^2_7=12.740; P>0.05). Given the previous results, not surprisingly the westslope and Yellowstone cutthroat trout alleles did not appear to be randomly distributed (X^2_6=14.062; P<0.05) among the fish in the combined sample. A likely explanation for the heterogeneity of allele frequencies at some of the diagnostic loci and the nonrandom distribution of the westslope and Yellowstone cutthroat trout alleles among the fish is that when this reach of the North Fork Blackfoot River was sampled it contained fish from two or more hybridized populations of rainbow, westslope cutthroat, and Yellowstone cutthroat trout with different amounts of hybridization.

East Fork North Fork Blackfoot River (middle): Sample #3360 (n=5)

Alleles characteristic of both rainbow and Yellowstone cutthroat trout were detected at ten of the 14 diagnostic loci between these fishes that were analyzed in the sample from the East Fork of the North Fork Blackfoot River. The allele frequencies were statistically homogeneous (X213=15.396; P>0.10) among the diagnostic loci but, the Yellowstone cutthroat trout alleles were not randomly distributed (X 29=18.940; P<0.05) among the fish in the sample. All of the fish in the sample, however, were definitely of hybrid origin between rainbow and Yellowstone cutthroat trout. At Omm1037-1*, a single copy of the 147 allele was detected in the sample. This allele is usually characteristic of westslope cutthroat trout and its presence, therefore, suggests that at least some of the fish in the East Fork of the North Fork Blackfoot River may have a minor westslope cutthroat trout genetic contribution. Considering all the data the East Fork of the North Fork Blackfoot River should be considered to contain hybridized fish with a predominant rainbow trout genetic contribution, a moderate Yellowstone cutthroat trout genetic contribution, and a minor contribution from westslope 367cutthroat trout. These results are highly concordant with those obtained from a previous allozyme analysis of fish collected from the East Fork of the North Fork Blackfoot River (sample #1203; col. 8/1/96; N=9). The previous results also indicated the population to contain hybrids among rainbow, Yellowstone cutthroat, and westslope cutthroat trout with a predominant rainbow trout genetic contribution.

East Fork North Fork Blackfoot River: Sample # 4762 (n=20)

Fish were collected from stream mile 1.9 and 9.0 in the East Fork of the North Fork Blackfoot River. Between the samples, 38 loci were polymorphic. The allele frequencies were statistically heterogeneous between the samples at two of these loci. These differences, however, were not significant at the modified level indicating they most likely represented chance departures from homogeneity rather than evidence of genetic differences between the samples. The samples, therefore, were combined for further analysis.

Alleles characteristic of rainbow trout were detected at all of the rainbow markers, 18 of the westslope markers were polymorphic, and alleles characteristic of Yellowstone cutthroat trout were detected at all of the Yellowstone markers in the sample from the East Fork of the North Fork Blackfoot River. This sample, therefore, provided conclusive evidence of hybridization among westslope cutthroat, rainbow, and Yellowstone cutthroat trout. Although the Yellowstone cutthroat (X^2_{19}=22.115, P>0.10) and westslope cutthroat trout (X^2_{19}=11.725, P>0.50) allele frequencies were statistically homogeneous among the respective markers, the Yellowstone cutthroat (X^2_8=41.184, P<0.001, Figure 1) and westslope cutthroat trout (X^2_5=46.967, P<0.001, Figure 2) alleles did not appear to be randomly distributed among the fish in the sample. The non-random distribution of the Yellowstone cutthroat trout alleles was due to two fish with a hybrid index of ten or 11. When these two individuals are removed from the data, the Yellowstone cutthroat trout alleles appear to be randomly distributed (X^2_5=5.599, P>0.50) among the remaining fish. The non-random distribution of the westslope cutthroat trout alleles was due to three fish with a hybrid index of five, six, or 11. When these fish are removed from the data, the westslope cutthroat trout alleles appear to be randomly distributed (X^2_3=7.237, P>0.0.05) among the remaining fish. Considering both the westslope and Yellowstone markers, only one fish in the sample showed no evidence of hybridization. The fish in the East Fork of the North Fork Blackfoot River, therefore, should simply be considered to be hybrids among rainbow, Yellowstone cutthroat, and westslope cutthroat trout with a major rainbow (about 87 percent) and minor Yellowstone (about nine percent) and westslope cutthroat trout (about four percent) genetic contribution.

The East Fork of the North Fork Blackfoot River was previously sampled twice. Allozyme (#1203, col. 8/1/96, T16N R10W S1, N=9) and indel/microsatellite (#3360, col. 7/11/06, T16N R9W S7, N=5) analyses also indicated the fish to be hybrids among westslope cutthroat, rainbow, and Yellowstone cutthroat trout with a predominant rainbow trout genetic component.

Scotty Creek: Sample #3362 (n=5)

Alleles characteristic of both rainbow and Yellowstone cutthroat trout were detected at all 14 diagnostic loci between these fishes that were analyzed in the sample from Scotty Creek. Although the allele frequencies were statistically homogeneous (X213=10.202; P>0.50) among the diagnostic loci, the
Yellowstone cutthroat trout alleles were not randomly distributed (X 212=346.963; P<0.001) among the fish in the sample. All of the fish in the sample except one, however, were definitely of hybrid origin between rainbow and Yellowstone cutthroat trout. The exception was one individual that may have been a non-hybridized rainbow trout. The conclusion that this individual was a non-hybridized rainbow trout is tentative because the small sample size precludes a reliable assessment of this likelihood. At Oki10*, a single copy of the 145allele was detected in the sample. A single copy of the 77allele was also detected at Omy0004*. These alleles are usually characteristic of westslope cutthroat trout and their presence indicates that at least some of the fish in Scotty Creek may have a minor westslope cutthroat trout genetic contribution. Thus, considering all the data Scotty Creek should be considered to contain hybridized fish with a substantial rainbow and Yellowstone cutthroat trout genetic contribution and a minor contribution from westslope cutthroat trout.

Spaulding Creek: Sample #4767 (n=2)

Only two trout were collected from Spaulding Creek. Both fish were definitely of hybrid origin between rainbow and Yellowstone cutthroat trout with hybrid indices calculated using only the Yellowstone cutthroat trout alleles at the rainbow and Yellowstone markers of four and five.

Sourdough Creek: Sample #3361 (n=3)

Alleles characteristic of both rainbow and Yellowstone cutthroat trout were detected at 13 of the 14 diagnostic loci between these fishes that were analyzed in the sample from Sourdough Creek. The allele frequencies were statistically homogeneous (X213=10.628; P>0.50) among the diagnostic loci but, the Yellowstone cutthroat trout alleles were not randomly distributed (X 212=346.963; P<0.001) among the fish in the sample. All of the fish in the sample, however, were definitely of hybrid origin between rainbow and Yellowstone cutthroat trout. At Omy0004*, two copies of the 77allele were detected in the sample. This allele is usually characteristic of westslope cutthroat trout and its presence, therefore, suggests that at least some of the fish in Sourdough Creek may have a minor westslope cutthroat trout genetic contribution. Thus, considering all the data Sourdough Creek should be considered to contain hybridized fish with a substantial rainbow and Yellowstone cutthroat trout genetic contribution and a minor contribution from westslope cutthroat trout.

Twin Lake: Sample: #3099 (n=25)

PINE fragments characteristic of Yellowstone cutthroat trout were detected in the sample at all four diagnostic loci for this fish that were analyzed. PINE fragments characteristic of rainbow trout were also detected in the sample at all six of the diagnostic loci for this fish that were analyzed. Finally, PINE fragments characteristic of westslope cutthroat trout were also detected in the sample at both of the diagnostic loci for this fish that were analyzed. The Yellowstone cutthroat trout fragments appeared to be randomly distributed (chi-square; P>0.025) among the fish in the sample, but the rainbow trout fragments were not as significantly (chi-square; P<0.001) more fish lacked rainbow trout fragments or possessed them at all diagnostic loci than expected by chance. This suggests the lake may be inhabited by two somewhat reproductively isolated populations both of which are hybridized. One population may have a predominant rainbow trout genetic contribution and the other a significant westslope and Yellowstone cutthroat trout genetic contribution. Despite this possibility, since all the fish in the sample were definitely of hybrid origin from a practical perspective the lake should simply be considered to possess a hybridized population of westslope cutthroat, Yellowstone cutthroat, and rainbow trout.

Meadow Lake: Sample #3279 (n=3)

All three individuals in the sample possessed PINE fragments usually characteristic of rainbow trout at all six diagnostic loci analyzed that usually distinguish rainbow from westslope cutthroat trout. At two of the seven diagnostic loci analyzed that usually distinguish westslope cutthroat trout from rainbow trout, one fish in the sample possessed a PINE fragments characteristic of westslope cutthroat trout. This fish, therefore, was almost certainly a later than first generation hybrid between rainbow and westslope cutthroat trout. Because of the small sample size, it is not possible for us to reliably determine whether or not the Meadow Lake population appears to be a hybrid swarm between westslope cutthroat and rainbow trout. Regardless of this statistical problem, the population clearly is not native westslope cutthroat trout and from a management perspective it should be considered to be hybridized with a predominant (98%) rainbow trout genetic contribution.

Parker Lake: Sample #3098 (n=26)

All of the fish in this sample possessed PINE fragments characteristic of Yellowstone cutthroat trout at two or more of the four diagnostic loci for this fish that were analyzed. PINE fragments characteristic of rainbow trout were also detected in the sample at five of the six diagnostic loci for this fish that were analyzed. Finally, PINE fragments characteristic of westslope cutthroat trout were detected in the sample at both of the diagnostic loci for this fish that were analyzed. Neither the Yellowstone cutthroat nor the rainbow trout fragments were randomly distributed among the fish in the sample. Significantly (chi-square; $P<0.001$) more fish possessed Yellowstone cutthroat trout fragments at all the diagnostic loci analyzed and significantly fewer fish lacked or possessed a Yellowstone cutthroat trout fragment at only one locus than expected by chance. Likewise, significantly (chi-square; $P<0.001$) more fish possessed rainbow trout fragments at four or five diagnostic loci and significantly fewer possessed them at only one or two diagnostic loci than expected by chance. Thus, although this population definitely contains individuals of hybrid origin among Yellowstone cutthroat, westslope cutthroat, and rainbow trout it does not appear to be a hybrid swarm. In contrast, the fish in the sample tend to have a higher Yellowstone cutthroat trout or rainbow trout genetic contribution than expected in a hybrid swarm. This suggests that the lake may be inhabited by two somewhat reproductively isolated populations both of which are hybridized. Despite this possibility, from a practical perspective the lake should simply be considered to contain a hybridized population with a predominant Yellowstone cutthroat trout and a relatively minor westslope cutthroat and rainbow trout genetic contribution.

Appendix E: Benthic invertebrates
(Organized alphabetically)

Waterbody Name: Blondie Creek

Station ID: WS_BLOND

Reference Status: Site Classification:

Benthic Sample ID: 18160

Rep. Num 0

STORET Activity ID: E01-T500-M

Collection Date: 08/06/2013

Collection Method: MAC-T-500

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Ameletus similior	4			
		Drunella doddsii	4			
		Nostoccocladius	22			
		Thienimannimyia gr.	4			
Coleoptera	Heterlimnius	Heterlimnius corpulentus	58	3	SC/CG	"CN/50%, BU/50%"
Diptera	Diamesinae	Pagastia	6	4	CG	sp
Diptera	Forcipomyiinae	Forcipomyia	2	6	PR/CG/SC	sp
Diptera	Orthocladiinae	Brillia	14		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	10		CG/SC	SP/BU
Diptera	Simuliidae	Simulium	2	6	CF	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	16	1	SC	"CN/75%, SP/25%"
Ephemeropte	Paraleptophlebia	Paraleptophlebia	4	1	CG	SW/CN/SP
Plecoptera	Chloroperlidae	Suwallia	4	1	PR	CN
Plecoptera	Chloroperlidae	Sweltsa	50	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	2	0	unk	CN
Plecoptera	Leuctridae	Despaxia augusta	34	1	SH	CN
Plecoptera	Megarcys	Megarcys	18	1	PR	CN
Plecoptera	Visoka	Visoka cataractae	10	0	SH	CN
Plecoptera	Yoraperla	Yoraperla brevis	16	0	SH	CN
Plecoptera	Zapada	Zapada cinctipes	2	2	SH	CN
Plecoptera	Zapada	Zapada columbiana	30	2	SH	CN
Trichoptera	Dicosmoecus	Dicosmoecus atripes	2	2	SC	SP
Trichoptera	Neothremma	Neothremma alicia	2	1	SC	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	10	1	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila pellisa	6	0	PR	CN

Sample Taxa List

Total Number of Individuals in Sample: 332

Waterbody Name: Broadus Creek

Station ID: WS_BROADUS

Reference Status:

Site Classification:

Benthic Sample ID: 18175

Rep. Num 0

STORET Activity ID: E09-T500-M

Collection Date: 08/28/2014

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 772

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
Coleoptera	Heterlimnius	Heterlimnius corpulentus	4	3	SC/CG	"CN/50%, BU/50%"
Diptera	Chironominae	Micropsectra	8	7	CG/CF/PR	BU/CN/SP
Diptera	Diamesinae	Diamesa	40	4	CG	sp
Diptera	Orthocladiinae	Tvetenia vitracies	8		CG/SC	SP/BU
Ephemeropte	Ameletus	Ameletus	16	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	84	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	8	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	4	1	SC	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	4	2	CG	CN
Ephemeropte	Epeorus	Epeorus grandis	28	2	CG	CN
Ephemeropte	Rhithrogena	Rhithrogena	92	0	CG	CN
Non-Insect ta	Nematoda	Nematoda	4	5	unk	BU
Plecoptera	Chloroperlidae	Sweltsa	48	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	20	0	unk	CN
Plecoptera	Leuctridae	Despaxia augusta	96	1	SH	CN
Plecoptera	Megarcys	Megarcys	36	1	PR	CN
Plecoptera	Visoka	Visoka cataractae	8	0	SH	CN
Plecoptera	Yoraperla	Yoraperla brevis	32	0	SH	CN
Plecoptera	Zapada	Zapada columbiana	132	2	SH	CN
Trichoptera	Dicosmoecus	Dicosmoecus atripes	8	2	SC	SP
Trichoptera	Parapsyche	Parapsyche elsis	28	0	CF	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	16	1	PR	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	20	0	PR	CN
Trichoptera	Rhyacophila hyalin	Rhyacophila Hyalinata Gr.	16	1	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	8	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila pellisa	4	0	PR	CN

Montana Bioassessment Report

Waterbody Name: Broadus Creek

Station ID: WS_BROAD15

Reference Status:

Site Classification:

Latitude:

Longitude:

Benthic Sample ID: 19812

Rep. Num 0

STORET Activity ID: E14-T500-M

Collection Date: 09/05/2015

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 800

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
Coleoptera	Heterlimnius	Heterlimnius corpulentus	8	3	SC/CG	"CN/50%, BU/50%"
Diptera	Diamesinae	Diamesa	8	4	CG	sp
Ephemeropte	Ameletus	Ameletus	40	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	16	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	4	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	4	1	SC	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	4	2	CG	CN
Ephemeropte	Epeorus	Epeorus grandis	108	2	CG	CN
Ephemeropte	Rhithrogena	Rhithrogena	40	0	CG	CN
Non-Insect ta	Nematoda	Nematoda	4	5	unk	BU
Plecoptera	Calineuria	Calineuria californica	52	2	PR	CN
Plecoptera	Chloroperlidae	Sweltsa	56	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	12	0	unk	CN
Plecoptera	Leuctridae	Despaxia augusta	36	1	SH	CN
Plecoptera	Megarcys	Megarcys	80	1	PR	CN
Plecoptera	Visoka	Visoka cataractae	0	0	SH	CN
Plecoptera	Yoraperla	Yoraperla brevis	16	0	SH	CN
Plecoptera	Zapada	Zapada columbiana	16	2	SH	CN
Plecoptera	Zapada	Zapada oregonensis gr.	72	2	SH	CN
Trichoptera	Anagapetus	Anagapetus	8	0	SC	CN
Trichoptera	Dicosmoecus	Dicosmoecus atripes	4	2	SC	SP
Trichoptera	Neothremma	Neothremma alicia	4	1	SC	CN
Trichoptera	Parapsyche	Parapsyche elsis	104	0	CF	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	56	1	PR	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	16	0	PR	CN
Trichoptera	Rhyacophila hyalin	Rhyacophila Hyalinata Gr.	20	1	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	4	0	PR	CN
Trichoptera	Rhyacophila vofixa	Rhyacophila vofixa gr.	8	0	PR	CN

Montana Bioassessment Report

Benthic Sample ID: 18176

Waterbody Name: Cooney Creek

Rep. Num 0

Station ID: WS_COONEY

STORET Activity ID: E03-T500-M

Reference Status:

Collection Date: 08/27/2014

Site Classification:

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 304

Sample Taxa List

Order:	OTU name:	FinalID:	Individuals	Tol Val:	FFG:	Habit:
		Epeorus longimannus	2			
		Thienimannimyia gr.	2			
.	Turbellaria	Polycelis coronata	18	4	CG/PR	SP
Coleoptera	Heterlimnius	Heterlimnius corpulentus	7	3	SC/CG	"CN/50%, BU/50%"
Coleoptera	Optioservus	Optioservus quadrimaculatus	2	5	SC	"CN/50%, BU/50%"
Diptera	Chironominae	Micropsectra	2	7	CG/CF/PR	BU/CN/SP
Diptera	Diamesinae	Diamesa	8	4	CG	sp
Diptera	Diamesinae	Pagastia	1	4	CG	sp
Diptera	Ormosia	Ormosia	1	6	CG	BU
Diptera	Orthocladiinae	Corynoneura	1		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella gracei	1		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	1		CG/SC	SP/BU
Diptera	Orthocladiinae	Parametriocnemus	1		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	1		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia vitracies	2		CG/SC	SP/BU
Diptera	Simuliidae	Prosimulium	8	6	CF	CN
Ephemeropte	Ameletus	Ameletus validus	7	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	6	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	6	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	3	1	SC	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	8	2	CG	CN
Ephemeropte	Paraleptophlebia	Paraleptophlebia	1	1	CG	SW/CN/SP
Ephemeropte	Rhithrogena	Rhithrogena	24	0	CG	CN
Lumbriculida	Oligochaeta	Lumbriculidae	17	8	CG	BU
Non-Insect ta	Nematoda	Nematoda	1	5	unk	BU
Plecoptera	Chloroperlidae	Sweltsa	31	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	11	0	unk	CN
Plecoptera	Leuctridae	Despaxia augusta	23	1	SH	CN
Plecoptera	Megarcys	Megarcys	15	1	PR	CN
Plecoptera	Yoraperla	Yoraperla brevis	10	0	SH	CN
Plecoptera	Zapada	Zapada columbiana	35	2	SH	CN
Plecoptera	Zapada	Zapada oregonensis gr.	4	2	SH	CN
Trichoptera	Chyrandra	Chyranda centralis	1	2	SH	SP
Trichoptera	Glossosoma	Glossosoma	2	0	SC	CN
Trichoptera	Parapsyche	Parapsyche elsis	17	0	CF	CN

Montana Bioassessment Report

Waterbody Name: Cooney Creek

Station ID: WS_COONEY

Reference Status:

Site Classification:

Benthic Sample ID: 18176

Rep. Num 0

STORET Activity ID: E03-T500-M

Collection Date: 08/27/2014

Collection Method: MAC-T-500

Sample Taxa List (cont.)

Total Number of Individuals in Sample: 304

Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	15	1	PR	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	5	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	1	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila pellisa	1	0	PR	CN
Trichoptera	Rhyacophila vofixa	Rhyacophila vofixa gr.	2	0	PR	CN

Montana Bioassessment Report

Waterbody Name: Cooney Creek Lower
Benthic Sample ID: 19813
Station ID: WS_C0NYL15
Rep. Num 0
Reference Status:
STORET Activity ID: E18-T500-M
Site Classification:
Collection Date: 09/05/2015
Collection Method: MAC-T-500
Latitude:
Longitude:
Total Number of Individuals in Sample: 1136

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Nostoccocladius	16			
		Thienimannimyia gr.	8			
.	Turbellaria	Polycelis coronata	96	4	CG/PR	SP
Coleoptera	Heterlimnius	Heterlimnius corpulentus	24	3	SC/CG	"CN/50%, BU/50%"
Coleoptera	Optioservus	Optioservus quadrimaculatus	8	5	SC	"CN/50%, BU/50%"
Diptera	Diamesinae	Diamesa	16	4	CG	sp
Diptera	Diamesinae	Pagastia	8	4	CG	sp
Diptera	Hexatoma	Hexatoma	8	2	PR	BU
Diptera	Orthocladiinae	Parakiefferiella	8		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	8		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia vitracies	8		CG/SC	SP/BU
Diptera	Simuliidae	Prosimulium	8	6	CF	CN
Ephemeropte	Ameletus	Ameletus validus	40	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	16	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	32	0	SC	CN
Ephemeropte	Epeorus	Epeorus deceptivus	8	2	CG	CN
Ephemeropte	Epeorus	Epeorus grandis	40	2	CG	CN
Ephemeropte	Paraleptophlebia	Paraleptophlebia	8	1	CG	SW/CN/SP
Ephemeropte	Rhithrogena	Rhithrogena	72	0	CG	CN
Lumbriculida	Oligochaeta	Lumbriculidae	16	8	CG	BU
Non-Insect ta	Nematoda	Nematoda	8	5	unk	BU
Plecoptera	Chloroperlidae	Sweltsa	80	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	64	0	unk	CN
Plecoptera	Isoperla	Isoperla	24	2	PR	CN
Plecoptera	Leuctridae	Despaxia augusta	40	1	SH	CN
Plecoptera	Megarcys	Megarcys	88	1	PR	CN
Plecoptera	Yoraperla	Yoraperla brevis	24	0	SH	CN
Plecoptera	Zapada	Zapada columbiana	64	2	SH	CN
Plecoptera	Zapada	Zapada frigida	16	2	SH	CN
Plecoptera	Zapada	Zapada oregonensis gr.	16	2	SH	CN
Trichoptera	Chyrandra	Chyranda centralis	8	2	SH	SP
Trichoptera	Glossosoma	Glossosoma	16	0	SC	CN
Trichoptera	Parapsyche	Parapsyche elsis	96	0	CF	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	72	1	PR	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	32	0	PR	CN

Montana Bioassessment Report

Waterbody Name: Cooney Creek Lower

Station ID: WS_C0NYL15

Reference Status:

Site Classification:

Latitude:

Longitude:

Benthic Sample ID: 19813

Rep. Num 0

STORET Activity ID: E18-T500-M

Collection Date: 09/05/2015

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 1136

Trichoptera	Rhyacophila hyalin	Rhyacophila Hyalinata Gr.	8	1	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	24	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila pellisa	8	0	PR	CN

Montana Bioassessment Report

Waterbody Name: Cooney Creek Upper

Benthic Sample ID: 19814

Station ID: WS_C0NYU15

Rep. Num 0

STORET Activity ID: E19-T500-M

Reference Status:

Site Classification:

Collection Date: 10/01/2015

Collection Method: MAC-T-500

Latitude:

Longitude:

Total Number of Individuals in Sample: 1416

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
. Diptera	Turbellaria	Polycelis coronata	8	4	CG/PR	SP
Diptera	Diamesinae	Diamesa Pagastia	8	4	CG	sp
Diptera	Diamesinae	Rheocricotopus	24	4	CG	sp
Ephemeropte	Orthocladiinae	Ameletus validus	16		CG/SC	SP/BU
Ephemeropte	Ameletus	Baetis tricaudatus	24	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Cinygmula	8	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Drunella coloradensis	16	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella doddsii	16	1	SC	"CN/75%, SP/25%"
Ephemeropte	Drunella doddsi	Epeorus deceptivus	8	1	SC	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus grandis	16	2	CG	CN
Ephemeropte	Epeorus	Paraleptophlebia	96	2	CG	CN
Ephemeropte	Paraleptophlebia	Rhithrogena	8	1	CG	SW/CN/SP
Lumbriculida	Rhithrogena	Lumbriculidae	248	0	CG	CN
Plecoptera	Oligochaeta	Sweltsa	24	8	CG	BU
Plecoptera	Chloroperlidae	Doroneuria theodora	88	1	PR	CN
Plecoptera	Doroneuria	Despaxia augusta	16	0	unk	CN
Plecoptera	Leuctridae	Megarcys	8	1	SH	CN
Plecoptera	Megarcys	Setvena bradleyi	160	1	PR	CN
Plecoptera	Setvena	Yoraperla brevis	40	0	PR	CN
Plecoptera	Yoraperla	Zapada columbiana	168	0	SH	CN
Plecoptera	Zapada	Zapada frigida	160	2	SH	CN
Plecoptera	Zapada	Zapada oregonensis gr.	8	2	SH	CN
Trichoptera	Zapada	Parapsyche elsis	40	2	SH	CN
Trichoptera	Parapsyche	Rhyacophila Betteni Gr.	32	0	CF	CN
	Rhyacophila betten		88	1	PR	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	32	0	PR	CN
Trichoptera	Rhyacophila hyalin	Rhyacophila Hyalinata Gr.	8	1	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	40	0	PR	CN
Trichoptera	Rhyacophila vofixa	Rhyacophila vofixa gr.	8	0	PR	CN

Montana Bioassessment Report

Waterbody Name: Camp Creek

Station ID: WS_CAMP15

Reference Status:

Site Classification:

Latitude:

Longitude:

Benthic Sample ID: 19815

Rep. Num 0

STORET Activity ID: E13-T500-M

Collection Date: 09/05/2015

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 2704

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Nostoccocladius	16			
.	Turbellaria	Polycelis coronata	88	4	CG/PR	SP
Coleoptera	Heterlimnius	Heterlimnius corpulentus	160	3	SC/CG	"CN/50%, BU/50%"
Diptera	Chelifera_Metachel	Chelifera	8	5	unk	SP
Diptera	Chironominae	Micropsectra	16	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Stempellina	8	7	CG/CF/PR	BU/CN/SP
Diptera	Diamesinae	Diamesa	32	4	CG	sp
Diptera	Diamesinae	Pagastia	24	4	CG	sp
Diptera	Orthocladiinae	Brillia	8		CG/SC	SP/BU
Diptera	Orthocladiinae	Hydrobaenus	40		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	16		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia vitracies	8		CG/SC	SP/BU
Diptera	Simuliidae	Prosimulium	24	6	CF	CN
Ephemeropte	Baetis	Baetis tricaudatus	96	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	88	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	8	1	SC	"CN/75%, SP/25%"
Ephemeropte	Drunella doddsi	Drunella doddsii	8	1	SC	"CN/75%, SP/25%"
Ephemeropte	Drunella spinifera	Drunella spinifera	8	0	PR	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	16	2	CG	CN
Ephemeropte	Epeorus	Epeorus grandis	16	2	CG	CN
Ephemeropte	Paraleptophlebia	Paraleptophlebia	16	1	CG	SW/CN/SP
Ephemeropte	Rhithrogena	Rhithrogena	896	0	CG	CN
Ephemeropte	Serratella	Serratella tibialis	16	2	CG	CN
Lumbriculida	Oligochaeta	Lumbriculidae	40	8	CG	BU
Plecoptera	Chloroperlidae	Sweltsa	128	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	128	0	unk	CN
Plecoptera	Isoperla	Isoperla	24	2	PR	CN
Plecoptera	Leuctridae	Despaxia augusta	144	1	SH	CN
Plecoptera	Megarcys	Megarcys	136	1	PR	CN
Plecoptera	Yoraperla	Yoraperla brevis	8	0	SH	CN
Plecoptera	Zapada	Zapada columbiana	112	2	SH	CN
Plecoptera	Zapada	Zapada oregonensis gr.	32	2	SH	CN
Trichoptera	Dicosmoecus	Dicosmoecus atripes	8	2	SC	SP
Trichoptera	Parapsyche	Parapsyche elsis	8	0	CF	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	144	1	PR	CN

Montana Bioassessment Report

Waterbody Name: Camp Creek

Station ID: WS_CAMP15

Reference Status:

Site Classification:

Latitude:

Longitude:

Benthic Sample ID: 19815

Rep. Num 0

STORET Activity ID: E13-T500-M

Collection Date: 09/05/2015

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 2704

Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	88	0	PR	CN
Trichoptera	Rhyacophila hyalin	Rhyacophila Hyalinata Gr.	8	1	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	72	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila pellisa	8	0	PR	CN

Montana Bioassessment Report

Waterbody Name: Camp Creek upper

Station ID: WS_CAMPU15

Reference Status:

Site Classification:

Latitude:

Longitude:

Benthic Sample ID: 19816

Rep. Num 0

STORET Activity ID: E20-T500-M

Collection Date: 09/05/2015

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 840

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
.	Turbellaria	Polycelis coronata	32	4	CG/PR	SP
Coleoptera	Heterlimnius	Heterlimnius corpulentus	16	3	SC/CG	"CN/50%, BU/50%"
Diptera	Chelifera_Metachel	Chelifera	8	5	unk	SP
Diptera	Diamesinae	Diamesa	16	4	CG	sp
Diptera	Diamesinae	Pagastia	16	4	CG	sp
Diptera	Orthocladiinae	Brillia	8		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	16		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia vitracies	8		CG/SC	SP/BU
Diptera	Simuliidae	Prosimulium	8	6	CF	CN
Ephemeropte	Baetis	Baetis tricaudatus	8	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	72	0	SC	CN
Ephemeropte	Drunella doddsi	Drunella doddsii	8	1	SC	"CN/75%, SP/25%"
Ephemeropte	Drunella spinifera	Drunella spinifera	8	0	PR	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	8	2	CG	CN
Ephemeropte	Epeorus	Epeorus grandis	8	2	CG	CN
Ephemeropte	Paraleptophlebia	Paraleptophlebia	8	1	CG	SW/CN/SP
Ephemeropte	Rhithrogena	Rhithrogena	112	0	CG	CN
Lumbriculida	Oligochaeta	Lumbriculidae	16	8	CG	BU
Plecoptera	Chloroperlidae	Sweltsa	64	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	88	0	unk	CN
Plecoptera	Isoperla	Isoperla	24	2	PR	CN
Plecoptera	Leuctridae	Despaxia augusta	24	1	SH	CN
Plecoptera	Megarcys	Megarcys	40	1	PR	CN
Plecoptera	Paraperla	Paraperla	16	1	unk	unk
Plecoptera	Yoraperla	Yoraperla brevis	8	0	SH	CN
Plecoptera	Zapada	Zapada columbiana	40	2	SH	CN
Plecoptera	Zapada	Zapada oregonensis gr.	8	2	SH	CN
Trichoptera	Dicosmoecus	Dicosmoecus atripes	8	2	SC	SP
Trichoptera	Glossosoma	Glossosoma	8	0	SC	CN
Trichoptera	Parapsyche	Parapsyche elsis	8	0	CF	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	64	1	PR	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	16	0	PR	CN
Trichoptera	Rhyacophila hyalin	Rhyacophila Hyalinata Gr.	8	1	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	32	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila pellisa	8	0	PR	CN

Montana Bioassessment Report

Waterbody Name: Dobrota Creek

Station ID: WS_DOBROTA

Reference Status:

Site Classification:

Benthic Sample ID: 18177

Rep. Num 0

STORET Activity ID: E07-T500-M

Collection Date: 08/28/2014

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 502

Sample Taxa List

Order:	OTU name:	FinalID:	Individuals	Tol Val:	FFG:	Habit:
		Drunella doddsii	3			
		Epeorus longimannus	3			
		Neophylax splendans	1			
		Nostoccocladius	41			
		Thienimannimyia gr.	3			
.	Turbellaria	Polycelis coronata	2	4	CG/PR	SP
Coleoptera	Heterlimnius	Heterlimnius corpulentus	6	3	SC/CG	"CN/50%, BU/50%"
Diptera	Chelifera_Metachel	Chelifera	1	5	unk	SP
Diptera	Chironominae	Micropsectra	3	7	CG/CF/PR	BU/CN/SP
Diptera	Diamesinae	Diamesa	20	4	CG	sp
Diptera	Diamesinae	Pagastia	5	4	CG	sp
Diptera	Dicranota	Dicranota	1	0	PR	SP
Diptera	Hexatoma	Hexatoma	2	2	PR	BU
Diptera	Orthocladiinae	Brillia	1		CG/SC	SP/BU
Diptera	Orthocladiinae	Corynoneura	1		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella gracei	1		CG/SC	SP/BU
Diptera	Orthocladiinae	Orthocladius	3		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	1		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	1		CG/SC	SP/BU
Diptera	Pelecorhynchidae	Glutops	2	1	PR	SP
Diptera	Pericoma/Telmatos	Pericoma	1	4	CG	BU
Diptera	Simuliidae	Prosimulium	2	6	CF	CN
Ephemeropte	Ameletus	Ameletus validus	4	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	68	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	3	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	11	1	SC	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	30	2	CG	CN
Ephemeropte	Epeorus	Epeorus grandis	8	2	CG	CN
Ephemeropte	Rhithrogena	Rhithrogena	12	0	CG	CN
Plecoptera	Chloroperlidae	Sweltsa	38	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	2	0	unk	CN
Plecoptera	Leuctridae	Despaxia augusta	88	1	SH	CN
Plecoptera	Megarcys	Megarcys	13	1	PR	CN
Plecoptera	Taeniopterygidae	Taeniopterygidae	2	2	SH	CN
Plecoptera	Yoraperla	Yoraperla brevis	10	0	SH	CN

Montana Bioassessment Report

Waterbody Name: Dobrota Creek

Station ID: WS_DOBROTA

Reference Status:

Site Classification:

Benthic Sample ID: 18177

Rep. Num 0

STORET Activity ID: E07-T500-M

Collection Date: 08/28/2014

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 502

Sample Taxa List (cont.)

