Watershed Restoration Plan

Jefferson River Watershed Council

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Table of Contents

Executive Summary

Jefferson River Watershed Restoration Plan

The Jefferson River Watershed Council (JRWC) Watershed Restoration Plan (WRP) represents the combined efforts of the JRWC board of directors and its council members. As the local organization responsible for implementation of the Montana Department of Environmental Quality; Upper Jefferson River Tributary Sediment Total Maximum Daily Load (TMDL), the WRP has as its primary focus strategies to abate sediment transport into the Jefferson River. However, as a local planning body the JRWC has reached out to other organizations agencies and landowners to incorporate strategies and specific project proposal addressing other key resource issues in the upper Jefferson River watershed.

The Jefferson River Watershed Council (JRWC) was created in 1999. JRWC is a Montana based 501(c)(3) nonprofit organization, which includes all interests that may be affected by water-use and natural resource management in the watershed. Thus, local landowners, irrigators, ranchers, outfitters, businesses, sporting/recreation, nonprofit organizations, and government agencies contribute to the creation and continued success of the council. Specifically, the council seeks to develop practical solutions to difficult problems, which impact the Jefferson River.

During the WRP planning process, the JRWC identified thirteen (13) priority resource concerns including: the Jefferson River main stem base flows and quality maintenance and restoration, riparian restoration, noxious weed control, flood plain planning, Conifer encroachment, fisheries enhancement, irrigation water management, prescribed grazing systems, sediment loading due to gully and rill erosion along interstate 90 and unpaved roads, sediment problems associated with irrigation return-flow sites, protection and maintenance of the local agricultural economy, the need to periodically evaluate the drought management plan, and ground-water characterization and management.

The upper Jefferson River Watershed can be broken down into two distinct areas. The southern Jefferson River downstream of the confluence of the Beaverhead and Big Hole rivers feed surface water and associated sediment into the Jefferson River main stem predominately via a number of small streams that discharge directly into the river.

The northern portion of the watershed, which drains into Jefferson Slough is significantly different. Streams that drain the northern watershed (including a portion of the Highlands, the Pipestone area, Homestake area, Whitetail area, and a significant portion of the Bull Mountains) feed their water and associated sediment into either Big Pipestone Creek or Whitetail Creek. These two creeks then feed their water and much of their sediment loads into the Jefferson Slough, which then drains into the Jefferson River. Subsequently, the sediment load must travel through miles of the lower gradient valley floor

The JRWC has chosen to address these two areas separately due to the differences in the relationship to the river and the types of strategies required to address the major resource concerns. Therefore, the WRP incorporates a strategy that addresses the southern portion of the watershed and the northern portion of the watershed individually with the northern portion being the priority area for the next five years. Specific goals, objectives and strategies are detailed in the plan for each area and specific drainages along with proposed projects identified by the planning participants.

Introduction

WATERSHED LOCATION AND OVERVIEW

The Upper Jefferson watershed area encompasses approximately 734 square miles of land in Jefferson and Madison counties beginning at the Jefferson River's point of origin near Twin Bridges and extending to its confluence with the Boulder River near Whitehall. The Jefferson River flows for nearly 80 miles before combining with the Madison and Gallatin rivers at the headwaters of the Missouri River. The watershed area includes a number of tributary streams including: Big Pipestone, Cherry, Fish, Hells Canyon Creek, Little Pipestone Creek, and Whitetail Creeks which drain portions of the Tobacco Root Mountains to the south and the Highland Mountains to the north. Land includes a mix of federal, state, and private lands.

The Jefferson River Valley is located in southwest Montana, surrounded by the peaks of the Continental Divide, Tobacco Root, Highland, Bull, and Elkhorn mountains. Vuke et al (2004) described the upper Jefferson Valley as an asymmetrical valley with large, steep, west-dipping faults on the east flank, and east dipping faults of smaller magnitude on the west flank. Both mountain ranges consist mainly of Precambrian basement rock with a core of granite emplaced about 70 million years ago. The west flank of the Tobacco Root Mountains has thick deposits of Paleozoic and Mesozoic sedimentary rocks. Similar deposits are observed along the east flank of the highland mountains with tightly folded sedimentary formations in the Silver Star area. The east flank of the Tobacco Root Mountains has a large terrace surface known as the Parrot bench that slopes gently westward toward the valley. It is believe the parrot bench is an older desert erosional surface developed during the Pliocene time, when the region had an extremely arid climate. The east side of the upper Jefferson Valley, as described by Vuke et al (2004), is almost entirely covered by alluvial fan deposits mainly of middle Pleistocene age or younger. A larger alluvial fan is present at the mouth of Fish Creek on the west side of the valley and differs from those on the east side of the valley. This alluvial fan contains large boulders believed to have resulted from glacial outbursts of melt waters derived from either a glacier or a glacier dammed lake.

Much of the Jefferson River is braided. During the irrigation season, virtually all of the tributaries to the Jefferson are diverted before reaching the river. Throughout its length, the Jefferson River is extensively used as a source of irrigation water. In below average years, portions of the river are severely dewatered. Two irrigation storage reservoirs (Ruby and Clark Canyon Reservoirs) on major upstream tributaries affect the flow pattern of the river.

The natural tendency of the river to migrate within its floodplain affects agricultural lands, pastures, home sites, bridges and irrigation diversions. Various methods to stabilize the channel and protect the floodplain development have been tried. Many projects, especially those which block high water channels have aggravated the instability problem. Many projects have also increased sedimentation and removed overhanging bank vegetation, both detrimental to the aquatic resource.

Climate

In the Upper Jefferson Watershed average precipitation ranges from 10 inches per year in the valley to 18 inches per year at higher elevations, while average snow fall ranges from 9 inches per year in the valley to 85.5

inches at higher elevations. May and June are consistently the wettest months of the year, and winter precipitation is dominated by snowfall. Temperature patterns reveal that July is the hottest month and January is the coldest throughout the watershed. Summertime highs are typically in the seventies to low eighties. Winter lows fall to approximately 11 degrees F.

Hydrology

Stream flows in the upper Jefferson watershed are at their highest between May and June. These are also the months with the greatest amounts of precipitation and snow melt runoff. Stream flows begin to decline in late June or in early July, and reach minimum flow levels in September as many streams go dry. This decrease in steam flow correlates with a dwindling water supply and increasing water demands for irrigation and other uses. About 42,000 acres or 9 percent of the total upper Jefferson River watershed area is irrigated. Stream flows begin to rebound in October and November when irrigation has ended and fall storms supplement the base flow.

Geology, Soils and Stream Morphology

The majorities of soils in the upper Jefferson watershed are moderately susceptible to erosion and produce moderate amounts of runoff. The areas of land draining to Big Pipestone, Little Pipestone, Halfway, Whitetail, and Fitz creeks are dominated by the granitic Boulder Batholiths, which is nutrient poor and highly erodible, contributing to naturally high sediment supply in these streams.

Many tributary streams in the upper Jefferson watershed have been historically straightened or channelized to accommodate a variety of land uses and or transportation networks. These alterations have significant effects on sediment transport dynamics of streams and affect the stability of stream banks.

Landownership

Private land dominates the upper Jefferson watershed with 44.7% in private ownership. US Forest Service lands account for 38.6% of the area, the U.S. Bureau of Land Management controls another 11.5% of the area, and the State of Montana owns 4.7% (including water).

Business Industry Overview

Twenty-four percent of the combined workers in the towns of Twin Bridges and Whitehall work in construction, extraction, and maintenance occupations, while 23% work in management and professional occupations. Sales and office occupations employ 19%. Service occupations receive 14% of the workers and production, transportation, and material occupations receive 13% of workers. Agriculture makes up the other major economic sector of the Jefferson River watershed area. Seven percent of workers in these towns are employed in farming, fishery and forestry occupations. Government is the largest employer in Jefferson County followed by education, manufacturing, mining, human services, construction, recreation, retail, transportation and the service sector.

A large open-pit gold and silver mine operates at the south end of the Bull Mountains located north of Whitehall just on the NE edge of the watershed area. Limestone is quarried in the Pipestone Creek drainage and an open pit-chlorite mine operates intermittently south of Silver Star on the SW edge corner of the watershed area.

Land-use and Land Cover

Evergreen forest (national forests and other forested lands) is the dominant land use at higher elevations in the watershed comprising 40.83% of the watershed area. Grass rangelands comprise 37.7% of the land area while crop and pasturelands make up 11.86% of the area. Brush rangeland and mixed rangeland total an additional combined 5.79% of the land area.

Land cover is dominated by a combination of grassland types (40.03%). A mix of several forest types, including Douglas-Fir mixed xeric forest, Lodge pole pine, and mixed subalpine and White bark Pine accounts for 38.6% of the land cover in the watershed. Sage brush accounts for 6.6% dry irrigated agricultural lands make up 4.61% of the land cover and montane park lands and subalpine meadows comprise 3.22% of the watershed. The remaining 7% of land consists of minor amounts of 19 different vegetation types.

Population

The main towns in the upper Jefferson River watershed include Twin Bridges in the south and Whitehall in the north. Twin Bridges saw an increase in human population from 374 in 1990 to 400 in 2000, while Whitehall had a slight decrease in population from 1,067 in 1990 to 1,044 in 2000. Estimates of the population outside the incorporated communities in the watershed area are not available. The median age of Jefferson County was 42.6 years of age in 2005. The total labor force in all of Jefferson County in 2006 was 5,696. The per capita income was $29,488 in 2005 the date of the last survey. The median household income in Jefferson County at the same date was $47,513.

Fish and Aquatic Life

Two fish species occurring within the upper Jefferson River watershed, the west slope cutthroat trout (Oncorhynchus clarki lewisi) and the Montana arctic grayling (Thymallus arcticus montanus) are listed by the State of Montana as species of special concern. West slope cutthroat trout are thought to occur in five streams, including four that appear on the 303 (d) lists. These include Halfway Creek, Fish Creek, Cherry Creek, and Hells Canyon Creek. Genetically pure populations of west slope cutthroat trout are thought to be limited to halfway and Fish Creeks. The present distribution of Montana fluvial arctic grayling in the upper Jefferson watershed is not well known. However, it is assumed that grayling may be present in the Jefferson River main stem as a result of an attempt to reestablish a population in the lower Beaverhead River upstream of the confluence of the Beaverhead and Big Hole Rivers.

The Jefferson River provides a good population of brown and rainbow trout that are popular with local residents of the Butte-Whitehall area and an increasing number of anglers from outside the area. The greatest limiting factor affecting angling use and success results from low flows. When drought conditions are present, the Jefferson River is the most often closed stream in the state. Brown trout in the 1 1/2-2 pound class are common, with trout in excess of 5 pounds taken annually. Rainbow trout numbers have been

increasing in the Jefferson since the mid-1990s. This has resulted from habitat restoration work done on a number of tributaries. The number of rainbows varies widely depending on the proximity to producing spawning streams. In general the river above Cardwell has a good number of rainbow, varying between 20 and 50% of the over-all trout population. Some rainbows have been documented to exceed 5 pounds.

Other species found in the Jefferson River and their relative abundance are Mountain Whitefish, abundant; Longnose sucker, abundant; Carp, common: Mountain sucker, uncommon; Longnose dace, uncommon; Flathead chub, uncommon; Mottled Sculpin, uncommon; Golden shiner, rare; Stonecat, rare; Yellow perch, rare; Black crappie rare; Largemouth bass, rare; Brook trout, rare.

The upper Jefferson River above the major irrigation diversions supports a somewhat greater trout population. Over one three-year period, estimated numbers of 3-year and older brown trout ranged from 253 to 503 per mile and biomass estimates varied between 318 and 535 pounds per mile for a 3.1-mike long study section.

A number of environmental factors are responsible for the overall depressed trout populations of the Jefferson River, the most notable being the severe dewatering and elevated water temperatures that occur during drought-year irrigation seasons in various river segments. Given adequate summer flows, the river is capable of supporting a greater biomass of trout.

Wildlife

The riparian habitat along the Jefferson River is extensive due to the many river meanders. This habitat supports excellent populations of furbearers, including beaver, mink and river otter. Both mule and whitetail deer inhabit the river bottom year round. Tributaries to the Jefferson River provide important winter range for Mule deer and Elk. Other inhabitants include black bear and bobcat. Other resident big game species include moose and black bear. Bald eagles winter along the river. Great blue heron rookeries are located near Cardwell.

Waterfowl commonly breed within the Jefferson River valley. Substantial numbers of Canada geese nest on islands between Caldwell and Waterloo. Duck production is excellent in many sloughs along the river. Various waterfowl, including swans, visit the area during migration. Golden eyes and mergansers are common winter residents. Mountain grouse are present in the tributaries to the Jefferson River.

HISTORY OF WATERSHED PLANNING IN THE WATERSHED

The Jefferson River Watershed Council (JRWC) was created in 1999. The JRWC is a Montana based 501(c)(3) nonprofit organization, which includes all interests that may be affected by water-use and natural resource management in the watershed. Thus, local landowners, irrigators, ranchers, outfitters, businesses, sporting/recreation, nonprofit organizations, and government agencies contribute to the creation and continued success of the council. The council seeks to develop practical solutions to difficult problems which may impact the Jefferson River.

The Upper Jefferson River Watershed is part of the Upper Missouri River Watershed which includes: the Big Hole, Beaverhead, Ruby, Lower Jefferson River Watershed, Madison, and the Greater Gallatin Watershed

areas. In addition, the JRWC interacts with the public and state agencies operating in the watershed. Where applicable those agencies assessments and activities are detailed in this document.

The organizational structure includes a board of directors, an overall watershed council made up of the above organizations and business sectors, and various committees on an as needed basis.
In addition, the JRWC contracts for the service of a watershed coordinator on a part-time basis.

JEFFERSON RIVER WATERSHED COUNCIL ORGANIZATIONAL OBJECTIVE

Improve Jefferson River base flows and quality

MANAGEMENT STRATEGIES DEVELOPED TO ACHIEVE THE COUNCIL'S OBJECTIVE

- Develop a watershed restoration plan which coordinates the activities of all key organizations and agencies to achieve the JRWC's objective.
- Coordinate with Bureau of Land management & United States Forest Service to integrate the agencies work in priority TMDL drainages with the JRWC.
- Coordinate with the Natural Resources and Conservation Service(NRCS) to integrate the NRCS planning priorities into the JRWC planning process
- Coordinate with the Jefferson Valley Conservation /district to integrate the district's plan of work into the JRWC planning process
- Coordinate with the Jefferson County Weed District to identify priority weed control issues, & areas to integrate the districts priorities into the JRWC planning process.
- Coordinate with Montana Fish Wildlife and Parks to integrate their planning priorities into the JRWC planning process
- Coordinate with Trout Unlimited to integrate their planning priorities into the JRWC Planning process
- Meet with other local organizations including , agricultural, economic development, sportsman groups, recreational groups and others as identified to seek their continual input into the JRWC planning process

PRIORITY RESOURCE ISSUES

The following are the priority resource issues identified by the JRWC based on the completed assessments by agencies organizations and local group in the Jefferson River Watershed area.

- Jefferson River main stem base flows and quality maintenance and restoration
- Riparian Restoration

- Noxious Weed Control
- Flood plain planning
- Conifer encroachment
- Fisheries enhancement
- Irrigation water management
- Prescribed grazing systems
- Sediment loading due to gully and rill erosion along interstate 90 and unpaved roads
- Sediment problems associated with irrigation return-flow sites
- Protection and maintenance of the local agricultural economy
- Periodically evaluate the Drought Management Plan
- Ground-water characterization and management

Watershed Assessment

The following section outlines the existing resource and environmental assessments completed by the JRWC, federal, state, and local agencies, and nonprofit organizations in the watershed area to date. As new assessments are completed and made available to JRWC they will be added.

EXISTING PRIVATE LANDS & LOCAL

Montana Department of Environmental Quality; Upper Jefferson River Tributary Sediment Total Maximum Daily Load (TMDLs)

The most recent and complete assessment in the watershed area is the "Upper Jefferson River Tributary Sediment Total Maximum Daily Loads (TMDLs) and Framework Watershed Water Quality Improvement Plan" completed in 2009 by the Montana Department of Environmental Quality. The TMDL forms the basis for much of the JRWC's Plan of Work. The following information is therefore taken directly from the TMDL. The first part of the assessment provides an overview of the watershed area with a general review of the situation and recommended activities to address the sedimentation issue followed by a more detailed assessment by tributary.

Sediment Total Maximum Daily Load (TMDLs) assessments were completed for six (6) tributary watersheds. The most important restoration approach for reducing sediment loading in the upper Jefferson River is streamside riparian restoration and long-term riparian zone management. Stream channel restoration may be necessary in areas that have lost channel integrity due to long-term riparian vegetation and/or irrigation infrastructure impacts. At least three sources of sediment coming from irrigation return-flow have been documented. Other sediment restoration actions would include unpaved road erosion, control near streams, and improved management of the I-90 corridor.

Erosion off of uplands was usually the second most predominant human influenced source of sediment identified in the TMDL. The restoration approach for upland erosion is also to increase streamside riparian area's sediment filtering capacity by restoring streamside vegetation zones. This approach reinforces the idea that riparian vegetation restoration and long-term riparian zone vegetation management should be the predominant restoration approach to reduce sediment.

On average, erosion off of unpaved roads fell next in line of controllable sediment sources in the Upper Jefferson Watershed. Restoration approaches for roads near streams should be to divert water off roads and ditches before it enters the stream. The diverted water should then be routed through natural healthy vegetation, which will act as filter zones for the sediment laden runoff before it enters streams. Sediment derived from roads as well as rill and gully wash erosion, may cause significant localized impact in some stream reaches even though at a watershed scale it may be a moderate or small source. Sediment loads from culvert failure and culvert caused scour were not assessed by the TMDL source assessment, but should be considered in road sediment restoration approaches.

All of these best management practices are considered reasonable restoration approaches due to their benefit and generally low costs. Riparian protection/restoration and road erosion control are standard best management practices identified by the Natural Resources Conservation Service (NRCS) and not overly expensive to our society. Many riparian areas could benefit from more active grazing management (possibly with some additional fencing) and would typically recover naturally. Active riparian vegetation planting along with bank sloping may be slightly more costly, but still are a reasonable and relatively cost-effective restoration approach. When stream channel restoration work is needed because of altered stream channels, cost increase and projects should be assessed on a case-by-case basis.

Historic placer mining as well as irrigation infrastructure may have very localized impacts that affect sediment production within the watershed. If found such sediment sources that can be restored at reasonable costs could be prioritized into a watershed restoration plan. Any unknown sediment sources could also be incorporated into the watershed restoration plan while considering cost and sediment reduction benefits.

An emerging concern is the issue of conifer encroachment on rangelands in the watershed. Riparian communities along stream corridors have been disrupted by encroaching conifers which can cause changes in riparian corridor functions. Native riparian vegetation, such as aspen over storey, and herbaceous and shrub understory provides crucial sediment filtering and channel protection that is significantly reduced when conifers come to dominate riparian vegetation. Studies have been shown that soil loss or erosion can be elevated by up to 100 times in juniper-encroached areas in comparison with native vegetation providing natural vegetative protection (DeBoodt, et.al. 2005). In addition to effects on soil erosivity as well as hydrologic changes such as reduced stream flow.

Through application of locally appropriate Best Management Practices, the Montana Department of Environmental Quality estimates that sediment loads in individual streams can be reduced between 36 to 46 percent.

Existing individual tributary assessments completed in the TMDL Framework plan:

<u>Big Pipestone Creek</u>

Ranked Controllable Sources

1) Eroding banks needing sustainable riparian zone vegetative condition, reduction in irrigation infrastructure effects.

