Fish Migration Improvement on the Boulder River

Whitehall Field Office

Targeted Implementation Plan

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2023 Jefferson County Targeted Implementation Plan (TIP) Summary

The Boulder River near Cardwell Montana is a major tributary to the Jefferson River. The Boulder River is a high value coldwater fishery and provides significant agricultural production in Jefferson County. Irrigated croplands in the valley bottom are a vital asset to many agricultural operations, although streamflow is often limited for providing optimal agricultural and fisheries benefits. Therefore, improving irrigation efficiency at strategic locations will benefit both the aquatic ecosystem and agriculture.

PRIMARY GOAL

The primary goal of this TIP is to provide aquatic habitat connectivity between the Jefferson and lower Boulder Rivers, and the spawning area at Cold Springs (Figure 1). This will be achieved by removing the channel-spanning diversion dam ("Shaw Diversion") and two more diversions, and the three associated irrigation supply ditches (Figure 2). The diversions and open ditches will be replaced with screened pumps placed in the river. The pumps will supply water to center pivots on croplands that are currently flood irrigated.

ASSOCIATED GOALS

Eliminating fish entrainment in ditches will be another benefit of converting to sprinklers and direct pumping from the river. Water will remain cooler in the river as compared to being diverted into ditches. Replacing wild (uncontrolled) flood irrigation with efficient sprinkler systems, and wetting only the root zone of the crop, will use less water and eliminate deep percolation and return flows back to the river, along with the sediment, nutrients and pathogens carried by the water. An irrigation water management plan, or IWM, on each field will provide guidelines for proper irrigation. Noxious weeds are present in the project area, and will be controlled to prevent their spread during installation of the ground-disturbing practices planned for fishery improvement.

This TIP will provide immediate, measurable benefits to two coldwater fisheries in Southwest Montana. 1. Fish will have access to thermal refugia in the cooler tributary to the Jefferson River. 2. No fish will be lost to irrigation ditches through entrainment after practice implementation. 3. Additional species of native and wild fish will be able to move upstream past the current location of Shaw Diversion to complete their life cycle.

PRIMARY RESOURCE CONCERN – AQUATIC HABITAT FOR FISH AND OTHER ORGANISMS

Fish passage issues due to an abrupt diversion and open ditches, along with high water consumption using the flood irrigation method is the focus of this project. Removing or

modifying the channel-spanning diversion dam to provide connectivity to the spawning area at Cold Springs will eliminate fish passage problems. Upstream movement of fish will be made possible, and entrainment in irrigation ditches will no longer be an issue.

SECONDARY RESOURCE CONCERNS

1. Inefficient Irrigation Water Use – Long distances across wild flood fields require long set times, and result in losses to groundwater.
2. Elevated Water Temperature – Diverting water into ditches with mostly denuded banks rather than allowing it to remain in the shaded river exposes more water surface to sunlight and heat than would be exposed if it was in the river.

Other Resource Concerns:

1. Surface Water Depletion – Ditch loss, and loss of water with the practice of uncontrolled wild flood irrigation depletes surface water.
2. Nutrients, pathogens, and sediment transported to surface and groundwater – Dislodged soil particles, fertilizer, and manure from grazing animals are transported by wild flood irrigation to receiving waters, compromising water quality and making them unavailable for plant use.
3. Plant Pest Pressure – Noxious weeds are present, and although not directly related to the focus of this TIP, they are nonetheless a resource concern and need to be controlled prior to ground disturbing conservation practices.

The total estimated project cost is $800,000. The financial request to NRCS through the Environmental Quality Incentives Program is estimated at $300,000 in Fiscal Year 2023 and Fiscal Year 2024 funding. Approximately $300,000 will be invested by the landowners for irrigation practices. The remainder of funding for project needs, about $200,000, will be provided by partners through various funding sources. Practices will be completed by 2026.

Geographic Focus

The project area includes two landowners who are located on the lower 5 miles of the Boulder River. Both have expressed interest in working with the Natural Resources Conservation Service (NRCS), Montana Fish, Wildlife & Parks (FWP), and Montana Trout Unlimited (MTU) to implement an irrigation efficiency project involving croplands near the mouth of the Boulder River and three open ditch irrigation diversions (Figures 1 and 2).