Plecoptera	Zapada	Zapada columbiana	39	2	SH	CN
Plecoptera	Zapada	Zapada frigida	1	2	SH	CN
Plecoptera	Zapada	Zapada oregonensis gr.	28	2	SH	CN
Trichoptera	Dicosmoecus	Dicosmoecus atripes	1	2	SC	SP
Trichoptera	Ecclisomyia	Ecclisomyia maculosa	1	4	CG	CN/SP/CM
Trichoptera	Glossosoma	Glossosoma	2	0	SC	CN
Trichoptera	Neothremma	Neothremma alicia	1	1	SC	CN
Trichoptera	Parapsyche	Parapsyche elsis	5	0	CF	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	11	1	PR	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	6	0	PR	CN
Trichoptera	Rhyacophila hyalin	Rhyacophila Hyalinata Gr.	3	1	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	3	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila pellisa	4	0	PR	CN
Trichoptera	Rhyacophila vagrit	Rhyacophila vagrita	1	0	PR	CN
Trichoptera	Rhyacophila vofixa	Rhyacophila vofixa gr.	3	0	PR	CN

Montana Bioassessment Report

Waterbody Name: East Fork Meadow Creek

Station ID: WS_EFMEAD

Reference Status:

Site Classification:

Benthic Sample ID: 18162

Rep. Num 0

STORET Activity ID: E03-T500-M

Collection Date: 08/07/2013

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 992

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Drunella doddsii	10			
		Epeorus longimannus	8			
Coleoptera	Heterlimnius	Heterlimnius corpulentus	6	3	SC/CG	"CN/50%, BU/50%"
Coleoptera	Optioservus	Optioservus quadrimaculatus	6	5	SC	"CN/50%, BU/50%"
Diptera	Limonia	Limonia	2		SH	BU
Diptera	Orthocladiinae	Brillia	8		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella gracei	16		CG/SC	SP/BU
Diptera	Orthocladiinae	Orthocladius	8		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	2		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	28		CG/SC	SP/BU
Ephemeropte	Ameletus	Ameletus	6	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	40	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygma	Cinygma	2	0	SC	CN
Ephemeropte	Cinygmula	Cinygmula	60	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	12	1	SC	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	220	2	CG	CN
Ephemeropte	Epeorus	Epeorus grandis	8	2	CG	CN
Ephemeropte	Rhithrogena	Rhithrogena	90	0	CG	CN
Ephemeropte	Serratella	Serratella tibialis	8	2	CG	CN
Plecoptera	Chloroperlidae	Suwallia	14	1	PR	CN
Plecoptera	Chloroperlidae	Sweltsa	120	1	PR	CN
Plecoptera	Chloroperlidae	Triznaka	10	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	18	0	unk	CN
Plecoptera	Kogotus	Kogotus	4	1	PR	CN
Plecoptera	Leuctridae	Despaxia augusta	44	1	SH	CN
Plecoptera	Megarcys	Megarcys	60	1	PR	CN
Plecoptera	Paraperla	Paraperla	20	1	unk	unk
Plecoptera	Yoraperla	Yoraperla brevis	2	0	SH	CN
Plecoptera	Zapada	Zapada columbiana	120	2	SH	CN
Plecoptera	Zapada	Zapada frigida	2	2	SH	CN
Trichoptera	Glossosoma	Glossosoma	2	0	SC	CN
Trichoptera	Parapsyche	Parapsyche elsis	24	0	CF	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	10	1	PR	CN
Trichoptera	Rhyacophila hyalin	Rhyacophila Hyalinata Gr.	2	1	PR	CN

Montana Bioassessment Report

Waterbody Name: East Fork NF Blackfoot

Benthic Sample ID: 18163

Station ID: WS_EFNFBL (lower)

Rep. Num 0

STORET Activity ID: E04-T500-M

Reference Status:

Site Classification:

Collection Date: 08/08/2013

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 920

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Epeorus longimannus	10			
		Isoperla punctata	8			
Coleoptera	Heterlimnius	Heterlimnius corpulentus	190	3	SC/CG	"CN/50%, BU/50%"
Coleoptera	Narpus	Narpus concolor	2	2	CG	"CN/50%, BU/50%"
Coleoptera	Optioservus	Optioservus quadrimaculatus	82	5	SC	"CN/50%, BU/50%"
Diptera	Ceratopogoninae	Probezzia	6	6	PR/CG	SP/BU/SW
Diptera	Chelifera_Metachel	Chelifera	8	5	unk	SP
Diptera	Diamesinae	Pagastia	90	4	CG	sp
Diptera	Hexatoma	Hexatoma	4	2	PR	BU
Diptera	Limonia	Limonia	2		SH	BU
Diptera	Orthocladiinae	Brillia	14		CG/SC	SP/BU
Diptera	Orthocladiinae	Cricotopus bicinctus	18		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia vitracies	20		CG/SC	SP/BU
Diptera	Simuliidae	Prosimulium	14	6	CF	CN
Diptera	Tipula	Tipula	2	4	SH	BU
Ephemeropte	Baetis	Baetis tricaudatus	80	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	68	0	SC	CN
Ephemeropte	Epeorus	Epeorus deceptivus	50	2	CG	CN
Ephemeropte	Paraleptophlebia	Paraleptophlebia	8	1	CG	SW/CN/SP
Ephemeropte	Rhithrogena	Rhithrogena	28	0	CG	CN
Ephemeropte	Serratella	Serratella tibialis	4	2	CG	CN
Plecoptera	Chloroperlidae	Sweltsa	44	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	12	0	unk	CN
Plecoptera	Hesperoperla	Hesperoperla pacifica	46	1	PR	CN
Plecoptera	Megarcys	Megarcys	24	1	PR	CN
Plecoptera	Zapada	Zapada cinctipes	10	2	SH	CN
Plecoptera	Zapada	Zapada columbiana	24	2	SH	CN
Trichoptera	Arctopsyche	Arctopsyche grandis	4	2	CF	CN
Trichoptera	Micrasema	Micrasema bactro	8	1	SH	CN
Trichoptera	Parapsyche	Parapsyche elsis	12	0	CF	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	8	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	18	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila pellisa	2	0	PR	CN

Montana Bioassessment Report

Waterbody Name: East Fork NF Blackfoot

Station ID: WS_EFNFBLU (upper)

Reference Status:

Site Classification:

Benthic Sample ID: 18164

Rep. Num 0

STORET Activity ID: E05-T500-M

Collection Date: 08/06/2013

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 876

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Drunella doddsii	8			
		Oreolepsis torrenticola	4			
Coleoptera	Heterlimnius	Heterlimnius corpulentus	160	3	SC/CG	"CN/50%, BU/50%"
Diptera	Ceratopogoninae	Probezzia	4	6	PR/CG	SP/BU/SW
Diptera	Chironominae	Micropsectra	8	7	CG/CF/PR	BU/CN/SP
Diptera	Dixa	Dixa	8	4	CG	SW
Diptera	Hexatoma	Hexatoma	4	2	PR	BU
Diptera	Orthocladiinae	Brillia	8		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	8		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia vitracies	12		CG/SC	SP/BU
Ephemeropte	Ameletus	Ameletus	24	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	132	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	100	0	SC	CN
Ephemeropte	Epeorus	Epeorus deceptivus	20	2	CG	CN
Ephemeropte	Paraleptophlebia	Paraleptophlebia	16	1	CG	SW/CN/SP
Ephemeropte	Rhithrogena	Rhithrogena	32	0	CG	CN
Ephemeropte	Serratella	Serratella tibialis	4	2	CG	CN
Plecoptera	Chloroperlidae	Sweltsa	76	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	48	0	unk	CN
Plecoptera	Hesperoperla	Hesperoperla pacifica	4	1	PR	CN
Plecoptera	Leuctridae	Despaxia augusta	20	1	SH	CN
Plecoptera	Megarcys	Megarcys	56	1	PR	CN
Plecoptera	Zapada	Zapada columbiana	16	2	SH	CN
Trichoptera	Parapsyche	Parapsyche elsis	8	0	CF	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	68	1	PR	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	4	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	16	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila pellisa	8	0	PR	CN

Montana Bioassessment Report

Waterbody Name: EF NF Blackfoot Upper | **Benthic Sample ID:** 19817

Station ID: WS_EFNFBLU15 | **Rep. Num** 0

Reference Status: | **STORET Activity ID:** E21-T500-M

Site Classification: | **Collection Date:** 09/04/2015

Latitude: | **Collection Method:** MAC-T-500

Longitude: | **Total Number of Individuals in Sample:** 1236

Sample Taxa List

Order:	OTU name:	FinalID:	Individuals	Tol Val:	FFG:	Habit:
		Ephemerella excruians	80			
.	Turbellaria	Polycelis coronata	8	4	CG/PR	SP
Coleoptera	Cleptelmis	Cleptelmis addenda	4	4	CG	"CN/50%, BU/50%"
Coleoptera	Heterlimnius	Heterlimnius corpulentus	220	3	SC/CG	"CN/50%, BU/50%"
Diptera	Ceratopogoninae	Probezzia	8	6	PR/CG	SP/BU/SW
Diptera	Chironominae	Micropsectra	32	7	CG/CF/PR	BU/CN/SP
Diptera	Diamesinae	Pagastia	48	4	CG	sp
Diptera	Hexatoma	Hexatoma	24	2	PR	BU
Diptera	Orthocladiinae	Brillia	4		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	8		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	8		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia vitracies	4		CG/SC	SP/BU
Diptera	Pericoma/Telmatos	Pericoma	16	4	CG	BU
Ephemeropte	Ameletus	Ameletus	4	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	52	5	CG	"SW/10%, CN/90%"
Ephemeropte	Caudatella	Caudatella hystrix	8	0	CG	CN
Ephemeropte	Cinygmula	Cinygmula	120	0	SC	CN
Ephemeropte	Drunella doddsi	Drunella doddsii	16	1	SC	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	20	2	CG	CN
Ephemeropte	Paraleptophlebia	Paraleptophlebia	48	1	CG	SW/CN/SP
Ephemeropte	Rhithrogena	Rhithrogena	128	0	CG	CN
Ephemeropte	Serratella	Serratella tibialis	4	2	CG	CN
Non-Insect ta	Ostracoda	Ostracoda	8		unk	SW
Plecoptera	Chloroperlidae	Sweltsa	100	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	36	0	unk	CN
Plecoptera	Hesperoperla	Hesperoperla pacifica	80	1	PR	CN
Plecoptera	Isoperla	Isoperla	8	2	PR	CN
Plecoptera	Leuctridae	Despaxia augusta	8	1	SH	CN
Plecoptera	Megarcys	Megarcys	8	1	PR	CN
Plecoptera	Paraperla	Paraperla	4	1	unk	unk
Plecoptera	Zapada	Zapada cinctipes	40	2	SH	CN
Trichoptera	Arctopsyche	Arctopsyche grandis	4	2	CF	CN
Trichoptera	Dicosmoecus	Dicosmoecus atripes	12	2	SC	SP
Trichoptera	Ochrotrichia	Ochrotrichia	8	4	CG	CN
Trichoptera	Parapsyche	Parapsyche elsis	8	0	CF	CN

Montana Bioassessment Report

Waterbody Name: EF NF Blackfoot Upper

Station ID: WS_EFNFBLU15

Reference Status:

Site Classification:

Latitude:

Longitude:

Benthic Sample ID: 19817

Rep. Num 0

STORET Activity ID: E21-T500-M

Collection Date: 09/04/2015

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 1236

Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	8	1	PR	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	4	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	32	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila pellisa	4	0	PR	CN

Montana Bioassessment Report

Benthic Sample ID: 18165

Rep. Num 0

STORET Activity ID: E06-T500-M

Collection Date: 08/06/2013

Waterbody Name: Lost Pony Creek

Collection Method: MAC-T-500

Station ID: WS_LOSTPONY

Total Number of Individuals in Sample: 1476

Reference Status:

Site Classification:

Sample Taxa List

Order:	OTU name:	FinalID:	Individuals	Tol Val:	FFG:	Habit:
		Drunella doddsii	36			
		Nostoccocladius	16			
Diptera	Diamesinae	Pagastia	28	4	CG	sp
Diptera	Dixa	Dixa	8	4	CG	SW
Diptera	Hexatoma	Hexatoma	8	2	PR	BU
Diptera	Orthocladiinae	Brillia	16		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella gracei	132		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	68		CG/SC	SP/BU
Diptera	Orthocladiinae	Parametriocnemus	40		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	80		CG/SC	SP/BU
Ephemeropte	Ameletus	Ameletus	12	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	128	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	36	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	12	1	SC	"CN/75%, SP/25%"
Ephemeropte	Drunella spinifera	Drunella spinifera	8	0	PR	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	24	2	CG	CN
Ephemeropte	Rhithrogena	Rhithrogena	68	0	CG	CN
Ephemeropte	Serratella	Serratella tibialis	8	2	CG	CN
Plecoptera	Chloroperlidae	Suwallia	20	1	PR	CN
Plecoptera	Chloroperlidae	Sweltsa	124	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	52	0	unk	CN
Plecoptera	Leuctridae	Despaxia augusta	44	1	SH	CN
Plecoptera	Megarcys	Megarcys	56	1	PR	CN
Plecoptera	Paraperla	Paraperla Yoraperla	8	1	unk	unk
Plecoptera	Yoraperla	brevis Zapada	28	0	SH	CN
Plecoptera	Zapada	columbiana	252	2	SH	CN
Trichoptera	Dicosmoecus	Dicosmoecus atripes	4	2	SC	SP
Trichoptera	Glossosoma	Glossosoma	72	0	SC	CN
Trichoptera	Parapsyche	Parapsyche elsis	28	0	CF	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	28	1	PR	CN
Trichoptera	Rhyacophila hyalin	Rhyacophila Hyalinata Gr.	20	1	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila pellisa	4	0	PR	CN
Trichoptera	Rhyacophila verrul	Rhyacophila verrula	8	0	PR	CN

Montana Bioassessment Report

Waterbody Name: Lost Pony Creek

Station ID: WS_LOSTPONY

Reference Status:

Site Classification:

Benthic Sample ID: 18166

Rep. Num 0

STORET Activity ID: E06-T500-M

Collection Date: 08/08/2013

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 56

Sample Taxa List (cont.)

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
Coleoptera	Heterlimnius	Heterlimnius corpulentus	56	3	SC/CG	"CN/50%, BU/50%"

Montana Bioassessment Report

Waterbody Name: Meadow Creek (lower)

Station ID: WS_MEADCRL

Reference Status:

Site Classification:

Benthic Sample ID: 18167

Rep. Num 0

STORET Activity ID: E07-T500-M

Collection Date: 08/08/2013

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 1564

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Ameletus similior	8			
		Isoperla punctata	40			
		Thienimannimyia gr.	4			
Arhynchobde	Erpobdellidae	Erpobdella punctata	4	8	PR	SW
Coleoptera	Heterlimnius	Heterlimnius corpulentus	96	3	SC/CG	"CN/50%, BU/50%"
Coleoptera	Optioservus	Optioservus quadrimaculatus	120	5	SC	"CN/50%, BU/50%"
Coleoptera	Zaitzevia	Zaitzevia parvula	8	5	SC/CG	"CN/50%, BU/50%"
Diptera	Ceratopogoninae	Probezzia	12	6	PR/CG	SP/BU/SW
Diptera	Diamesinae	Pagastia	20	4	CG	sp
Diptera	Hexatoma	Hexatoma	12	2	PR	BU
Diptera	Orthocladiinae	Eukiefferiella gracei	4		CG/SC	SP/BU
Diptera	Orthocladiinae	Parametriocnemus	4		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	36		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia vitracies	32		CG/SC	SP/BU
Diptera	Tipula	Tipula	12	4	SH	BU
Ephemeropte	Baetis	Baetis flavistriga	24	5	CG	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	60	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	280	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	8	1	SC	"CN/75%, SP/25%"
Ephemeropte	Drunella grandis	Drunella grandis	4	2	PR	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	20	2	CG	CN
Ephemeropte	Paraleptophlebia	Paraleptophlebia	104	1	CG	SW/CN/SP
Ephemeropte	Rhithrogena	Rhithrogena	28	0	CG	CN
Ephemeropte	Serratella	Serratella tibialis	56	2	CG	CN
Haplotaxida	Oligochaeta	Tubificidae	8	8	CG	BU
Non-Insect ta	Nematoda	Nematoda	4	5	unk	BU
Plecoptera	Capniidae	Capniidae	8	1	SH	CN
Plecoptera	Chloroperlidae	Sweltsa	208	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	60	0	unk	CN
Plecoptera	Megarcys	Megarcys	52	1	PR	CN
Plecoptera	Zapada	Zapada cinctipes	220	2	SH	CN
Trichoptera	Dicosmoecus	Dicosmoecus gilvipes	8	2	SC	SP

Montana Bioassessment Report

Waterbody Name: Meadow Creek (upper)

Benthic Sample ID: 18161

Station ID: WS_MEADCRU

Rep. Num 0

STORET Activity ID: E02-T500-M

Reference Status:

Collection Date: 08/07/2013

Site Classification:

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 668

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Drunella doddsii	2			
		Epeorus longimannus	2			
		Isoperla punctata	4			
.	Turbellaria	Polycelis coronata	8	4	CG/PR	SP
Coleoptera	Heterlimnius	Heterlimnius corpulentus	44	3	SC/CG	"CN/50%, BU/50%"
Diptera	Diamesinae	Pagastia	2	4	CG	sp
Diptera	Hexatoma	Hexatoma	4	2	PR	BU
Diptera	Orthocladiinae	Brillia	4		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella gracei	22		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	8		CG/SC	SP/BU
Diptera	Rhabdomastix	Rhabdomastix	2	1	unk	BU
Ephemeropte	Ameletus	Ameletus oregonensis	8	0	SC	"SW/10%, CN/90%"
Ephemeropte	Ameletus	Ameletus validus	4	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	38	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	110	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	2	1	SC	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	68	2	CG	CN
Ephemeropte	Epeorus	Epeorus grandis	20	2	CG	CN
Ephemeropte	Rhithrogena	Rhithrogena	52	0	CG	CN
Ephemeropte	Serratella	Serratella tibialis	4	2	CG	CN
Plecoptera	Chloroperlidae	Sweltsa	84	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	8	0	unk	CN
Plecoptera	Hesperoperla	Hesperoperla pacifica	2	1	PR	CN
Plecoptera	Leuctridae	Despaxia augusta	16	1	SH	CN
Plecoptera	Visoka	Visoka cataractae	4	0	SH	CN
Plecoptera	Zapada	Zapada cinctipes	2	2	SH	CN
Plecoptera	Zapada	Zapada columbiana	78	2	SH	CN
Trichoptera	Glossosoma	Glossosoma	16	0	SC	CN
Trichoptera	Parapsyche	Parapsyche elsis	44	0	CF	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	4	1	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila pellisa	2	0	PR	CN

Montana Bioassessment Report

Waterbody Name: Mineral Creek

Station ID: WS_MINERAL

Reference Status:

Site Classification:

Latitude:

Longitude:

Benthic Sample ID: 19818

Rep. Num 0

STORET Activity ID: E22-T500-M

Collection Date: 09/05/2015

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 2496

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
.	Turbellaria	Polycelis coronata	72	4	CG/PR	SP
Coleoptera	Heterlimnius	Heterlimnius corpulentus	252	3	SC/CG	"CN/50%, BU/50%"
Diptera	Ceratopogoninae	Probezzia	24	6	PR/CG	SP/BU/SW
Diptera	Chironominae	Micropsectra	48	7	CG/CF/PR	BU/CN/SP
Diptera	Diamesinae	Pagastia	108	4	CG	sp
Diptera	Hexatoma	Hexatoma	12	2	PR	BU
Diptera	Orthocladiinae	Brillia	6		CG/SC	SP/BU
Diptera	Orthocladiinae	Corynoneura	6		CG/SC	SP/BU
Diptera	Orthocladiinae	Cricotopus	30		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella	30		CG/SC	SP/BU
Diptera	Orthocladiinae	Hydrobaenus	6		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	30		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	18		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia vitracies	18		CG/SC	SP/BU
Diptera	Tipula	Tipula	6	4	SH	BU
Ephemeropte	Ameletus	Ameletus	90	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	132	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	672	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	24	1	SC	"CN/75%, SP/25%"
Ephemeropte	Drunella doddsi	Drunella doddsii	84	1	SC	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	90	2	CG	CN
Ephemeropte	Epeorus	Epeorus longimanus	6	2	CG	CN
Ephemeropte	Rhithrogena	Rhithrogena	102	0	CG	CN
Ephemeropte	Serratella	Serratella tibialis	18	2	CG	CN
Lumbriculida	Oligochaeta	Lumbriculidae	48	8	CG	BU
Plecoptera	Chloroperlidae	Sweltsa	180	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	18	0	unk	CN
Plecoptera	Isoperla	Isoperla	6	2	PR	CN
Plecoptera	Leuctridae	Despaxia augusta	24	1	SH	CN
Plecoptera	Megarcys	Megarcys	6	1	PR	CN
Plecoptera	Setvena	Setvena bradleyi	6	0	PR	CN
Plecoptera	Taeniopterygidae	Taeniopterygidae	30	2	SH	CN
Plecoptera	Visoka	Visoka cataractae	18	0	SH	CN
Plecoptera	Yoraperla	Yoraperla brevis	6	0	SH	CN
Plecoptera	Zapada	Zapada columbiana	72	2	SH	CN

Montana Bioassessment Report

Waterbody Name: Mineral Creek

Station ID: WS_MINERAL

Reference Status:

Site Classification:

Latitude:

Longitude:

Benthic Sample ID: 19818

Rep. Num 0

STORET Activity ID: E22-T500-M

Collection Date: 09/05/2015

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 2496

Plecoptera	Zapada	Zapada oregonensis gr.	30	2	SH	CN
Trichoptera	Ecclisomyia	Ecclisomyia maculosa	6	4	CG	CN/SP/CM
Trichoptera	Glossosoma	Glossosoma	18	0	SC	CN
TRICHOPTE	Neophylax	NEOPHYLAX OCCIDENTIS	12	3	SC	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	18	1	PR	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	6	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	96	0	PR	CN
Trichoptera	Rhyacophila vagrit	Rhyacophila vagrita gr.	6	0	PR	CN
Trichoptera	Rhyacophila vofixa	Rhyacophila vofixa gr.	6	0	PR	CN

Montana Bioassessment Report

Waterbody Name: North Fork Blackfoot River nr. EFBLF confluence

Station ID: WS_NFBLF473 (lower)

Benthic Sample ID: 18178

Rep. Num 0

Reference Status:

Site Classification:

STORET Activity ID: E02-T500-M

Collection Date: 08/27/2014

Collection Method: MAC-T-500

Sample Taxa List

Total Number of Individuals in Sample: 968

Order:	OTU name:	FinalID:	Individuals	Tol Val:	FFG:	Habit:
		Epeorus longimannus	48			
		Nostoccocladius	112			
		Thienimannimyia gr.	8			
.	Turbellaria	Polycelis coronata	4	4	CG/PR	SP
Coleoptera	Heterlimnius	Heterlimnius corpulentus	120	3	SC/CG	"CN/50%, BU/50%"
Diptera	Ceratopogoninae	Probezzia	4	6	PR/CG	SP/BU/SW
Diptera	Diamesinae	Pagastia	4	4	CG	sp
Diptera	Hexatoma	Hexatoma	8	2	PR	BU
Diptera	Orthocladiinae	Eukiefferiella devonica	8		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella gracei	12		CG/SC	SP/BU
Diptera	Orthocladiinae	Orthocladius	16		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	4		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	4		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia vitracies	8		CG/SC	SP/BU
Diptera	Pericoma/Telmatos	Pericoma	4	4	CG	BU
Diptera	Simuliidae	Prosimulium	32	6	CF	CN
Diptera	Simuliidae	Simulium	72	6	CF	CN
Ephemeropte	Ameletus	Ameletus validus	4	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	88	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	4	0	SC	CN
Ephemeropte	Epeorus	Epeorus deceptivus	16	2	CG	CN
Ephemeropte	Epeorus	Epeorus grandis	60	2	CG	CN
Ephemeropte	Paraleptophlebia	Paraleptophlebia	4	1	CG	SW/CN/SP
Ephemeropte	Rhithrogena	Rhithrogena	20	0	CG	CN
Ephemeropte	Serratella	Serratella tibialis	8	2	CG	CN
Non-Insect ta	Nematoda	Nematoda	8	5	unk	BU
Plecoptera	Chloroperlidae	Sweltsa	32	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	36	0	unk	CN
Plecoptera	Leuctridae	Despaxia augusta	8	1	SH	CN
Plecoptera	Megarcys	Megarcys	32	1	PR	CN
Plecoptera	Zapada	Zapada cinctipes	4	2	SH	CN
Plecoptera	Zapada	Zapada columbiana	52	2	SH	CN
Plecoptera	Zapada	Zapada oregonensis gr.	4	2	SH	CN
Trichoptera	Cryptochia	Cryptochia pilosa	4	3	SC	SP
Trichoptera	Dicosmoecus	Dicosmoecus atripes	4	2	SC	SP

Montana Bioassessment Report

Waterbody Name: North Fork Blackfoot River nr. EFBLF confluence **Benthic Sample ID:** 18178

Station ID: WS_NFBLF473 (lower) **Rep. Num** 0

Reference Status: **STORET Activity ID:** E02-T500-M

Site Classification:

Collection Date: 08/27/2014

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 968

Sample Taxa List (cont.)

Trichoptera	Neothremma	Neothremma alicia	4	1	SC	CN
Trichoptera	Parapsyche	Parapsyche elsis	48	0	CF	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	12	1	PR	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	16	0	PR	CN
Trichoptera	Rhyacophila hyalin	Rhyacophila Hyalinata Gr.	24	1	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	4	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila pellisa	4	0	PR	CN

Montana Bioassessment Report

Waterbody Name: North Fork Blackfoot River below Broadus Cr

Station ID: WS_NFBLF481 (middle)

Benthic Sample ID: 18180

Rep. Num 0

Reference Status:

Site Classification:

STORET Activity ID: E06-T500-M

Collection Date: 08/28/2014

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 774

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Drunella doddsii	6			
		Neophylax splendans	2			
		Nostoccocladius	2			
		Onocomoecus unicolor	2			
.	Turbellaria	Polycelis coronata	4	4	CG/PR	SP
Coleoptera	Heterlimnius	Heterlimnius corpulentus	32	3	SC/CG	"CN/50%, BU/50%"
Diptera	Ceratopogoninae	Probezzia	4	6	PR/CG	SP/BU/SW
Diptera	Chelifera_Metachel	Chelifera	2	5	unk	SP
Diptera	Chironominae	Micropsectra	22	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Stempellina	8	7	CG/CF/PR	BU/CN/SP
Diptera	Diamesinae	Diamesa	18	4	CG	sp
Diptera	Dicranota	Dicranota	2	0	PR	SP
Diptera	Hexatoma	Hexatoma	10	2	PR	BU
Diptera	Orthocladiinae	Brillia	2		CG/SC	SP/BU
Diptera	Orthocladiinae	Corynoneura	2		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella gracei	4		CG/SC	SP/BU
Diptera	Orthocladiinae	Orthocladius	6		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	2		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	2		CG/SC	SP/BU
Diptera	Pelecorhynchidae	Glutops	4	1	PR	SP
Diptera	Pericoma/Telmatos	Pericoma	2	4	CG	BU
Diptera	Simuliidae	Prosimulium	4	6	CF	CN
Ephemeropte	Baetis	Baetis tricaudatus	26	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	18	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	2	1	SC	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	50	2	CG	CN
Ephemeropte	Epeorus	Epeorus grandis	6	2	CG	CN
Ephemeropte	Rhithrogena	Rhithrogena	46	0	CG	CN
Ephemeropte	Serratella	Serratella tibialis	8	2	CG	CN
Haplotaxida	Oligochaeta	Lumbricina	2	8	CG	BU
Lumbriculida	Oligochaeta	Lumbriculidae	8	8	CG	BU
Plecoptera	Chloroperlidae	Sweltsa	92	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	10	0	unk	CN
Plecoptera	Isoperla	Isoperla	16	2	PR	CN
Plecoptera	Leuctridae	Despaxia augusta	66	1	SH	CN

Montana Bioassessment Report

Waterbody Name: North Fork Blackfoot River below Broadus Cr **Benthic Sample ID:** 18180

Station ID: WS_NFBLF481 (middle) **Rep. Num** 0

Reference Status: **STORET Activity ID:** E06-T500-M

Site Classification:

Collection Date: 08/28/2014

Collection Method: MAC-T-500

Sample Taxa List (cont.)

Total Number of Individuals in Sample: 774

Plecoptera	Megarcys	Megarcys	36	1	PR	CN
Plecoptera	Visoka	Visoka cataractae	4	0	SH	CN
Plecoptera	Yoraperla	Yoraperla brevis	14	0	SH	CN
Plecoptera	Zapada	Zapada columbiana	136	2	SH	CN
Plecoptera	Zapada	Zapada oregonensis gr.	6	2	SH	CN
Trichoptera	Dicosmoecus	Dicosmoecus atripes	6	2	SC	SP
Trichoptera	Glossosoma	Glossosoma	4	0	SC	CN
Trichoptera	Neothremma	Neothremma alicia	2	1	SC	CN
Trichoptera	Parapsyche	Parapsyche elsis	16	0	CF	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	16	1	PR	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	6	0	PR	CN
Trichoptera	Rhyacophila hyalin	Rhyacophila Hyalinata Gr.	8	1	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila pellisa	8	0	PR	CN
Trichoptera	Rhyacophila vagrit	Rhyacophila vagrita	14	0	PR	CN
Trichoptera	Rhyacophila vofixa	Rhyacophila vofixa gr.	6	0	PR	CN

Montana Bioassessment Report

Waterbody Name: North Fork Blackfoot River

Station ID: WS_NFBLF478 (upper)

Reference Status:

Site Classification:

Benthic Sample ID: 18179

Rep. Num 0

STORET Activity ID: E05-T500-M

Collection Date: 08/28/2014

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 502

Sample Taxa List

Order:	OTU name:	FinalID:	Individuals	Tol Val:	FFG:	Habit:
		Drunella doddsii	5			
		Epeorus longimannus	5			
		Thienimannimyia gr.	18			
.	Turbellaria	Polycelis coronata	4	4	CG/PR	SP
Coleoptera	Heterlimnius	Heterlimnius corpulentus	22	3	SC/CG	"CN/50%, BU/50%"
Coleoptera	Optioservus	Optioservus quadrimaculatus	1	5	SC	"CN/50%, BU/50%"
Diptera	Chelifera_Metachel	Chelifera	1	5	unk	SP
Diptera	Chironominae	Micropsectra	16	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Stempellina	8	7	CG/CF/PR	BU/CN/SP
Diptera	Dicranota	Dicranota	1	0	PR	SP
Diptera	Hexatoma	Hexatoma	3	2	PR	BU
Diptera	Orthocladiinae	Brillia	3		CG/SC	SP/BU
Diptera	Orthocladiinae	Orthocladius	3		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	3		CG/SC	SP/BU
Diptera	Pelecorhynchidae	Glutops	2	1	PR	SP
Diptera	Simuliidae	Prosimulium	2	6	CF	CN
Ephemeropte	Baetis	Baetis tricaudatus	48	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	10	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	1	1	SC	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	40	2	CG	CN
Ephemeropte	Epeorus	Epeorus grandis	1	2	CG	CN
Ephemeropte	Rhithrogena	Rhithrogena	18	0	CG	CN
Plecoptera	Chloroperlidae	Sweltsa	71	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	36	0	unk	CN
Plecoptera	Isoperla	Isoperla	8	2	PR	CN
Plecoptera	Leuctridae	Despaxia augusta	24	1	SH	CN
Plecoptera	Megarcys	Megarcys	22	1	PR	CN
Plecoptera	Yoraperla	Yoraperla brevis	1	0	SH	CN
Plecoptera	Zapada	Zapada cinctipes	2	2	SH	CN
Plecoptera	Zapada	Zapada columbiana	56	2	SH	CN
Trichoptera	Glossosoma	Glossosoma	2	0	SC	CN
Trichoptera	Micrasema	Micrasema bactro	2	1	SH	CN
Trichoptera	Neothremma	Neothremma alicia	5	1	SC	CN
Trichoptera	Parapsyche	Parapsyche elsis	20	0	CF	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	17	1	PR	CN

Montana Bioassessment Report

Waterbody Name: North Fork Blackfoot River
Station ID: WS_NFBLF478 (upper)
Reference Status:
Site Classification:

Benthic Sample ID: 18179
Rep. Num 0
STORET Activity ID: E05-T500-M
Collection Date: 08/28/2014
Collection Method: MAC-T-500
Total Number of Individuals in Sample: 502

Sample Taxa List (cont.)

Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	5	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila pellisa	4	0	PR	CN
Trichoptera	Rhyacophila vagrit	Rhyacophila vagrita	7	0	PR	CN
Trichoptera	Rhyacophila vofixa	Rhyacophila vofixa gr.	5	0	PR	CN

Montana Bioassessment Report

Waterbody Name: NF Blackfoot River

Station ID: WS_NFBLF2015

Reference Status:

Site Classification:

Latitude:

Longitude:

Benthic Sample ID: 19819

Rep. Num 0

STORET Activity ID: E23-T500-M

Collection Date: 09/06/2015

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 2512

Sample Taxa List

Order:	OTU name:	FinalID:	Individuals	Tol Val:	FFG:	Habit:
		Epeorus longimannus	8			
		Nostoccocladius	40			
		Thienimannimyia gr.	16			
.	Turbellaria	Polycelis coronata	8	4	CG/PR	SP
Coleoptera	Heterlimnius	Heterlimnius corpulentus	80	3	SC/CG	"CN/50%, BU/50%"
Diptera	Ceratopogoninae	Probezzia	8	6	PR/CG	SP/BU/SW
Diptera	Diamesinae	Pagastia	8	4	CG	sp
Diptera	Hexatoma	Hexatoma	40	2	PR	BU
Diptera	Orthocladiinae	Eukiefferiella	16		CG/SC	SP/BU
Diptera	Orthocladiinae	Orthocladius	32		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	8		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	8		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia vitracies	16		CG/SC	SP/BU
Diptera	Pericoma/Telmatos	Pericoma	112	4	CG	BU
Diptera	Simuliidae	Prosimulium	64	6	CF	CN
Diptera	Simuliidae	Simulium	144	6	CF	CN
Ephemeropte	Ameletus	Ameletus validus	80	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	24	5	CG	"SW/10%, CN/90%"
Ephemeropte	Caudatella	Caudatella hystrix	8	0	CG	CN
Ephemeropte	Cinygmula	Cinygmula	48	0	SC	CN
Ephemeropte	Diphetor	Diphetor hageni	8	5	CG	"SW/10%, CN/90%"
Ephemeropte	Epeorus	Epeorus deceptivus	16	2	CG	CN
Ephemeropte	Epeorus	Epeorus grandis	112	2	CG	CN
Ephemeropte	Paraleptophlebia	Paraleptophlebia	8	1	CG	SW/CN/SP
Ephemeropte	Rhithrogena	Rhithrogena	368	0	CG	CN
Ephemeropte	Serratella	Serratella tibialis	16	2	CG	CN
Lumbriculida	Oligochaeta	Lumbriculidae	32	8	CG	BU
Plecoptera	Calineuria	Calineuria californica	16	2	PR	CN
Plecoptera	Chloroperlidae	Sweltsa	120	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	8	0	unk	CN
Plecoptera	Leuctridae	Despaxia augusta	16	1	SH	CN
Plecoptera	Megarcys	Megarcys	88	1	PR	CN
Plecoptera	Paraperla	Paraperla	16	1	unk	unk
Plecoptera	Yoraperla	Yoraperla brevis	8	0	SH	CN
Plecoptera	Zapada	Zapada cinctipes	8	2	SH	CN

Montana Bioassessment Report

Waterbody Name: NF Blackfoot River

Station ID: WS_NFBLF2015

Reference Status:

Site Classification:

Latitude:

Longitude:

Benthic Sample ID: 19819

Rep. Num 0

STORET Activity ID: E23-T500-M

Collection Date: 09/06/2015

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 2512

Plecoptera	Zapada	Zapada columbiana	128	2	SH	CN
Plecoptera	Zapada	Zapada frigida	8	2	SH	CN
Plecoptera	Zapada	Zapada oregonensis gr.	160	2	SH	CN
Trichoptera	Dicosmoecus	Dicosmoecus atripes	8	2	SC	SP
Trichoptera	Ecclisomyia	Ecclisomyia maculosa	8	4	CG	CN/SP/CM
Trichoptera	Neothremma	Neothremma alicia	8	1	SC	CN
Trichoptera	Parapsyche	Parapsyche elsis	216	0	CF	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	104	1	PR	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	24	0	PR	CN
Trichoptera	Rhyacophila hyalin	Rhyacophila Hyalinata Gr.	56	1	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	24	0	PR	CN
Trichoptera	Rhyacophila vofixa	Rhyacophila vofixa gr.	160	0	PR	CN

Montana Bioassessment Report

Waterbody Name: NF Blackfoot River Upper

Benthic Sample ID: 19820

Station ID: WS_NFBLFU2015

Rep. Num 0

STORET Activity ID: E24-T500-M

Reference Status:

Site Classification:

Collection Date: 09/30/2015

Collection Method: MAC-T-500

Latitude:

Longitude:

Total Number of Individuals in Sample: 1392

Sample Taxa List

Order:	OTU name:	FinalID:	Individuals	Tol Val:	FFG:	Habit:
		Epeorus longimannus	6			
		Ephemerella excruians	12			
		Nostoccocladius	30			
		Thienimannimyia gr.	6			
.	Turbellaria	Polycelis coronata	18	4	CG/PR	SP
Coleoptera	Heterlimnius	Heterlimnius corpulentus	108	3	SC/CG	"CN/50%, BU/50%"
Diptera	Antocha	Antocha	6	3	CG	CN
Diptera	Ceratopogoninae	Probezzia	6	6	PR/CG	SP/BU/SW
Diptera	Chironominae	Micropsectra	18	7	CG/CF/PR	BU/CN/SP
Diptera	Diamesinae	Diamesa	54	4	CG	sp
Diptera	Diamesinae	Pagastia	48	4	CG	sp
Diptera	Hexatoma	Hexatoma	36	2	PR	BU
Diptera	Orthocladiinae	Eukiefferiella	12		CG/SC	SP/BU
Diptera	Orthocladiinae	Orthocladius	24		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	18		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	6		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia vitracies	6		CG/SC	SP/BU
Diptera	Pericoma/Telmatos	Pericoma	30	4	CG	BU
Diptera	Simuliidae	Prosimulium	24	6	CF	CN
Ephemeropte	Ameletus	Ameletus validus	6	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	78	5	CG	"SW/10%, CN/90%"
Ephemeropte	Caudatella	Caudatella hystrix	6	0	CG	CN
Ephemeropte	Cinygmula	Cinygmula	78	0	SC	CN
Ephemeropte	Diphetor	Diphetor hageni	6	5	CG	"SW/10%, CN/90%"
Ephemeropte	Drunella coloraden	Drunella coloradensis	12	1	SC	"CN/75%, SP/25%"
Ephemeropte	Drunella spinifera	Drunella spinifera	18	0	PR	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	6	2	CG	CN
Ephemeropte	Epeorus	Epeorus grandis	24	2	CG	CN
Ephemeropte	Paraleptophlebia	Paraleptophlebia	6	1	CG	SW/CN/SP
Ephemeropte	Rhithrogena	Rhithrogena	96	0	CG	CN
Ephemeropte	Serratella	Serratella tibialis	12	2	CG	CN
Lumbriculida	Oligochaeta	Lumbriculidae	12	8	CG	BU
Plecoptera	Chloroperlidae	Sweltsa	108	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	96	0	unk	CN
Plecoptera	Hesperoperla	Hesperoperla pacifica	6	1	PR	CN

Montana Bioassessment Report

Waterbody Name: NF Blackfoot River Upper

Station ID: WS_NFBLFU2015

Reference Status:

Site Classification:

Latitude:

Longitude:

Benthic Sample ID: 19820

Rep. Num 0

STORET Activity ID: E24-T500-M

Collection Date: 09/30/2015

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 1392

Plecoptera	Leuctridae	Despaxia augusta	30	1	SH	CN
Plecoptera	Megarcys	Megarcys	42	1	PR	CN
Plecoptera	Paraperla	Paraperla	12	1	unk	unk
Plecoptera	Zapada	Zapada cinctipes	12	2	SH	CN
Trichoptera	Arctopsyche	Arctopsyche grandis	42	2	CF	CN
Trichoptera	Ecclisomyia	Ecclisomyia maculosa	6	4	CG	CN/SP/CM
Trichoptera	Glossosoma	Glossosoma	6	0	SC	CN
Trichoptera	Neothremma	Neothremma alicia	6	1	SC	CN
Trichoptera	Parapsyche	Parapsyche elsis	42	0	CF	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	96	1	PR	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	12	0	PR	CN
Trichoptera	Rhyacophila hyalin	Rhyacophila Hyalinata Gr.	12	1	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	18	0	PR	CN
Trichoptera	Rhyacophila vofixa	Rhyacophila vofixa gr.	18	0	PR	CN

Montana Bioassessment Report

Waterbody Name: Sarbo Creek

Station ID: WS_SARBO

Reference Status:

Site Classification:

Benthic Sample ID: 18181

Rep. Num 0

STORET Activity ID: E01-T500-M

Collection Date: 08/27/2014

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 503

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Drunella doddsii	5			
		Epeorus longimannus	7			
.	Turbellaria	Polycelis coronata	9	4	CG/PR	SP
Coleoptera	Heterlimnius	Heterlimnius corpulentus	21	3	SC/CG	"CN/50%, BU/50%"
Diptera	Chelifera_Metachel	Chelifera	2	5	unk	SP
Diptera	Chironominae	Micropsectra	4	7	CG/CF/PR	BU/CN/SP
Diptera	Clinocera	Clinocera	1	5	unk	CN
Diptera	Diamesinae	Diamesa	5	4	CG	sp
Diptera	Diamesinae	Pagastia	12	4	CG	sp
Diptera	Dixa	Dixa	1	4	CG	SW
Diptera	Orthocladiinae	Brillia	12		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella devonica	4		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella gracei	22		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	2		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	15		CG/SC	SP/BU
Diptera	Pelecorhynchidae	Glutops	2	1	PR	SP
Ephemeropte	Ameletus	Ameletus validus	14	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	72	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	22	0	SC	CN
Ephemeropte	Drunella spinifera	Drunella spinifera	2	0	PR	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus grandis	19	2	CG	CN
Ephemeropte	Rhithrogena	Rhithrogena	6	0	CG	CN
Plecoptera	Chloroperlidae	Sweltsa	40	1	PR	CN
Plecoptera	Isoperla	Isoperla	2	2	PR	CN
Plecoptera	Leuctridae	Despaxia augusta	34	1	SH	CN
Plecoptera	Megarcys	Megarcys	18	1	PR	CN
Plecoptera	Setvena	Setvena bradleyi	4	0	PR	CN
Plecoptera	Yoraperla	Yoraperla brevis	45	0	SH	CN
Plecoptera	Zapada	Zapada columbiana	55	2	SH	CN
Plecoptera	Zapada	Zapada oregonensis gr.	4	2	SH	CN
Trichoptera	Micrasema	Micrasema bactro	3	1	SH	CN
Trichoptera	Neothremma	Neothremma alicia	10	1	SC	CN
Trichoptera	Parapsyche	Parapsyche elsis	10	0	CF	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	12	1	PR	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	4	0	PR	CN

Montana Bioassessment Report

Waterbody Name: Sarbo Creek

Station ID: WS_SARBO

Reference Status:

Site Classification:

Benthic Sample ID: 18181

Rep. Num 0

STORET Activity ID: E01-T500-M

Collection Date: 08/27/2014

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 503

Sample Taxa List (cont.)

Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	2	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila pellisa	1	0	PR	CN

Montana Bioassessment Report

Benthic Sample ID: 19821

Waterbody Name: Sarbo Creek

Rep. Num 0

Station ID: WS_SARBO15

STORET Activity ID: E17-T500-M

Reference Status:

Collection Date: 09/30/2015

Site Classification:

Collection Method: MAC-T-500

Latitude:

Total Number of Individuals in Sample: 1752

Longitude:

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Epeorus longimannus	4			
.	Turbellaria	Polycelis coronata	72	4	CG/PR	SP
Coleoptera	Heterlimnius	Heterlimnius corpulentus	80	3	SC/CG	"CN/50%, BU/50%"
Diptera	Chironominae	Micropsectra	56	7	CG/CF/PR	BU/CN/SP
Diptera	Clinocera	Clinocera	8	5	unk	CN
Diptera	Diamesinae	Diamesa	28	4	CG	sp
Diptera	Diamesinae	Pagastia	132	4	CG	sp
Diptera	Dicranota	Dicranota	124	0	PR	SP
Diptera	Oreogeton	Oreogeton	8	4	PR	SP
Diptera	Orthocladiinae	Brillia	12		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella devonica	4		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella gracei	20		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	8		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	16		CG/SC	SP/BU
Diptera	Pelecorhynchidae	Glutops	40	1	PR	SP
Diptera	Pericoma/Telmatos	Pericoma	252	4	CG	BU
Ephemeropte	Ameletus	Ameletus validus	12	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	8	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	4	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	4	1	SC	"CN/75%, SP/25%"
Ephemeropte	Drunella doddsi	Drunella doddsii	16	1	SC	"CN/75%, SP/25%"
Ephemeropte	Drunella spinifera	Drunella spinifera	4	0	PR	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus grandis	56	2	CG	CN
Ephemeropte	Rhithrogena	Rhithrogena	8	0	CG	CN
Plecoptera	Chloroperlidae	Sweltsa	32	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	16	0	unk	CN
Plecoptera	Isoperla	Isoperla	8	2	PR	CN
Plecoptera	Leuctridae	Despaxia augusta	76	1	SH	CN
Plecoptera	Megarcys	Megarcys	24	1	PR	CN
Plecoptera	Setvena	Setvena bradleyi	132	0	PR	CN
Plecoptera	Yoraperla	Yoraperla brevis	100	0	SH	CN
Plecoptera	Zapada	Zapada columbiana	20	2	SH	CN
Plecoptera	Zapada	Zapada oregonensis gr.	48	2	SH	CN
Trichoptera	Neothremma	Neothremma alicia	52	1	SC	CN

Trichoptera	Parapsyche	Parapsyche elsis	24	0	CF	CN

Montana Bioassessment Report

Waterbody Name: Sarbo Creek

Station ID: WS_SARBO15

Reference Status:

Site Classification:

Latitude:

Longitude:

Benthic Sample ID: 19821

Rep. Num 0

STORET Activity ID: E17-T500-M

Collection Date: 09/30/2015

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 1752

Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	36	1	PR	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	68	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	128	0	PR	CN
Trichoptera	Rhyacophila vofixa	Rhyacophila vofixa gr.	12	0	PR	CN

Montana Bioassessment Report

Waterbody Name: Scotty Creek

Station ID: WS_SCOTTY

Reference Status:

Site Classification:

Benthic Sample ID: 18168

Rep. Num 0

STORET Activity ID: E08-T500-M

Collection Date: 08/06/2013

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 2176

Sample Taxa List

Order:	OTU name:	FinalID:	Individuals	Tol Val:	FFG:	Habit:
		Isoperla punctata	8			
.	Turbellaria	Polycelis coronata	16	4	CG/PR	SP
Coleoptera	Heterlimnius	Heterlimnius corpulentus	64	3	SC/CG	"CN/50%, BU/50%"
Diptera	Ceratopogoninae	Probezzia	16	6	PR/CG	SP/BU/SW
Diptera	Chelifera_Metachel	Chelifera	8	5	unk	SP
Diptera	Chironominae	Micropsectra	112	7	CG/CF/PR	BU/CN/SP
Diptera	Clinocera	Clinocera	24	5	unk	CN
Diptera	Diamesinae	Pagastia	64	4	CG	sp
Diptera	Oreogeton	Oreogeton	24	4	PR	SP
Diptera	Orthocladiinae	Brillia	216		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella gracei	40		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	160		CG/SC	SP/BU
Diptera	Orthocladiinae	Parametriocnemus	32		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	120		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia vitracies	32		CG/SC	SP/BU
Ephemeropte	Baetis	Baetis tricaudatus	72	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	24	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	32	1	SC	"CN/75%, SP/25%"
Ephemeropte	Rhithrogena	Rhithrogena	64	0	CG	CN
Ephemeropte	Serratella	Serratella tibialis	32	2	CG	CN
Lumbriculida	Oligochaeta	Lumbriculidae	16	8	CG	BU
Plecoptera	Chloroperlidae	Suwallia	24	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	120	0	unk	CN
Plecoptera	Leuctridae	Despaxia augusta	72	1	SH	CN
Plecoptera	Megarcys	Megarcys	48	1	PR	CN
Plecoptera	Setvena	Setvena bradleyi	32	0	PR	CN
Plecoptera	Zapada	Zapada columbiana	304	2	SH	CN
Trichoptera	Parapsyche	Parapsyche elsis	40	0	CF	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	8	1	PR	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	112	0	PR	CN
Trichoptera	Rhyacophila hyalin	Rhyacophila Hyalinata Gr.	40	1	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	32	0	PR	CN
Trichoptera	Rhyacophila vagrit	Rhyacophila vagrita	48	0	PR	CN
Trichoptera	Stactobiella	Stactobiella	120		SH	CN

Montana Bioassessment Report

Waterbody Name: Sourdough Creek (lower)

Benthic Sample ID: 18169

Station ID: WS_SOURL

Rep. Num 0

STORET Activity ID: E09-T500-M

Reference Status:

Site Classification:

Collection Date: 08/06/2013

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 1488

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Epeorus longimannus	4			
		Isoperla punctata	4			
. Diptera	Turbellaria	Polycelis coronata	12	4	CG/PR	SP
Diptera	Chironominae	Micropsectra	12	7	CG/CF/PR	BU/CN/SP
Diptera	Diamesinae	Pagastia	4	4	CG	sp
Diptera	Limnophila	Limnophila	4	3	PR	BU
Diptera	Oreogeton	Oreogeton	20	4	PR	SP
Diptera	Orthocladiinae	Brillia	12		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	8		CG/SC	SP/BU
Ephemeropte	Simuliidae	Prosimulium	8	6	CF	CN
Ephemeropte	Baetis	Baetis bicaudatus	56	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	40	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	16	1	SC	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	484	2	CG	CN
Ephemeropte	Epeorus	Epeorus grandis	8	2	CG	CN
Lumbriculida	Rhithrogena	Rhithrogena	120	0	CG	CN
Plecoptera	Oligochaeta	Lumbriculidae	8	8	CG	BU
Plecoptera	Capniidae	Utacapnia	12	1	SH	CN
Plecoptera	Chloroperlidae	Suwallia	80	1	PR	CN
Plecoptera	Chloroperlidae	Sweltsa	84	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	12	0	unk	CN
Plecoptera	Leuctridae	Despaxia augusta	72	1	SH	CN
Plecoptera	Megarcys	Megarcys	76	1	PR	CN
Plecoptera	Paraperla	Paraperla Yoraperla	24	1	unk	unk
Plecoptera	Yoraperla	brevis Zapada	20	0	SH	CN
Trichoptera	Zapada	columbiana	260	2	SH	CN
Trichoptera	Parapsyche	Parapsyche elsis	8	0	CF	CN
Trichoptera	Rhyacophila albert	Rhyacophila alberta	4	0	PR	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	8	1	PR	CN
	Rhyacophila sibiric	Rhyacophila pellisa	8	0	PR	CN

Montana Bioassessment Report

Waterbody Name: Sourdough Creek (upper)

Benthic Sample ID: 18170

Station ID: WS_SOURU

Rep. Num 0

STORET Activity ID: E10-T500-M

Reference Status:

Site Classification:

Collection Date: 08/06/2013

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 784

Sample Taxa List

Order:	OTU name:	FinalID:	Individuals	Tol Val:	FFG:	Habit:
		Epeorus longimannus	4			
.	Turbellaria	Polycelis coronata	50	4	CG/PR	SP
Coleoptera	Optioservus	Optioservus quadrimaculatus	8	5	SC	"CN/50%, BU/50%"
Diptera	Diamesinae	Pagastia	4	4	CG	sp
Diptera	Dicranota	Dicranota	4	0	PR	SP
Diptera	Oreogeton	Oreogeton	24	4	PR	SP
Diptera	Orthocladiinae	Brillia	6		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella gracei	4		CG/SC	SP/BU
Diptera	Orthocladiinae	Orthocladius	6		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	4		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	22		CG/SC	SP/BU
Ephemeropte	Ameletus	Ameletus	24	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis bicaudatus	22	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	154	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	10	1	SC	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	270	2	CG	CN
Ephemeropte	Rhithrogena	Rhithrogena	48	0	CG	CN
Lumbriculida	Oligochaeta	Lumbriculidae	18	8	CG	BU
Plecoptera	Chloroperlidae	Suwallia	6	1	PR	CN
Plecoptera	Chloroperlidae	Sweltsa	36	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	4	0	unk	CN
Plecoptera	Isoperla	Isoperla	2	2	PR	CN
Plecoptera	Leuctridae	Despaxia augusta	4	1	SH	CN
Plecoptera	Megarcys	Megarcys	16	1	PR	CN
Plecoptera	Yoraperla	Yoraperla brevis	2	0	SH	CN
Plecoptera	Zapada	Zapada columbiana	24	2	SH	CN
Trichoptera	Ecclisomyia	Ecclisomyia maculosa	2	4	CG	CN/SP/CM
Trichoptera	Glossosoma	Glossosoma	2	0	SC	CN
Trichoptera	Homophylax	Homophylax	2	2	SH	CN/SP
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	2	0	PR	CN

Montana Bioassessment Report

Waterbody Name: Sourdough Creek lower

Benthic Sample ID: 19822

Station ID: WS_SOURL15

Rep. Num 0

STORET Activity ID: E15-T500-M

Reference Status:

Site Classification:

Collection Date: 09/03/2015

Collection Method: MAC-T-500

Latitude:

Longitude:

Total Number of Individuals in Sample: 1416

Sample Taxa List

Order:	OTU name:	FinalID:	Individuals	Tol Val:	FFG:	Habit:
		Epeorus longimannus	6			
		Isoperla punctata	6			
		Rhyacophila siberica gr.	6			
		Utacapnia sopladora	6			
. Diptera	Turbellaria	Polycelis coronata	54	4	CG/PR	SP
Diptera	Chironominae	Micropsectra	12	7	CG/CF/PR	BU/CN/SP
Diptera	Diamesinae	Diamesa	12	4	CG	sp
Diptera	Diamesinae	Pagastia	6	4	CG	sp
Diptera	Dicranota	Dicranota	6	0	PR	SP
Diptera	Limnophila	Limnophila	6	3	PR	BU
Diptera	Oreogeton	Oreogeton	6	4	PR	SP
Diptera	Orthocladiinae	Rheocricotopus	12		CG/SC	SP/BU
Ephemeropte	Simuliidae	Prosimulium	6	6	CF	CN
Ephemeropte	Ameletus	Ameletus	18	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis bicaudatus	30	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	162	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	30	1	SC	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	498	2	CG	CN
Ephemeropte	Epeorus	Epeorus grandis	6	2	CG	CN
Lumbriculida	Rhithrogena	Rhithrogena	138	0	CG	CN
Plecoptera	Oligochaeta	Lumbriculidae	12	8	CG	BU
Plecoptera	Chloroperlidae	Suwallia	30	1	PR	CN
Plecoptera	Chloroperlidae	Sweltsa	96	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	6	0	unk	CN
Plecoptera	Leuctridae	Despaxia augusta	6	1	SH	CN
Plecoptera	Megarcys	Megarcys	66	1	PR	CN
Plecoptera	Paraperla	Paraperla Yoraperla	6	1	unk	unk
Plecoptera	Yoraperla	brevis Zapada	12	0	SH	CN
Plecoptera	Zapada	columbiana	30	2	SH	CN
Trichoptera	Zapada	Zapada oregonensis gr.	66	2	SH	CN
Trichoptera	Parapsyche	Parapsyche elsis	18	0	CF	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	6	1	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	24	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila pellisa	6	0	PR	CN
	Rhyacophila vagrit	Rhyacophila vagrita gr.	6	0	PR	CN

Montana Bioassessment Report

Waterbody Name: Sourdough Creek upper

Station ID: WS_SOURU15

Reference Status:

Site Classification:

Latitude:

Longitude:

Benthic Sample ID: 19823

Rep. Num 0

STORET Activity ID: E16-T500-M

Collection Date: 09/30/2015

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 1040

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Ameletus similior	144			
		Epeorus longimannus	4			
.	Turbellaria	Polycelis coronata	192	4	CG/PR	SP
Coleoptera	Optioservus	Optioservus quadrimaculatus	4	5	SC	"CN/50%, BU/50%"
Diptera	Diamesinae	Diamesa	4	4	CG	sp
Diptera	Diamesinae	Pagastia	8	4	CG	sp
Diptera	Dicranota	Dicranota	8	0	PR	SP
Diptera	Oreogeton	Oreogeton	48	4	PR	SP
Diptera	Orthocladiinae	Brillia	4		CG/SC	SP/BU
Diptera	Orthocladiinae	Orthocladius	12		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	12		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	20		CG/SC	SP/BU
Ephemeropte	Baetis	Baetis bicaudatus	4	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	136	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	20	1	SC	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	116	2	CG	CN
Ephemeropte	Rhithrogena	Rhithrogena	124	0	CG	CN
Lumbriculida	Oligochaeta	Lumbriculidae	20	8	CG	BU
Plecoptera	Chloroperlidae	Sweltsa	52	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	12	0	unk	CN
Plecoptera	Isoperla	Isoperla	4	2	PR	CN
Plecoptera	Leuctridae	Despaxia augusta	16	1	SH	CN
Plecoptera	Megarcys	Megarcys	32	1	PR	CN
Plecoptera	Yoraperla	Yoraperla brevis	4	0	SH	CN
Plecoptera	Zapada	Zapada columbiana	20	2	SH	CN
Trichoptera	Anagapetus	Anagapetus	4	0	SC	CN
Trichoptera	Homophylax	Homophylax	8	2	SH	CN/SP
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	4	0	PR	CN
Trombidiform	Acarina	Testudacarus	4	5	PR	"SW/10%, CN/90%"

Montana Bioassessment Report

Benthic Sample ID: 18171

Waterbody Name: Spaulding Creek

Rep. Num 0

Station ID: WS_SPAULD

STORET Activity ID: E11-T500-M

Reference Status:

Collection Date: 08/08/2013

Site Classification:

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 2124

Sample Taxa List

Order:	OTU name:	FinalID:	Individuals	Tol Val:	FFG:	Habit:
		Ameletus similior	16			
		Isoperla punctata	4			
.	Turbellaria	Polycelis coronata	32	4	CG/PR	SP
Coleoptera	Heterlimnius	Heterlimnius corpulentus	140	3	SC/CG	"CN/50%, BU/50%"
Coleoptera	Zaitzevia	Zaitzevia parvula	4	5	SC/CG	"CN/50%, BU/50%"
Diptera	Chelifera_Metachel	Chelifera	4	5	unk	SP
Diptera	Clinocera	Clinocera	12	5	unk	CN
Diptera	Diamesinae	Pagastia	8	4	CG	sp
Diptera	Orthocladiinae	Eukiefferiella gracei	16		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	32		CG/SC	SP/BU
Diptera	Orthocladiinae	Parametriocnemus	8		CG/SC	SP/BU
Ephemeropte	Ameletus	Ameletus oregonensis	76	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	256	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	104	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	4	1	SC	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	24	2	CG	CN
Ephemeropte	Epeorus	Epeorus grandis	4	2	CG	CN
Ephemeropte	Rhithrogena	Rhithrogena	200	0	CG	CN
Ephemeropte	Serratella	Serratella tibialis	32	2	CG	CN
Plecoptera	Chloroperlidae	Sweltsa	84	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	188	0	unk	CN
Plecoptera	Leuctridae	Despaxia augusta	100	1	SH	CN
Plecoptera	Megarcys	Megarcys	44	1	PR	CN
Plecoptera	Setvena	Setvena bradleyi	4	0	PR	CN
Plecoptera	Yoraperla	Yoraperla brevis	140	0	SH	CN
Plecoptera	Zapada	Zapada columbiana	268	2	SH	CN
Plecoptera	Zapada	Zapada frigida	4	2	SH	CN
Trichoptera	Chyrandra	Chyranda centralis	4	2	SH	SP
Trichoptera	Dolophilodes	Dolophilodes	16	0	CF	CN
Trichoptera	Micrasema	Micrasema bactro	24	1	SH	CN
Trichoptera	Parapsyche	Parapsyche elsis	64	0	CF	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	100	1	PR	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	12	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	20	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila pellisa	36	0	PR	CN

Montana Bioassessment Report

Waterbody Name: Spaulding Creek

Station ID: WS_SPAULD

Reference Status:

Site Classification:

Benthic Sample ID: 18171

Rep. Num 0

STORET Activity ID: E11-T500-M

Collection Date: 08/08/2013

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 2124

Sample Taxa List (cont.)

Trichoptera	Rhyacophila vagrit	Rhyacophila vagrita	12	0	PR	CN
Trichoptera	Rhyacophila vofixa	Rhyacophila vofixa gr.	28	0	PR	CN

Montana Bioassessment Report

Waterbody Name: Theodore Creek

Station ID: WS_THEODOR

Reference Status:

Site Classification:

Benthic Sample ID: 18182

Rep. Num 0

STORET Activity ID: E08-T500-M

Collection Date: 08/28/2014

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 512

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
.	Turbellaria	Polycelis coronata	30	4	CG/PR	SP
Coleoptera	Optioservus	Optioservus quadrimaculatus	2	5	SC	"CN/50%, BU/50%"
Diptera	Chelifera_Metachel	Chelifera	2	5	unk	SP
Diptera	Chironominae	Micropsectra	14	7	CG/CF/PR	BU/CN/SP
Diptera	Clinocera	Clinocera	4	5	unk	CN
Diptera	Dicranota	Dicranota	4	0	PR	SP
Diptera	Orthocladiinae	Brillia	6		CG/SC	SP/BU
Diptera	Orthocladiinae	Hydrobaenus	10		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	4		CG/SC	SP/BU
Diptera	Orthocladiinae	Parametriocnemus	6		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia vitracies	26		CG/SC	SP/BU
Ephemeropte	Baetis	Baetis bicaudatus	56	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	26	0	SC	CN
Ephemeropte	Drunella coloraden	Drunella coloradensis	2	1	SC	"CN/75%, SP/25%"
Ephemeropte	Epeorus	Epeorus deceptivus	6	2	CG	CN
Ephemeropte	Epeorus	Epeorus grandis	10	2	CG	CN
Ephemeropte	Rhithrogena	Rhithrogena	2	0	CG	CN
Lumbriculida	Oligochaeta	Lumbriculidae	30	8	CG	BU
Plecoptera	Chloroperlidae	Sweltsa	58	1	PR	CN
Plecoptera	Doroneuria	Doroneuria theodora	22	0	unk	CN
Plecoptera	Isoperla	Isoperla	4	2	PR	CN
Plecoptera	Leuctridae	Despaxia augusta	10	1	SH	CN
Plecoptera	Visoka	Visoka cataractae	8	0	SH	CN
Plecoptera	Yoraperla	Yoraperla brevis	76	0	SH	CN
Plecoptera	Zapada	Zapada columbiana	58	2	SH	CN
Trichoptera	Dicosmoecus	Dicosmoecus atripes	2	2	SC	SP
Trichoptera	Neothremma	Neothremma alicia	4	1	SC	CN
Trichoptera	Parapsyche	Parapsyche elsis	6	0	CF	CN
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	8	1	PR	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	10	0	PR	CN
Trichoptera	Rhyacophila hyalin	Rhyacophila Hyalinata Gr.	2	1	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	2	0	PR	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila pellisa	2	0	PR	CN

Montana Bioassessment Report

Waterbody Name: Unnamed tributary to NFBLF

Station ID: WS_UNN474

Reference Status:

Site Classification:

Benthic Sample ID: 18183

Rep. Num 0

STORET Activity ID: E04-T500-M

Collection Date: 08/27/2014

Collection Method: MAC-T-500

Total Number of Individuals in Sample: 964

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
Coleoptera	Ochthebius	Ochthebius	4		unk	unk
Diptera	Chelifera_Metachel	Chelifera	4	5	unk	SP
Diptera	Limnophila	Limnophila	4	3	PR	BU
Diptera	Orthocladiinae	Lopescladius	4		CG/SC	SP/BU
Diptera	Orthocladiinae	Orthocladius	12		CG/SC	SP/BU
Diptera	Pelecorhynchidae	Glutops	16	1	PR	SP
Diptera	Simuliidae	Simulium	4	6	CF	CN
Ephemeropte	Ameletus	Ameletus validus	4	0	SC	"SW/10%, CN/90%"
Plecoptera	Chloroperlidae	Sweltsa	48	1	PR	CN
Plecoptera	Isoperla	Isoperla	8	2	PR	CN
Plecoptera	Setvena	Setvena bradleyi	16	0	PR	CN
Plecoptera	Yoraperla	Yoraperla brevis	300	0	SH	CN
Plecoptera	Zapada	Zapada columbiana	160	2	SH	CN
Trichoptera	Dicosmoecus	Dicosmoecus atripes	4	2	SC	SP
Trichoptera	Glossosoma	Glossosoma	4	0	SC	CN
Trichoptera	Micrasema	Micrasema bactro	20	1	SH	CN
Trichoptera	Neothremma	Neothremma alicia	312	1	SC	CN
Trichoptera	Rhyacophila sibiric	Rhyacophila narvae	4	0	PR	CN
Trichoptera	Rhyacophila vagrit	Rhyacophila vagrita	4	0	PR	CN
Trichoptera	Rhyacophila vofixa	Rhyacophila vofixa gr.	32	0	PR	CN

Montana Bioassessment Report

Waterbody Name: Blondie Creek
Benthic Sample ID: 18160
Rep. Num 0
Station ID: WS_BLOND
Reference Status:
STORET Activity ID: E01-T500-M
Site Classification:
Collect. Date: 08/06/2013
Four Code HUC:
Collect Method: MAC-T-500
TMDL Plan. Area:
Total Indiv. in Sample: 332
Latitude: GIS_LAT
Longitude: GIS_LONG:

Mountain MMI: ***79.6***

Metric:	***Value***	***Score***
Ephemeroptera Taxa:	**2**	***20.0***
Plecoptera Taxa:	**7**	***99.9***
EPT Percent:	**62.0**	***68.9***
Non-Insect Percent:		***100.0***
Predator Percent:	**27.1**	***69.5***
Burrower Taxa %:	**11.1**	***100.0***
HBI:	**1.56**	***99.0***

Waterbody Name: Broadus Creek
Benthic Sample ID: 18175
Rep. Num 0
Station ID: WS_BROADUS
Reference Status:
STORET Activity ID: E09-T500-M
Site Classification:
Collect. Date: 08/28/2014
Four Code HUC:
Collect Method: MAC-T-500
TMDL Plan. Area:
Total Indiv. in Sample: 772
Latitude: GIS_LAT
Longitude: GIS_LONG:

Mountain MMI: ***85.9***

Metric:	***Value***	***Score***
Ephemeroptera Taxa:	**6**	***58.4***
Plecoptera Taxa:	**7**	***99.7***
EPT Percent:	**91.7**	***100.0***
Non-Insect Percent:	**0.5**	***98.1***
Predator Percent:	**20.2**	***51.8***
Burrower Taxa %:	**15.7**	***94.8***
HBI:	**1.61**	***98.2***

Montana Bioassessment Report

Waterbody Name: Broadus Creek

Benthic Sample ID: 19812
Rep. Num 0

Station ID: WS_BROAD15
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

STORET Activity ID: E14-T500-M
Collect. Date: 09/05/2015
Collect Method: MAC-T-500
Total Indiv. in Sample: 800

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***92.7***

Metric:	***Value***	***Score***
Ephemeroptera Taxa:	**6**	***57.0***
Plecoptera Taxa:	**7**	***99.9***
EPT Percent:	**97.5**	***100.0***
Non-Insect Percent:	**0.5**	***98.2***
Predator Percent:	**36.5**	***93.6***
Burrower Taxa %:	**7.6**	***100.0***
HBI:	**1.16**	***100.0***

Waterbody Name: Cooney Creek

Benthic Sample ID: 18176
Rep. Num 0

Station ID: WS_COONEY
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

STORET Activity ID: E03-T500-M
Collect. Date: 08/27/2014
Collect Method: MAC-T-500
Total Indiv. in Sample: 304

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***78.5***

Metric:	***Value***	***Score***
Ephemeroptera Taxa:	**7**	***69.9***
Plecoptera Taxa:	**6**	***85.7***
EPT Percent:	**75.0**	***83.3***
Non-Insect Percent:	**11.8**	***57.7***
Predator Percent:	**29.6**	***75.9***
Burrower Taxa %:	**23.3**	***84.1***
HBI:	**1.92**	***93.0***

Montana Bioassessment Report

Waterbody Name: Cooney Creek Lower

Benthic Sample ID: 19813
Rep. Num 0

Station ID: WS_C0NYL15
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

STORET Activity ID: E18-T500-M
Collect. Date: 09/05/2015
Collect Method: MAC-T-500
Total Indiv. in Sample: 1136

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***85.2***

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	6	*59.1*
Plecoptera Taxa:	7	*100.0*
EPT Percent:	78.9	*87.6*
Non-Insect Percent:	10.6	*62.3*
Predator Percent:	38.7	*99.3*
Burrower Taxa %:	20.2	*88.4*
HBI:	1.43	*100.0*

Waterbody Name: Cooney Creek Upper

Benthic Sample ID: 19814
Rep. Num 0

Station ID: WS_C0NYU15
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

STORET Activity ID: E19-T500-M
Collect. Date: 10/01/2015
Collect Method: MAC-T-500
Total Indiv. in Sample: 1416

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***92.9***

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	8	*75.1*
Plecoptera Taxa:	7	*97.6*
EPT Percent:	94.4	100.0
Non-Insect Percent:	2.3	*91.9*
Predator Percent:	33.3	*85.5*
Burrower Taxa %:	8.3	*100.0*
HBI:	1.01	*100.0*

Montana Bioassessment Report

Waterbody Name: Camp Creek

Station ID: WS_CAMP15
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

Benthic Sample ID: 19815
Rep. Num 0

STORET Activity ID: E13-T500-M
Collect. Date: 09/05/2015
Collect Method: MAC-T-500
Total Indiv. in Sample: 2704

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***86.8***

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	8	*75.0*
Plecoptera Taxa:	7	*93.6*
EPT Percent:	82.0	91.1
Non-Insect Percent:	4.7	*83.1*
Predator Percent:	26.9	*69.0*
Burrower Taxa %:	14.9	*95.9*
HBI:	1.24	*100.0*

Waterbody Name: Camp Creek (Upper)

Station ID: WS_CAMPU15
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

Benthic Sample ID: 19816
Rep. Num 0

STORET Activity ID: E20-T500-M
Collect. Date: 09/05/2015
Collect Method: MAC-T-500
Total Indiv. in Sample: 840

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***90.1***

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	7	*68.8*
Plecoptera Taxa:	8	*100.0*
EPT Percent:	82.9	92.1
Non-Insect Percent:	5.7	*79.6*
Predator Percent:	35.2	*90.4*
Burrower Taxa %:	10.5	*100.0*
HBI:	1.22	*100.0*

Montana Bioassessment Report

Waterbody Name:	Dobrota Creek	**Benthic Sample ID:**	18177
Station ID:	WS_DOBROTA	**Rep. Num**	0
Reference Status:		**STORET Activity ID:**	E07-T500-M
Site Classification:		**Collect. Date:**	08/28/2014
Four Code HUC:		**Collect Method:**	MAC-T-500
TMDL Plan. Area:		**Total Indiv. in Sample:**	502

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***82.3***

Metric:	***Value***	***Score***
Ephemeroptera Taxa:	**6**	***59.1***
Plecoptera Taxa:	**7**	***95.4***
EPT Percent:	**79.3**	***88.1***
Non-Insect Percent:	**0.4**	***98.6***
Predator Percent:	**18.3**	***47.0***
Burrower Taxa %:	**14.2**	***96.9***
HBI:	**2.03**	***91.1***

Montana Bioassessment Report

Waterbody Name: East Fork Meadow Creek

Station ID: WS_EFMEAD
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

Benthic Sample ID: 18162
Rep. Num 0

STORET Activity ID: E03-T500-M
Collect. Date: 08/07/2013
Collect Method: MAC-T-500
Total Indiv. in Sample: 992

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***89.3***

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**7**	***73.3***
Plecoptera Taxa:	**7**	***100.0***
EPT Percent:	**90.5**	***100.0***
Non-Insect Percent:		***100.0***
Predator Percent:	**22.2**	***56.9***
Burrower Taxa %:	**15.7**	***94.8***
HBI:	**1.38**	***100.0***

Waterbody Name: East Fork NF Blackfoot

Station ID: WS_EFNFBL (Lower)
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

Benthic Sample ID: 18163
Rep. Num 0

STORET Activity ID: E04-T500-M
Collect. Date: 08/08/2013
Collect Method: MAC-T-500
Total Indiv. in Sample: 920

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***69.6***

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**6**	***57.5***
Plecoptera Taxa:	**5**	***71.3***
EPT Percent:	**48.9**	***54.3***
Non-Insect Percent:		***100.0***
Predator Percent:	**16.5**	***42.4***
Burrower Taxa %:	**25.6**	***80.8***
HBI:	**2.63**	***81.1***

Montana Bioassessment Report

Waterbody Name: East Fork NF Blackfoot

Benthic Sample ID: 18164
Rep. Num 0

Station ID: WS_EFNFBL (Upper)
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

STORET Activity ID: E05-T500-M
Collect. Date: 08/06/2013
Collect Method: MAC-T-500
Total Indiv. in Sample: 876

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***83.9***

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**7**	***68.1***
Plecoptera Taxa:	**6**	***83.0***
EPT Percent:	**74.4**	***82.7***
Non-Insect Percent:		***100.0***
Predator Percent:	**28.3**	***72.6***
Burrower Taxa %:	**20.9**	***87.4***
HBI:	**1.89**	***93.5***

Waterbody Name: EF NF Blackfoot (Upper)

Benthic Sample ID: 19817
Rep. Num 0

Station ID: WS_EFNFBLU15
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

STORET Activity ID: E21-T500-M
Collect. Date: 09/04/2015
Collect Method: MAC-T-500
Total Indiv. in Sample: 1236

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***84.8***

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**8**	***82.2***
Plecoptera Taxa:	**7**	***100.0***
EPT Percent:	**97.5**	***100.0***
Non-Insect Percent:	**0.5**	***98.2***
Predator Percent:	**36.5**	***93.6***
Burrower Taxa %:	**7.6**	***100.0***
HBI:	**1.16**	***100.0***

Montana Bioassessment Report

Waterbody Name: Lost Pony Creek

Benthic Sample ID: 18165
Rep. Num 0

Station ID: WS_LOSTPONY
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

STORET Activity ID: E06-T500-M
Collect. Date: 08/08/2013
Collect Method: MAC-T-500
Total Indiv. in Sample: 1476

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***85.5***

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**8**	***75.4***
Plecoptera Taxa:	**7**	***97.7***
EPT Percent:	**70.7**	***78.6***
Non-Insect Percent:		***100.0***
Predator Percent:	**18.7**	***47.9***
Burrower Taxa %:	**7.6**	***100.0***
HBI:	**1.55**	***99.1***

Waterbody Name: Mineral Creek

Benthic Sample ID: 19818
Rep. Num 0

Station ID: WS_MINERAL
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

STORET Activity ID: E22-T500-M
Collect. Date: 09/05/2015
Collect Method: MAC-T-500
Total Indiv. in Sample: 2496

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***82.1***

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**8**	***78.6***
Plecoptera Taxa:	**8**	***100.0***
EPT Percent:	**78.9**	***87.6***
Non-Insect Percent:	**10.6**	***62.3***
Predator Percent:	**38.7**	***99.3***
Burrower Taxa %:	**20.2**	***88.4***
HBI:	**1.43**	***100.0***

Montana Bioassessment Report

Waterbody Name: Meadow Creek (lower)

Station ID: WS_MEADCR
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

Benthic Sample ID: 18167
Rep. Num 0

STORET Activity ID: E07-T500-M
Collect. Date: 08/08/2013
Collect Method: MAC-T-500
Total Indiv. in Sample: 1564

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***75.5***

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	7	*73.8*
Plecoptera Taxa:	5	*68.8*
EPT Percent:	72.9	*81.0*
Non-Insect Percent:	1.0	*96.3*
Predator Percent:	18.7	*47.9*
Burrower Taxa %:	35.4	*67.1*
HBI:	1.87	*93.8*

Waterbody Name: Meadow Creek (upper)

Station ID: WS_MEADCR
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

Benthic Sample ID: 18161
Rep. Num 0

STORET Activity ID: E02-T500-M
Collect. Date: 08/07/2013
Collect Method: MAC-T-500
Total Indiv. in Sample: 668

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***81.2***

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	7	*66.0*
Plecoptera Taxa:	6	*80.0*
EPT Percent:	84.7	*94.1*
Non-Insect Percent:	1.2	*95.7*
Predator Percent:	15.6	*39.9*
Burrower Taxa %:	17.1	*92.8*
HBI:	1.32	*100.0*

Montana Bioassessment Report

Waterbody Name:	North Fork Blackfoot River nr. EFBLF confluen	**Benthic Sample ID:**	18178
		Rep. Num	0
Station ID:	WS_NFBLF473 (lower)		
Reference Status:		**STORET Activity ID:**	E02-T500-M
Site Classification:		**Collect. Date:**	08/27/2014
Four Code HUC:		**Collect Method:**	MAC-T-500
TMDL Plan. Area:		**Total Indiv. in Sample:**	968
Latitude:	GIS_LAT	**Longitude:**	GIS_LONG:

Mountain MMI: ***70.2***

Metric:	***Value***	***Score***
Ephemeroptera Taxa:	**6**	***62.7***
Plecoptera Taxa:	**5**	***70.7***
EPT Percent:	**50.8**	***56.5***
Non-Insect Percent:	**1.2**	***95.6***
Predator Percent:	**14.5**	***37.1***
Burrower Taxa %:	**20.6**	***87.9***
HBI:	**2.64**	***81.0***

Waterbody Name:	North Fork Blackfoot River below Broadus Cr	**Benthic Sample ID:**	18180
		Rep. Num	0
Station ID:	WS_NFBLF481 (middle)		
Reference Status:		**STORET Activity ID:**	E06-T500-M
Site Classification:		**Collect. Date:**	08/28/2014
Four Code HUC:		**Collect Method:**	MAC-T-500
TMDL Plan. Area:		**Total Indiv. in Sample:**	774
Latitude:	GIS_LAT	**Longitude:**	GIS_LONG:

Mountain MMI: ***86.9***

Metric:	***Value***	***Score***
Ephemeroptera Taxa:	**6**	***56.1***
Plecoptera Taxa:	**8**	***100.0***
EPT Percent:	**80.4**	***89.3***
Non-Insect Percent:	**1.8**	***93.5***
Predator Percent:	**33.1**	***84.8***
Burrower Taxa %:	**19.0**	***90.1***
HBI:	**1.84**	***94.3***

Montana Bioassessment Report

Waterbody Name:	NF Blackfoot River	**Benthic Sample ID:**	19819
		Rep. Num	0
Station ID:	WS_NFBLF2015		
Reference Status:		**STORET Activity ID:**	E23-T500-M
Site Classification:		**Collect. Date:**	09/06/2015
Four Code HUC:		**Collect Method:**	MAC-T-500
TMDL Plan. Area:		**Total Indiv. in Sample:**	2512

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***86.7***

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**8**	***77.4***
Plecoptera Taxa:	**7**	***98.4***
EPT Percent:	**94.4**	***100.0***
Non-Insect Percent:	**2.3**	***91.9***
Predator Percent:	**33.3**	***85.5***
Burrower Taxa %:	**8.3**	***100.0***
HBI:	**1.01**	***100.0***

Waterbody Name:	North Fork Blackfoot River	**Benthic Sample ID:**	18179
		Rep. Num	0
Station ID:	WS_NFBLF478 (upper)		
Reference Status:		**STORET Activity ID:**	E05-T500-M
Site Classification:		**Collect. Date:**	08/28/2014
Four Code HUC:		**Collect Method:**	MAC-T-500
TMDL Plan. Area:		**Total Indiv. in Sample:**	502

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***86.2***

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**5**	***46.0***
Plecoptera Taxa:	**7**	***94.2***
EPT Percent:	**80.7**	***89.6***
Non-Insect Percent:	**0.8**	***97.2***
Predator Percent:	**34.5**	***88.4***
Burrower Taxa %:	**16.1**	***94.3***
HBI:	**1.88**	***93.6***

Montana Bioassessment Report

Waterbody Name: NF Blackfoot River

Benthic Sample ID: 19819
Rep. Num 0

Station ID: WS_NFBLF2015
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

STORET Activity ID: E23-T500-M
Collect. Date: 09/06/2015
Collect Method: MAC-T-500
Total Indiv. in Sample: 2512

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***86.7***

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**8**	***77.4***
Plecoptera Taxa:	**7**	***98.4***
EPT Percent:	**82.0**	***91.1***
Non-Insect Percent:	**4.7**	***83.1***
Predator Percent:	**26.9**	***69.0***
Burrower Taxa %:	**14.9**	***95.9***
HBI:	**1.24**	***100.0***

Waterbody Name: NF Blackfoot River Upper

Benthic Sample ID: 19820
Rep. Num 0

Station ID: WS_NFBLFU2015
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

STORET Activity ID: E24-T500-M
Collect. Date: 09/30/2015
Collect Method: MAC-T-500
Total Indiv. in Sample: 1392

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***88.5***

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**10**	***99.5***
Plecoptera Taxa:	**7**	***95.1***
EPT Percent:	**82.9**	***92.1***
Non-Insect Percent:	**5.7**	***79.6***
Predator Percent:	**35.2**	***90.4***
Burrower Taxa %:	**10.5**	***100.0***
HBI:	**1.22**	***100.0***

Montana Bioassessment Report

Benthic Sample ID: 18181
Rep. Num 0

Waterbody Name: Sarbo Creek

Station ID: WS_SARBO
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

STORET Activity ID: E01-T500-M
Collect. Date: 08/27/2014
Collect Method: MAC-T-500
Total Indiv. in Sample: 503

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***82.3***

Metric:	***Value***	***Score***
Ephemeroptera Taxa:	**6**	***58.3***
Plecoptera Taxa:	**7**	***97.3***
EPT Percent:	**75.3**	***83.7***
Non-Insect Percent:	**1.8**	***93.6***
Predator Percent:	**19.9**	***51.0***
Burrower Taxa %:	**11.3**	***100.0***
HBI:	**1.96**	***92.4***

Waterbody Name: Sarbo Creek

Benthic Sample ID: 19821
Rep. Num 0

Station ID: WS_SARBO15
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

STORET Activity ID: E17-T500-M
Collect. Date: 09/30/2015
Collect Method: MAC-T-500
Total Indiv. in Sample: 1752

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***84.6***

Metric:	***Value***	***Score***
Ephemeroptera Taxa:	**6**	***59.9***
Plecoptera Taxa:	**8**	***100.0***
EPT Percent:	**61.8**	***68.7***
Non-Insect Percent:	**1.3**	***95.4***
Predator Percent:	**25.6**	***65.6***
Burrower Taxa %:	**21.2**	***87.0***
HBI:	**1.80**	***95.0***

Montana Bioassessment Report

Waterbody Name:	Scotty Creek	**Benthic Sample ID:**	18168
		Rep. Num	0
Station ID:	WS_SCOTTY		
Reference Status:		**STORET Activity ID:**	E08-T500-M
Site Classification:		**Collect. Date:**	08/06/2013
Four Code HUC:		**Collect Method:**	MAC-T-500
TMDL Plan. Area:		**Total Indiv. in Sample:**	2176

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***76.3***

Metric:	***Value***	***Score***
Ephemeroptera Taxa:	**5**	***49.6***
Plecoptera Taxa:	**6**	***85.2***
EPT Percent:	**56.3**	***62.5***
Non-Insect Percent:	**1.5**	***94.7***
Predator Percent:	**23.5**	***60.3***
Burrower Taxa %:	**17.9**	***91.7***
HBI:	**2.09**	***90.1***

Waterbody Name:	Sourdough Creek (lower)	**Benthic Sample ID:**	18169
		Rep. Num	0
Station ID:	WS_SOURL		
Reference Status:		**STORET Activity ID:**	E09-T500-M
Site Classification:		**Collect. Date:**	08/06/2013
Four Code HUC:		**Collect Method:**	MAC-T-500
TMDL Plan. Area:		**Total Indiv. in Sample:**	1488

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***84.3***

Metric:	***Value***	***Score***
Ephemeroptera Taxa:	**5**	***49.7***
Plecoptera Taxa:	**8**	***100.0***
EPT Percent:	**93.5**	***100.0***
Non-Insect Percent:	**1.3**	***95.2***
Predator Percent:	**20.7**	***53.1***
Burrower Taxa %:	**14.8**	***96.0***
HBI:	**1.72**	***96.4***

Montana Bioassessment Report

Waterbody Name: Sourdough Creek lower

Station ID: WS_SOURL15
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

Benthic Sample ID: 19822
Rep. Num 0

STORET Activity ID: E15-T500-M
Collect. Date: 09/03/2015
Collect Method: MAC-T-500
Total Indiv. in Sample: 1416

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***83.3***

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**6**	***59.9***
Plecoptera Taxa:	**6**	***88.9***
EPT Percent:	**71.4**	***79.3***
Non-Insect Percent:	**4.8**	***82.8***
Predator Percent:	**19.5**	***49.9***
Burrower Taxa %:	**21.1**	***87.2***
HBI:	**1.68**	***97.0***

Waterbody Name: Sourdough Creek upper

Station ID: WS_SOURU15
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

Benthic Sample ID: 19823
Rep. Num 0

STORET Activity ID: E16-T500-M
Collect. Date: 09/30/2015
Collect Method: MAC-T-500
Total Indiv. in Sample: 1040

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***71.6***

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**5**	***47.4***
Plecoptera Taxa:	**6**	***92.4***
EPT Percent:	**74.5**	***82.8***
Non-Insect Percent:	**1.6**	***94.3***
Predator Percent:	**25.8**	***66.1***
Burrower Taxa %:	**18.5**	***90.8***
HBI:	**1.66**	***97.3***

Montana Bioassessment Report

Waterbody Name:	Spaulding Creek	**Benthic Sample ID:**	18171
		Rep. Num	0
Station ID:	WS_SPAULD		
Reference Status:		**STORET Activity ID:**	E11-T500-M
Site Classification:		**Collect. Date:**	08/08/2013
Four Code HUC:		**Collect Method:**	MAC-T-500
TMDL Plan. Area:		**Total Indiv. in Sample:**	2124

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI: ***84.7***

Metric:	***Value***	***Score***
Ephemeroptera Taxa:	**6**	***64.4***
Plecoptera Taxa:	**6**	***92.2***
EPT Percent:	**87.0**	***96.7***
Non-Insect Percent:	**1.5**	***94.6***
Predator Percent:	**17.5**	***44.9***
Burrower Taxa %:	**9.3**	***100.0***
HBI:	**1.46**	***100.0***

Montana Bioassessment Report

Waterbody Name: Theodore Creek

Station ID: WS_THEODOR
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

Benthic Sample ID: 18182
Rep. Num 0

STORET Activity ID: E08-T500-M
Collect. Date: 08/28/2014
Collect Method: MAC-T-500
Total Indiv. in Sample: 512

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI:

76.7

Metric:	***Value***	***Score***
Ephemeroptera Taxa:	**5**	***46.6***
Plecoptera Taxa:	**7**	***99.6***
EPT Percent:	**73.0**	***81.2***
Non-Insect Percent:	**11.7**	***58.1***
Predator Percent:	**26.2**	***67.1***
Burrower Taxa %:	**14.8**	***96.0***
HBI:	**2.22**	***88.0***

Waterbody Name: Unnamed tributary toNFBLKF

Station ID: WS_UNN474
Reference Status:
Site Classification:
Four Code HUC:
TMDL Plan. Area:

Benthic Sample ID: 18183
Rep. Num 0

STORET Activity ID: E04-T500-M
Collect. Date: 08/27/2014
Collect Method: MAC-T-500
Total Indiv. in Sample: 964

Mountain MMI: 73

Similarity tables

Broadus Cr: Control vs Treatment							
Total	**804**	**773**	**2**	**28**	**25**	**31**	**100.71**
cum total		**1577**					
% COMM. Similarity	**49.64**						
% TAXA Similarity	**80.65**						
Taxa	**2015 Control**	**2014 Treatment**	**TAXA 1**	**TAXA 2**	**COMMON**	**TAXA 1+2**	**,ai-bi,**
Ameletus	40	**16**	1	1	1	1	2.91
Anagapetus	8	**0**	1	0	0	1	1.00
Baetis tricaudatus	16	**84**	1	1	1	1	8.88
Calineuria californica	52	**1**	1	1	1	1	6.34
Cinygmula	4	**8**	1	1	1	1	0.54
Despaxia augusta	36	**96**	1	1	1	1	7.94
Diamesa	8	**40**	1	1	1	1	4.18
Dicosmoecus atripes	4	**8**	1	1	1	1	0.54
Doroneuria theodora	12	**20**	1	1	1	1	1.09
Drunella coloradensis	4	**4**	1	1	1	1	0.02
Epeorus deceptivus	4	**4**	1	1	1	1	0.02
Epeorus grandis	108	**28**	1	1	1	1	9.81
Heterlimnius corpulentus	8	**4**	1	1	1	1	0.48
Megarcys	80	**36**	1	1	1	1	5.29
Micropsectra	0	**8**	0	1	0	1	1.03
Nematoda	4	**4**	1	1	1	1	0.02
Neothremma alicia	4	**0**	1	0	0	1	0.50
Parapsyche elsis	104	**28**	1	1	1	1	9.31
Rhithrogena	40	**92**	1	1	1	1	6.93
Rhyacophila betteni gr.	56	**16**	1	1	1	1	4.90
Rhyacophila brunnea gr.	16	**20**	1	1	1	1	0.60
Rhyacophila hyalinata gr.	20	**16**	1	1	1	1	0.42
Rhyacophila narvae	4	**8**	1	1	1	1	0.54
Rhyacophila pellisa	0	**4**	0	1	0	1	0.52
Rhyacophila vofixa gr.	8	**0**	1	0	0	1	1.00
Sweltsa	56	**48**	1	1	1	1	0.76
Tvetenia vitracies	4	**8**	1	1	1	1	0.54
Visoka cataractae	0	**8**	0	1	0	1	1.03
Yoraperla brevis	16	**32**	1	1	1	1	2.15
Zapada columbiana	16	**122**	1	1	1	1	13.79
Zapada oregonensis gr.	72	**10**	1	1	1	1	7.66

Camp Cr: Treatment vs Control							
Total	**2704**	**840**	**39**	**35**	**33**	**41**	**69.1518737**
cum total		**3544**					
% COMM. Similarity	**65.42**						
% TAXA Similarity	**80.49**						
Taxa	**Treatment**	**Control**	**TAXA 1**	**TAXA 2**	**COMMON**	**TAXA 1+2**	**,ai-bi,**
Baetis tricaudatus	96	8	1	1	1	1	2.60
Brillia	8	8	1	1	1	1	0.66
Chelifera	8	8	1	1	1	1	0.66
Cinygmula	88	72	1	1	1	1	5.32
Despaxia augusta	144	24	1	1	1	1	2.47
Diamesa	32	16	1	1	1	1	0.72
Dicosmoecus atripes	8	8	1	1	1	1	0.66
Doroneuria theodora	128	88	1	1	1	1	5.74
Drunella coloradensis	8	0	1	0	0	1	0.30
Drunella doddsii	8	8	1	1	1	1	0.66
Drunella spinifera	8	8	1	1	1	1	0.66
Epeorus deceptivus	16	8	1	1	1	1	0.36
Epeorus grandis	16	8	1	1	1	1	0.36
Glossosoma	0	8	0	1	0	1	0.95
Heterlimnius corpulentus	160	16	1	1	1	1	4.01
Hydrobaenus	40	0	1	0	0	1	1.48
Isoperla	24	24	1	1	1	1	1.97
Lumbriculidae	40	16	1	1	1	1	0.43
Megarcys	136	40	1	1	1	1	0.27
Micropsectra	16	0	1	0	0	1	0.59
Nostoccocladius	16	0	1	0	0	1	0.59
Pagastia	24	16	1	1	1	1	1.02
Parakiefferiella	16	16	1	1	1	1	1.31
Paraleptophlebia	16	8	1	1	1	1	0.36
Paraperla	0	16	0	1	0	1	1.90
Parapsyche elsis	8	8	1	1	1	1	0.66
Polycelis coronata	88	32	1	1	1	1	0.56
Prosimulium	24	8	1	1	1	1	0.06
Rhithrogena	896	112	1	1	1	1	19.80
Rhyacophila betteni gr.	144	64	1	1	1	1	2.29
Rhyacophila brunnea gr.	88	16	1	1	1	1	1.35
Rhyacophila hyalinata gr.	8	8	1	1	1	1	0.66
Rhyacophila narvae	72	32	1	1	1	1	1.15
Rhyacophila pellisa	8	8	1	1	1	1	0.66
Serratella tibialis	16	0	1	0	0	1	0.59
Stempellina	8	0	1	0	0	1	0.30
Sweltsa	128	64	1	1	1	1	2.89
Tvetenia vitracies	8	8	1	1	1	1	0.66
Yoraperla brevis	8	8	1	1	1	1	0.66
Zapada columbiana	112	40	1	1	1	1	0.62
Zapada oregonensis gr.	32	8	1	1	1	1	0.23

Cooney Cr: Treatment vs Control							
Total	**1472**	**1432**	**31**	**41**	**27**	**45**	**95.85256255**
cum total		**2904**					
% COMM. Similarity	**52.07**						
% TAXA Similarity	**60.00**						
Taxa	**2015 Control**	**2015 Treatment**	**TAXA 1**	**TAXA 2**	**COMMON**	**TAXA 1+2**	**,ai-bi,**
Ameletus validus	24	**40**	1	1	1	1	1.16
Baetis tricaudatus	8	**16**	1	1	1	1	0.57
Chyranda centralis	0	**8**	0	1	0	1	0.56
Cinygmula	16	**32**	1	1	1	1	1.15
Corynoneura	0	**0**	0	0	0	0	0.00
Despaxia augusta	8	**40**	1	1	1	1	2.25
Diamesa	8	**16**	1	1	1	1	0.57
Doroneuria theodora	16	**64**	1	1	1	1	3.38
Drunella coloradensis	16	**0**	1	0	0	1	1.09
Drunella doddsii	8	**0**	1	0	0	1	0.54
Epeorus deceptivus	16	**8**	1	1	1	1	0.53
Epeorus longimannus	0	**0**	0	0	0	0	0.00
Epeorus grandis	96	**40**	1	1	1	1	3.73
Eukiefferiella gracei	0	**0**	0	0	0	0	0.00
Glossosoma	0	**16**	0	1	0	1	1.12
Heterlimnius corpulentus	0	**24**	0	1	0	1	1.68
Hexatoma	0	**8**	0	1	0	1	0.56
Isoperla	0	**24**	0	1	0	1	1.68
Lumbriculidae	24	**16**	1	1	1	1	0.51
Megarcys	160	**88**	1	1	1	1	4.72
Micropsectra	0	**0**	0	0	0	0	0.00
Nematoda	0	**8**	0	1	0	1	0.56
Nostoccocladius	0	**16**	0	1	0	1	1.12
Optioservus	0	**8**	0	1	0	1	0.56
Ormosia	0	**0**	0	0	0	0	0.00
Pagastia	24	**8**	1	1	1	1	1.07
Parakiefferiella	0	**8**	0	1	0	1	0.56
Paraleptophlebia	8	**8**	1	1	1	1	0.02
Parametriocnemus	0	**0**	0	0	0	0	0.00
Parapsyche elsis	32	**96**	1	1	1	1	4.53
Polycelis coronata	8	**96**	1	1	1	1	6.16
Prosimulium	0	**8**	0	1	0	1	0.56
Rheocricotopus	16	**8**	1	1	1	1	0.53
Rhithrogena	248	**72**	1	1	1	1	11.82
Rhyacophila betteni gr.	88	**72**	1	1	1	1	0.95
Rhyacophila brunnea gr.	32	**32**	1	1	1	1	0.06
Rhyacophila hyalinata gr.	8	**8**	1	1	1	1	0.02
Rhyacophila narvae	40	**24**	1	1	1	1	1.04
Rhyacophila pellisa	0	**8**	0	1	0	1	0.56
Rhyacophila vofixa gr.	8	**0**	1	0	0	1	0.54
Setvena bradleyi	40	**0**	1	0	0	1	2.72
Sweltsa	88	**80**	1	1	1	1	0.39
Thienimannimyia gr.	0	**8**	0	1	0	1	0.56
Tvetenia vitracies	0	**8**	0	1	0	1	0.56
Yoraperla brevis	168	**24**	1	1	1	1	9.74
Zapada columbiana	160	**64**	1	1	1	1	6.40
Zapada frigida	8	**16**	1	1	1	1	0.57

Cooney Cr: Treatment vs Control cont'd							
Taxa	**2015 Control**	**2015 Treatment**	**TAXA 1**	**TAXA 2**	**COMMON**	**TAXA 1+2**	**,ai-bi,**
Zapada oregonensis gr.	40	**16**	1	1	1	1	1.60
Zapada columbiana	52	**128**	1	1	1	1	5.41
Zapada frigida	0	**8**	0	1	0	1	0.56
Zapada oregonensis gr.	4	**160**	1	1	1	1	10.90

Cooney Cr: (Lower) 2014 vs 2015

Total	**1216**	**1136**	40	38	32	46	60.2112676
cum total		**2352**					
% COMM. Similarity	**69.89**						
% TAXA Similarity	**69.57**					cooney lower	

Taxa	**2014**	**2015**	**TAXA 1**	**TAXA 2**	**COMMON**	**TAXA 1+2**	**,ai-bi,**
Ameletus validus	**28**	**40**	1	1	1	1	1.22
Baetis tricaudatus	**24**	**16**	1	1	1	1	0.57
Chyranda centralis	**4**	**8**	1	1	1	1	0.38
Cinygmula	**24**	**32**	1	1	1	1	0.84
Corynoneura	**4**	**0**	1	0	0	1	0.33
Despaxia augusta	**92**	**40**	1	1	1	1	4.04
Diamesa	**32**	**16**	1	1	1	1	1.22
Doroneuria theodora	**44**	**64**	1	1	1	1	2.02
Drunella coloradensis	**12**	**0**	1	0	0	1	0.99
Epeorus deceptivus	**32**	**8**	1	1	1	1	1.93
Epeorus longimannus	**8**	**0**	1	0	0	1	0.66
Epeorus grandis	**0**	**40**	0	1	0	1	3.52
Eukiefferiella gracei	**4**	**0**	1	0	0	1	0.33
Glossosoma	**8**	**16**	1	1	1	1	0.75
Heterlimnius corpulentus	**28**	**24**	1	1	1	1	0.19
Hexatoma	**0**	**8**	0	1	0	1	0.70
Isoperla	**0**	**24**	0	1	0	1	2.11
Lumbriculidae	**68**	**16**	1	1	1	1	4.18
Megarcys	**60**	**88**	1	1	1	1	2.81
Micropsectra	**8**	**0**	1	0	0	1	0.66
Nematoda	**4**	**8**	1	1	1	1	0.38
Nostoccocladius	**0**	**16**	0	1	0	1	1.41
Optioservus quadrimaculatus	**8**	**8**	1	1	1	1	0.05
Ormosia	**4**	**0**	1	0	0	1	0.33
Pagastia	**4**	**8**	1	1	1	1	0.38
Parakiefferiella	**4**	**8**	1	1	1	1	0.38
Paraleptophlebia	**4**	**8**	1	1	1	1	0.38
Parametriocnemus	**4**	**0**	1	0	0	1	0.33
Parapsyche elsis	**68**	**96**	1	1	1	1	2.86
Polycelis coronata	**72**	**96**	1	1	1	1	2.53
Prosimulium	**32**	**8**	1	1	1	1	1.93
Rheocricotopus	**4**	**8**	1	1	1	1	0.38
Rhithrogena	**96**	**72**	1	1	1	1	1.56
Rhyacophila betteni gr.	**60**	**72**	1	1	1	1	1.40
Rhyacophila brunnea gr.	**20**	**32**	1	1	1	1	1.17
Rhyacophila hyalinata gr.	**0**	**8**	0	1	0	1	0.70
Rhyacophila narvae	**4**	**24**	1	1	1	1	1.78
Rhyacophila pellisa	**4**	**8**	1	1	1	1	0.38
Rhyacophila vofixa gr.	**8**	**0**	1	0	0	1	0.66
Sweltsa	**124**	**80**	1	1	1	1	3.16
Thienimannimyia gr.	**8**	**8**	1	1	1	1	0.05
Tvetenia vitracies	**8**	**8**	1	1	1	1	0.05
Yoraperla brevis	**40**	**24**	1	1	1	1	1.18
Zapada columbiana	**140**	**64**	1	1	1	1	5.88
Zapada frigida	**0**	**16**	0	1	0	1	1.41
Zapada oregonensis gr.	**16**	**16**	1	1	1	1	0.09