Ranked best management type
- Riparian grazing management,
- Riparian willow vegetation restoration,
- Move haying from riparian green line,
- Irrigation infrastructure mitigation

2) Upland sediment from grazing

Ranked best management practices
- Riparian grazing management,
- Provide filter strips along streams

3) Paved and unpaved roads

Ranked best management practices
- Road maintenance and runoff BMPs

Spatial Concerns Big Pipestone Creek

Eroding banks with insufficient riparian cover occur along significant but intermittent reaches of both the lower and upper portions of the creek.

Some riparian areas are managed well and others need riparian restoration work.

Riparian health appears to be fair in upper portions of the watershed while health markedly declines to a mix of fair and poor in the lower portions.

Tributaries should also be addressed to reduce sediment loads to Big Pipestone Creek.

In both the lower and upper portions of the watershed, effects from irrigation infrastructure are apparent.

Road maintenance BMPs should occur on I-90 and many unpaved road crossings

Cherry Creek

Ranked controllable source

1) Upland sediment from grazing

Ranked best management type
- Riparian grazing management,
- Provide filter strips along streams

2) Eroding banks needing sustainable riparian zone vegetative condition

Ranked best management practice
- Riparian grazing management,
- Riparian willow vegetation restoration

Spatial concerns Cherry Creek

A few improvements could be achieved in upper Cherry Creek but riparian management appears to be good to fair along the upper/middle of the watershed.

Grazing related impacts were noted in the area just downstream of public lands on private property. Much of grazing effects occur on private lands. There may also be some effects from irrigation infrastructure.

Green line degradation in the floodplain and the loss of riparian habitat is much more prevalent in the lowest segments of the watershed.

Fish Creek

Ranked controllable source

1) Eroding banks needing sustainable riparian zone vegetative condition

   Ranked best management type
   - Riparian grazing management,
   - Riparian willow vegetation restoration in grazed and cropped areas

2) Upland sediment from grazing and hay production

   Ranked best management type
   - Riparian grazing and cropping management,
   - Provide filter strips along streams

3) Unpaved roads

   Ranked best management practice types
   - Road maintenance and runoff BMPS

Spatial concerns Fish Creek

Eroding banks with insufficient riparian cover occur along significant but intermittent reaches of both the lower and upper portions of the creek.

Some riparian areas are managed well and others need riparian restoration work.

Riparian health appears to be fair in the upper portions of the watershed with a few heavily impacted areas of poor health. Within this reach of Fish Creek - above a barrier falls, a pure Westslope cutthroat trout population has persisted. Initial communications have been made to attempt restoration efforts and improve the over-all health and size of this population.

The lower portions of the watershed exhibit good, fair and poor riparian condition and impacts are primarily associated with grazing and haying within the riparian zone.

In the upper portions of the watershed effects from placer mining including channelization and degraded riparian health are apparent.

A substantial portion of the water from Fish Creek is used to supply the Butte Water Company through an inter-basin transfer in the Highland Mountains. Thus, there are substantial periods of time when no flow within the Fish Creek channel reaches Highway 55. This modified hydrograph is at least partially the cause of the erosion/sedimentation that results when stream-flow does return. With inadequate year-round water in the channel, the lower reaches of Fish Creek cannot support the needed riparian plant community to prevent soil erosion.

Road maintenance should occur on many unpaved road crossings.

Hells Canyon Creek

Ranked controllable source

1) Eroding banks needing sustainable riparian zone vegetative condition

   Ranked best management type
   - Riparian grazing management,
   - Riparian willow vegetation restoration in grazed and cropped areas

2) Upland Sediment from grazing

   Ranked Best management type
   - Riparian grazing and cropping management,
   - Provide filter strips along streams

3) Unpaved Roads

   Ranked best management type
   - Road maintenance and runoff BMPS

Spatial Concerns Hells Canyon Creek

Eroding banks with insufficient riparian cover occur along significant but intermittent reaches of both the lower and upper portions of the creek.

Some riparian areas are managed well and others need riparian restoration work. Riparian health appears to be fair in upper portions of the watershed with a few heavily impacted areas of poor health.

The lower portions of the watershed exhibit good, fair and poor riparian condition and impacts are primarily associated with grazing and haying within the riparian zone.

In the upper portions of the watershed effects from placer mining including channelization and degraded riparian health are apparent.

A project accomplished in the mid-1990s by the Montana Department of Fish Wildlife & Parks resulted in a mechanical fish screen, a water lease and a successful conversion to gravity-fed sprinkler irrigation. This effort resulted in the population increase and expanded spawning use of Hell's Canyon Creek by rainbow and brown trout. Additionally, the rainbows from this stream are the fish used in all other restoration projects along the Jefferson where imprinting was used to improve the over-all fish population.

Road maintenance should occur on many unpaved road crossings

Little Pipestone Creek

Ranked Controllable Source

1) Eroding banks needing sustainable riparian zone vegetative condition

   Ranked best management type
   - Riparian grazing management,
   - Riparian willow vegetation restoration,
   - Move haying from riparian green line

2) Upland sediment from grazing

   Ranked best management type
   - Riparian grazing management,
   - Provide filter strips along streams

3) Paved and unpaved roads

   Ranked best management type
   - Road maintenance and runoff BMPS

Spatial concerns Little Pipestone Creek

Eroding banks with insufficient riparian cover occur along significant but intermittent reaches of both the lower and upper portions of the creek.

Some riparian areas are managed well and others need riparian restoration work.

Riparian health appears to be fair in upper portions of the watershed while health markedly declines to a mix of fair and poor in the lower portions.

Tributaries should also address to reduce sediment loads to Little Pipestone Creek. In both the lower and upper portions of the watershed effects from irrigation infrastructure are apparent.

Road maintenance should occur on unpaved road crossings and road wash sources

Whitetail Creek

Controllable sources ranked

1) Eroding banks needing sustainable riparian zone vegetative condition

Ranked best management type
- Riparian grazing management,
- Riparian willow vegetation restoration,
- Move haying from riparian green line

2) Upland sediment from grazing,

Ranked best management type
- Riparian grazing management
- Provide filter strips along streams

Spatial concerns Whitetail Creek

Eroding banks with insufficient riparian cover occur along significant but intermittent reaches of both the upper and lower portions of the creek.

Some riparian areas are managed well and others need riparian restoration work.

Riparian health appears to be fair in upper portions of the watershed while health markedly declines to poor in the lower portions.

Tributaries should also be addressed to reduce sediment loads to Little Pipestone Creek.

In both the lower and upper portions of the watershed effects from irrigation infrastructure are apparent.

Jefferson County Weed Board

Noxious weed management in the watershed area is the responsibility of the Jefferson County Weed Board. The Board is granted certain powers and charged with certain duties under Section 7-22-2109 of the County Weed Management Act. The board is required to administer the district's noxious weed program, establish management criteria for noxious weeds on all lands within the district, and make all reasonable efforts to develop and implement a noxious weed program on land owned by a federal agency.

Weeds of concern in Jefferson County that are present in the watershed area are:

- Dalmatian toadflax-Linaria genistifolia
- Canada Thistle-Cirsium arvense
- Spotted knapweed-Centaurea malculosa
- Russian knapweed-Centaurea repens
- Leafy spurge-Euphorbis esula
- Yellow Toadflax-Linaria vulgaris
- Field bindweed-Convolvulus arvensis
- Sulfur cinquefoil-Potentilla recta
- St Johnswort-Hypericum perforatum
- White top- Cardaria draba

The majority of weed treatment in the watershed area is applied on the knapweeds, Leafy Spurge and Dalmatian toadflax.

A major weed mapping effort was undertaken in 2007 in the Fish Creek drainage in cooperation with the JRWC. Weed control efforts were launched the same year in the drainage. To date, this effort remains the most detailed survey of the noxious weed problem in the watershed area.

Trout Unlimited Ground Water Waterloo Area

Prepared by Water & Environmental Technologies; prepared for Trout Unlimited and the Jefferson River Watershed Council May 22, 2006.

The Waterloo area ground water study was performed in order to define the ground water/surface water interaction in the Waterloo area of the Jefferson River. Three major irrigation ditches are located in this reach of the river, (Creeklyn, Parrot, and Fish Creek) and water shortages regularly occur during low flow summer conditions when irrigation needs are high. The project study area consists of the area between the Jefferson River and the Tobacco Root Mountain Range from the parrot Ditch diversions to the confluence of willow Springs. Parsons Slough and Willow Springs, two important spawning tributaries, are located in the study area.

The specific goals of the project were to define the nature of water movement though the study area and broadly define the interaction between the Jefferson River, spawning tributaries, the Parrot Ditch, mountain recharge and ground water flow. The project completed during the second half of the 2004 irrigation season and the entire 2005 season was completed using a combination of historical data review, groundwater and surface water monitoring, aquifer testing, and interviews.

Irrigation in the Waterloo area generally begins in mid-April when the Parrot Ditch is opened and runs through early July when the first cutting takes place. During this time period, spring precipitation and snowmelt results in high river flows and there is an excess of water for both irrigation and fisheries needs. The ditch is generally shut down for a week over the 4th of July weekend, and reopened in mid-July through late October. During the period from mid-July through mid September, irrigation needs are the greatest at a time when river flows are at their lowest and water temperatures are at their highest. This two-month period is when frequent water shortages have occurred in the Jefferson River, creating a strain on both the fishery and agriculture operations, and the potential exists to dry up the river.

A detailed evaluation of monitoring results shows a complex connection between ground water, surface water, and irrigation practices throughout the study area. In the first part of the irrigation season, ground water and surface water exhibit distinct characteristics that would generally be expected in a system with no ground water/surface water interaction: warmer ground water temperatures, stable water quality parameters, and rising ground water elevations and surface flows in response to spring precipitation and snowmelt. A component of ground water inflow from the Tobacco Root Mountains is also visible in water quality results. The Parrot Ditch is shutoff in early July and there is a brief stop in irrigation, while ranchers harvest their first cutting. The impacts of this shutdown can be seen in groundwater elevations across the Parson-Willow area, which indicates a connection between irrigation practices and ground water. Ground water quality begins to show impacts from surface water, specifically in the Parson-Willow area.

During the peak irrigation season (mid-July through mid-September), groundwater elevations continue to rise due to irrigation impacts, and surface water temperature and conductivity values show strong correlations with ground water. During this critical time, ground water and irrigation return flow provide the majority of water to the Jefferson River in the study area. Ground water inflow enters the river as discharge through various slough channels, i.e., Parson's Slough, Willow Springs, and direct flux into the river. Irrigation return flow appears to be the primary component of ground water inflow, and enters the aquifer by ditch seepage, crop return flow, and flood irrigation returns.

Late in the irrigation season (September-October), ground water elevations reach their seasonal highs, most notably in the lower project area, as the ditch continues to flow but the majority of late season irrigation is flood irrigation. Surface flows in Parson's Slough and Willow springs are also at their peak levels, which is consistent with a strong groundwater/surface water interaction. Ground waters and surface water are very well mixed based on uniform water quality parameters throughout the valley. During the off-season (November-March), data show ground water and surface water slowly returning to base flow conditions.

During periods of low stream flow and high irrigation needs, the river flows remain only due to conservation efforts by irrigators, and a significant amount of ground water and irrigation return flows. The first reaction to remedy this situation is to decrease ditch diversions, and increase on farm efficiency by converting from flood to sprinkler irrigation methods. Although some water savings can be achieved by more closely

managing diversions and irrigation needs, and an increase in the minimum base flow in the river is needed, caution should be taken before making widespread changes to the current irrigation regime.

Irrigation return flow supplies water to the alluvial aquifer, which in turn discharges to surface water bodies and helps maintain river flows during the late season water shortages. If this important ground water recharge source is reduced to drastically, it could change the hydrologic system and reduce or eliminate historical return flow that helps support the river during critically low flows. A certain percentage of base flow during the off-season exists due to irrigation return flow from the precious season; however, it is unknown what that amount is.

The study concluded that there are a number of improvements and water savings that can be achieved, but the majority of these savings are aimed at water delivery and reduction of blow off water than on-farm efficiency. Stakeholders must walk a fine line between finding available water savings without significantly altering the hydrology of the valley.

Specific recommendations include:

Surface Water Administrative Efforts

1) Increasing ditch oversight and management by the ditch walker.
2) Find a long-term funding source to continue the JRWC Drought Management Plan.
3) Conduct a return flow study between the USGS station near Twin Bridges to the mouth of Willow Springs.
4) Educate landowners on Irrigation Timing.

Surface Water Structural Efforts

1) Installation of new canal structures with continuous flow monitoring equipment on the three major irrigation ditches.

Ground Water Conservation Efforts

1) Development of a scaled back groundwater monitoring network to be implemented annually in conjunction with JRWC Drought Management plan Monitoring.
2) Maintaining the current irrigation practices in the Willow Springs area in their current configuration, as any significant changes could lead to a different flow and temperature regime in the stream, which could impact the valuable Rainbow trout spawning tributary.
3) Implementation of a pilot study in the Parsons Slough area that consist of stopping flood irrigation in the immediate area, and closely monitoring impacts on the slough.
4) Limit Ground Water Withdrawal within the Study Area.

Trout Unlimited: Upper Jefferson River Irrigation Delivery Improvement Project

An engineering study was completed in June 2006 to investigate and determine alternative approaches to increase the flow in the Jefferson River during periods of drought. The intent of the work was to identify

viable measures to increase flows thereby improving fish population numbers. Drought conditions over the previous years had reduced wild trout populations by approximately seventy percent (70%). Ideally, solutions would offer ways to maintain agricultural production while improving the fishery. The emphasis of the study was on improving the irrigation delivery systems but the investigations also included on-farm practices and reservoir storage so that these costs could be compared.

A review of historic information resulted in defining severe flow shortages below the Waterloo Bridge at discharges less than 100 cfs. The existing Jefferson River Watershed Council Voluntary Drought Management Plan works to maintain a minimum flow of 50 cfs. The eighty (80%) chance August stream flow of 367 cfs is only slightly larger than the normal August combined the diversion of 330 cfs for the Creeklyn, Parrot and Fish Creek/Jefferson ditches. Whenever the steam flow drops to this level, the river is in danger of drying up.

The recommended plan has three components: canal sealant, canal management, and canal structures. These are the least costly measures as determined on a cost per acre-foot of water saved. The canal sealant and canal management programs will be initiated only during dry years when a water shortage is imminent, estimated to be 30% of the time. The proposed canal structures will reduce leaking and will enable both better measurements and better management of the systems.

Implementation of the plan is expected to increase the Jefferson River flow by 45 cfs during drought periods. Of this, 22 cfs is expected from reduced canal seepage as a result of the sealant program. Fifteen cfs is expected from reduced canal spills as a result of improved management and 8 cfs will be saved at canal structures.

Additional canal discharge measurements and seepage tests determined that canal seepage is not excessive and areas with high losses could not be found. Permanent lining of the ditches was therefore found to be too costly to be justified. On-farm sprinklers and upstream storage reservoirs were also found to be much more costly than recommended plan measures. The cost per acre-foot for on-farm pipelines is comparable to the cost of canal structures, but the water savings is dependent on abandoning the farm ditches and this practice was not selected for the plan.

The impact of this plan on springs and wetlands is minor and temporary. The greatest impact of these actions will be the beneficial effect of more water in the Jefferson River during periods of drought.

Trout Unlimited: Mayflower Gulch, Preliminary Assessment

Mayflower Gulch is a natural drainage of about 5.3 square miles located at the end of the Parrot Ditch. The ditch uses the lower 3800 feet of the gulch to convey excess water back to the Jefferson River. In addition to the wastewater from the ditch, the channel must convey the occasional floodwater from the upper gulch drainage.

The existing drop structure at the end of the ditch, although adequate for the ditch water, is too small to carry the floodwater. It either needs replacement or enlargement, or the floodwater needs to be conveyed past the restriction. A replacement structure is proposed which will convey both the full ditch of water and the 50-

year flood discharge. A preliminary cost estimate for this structure and an additional channel stabilizing structure is $270,000.

To stabilize the lower 1800 feet of the gulch, a series of nine rock drops is proposed. Each drop would be 12 to 16 feet wide and would drop the stream channel by eight feet. In addition to the drops, the channel would be excavated as needed and steep slopes in the gulch would be flattened and shaped. The total estimated cost for the channel stabilization is $313,950. The work would eliminate most of the estimated 530 tons of average annual erosion in the gulch.

There would be no wastewater savings from this work. Benefits to the fishery from the reduced sedimentation in the river have not been determined.

Trout Unlimited: Slaughterhouse Slough & Jefferson Slough

The background information effecting the Slaughterhouse Slough and indirectly affecting the summer base flows of the Jefferson Slough all started at least thirty years ago. In the late 1970's, Slaughterhouse Slough was the main channel of the Jefferson River and is still the county line between Madison and Jefferson counties. The east channel (the present main channel) existed as a lesser and secondary river channel. The Jefferson Slough was supplied with water coming from Pipestone and Whitetail Creeks and was supplemented (especially during the high flow period) by Jefferson River flows that entered the upper Jefferson Slough area via numerous small finger channels originating from the (then) main Jefferson River channel in the Slaughterhouse Slough area (just south of Whitehall).

Several channel changes occurred in the east (lesser Jefferson River channel) in the late 1970's. These channel changes cut-off at least two large meander loops and significantly shortened that channel's length. What then occurred was the initiation of a severe "headcut". A headcut is the erosion of a channel bottom caused by excessive velocity and moves in an upstream direction. The headcut moved upstream to the location of the split channel area at Renova. Once the east channel was deeper, the majority of the streamflow went to the east and left the Slaughterhouse Slough in a reduced flow condition.

A diversion channel had been cut from the Slaughterhouse Slough channel to the upper Jefferson Slough channel to ensure season-long water supplies. The diversion of water from the main Jefferson River channel was becoming an increasingly important issue to the Jefferson Slough irrigators, since less and less water was coming down from Pipestone and Whitehall Creeks.

By the mid-1980's, this situation had become very controversial. With the requirements of stream permitting (310 Law) much of the problem focus fell directly onto the Fish and Game Department. After many volatile meetings, a plan of action was decided upon. An independent consulting group was selected (Geomax) to design and construct a "drop-structure" to better balance the flows between the two channels at the Renova site. The bulk of the expense for this work was paid for by the Golden Sunlight Mine and the Montana Fish and Game Department. The resulting drop-structure divided the channel in an appropriate fashion for a considerable length of time.

By the late 1990's, talk was again surfacing about needing to do some additional work in the area of the drop-structure. What had happened in the 15 or so years was that the boat passage notch was not working very well, the structure had settled and was not dividing the flows as well as in the past and a large island had developed above the structure that was causing the main channel to move to the west.

Montana Department of Fish Wildlife and Parks: Montana's Comprehensive Fish and Wildlife Conservation Strategy

Aquatic

There are 20 aquatic species found in the Jefferson Watershed. Conservation concerns and conservation strategies identified in this report include:

Conservation concern: Culverts, dams, irrigation diversions, and other instream barriers that fully or partially impede fish movement and reduce habitat connectivity.

> Conservation strategies: Restore or modification of barriers in a manner that restores fish passage.

Conservation concern: Modifications and degradation of stream channels by various construction or land management practices,

> Conservation strategy: Restoration of stream channels or stream banks to a condition that simulates their natural form and function.

Conservation concern: Riparian vegetation effected by range and forest management practices and streamside residential development (such activities destabilize stream banks and increase sediment).

> Conservation strategies: 1) Support government and private conservation activities that encourage and support sustainable land management practices in riparian areas. 2) Modification of riparian management practices such that riparian vegetation is allowed to recover. 3) Develop statewide riparian best management practices.

Conservation concerns: Entrapment by juveniles and adult fishes by irrigation diversions or other water intakes.

Conservation concerns: Alteration of the quality or timing of stream flows causing dewatering temperature change or unnatural flow fluctuations that diminish the quality or quantity of essential habitat.

> Conservation strategies: Implementation of various water conservation or flow management practices that restore essential habitats help sustains lower temperatures and simulate the natural hydrographic and protect in stream flows.