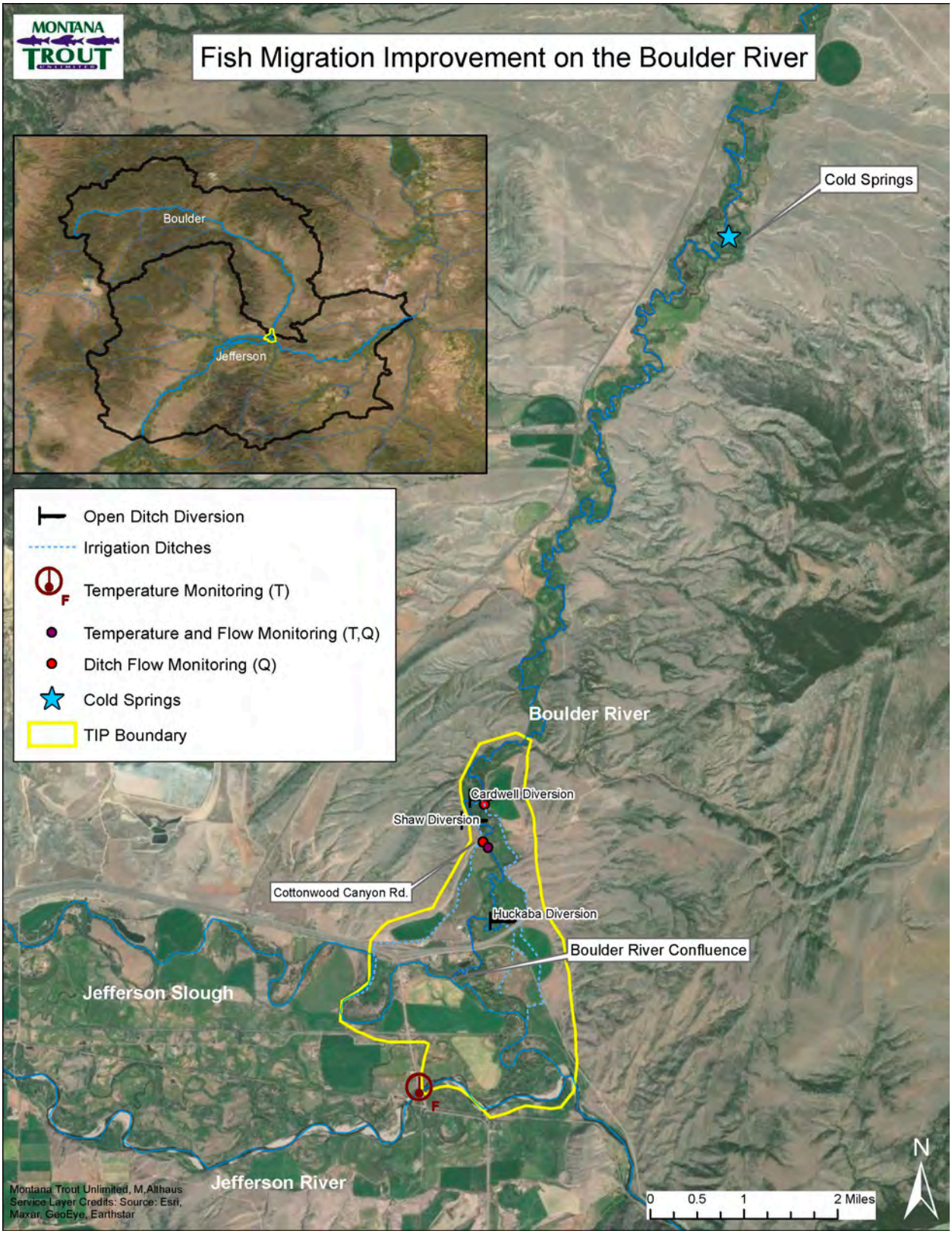

Figure 1. Overview of the lower Boulder River from Cold Springs to the confluence with Jefferson Slough.

Geographic Focus - Background Information

The Boulder River enters the Jefferson River near the midpoint of the Jefferson's 83-mile length. It is an ecologically significant contributor to the Jefferson River because of its large drainage area (769 square miles) and the cool base-flow it provides. The highly reliable and productive Cold Springs provides approximately 41-45 cfs of 54-degree spring water to the Boulder about ten miles upstream of the confluence (Figure 1). Brown Trout in the lower Jefferson River travel long distances to spawn in the Boulder River near Cold Springs, and thousands of juvenile trout move downstream after hatching. The existing diversions and ditches in the project area significantly interrupt this important process.