EF North Fork Blackfoot: 2013 vs 2015							
Total	**920**	**1237**	33	40	24	49	84.2852623
cum total		**2157**					
% COMM. Similarity	**57.86**						
% TAXA Similarity	**48.98**					EFNF BLK	
Taxa	**2013**	**2015**	**TAXA 1**	**TAXA 2**	**COMMON**	**TAXA 1+2**	**,ai-bi,**
Ameletus	**0**	**4**	0	1	0	1	0.32
Arctopsyche grandis	**4**	**4**	1	1	1	1	0.11
Baetis tricaudatus	**80**	**52**	1	1	1	1	4.49
Brillia	**14**	**4**	1	1	1	1	1.20
Chelifera	**8**	**0**	1	0	0	1	0.87
Caudatella hystrix	**0**	**8**	0	1	0	1	0.65
Cinygmula	**68**	**120**	1	1	1	1	2.31
Cleptelmis addenda	**0**	**4**	0	1	0	1	0.32
Cricotopus bicinctus	**18**	**0**	1	0	0	1	1.96
Despaxia augusta	**0**	**8**	0	1	0	1	0.65
Dicosmoecus atripes	**0**	**12**	0	1	0	1	0.97
Doroneuria theodora	**12**	**36**	1	1	1	1	1.61
Drunella doddsii	**0**	**16**	0	1	0	1	1.29
Epeorus deceptivus	**50**	**20**	1	1	1	1	3.82
Epeorus longimannus	**10**	**0**	1	0	0	1	1.09
Ephemerella excruians	**0**	**80**	0	1	0	1	6.47
Hesperoperla pacifica	**46**	**80**	1	1	1	1	1.47
Heterlimnius corpulentus	**190**	**220**	1	1	1	1	2.87
Hexatoma	**4**	**24**	1	1	1	1	1.51
Isoperla punctata	**8**	**8**	1	1	1	1	0.22
Limonia	**2**	**0**	1	0	0	1	0.22
Megarcys	**24**	**8**	1	1	1	1	1.96
Micropsectra	**0**	**32**	0	1	0	1	2.59
Micrasema bactro	**8**	**0**	1	0	0	1	0.87
Narpus concolor	**2**	**0**	1	0	0	1	0.22
Optioservus quadrimaculatus	**82**	**0**	1	0	0	1	8.91
Ochrotrichia	**0**	**8**	0	1	0	1	0.65
Ostracoda	**0**	**8**	0	1	0	1	0.65
Pagastia	**90**	**48**	1	1	1	1	5.90
Parakiefferiella	**0**	**8**	0	1	0	1	0.65
Paraleptophlebia	**8**	**48**	1	1	1	1	3.01
Paraperla	**0**	**4**	0	1	0	1	0.32
Parapsyche elsis	**12**	**8**	1	1	1	1	0.66
Pericoma	**0**	**16**	0	1	0	1	1.29
Polycelis coronata	**0**	**8**	0	1	0	1	0.65
Probezzia	**6**	**8**	1	1	1	1	0.01
Prosimulium	**14**	**0**	1	0	0	1	1.52
Rheocricotopus	**0**	**8**	0	1	0	1	0.65
Rhithrogena	**28**	**128**	1	1	1	1	7.30
Rhyacophila betteni gr.	**0**	**8**	0	1	0	1	0.65
Rhyacophila brunnea gr.	**8**	**4**	1	1	1	1	0.55
Rhyacophila narvae	**18**	**32**	1	1	1	1	0.63
Rhyacophila pellisa	**2**	**4**	1	1	1	1	0.11
Serratella tibialis	**4**	**4**	1	1	1	1	0.11
Sweltsa	**44**	**100**	1	1	1	1	3.30
Tipula	**2**	**0**	1	0	0	1	0.22
Tvetenia vitracies	**20**	**4**	1	1	1	1	1.85
Zapada cinctipes	**10**	**40**	1	1	1	1	2.15
Zapada columbiana	**24**	**1**	1	1	1	1	2.53

NF Blackfoot: 2014 vs 2015							
Total	**968**	**2512**	**42**	**48**	**39**	**51**	**93.7621729**
cum total		**3480**					
% COMM. Similarity	**53.12**						
% TAXA Similarity	**76.47**					**NF**	
Taxa	**2014**	**2015**	**TAXA 1**	**TAXA 2**	**COMMON**	**TAXA 1+2**	**,ai-bi,**
Ameletus validus	4	**80**	1	1	1	1	2.77
Baetis tricaudatus	88	**24**	1	1	1	1	8.14
Calineuria californica	0	**16**	0	1	0	1	0.64
Caudatella hystrix	0	**8**	0	1	0	1	0.32
Cinygmula	4	**48**	1	1	1	1	1.50
Cryptochia pilosa	4	**0**	1	0	0	1	0.41
Despaxia augusta	8	**16**	1	1	1	1	0.19
Dicosmoecus atripes	4	**8**	1	1	1	1	0.09
Diphetor hageni	0	**8**	0	1	0	1	0.32
Doroneuria theodora	36	**8**	1	1	1	1	3.40
Ecclisomyia maculosa	0	**8**	0	1	0	1	0.32
Epeorus deceptivus	16	**16**	1	1	1	1	1.02
Epeorus grandis	60	**112**	1	1	1	1	1.74
Epeorus longimannus	48	**8**	1	1	1	1	4.64
Eukiefferiella devonica	8	**8**	1	1	1	1	0.51
Eukiefferiella gracei	12	**8**	1	1	1	1	0.92
Heterlimnius corpulentus	120	**80**	1	1	1	1	9.21
Hexatoma	8	**40**	1	1	1	1	0.77
Lumbriculidae	0	**32**	0	1	0	1	1.27
Megarcys	32	**88**	1	1	1	1	0.20
Nematoda	8	**0**	1	0	0	1	0.83
Neothremma alicia	4	**8**	1	1	1	1	0.09
Nostoccocladius	112	**40**	1	1	1	1	9.98
orthocladius	16	**32**	1	1	1	1	0.38
Pagastia	4	**8**	1	1	1	1	0.09
Parakiefferiella	4	**8**	1	1	1	1	0.09
Paraleptophlebia	4	**8**	1	1	1	1	0.09
Paraperla	0	**16**	0	1	0	1	0.64
Parapsyche elsis	48	**216**	1	1	1	1	3.64
Pericoma	4	**112**	1	1	1	1	4.05
Polycelis coronata	4	**8**	1	1	1	1	0.09
Probezzia	4	**8**	1	1	1	1	0.09
Prosimulium	32	**64**	1	1	1	1	0.76
Rheocricotopus	4	**8**	1	1	1	1	0.09
Rhithrogena	20	**368**	1	1	1	1	12.58
Rhyacophila betteni gr.	12	**104**	1	1	1	1	2.90
Rhyacophila brunnea gr.	16	**24**	1	1	1	1	0.70
Rhyacophila hyalinata gr.	24	**56**	1	1	1	1	0.25
Rhyacophila narvae	4	**24**	1	1	1	1	0.54
Rhyacophila pellisa	4	**0**	1	0	0	1	0.41
Rhyacophila vofixa gr.	0	**160**	0	1	0	1	6.37
Serratella tibialis	8	**16**	1	1	1	1	0.19
Simulium	72	**144**	1	1	1	1	1.71
Sweltsa	32	**120**	1	1	1	1	1.47
Thienimannimyia gr.	8	**16**	1	1	1	1	0.19
Tvetenia vitracies	8	**16**	1	1	1	1	0.19
Yoraperla brevis	0	**8**	0	1	0	1	0.32
Zapada cinctipes	4	**8**	1	1	1	1	0.09
Zapada columbiana	52	**128**	1	1	1	1	0.28
Zapada frigida	0	**8**	0	1	0	1	0.32

NF Blackfoot: 2014 vs 2015 cont’d							
Taxa	**2014**	**2015**	**TAXA 1**	**TAXA 2**	**COMMON**	**TAXA 1+2**	**,ai-bi,**
Zapada oregonensis gr.	4	**160**	1	1	1	1	5.96

Sarbo Cr: Treatment vs Control							
Total	**2012**	**1604**	**37**	**39**	**33**	**43**	**64.63066985**
cum total		**3616**					
% COMM. Similarity	**67.68**						
% TAXA Similarity	**76.74**						
Taxa	**2014**	**2015**	**TAXA 1**	**TAXA 2**	**COMMON**	**TAXA 1+2**	**,ai-bi,**
Ameletus validus	56	**8**	1	1	1	1	2.28
Baetis tricaudatus	288	**88**	1	1	1	1	8.83
Brillia	48	**8**	1	1	1	1	1.89
Chelifera	8	**0**	1	0	0	1	0.40
Cinygmula	88	**112**	1	1	1	1	2.61
Clinocera	4	**8**	1	1	1	1	0.30
Despaxia augusta	136	**24**	1	1	1	1	5.26
Diamesa	20	**40**	1	1	1	1	1.50
Dicranota	0	**8**	0	1	0	1	0.50
Doroneuria theodora	0	**40**	0	1	0	1	2.49
Dixa	4	**0**	1	0	0	1	0.20
Drunella coloradensis	0	**8**	0	1	0	1	0.50
Drunella doddsii	20	**8**	1	1	1	1	0.50
Drunella spinifera	8	**8**	1	1	1	1	0.10
Epeorus grandis	76	**56**	1	1	1	1	0.29
Epeorus longimannus	28	**8**	1	1	1	1	0.89
Eukiefferiella devonica	16	**16**	1	1	1	1	0.20
Eukiefferiella gracei	88	**40**	1	1	1	1	1.88
Glutops	8	**8**	1	1	1	1	0.10
Heterlimnius corpulentus	84	**16**	1	1	1	1	3.18
Isoperla	8	**12**	1	1	1	1	0.35
Megarcys	72	**64**	1	1	1	1	0.41
Micrasema bactro	12	**0**	1	0	0	1	0.60
Micropsectra	16	**24**	1	1	1	1	0.70
Neothremma alicia	40	**16**	1	1	1	1	0.99
Oreogeton	0	**8**	0	1	0	1	0.50
Pagastia	48	**40**	1	1	1	1	0.11
Parakiefferiella	8	**8**	1	1	1	1	0.10
Parapsyche elsis	40	**64**	1	1	1	1	2.00
Pericoma	0	**16**	0	1	0	1	1.00
Polycelis coronata	36	**56**	1	1	1	1	1.70
Rheocricotopus	60	**32**	1	1	1	1	0.99
Rhithrogena	24	**160**	1	1	1	1	8.78
Rhyacophila betteni gr.	48	**88**	1	1	1	1	3.10
Rhyacophila brunnea gr.	16	**16**	1	1	1	1	0.20
Rhyacophila narvae	8	**16**	1	1	1	1	0.60
Rhyacophila pellisa	4	**0**	1	0	0	1	0.20
Rhyacophila vofixa gr.	0	**16**	0	1	0	1	1.00
Setvena bradleyi	16	**24**	1	1	1	1	0.70
Sweltsa	160	**128**	1	1	1	1	0.03
Yoraperla brevis	180	**176**	1	1	1	1	2.03
Zapada columbiana	220	**112**	1	1	1	1	3.95
Zapada oregonensis gr.	16	**24**	1	1	1	1	0.70

Sourdough Cr: (Lower) 2013 vs 2015							
Total	**1416**	**1488**	**35**	**30**	**28**	**37**	**60.04191726**
cum total		**2904**					
% COMM. Similarity	**69.98**						
% TAXA Similarity	**75.68**						
Taxa	**2013**	**2015**	**TAXA 1**	**TAXA 2**	**COMMON**	**TAXA 1+2**	**,ai-bi,**
Ameletus	18	**0**	1	0	0	1	1.27
Baetis bicaudatus	30	**56**	1	1	1	1	1.64
Brillia	0	**12**	0	1	0	1	0.81
Cinygmula	162	**40**	1	1	1	1	8.75
Despaxia augusta	6	**72**	1	1	1	1	4.41
Diamesa	12	**0**	1	0	0	1	0.85
Dicranota	6	**0**	1	0	0	1	0.42
Doroneuria theodora	6	**12**	1	1	1	1	0.38
Drunella coloradensis	30	**16**	1	1	1	1	1.04
Epeorus deceptivus	498	**484**	1	1	1	1	2.64
Epeorus grandis	6	**8**	1	1	1	1	0.11
Epeorus longimannus	6	**4**	1	1	1	1	0.15
Isoperla punctata	6	**4**	1	1	1	1	0.15
Limnophila	6	**4**	1	1	1	1	0.15
Lumbriculidae	12	**8**	1	1	1	1	0.31
Megarcys	66	**76**	1	1	1	1	0.45
Micropsectra	12	**12**	1	1	1	1	0.04
Oreogeton	6	**20**	1	1	1	1	0.92
Pagastia	6	**4**	1	1	1	1	0.15
Paraperla	6	**24**	1	1	1	1	1.19
Parapsyche elsis	18	**8**	1	1	1	1	0.73
Polycelis coronata	54	**12**	1	1	1	1	3.01
Prosimulium	6	**8**	1	1	1	1	0.11
Rheocricotopus	12	**8**	1	1	1	1	0.31
Rhithrogena	138	**120**	1	1	1	1	1.68
Rhyacophila alberta	0	**4**	0	1	0	1	0.27
Rhyacophila betteni	6	**8**	1	1	1	1	0.11
Rhyacophila narvae	24	**0**	1	0	0	1	1.69
Rhyacophila pellisa	6	**8**	1	1	1	1	0.11
Rhyacophila siberica	6	**0**	1	0	0	1	0.42
Rhyacophila vagrita	6	**0**	1	0	0	1	0.42
Suwallia	30	**80**	1	1	1	1	3.26
Sweltsa	96	**84**	1	1	1	1	1.13
Utaperla sopladora	6	**12**	1	1	1	1	0.38
Yoraperla brevis	12	**20**	1	1	1	1	0.50
Zapada columbiana	30	**260**	1	1	1	1	15.35
Zapada oregonensis	66	**0**	1	0	0	1	4.66

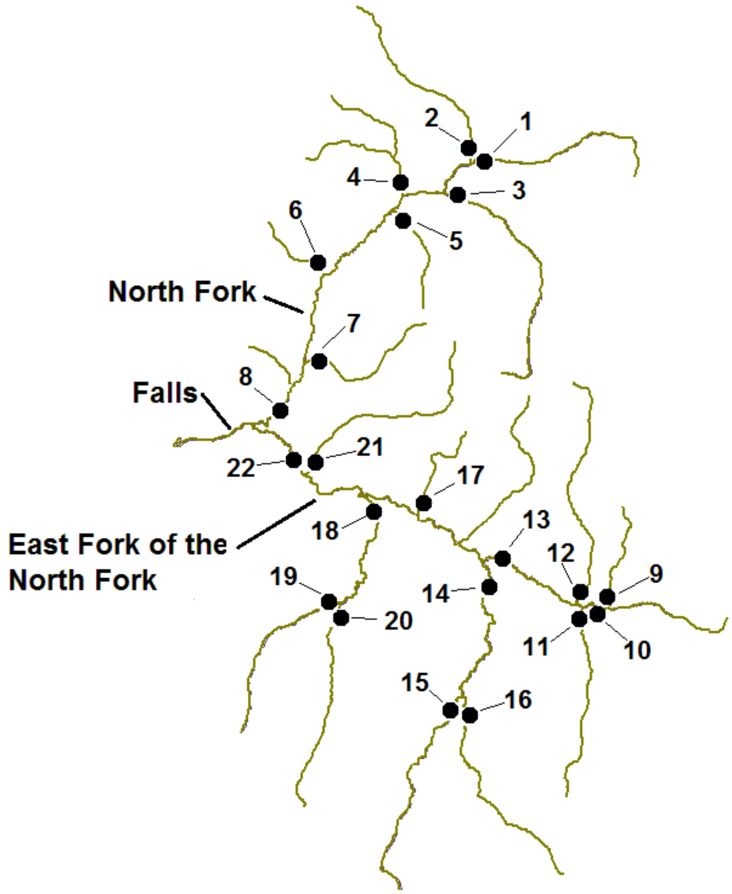
Sourdough Cr: (Upper) 2013 vs 2015							
Total	**784**	**1040**	**30**	**29**	**26**	**33**	**75.18838305**
cum total		**1824**					
% COMM. Similarity	**62.41**						
% TAXA Similarity	**78.79**				**Sourdough between years**		
Taxa	**2013**	**2015**	**TAXA 1**	**TAXA 2**	**COMMON**	**TAXA 1+2**	**,ai-bi,**
Ameletus	24	**144**	1	1	1	1	10.78
Anagapetus	0	**4**	0	1	0	1	0.38
Baetis bicaudatus	22	**4**	1	1	1	1	2.42
Brillia	6	**4**	1	1	1	1	0.38
Cinygmula	154	**136**	1	1	1	1	6.57
Despaxia augusta	4	**16**	1	1	1	1	1.03
Diamesa	0	**4**	0	1	0	1	0.38
Dicranota	4	**8**	1	1	1	1	0.26
Doroneuria theodora	4	**12**	1	1	1	1	0.64
Drunella coloradensis	10	**20**	1	1	1	1	0.65
Ecclisomyia maculosa	2	**0**	1	0	0	1	0.26
Epeorus deceptivus	270	**116**	1	1	1	1	23.28
Epeorus longimannus	4	**4**	1	1	1	1	0.13
Eukiefferiella gracei	4	**0**	1	0	0	1	0.51
Glossosoma	2	**0**	1	0	0	1	0.26
Homophylax	2	**8**	1	1	1	1	0.51
Isoperla	2	**4**	1	1	1	1	0.13
lumbriculidae	18	**20**	1	1	1	1	0.37
Megarcys	16	**32**	1	1	1	1	1.04
Optioservus quadrimac	8	**4**	1	1	1	1	0.64
Oreogeton	24	**48**	1	1	1	1	1.55
orthocladius	6	**12**	1	1	1	1	0.39
Pagastia	4	**8**	1	1	1	1	0.26
Parakiefferiella	4	**12**	1	1	1	1	0.64
Polycelis coronata	50	**192**	1	1	1	1	12.08
Rheocricotopus	22	**20**	1	1	1	1	0.88
Rhithrogena	48	**124**	1	1	1	1	5.80
Rhyacophila brunnea gr	2	**4**	1	1	1	1	0.13
Suwallia	6	**0**	1	0	0	1	0.77
Sweltsa	36	**52**	1	1	1	1	0.41
Testudacarus	0	**4**	0	1	0	1	0.38
Yoraperla brevis	2	**4**	1	1	1	1	0.13
Zapada columbiana	24	**20**	1	1	1	1	1.14

Sourdough Cr: Control vs Treatment 2013							
Total	**1488**	**1040**	**30**	**29**	**19**	**40**	**118.974359**
cum total		**2528**					
% COMM. Similarity	**40.51**						
% TAXA Similarity	**47.50**						
Taxa	**Control 2013**	**Treatment 2013**	**TAXA 1**	**TAXA 2**	**COMMON**	**TAXA 1+2**	,ai-bi,
Ameletus	0	**144**	0	1	0	1	13.85
Anagapetus	0	**4**	0	1	0	1	0.38
Baetis bicaudatus	56	**4**	1	1	1	1	3.38
Brillia	12	**4**	1	1	1	1	0.42
Cinygmula	40	**136**	1	1	1	1	10.39
Despaxia augusta	72	**16**	1	1	1	1	3.30
Diamesa	0	**4**	0	1	0	1	0.38
Dicranota	0	**8**	0	1	0	1	0.77
Doroneuria theodora	12	**12**	1	1	1	1	0.35
Drunella coloradensis	16	**20**	1	1	1	1	0.85
Epeorus deceptivus	484	**116**	1	1	1	1	21.37
Epeorus grandis	8	**0**	1	0	0	1	0.54
Epeorus longimannus	4	**4**	1	1	1	1	0.12
Homophylax	0	**8**	0	1	0	1	0.77
Isoperla punctata	4	**4**	1	1	1	1	0.12
Limnophila	4	**0**	1	0	0	1	0.27
lumbriculidae	8	**20**	1	1	1	1	1.39
Megarcys	76	**32**	1	1	1	1	2.03
Micropsectra	12	**0**	1	0	0	1	0.81
Oreogeton	20	**48**	1	1	1	1	3.27
Optioservus quadrimaculatus	0	**4**	0	1	0	1	0.38
orthocladius	0	**12**	0	1	0	1	1.15
Pagastia	4	**8**	1	1	1	1	0.50
Paraperla	24	**0**	1	0	0	1	1.61
Parapsyche elsis	8	**0**	1	0	0	1	0.54
Parakiefferiella	0	**12**	0	1	0	1	1.15
Polycelis coronata	12	**192**	1	1	1	1	17.66
Prosimulium	8	**0**	1	0	0	1	0.54
Rheocricotopus	8	**20**	1	1	1	1	1.39
Rhithrogena	120	**124**	1	1	1	1	3.86
Rhyacophila alberta	4	**0**	1	0	0	1	0.27
Rhyacophila betteni gr.	8	**0**	1	0	0	1	0.54
Rhyacophila brunnea gr.	0	**4**	0	1	0	1	0.38
Rhyacophila pellisa	8	**0**	1	0	0	1	0.54
Suwallia	80	**0**	1	0	0	1	5.38
Sweltsa	84	**52**	1	1	1	1	0.65
Testudacarus	0	**4**	0	1	0	1	0.38
Utacapnia	12	**0**	1	0	0	1	0.81
Yoraperla brevis	20	**4**	1	1	1	1	0.96
Zapada columbiana	260	**20**	1	1	1	1	15.55

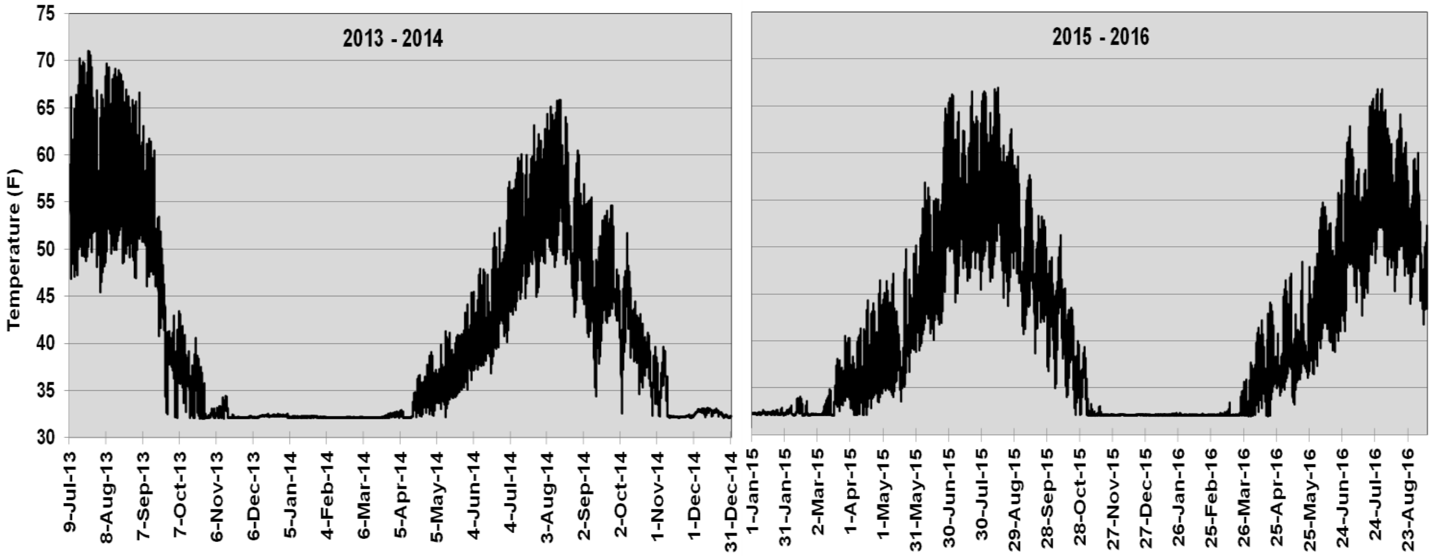
Sourdough Cr: Control vs Treatment 2015							
Total	**1040**	**1416**	**29**	**35**	**22**	**42**	**89.0612777**
cum total		**2456**					
% COMM. Similarity	**55.47**						
% TAXA Similarity	**52.38**						
Taxa	**Control 2015**	**Treatment 2015**	**TAXA 1**	**TAXA 2**	**COMMON**	**TAXA 1+2**	**,ai-bi,**
Ameletus similior	144	**18**	1	1	1	1	12.57
Anagapetus	4	**0**	1	0	0	1	0.38
Baetis bicaudatus	4	**30**	1	1	1	1	1.73
Brillia	4	**0**	1	0	0	1	0.38
Cinygmula	136	**162**	1	1	1	1	1.64
Despaxia augusta	16	**6**	1	1	1	1	1.11
Diamesa	4	**12**	1	1	1	1	0.46
Dicranota	8	**6**	1	1	1	1	0.35
Doroneuria theodora	12	**6**	1	1	1	1	0.73
Drunella coloradensis	20	**30**	1	1	1	1	0.20
Epeorus deceptivus	116	**498**	1	1	1	1	24.02
Epeorus grandis	0	**6**	0	1	0	1	0.42
Epeorus longimannus	4	**6**	1	1	1	1	0.04
Homophylax	8	**0**	1	0	0	1	0.77
Isoperla	4	**6**	1	1	1	1	0.04
Limnophila	0	**6**	0	1	0	1	0.42
lumbriculidae	20	**12**	1	1	1	1	1.08
Megarcys	32	**66**	1	1	1	1	1.58
Micropsectra	0	**12**	0	1	0	1	0.85
Optioservus quadrimaculatus	4	**0**	1	0	0	1	0.38
Oreogeton	48	**6**	1	1	1	1	4.19
orthocladius	12	**0**	1	0	0	1	1.15
Pagastia	8	**6**	1	1	1	1	0.35
Paraperla	0	**6**	0	1	0	1	0.42
Parakiefferiella	12	**0**	1	0	0	1	1.15
Parapsyche elsis	0	**18**	0	1	0	1	1.27
Polycelis coronata	192	**54**	1	1	1	1	14.65
Prosimulium	0	**6**	0	1	0	1	0.42
Rheocricotopus	20	**12**	1	1	1	1	1.08
Rhithrogena	124	**138**	1	1	1	1	2.18
Rhyacophila alberta	0	**0**	0	0	0	0	0.00
Rhyacophila betteni gr.	0	**6**	0	1	0	1	0.42
Rhyacophila brunnea gr.	4	**0**	1	0	0	1	0.38
Rhyacophila narvae	0	**24**	0	1	0	1	1.69
Rhyacophila pellisa	0	**6**	0	1	0	1	0.42
Rhyacophila siberica gr.	0	**6**	0	1	0	1	0.42
Rhyacophila vagrita gr.	0	**6**	0	1	0	1	0.42
Suwallia	0	**30**	0	1	0	1	2.12
Sweltsa	52	**96**	1	1	1	1	1.78
Testudacarus	4	**6**	1	1	1	1	0.04
Yoraperla brevis	4	**12**	1	1	1	1	0.46
Zapada columbiana	20	**30**	1	1	1	1	0.20
Zapada oregonensis gr.	0	**66**	0	1	0	1	4.66

Appendix F. Water temperature monitoring locations at 22 sites, 2013-2016.