Terrestrial

The rugged peaks of the Tobacco Root Mountains with their abundant high mountain lakes and small running stream systems overlook this area. These mountains have seen extensive historical mining activity that has resulted in numerous roads. The foothills provide important elk and mule deer winter rangeland and are dominated by sagebrush/grassland that has seen conversion from the spraying and burning of sagebrush.

Along the Jefferson River there are productive cottonwood riparian habitats that support an abundance of wildlife species including white-tailed deer and recently introduced Merriam's turkeys.

The valley bottom is home to extensive agricultural production of cattle and alfalfa and little or no grain production.

Conservation Concern: Habitat loss, degradation, and fragmentation, especially as a result of population growth/development.

Conservation Strategies:

1) Support strategic conservation easements/protection by conservation organizations or public agencies by providing advice and technical assistance.

2) Promote and further develop county ordinances that help manage and plan for development

3) Support state/federal tax incentives that discourage habitat fragmentation.

4) Identify and prioritize key wildlife linkage areas, and work with other state and federal agencies, conservation groups, and landowners to restore wildlife connectivity

Conservation Concern: Invasive or exotic plant species

Conservation Strategy: Participate in partnerships to develop and implement weed control strategies

Conservation Concerns: Range or forest management practices

Conservation Strategy: Support government and private conservation activities that encourage and support sustainable land management practices (example: rest and rotation schedules)

Conservation Concern: Streamside residential development

Conservation Strategy: Develop statewide riparian best management principles.

Fish Creek Habitat Enhancement Project

Fish Creek originates in the Highland Mountains and enters the Jefferson River upstream of Whitehall, Montana. The upstream reaches of Fish Creek provide valuable fish and wildlife habitat and contain a small population of native Westslope cutthroat trout. Habitat alterations and relatively poor riparian health in the upper reaches of the stream result in a tenuous situation for maintaining the cutthroat trout population. Thus, the Jefferson River Watershed Council is exploring measures to improve the health of the stream and the associated riparian corridor to enhance habitat conditions in the drainage.

In 2007, Montana Fish, Wildlife and Parks, and the U.S. Forest Service conducted fish surveys in 11 sections of Fish Creek to determine abundance of west slope cutthroat trout and eastern brook trout. Cutthroat trout were found in the upper four sections without competition from brook trout due to the presence of a natural

barrier above the confluence with Mammoth Creek. Downstream of this natural barrier to fish movement near Mammoth Creek, moderate numbers of brook trout were found with cutthroat trout, and downstream of Pigeon Creek, brook trout were found in relatively large numbers were they are apparently out-competing native cutthroat trout (Figure 1).

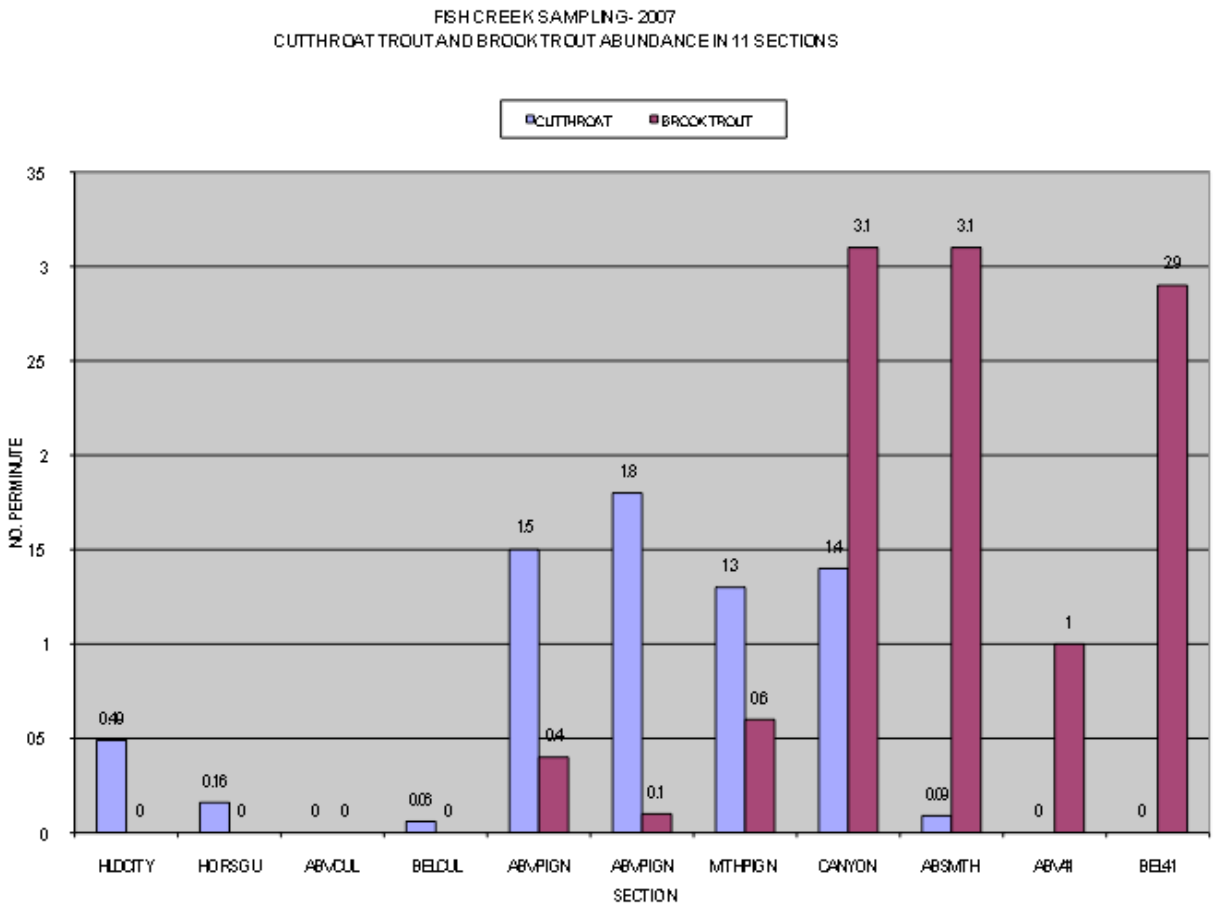


Figure 1. Relative abundance of cutthroat trout and brook trout in 11 sections of fish creek. Highland City is the upper-most sampling section and below highway 41 represents the lower-most sampling section.

The relatively low numbers of fish in the upper four sections are probably a result of low flow and poor habitat conditions. Projects to improve riparian health in these four reaches have significant potential for improving the fish population. Stream channel enhancement by conducting placer reclamation, riparian protection and other projects is recommended in this reach of Fish Creek.

Montana Department of Fish, Wildlife & Parks: Monitoring Inflows of the Jefferson River Near Twin Bridges, MT (2007-2008)

The Jefferson River is formed by the confluence of three major river systems (Ruby River, Beaverhead River, and Big Hole River). Beginning in 2000, the Jefferson River Watershed Council began implementing a drought management plan for the Upper Jefferson River from Twin Bridges to approximately Waterloo.

Monitoring flow of the Jefferson at Twin Bridges and Waterloo, and at selected irrigation canals has been the primary tool for evaluating inflow to the system and the Drought Plan from 2000 to 2008.

In addition to monitoring the Jefferson River and associated irrigation canals, JRWC also found it important to understand flow trends of the upstream water sources during the past 9 years to help manage the water resources during periods of water shortage. Therefore, flow information has been collected near the mouths of the Ruby, Beaverhead and Big Hole Rivers intermittently from 2000 to 2007. As of 2008, seasonal USGS gauging stations were operated near the mouth of each of the three major tributaries to the Jefferson River (Figure 1).

The drainage area of the Big Hole River, Beaverhead River (including Red Rock River), and Ruby River is 7,254 sq. miles, 3,783 sq. miles, and 989 sq. miles respectively (Figure 2). The Big Hole River basin has no large impoundments for water storage, the Ruby River basin is influenced by Ruby Reservoir, and the Beaverhead River basin contains Lima Reservoir and Clark Canyon Reservoir.

Despite the small drainage area of the Ruby, this drainage provides a significant amount of water for the Jefferson River during the low summer flow period (Figure 3). Increased reservoir releases in mid-August appear to be particularly beneficial for the Jefferson River. During the weekly flow measurements of 19 an 26 August 2007, the Ruby River near the mouth provided more water to the Upper Jefferson than the lower Big Hole or the lower Beaverhead.

The relatively large Big Hole basin experiences severe flow shortages near the mouth during drought, but relatively large amounts of return flow that enter the lower Beaverhead River via sloughs near Twin Bridges that are likely to be supplemented by irrigation ditches that originate in the lower Big Hole. This return flow averaged about 100 cfs during the summer months of 2007, and this water improves flow of the lower Beaverhead and upper Jefferson significantly.

Measuring 2008, flow at Twin Bridges was considerably higher than during 2007. During these improved flow conditions, it appears that the relative contributions of the four major sources of water to the upper Jefferson are essentially equal during the critical, late August period (Figure 4). Mean August flow at Twin Bridges was 303 cfs in 2007 and 531 cfs in 2008.

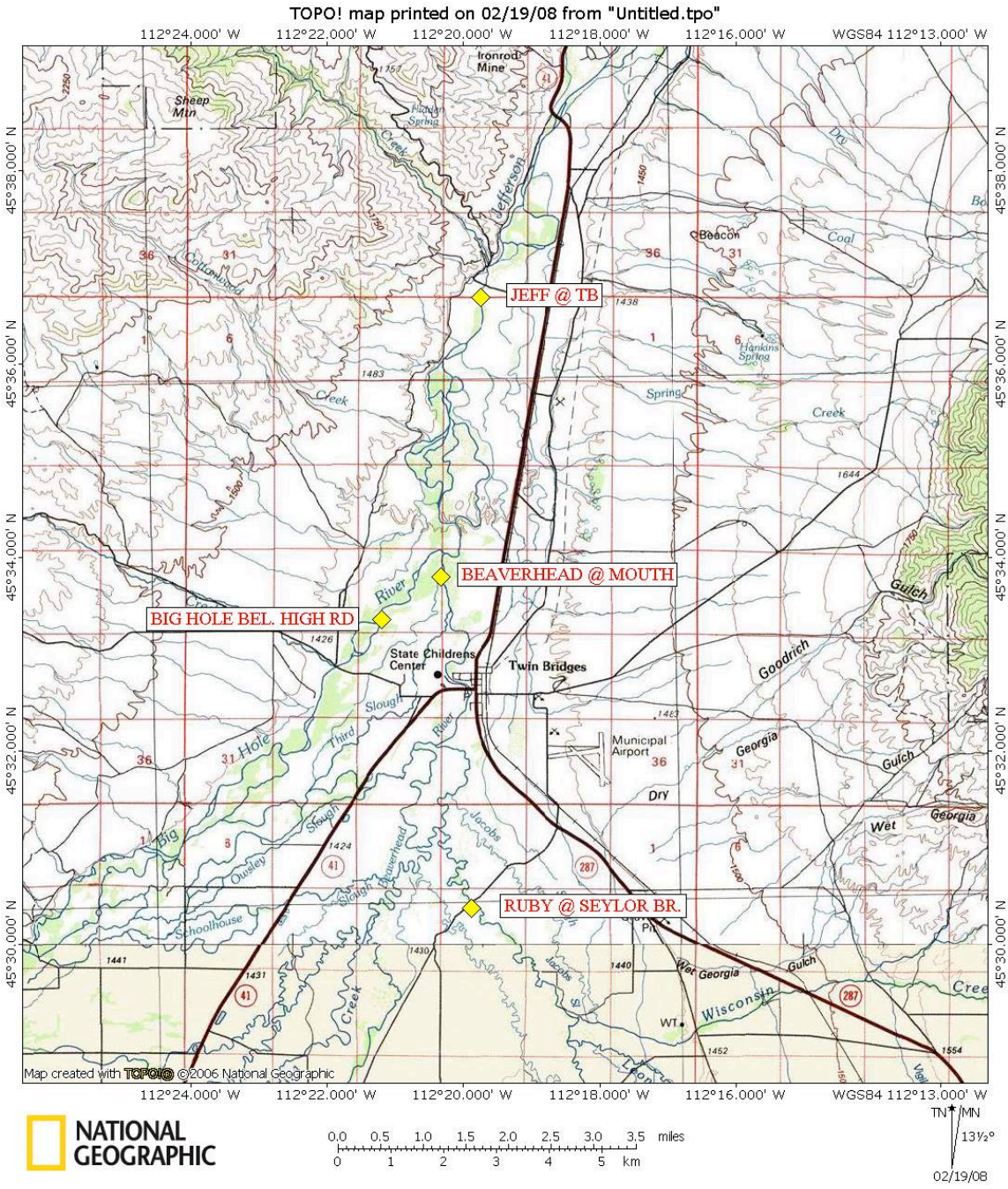


Figure 1. Map of the headwaters of the Jefferson River near Twin Bridges showing location of four flow monitoring locations: Jefferson at Twin Bridges (USGS), Big Hole below Hamilton Ditch return (USGS), Beaverhead near mouth (aquarod installation), Ruby at Seylor Lane (staff gage).

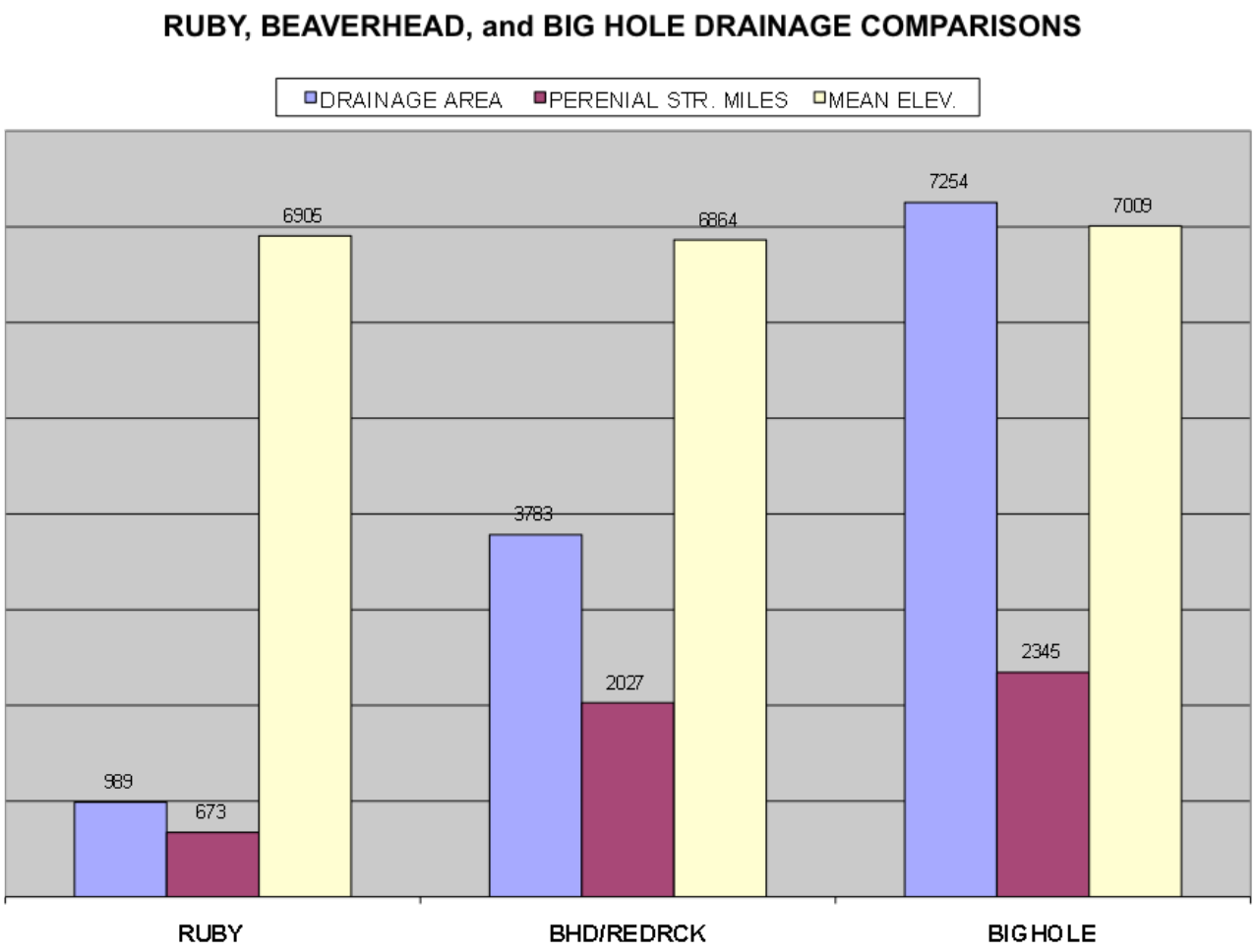


Figure 2. Drainage comparisons of the Ruby, Beaverhead/Red Rock, and Big Hole basins (Drainage Area in square miles).

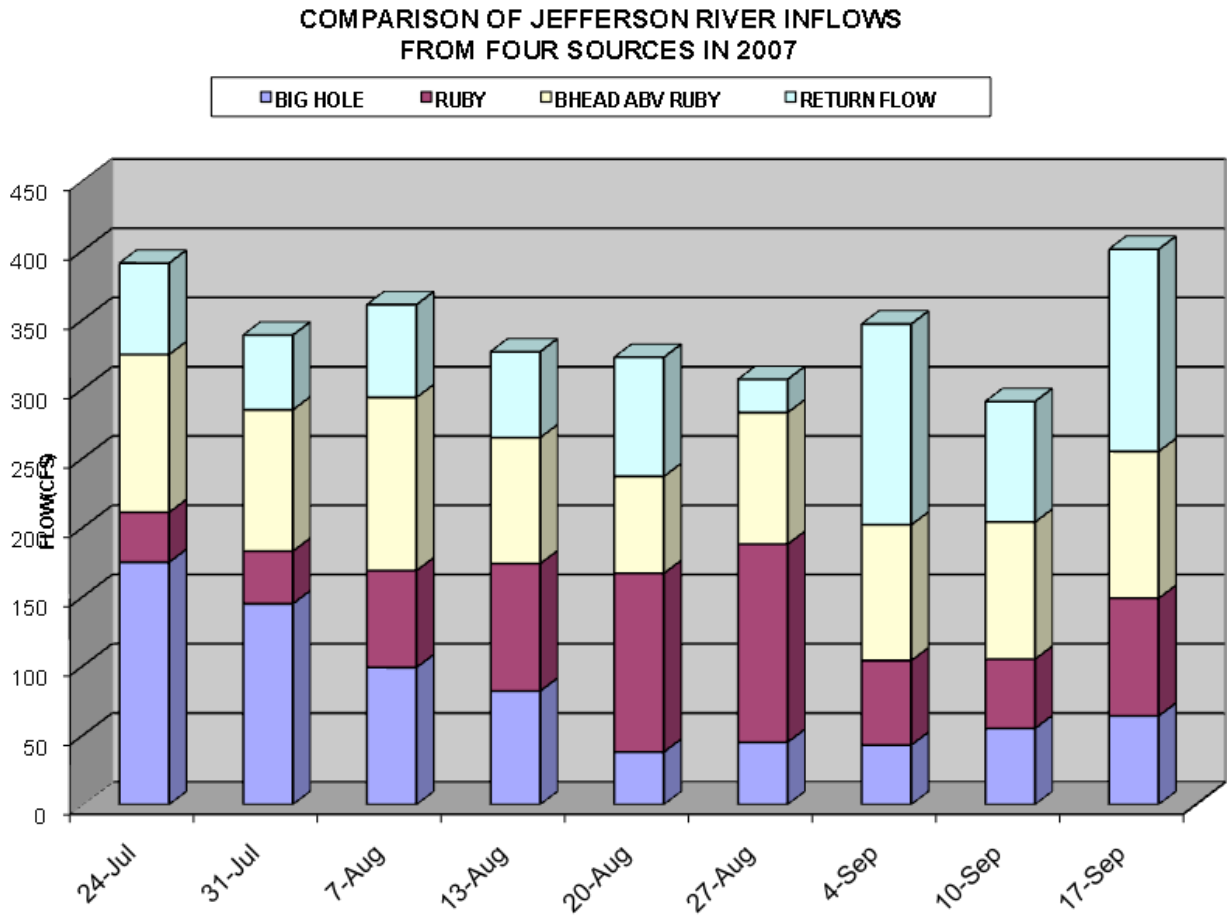


Figure 3. Comparison of stream flow contributions from the Ruby River at Seylor Lane, Beaverhead River above the confluence with the Ruby River (USGS), the Big Hole below Hamilton Ditch (USGS), and estimated return flow to the lower Beaverhead from the Big Hole River during summer, 2007.