Site #	Stream Name	Stream mile	Lat	Long
1	North Fork Blackfoot River	34.7	47.2669	112.80636
2	Dobrota Creek	0.1	47.26688	112.80663
3	Cooney Creek	0.2	47.25836	112.81499
4	Broadus Creek	0.1	47.25778	112.83207
5	Theodore Creek	0.1	47.25367	112.83528
6	Sarbo Creek	0.1	47.23612	112.86185
7	South Creek	0.1	47.21288	112.86847
8	North Fork Blackfoot River	27	47.19709	112.88103
9	Blondie Creek	0.1	47.15423	112.74626
10	East Fork of the North Fork	9.4	47.15252	112.75653
11	Sourdough Creek	0.1	47.15256	112.75677
12	Scotty Creek	0.2	47.15463	112.75708
13	East Fork of the North Fork	7	47.16439	112.7942
14	Meadow Creek	1.4	47.15121	112.79451
15	Meadow Creek	4.7 & 5.3	47.12273	112.80659
16	East Fork Meadow Creek	0.1 & 0.9	47.11964	112.80044
17	Spaulding Creek	0.15	47.17592	112.8201
18	Mineral Creek	0.3	47.17638	112.83852
19	Mineral Creek	3.5	47.15064	112.84966
20	East Fork Mineral Creek	0.1	47.15064	112.84966
21	Camp Creek	0.1	47.1835	112.86493
22	East Fork of the North Fork	1.7	47.18415	112.86679

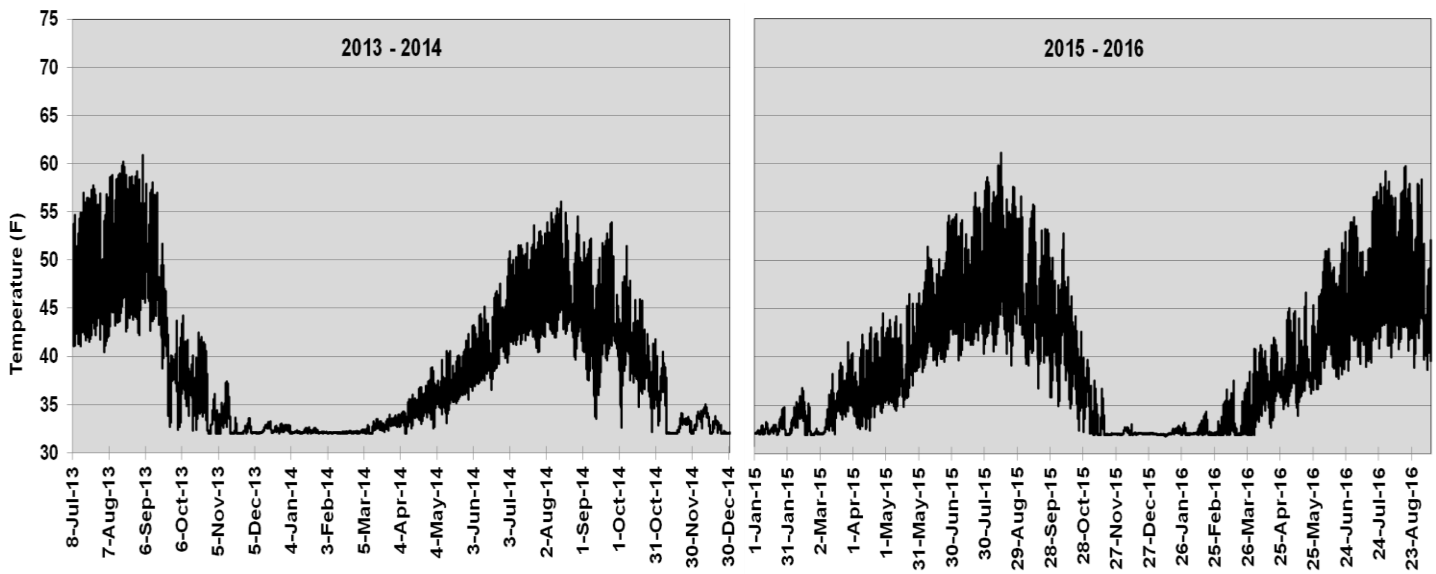


North Fork Blackfoot River upstream of Dobrota Creek (Mile 34.7)



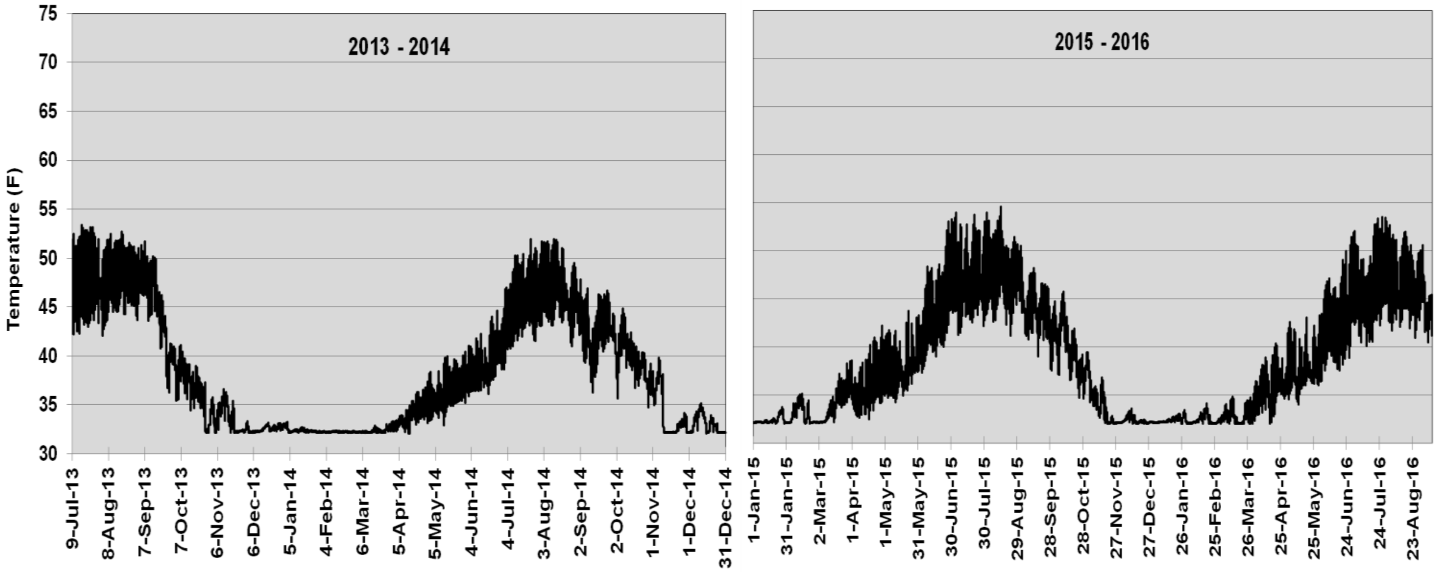
Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
2013	July	71.0	46.8	57.2	6.1	37.4
	August	69.6	45.4	56.7	5.6	31.2
	September	66.6	32.5	49.4	7.3	53.5
	October	43.4	32	35.3	2.8	7.7
	November	34.4	32	32.4	0.5	0.2
	December	32.5	32.1	32.3	0.1	0.0
2014	January	32.5	32.1	32.2	0.1	0.0
	February	32.2	32.1	32.1	0.0	0.0
	March	32.7	32.1	32.2	0.1	0.0
	April	39.1	32.1	33.3	1.3	1.8
	May	44.1	32.2	36.2	2.3	5.2
	June	52.2	36.2	42.2	3.4	11.5
	July	63.1	40.2	51.7	4.8	22.8
	August	65.8	42.8	54.0	5.2	26.7
	September	56.9	34.4	46.2	4.3	18.7
	October	51.7	32.3	39.6	3.5	12.0
	November	39.6	32.1	33.2	1.8	3.3
	December	33.1	32.1	32.6	0.3	0.1
2015	January	32.9	32.1	32.3	0.1	0.0
	February	34.0	32.1	32.5	0.4	0.2
	March	40.5	32.1	33.6	1.8	3.1
	April	46.4	32.1	36.1	3.0	9.1
	May	50.1	33.6	39.4	3.4	11.4
	June	65.3	39.0	48.4	5.8	33.5
	July	66.6	44.2	54.4	5.0	25.5
	August	66.9	43.8	54.6	5.0	25.1
	September	59.6	36.8	46.9	4.2	17.9
	October	51.2	32.1	39.9	4.2	18.0
	November	39.3	32.0	32.6	1.3	1.7
	December	32.2	32.1	32.1	0.0	0.0
2016	January	32.3	32.1	32.1	0.0	0.0
	February	32.2	32.0	32.1	0.0	0.0
	March	35.9	32.0	32.3	0.7	0.4
	April	44.1	32.0	35.7	2.6	6.6
	May	48.4	33.2	39.2	3.0	9.2
	June	61.6	37.4	47.0	5.1	25.6
	July	66.8	42.7	54.1	5.4	28.9
	August	64.6	43.9	53.6	4.4	18.9
	September	60.0	41.7	47.9	3.8	14.6

Dobrota Creek (Mile 0.1)



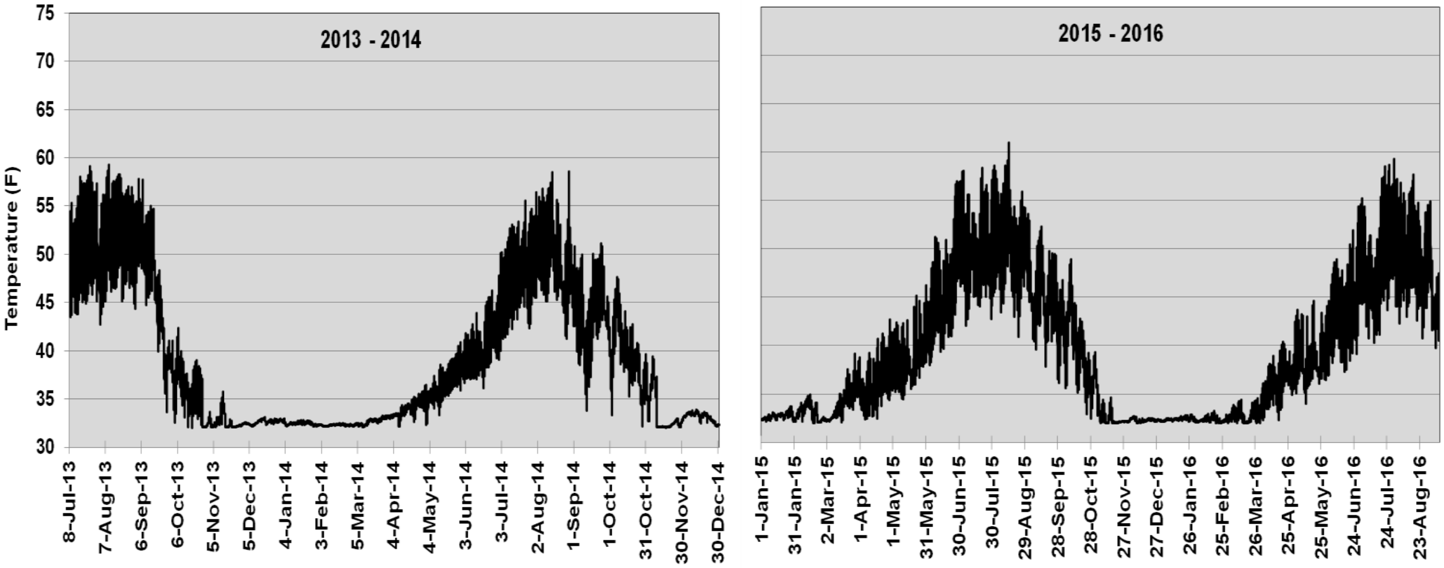
Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
2013	July	57.8	41.0	47.2	4.5	20.5
	August	60.2	40.4	49.0	4.7	21.9
	September	61	32.7	45.8	5.6	31.1
	October	44.3	32	36.2	2.6	6.9
	November	37.4	32	33	1.2	1.4
	December	33.6	32	32.4	0.34	0.1
2014	January	32.9	32.0	32.2	0.2	0.0
	February	32.2	32.0	32.1	0.0	0.0
	March	33.9	32.0	32.6	0.5	0.2
	April	38.8	32.0	34.1	1.1	1.2
	May	42.3	32.6	36.5	1.7	2.7
	June	47.6	36.5	40.4	2.3	5.1
	July	53.6	39.4	45.1	3.1	9.3
	August	56.1	39.7	46.3	3.5	12.5
	September	53.9	33.6	43.1	4.0	16.0
	October	51.4	32.2	39.5	3.1	9.6
	November	40.4	32.0	33.8	2.1	4.4
	December	35.0	32.0	32.9	0.8	0.7
2015	January	34.8	32.0	32.5	0.5	0.3
	February	36.7	32.0	33.0	1.0	1.1
	March	41.5	32.0	34.4	1.9	3.5
	April	44.5	32.4	36.1	2.4	5.8
	May	46.6	34.5	38.7	2.5	6.2
	June	54.6	38.5	43.7	3.3	11.0
	July	58.1	39.7	46.3	3.9	15.5
	August	61.1	39.1	48.2	4.5	20.6
	September	56.6	35.8	44.4	4.1	16.5
	October	52.8	32.2	40.1	3.9	14.9
	November	39.7	31.9	32.9	1.7	2.8
	December	33.0	32.0	32.1	0.2	0.0
2016	January	33.2	31.8	32.2	0.2	0.1
	February	34.3	32.0	32.3	0.4	0.2
	March	38.5	31.9	33.0	1.3	1.7
	April	42.0	32.0	36.3	2.0	3.9
	May	46.7	33.9	38.7	2.3	5.4
	June	54.0	37.2	43.5	3.6	12.9
	July	59.2	39.0	46.2	4.4	19.5
	August	59.7	38.9	47.5	4.5	20.3
	September	58.4	38.7	44.4	3.8	14.5

Cooney Creek (Mile 0.2)



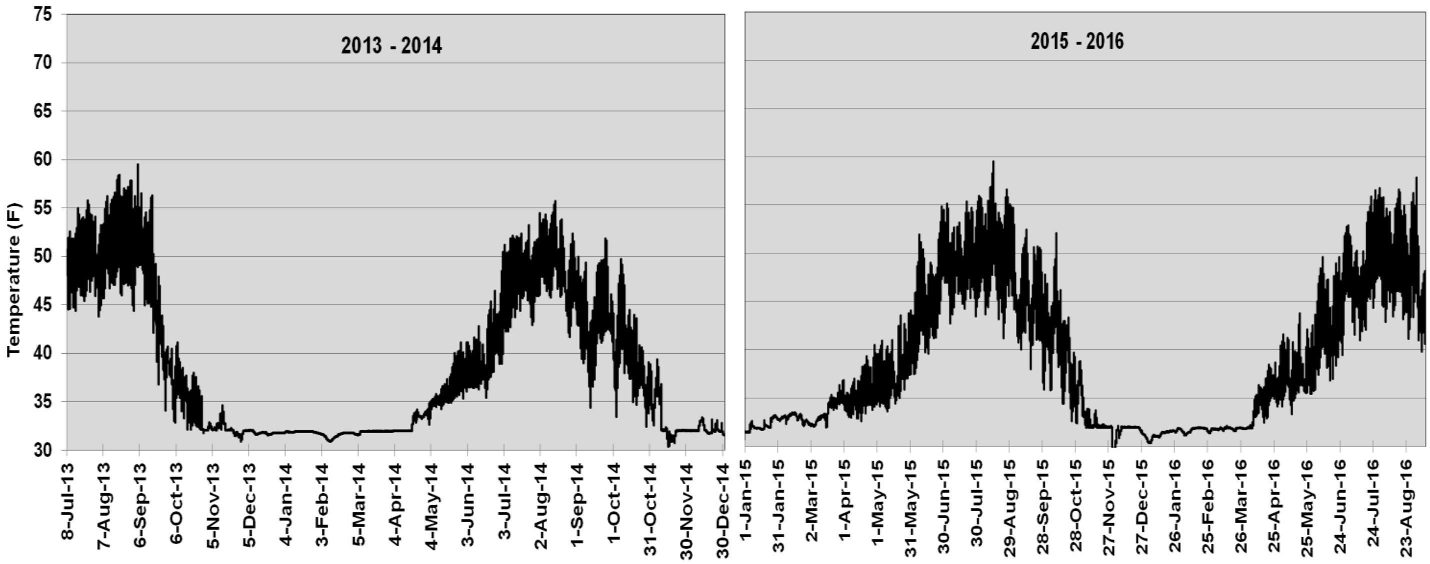
Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
2013	July	53.4	42.2	43.7	3.0	9.0
	August	52.7	42.1	47.8	2.3	5.2
	September	51.7	36.3	45.2	3.5	12.2
	October	41.1	32.2	36.7	2.2	4.6
	November	36.6	32.2	33.5	1.3	1.6
	December	33.3	32.2	32.6	0.3	0.08
2014	January	33.2	32.1	32.4	0.2	0.0
	February	32.3	32.2	32.2	0.0	0.0
	March	33.3	32.1	32.4	0.2	0.1
	April	38.2	32.1	34.0	1.1	1.2
	May	40.4	32.9	36.0	1.4	2.0
	June	44.6	35.9	38.9	1.8	3.1
	July	51.9	38.7	44.9	2.6	6.9
	August	51.9	41.0	46.4	2.4	5.6
	September	47.8	36.3	42.7	2.2	4.7
	October	44.9	34.8	39.6	1.9	3.7
	November	39.8	32.1	33.9	2.2	5.0
	December	35.1	32.1	32.9	0.8	0.7
2015	January	33.8	32.1	32.4	0.4	0.1
	February	35.2	32.0	32.9	0.9	0.8
	March	38.6	32.1	34.0	1.5	2.3
	April	42.2	32.5	35.6	1.9	3.5
	May	43.8	34.3	37.7	1.9	3.4
	June	53.3	37.4	43.1	3.2	10.5
	July	54.0	41.3	46.7	2.8	7.8
	August	54.6	41.2	47.5	2.6	6.8
	September	50.5	37.6	43.7	2.3	5.1
	October	45.7	34.7	39.9	2.5	6.4
	November	39.5	32.0	33.9	1.8	3.4
	December	33.6	32.1	32.4	0.3	0.1
2016	January	33.4	32.1	32.4	0.3	0.1
	February	34.1	32.0	32.4	0.4	0.2
	March	35.1	32.0	32.8	0.7	0.5
	April	40.4	32.1	35.4	1.5	2.4
	May	43.3	34.0	37.6	1.7	3.0
	June	51.9	36.5	42.2	3.0	8.9
	July	53.5	40.1	46.0	3.1	9.7
	August	52.7	41.0	46.5	2.5	6.2
	September	50.6	40.5	44.2	2.0	4.1

Broadus Creek (Mile 0.1)



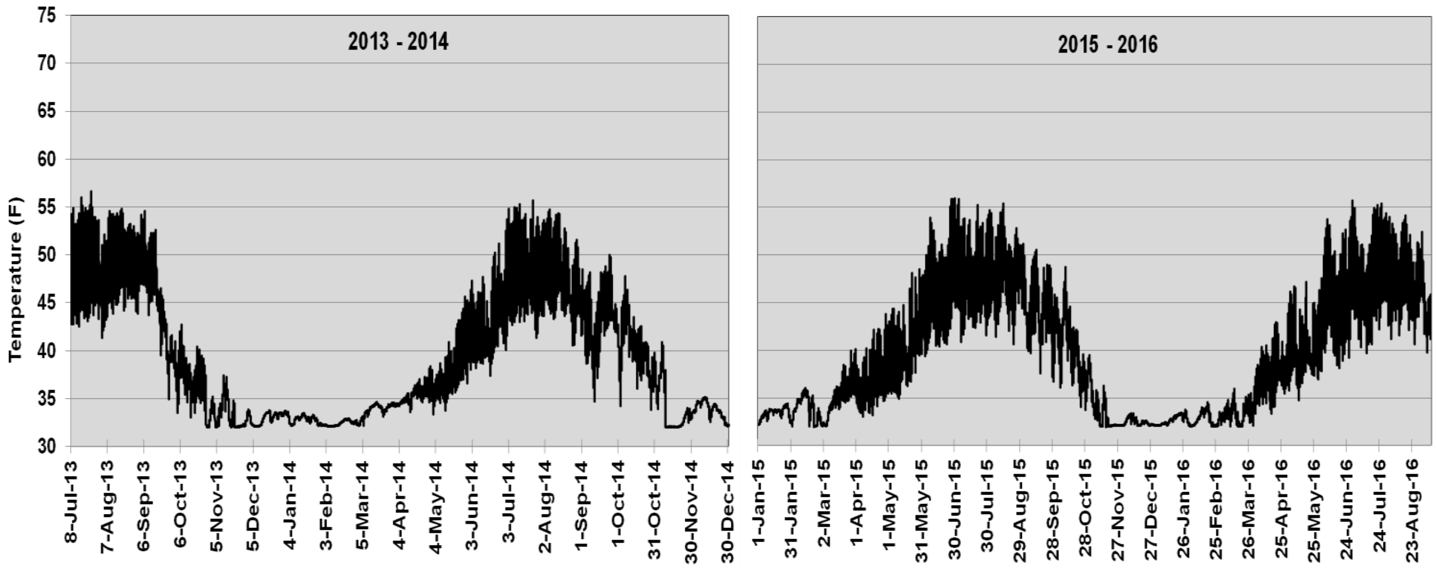
Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
2013	July	59.1	43.5	49.9	3.6	13.2
	August	59.2	42.8	50.8	3.4	11.5
	September	57.8	33.7	46.8	5.4	29.3
	October	42.3	32	35.5	2.3	5.2
	November	35.7	32.1	32.6	0.7	0.5
	December	33.1	32.2	32.6	0.2	0.0
2014	January	32.9	32.2	32.5	0.2	0.0
	February	32.5	32.1	32.3	0.1	0.0
	March	33.3	32.1	32.7	0.3	0.1
	April	36.4	32.1	33.9	0.7	0.5
	May	40.9	32.3	36.1	1.4	2.0
	June	46.3	36.2	39.8	2.0	4.2
	July	55.5	39.1	47.0	3.3	11.2
	August	58.5	41.3	49.1	3.3	11.0
	September	51.1	33.8	43.7	3.5	12.1
	October	47.6	32.1	39.6	2.9	8.4
	November	39.4	32.0	33.4	1.9	3.8
	December	33.9	32.2	33.1	0.4	0.2
2015	January	33.7	32.1	32.7	0.3	0.1
	February	34.9	32.0	33.0	0.7	0.5
	March	39.1	32.1	34.0	1.5	2.2
	April	42.7	32.4	35.7	2.0	3.9
	May	46.2	34.5	38.3	2.1	4.4
	June	57.0	38.0	44.9	4.0	15.8
	July	58.4	42.1	49.2	3.3	10.9
	August	60.9	40.9	50.3	3.6	12.9
	September	53.6	36.2	44.8	3.3	11.0
	October	48.9	32.4	39.9	3.5	12.5
	November	39.3	32.0	32.8	1.5	2.2
	December	32.7	32.0	32.3	0.1	0.0
2016	January	32.9	32.1	32.4	0.1	0.0
	February	33.2	32.0	32.3	0.2	0.1
	March	35.0	32.0	32.7	0.6	0.4
	April	40.4	32.3	35.7	1.6	2.6
	May	44.6	34.0	38.3	2.0	3.9
	June	54.6	37.0	43.5	3.6	12.6
	July	59.3	40.3	48.2	4.0	15.7
	August	57.7	40.8	48.9	3.5	11.9
	September	54.9	39.8	45.1	3.1	9.8

Theodore Creek (mile 0.1)



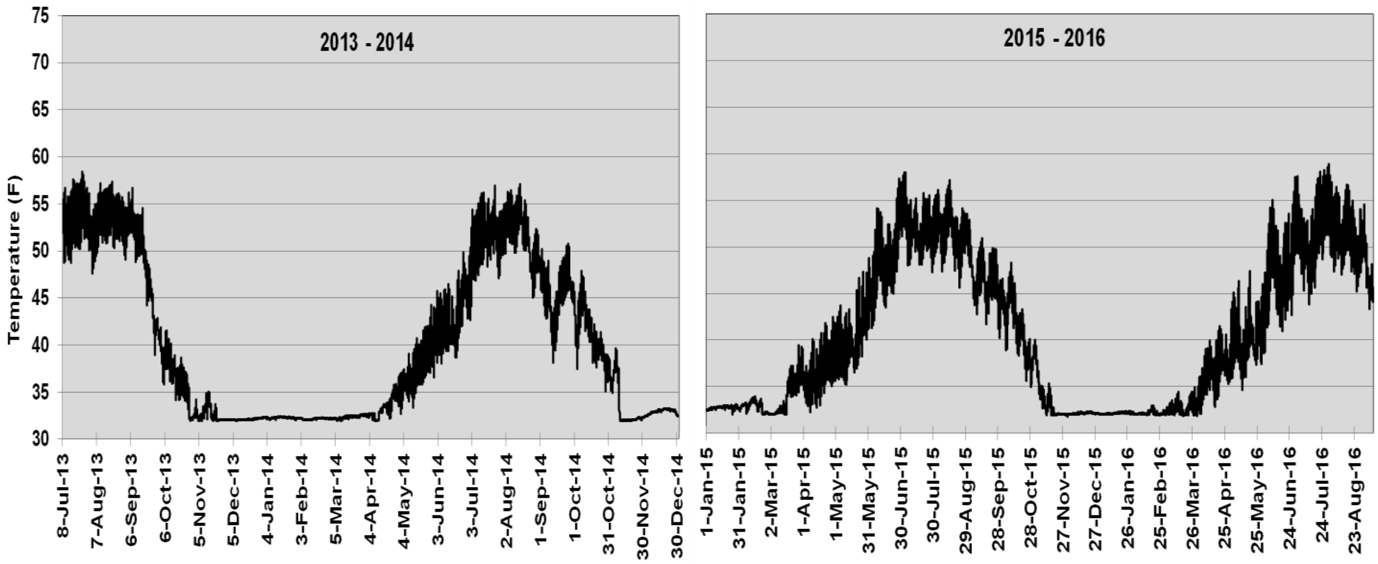
Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
2013	July	55.8	44.4	49.5	2.6	6.5
	August	58.3	43.8	50.5	3.1	9.5
	September	59.5	34.1	46.4	5.4	29
	October	41.1	31.8	34.9	2.2	4.7
	November	34.6	31	32.2	0.6	0.4
	December	32	31.5	31.8	0.1	0.0
2014	January	32.0	31.7	31.8	0.1	0.0
	February	31.8	30.9	31.5	0.3	0.1
	March	32.0	31.5	31.8	0.1	0.0
	April	34.2	31.9	32.6	0.8	0.6
	May	41.1	32.6	35.8	1.5	2.1
	June	46.4	35.4	39.3	2.2	4.9
	July	53.2	38.9	47.4	2.8	7.7
	August	55.7	41.7	48.6	2.8	7.6
	September	51.8	34.4	43.3	3.2	10.1
	October	49.7	32.4	39.2	3.1	9.9
	November	39.4	30.4	32.9	2.0	4.1
	December	33.4	31.5	32.1	0.4	0.2
2015	January	33.2	31.4	32.2	0.5	0.3
	February	33.5	32.1	32.9	0.4	0.1
	March	36.8	32.0	33.6	1.2	1.3
	April	40.5	32.6	35.2	1.5	2.2
	May	44.0	33.6	37.4	2.1	4.4
	June	54.9	37.5	44.8	3.8	14.4
	July	55.4	42.8	48.7	2.5	6.5
	August	59.5	41.2	49.7	3.3	10.8
	September	54.7	35.9	44.5	3.2	10.1
	October	52.1	32.4	39.7	3.8	14.1
	November	38.8	28.0	32.6	1.5	2.3
	December	32.1	26.4	31.4	1.1	1.1
2016	January	31.9	30.4	31.3	0.4	0.2
	February	31.9	31.1	31.7	0.2	0.1
	March	32.1	31.6	31.8	0.1	0.0
	April	38.7	31.9	34.5	1.7	2.8
	May	43.8	33.4	37.3	1.9	3.5
	June	52.7	35.9	43.3	3.5	12.3
	July	56.7	41.0	48.0	3.2	10.4
	August	56.6	41.1	48.5	3.2	10.2
	September	57.9	39.9	45.0	3.3	11.1

Sarbo Creek (Mile 0.1)



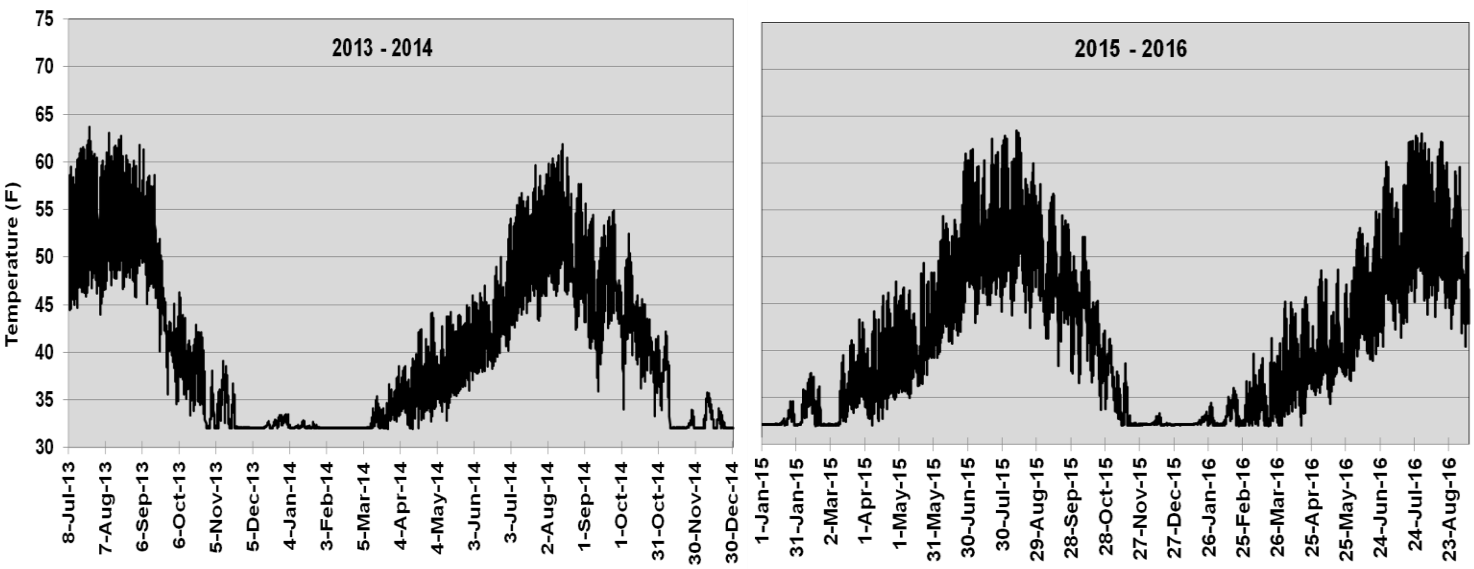
Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
2013	July	56.6	42.5	48.6	3.7	13.5
	August	54.8	41.4	48.8	3.0	8.8
	September	54.6	35	45.9	4.3	18.5
	October	42.7	32	36.6	2.3	5.4
	November	37.4	32	33.3	1.3	1.8
	December	33.8	32.1	33	0.6	0.3
2014	January	33.7	32.1	32.8	0.4	0.2
	February	33.0	32.1	32.4	0.3	0.1
	March	34.6	32.1	33.8	0.7	0.4
	April	38.3	33.6	35.3	0.8	0.6
	May	45.6	33.3	37.5	2.4	5.7
	June	51.1	37.4	42.5	2.7	7.2
	July	55.7	40.1	47.6	3.4	11.9
	August	54.7	40.5	47.6	3.1	9.4
	September	50.0	34.7	43.6	2.9	8.5
	October	47.8	33.9	40.2	2.5	6.5
	November	40.9	32.0	33.8	2.4	5.6
	December	35.1	32.1	33.8	0.8	0.7
2015	January	34.4	32.2	33.4	0.5	0.3
	February	36.0	31.9	33.9	1.2	1.4
	March	40.1	32.0	34.9	1.7	2.9
	April	43.8	33.0	36.6	2.2	5.0
	May	48.5	35.0	39.9	2.8	7.9
	June	55.9	39.4	45.7	3.6	13.2
	July	55.9	40.9	47.6	3.3	10.7
	August	55.4	40.6	48.2	3.0	8.8
	September	51.1	36.7	44.2	2.8	7.9
	October	48.8	33.8	40.2	3.1	9.5
	November	39.5	31.9	33.3	1.8	3.1
	December	33.4	32.1	32.4	0.3	0.1
2016	January	33.8	32.1	32.7	0.5	0.2
	February	34.5	32.0	32.8	0.7	0.5
	March	36.2	32.0	33.4	0.9	0.8
	April	42.9	33.4	37.0	1.9	3.5
	May	47.2	34.8	40.0	2.5	6.2
	June	55.7	37.8	45.1	3.8	14.5
	July	55.4	39.7	47.3	3.7	13.6
	August	54.1	40.7	47.5	2.9	8.6
	September	52.4	39.8	44.4	2.6	6.7

South Creek (Mile 0.1)



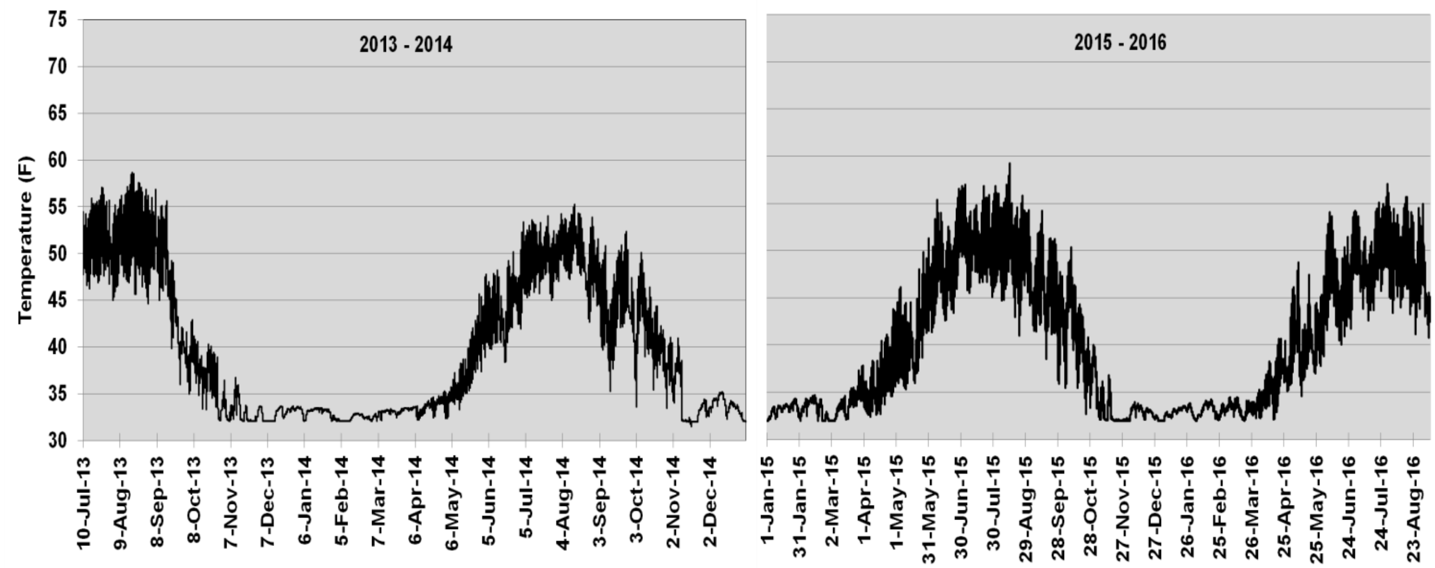
Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
2013	July	58.4	48.8	53.5	2.3	5.1
	August	57.3	47.6	53.2	1.9	3.7
	September	56.6	39	49.1	4.4	19.7
	October	41.8	32	36.5	2.5	6.2
	November	35	32	32.6	0.7	0.5
	December	32.3	32	32.1	0.07	0.0
2014	January	32.4	32.1	32.3	0.1	0.0
	February	32.3	32.0	32.2	0.1	0.0
	March	32.6	32.0	32.4	0.2	0.0
	April	36.8	32.0	33.3	1.0	1.0
	May	44.3	32.7	37.4	2.2	4.9
	June	49.9	38.1	42.9	2.6	6.6
	July	56.9	42.7	51.3	2.5	6.1
	August	57.1	45.1	51.8	2.5	6.5
	September	50.8	38.2	45.6	2.5	6.3
	October	47.9	35.1	41.0	2.6	7.0
	November	39.6	32.0	33.6	2.4	5.6
	December	33.2	32.3	32.9	0.3	0.1
2015	January	33.1	32.0	32.7	0.2	0.0
	February	33.9	32.0	32.8	0.5	0.3
	March	39.5	32.0	33.8	1.8	3.3
	April	42.5	32.3	36.2	2.1	4.3
	May	48.8	35.2	40.1	2.6	7.0
	June	57.3	41.3	48.6	3.4	11.7
	July	58.0	47.3	52.0	2.1	4.4
	August	57.2	45.6	51.7	2.1	4.5
	September	52.9	40.3	46.5	2.3	5.3
	October	48.3	35.0	41.4	3.0	9.2
	November	40.0	31.9	33.4	1.9	3.7
	December	32.3	31.8	32.1	0.1	0.0
2016	January	32.3	32.0	32.1	0.1	0.0
	February	32.9	31.9	32.1	0.2	0.0
	March	35.0	31.9	32.6	0.6	0.3
	April	41.5	32.1	36.2	1.9	3.6
	May	47.4	34.6	40.0	2.3	5.4
	June	57.5	38.8	47.3	3.4	11.7
	July	58.9	43.9	51.1	3.0	9.0
	August	56.9	45.3	50.8	2.2	4.8
	September	54.6	43.4	47.2	2.4	5.7