"Return flow" value estimated by subtracting flow of Ruby, Big Hole, and Beaverhead above confluence with the Ruby from the flow measured at Jefferson @ Twin Bridges. For example, on 19 August 2007:

Jeff @ TB - Ruby + Big Hole + Beaverhead = "Return Flow"

323 cfs - (129 + 38 + 70) = 86 cfs

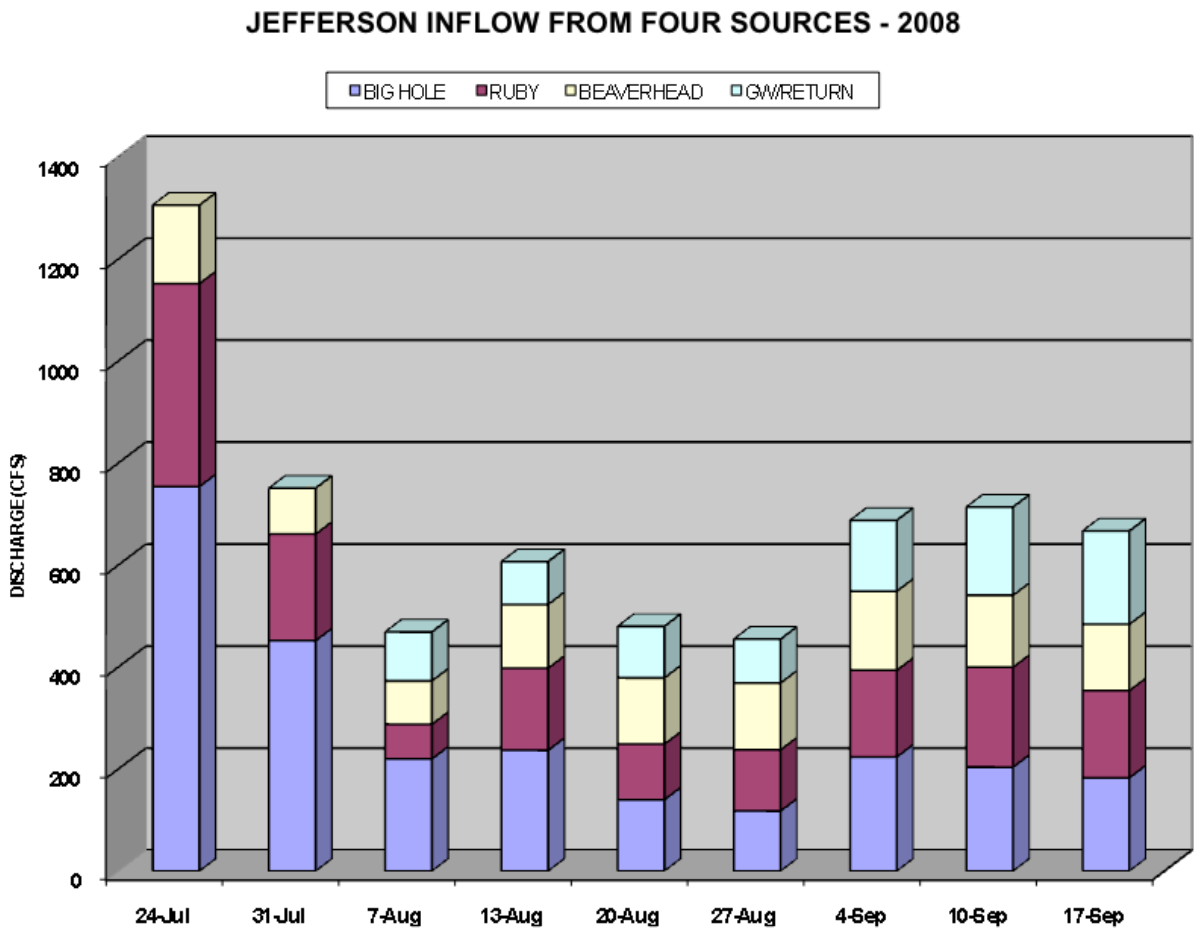


Figure 4. Comparison of four major inflows to the upper Jefferson River during 2008

The higher inflow to the Jefferson River in 2008 resulted in higher flow at the critical location of the Waterloo Gaging station. The highest mean August flow at the Twin Bridges Gage (531 cfs) recorded in the past 9 years resulted in the highest mean August flow at the Waterloo Gage (235 cfs). In addition, the higher flow level resulted in a larger percentage of water reaching the Waterloo Gage, with August flow at Waterloo averaging 44% of the flow at Twin Bridges (Figurre 5). During extremely low flow years, only 16 to 17 % of the flow at Twin Bridges Gage reached the Waterloo Gage.

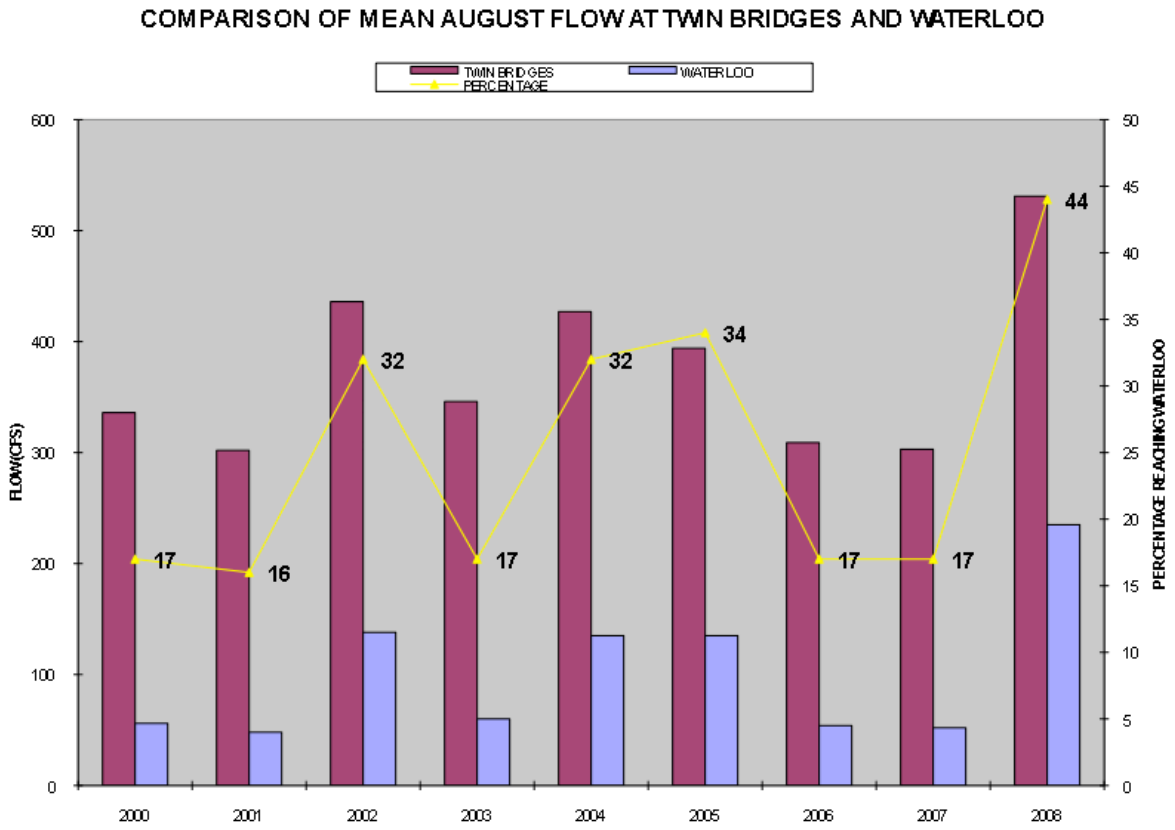
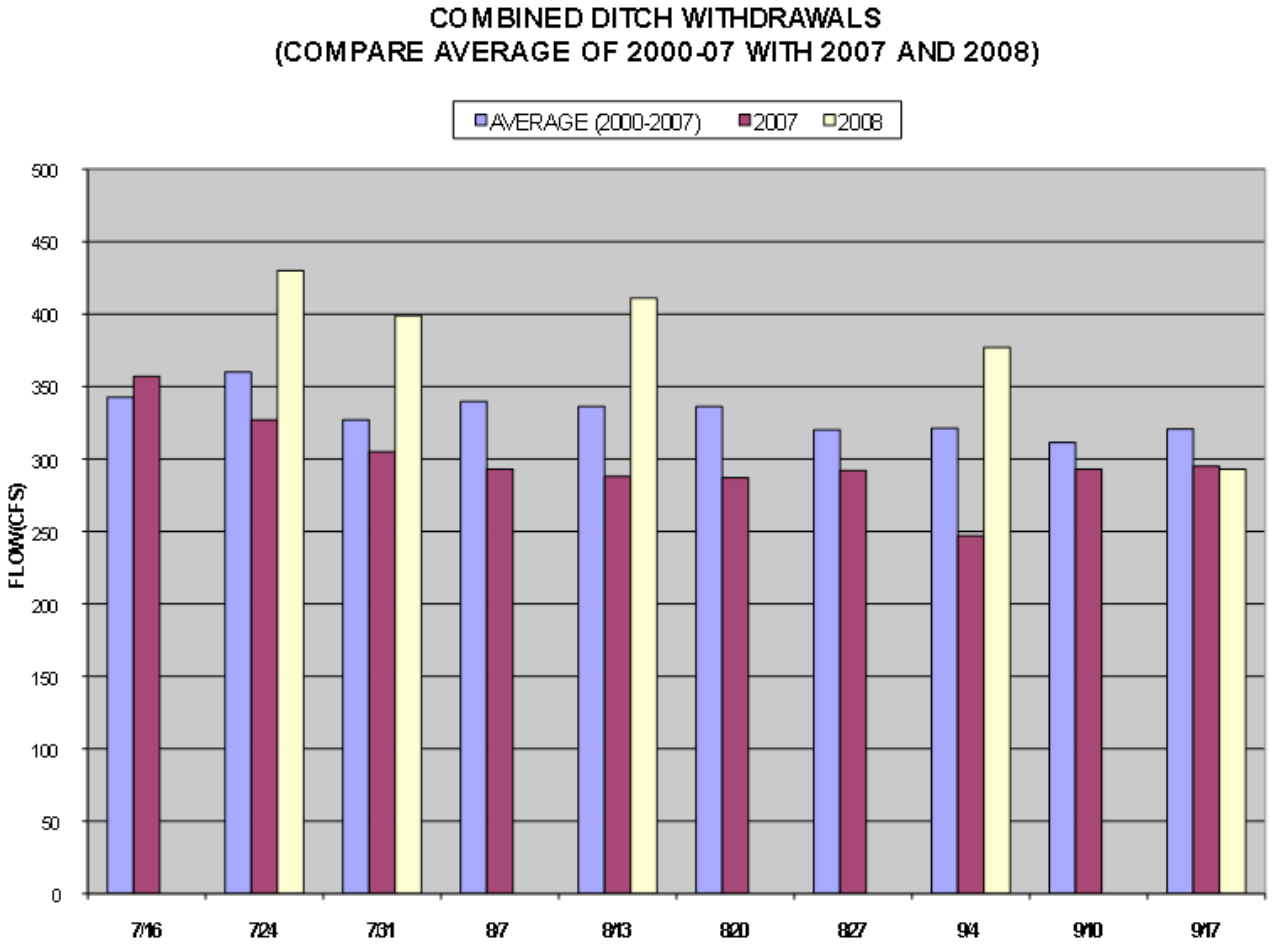


Figure 5. Comparison of mean August flow of the Jefferson River at Twin Bridges and at Waterloo from 2000 to 2008. Percentage of flow reaching Waterloo was determined by the ratio of flow at Waterloo compared to Twin Bridges.

The drought plan for the Jefferson River uses a "trigger flow" of 280 cfs at the Twin Bridges Gage to implement fishing restrictions and begin weekly meetings with water users to attempt to maintain a flow of 50 cfs at the Waterloo Gage. As a result of more typical summer flow conditions in 2008, flow at Twin Bridges did not fall below 280 cfs (minimum flow was 455 cfs on 21 August) and there were no weekly meetings to coordinate with water users. Therefore, 2008 represents the first year during this evaluation when water users were not asked to voluntarily provide water to the Jefferson River to maintain critical flow at the Waterloo Gauging Station.

As a result of higher river flow and the lack of coordinated efforts to maintain minimum flow in 2008, combined ditch withdrawals were generally over 50 cfs higher than average ditch withdrawals from 2000 to 2007 (Figure 6). The observation that ditch flow was higher during cooler and wetter conditions in 2008 is an indication of the effectiveness of voluntary contributions of water resulting in lower ditch withdrawals during the extremely dry and warm conditions of 2000 to 2007 when expected irrigation demand should be relatively high.


COMBINED DITCH WITHDRAWALS
(COMPARE AVERAGE OF 2000-07 WITH 2007 AND 2008)
AVERAGE (2000-2007)
2007
2008
FLOW(CFS)
500
450
400
350
300
250
200
150
100
50
0
7/16
724
731
87
813
820
827
94
910
917

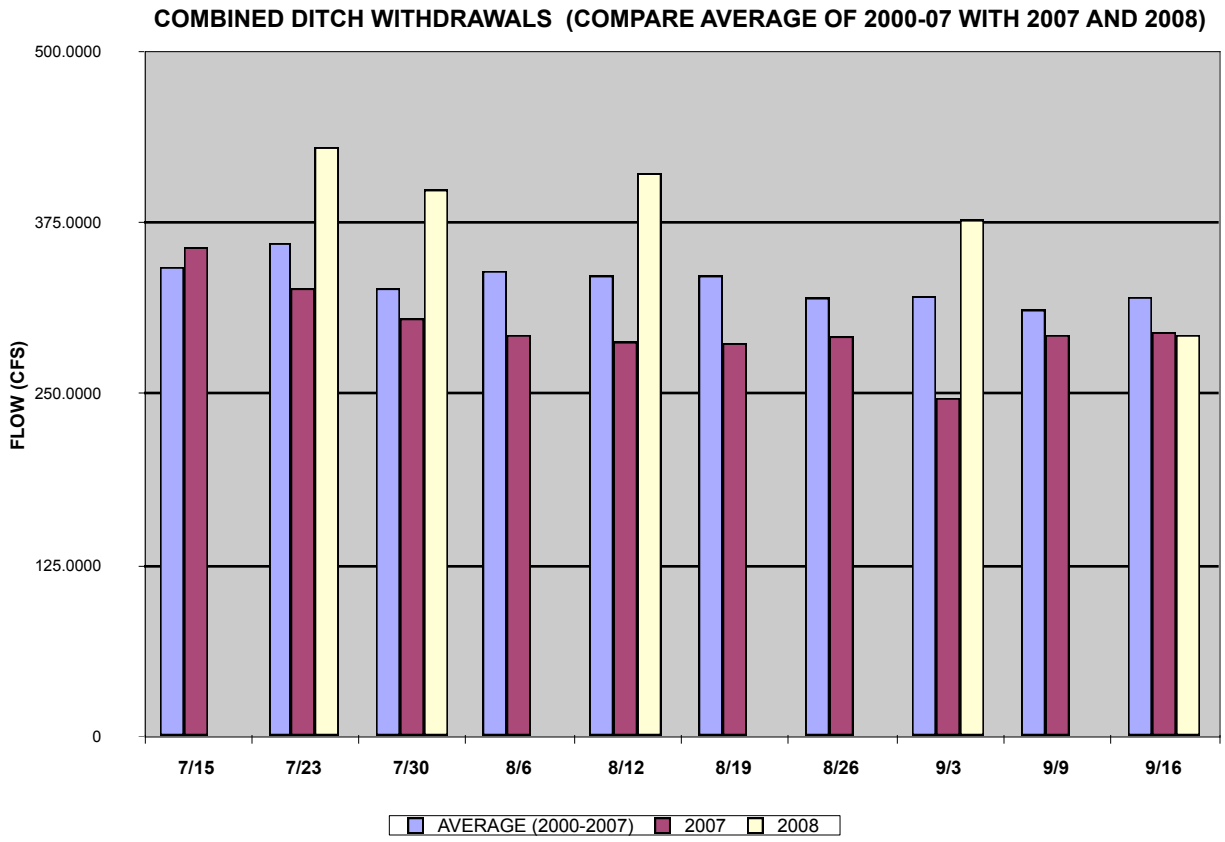


Figure 6. Combined total of irrigation ditch withdrawals from 2000 to 2008, comparing the average of ditch withdrawals from 2000 to 2007 to an extremely low flow year (2007 in red) and a relatively good flow year (2008 in yellow) when no drought plan meetings with water users were needed.

The ultimate measure of success for the drought management plan is the number of days that the 50 cfs flow target is met during the irrigation season. During 2008, flow did not fall below the 50 cfs target set by the drought plan. For the first time since 2000, flow did not fall below 100 cfs at Waterloo during the irrigation season (Figure 7).

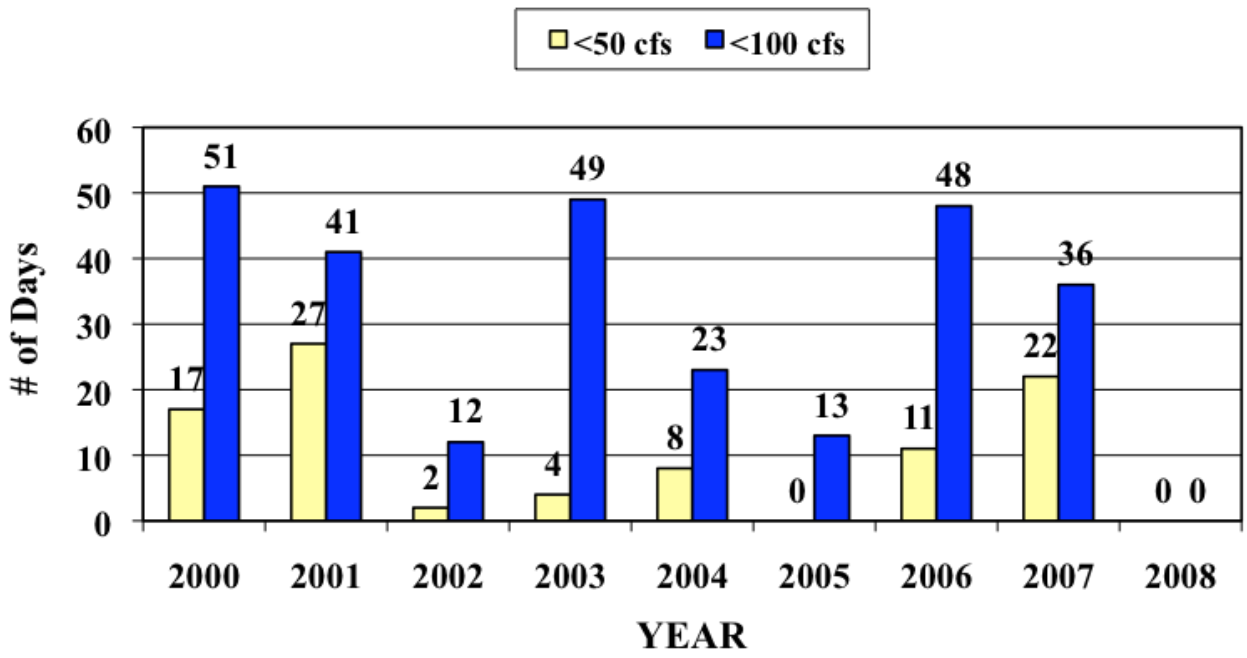


Figure 7. Number of days that flow was less than the drought plan target of 50 cfs at the Waterloo Gauging station from 2000 to 2008. The number of days that flow was less than 100 cfs was also included for reference.

In addition to improved flow conditions during 2008, high water temperatures associated with drought conditions were avoided during a summer with more typical temperature and precipitation. From 2000 to 2007, water temperature frequently exceeded 23 C at the Twin Bridges Gage during late July and early August, but in 2008 water temperature did not exceed 23 C, which is a trigger for implementing fishing restrictions on the Jefferson River.

Table 1. Potential use of water temperature criteria for drought-related fishing closures. Data was provided by the USGS gaging station at Twin Bridges.

DATE	# DAYS > 23 C	RANGE OF DATES MAX TEMP > 23C	Tmax
1995	0	N/A	18.5
1996	2	27, 28 July	23.0
1997	0	N/A	22.5
1998	2	12, 13 August	23.0
1999	3	27, 28, 30 July	23.0
2000*	16	July 12, 13, 14, 16, 21, 22, 23, 24, 25, 27, 28, 29, 30, 31, August 1, 2	24.5 (7/28-31)
2001*	17	June 28, 29, July 1, 2, 3, 8, 9, 11, 12, 24, 25, 26, 27, August 5, 6, 7, 8	24.5 (7/8)
2002*	16	June 25, 26, 27, July 8, 9, 10, 11, 12 13, 14, 15, 17, 18, 21, 23, 24	25.5 (7/12)
2003*	32	July 7, 10, 11,12,13, 14, 15, 16, 17, 18,19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, August 1, 2, 3, 4, 7, 9, 10, 13, 20	26.0 (7/23-24)
2004*	7	July 14, 15, 16, 17….19, 20, 21	25.0 (7/17)
2005*	13	July 12..14, 15..18, 19, 20, 21..23, 24..Aug 4, 5, 6, 7	24.5 (7/21-23)
2006*	18	July 4..8..15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25..26, 27, 28, 29, 30	26.0 (7/23,24)
2007*	30	July 1, 2, 3, 4, 5, 6, 7, 8, 9..12, 13 14, 15, 16, 17, 18, 19, 20, 21, 22, 23.. 25, 26, 27, 28, 29, 30, 31..Aug 2, 3	25.3 (7/22)
2008	0		20.6 (7/26)

.

Temperature Monitoring & Modeling Upper Jefferson River TPA

Montana Department of Environmental Quality, Water Quality Bureau

Prepared by: *Water and Environmental Technologies, PC, Butte, Montana*

Introduction

Existing temperature and climate conditions within the Upper Jefferson River TMDL Planning Area (TPA) were collected and modeled as part of the development of temperature TMDLs. The Temperature Monitoring and Modeling document of the Jefferson River TPA documents details the collection of input requirements for the selected temperature and shade models, as well as modeling scenarios that were anticipated to reduce water temperature in the Jefferson River through the implementation of all reasonable land, soil, and water conservation practices. The document discusses the filed data collection protocols and the Quality Assurance Project Plan (QAPP) to accurately calibrate and validate the temperature model. Field monitoring locations, sampling procedures, and model input parameters were discussed in Section 2.0, while QAPP details are discussed in Section 3.0. Section 4.0 includes a discussion of the model scenarios that are expected to positively impact temperatures in the Upper Jefferson River.

The Jefferson River (Water Body MT41G001_010, 83.6 miles from the headwaters to the mouth) and Big Pipestone Creek (Water Body MT41G002_010, 24.4 miles), a tributary to the Jefferson River were listed as impaired due to temperatures on the 2006 303(d) list. Both impaired streams were listed as B-1 use class, which are regulated by the Administrative Rules of Montana (ARM 17.30.623 (2) (e) to:

(1) A maximum allowable increase of 1 degree F above naturally occurring temperatures within the range of 32 ° to 66 ° F.

(2) No discharge is allowed which will cause the water temperature to exceed 67 ° F within the naturally occurring range of 66 ° F to 66. 5 ° F.

(3) Where the naturally occurring water temperature is 66.5 ° F or greater, the maximum allowable increase in water temperature is 0.5 ° F.

A temperature model calibrated with July 2009 field data was used to document existing temperature conditions and to determine management practices which would reduce temperature in the Upper Jefferson River to meet B-1 classification requirements. Big Pipestone Creek discharges to Whitetail Creek, and the combined flow discharges to the Jefferson Slough. Big Pipestone Creek was not modeled as a part of the temperature study; however, potential impacts from the Whitehall municipal wastewater lagoons will be monitored.

Prediction of available shade due to existing vegetation was modeled with Shade.xls software. Input data collection is discussed in Aerial Photo Assessment (Section 5.1.1), Modeling of the existing conditions and best management practices scenarios will utilize the QUAL2K program with input from field data and the shade.xls output. This report assumes that the data follows steady state conditions in order to utilize the QUAL.2K model.

Other ancillary tasks in this plan are flow and temperature monitoring associated with the Twin Bridges municipal wastewater lagoons, and shade characteristics on the Beaverhead River. A headwaters

tributary of the Jefferson River, which will be modeled for temperature impacts in coordination with this study.

3.0 Project Plan

Continuous temperature measurement will be collected from the main stem, tributaries, irrigation diversions, return flows, and split channels of the Upper Jefferson River. Instantaneous temperature, streamflow, and shade measurements were collected over a two week field effort in support of the model development. This plan identified proposed sampling sites for temperature, streamflow, channel geometry methods and worksheets. In order to attain a well calibrated QUAL2 and shade model, strict quality in the field will be used for data collection in the field and for the modeling effort.

3.1 Study Design

Field data collection consisted of the following parameters and locations in order to attain well calibrated temperature and shade models

Temperature: Forty-three (43) sampling sites were selected on the main stem of Jefferson River, major split channels, tributary inflows, irrigation return flows and temperature wastewater discharges (Whitehall and Twin Bridges) to measure diurnal temperature ranges. In addition, data was used from five USGS gaging stations for a total of 48 temperature locations.

Stream flow: Fifty-five (55) sites were selected for manual flow measurements, including the main stem Jefferson River, major tributary inflows, irrigation diversions, irrigation return flows, and wastewater discharges (Whitehall and Twin Bridges). In addition, data was used from five USGS gauging stations and three staff gauges with discharge/stage relationships maintained by the Jefferson River Watershed Council and Fish Wildlife and Parks for a total of 63 flow locations.

Shade (Jefferson TPA): Twenty-four (24) verification sites have been selected to provide a representative subset of riparian vegetation conditions on the main stem.

Channel Geometry: Five cross section locations were measured on the main stem to define channel characteristics.

Model Scenarios and Application of Results

The model output will be used to document existing temperature conditions in the Jefferson River, which will estimate temperature increase related to different levels of influence from human activities to the river system. The model will then estimate temperature under "reference" conditions, which will occur with all reasonable land, soil and water conservation efforts implemented on the Jefferson River, as well as headwater streams (Beaverhead, Big Hole, and Ruby). Model output and potential temperature reduction scenarios will be used to set water quality targets for temperature in the Jefferson River.

Performance-based allocations for addressing sources of thermal modification will focus on management practices to reduce dewatering and improve riparian vegetation cover and bank stability. These allocations will include and estimate of attainable reductions in thermal loading from each source of impairment, and will specify the actions needed to achieve the reduction goal. Several hypothetical scenarios will be examined in the Shade.xls and QUAL2K modeling processes to

determine if actions such as management changes related to irrigation management or riparian area use will result in a measurable change in stream temperature. Five scenarios are projected to have the most impact: 1) increased shade and decreased riparian frazing 2) improved irrigation water management, 3) changes in channel form, 4) all reasonable land, soil and water conservation efforts implemented to upstream tributaries, and 5) water management on the Ruby Dam.

FEDERAL LANDS

Bureau of Land Management - Butte Field Office

Bureau of Land Management: Land Health Evaluation Report Big Pipestone Creek Allotment

Introduction and Assessment Process: This report documents whether land health standards were achieved for the Big Pipestone Creek Grazing Allotment administered by the Bureau of Land Management's Butte Field Office. Standards for Rangeland Health were evaluated utilizing an interdisciplinary team (ID team) of resource specialists.

Rangeland Health Standards for Western Montana are described in detail in the Record of Decision (ROD) issued for Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Montana, North Dakota and South Dakota (August 1997). The preamble of the Western Montana Standards states: "The purpose of the S&Gs (Standards and Guidelines) are to facilitate the achievement and maintenance of healthy, properly functioning ecosystems within the historic and natural range of variability for long-term sustainable use." Standards are statements of physical and biological condition or degree of function required for healthy sustainable lands. Achieving or making significant progress towards these functions and conditions is required of all uses of public land as stated in 43 CFR 4180.1.

Available monitoring data from both upland and riparian sites, existing inventories, historical photographs and standardized methodology are used by an ID team to assess condition and function.

Condition/function declarations regarding are expressed as:

- Proper Functioning Condition (PFC)
- Functioning at Risk (FAR), which is assigned a trend of up, down, static or not apparent
- Nonfunctioning (NF)

Standards are met when conditions are at PFC or FAR with an upward trend. This is dependent on scope and scale. The BLM will consider the information contained in this report along with public scoping and other sources of information to make a determination regarding causal factors and courses of action to be analyzed in a National Environmental Policy Act (NEPA) document.

STANDARD #1 UPLAND HEALTH - FINDING STANDARD IS NOT MET

RATIONALE: Uplands were assessed in the field at BPC allotment during the first two weeks of June, 2009. The assessment evaluated five representative eco-sites for land health indicators and included

observations through a general allotment walk-through. NRCS/SCS ecological/range site reference guides were used to identify departures from the expected conditions at the eco-site and the other observed areas. These departures were then assessed along with data from seven vegetation trend monitoring transects established at the allotment.

The assessment area's geomorphology contains actively decomposing granite that is highly erosive. Signs of more active erosion and deposition were therefore expected from this natural process; however, the amount of soil erosion and deposition observed appeared higher than anticipated in many areas along off-highway vehicle (OHV) routes, stream crossings, in gullies/alluvial fans, and some areas where conifers had encroached and shaded out the pre-existing vegetation. Pedestals were common throughout the allotment along with some water-flow patterns but the majority appeared to be remnants from historical events. The remaining soils outside of these disturbance areas appeared fairly stable across the landscape.

The hydrologic function was inadequate because water capture and infiltration over the majority of the allotment was presumed to be less than expected due to the departure from the expected plant community. Conifer (i.e. Rocky Mountain juniper and Douglas fir) encroachment into the sagebrush-grassland was observed across the allotment, which significantly impacts soil moisture availability. Higher than expected densities and cover of conifers has contributed to a decline in production of grasses and forbs as observed at the ecosite evaluation areas and across the allotment. Encroachment reduces site stability and productivity by shading out sunlight, reducing litter cover, decreasing water infiltration, and increasing areas of bare soil and erosion. Big sagebrush was also much denser than expected and reduced the density of herbaceous species but was being encroached in turn by conifers.

The density and distribution of blue bunch wheatgrass was reduced from what was expected on many parts of the allotment from a dominant to a sub-dominant species. All five ecosite evaluation areas and half of the trend monitoring transects reflect that departure. Additionally, species such as blue grama, dense clubmoss, and Sandberg bluegrass were more prevalent than expected in areas where they should have been smaller components.

The long-term vegetative trend, based on the seven current vegetation monitoring transects at BPC allotment, is ambiguous when the data are considered cumulatively. Together, they do not show a clear positive or negative trend. Species have fluctuated in frequency, cover, and composition over roughly a 30-year monitoring period. The key species for example, blue bunch wheatgrass, has increased at some transects and decreased at others. Big sagebrush, however, has been increasing at most transects and is a generally a dominant or co-dominant species, which is a notable departure from the expected plant community under a normal fire regime. Even though most transects have not detected conifer encroachment, the available multi-year transect photographs do however show an increase in conifer cover over the past 30 years across the landscape.

Litter cover for site protection appeared sufficient in some areas and lacking in others depending upon that sites herbaceous component. The frequency and size of bare areas also appeared to correlate in some areas with the degree of conifer encroachment.

Noxious weeds and non-native invasive species were identified throughout the allotment. Identified species included knapweed, cheatgrass, mullein, hounds tongue, dandelion, leafy spurge, and yellow toadflax.

Knapweed and Cheatgrass were common in the uplands adjacent to Homestake Creek and Dry Creek riparian areas. Cheatgrass was also prevalent along OHV routes.

Overall, due to conifer encroachment, areas of accelerated erosion, and noxious weeds/non-native invasive species, it was determined that the uplands do not meet Montana land health standards.

STANDARD #2 RIPARIAN/WETLAND HEALTH - FINDING STANDARD IS MET

RATIONALE: Twelve riparian reaches at Big Pipestone Creek allotment previously rated as functioning-at-risk or nonfunctioning were re-evaluated using the methodology from the Riparian Area Management Guidebook (lotic areas). Reaches J-31-1, J-31-2, J-31-3, J-34, J-35, and J-36-1 were determined to be in proper-functioning-condition. Reach J-90-3 was determined to be functioning-at-risk with an upward trend. After inspecting reaches J-37, J-90-1, J-90-2, J-118-2, and J-119, it was determined that they lacked adequate components for riparian classification and were not evaluated for functioning.

Riparian reaches J-31-1, J-31-2 and J-31-3 are located along Homestake Creek in a steep rocky gorge with little access. All of the hydrological, vegetation, and erosion/deposition criteria in the lotic riparian checklist were either met or not applicable. Sediment deposition did appear excessive in spots but it was thought to be more from the high amount of naturally decomposing/eroding granite from the surrounding landscape.

Reach J-34 is located along Halfway Creek. All vegetation criteria were met during the riparian evaluation. Most hydrological and erosion/deposition criteria were met. Departures from the expected condition were a result of upland erosion from adjacent roads and stream crossings observed along the reach northeast of the railroad trestle. In addition to the riparian assessment, data was also reviewed from one vegetation coverboard plot (J-34-1) read in 1982, 1990, and 2008. The data shows very notable decline in riparian shrubs and trees (i.e. Sitka alder, redosier dogwood, and currant) and an increase in Rocky Mountain juniper. Despite the additional sediment being supplied and shift in riparian species composition, the reach was still determined to be in proper-functioning-condition, overall.

Reach J-35 is located along Beef Straight Creek. All vegetation and deposition/erosion criteria were met during the riparian evaluation. Only one hydrological criterion was not met due to sedimentation from an OHV creek crossing and adjacent alluvial fans. Overall, despite the additional stream input, the reach was still determined to be in proper functioning condition.

Reach J-36-1 is located along Big Pipestone Creek. The reach is in a steep rocky gorge, dominated by boulders that consist of decomposing granite. Access is very limited. Riparian vegetation only exists where boulders are lacking. All hydrological, vegetation, and deposition/erosion criteria were met during the riparian evaluation. The reach was determined to be in proper-functioning condition.

Reach J-90-3 is located along Dry Creek. There was a mixed result of hydrological, vegetation, and deposition/erosion criteria that were either being met, not met, both, or not applicable during the riparian evaluation. Dry Creek had an intermittent-interrupted flow with very little water. Riparian areas were also intermittent. Those intermittent areas contained adequate riparian species and age diversity; however, it is being threatened by the noxious weeds/non-native invasive species that were present along the reach, which included hounds tongue, knapweed, cheatgrass, yellow toadflax, and leafy spurge.

It was determined that vegetative cover was inadequate to protect banks during high flow events, but conversely where riparian vegetation was present, the stream bank was comprised of species with root masses that would withstand high flow events. Conifers were cut from the reach and placed within the channel approximately eight years ago and were contributing to riparian improvement. Observed sedimentation in the lower portion of the reach was excessive with contributions from non-channel areas. OHV trails in and adjacent to the reach were also facilitating erosion and deposition. Even though the riparian area did not appear to be widening within its potential, there were aspen, cottonwood, and/or willow seedlings/suckers observed in the reach where riparian vegetation was present. Overall, the system was determined to be functioning-at-risk but with an upward trend.

STANDARD #3 WATER QUALITY - FINDING STANDARD IS NOT MET

RATIONALE: Big Pipestone and Halfway Creeks are two water bodies within the allotment on the Montana 303 (d) list as impaired. TMDLs have not been established for either water body.
The beneficial uses that Big Pipestone Creek supports include agriculture and drinking water. The creek partially supports aquatic life, cold water fishery, industrial and primary contact recreation. Probably sources of impairment for Big Pipestone Creek are listed as agriculture, channelization, construction, grazing sources, habitat modification, highway maintenance/runoff, highway/road/bridge construction, hydrological modification, logging road construction/maintenance, municipal point sources, removal of riparian vegetation, sediment re-suspension, and silviculture. Probably causes are listed as bank erosion, channel incisement, fish habitat degradation, nutrients, other habitat alterations, riparian degradation, suspended solids, and thermal modifications.

The beneficial uses that Halfway Creek supports include agriculture, industrial, primary contact recreation, and drinking water. The creek only partially supports aquatic life and cold water fishery. Probable sources of impairment for Halfway Creek are listed as riparian/shoreline grazing, loss of riparian habitat, and unspecified unpaved road/trail. Probable causes are listed as sedimentation/siltation and altered streamside or littoral vegetative covers.

During the BPC allotment assessment, it was determined that the overall conditions of the riparian areas were not impairing water quality. Observed spring sources were protected by exclosures and well vegetated with no soil movement. Creek sedimentation was observed, primarily in Homestake, Dry, and Beef straight Creeks, due to erosion from adjacent gullies/alluvial fans, historical placer mining sites, and/or roads/trails; however, stream sedimentation also appears to be from the high amount of naturally decomposing/eroding granite in the surrounding landscape. Since TMDLs have not been established, it is unknown whether the additional sediment is impairing water quality.

Due to the 303(d) listing of Big Pipestone and Halfway Creeks in BPC allotment, it was determined that the water quality does not meet Montana land health standards.

STANDARD #4 AIR QUALITY - FINDING STANDARD IS MET

RATIONALE: Air quality data was not collected within BPC allotment; however, observed vegetation was not dust covered and there was no impairment of visibility.

STANDARD #5 BIODIVERSITY - FINDING STANDARD IS MET (BUT WITH RESERVATIONS)

RATIONALE: The following indicators were used to assess whether existing habitat conditions are at a condition to support viable and diverse populations of native plant and animal species, including special status species:

- Plants and animals are diverse, vigorous, and reproducing satisfactorily
- Noxious weeds are absent or insignificant in the overall plant community.
- Spatial distribution of species is suitable to ensure reproductive capability and recovery.
- A variety of age classes is present.
- Connectivity of habitat or presence of corridors prevents habitat fragmentation.
- Diversity of species (including plants, animals, insects, and microbes) are represented.
- Plant communities in a variety of successional stages are represented across the landscape.

A variety of native wildlife species are represented on the allotment. Big game including moose, elk, and deer are present; small mammal burrows were noted; red-tailed hawks and numerous passerine species were seen during the allotment evaluation; records indicate reptile and amphibian species have been found on or near the allotment; numerous insect and arachnid species were seen. Riparian area health has generally improved since it was last assessed. Wildlife appears to be healthy, diverse, and reproducing satisfactorily. Interstate 90 presents a significant barrier to wildlife movement to the south, but the allotment is connected to large areas of habitat on the north, east, and west.