North Fork Blackfoot River upstream of East Fork (Mile 27)



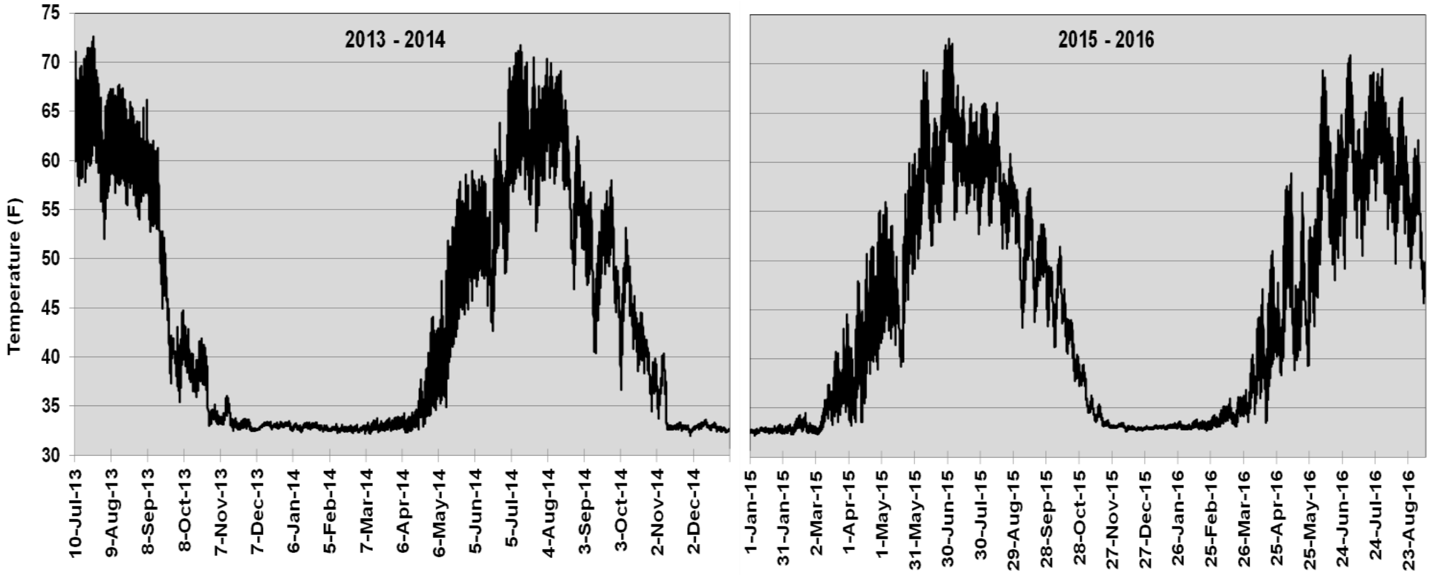
Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
2013	July	63.7	44.5	52.9	4.8	23.2
	August	63.0	44.0	53.4	4.3	18.8
	September	61.8	35.6	48.9	5.6	31.1
	October	46.3	32.1	37.8	3.2	10.5
	November	39.1	32	33.6	1.8	3.4
	December	33.4	32.1	32.4	0.4	0.1
2014	January	33.5	32.1	32.2	0.3	0.1
	February	32.1	32.1	32.1	0.0	0.0
	March	36.6	32.0	32.9	1.0	1.1
	April	44.1	32.0	35.6	2.3	5.4
	May	44.9	32.8	37.9	2.6	6.7
	June	50.0	37.1	41.9	2.7	7.5
	July	59.6	40.2	49.4	4.0	16.3
	August	61.8	42.4	51.4	4.2	17.7
	September	55.6	35.9	46.4	3.9	15.6
	October	52.5	33.3	41.6	3.4	11.3
	November	42.2	32.0	33.9	2.8	8.0
	December	35.7	32.0	32.7	1.0	0.9
2015	January	34.6	32.0	32.3	0.5	0.3
	February	37.6	31.9	33.3	1.5	2.3
	March	43.3	32.0	34.8	2.5	6.5
	April	47.3	32.0	37.4	3.3	11.0
	May	49.3	34.9	40.3	3.0	9.2
	June	60.9	39.3	47.1	4.6	20.9
	July	62.6	43.0	51.7	4.4	19.2
	August	63.5	42.4	52.7	4.4	19.8
	September	57.7	37.6	47.3	4.0	15.9
	October	52.1	33.7	42.2	3.8	14.4
	November	41.2	32.0	33.8	2.3	5.3
	December	33.2	32.0	32.2	0.2	0.1
2016	January	34.4	32.0	32.4	0.5	0.2
	February	36.7	31.9	33.0	1.1	1.3
	March	41.3	31.9	34.7	2.2	4.6
	April	45.7	32.0	37.6	2.9	8.7
	May	48.6	34.3	40.1	3.0	8.9
	June	60.1	37.8	46.2	4.5	19.9
	July	63.1	41.4	51.4	5.1	25.6
	August	62.2	42.3	51.9	4.5	19.9
	September	59.6	40.4	47.3	3.8	14.4

Blonde Creek (Mile 0.1)



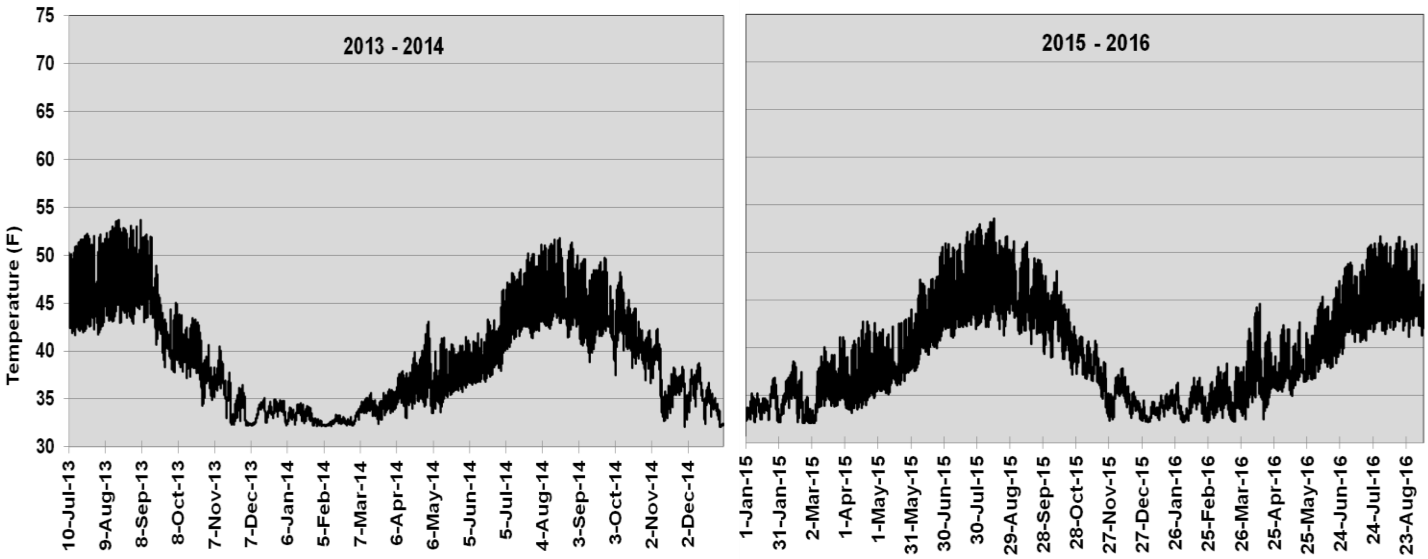
Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
2013	July	57.1	46.2	51.1	2.5	6.2
	August	58.7	45.0	51.0	2.9	8.3
	September	56.9	36	47.1	4.7	21.6
	October	42.9	32.1	37	2.4	5.5
	November	36.7	32	33	1.1	1.3
	December	33.7	32	32.8	0.6	0.4
2014	January	33.6	32.0	33.0	0.4	0.2
	February	32.8	32.0	32.4	0.3	0.1
	March	33.5	32.0	33.0	0.4	0.1
	April	35.2	32.2	33.6	0.5	0.3
	May	45.7	32.3	36.9	2.8	7.9
	June	50.1	38.4	43.6	2.6	6.5
	July	54.0	42.0	49.3	2.3	5.2
	August	55.2	42.7	49.8	2.5	6.4
	September	52.3	35.3	44.4	3.2	9.9
	October	50.1	33.4	40.8	3.0	9.3
	November	40.9	31.5	34.0	2.4	5.9
	December	35.2	32.0	33.6	0.9	0.7
2015	January	34.3	32.0	33.2	0.6	0.3
	February	34.7	32.0	33.2	0.8	0.7
	March	37.8	32.0	33.6	1.1	1.3
	April	43.8	32.4	35.8	2.3	5.1
	May	51.3	35.3	40.9	3.3	10.7
	June	56.5	41.4	48.3	3.4	11.5
	July	57.0	45.1	50.5	2.6	6.5
	August	59.2	41.0	50.0	3.2	10.2
	September	54.3	35.9	45.3	3.3	10.9
	October	50.4	32.7	40.8	3.6	13.2
	November	39.8	32.0	33.2	1.8	3.4
	December	33.9	32.0	32.8	0.6	0.3
2016	January	34.3	32.0	33.2	0.6	0.3
	February	34.7	32.0	33.2	0.8	0.7
	March	37.8	32.0	33.6	1.1	1.3
	April	43.8	32.4	35.8	2.3	5.1
	May	51.3	35.3	40.9	3.3	10.7
	June	56.5	41.4	48.3	3.4	11.5
	July	57.0	45.1	50.5	2.6	6.5
	August	59.2	41.0	50.0	3.2	10.2
	September	54.3	44.2	48.4	2.4	5.7

East Fork of North Fork Blackfoot River (Mile 9.4)



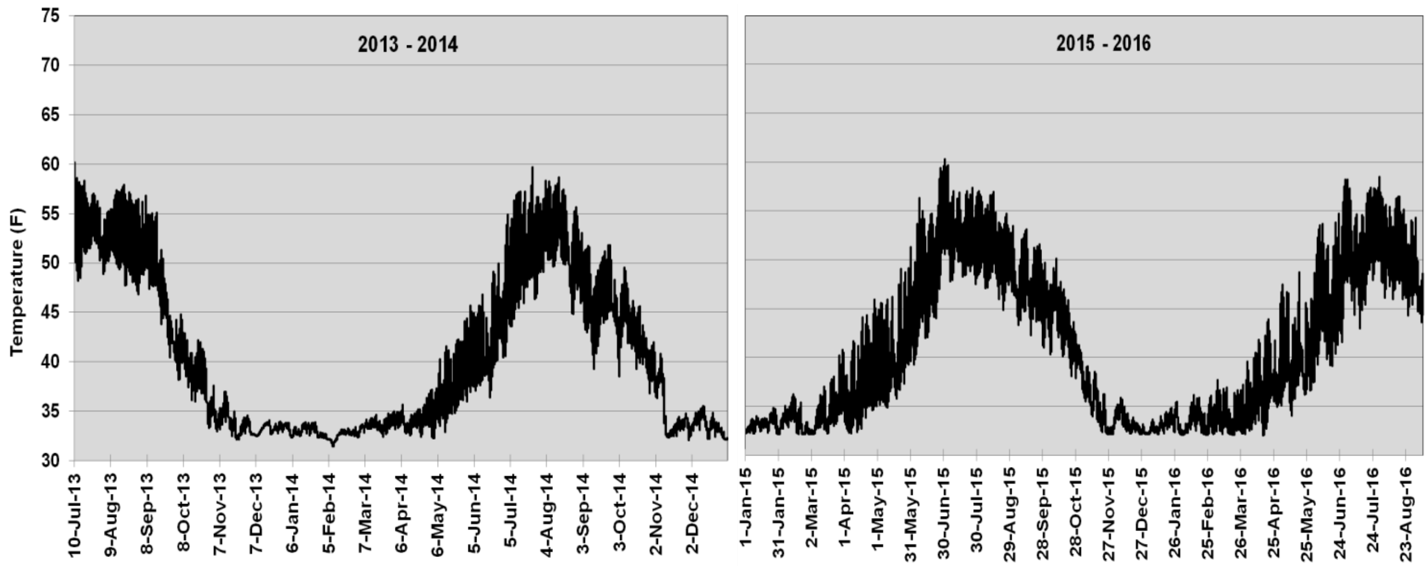
Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
2013	July	72.6	55.8	64.5	3.8	14.5
	August	67.7	52.1	61.0	3.3	10.8
	September	66.1	37.4	52.5	7.5	56.1
	October	44.7	33	38.6	2.5	6.5
	November	36	32.5	33.6	0.7	0.5
	December	33.4	32.5	32.9	0.2	0.1
2014	January	33.5	32.3	32.9	0.2	0.0
	February	33.1	32.3	32.7	0.1	0.0
	March	33.8	32.2	32.8	0.3	0.1
	April	44.0	32.3	34.4	2.1	4.5
	May	58.5	34.7	44.4	5.9	34.5
	June	63.8	42.7	52.6	4.1	16.9
	July	71.7	49.9	62.4	4.2	18.0
	August	70.3	46.9	60.5	5.0	25.3
	September	58.0	40.4	50.7	3.7	13.9
	October	53.2	34.5	42.6	3.9	15.1
	November	40.3	32.0	34.1	2.1	4.6
	December	33.6	32.4	32.8	0.2	0.1
2015	January	33.3	32.2	32.7	0.1	0.0
	February	34.5	32.4	33.0	0.4	0.2
	March	44.5	32.4	35.6	2.5	6.3
	April	55.1	33.2	41.7	5.0	24.9
	May	60.9	39.2	48.3	4.8	23.2
	June	71.9	50.2	60.3	4.9	24.3
	July	72.5	52.7	61.2	3.8	14.5
	August	66.0	51.2	58.3	3.3	11.1
	September	57.3	43.2	50.1	3.3	11.2
	October	51.4	37.3	43.3	3.6	13.2
	November	39.4	33.0	34.4	1.5	2.2
	December	33.5	32.6	33.0	0.2	0.0
2016	January	33.6	32.8	33.1	0.1	0.0
	February	34.3	32.7	33.2	0.3	0.1
	March	36.8	33.1	34.4	0.8	0.6
	April	50.9	33.5	40.5	3.6	12.7
	May	58.9	38.9	47.3	4.6	21.4
	June	70.6	46.3	58.3	5.2	27.2
	July	70.8	50.5	61.4	4.2	17.6
	August	66.6	49.2	58.0	3.7	13.6
	September	62.2	45.7	52.1	4.3	18.9

Sourdough Creek (Mile 0.1)



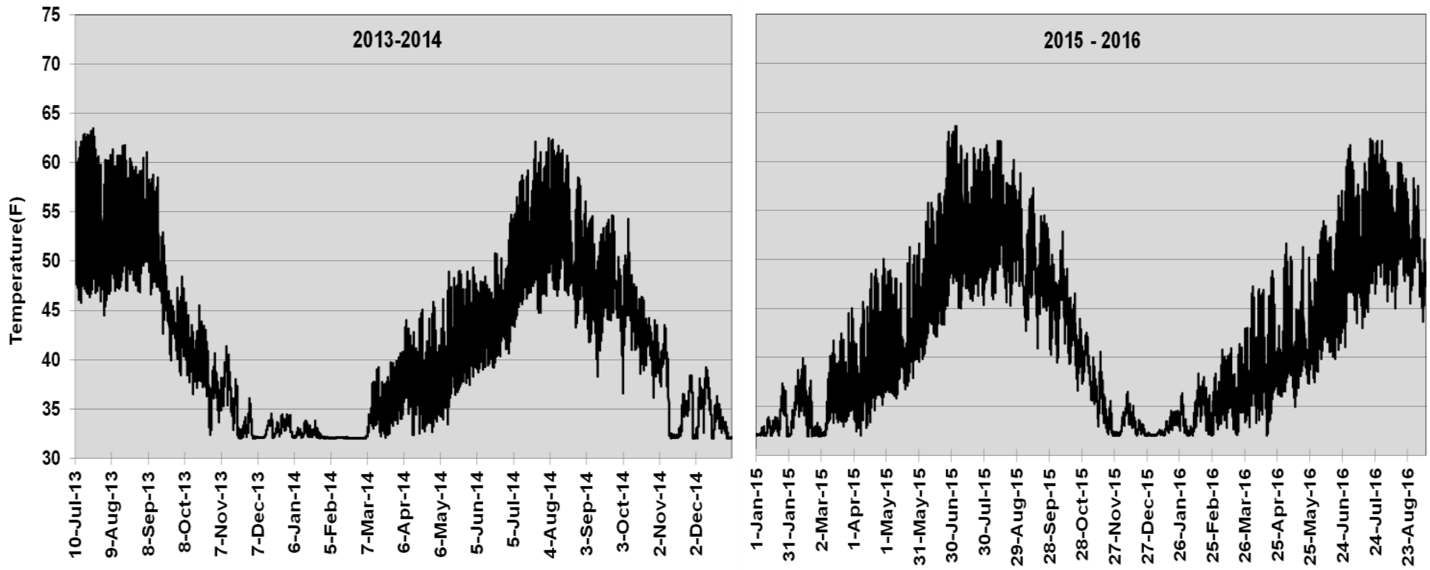
Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
2013	July	52.2	41.7	45.5	2.9	8.2
	August	53.7	41.7	46.6	2.9	8.3
	September	53.7	38.4	45.1	3.1	9.4
	October	45	34.3	40	2	3.9
	November	40.6	32.3	35.8	1.8	3.4
	December	35.6	32.3	33.5	0.9	0.8
2014	January	34.8	32.2	33.3	0.6	0.4
	February	33.3	32.2	32.6	0.3	0.1
	March	36.0	32.2	33.9	0.7	0.5
	April	41.8	33.0	36.0	1.4	2.0
	May	43.0	33.5	36.8	1.7	3.1
	June	43.3	36.2	38.7	1.5	2.3
	July	50.2	37.9	43.8	2.3	5.3
	August	51.8	41.5	45.4	2.4	5.6
	September	49.9	38.9	43.8	2.3	5.4
	October	48.2	37.0	41.4	2.0	4.0
	November	42.3	32.1	36.6	2.3	5.2
	December	38.7	32.1	35.0	1.6	2.6
2015	January	36.8	32.2	33.8	1.0	1.1
	February	38.5	32.1	34.3	1.5	2.3
	March	41.1	32.1	35.3	1.8	3.4
	April	42.7	33.1	36.1	2.1	4.4
	May	44.0	35.1	37.9	1.7	2.8
	June	50.5	37.6	42.2	2.6	6.6
	July	52.6	41.1	45.2	2.6	7.0
	August	53.6	41.3	46.3	2.7	7.2
	September	51.1	39.4	44.4	2.4	5.5
	October	48.0	37.2	41.6	2.2	4.7
	November	41.1	32.3	36.9	2.1	4.6
	December	37.8	32.2	34.5	1.4	1.9
2016	January	36.3	32.2	33.8	0.9	0.7
	February	36.8	32.2	33.8	1.2	1.4
	March	38.6	32.2	34.6	1.4	1.9
	April	44.5	32.5	37.0	2.2	4.8
	May	42.7	34.9	37.8	1.5	2.2
	June	48.5	36.8	41.2	2.3	5.3
	July	51.7	40.6	44.4	2.5	6.3
	August	51.6	41.1	45.3	2.4	5.9
	September	50.8	41.3	44.2	1.9	3.5

Scotty Creek (Mile 0.2)



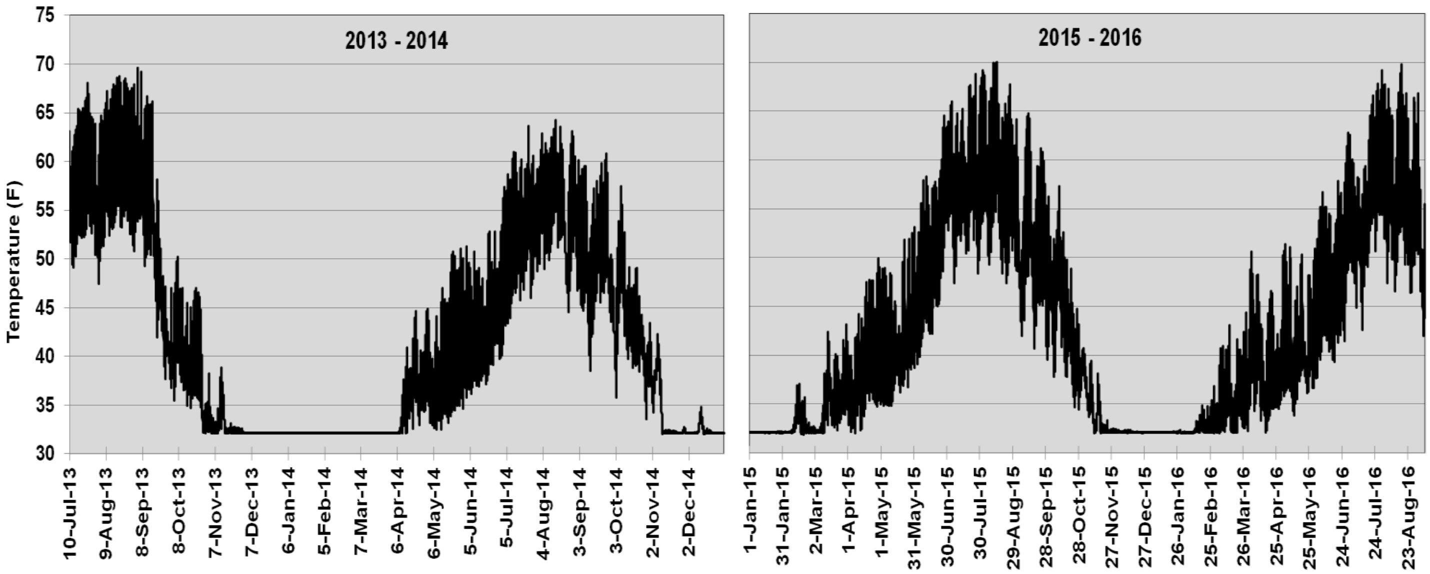
Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
2013	July	60.2	48.2	53.5	2.1	4.5
	August	57.9	47.2	52.1	2.2	4.9
	September	56.8	40.4	48.2	3.7	13.5
	October	44.8	33.3	38.8	2.3	5.4
	November	37.6	32.2	34	1.1	1.1
	December	34.2	32.5	33.2	0.5	0.2
2014	January	33.9	32.4	33.0	0.4	0.2
	February	33.4	31.4	32.5	0.4	0.2
	March	35.0	32.3	33.5	0.5	0.2
	April	37.1	32.4	33.9	0.7	0.5
	May	44.4	32.3	36.7	2.4	5.8
	June	50.0	36.4	41.5	2.9	8.4
	July	59.7	40.6	50.4	3.5	12.6
	August	58.7	44.9	52.0	2.8	8.0
	September	53.0	39.3	46.1	2.5	6.4
	October	49.5	36.8	42.3	2.4	5.7
	November	41.0	32.1	34.7	2.4	5.8
	December	35.5	32.2	33.5	0.8	0.7
2015	January	34.8	32.1	33.1	0.6	0.3
	February	36.2	32.1	33.3	0.9	0.8
	March	40.8	32.1	34.1	1.6	2.6
	April	45.9	32.2	36.5	2.9	8.3
	May	51.3	34.9	40.0	3.2	9.9
	June	59.6	39.3	48.3	4.5	20.5
	July	60.3	47.5	52.2	2.5	6.3
	August	57.0	44.9	50.5	2.5	6.0
	September	53.4	41.0	46.6	2.4	5.6
	October	50.1	37.9	43.1	2.5	6.2
	November	40.7	32.2	35.2	2.2	5.0
	December	35.9	32.1	33.2	0.9	0.8
2016	January	35.4	32.1	33.1	0.7	0.5
	February	36.1	32.1	33.2	1.0	0.9
	March	37.7	32.1	33.6	1.2	1.4
	April	43.9	32.0	36.1	2.4	5.6
	May	48.7	34.0	39.4	2.8	7.9
	June	58.2	37.5	46.3	4.3	18.2
	July	58.5	43.0	50.9	3.1	9.8
	August	56.5	44.3	49.9	2.6	6.6
	September	54.3	43.6	46.9	2.1	4.5

East Fork of North Fork Blackfoot River (Mile 7.0)



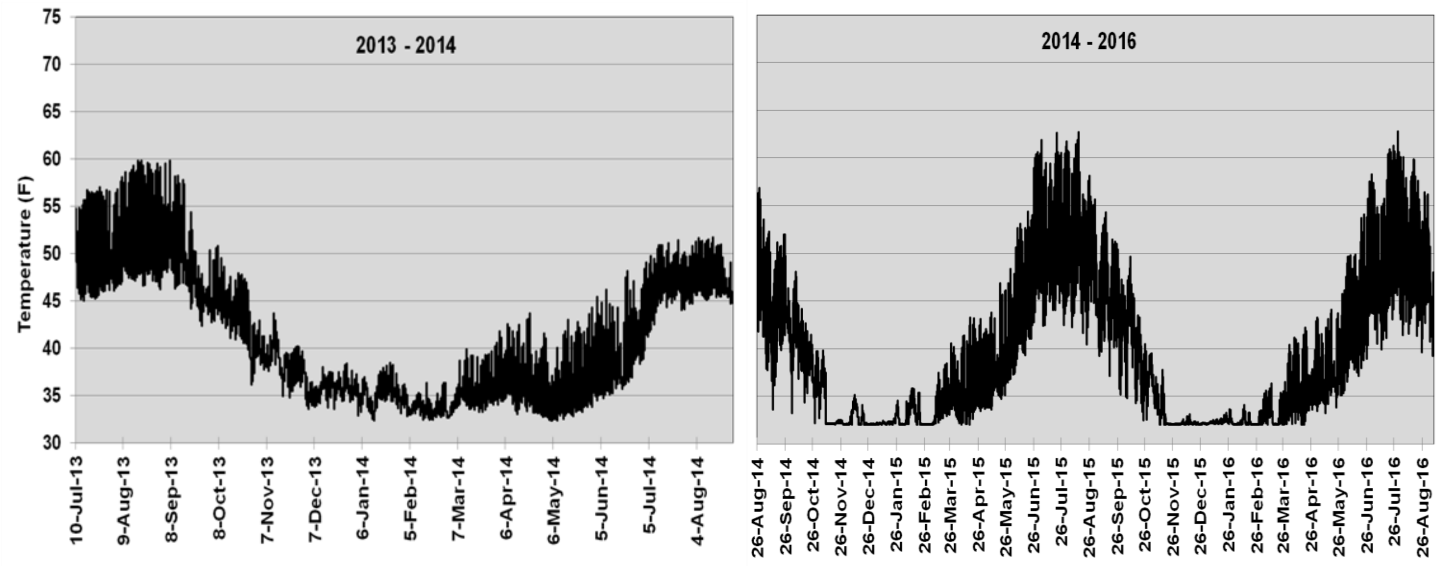
Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
2013	July	63.5	45.8	54.2	5.0	25.1
	August	61.8	44.5	53.5	4.1	16.5
	September	61.1	40	49.7	4.7	21.9
	October	48.4	32.4	40.5	3	9
	November	41.4	32	35.5	2.4	5.6
	December	35.5	32	32.8	0.8	0.6
2014	January	34.4	32.0	32.6	0.5	0.3
	February	32.1	32.0	32.1	0.0	0.0
	March	39.9	32.0	34.3	1.9	3.6
	April	45.9	32.3	37.4	2.9	8.4
	May	49.0	33.4	40.0	3.8	14.3
	June	50.7	38.3	43.2	2.9	8.1
	July	62.1	40.7	50.8	4.4	19.1
	August	62.5	43.3	52.4	4.4	19.3
	September	56.0	38.3	47.9	3.4	11.7
	October	54.3	36.2	43.4	3.0	8.8
	November	43.5	32.0	35.7	3.4	11.4
	December	39.2	32.0	34.3	1.9	3.7
2015	January	37.4	31.9	33.1	1.2	1.5
	February	39.9	31.9	34.4	2.0	4.1
	March	45.0	31.9	35.7	2.8	7.8
	April	50.0	32.0	38.8	4.1	16.5
	May	51.6	35.8	41.5	3.4	11.8
	June	63.0	39.9	48.7	5.1	26.3
	July	63.6	45.0	53.1	4.5	19.9
	August	62.1	45.3	53.1	3.7	13.9
	September	58.8	40.3	48.6	3.5	12.1
	October	52.8	36.6	43.4	3.2	10.5
	November	42.5	32.0	35.3	2.8	7.6
	December	36.5	32.0	33.1	1.0	1.1
2016	January	36.4	32.0	33.1	0.9	0.9
	February	38.3	32.0	34.1	1.7	2.7
	March	43.0	32.1	36.1	2.3	5.1
	April	48.8	32.0	39.1	3.6	12.6
	May	51.6	35.0	41.4	3.4	11.9
	June	61.3	38.6	47.2	4.8	22.7
	July	62.3	43.0	52.7	4.8	22.7
	August	60.1	45.0	52.7	3.3	11.2
	September	57.5	43.6	49.2	3.1	9.5

Meadow Creek (Mile 1.4)



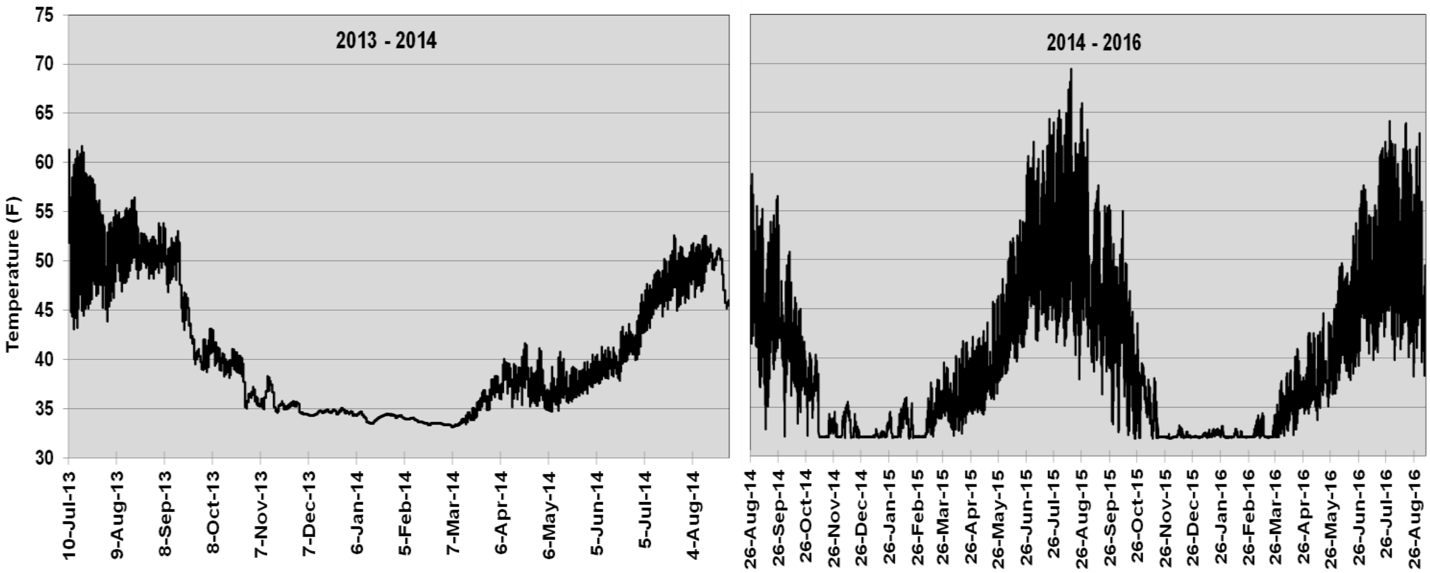
Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
2013	July	68.1	49.2	58.3	4.2	17.6
	August	68.7	47.4	58.6	4.7	21.9
	September	69.6	37.7	52.2	7.5	56
	October	50.2	32.1	39.1	3.9	15.2
	November	38.8	32.1	32.8	1.2	1.3
	December	32.1	32.1	32.1	0.02	0.0
2014	January	32.1	32.1	32.1	0.0	0.0
	February	32.1	32.1	32.1	0.0	0.0
	March	32.1	32.1	32.1	0.0	0.0
	April	44.6	32.1	35.4	3.0	9.2
	May	51.1	32.5	39.0	4.4	19.4
	June	52.8	35.8	42.8	4.0	16.0
	July	63.6	40.1	52.4	4.6	20.7
	August	64.2	44.5	55.3	4.0	16.0
	September	60.8	38.5	49.9	4.4	19.5
	October	57.4	33.6	42.9	4.1	16.4
	November	42.2	32.0	33.9	2.9	8.2
	December	34.8	32.0	32.3	0.5	0.2
2015	January	32.2	32.0	32.1	0.0	0.0
	February	37.0	31.9	32.7	1.0	1.0
	March	43.2	32.0	35.2	2.7	7.0
	April	49.9	32.0	38.9	4.1	16.8
	May	53.1	34.8	41.3	4.0	15.9
	June	64.5	39.1	50.5	5.9	34.6
	July	68.8	47.4	57.4	4.4	19.1
	August	70.0	47.4	57.7	5.2	26.9
	September	64.8	39.6	50.6	5.3	28.2
	October	57.3	34.5	43.5	4.6	21.5
	November	40.7	32.0	33.9	2.2	5.0
	December	32.4	32.0	32.1	0.0	0.0
2016	January	32.3	32.0	32.1	0.0	0.0
	February	36.8	32.0	32.6	0.8	0.6
	March	44.4	32.0	35.0	2.6	6.5
	April	50.6	32.1	38.8	3.6	12.8
	May	51.3	33.8	41.0	3.9	15.5
	June	62.8	37.8	48.4	5.2	27.5
	July	69.2	42.6	55.5	5.0	25.4
	August	69.8	46.4	56.0	5.1	25.7
	September	66.8	42.0	50.5	5.3	27.7