Native plant species are numerous and diverse across the allotment. Healthy bitterbrush and mountain mahogany, important browse species, were noted in places. However, as discussed in the Standard 1 section, noxious weeds, invasive species and conifer expansion are significant problems in the BPC allotment. Due to Standard 1 not being met because of these factors, Standard 5 could be considered to be in a downward trend, or functioning at risk. Currently, native species are maintaining health and reproduction, but significant ecosystem changes can be expected if conifers and undesirable nonnative plants are allowed to continue their expansion.

Preliminary Identification of Causal Factors and Recommendations

Based on the field review and observations, it appears the following factors may be contributing to land health standards not being achieved:

- Wildfire suppression resulting in a departure from the historical fire disturbance regime that has altered the biotic integrity, hydrology, and soil/site stability.
- Noxious weeds/invasive non-native plant infestations.
- OHV use on highly erodible soils.
- Transportation of weeds by OHVs.

Final determinations will be made upon assessment of further information. It should be noted that if changing a current management or use will not result in progress toward meeting the standards, then the current management or use should not be considered a significant causal factor.

The following actions may be necessary in order to make significant progress in achieving the Western Montana Standards for Rangeland Health:

- Remove conifers encroaching into sage-brush grasslands.
- Place cut conifers in gullies/alluvial fans where excessive erosion is occurring to help store eroded silt/sand and slow its release into adjacent creeks.
- The BLM has previously taken steps to address sedimentation of the creeks within the allotment by closing unauthorized OHV trails on BLM administered land, establishing legal trails, building a bridge across Big Pipestone Creek, and monitoring areas of concern. These steps should continue further by reevaluating OHV routes for erodability and sedimentation issues. Priority should be given to areas with TMDLs, OHV stream crossings, and steep routes in or adjacent gullies/alluvial fans where there is sediment delivery into creeks.
- Prioritize weed treatment efforts at Big Pipestone Creek allotment along OHV routes and Dry Creek. Management of weeds along Homestake Creek would be difficult and meet with little success due to the inhospitable climate for current bio-controls and accessibility for consistent mechanical treatments.
- Identify and reclaim abandoned placer mine sites that are releasing sediment.

Land Health Evaluation Report, Big Foot Allotment, Bureau of Land Management

General Allotment Summary

Allotment Name/Number: Big Foot 20239
Current Management Category: M (Maintain)
Location: T4N, R4W, Sections 4, 5, 8, 17, 20; Jefferson County
Public Acres: 1520 acres.
Season of Use: 06/16 to 10/15
Public Animal Unit Months: 280
Assessment Date: May 6, 13, & 20, 2009

The Big Foot Allotment lies about 7 miles south of Boulder, MT and about 14 miles north of Whitehall, MT. The allotment is grazed in conjunction with adjacent private property (approx. 4000 acres) and United States Forest Service (USFS) lands (approx. 20,000 acres). This allotment is included as lower elevation portions of 3 pastures within the USFS's Big Foot Allotment. The 3 pastures are Little Whitetail, Big Foot and Beacon. The BLM's Rocky Canyon Allotment is also grazed as a pasture within the USFS's Big Foot Allotment grazing system. The USFS Big Foot Allotment including these BLM managed lands, is managed as a 9 pasture deferred grazing system with approximately 550 c/c pairs. This allotment was changed from a rest rotation grazing system to a deferred system, in order to shorten the grazing period on the allotment's riparian areas. The USFS has the lead for grazing management on this allotment.

The Boulder weather station reports 11.48 inches of precipitation on average, and an average daily temperature of 42.6 degrees Fahrenheit. The Big Foot Allotment sits at higher elevations than the Boulder weather station, and receives more precipitation and cooler weather than is recorded at the weather station.

Summary of Standards Achieved

STANDARD #1 UPLAND HEALTH - FINDING OF STANDARD IS MET

RATIONALE: The rangeland health evaluation conducted on this allotment was compared to the Natural Resource Conservation Service's ecological site guides. The sites evaluated on this allotment showed little departure from the soil stability, hydrologic and biotic function indicators. There is some scattered Douglas fir expansion. Utilization is within acceptable levels on this allotment and on adjacent private property managed with the public land.

Site 1: a Rangeland Health Evaluation Worksheet was completed at T4N, R4W, Sec. 8: NE1/4NW1/4. The soil type for this site is Burtoner-Connieo, bouldery-rock outcrop complex, 4 to 15 percent slopes (1372D). This site was determined to be a shallow 15-19" precipitation zone ecological site. The assessment showed 17 of 17 indicators rated none to slight from departure. The site had a good representation of native vegetation.

Site 2: a Rangeland Health Evaluation Worksheet was completed at T4N, R4W, Sec. 5: NE1/4NE1/4. The soil type for this site is Burtoner-Connieo, bouldery-rock outcrop complex, 4 to 15 percent slopes (1372D). This site was determined to be a shallow 15-19" precipitation zone ecological site. The assessment showed 14 of 17 indicators rated none to slight from departure. The plant community composition and distribution relative to infiltration and runoff indicator was rated as slight to moderate. Club moss 4 and conifer encroachment have a slight to moderate effect on infiltration. The functional/ structural groups indicator was rated as slight to moderate. The presence of club moss has slightly to moderately altered the relative dominance of vegetation on the site. The annual production indicator was rated as slight to moderate. The amount of club moss has slightly to moderately reduced the annual production of blue bunch wheatgrass on the site. Blue bunch wheatgrass is the dominant species on this site.

Site 3: a Rangeland Health Evaluation Worksheet was completed at T4N, R4W, Sec. 8: SE1/4SW1/4. The soil type for this site is Martinsdale-Martinsdale, shawmut complex, 2 to 8 percent slopes (1222c). This site was determined to be a silty 15-19" precipitation zone ecological site. The assessment showed 15 of 17 indicators rated none to slight from departure. The plant community composition and distribution relative to infiltration and runoff indicator was rated as slight to moderate. Club moss and sagebrush have a slight to moderate effect on infiltration. The functional/structural groups indicator was rated as slight to moderate. The presence of club moss has slightly to moderately altered the relative dominance of vegetation on the site.

Site 4: a Rangeland Health Evaluation Worksheet was completed at T4N, R4W, Sec. 20: NE1/4NW1/4. The soil type for this site is Burtoner-Connieo, bouldery-Rock outcrop complex, 4 to 15 percent slopes (1372D). This site was determined to be a silty 15-19" precipitation zone ecological site. The assessment showed 11 of 17 indicators rated none to slight from departure. The plant community composition and distribution relative to infiltration and runoff indicator was rated as moderate. Club moss has a moderate effect on infiltration. The functional/structural groups indicator was rated as slight to moderate. The presence of club moss has slightly to moderately altered the relative dominance of vegetation on the site. The plant mortality/decadence indicator was rated as slight to moderate. There is older sagebrush on site. The litter amount, annual production and reproductive capability of perennial plants indicators were rated as slight to moderate. The presence of club moss affected all these indicators.

Overall, the uplands are in Proper Functioning Condition.

STANDARD #2 RIPARIAN/WETLAND HEALTH - FINDING STANDARD IS NOT MET.

RATIONALE: All riparian reaches were rated in Proper Functioning Condition (PFC) with the exception of J-93, a tributary to Little Whitetail Creek, which was rated as non-riparian and J-15-2, Little Whitetail Creek, which was rated as Functioning at Risk (F@R) with no apparent trend.
Reach J-93 was reclassified as an intermittent draw which contained little riparian 5 vegetation. The majority of this draw is dry and is covered with conifer species. Reach J-15-2 was rated as F@R with Trend Not Apparent. This is a fairly level area on the reach. The reach has an adequate diversity and composition of riparian vegetation, however it is receiving some animal trampling. The interdisciplinary team could not give J-15-2 an upward or downward trend. It was felt that the grazing treatment on this reach was short enough to not negatively affect the composition of the riparian vegetation of this reach, but the topography of the area funneled animals to this site. This animal concentration is creating some annual bank impact.

The following reaches are rated as PFC:

- Rocky Canyon Tributary J-11
- Tributary to Little Whitetail J-12
- Little Whitetail Cr. J-15-1
- Little Whitetail Cr. Trib J-136
- Big Foot Creek J-13-1
- State Creek J-17
- Big Foot Creek J-95
- Not Named Intermittent J-14
- Little Whitetail Cr J-18

Little Whitetail Creek has been separated into 3 different riparian reaches, because of slope and land status differences of these reaches. There is approximately 26,000 feet of total riparian reach in the Big Foot Allotment. Twenty five thousand feet of these reaches rated PFC and approximately 1000 (J-15-2) feet rated F@R with trend Not Apparent. Since, 1000 feet of riparian reach does

STANDARD #3 WATER QUALITY - FINDING STANDARD IS MET.

RATIONALE: The State of Montana, Department of Environmental Quality (DEQ) has responsibility for implementing the Clean Water Act. This responsibility includes making beneficial use determinations. The State of Montana 303(d) list of impaired water bodies was checked for Jefferson County and these riparian reaches were not included on this list. No excess sediment is produced from water running off this allotment.

STANDARD #4 AIR QUALITY - FINDING STANDARD IS MET.

RATIONALE: Although the actual air quality in the allotment is unknown, there is no evidence to suggest that the current allotment conditions would be contributing to any air quality problems in terms of a source of smoke or dust particulates. No visual impairment was observed.

STANDARD #5 BIODIVERSITY - FIND STANDARD IS MET.

RATIONALE: The following indicators were used to assess whether existing habitat conditions are at a condition to support viable and diverse populations of native plant and animal species, including special status species.

- Plants and animals are diverse, vigorous, and reproducing satisfactorily.
- Noxious weeds are absent or insignificant in the overall plant community.
- Spatial distribution of species is suitable to ensure reproductive capability and recovery.
- A variety of age classes is present.
- Connectivity of habitat or presence of corridors prevents habitat fragmentation.
- Diversity of species (including plants, animals, insects, and microbes) are represented.
- Plant communities in a variety of successional stages are represented across the landscape.

A variety of native wildlife species are represented on the allotment. Big game including moose, elk, and deer are present; small mammal burrows were noted; red-tailed hawks, ruffed grouse and numerous passerine species were seen during the allotment evaluation; numerous insect and arachnid species were seen. Wildlife appears to be healthy, diverse, and reproducing satisfactorily. Although the allotment is too small to sustain healthy and diverse wildlife communities on its own, it is connected on all sides to USFS, state, and undeveloped private land. There are no significant barriers to wildlife movement in and out of the allotment.

Noxious weeds and invasive plant species are rare. Conifer species are expanding into sage, grass, and riparian areas due to alteration of historic disturbance but have not become completely dominant in these areas.

Preliminary Identification of Causal Factors and Recommendations

Based on the field review and observations, it appears the following factors may be contributing to land health standards not being achieved:

- Stream bank trampling on a portion of reach J-15-2.

Final determinations will be made upon assessment of further information. It should be noted that if changing a current management or use will not result in progress toward meeting the standards, then the current management or use should not be considered a significant causal factor.

The following actions may be necessary in order to make significant progress in achieving the Western Montana Standards for Rangeland Health:

- Monitoring to determine trend of riparian reach J-15-2.
- Some type of barrier to grazing use of a portion of reach J-15-2.

Land Health Evaluation Report, Rocky Canyon SGC Allotment Bureau of Land Management

General Allotment Summary

Allotment Name/Number: Rocky Canyon SGC # 10240
Current Management Category: M (Maintain)
Location: T4N, R4W, Sections 4, Jefferson County
Public Acres: 243 acres.
Season of Use: 06/16 to 10/15
Public Animal Unit Months: 50

Assessment Date: May 6, 2009

The Rocky Canyon SGC Allotment lies about 7 miles south of Boulder, MT and about 17 miles north of Whitehall, Montana. The allotment is grazed in conjunction with adjacent private property and United States Forest Service (USFS) lands. This allotment is managed as a pasture within the USFS's Big Foot Allotment. The USFS Big Foot Allotment including these and other BLM managed lands is managed as a 9 pasture deferred grazing system with approximately 550 c/c pairs. This allotment was changed from a rest rotation grazing system to a deferred system, in order to shorten the grazing period on the allotment's riparian areas. The USFS has the lead for grazing management on this allotment. The Big Foot Allotment contains about 4000 acres of private property, 1800 acres of BLM managed lands and approximately 20,000 acres of USFS managed lands.

The Boulder weather station reports 11.48 inches of precipitation on average, and an average daily temperature of 42.6 degrees Fahrenheit. The Rocky Canyon Allotment sits at higher elevations than the Boulder weather station, and receives more precipitation and cooler weather than is recorded at the weather station.

STANDARD #1 UPLAND HEALTH - FINDING STANDARD IS MET.

RATIONALE: The rangeland health evaluation conducted on this allotment was compared to the Natural Resource Conservation Service's ecological site guides. The site evaluated on this allotment showed little departure from the soil stability, hydrologic and biotic function indicators. There is some scattered Douglas fir encroachment. Utilization is within acceptable levels on this allotment and on adjacent private property and USFS managed land that is included in the Rocky Canyon Pasture.

Site 1: a Rangeland Health Evaluation Worksheet was completed at T4N, R4W, Sec. 4: NE1/4NE1/4. The soil type for this site is Casey peak-Branham-Rock outcrop complex, 15 to 35 percent slopes (1842E). This site was determined to be a silty 15-19" precipitation zone ecological site. The assessment showed 16 of 17 indicators to be none to slight from departure. The functional/structural groups indicator was rated as slight to moderate. The site had a good representation of native vegetation and the introduced species Kentucky bluegrass was also present. The ecological site description for a silty site does not include Kentucky bluegrass.

Overall, the uplands are in Proper Functioning Condition.

STANDARD #2 RIPARIAN/WETLAND HEALTH - FINDING STANDARD IS NOT MET.

RATIONALE: Riparian reach No. J-10, Rocky Canyon Creek was split into J-10-1 and J-10-2, because of the topography and channel differences of the stream in these locations. Reach J-10-1 is approximately 500 feet

long, a B type channel (2 to 4 % gradient), and is located on fairly level land. This reach was rated as F@R with trend Not Apparent in 2009. The stream in this area has been widened out in places. The Interdisciplinary Team (ID) noted that sinuosity and width/depth ratio of reach J-10-1 were not in balance with the landscape setting. It is not apparent if the present grazing system is improving conditions or if they are remaining static. The stream is well vegetated, however, the more level topography of this site and the location of the nearby BLM/USFS boundary fence concentrates animal use along this 500 feet of the reach. The remainder of the reach, an A type channel (4 to 10% gradient), about 3200 feet long was designated as J-10-2. This reach is steeper than the previous reach and is contained by rocks along the creek, which maintain the stability and integrity of the stream bank. This reach was rated as PFC in 2009. Reach J-104, the northern tributary to Rocky Canyon Creek, was reclassified as a woody draw, because of its lack of surface water and riparian vegetation. This draw supplies little water to Rocky Canyon Creek, only seasonal runoff.

The other riparian reaches in this allotment: J-105, the southern tributary to Rocky Canyon Creek, and J-9-02, the South Fork of Little Whitetail Creek are rated as PFC. These reaches all contain a high quality and quantity of riparian vegetation that is in good to excellent condition. There is approximately 9300 feet of total riparian reach in the Rocky Canyon Allotment. Eighty seven hundred feet of these reaches rated PFC and 500 feet rated F@R with trend Not Apparent. Since, 500 feet of riparian reach does not have an apparent upward trend the riparian standard is not met on this allotment.

STANDARD #3 WATER QUALITY - FINDING STANDARD IS NOT MET.

RATIONALE: The State of Montana, Department of Environmental Quality (DEQ) has responsibility for implementing the Clean Water Act. This responsibility includes making beneficial use determinations. The State of Montana 303(d) list of impaired water bodies was checked for Jefferson County and none of the riparian reaches, in the Rocky Canyon Allotment, were included on this list.

STANDARD #4 AIR QUALITY - FINDING STANDARD IS NOT MET.

RATIONALE: Although the actual air quality in the allotment is unknown, there is no evidence to suggest that the current allotment conditions would be contributing to any air quality problems in terms of a source of smoke or dust particulates. No visual impairment was observed.

STANDARD #5 BIODIVERSITY - FINDING STANDARD IS NOT MET.

RATIONALE: The following indicators were used to assess whether existing habitat conditions are at a condition to support viable and diverse populations of native plant and animal species, including special status species.

- Plants and animals are diverse, vigorous, and reproducing satisfactorily.
- Noxious weeds are absent or insignificant in the overall plant community.
- Spatial distribution of species is suitable to ensure reproductive capability and recovery.
- A variety of age classes is present.
- Connectivity of habitat or presence of corridors prevents habitat fragmentation.
- Diversity of species (including plants, animals, insects, and microbes) are represented.
- Plant communities in a variety of successional stages are represented across the landscape.

A variety of native wildlife species are distributed across the allotment. Big game including moose, elk and deer are present; small mammal burrows were noted; ruffed grouse and numerous passerine species were seen during the allotment evaluation; numerous insect and arachnid species were observed. Wildlife and plants appear to be healthy, diverse, and reproducing satisfactorily. Although the BLM portion of the allotment is too small to sustain healthy and diverse wildlife communities on its own, it is connected on all sides to USFS, other BLM and undeveloped private land. There are no significant barriers to wildlife movement in and out of the allotment. Noxious weeds and invasive plant species are rare. The vegetative composition and reproductive capability are healthy throughout the allotment. A variety of successional stages and age classes of plant communities are represented across the allotment.

Preliminary Identification of Causal Factors and Recommendations

Based on the field review and observations, it appears the following factors may be contributing to land health standards not being achieved:

- There is no apparent factor. It appears that wildlife and livestock use may be concentrated on reach J-10-1 by a nearby fence line.

Final determinations will be made upon assessment of further information. It should be noted that if changing a current management or use will not result in progress toward meeting the standards, then the current management or use should not be considered a significant causal factor. The following actions may be necessary in order to make significant progress in achieving the Western Montana Standards for Rangeland Health:

- Riparian monitoring to determine trend.
- Construction of an alternative watering source for both wildlife and livestock

U.S. Forest Service

The JRWC will continue to work with the U.S. forest Service in an attempt to match up local priorities with already established Forest Service Watershed initiatives. Currently no coordinated activities or cooperative efforts are in place.

Additional Technical and Financial Resource Needs

TROUT UNLIMITED: GROUND WATER STUDY OF THE WATERLOO AREA

Additional funding needs to be sought through various grant programs to increase the on-site oversight time during the mid-July to mid-September time period. The goal of a greater on-site presence would be to shorten the reaction time on canal flow adjustments, and reducing the amount of excess diverted water. More on-site time could also be used to improve communication between waters users and the ditch manager.

The need exists to secure a long-term source of funding for implementation of the JRWC Drought Management Plan.

Irrigators in the watershed area and the Creeklyn, Parrot and Fish Creek ditch companies have been extremely cooperative in water conservation efforts, but they can only do as good of a job as their equipment will allow. Many diversion structures along major canals, although serviceable, should be replaced with more efficient structures. These new structures should be equipped with flow measuring equipment which would allow for more accurate adjustments by ditch walkers. Structures could also be equipped with telemetry equipment, which would allow remote flow adjustments. Capital cost could vary depending on the project; however.

TROUT UNLIMITED: UPPER JEFFERSON RIVER IRRIGATION DELIVERY IMPROVEMENT PROJECT

The recommended plan has three components: Canal sealant, canal management, and canal measurement and operating structures. The implementation of these recommendations will require funding. Only the canal structures (of which two are now in place) will require capital expenditure. A preliminary cost for the three operating structures and three measuring structures was $200,000. That cost is now considerably less with the earlier construction of two of the operating structures. The remaining costs are currently undefined.

The canal sealant and canal management programs will only require funding during dry years. This funding could be obtained whenever a drought year is expected or a reserve fund could be set up to fund one or more years of future needs. In 2006. the estimated cost of the sealant program was estimated at $445 per mile or $17,800 for 40 miles. The estimated canal system management to save 15 cfs, also in 2006 dollars was 12,100.