Meadow Creek (Miles 4.7 & 5.3)



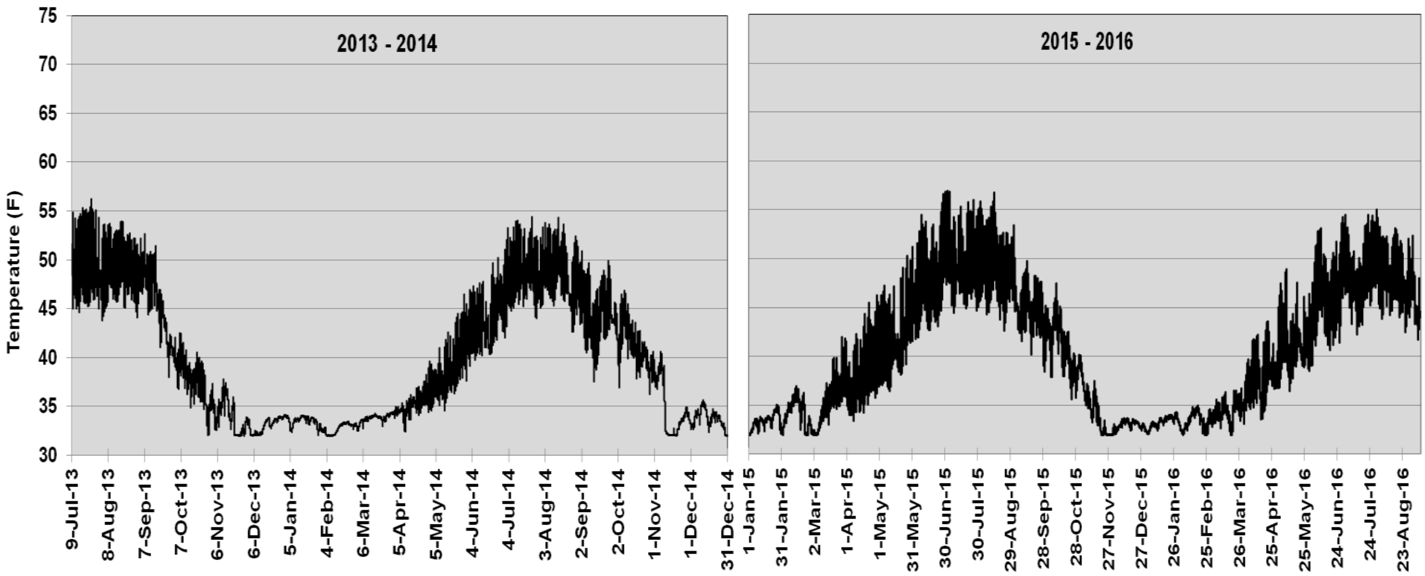
	Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
Mile 4.7	2013	July	57.0	45.0	50.0	3.4	11.2
		August	59.8	46.1	51.6	3.7	13.7
		September	59.8	42.4	49.3	3.7	13.5
		October	50.8	36.2	43.5	2.8	7.7
		November	43.7	34.8	38.5	1.6	2.6
		December	38.4	33.6	35.6	0.9	0.9
	2014	January	38.5	32.4	35.1	1.1	1.2
		February	36.4	32.5	33.8	0.8	0.6
		March	40.6	32.7	35.3	1.6	2.6
		April	43.7	32.8	36.4	2.4	5.8
		May	44.3	32.4	35.8	3.0	7.3
		June	48.1	34.5	39.3	3.0	8.7
		July	51.4	39.0	46.6	2.3	5.5
		26-Aug	51.7	44.7	47.5	1.7	3.1
Mile 5.3	2014	26-Aug	56.8	41.8	48.5	3.9	15.4
		September	53.6	33.6	44.2	3.8	14.8
		October	48.0	32.2	39.5	2.9	8.6
		November	39.8	32.1	33.4	2.1	4.5
		December	35.1	32.1	32.6	0.8	0.6
	2015	January	34.5	32.1	32.3	0.4	0.2
		February	35.8	32.1	32.9	1.0	1.1
		March	40.6	32.1	34.0	1.7	2.9
		April	43.3	32.1	35.5	2.5	6.2
		May	48.4	33.6	37.8	2.8	7.7
		June	60.6	37.3	45.7	5.1	26.4
		July	62.6	42.4	50.8	4.7	21.9
		August	62.7	40.4	50.8	4.6	21.1
		September	55.6	35.2	45.2	3.9	15.0
		October	49.6	32.5	40.2	3.7	13.6
		November	39.5	32.0	33.7	2.0	4.0
		December	33.1	32.1	32.2	0.2	0.0
	2016	January	33.6	32.1	32.4	0.3	0.1
		February	34.1	32.1	32.3	0.4	0.2
		March	38.4	32.1	33.2	1.2	1.4
		April	42.2	32.0	35.3	2.1	4.6
		May	45.7	33.2	37.1	2.4	6.0
		June	57.5	35.6	43.5	4.5	20.7
		July	62.7	40.0	49.4	5.1	25.6
		August	60.1	39.6	49.4	4.6	20.9
		September	56.1	39.3	45.6	3.7	13.6

East Fork Meadow Creek (Miles 0.1 & 0.9)



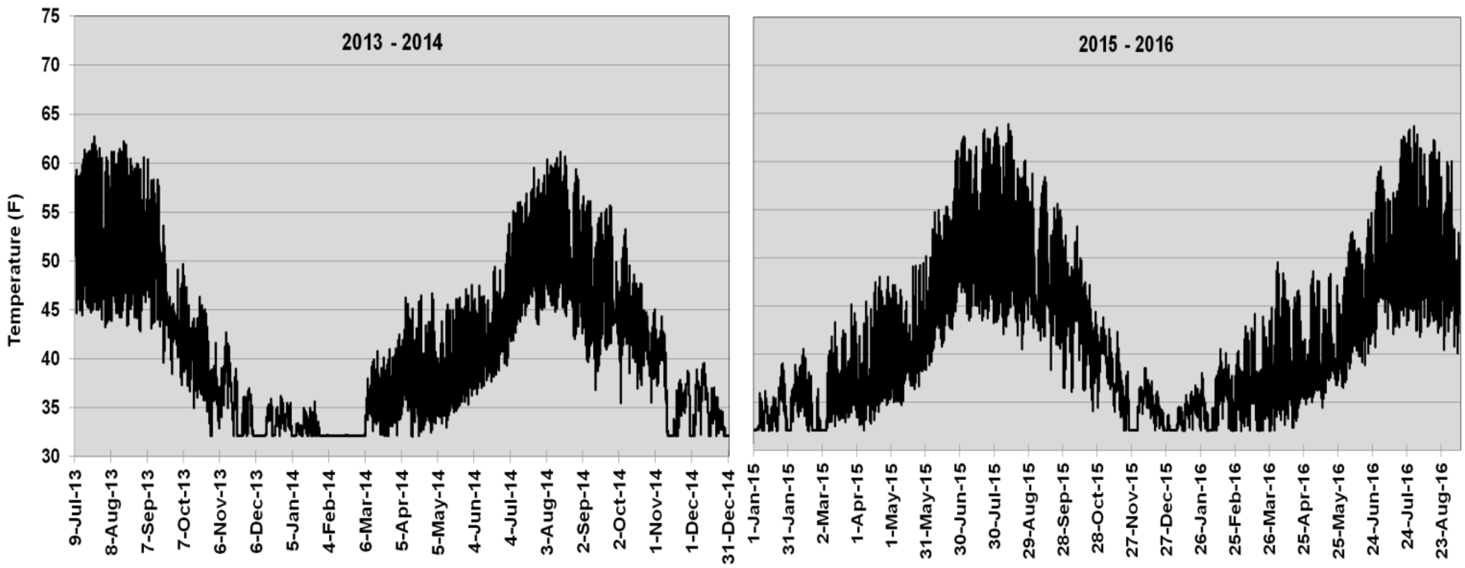
	Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
Mile 0.1	2013	July	55.4	44.3	49.4	2.9	8.5
		August	55.6	43.4	49.1	2.7	7.3
		September	54.6	37.2	46.1	3.6	13.3
		October	43.7	31.9	37.2	2.5	6.1
		November	37.3	31.9	33.8	1.3	1.6
		December	34.2	31.9	33	0.7	0.5
	2014	January	34.1	32.0	32.9	0.5	0.3
		February	33.5	32.0	32.5	0.4	0.1
		March	34.9	32.0	33.1	0.6	0.3
		April	37.8	32.0	33.3	1.0	1.0
		May	43.1	32.6	37.1	2.1	4.5
		June	47.8	37.6	41.6	2.1	4.4
		July	54.8	40.6	48.0	2.7	7.1
		26-Aug	55.4	42.0	48.5	2.7	7.1
Mile 0.9	2014	26-Aug	58.8	41.5	47.6	4.1	16.4
		September	56.5	32.7	43.9	4.5	20.4
		October	50.8	32.0	39.6	3.3	10.8
		November	40.3	31.9	33.8	2.3	5.4
		December	35.5	31.9	32.7	1.0	1.0
	2015	January	34.5	31.9	32.3	0.5	0.3
		February	35.9	31.8	32.8	1.1	1.1
		March	39.5	31.9	34.0	1.6	2.6
		April	42.2	32.1	35.6	2.0	3.8
		May	48.0	34.3	38.4	2.5	6.2
		June	60.6	38.4	45.7	4.5	20.1
		July	64.4	41.6	50.1	5.1	25.8
		August	69.4	37.8	51.2	6.4	40.6
		September	63.2	33.2	45.0	5.0	24.7
		October	54.9	31.8	39.7	4.7	22.4
		November	39.2	31.8	33.7	2.1	4.4
		December	33.1	31.8	32.1	0.3	0.1
	2016	January	33.0	31.9	32.2	0.3	0.1
		February	32.8	31.9	32.0	0.2	0.0
		March	36.7	31.9	32.5	0.7	0.6
		April	40.9	32.1	35.2	1.6	2.6
		May	45.0	33.7	38.0	2.2	4.7
		June	57.0	36.9	43.7	4.0	15.7
		July	64.1	39.8	48.7	5.0	24.6
		August	63.9	38.1	48.9	5.4	29.5

Spaulding Creek (Mile 0.1)



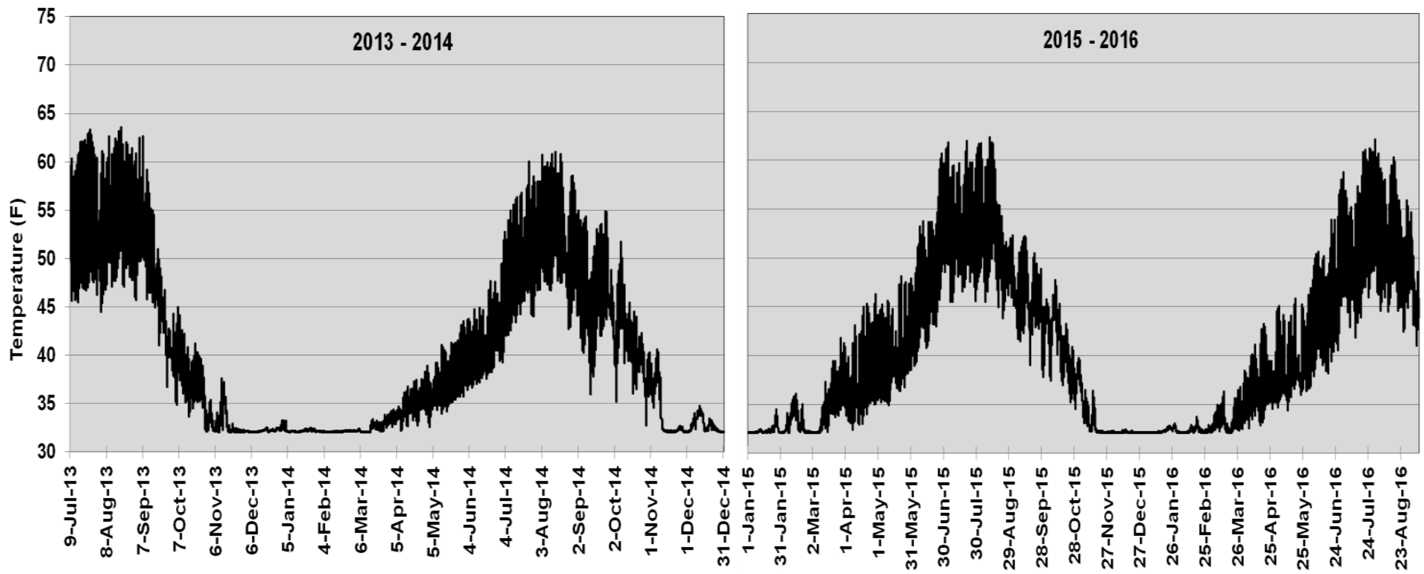
Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
2013	July	56.3	44.6	49.2	2.6	6.5
	August	54.0	43.8	48.7	2.2	4.7
	September	52.6	38	45.8	3.2	10.2
	October	42.5	32	37.7	2.1	4.4
	November	37.7	32	34.1	1.6	2.4
	December	34.1	32	33	0.7	0.5
2014	January	34.1	32.1	33.5	0.5	0.2
	February	33.4	32.0	32.7	0.5	0.3
	March	34.4	32.5	33.8	0.4	0.2
	April	39.6	32.4	35.1	1.0	1.0
	May	46.4	34.6	38.6	2.5	6.1
	June	50.2	39.2	43.7	2.4	5.7
	July	54.4	42.0	48.5	2.3	5.4
	August	54.3	42.6	48.2	2.3	5.1
	September	50.9	37.5	44.0	2.3	5.2
	October	46.8	36.2	40.9	2.0	3.9
	November	40.6	32.0	34.6	2.7	7.1
	December	35.6	32.0	33.8	0.9	0.8
2015	January	35.1	32.0	33.3	0.8	0.6
	February	36.9	32.0	34.1	1.3	1.7
	March	42.0	32.0	35.0	2.1	4.3
	April	46.2	33.4	37.6	2.5	6.4
	May	51.2	36.5	41.7	2.9	8.3
	June	56.8	41.8	47.6	3.0	9.3
	July	56.9	44.4	49.1	2.4	5.9
	August	56.7	42.6	48.5	2.4	6.0
	September	53.4	38.5	44.7	2.2	4.7
	October	47.5	35.6	40.9	2.4	6.0
	November	40.0	32.0	34.3	2.2	4.7
	December	33.7	32.0	33.0	0.4	0.2
2016	January	34.3	32.0	33.3	0.6	0.3
	February	35.0	31.9	33.3	0.8	0.7
	March	37.4	31.9	34.4	1.0	1.1
	April	43.6	33.6	37.6	2.0	3.9
	May	48.9	36.5	41.2	2.3	5.2
	June	54.3	39.2	46.4	3.0	9.0
	July	55.0	42.2	48.3	2.5	6.5
	August	53.2	42.5	47.7	2.1	4.6
	September	52.3	41.7	45.3	2.0	4.0

Mineral Creek (Mile 0.3)



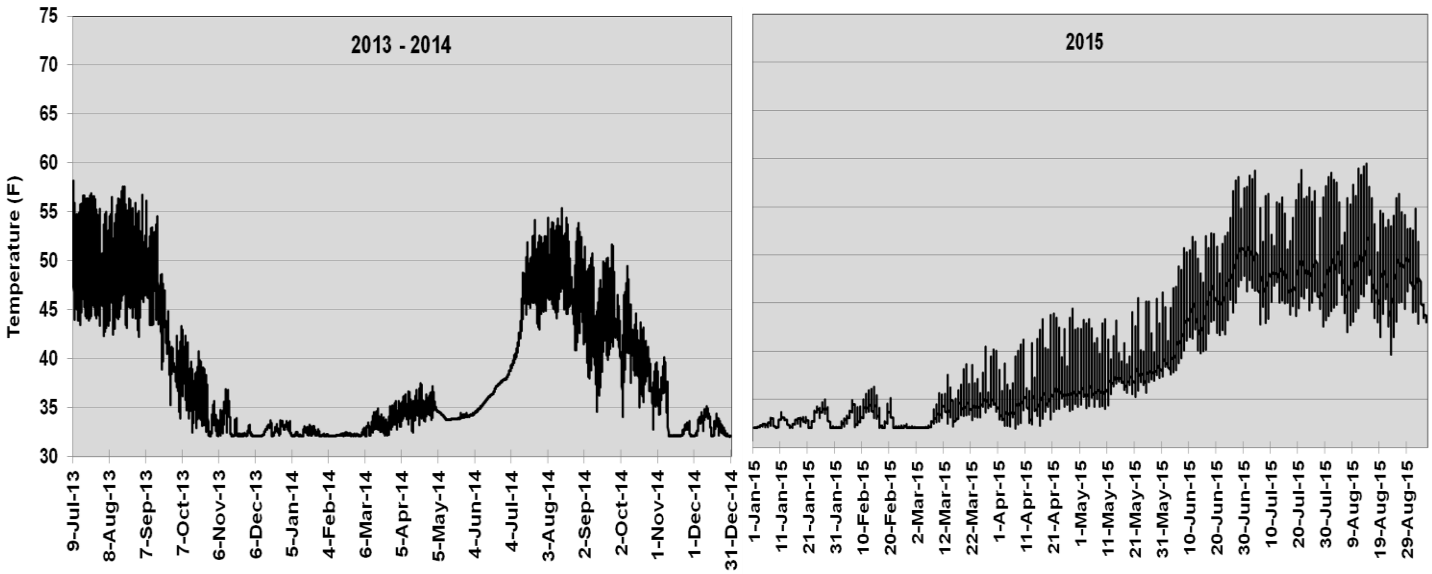
Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
2013	July	62.7	44.0	52.1	5.2	26.8
	August	62.2	43.0	51.6	5.2	27.2
	September	60.6	38.5	48.2	4.9	23.7
	October	49.6	32.1	40.4	3.5	11.9
	November	42.7	32.1	35.8	2.5	6.5
	December	36.4	32.1	33.2	1.2	1.4
2014	January	35.6	32.1	32.8	0.9	0.8
	February	32.2	32.1	32.1	0.0	0.0
	March	41.0	32.1	35.1	2.4	5.9
	April	46.7	32.0	37.9	3.5	12.4
	May	47.1	33.0	38.2	3.4	11.6
	June	49.6	36.3	41.4	3.0	8.9
	July	59.5	39.3	49.1	4.1	17.2
	August	61.2	42.0	50.6	4.6	21.3
	September	56.6	36.8	46.7	4.5	19.8
	October	53.2	35.4	42.8	3.3	10.8
	November	44.4	32.1	36.0	3.4	11.6
	December	39.5	32.1	34.6	2.1	4.4
2015	January	39.0	32.0	33.6	1.7	2.9
	February	40.5	32.0	34.5	2.1	4.6
	March	45.1	32.1	35.7	2.9	8.2
	April	48.0	32.1	38.0	3.7	13.9
	May	50.1	34.7	40.5	3.3	11.0
	June	61.1	38.9	47.7	4.9	23.9
	July	63.3	43.2	51.4	5.4	29.3
	August	63.9	40.5	51.2	5.5	30.7
	September	58.8	36.5	47.3	4.6	21.2
	October	53.3	34.1	42.8	3.8	14.6
	November	43.8	32.1	36.2	3.3	10.7
	December	38.5	32.1	34.2	1.8	3.1
2016	January	38.0	32.0	33.9	1.4	2.0
	February	40.5	32.0	34.8	2.4	5.6
	March	44.8	32.0	36.6	3.1	9.9
	April	49.5	32.4	38.2	3.7	14.0
	May	48.6	34.5	40.0	3.1	9.5
	June	58.9	37.4	45.9	4.4	19.7
	July	63.6	42.1	50.6	5.3	28.3
	August	62.8	40.4	50.4	5.5	29.7
	September	60.0	40.1	47.0	4.0	16.2

Mineral Creek (Mile 3.5)



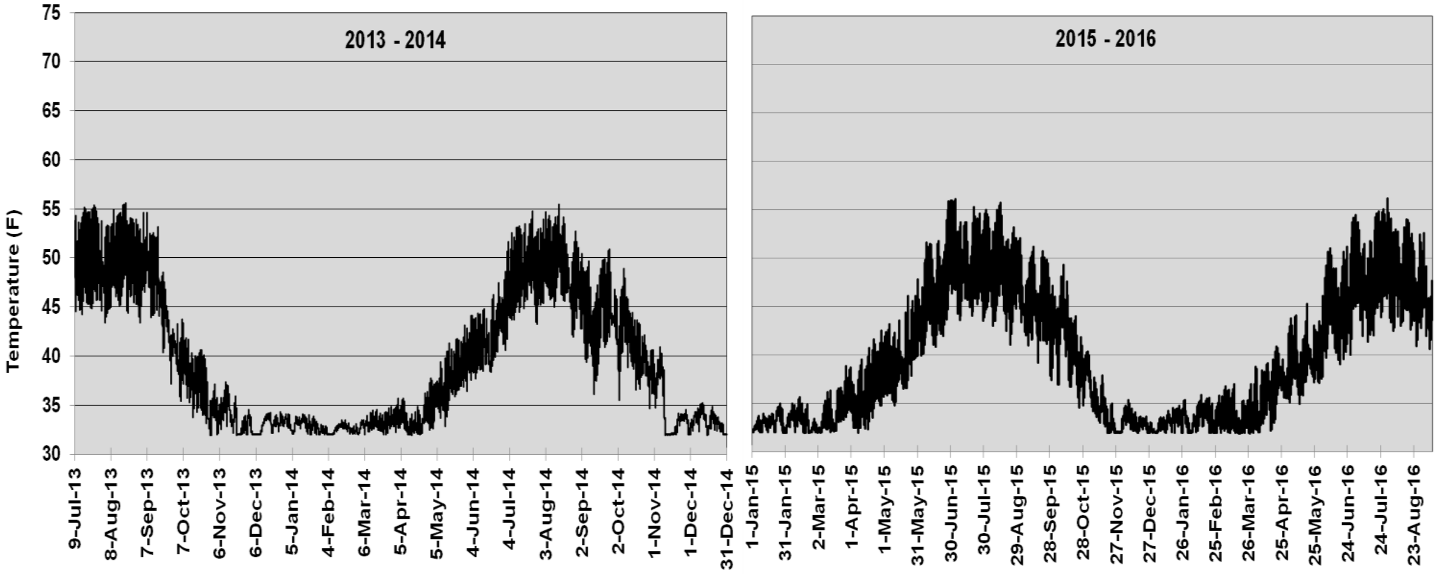
Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
2013	July	63.3	45.5	53.3	4.7	22.1
	August	63.6	44.5	53.8	4.3	18.5
	September	62.6	36.7	48.4	5.4	29.3
	October	44.9	32.1	37.6	2.7	7.1
	November	37.6	32.1	33	1.2	1.4
	December	33.2	32.1	32.2	0.16	0.0
2014	January	33.2	32.1	32.2	0.2	0.0
	February	32.2	32.1	32.1	0.0	0.0
	March	34.2	32.1	33.0	0.5	0.2
	April	38.9	32.2	34.5	1.2	1.3
	May	43.5	32.6	36.8	2.0	4.1
	June	49.4	36.5	40.6	2.5	6.4
	July	60.0	39.3	49.0	4.2	17.8
	August	61.0	42.8	52.0	4.0	15.9
	September	54.9	36.0	46.5	3.8	14.4
	October	51.7	32.8	41.0	3.3	10.9
	November	40.6	32.1	33.7	2.5	6.1
	December	34.8	32.1	32.8	0.7	0.5
2015	January	34.5	32.1	32.3	0.4	0.2
	February	36.1	32.1	32.9	1.0	1.0
	March	41.8	32.1	34.4	2.0	4.2
	April	46.3	32.4	37.0	2.9	8.5
	May	48.1	35.0	39.6	2.8	7.8
	June	60.6	38.9	47.4	4.8	23.0
	July	62.0	45.5	52.8	3.9	14.9
	August	62.3	43.8	51.9	4.1	17.1
	September	52.3	37.8	45.7	2.7	7.3
	October	47.7	34.6	41.0	3.1	9.4
	November	39.7	32.1	33.5	1.9	3.6
	December	32.4	32.1	32.1	0.1	0.0
2016	January	33.0	32.1	32.3	0.2	0.0
	February	33.7	32.1	32.3	0.3	0.1
	March	37.1	32.1	33.3	1.0	1.1
	April	43.2	32.6	36.1	2.0	4.1
	May	46.2	34.4	38.6	2.4	5.8
	June	58.0	36.9	44.7	4.3	18.6
	July	62.1	41.9	51.1	4.5	20.2
	August	60.6	42.5	50.7	3.7	13.8
	September	54.6	41.0	46.4	2.9	8.7

East Fork Mineral Creek (Mile 0.1)



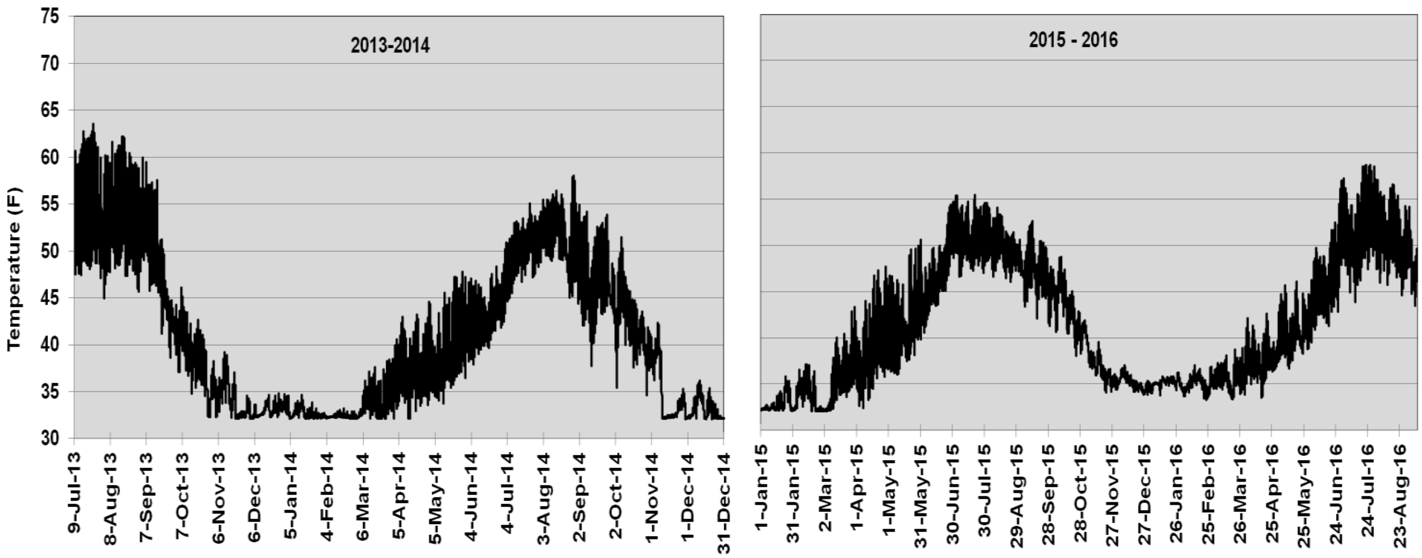
Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
2013	**July**	58.2	43.4	49.1	3.7	13.3
	August	57.5	42.3	48.8	3.5	12.6
	September	56.7	35.3	45.6	4.3	18.7
	October	43.3	32.1	36.3	2.5	6.3
	November	36.8	32.1	33.1	1.1	1.3
	December	33.7	32.1	32.6	0.5	0.2
2014	**January**	33.6	32.1	32.4	0.3	0.1
	February	32.5	32.1	32.2	0.1	0.0
	March	35.6	32.1	33.1	0.8	0.6
	April	37.5	32.4	34.7	1.0	0.9
	May	36.6	33.7	34.1	0.4	0.2
	June	38.2	34.2	36.1	1.2	1.5
	July	54.1	38.1	44.8	4.1	16.9
	August	55.3	40.9	47.8	2.9	8.6
	September	51.6	34.6	43.4	3.3	11.0
	October	49.5	32.7	39.7	2.8	8.0
	November	40.1	32.1	33.7	2.2	4.8
	December	35.1	32.0	33.1	0.9	0.7
2015	**January**	35.0	32.0	32.7	0.6	0.4
	February	36.3	32.0	33.0	1.0	1.0
	March	40.5	32.0	34.0	1.7	2.9
	April	44.4	32.0	35.8	2.7	7.2
	May	46.1	34.0	38.0	2.4	5.6
	June	58.1	37.6	45.3	4.5	19.9
	July	58.8	42.6	49.1	3.7	13.4
	August	59.5	39.6	48.8	4.0	16.0
	September	54.8	42.9	45.9	2.7	7.4

Camp Creek (Mile 0.1)



Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
2013	July	55.4	44.3	49.4	2.9	8.5
	August	55.6	43.4	49.1	2.7	7.3
	September	54.6	37.2	46.1	3.6	13.3
	October	43.7	31.9	37.2	2.5	6.1
	November	37.3	31.9	33.8	1.3	1.6
	December	34.2	31.9	33	0.7	0.5
2014	January	34.1	32.0	32.9	0.5	0.3
	February	33.5	32.0	32.5	0.4	0.1
	March	34.9	32.0	33.1	0.6	0.3
	April	37.8	32.0	33.3	1.0	1.0
	May	43.1	32.6	37.1	2.1	4.5
	June	47.8	37.6	41.6	2.1	4.4
	July	54.8	40.6	48.0	2.7	7.1
	August	55.4	42.0	48.5	2.7	7.1
	September	50.9	36.1	43.9	2.9	8.5
	October	48.9	34.7	40.6	2.6	6.6
	November	41.0	31.9	34.3	2.5	6.3
	December	35.2	31.9	33.3	0.8	0.7
2015	January	35.0	31.9	32.9	0.7	0.4
	February	35.6	31.9	33.0	0.7	0.6
	March	38.8	31.9	33.6	1.4	2.0
	April	42.5	31.9	35.7	2.1	4.6
	May	47.8	34.8	39.4	2.3	5.3
	June	55.9	39.9	45.9	3.3	11.2
	July	56.0	43.5	48.8	2.7	7.4
	August	55.7	41.0	48.3	2.9	8.5
	September	52.0	37.4	44.7	2.7	7.4
	October	49.2	34.6	41.0	3.0	8.9
	November	40.3	31.9	34.3	2.0	4.2
	December	35.3	31.9	33.0	0.8	0.6
2016	January	35.3	31.9	33.1	0.8	0.6
	February	35.8	31.9	33.1	0.9	0.9
	March	37.0	31.9	33.2	1.1	1.2
	April	40.9	32.0	35.7	2.1	4.3
	May	45.2	34.9	39.1	1.9	3.7
	June	54.1	37.8	44.8	3.1	9.9
	July	56.1	41.3	48.0	3.1	9.7
	August	54.1	40.9	47.3	2.8	7.7
	September	52.6	40.6	44.9	2.4	5.8

East Fork of North Fork Blackfoot River (Mile 1.7)



Year	Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
2013	July	63.5	47.1	54.7	4.2	17.6
	August	62.2	45.0	53.7	3.8	14.3
	September	60	38.6	48.9	4.8	23.3
	October	46.1	32.3	38.8	2.9	8.4
	November	39.1	32.1	34.3	1.9	3.5
	December	38.8	32.2	33	0.7	0.4
2014	January	34.6	32.1	32.7	0.5	0.3
	February	33.2	32.2	32.4	0.2	0.0
	March	38.5	32.1	34.0	2.0	0.4
	April	44.5	32.1	37.0	2.4	5.9
	May	47.8	33.8	39.5	3.2	10.4
	June	48.3	37.9	42.9	2.3	5.1
	July	55.1	42.5	49.7	2.3	5.4
	August	58.0	45.1	51.6	2.6	6.6
	September	54.9	37.8	47.1	3.2	10.5
	October	51.4	34.7	42.1	2.9	8.4
	November	42.3	32.1	34.7	3.0	9.3
	December	36.2	32.1	33.1	1.0	1.1
2015	January	35.8	32.1	32.8	0.8	0.6
	February	37.1	32.1	33.6	1.4	2.0
	March	43.4	32.1	35.4	2.5	6.2
	April	47.6	32.4	38.7	3.3	10.8
	May	50.6	36.0	41.6	3.0	9.2
	June	54.6	40.6	46.8	3.0	9.0
	July	55.5	46.6	50.8	2.0	4.0
	August	54.6	46.0	49.8	1.7	3.0
	September	52.6	41.3	47.1	2.1	4.6
	October	48.8	38.0	43.2	2.4	5.6
	November	41.9	34.1	37.0	1.7	2.9
	December	37.0	33.8	35.1	0.7	0.5
2016	January	36.2	33.8	35.1	0.4	0.2
	February	37.0	33.3	35.0	0.7	0.6
	March	39.1	33.4	35.6	1.1	1.2
	April	42.6	33.5	37.7	1.6	2.6
	May	46.0	36.7	40.7	2.0	3.9
	June	57.0	39.5	46.6	3.4	11.4
	July	58.7	43.9	51.7	3.3	10.6
	August	57.0	44.6	50.7	2.6	6.5
	September	54.1	43.5	47.5	2.2	4.9