MONTANA BUREAU OF MINES AND GEOLOGY: GROUND-WATER INVESTIGATION PROGRAM

Currently, there are 3,981 well logs for Jefferson County and over 3000 well logs listed for the Jefferson River basin in the Montana Bureau of Mines Groundwater Information System (GWIC). This total for the basin includes all reported well logs for the basin down to the Missouri headwaters at Three Forks. Groundwater in the Jefferson River Basin is used for domestic, industrial, municipal and agricultural purposes.

The relationship between groundwater and surface water is very complex and controversial subject. Past and current conflicts between water rights holders' developers and other individuals and organizations with interest in Montana's waters resources have prompted the Montana Legislature to pass laws attempting to address these conflicts. Principle among these laws is the Montana Water Rights Laws.

Under Montana Water Rights Laws, the Jefferson River Basin is a considered a closed basin. This means that, due to chronic severe dewatering of the basin's water resources and associated over allocation of the basin's water resources, new surface water rights cannot be granted in the Jefferson River Basin with few exceptions. Permits for new groundwater rights can be issued, but a very rigid permitting process is required. Through this process, the applicant must conduct a hydrogeologic assessment that predicts

whether the proposed appropriation will result in net depletion of surface water, and provide an aquifer recharge or mitigation plan if required. Domestic wells of 35 GPM/10 acre feet per year are exempt from this process.

As a result of these issues across the State of Montana, the 2008 Legislature passed laws and provided funding for the Montana Bureau of Mines to develop the Ground-Water Investigation program. The JRWC has applied for participation in the Ground Water Investigation program for the watershed. The JRWC recognized that completion for water resources and the lack of detailed information on groundwater/surface water interaction in the watershed hampers the JRWC's ability to be proactive in regards to the future water issues facing the watershed. The JRWC has made the formal request to participate in the study and is now awaiting the reply from the Montana Bureau of Mines and Geology.

As stated in Bureau information on the program the study would provide specific scientific information on important water resource issues in the watershed including:

- Stream depletion from groundwater development by new withdrawals;
- Cumulative effects of existing and proposed water development;
- Groundwater/surface water response to changes in irrigation practices; and
- Evaluating future potential mitigation/offset plans in the basin.

A typical groundwater investigation will involve the compilation of existing data, drilling of test and monitoring wells, aquifer testing, water quality sampling, stream flow analyses, and extensive modeling of groundwater, surface water, and chemistry.

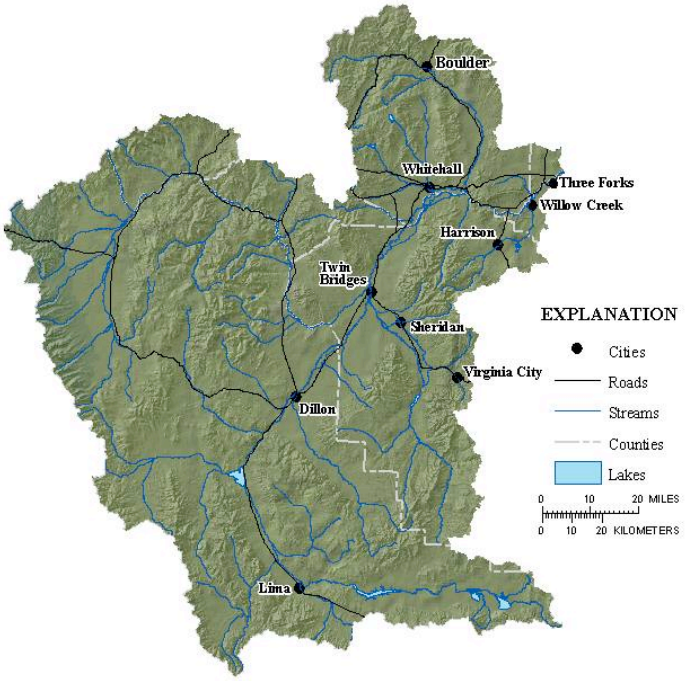
When completed the Ground-Water Investigation Program will deliver the following products.

- A detailed report that describes the hydrogeologic system.
- Models that stimulate hydrogeologic features and processes.
- A comprehensive set of hydrogeologic data available on line.

UNITED STATE GEOLOGICAL SURVEY: CLIMATE VARIABILITY & WATER QUANTITY "STREAMFLOW RESPONSE TO CLIMATE VARIABILITY AND CHANGE"

The Jefferson River, a headwater to the Missouri River, is formed by the confluence of the Ruby, Beaverhead, and Big Hole Rivers in southwestern Montana. Approximately 350 square miles of crops and pasture are irrigated by the Jefferson River and its tributaries. These same streams are also an important recreational and commercial destination for anglers and boaters. During the irrigation season, much of the flow within the tributaries to the Jefferson River is diverted before reaching the main stem of the river. During dry years, runoff and base flow to the main stem are severely reduced, stream flows are not sufficient for irrigation and boating, and increased temperatures in the river severely reduce habitat suitability for fish.

Recent trends and future climate models forecast a future with warmer temperatures across the western United States. Scientists have shown that warmer temperatures will produce more precipitation as rainfall instead of snowfall at lower and middle elevations and cause most of the mountain snowpack to melt earlier. These changes would tend to increase stream flows throughout the winter and spring and decrease stream flows in the summer. Decreased summer flows will negatively affect management of surface water resources in the Jefferson River and its tributaries and the capacity of the system to support agriculture, recreation, and fisheries.



Jefferson River Watershed

One way to understand streamflow trends and variability caused by changing climate conditions is by analyzing long-term streamflow gaging records. Currently (2010) the United States Geological Survey (USGS) operates 19 streamflow gaging stations on the Red Rock, Big Hole, Beaverhead, Ruby, and Boulder Rivers (combined stream length of 521 miles) and 3 gaging stations on the 90-mile long Jefferson River. Most of these gaging stations are funded through partnerships with Federal, State, and local agencies. Financial support is precarious from year-to-year and often gaging stations must be discontinued due to loss of funding. Missing streamflow data are impossible to replace and difficult to estimate.

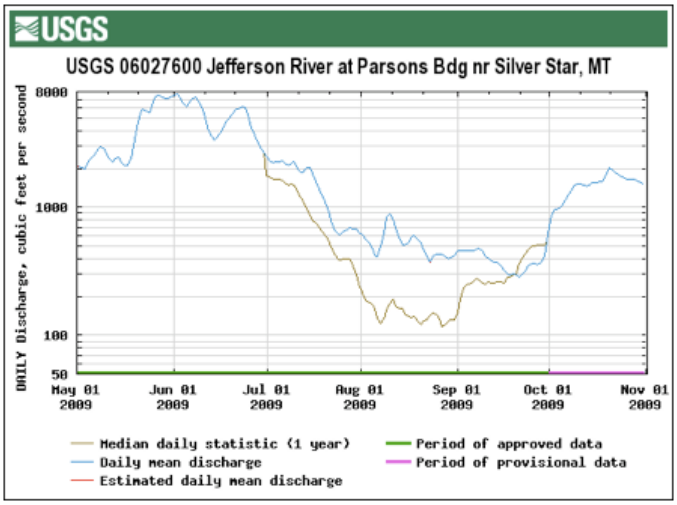


Photo and daily discharge data from the Jefferson River at Parsons Bridge near Silver Star (06027600).

COSTS

Development of the PRMS watershed model would cost about $260,000, and simulating climate change scenarios in PRMS is estimated to cost $190,000. The cost for maintaining a USGS real-time streamflow gaging station in 2010 is approximately $16,000. This includes quality assurance of the data and posting the data on the USGS website, http://mt.water.usgs.gov/.

Five Year Plan

The southern Jefferson River downstream of the confluence of the Beaverhead and Big Hole Rivers feed surface water and associated sediment into the Jefferson River main stem predominately via a number of small streams that discharge directly into the river.

The northern portion of the watershed, which drains into Jefferson Slough is significantly different. Streams that drain the northern watershed, (including a portion of the highlands, the Pipestone area, Homestake area, Whitetail area, and a significant portion of the Bull Mountains) feed their water and associated sediment into either Big Pipestone Creek or Whitetail Creek. These two creeks then feed their water and much of their sediment loads into the Jefferson Slough, which then drains into the Jefferson River. Subsequently, the sediment load must travel through miles of the lower gradient valley floor

Focus areas and priority resource concerns:

1. The Jefferson River Main stem
    a) Water quality & quantity
    b) Monitoring
    c) On farm irrigation
    d) Flood plain management

e) Fisheries enhancement

2. Tributary Riparian Issues
   a) Water quality & quantity
   b) Eroding banks
   c) Riparian health
   d) Historic placer mining
   e) Flood plain management

3. Upland Resource Concerns
   a) Conifer encroachment
   b) Rangeland health
   c) Riparian health

4. Transportation Related Water Quality Issues
   a) Unpaved road erosion control near streams
   b) Improved management of the I-90 corridor
   c) Road maintenance and runoff BMPS

5. Cross Cutting Issues
   a) Council operations
   b) Drought management
   c) Ground water depletion
   d) Invasive/noxious weed control
   e) Funding & fundraising

Interim Progress Indicators for WRP implementation

Each year, the JRWC will hold a WRP implementation review at the November board of directors meeting in order to complete and annual summary report. Measurable accomplishment will be reviewed and activities related to the accomplishment documented. The measurable milestone used for each measurable accomplishment will be those actions proposed in the WRP. If the proposed strategies and timelines are not being met the JRWC will review in depth the existing situation and take the necessary steps to update or revise the proposed activity.

Measureable Accomplishments

SOUTHERN PORTION OF THE WATERSHED

1. Coordinated Bank Flow Release from Clark Canyon Dam

Background: In 2006, the Bureau of Reclamation (Reclamation), Montana Area Office, and the State of Montana Department of Fish Wildlife and Parks (Department) signed a Memorandum of Understanding (MOU) regarding the management of the Clark Canyon Reservoir. The purpose was to define the roles and responsibilities of the Reclamation and the Development to examine the opportunities to improve the environmental health of Clark Canyon Reservoir and the Beaverhead River while continuing to provide water to entities holding contracts with Reclamation including irrigation, municipal, and industrial needs.
As a part of the agreed to items the Bureau of Reclamation agreed to consider actions which would have a direct positive impact on the Jefferson River.

- Study the potential of dedicated reservoir storage in order to accomplish higher river flows during naturally low-flow months in all years, and especially in average and drought years.
- Study the potential of dedicated reservoir storage to accomplish short-term bank-full events in average and wet years.

Objective: Implementation of the Clark Canyon Reservoir MOU

Strategies:

1. Meet with TU, FW&Ps, & Bureau of Reclamation representatives to seek implementation of the proposed actions.

2. Present JRWC's support for the proposed actions to the congressional delegation.

Responsibility: JRWC Board of Directors and JRWC Coordinator, seek issue implementation leadership from an individual JRWC Council member.

Timelines: Begin involvement in the process by mid 2010 and stay engaged.

2. Mayflower Gulch Project

Background: Mayflower Gulch is a natural drainage of about 5.3 square miles located at the end of the Parrot Ditch. The ditch uses the lower 3,800 feet of the gulch to convey excess water back to the Jefferson River. In addition to the wastewater from the ditch, the channel must convey the occasional floodwater from the upper gulch drainage.

The existing drop structure at the end of the ditch, although adequate for the ditch water, is too small to carry the floodwater. It either needs replacement or enlargement or the floodwater needs to be conveyed past the restriction. A replacement structure is proposed that will convey both the full ditch of water and the 50-year flood discharge. A preliminary cost-estimate for this structure and an additional channel stabilizing structure is 270,000.

To stabilize the lower 1,800 feet of the gulch a series of nine rock drops is proposed. Each drop would be 12 to 16 feet wide and would drop the stream channel by eight feet. In addition to the drops, the channel would be excavated as needed and steep slopes in the gulch would be flattened and shaped. The total estimated cost for the channel stabilization is $313,950. The work would eliminate most of the estimated 530 tons of average annual erosion in the gulch.

There would be no wastewater savings from this work. Benefits to the fishery from the reduced sedimentation in the river have not been determined.

Objective: Complete final design and present to key landowner for review.

Strategies:

1. Seek final design assistance from NRCS
2. Present findings to key landowners and agency staff.
3. Upon acceptance of a proposed alternative develop project funding strategy.

Responsibility: JRWC Board of Directors, JRWC Coordinator, seek leadership from a JRWC Council member.

Timelines:

1. Final design 2010
2. Acceptance of selected alternative, 2011
3. Development of funding strategy, 2011
4. Project Implementation, 2012

3. Fish Creek Project

Background: Fish Creek originates in the Highland Mountains and enters the Jefferson River upstream of Whitehall, Montana. The upstream reaches of Fish Creek provide valuable fish and wildlife habitat and contain a small population of native Westslope cutthroat trout. Habitat alterations and relatively poor riparian health in the upper reaches of the stream result in a tenuous situation for maintaining the cutthroat

trout population. Thus, the Jefferson River Watershed Council is exploring measures to improve the health of the stream and the associated riparian corridor to enhance habitat conditions in the drainage.

In 2007, Montana Fish, Wildlife and Parks and U.S. Forest Service conducted fish surveys in 11 sections of Fish Creek to determine abundance of Westslope cutthroat trout and eastern brook trout. Cutthroat trout were found in the upper four sections without competition from brook trout due to the presence of a natural barrier above the confluence with Mammoth Creek. Downstream of this natural barrier to fish movement near Mammoth Creek, moderate numbers of brook trout were found with cutthroat trout, and downstream of Pigeon Creek, brook trout were found in relatively large numbers were they are apparently out-competing native cutthroat trout.

Objective: Continue to seek the development of cooperative efforts between federal and private landowners on the upstream reaches of Fish Creek.

Strategy: Seek opportunities to foster cooperative efforts through ongoing discussions and seeking funding for conservation practice installation.

Responsibility: JRWC Board of Director and JRWC Coordinator

Timeline: Ongoing

4. Hell's Canyon Creek

Background: The Hells Canyon area has eroding banks with insufficient riparian cover erosion occur along significant but intermittent reaches of both the lower and upper portions of the creek. Some riparian areas are managed well and others need riparian restoration work. Riparian health appears to be fair in upper portions of the watershed with a few heavily impacted areas of poor health. The lower portions of the watershed exhibit Good, Fair and Poor riparian condition and impacts are primarily associated with grazing and haying within the riparian zone. In the upper portions of the watershed effects from placer mining including channelization and degraded riparian health are apparent. Road maintenance should occur on many unpaved road crossings.

A project accomplished in the mid-1990 by the Montana Department of Fish Wildlife & Parks resulted in a mechanical fish screen, a water lease and a successful conversion to gravity-fed sprinkler irrigation. This effort resulted in the population increase and expanded spawning use of Hell's Canyon Creek by rainbow and brown trout. Additionally, the rainbows from this stream are the fish used in all other restoration projects along the Jefferson where imprinting was used to improve the over-all fish population.

Objective: Seek opportunities to become engaged and supportive in efforts supported by landowners and key federal and state agencies which support the implementation of practices which address the concerns identified in the TMDL.

Strategy: Provide a forum for projects to emerge.

Responsibility: JRWC Board of Directors and JRWC Watershed Coordinator

Timelines: Ongoing

5. Slaughterhouse Slough/Jefferson Slough

Background: The background information affecting the Slaughterhouse Slough and indirectly affecting the summer base flows of the Jefferson Slough all started at least thirty years ago. At one time, Slaughterhouse Slough was the main channel of the Jefferson River and is still the county line between Madison and Jefferson counties. The east channel (the present main channel) existed as a lesser and secondary river channel. The Jefferson Slough was supplied with water coming from Pipestone and Whitetail Creeks and was supplemented (especially during the high flow period) by Jefferson River flows that entered the upper Jefferson Slough area via numerous small finger channels originating from the (then) main Jefferson River channel in the Slaughterhouse Slough area (just south of Whitehall).

Several channel changes occurred in the east (lesser Jefferson River channel) in the late 1970's. These channel changes cut-off at least two large meander loops and significantly shortened that channels length. What then occurred was the initiation of a severe "headcut". A "headcut "is the erosion of a channel bottom caused by excessive velocity and moves in an upstream direction. The headcut moved upstream to the location of the split channel area at Renova. Once the east channel was deeper, the majority of the streamflow went to the east and left the Slaughterhouse Slough in a reduced flow condition.

A diversion channel had been cut from the Slaughterhouse Slough channel to the upper Jefferson Slough channel to ensure season-long water supplies. The diversion of water from the main Jefferson River channel was becoming an increasingly important issue to the Jefferson Slough irrigators, since less and less water was coming down from Pipestone and Whitehall Creeks.

By the mid-1980's, this situation had become very controversial. With the requirements of stream permitting (310 Law) much of the problem focus fell directly onto the Fish and Game Department. After many volatile meetings, a plan of action was decided upon. An independent consulting group was selected (Geomax) to design and construct a "drop-structure" to better balance the flows between the two channels at the Renova site. The bulk of the expense for this work was paid for by the Golden Sunlight Mine and the Montana Fish and Game. The resulting drop-structure divided the channel in an appropriate fashion for a considerable length of time.

By the late 1990's, talk was again surfacing about needing to do some additional work in the area of the drop-structure. What had happened in the 15 or so years was that the boat passage notch was not working very well, the structure had settled and was not dividing the flows as well as in the past and that a large island had developed above the structure that was causing the main channel to move to the west.

After the Jefferson River Watershed Council (JRWC) was started, the Slaughterhouse Slough issue was thought to be worthy of the Council's attention. Trout Unlimited, as a member of the JRWC, volunteered to seek public support and would attempt to locate adequate project funding. A contracted engineer, Joe Van Mullen, accomplished a site review, site survey and preliminary design. A public meeting was held and Tim Mulligan and Bruce Rehwinkel traveled to Washington D.C. to meet with our congressional delegation in an effort to find funding. Eventually, the state office of the NRCS agreed to fund this project up to $300,000. Again meetings were held with all landowners and then later with only the irrigators. At that time, additional designs were requested. Joe Van Mullen re-designed the project to reflect a series of options and their

relative costs. Later, a design class from MSU was asked to make suggestions. All negotiations finally deteriorated and the funding was returned to the NRCS.

New concerns over the situation were raised in April 2010 by a landowner. A meeting was held on April 14th with commissioners from both Madison and Jefferson County, landowners and others. Commissioners from both counties agreed to begin meeting and seeking funding for a technical assessment of the problem.

Objective: The JRWC will continue to meet with commissioners from both counties and others to assist in obtaining the necessary funding and technical design work to address the problem in a way that all issue are addressed.

Strategy: Attend meetings held by Madison and Jefferson County Commissioners and provide assistance in addressing the problem based on an objective of fully addressing all issues, not continuing the strategy off placing band aids on the problem.

Responsibility: JRWC Board of Directors, JRWC Coordinator, and Commissioner Jefferson, and Madison County Commissioners.

Timelines: Ongoing until problem is addressed

6. Cooperation with the DNRC in the Ruby Dam Rehabilitation Project

Background: Ruby Dam and Reservoir are located about midway down the Ruby River drainage. The dam is owned by the DNRC and managed by the SWPB. The project has been operated by the Ruby River Water Users Association since the dam was built in 1938.

The spillway condition has been deteriorating for many years. An inspection conducted by the Army Corps of Engineers (COE) in 1981 found the spillway capacity inadequate, with the spillway showing serious deterioration. For this reason, the Corps classified the dam as unsafe according to the standards set forth under the National Dam Inspection Act, Public Law 92-367. The spillway has since deteriorated to the point that replacement of the entire structure is needed.

The proposed action calls for the construction of a new spillway that will meet or exceed all current state dam safety requirements. The existing low level outlet control gate will be removed and the downstream portion of the outlet works conduit will be slip lined with a steel penstock. A new control gate will also be installed on the downstream end of the penstock at the dam toe. A new outlet terminal structure will also be constructed to replace the existing deteriorating structure.

Sedimentation has reduced the storage capacity of the reservoir by approximately 2,000 acre-feet over the past 70 years. In order to enhance and reestablish the original storage capacity of the reservoir, the proposed action calls for the spillway crest to be raised 7.0 feet above the existing flashboards, and the dam crest raised 4 feet. This will increase the existing capacity of the reservoir from 37,642 (existing top of flashboards) to 45,115 acre-feet. This will provide an additional 7,473 acre-feet of storage (recovers the 39,850 A/f original water right plus 5,265 acre-feet), of which 2,600 acre feet is proposed to become an established minimum pool for the reservoir, downstream fisheries and their beneficial uses. *

This project will have approximately 2,665 acre feet of "new" water that will likely be designated to non-consumptive uses. The right for this water will likely be subject to prior appropriations downstream and subject to the upper Missouri moratorium on further water right claims. It is this waters that Trout Unlimited (TU) has been pursuing. This amount of water – if delivered in total – could increase Jefferson River flows by approximately 41 cfs for the 30 day drought period. TU has already submitted to different grants for a total of over $900,000 to be added to the DNRC budget of $13,000,000. The funds sought by TU are intended to be used for a prorated share of the water and the associated construction costs, a Trust Fund to cover the annual Operation and Maintenance assessment and infrastructure required to ensure delivery. The final decision on water rights and their availability will not occur until July 2010.

Objective: The JRWC supports ongoing efforts to secure additional stored water which can be dedicated to the Jefferson River drought-year base flow. The process to achieve this goal is mainly being handled by the Montana Water Project (Trout Unlimited) and FWP. The JRWC needs to support these efforts as the water rights for this "new" water are being decided.

Strategy: The Ruby Dam Rehabilitation Project's "Preferred Alternative" supports the raising the dam and creating 2,665 acre feet of newly stored water. As was done at Painted Rocks Reservoir on the Bitterroot River, outside funding was secured to cover the additional water storage and that was made available to main-stem interests. The most practical approach is for the JRWC to continue working with Trout Unlimited Montana Water Project and FWP to negotiate for this water. Letter-writing support may be needed at critical points in this process.

Responsibility: The JRWC needs only to remain informed on the process and support Trout Unlimited and FWP's efforts.

Timelines: The most current information indicates that the Montana DNRC will be taking their water right changes out to the public by July 2011 or a little later. That is the critical time for public support and over-view of the water rights being offered.

NORTHERN PORTION OF THE WATERSHED

1. Addressing the Impacts of Sediment Deposition on the Northern Portion of the Jefferson River Watershed

Background: The Big Pipestone Creek, Little Pipestone Creek, Whitetail Creek, and the Jefferson Slough have significant impacts on the local area. They provide several miles of riparian corridor in the valley, have provided popular fishing opportunities in the past, and are important sources of irrigation water to many ranches. There is also significant development within the flood plain of the lower portions of these streams, particularly along Big Pipestone Creek and the Jefferson Slough.

In the last several years, these streams have experienced significant dewatering and very intermittent and short duration bank full events during spring runoff. As a result, the sediment load from these steams is not

being handled efficiently, and sediment is building up in the stream channels particularly in lower Big Pipestone Creek and the Jefferson Slough. In addition, the sediment problem is being aggravated by significant sheet erosion in the uplands of the watershed and severe erosion in the Pipestone Creek channels.

The consequences of dewatering, a lack of bank full events, and sediment build up are significant. The impacts include changes in floodplain size and health and a subsequent increase in potential flood risk to residents of Whitehall and along the Jefferson Slough; impairment of the health of the riparian corridor, wetlands areas, and wildlife populations along these streams; impacts on fisheries including loss of spawning habitat; and impacts on irrigators.

Objective: Implementation of vegetative and structural conservation practices across the northern end of the watershed to stop excessive sediment deposition on the flood plain and its associated impacts.
Strategies:

a) Secure reassessment of the 1984 Whitehall Flood Plain Study by the NRCS.
b) Secure conservation needs assessment by the NRCS with accompanying conservation practice recommendations through the watershed with an emphasis on the northern portion of the watershed.
c) Secure cooperation on federal lands from BLM and USFS
d) Seek cooperation from the Montana Department of Transportation
e) Seek funding and watershed initiative from NRCS for proposed solutions

Responsibilities: JRWC Board of Directors, JRWC Coordinator, NRCS Jefferson Valley C.D., Town of Whitehall, Bureau of Land Management, U.S. Forest Service, NRCS & the Montana Department of Transportation

Timelines:

a) Plan development 2010
b) B) Secure necessary cooperation from agencies, & private landowners 2010
c) Secure funding/watershed initiative from NRCS

CROSS CUTTING ISSUES

1. Ground Water Depletion

Background: The Jefferson River has been subjected to more stream closures than any other river in Montana. The Jefferson River has depressed trout populations due to primarily to severe dewatering and elevated water temperatures that occur during drought-year irrigation seasons in various river segments.

The Jefferson River Basin is designated as a closed basin due to over appropriations and water availability problems. Because of this closure and the resultant limitations on new surface water rights there is currently a shift toward new water developments that rely on groundwater sources.

The JRWC has a drought management plan in place that relies on voluntary action from all water users to maintain critical flows in the Jefferson River while respecting water rights. In addition, since 2000, the JRWC has initiated a limited groundwater study and an intensive stream gauging initiative.

Through the stream gauging program, the JRWC has established that from 2000 through 2007; mean August flow at the headwaters (Twin Bridges USGS gage) ranged from about 300 cfs to about 440 cfs. During the years that flow was approximately 300 cfs at Twin Bridges (2000, 2001, 2006, 2007), flow at Parsons Bridge (below the major diversions) was 17% of the inflow despite the fact that average ditch withdrawal was about equaled or exceeded the available water measured at Twin Bridges .

In other words, average August flow at Parsons Bridge ranged from 48 to 54 cfs in 2000, 2001, 2006, and 2007 despite the fact that measured ditch withdrawals between Twin Bridges and Parsons Bridge equaled or exceeded the Jefferson River flow measurement at Twin Bridges. These flow comparisons indicate that approximately 50 cfs of seepage flow (groundwater, direct irrigation return flow, irrigation seepage return flow, or other sources of inflow) is critical for keeping the river alive during severe drought conditions.

Through these locally developed and managed initiatives, the JRWC has successfully obtained cooperation from water users to address the severe dewatering issue on the Jefferson River. However, with the increased development of new ground water sources the council is concerned that the advances gained to date will be set back. The proposed ground-water investigation is critical to the council's ability to address the increased ground water development issue.

Objective: Obtain approval for the Montana Bureau of Mines & Geology (MBMG) to conduct a ground water study in the Upper Jefferson River watershed.

Strategies:

a) Letter of request submitted to MBMG
b) Seek legislative support for the request
c) Attend stare committee meeting to prevent testimony on need

Responsibility: JRWC Board, Council, Watershed Coordinator, and MBMG

Timelines: Application submitted waiting response

2. Climate Variability & Water Quantity Stream flow Response to Climate Variability and Change

Background: One way to understand streamflow trends and variability caused by changing climate conditions is by analyzing long-term streamflow gaging records. Currently (2010) the United States Geological Survey (USGS) operates 19 streamflow gaging stations on the Red Rock, Big Hole, Beaverhead, Ruby, and Boulder Rivers (combined stream length of 521 miles) and 3 gaging stations on the 90-mile long Jefferson River. Most of these gaging stations are funded through partnerships with federal, state, and local agencies. Financial support is precarious from year-to-year and often gaging stations must be discontinued due to loss of funding. Missing streamflow data are impossible to replace and difficult to estimate.

Hydrologists at the USGS Montana Water Science Center will use the USGS Precipitation-Runoff Modeling System (PRMS) to model the watershed. Daily temperature and precipitation data from National Weather Service climate stations and from Natural Resources Conservation Service Snowpack Telemetry (SNOTEL) stations will be collected along with topography, soils, and vegetation information for the watershed. The model will be calibrated to historical streamflow data. Projected temperatures and precipitation output from a regional climate model developed at Oregon State University will be input to the PRMS model to estimate future streamflows in the Jefferson River. Biologists at the USGS Northern Rocky Mountain Science Center will interpret the biological impacts from the projected streamflow changes.

USGS hydrologists and biologists will determine which streamflow gages are vital for understanding streamflow variability across the Jefferson watershed. The USGS will continue to operate gaging stations and, if possible, re-establish discontinued gaging stations.

Objectives:

a) Develop a watershed model for the 9,635-square mile Jefferson River Watershed. This model will enable users to calculate streamflows in the Jefferson River and its tributaries given daily inputs of precipitation and temperature.
b) Continue fish population sampling in the Jefferson River so fisheries data correlated with modeling results.
c) Model streamflows resulting from future climate scenarios.
d) Retain existing streamflow gaging stations & re-established other s previously put in place.

Strategies:

a) Seek support of other Missouri Headwaters Watershed
b) Meet with congressional delegation to seek support for federal funding
c) Develop funding requests
d) Work with USGS & others to support funding requests

Responsibility: JRWC Board, Council, Watershed Coordinator, USGS, and FW&P's,

Timelines: Action underway by council. Work on obtaining funding will be ongoing.

3. Drought Management Plan

Background: The purpose of the Drought Management Plan is to reduce resource damage and to aid in the equitable distribution of water resources during water critical periods. The plan is a voluntary effort involving local interests including agriculture, conservation groups, anglers, municipalities, businesses, and government agencies.

The first Drought Management Plan was prepared and approved by the Jefferson River Watershed Council on 25 July, 2000. The plan was implemented for five years (2000 through 2004) and increased flow at the target location (Waterloo Gage below Fish Creek Canal) was documented by monitoring river and irrigation canal flows during the period. The drought management plan goal of maintaining at least 50 cfs at Waterloo was not always met during these years, but cooperation by water users helped improve flows at this critical

location. Prior to developing the drought plan, the Jefferson River was severely dewatered at this location during dry years, and in 1988, only 5 cfs was measured at the Waterloo Gage location.

Drought Management Plan Triggers:

The 2000 version of the Drought Management Plan established flow triggers for directing actions of anglers, water users, and government agencies. The triggers were revised in February 2005 based on observations of the previous 5 years of plan implementation. As of 2007, the current drought plan triggers are listed below.

The following prescribed actions are to occur when the river flow drops below the following levels or when maximum daily water temperature exceeds 73 degrees F for three consecutive days at the Twin Bridges Gaging Station (06026500):

600 cfs: The 600 cfs trigger flow at the Twin Bridges Gage serves to alert water users and anglers of declining flow conditions and requests voluntary water conservation measures and angler awareness of stress caused by fishing during periods of low flow and high water temperature. A press release will be issued to inform the public of low flow conditions on the Jefferson River.

280 cfs: Montana Dept. of Fish, Wildlife & Parks will evaluate the need for a mandatory fishing closure throughout the Jefferson River at this flow level at the Twin Bridges Gage. Voluntary reduction of irrigation and municipal water use is also initiated when the river drops below 280 cfs, and weekly meetings with water users will be coordinated by JRWC. The meetings will update water users on inflows to the river, ditch withdrawals, and status of the flow at the Waterloo Gage to attempt to maintain a minimum flow of 50 cfs at Waterloo. The angling closure will remain in effect until flows reach or exceed 300 cfs for seven consecutive days at the Twin Bridges Gage.

73 Degrees F: Independent of stream flow level, Montana Dept. of Fish, Wildlife & Parks can implement a mandatory time of day closure to prohibit angling throughout the Jefferson River between the hours of 2:00 PM to 12:00 AM (midnight) when maximum daily water temperature equals or exceeds 73 degrees F (23 degrees C) for three consecutive days. Lifting of summer temperature restrictions will be conducted on September 15 unless an earlier/later date is designated by the FWP Commission.

Objective: Continue implementation of the Drought Management Plan in cooperation with FW&P's, Trout Unlimited, and local irrigators.

Strategy: Follow established procedures

Responsibility: JRWC Board of Directors, JRWC Coordinator, and FW&P's

Timelines: Ongoing

4. Invasive/Noxious Weed Control

Background: Noxious weed management in the watershed area is the responsibility of the Jefferson County Weed Board. The Board is granted certain powers and charged with certain duties under Section7-22-2109 of the County Weed Management Act. The board is required to administer the district's noxious weed

program, establish management criteria for noxious weeds on all lands within the district, make all reasonable efforts to develop and implement a noxious weed program on land owned by a federal agency.

The weed district and the JRWC are now cooperating to provide equipment for spraying weeds in difficult to reach areas of the watershed. The JRWC has purchased an ATV mounted sprayer and seeder available for use by organizational and landowners. The weed district is responsible for leasing of the equipment on behalf of the JRWC.

Objective: Assist the Jefferson county Weed Board in controlling the spread of invasive/noxious weeds in the watershed area.

Strategies:

a) Coordinate the rental of the ATV sprayer and seeder with the weed district

b) Continue to coordinate with the weed district on the development of coordinated weed grants in the watershed.

c) Integrate invasive/noxious weed control in all watershed activities

Responsibility: JRWC Board of directors, Jefferson County Weed district, and JRWC Watershed Coordinator

Timelines: Ongoing

5. Thermal Modification for Irrigation Return Flows through Wetland Construction

Background: There are large volumes of irrigation return flow that re-enter the Jefferson River, potentially adding heated water to the system.

Objective: Develop a pilot project which can be then applied to other locations in the Jefferson River Watershed Area.

Strategies:

a) Work with NRCS, WET, TU & FW&Ps to identify potential sites

b) Meet with landowners to gain cooperation

c) Develop project plans

d) Seek funds for implementation

e) Promote the project to others in the watershed

Responsibility: JRWC Board of Directors, Watershed Coordinator, WET, NRCS FW&Ps

Timelines: Beginning June 2010 until completion

6. Council Operations

Background: The organization structure includes the JRWC Board of Directors, an overall watershed council made up of local organizations and agencies and individuals committed to supporting local efforts in the watershed.

Objectives: Insure local input into all planning and implementation projects carried out by the council

Strategies:

a) Conduct a minimum of 6 monthly board or council meetings yearly
b) Finalize the development of a JRWC Watershed Restoration Plan (WRP) through a series of local planning meetings and postings on the JRWC web site.
c) Continue the publishing of the JRWC newsletter.
d) Develop an annual Plan of Work for the JRWC based on the WRP
e) Develop an annual operations budget

Responsibility: JRWC Board of Directors, and JRWC Watershed Coordinator

Timelines: Ongoing

7. Funding and Fund Raising

Background: In order to accomplish its mission, the JRWC needs funds to pay for operating costs as well as specific projects. Operating funds go to pay for the JRWC's coordinator, communication through a variety of means, meetings, insurance, office supplies and fees. Project funds pay for specific projects that are consistent with the JRWC's mission and identified in the JRWC's work plan.

The JRWC strives to attain stable and sustainable funding by achieving an appropriate balance among the following funding sources:

- Grants;
- Membership contributions;
- Major donors; and
- Fundraising events.

The JRWC recognizes that education and outreach activities are essential to its mission. Education and outreach will be integrated into fundraising activities whenever possible and appropriate.

Objective: Secure ongoing funding for implementation the the JRWC Watershed Restoration Plan and Annual Plan of work.

Strategies:

a). Annual Budget- Develop an annual budget for the JRWC to guide fundraising activities as well as day-to-day spending decisions.

b). Fundraising Targets-- Set targets for each fundraising category to raise sufficient funds to cover the JRWC's annual budget.

Responsibility: JRWC Board of Directors in consultation with Council, and JRWC Watershed Coordinator

Timelines: All developed at first board of directors meeting annually, taken to the council for concurrence the first council meeting g annually.

8. Outreach and Education

Background: JRWC achieves all of its successful efforts through voluntary support for its activities. A proactive outreach and education program is necessary to maintain support for the JRWC and to insure that JRWC's projects and associated program activities are know and supported by watershed residents, and potential funders.

Objective: Have a proactive outreach and education plan for all JRWC programs and projects which promotes and educates stakeholders on the JRWC's activities.

Strategies:

1. Identify Target audiences

Compile and provide resource information to realtors, residents and local groups in the watershed area. Priority groups:

New residents
Realtors
Land managers
Local organizations
Local governments
Canal Managers
Legislators & congressional delegation

2. Implementation Tools

a) JRWC Web site;
Strategy: Continue to update as needed
Responsibility: JRWC Coordinator
Timelines; Ongoing

b) Workshops:
Strategy: Organize stand alone & cooperative workshops
Responsibility: JRWC Board, Council, Coordinator
Timelines: Scheduled on an ongoing basis

c) Educational/Field tours:
Strategy: Scheduled on an as needed basis

Responsibility: JRWC Board, Council, Coordinator
Timelines: Continue to review and distribute materials that already exist
Assist in advertising workshops, conferences and other informational and education activities being implemented by JRWC partners.

d) JRWC News Letter
Strategy: Develop a minimum of two per year
Responsibility: JRWC Watershed Coordinator
Timelines: Twice annually

Monitoring and Long Term Evaluation

In order to collect baseline data and create the ability to conduct long term monitoring the JRWC is establishing a Watershed Water Quality Monitoring program led by a qualified specialist in conjunction with local volunteers.

The objectives of the JRWC's baseline watershed assessment program include:

- Coordinating with the local school system to provide educational opportunities for students;
- Providing information and outreach on current water quality issues and how those issues impact surrounding communities, landowners and wildlife;
- Collecting water quality data that meets the Montana Department of environmental Quality (DEQ) requirements; and
- Providing a long term assessment of water quality to measure effectiveness of future conservation practices implemented in the watershed.
- In-depth monitoring will be conducted on individual restoration projects sites prior to and after their instillation.

To meet these objectives, four tasks are planned which include:

Task 1 Preparing a Sampling and Analysis plan (SAP) and Quality Assurance/quality control (QA/QC) Plan meeting DEQ requirements,

Task 2 Conducting the field testing,

Task 3 Conduct onsite data collection at individual restoration project sites prior to project instillation and long term site monitoring after project completion, and

Task 4. Short Term Criteria

During the WRP implementation review the JRWC will develop an annual Summary Report. This report will be an assessment of water quality trends and progress in watersheds having completed watershed restoration projects. This assessment will describe if short term progress is being made toward TMDL targets.

Task 5. Preparing an Annual Data Summary Report.

In addition to the above tasks the Montana Department of Fish Wildlife and Parks, (FW&P)and the Golden Sunlight Mine will increase existing monitoring programs in conjunction with the JRWC or will implement new sampling programs.

The initial monitoring sites are planned for the following locations. These proposed sites relate to the JRWC's immediate focus on the northern portion of the watershed. This is necessary in order to address the major water quality issues associated with streams in that portion of the watershed. The southern portion of the watershed will be addressed as the opportunity arises and resources become available to the JRWC, and upon successful completion the major restoration requirements in the Northern portion of the watershed.

- Headwaters of Big Pipestone Creek
- Pipestone Creek near highway 55 bridge
- Upper whitetail Creek
- Whitetail creek adjacent to the Whitehall High School
- Down gradient of confluence of Slaughterhouse Slough and Whitetail Creek
- Jefferson Slough prior to the confluence with the Boulder River

The first year of the monitoring program will initiate the following sampling at the 6 locations, collecting the data listed below. After establishment of the baseline the first year of the program the data collection may be modified.

- Ph, Specific Conductance, Temperature, dissolved Oxygen, and Flow rate;
- Total dissolved Solids and Total suspended Solids
- Nutrient analysis (consisting of total persulfate nitrogen, nitrate-nitrite as nitrogen, total ammonia as nitrogen, and total phosphorous)
- Documenting Stream bank Stability
- Macroinvertebrate documentation; and
- Total Recoverable metals (Copper, iron, Lead, mercury, Zinc) and hardness as calcium carbonate analysis).

Jefferson River Maps