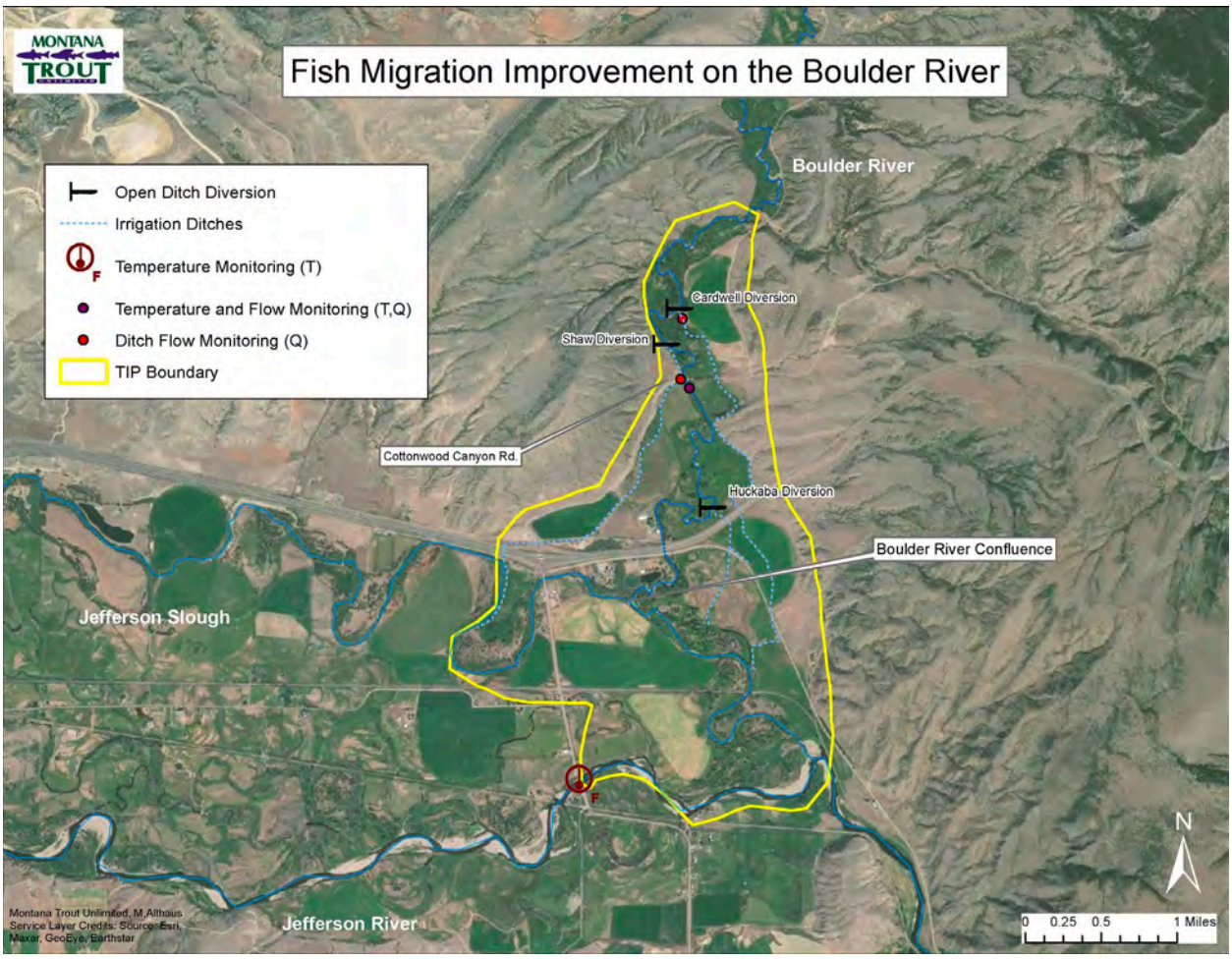

Figure 2. The boundary of lower Boulder River irrigated acreage, location of three open ditch diversions, and monitoring sites.

The project area (Figure 2) was selected because it is at a key location in the Jefferson River watershed where increased fish passage and improved irrigation systems can benefit aquatic life in both the Boulder and Jefferson Rivers. Interested landowners at this location

also provide an important basis for selecting the TIP project, as they are willing to make the necessary irrigation changes to restore habitat connectivity. Due to irrigation diversions and senior water rights often being located near the confluence of tributaries, opportunities to develop win-win solutions for fisheries and agricultural interests are often strategically located near the confluence.

Figure 3. Shaw Diversion during irrigation season with flashboards installed. Upstream fish passage is significantly impaired during summer and fall for all fish including adults.

Boulder River Fishery Summary

Brown Trout are the most common sport fish species in the Boulder River, and the Boulder River also serves as an important spawning tributary of the Jefferson River. Brown Trout spawners move into the Boulder River during late summer, spawn during the fall, and juveniles hatch and return to the Jefferson River during the first or second year of life. Spawning fish are drawn to the quality inflows of Cold Springs upstream of the Shaw Diversion. Improving the connection between the Boulder and Jefferson Rivers also benefits other fish species in the area.

Eliminating three irrigation diversions will assist the Brown Trout fishery in a variety of ways:

- Upstream migration of spawning fish is improved by removing a seasonal barrier, Shaw Diversion (Figure 3).
- Downstream entrainment of juvenile Brown Trout into three irrigation canals is eliminated by using screened pump sites in the river.
- Approximately 7 to 10 cfs of streamflow improvement in the lower Boulder River will result from switching from open ditch/flood irrigation to pumping and center pivot irrigation.
- The increased flow and relatively cool water of the Boulder River will benefit the warmer Jefferson River and the associated coldwater trout fishery.
- Water quality of the Boulder River will be improved with increased flow and dilution, and by restoring irrigation diversion grade.
- Water savings will be protected legally by leasing water rights for instream purposes.

Resource Concerns

Primary Resource Concern – Aquatic Habitat for Fish and other Organisms

Three irrigation diversions deliver surface water for wild flood irrigation and off-stream pump sites for wheel lines and pivots in the lowest 5-mile reach of the Boulder River. Shaw Diversion is a documented fish passage barrier when check boards are in place. All three diversions entrain fish that cannot return to the river. When boards are removed after irrigation season, some adult Brown Trout are able to ascend the structure but upstream fish passage by other species, especially native Mountain Whitefish, Longnose Dace, and Sculpin, are minimal. The Denil fish ladder installed in 2008 works for adult fish at times, but regularly fills with debris and requires significant maintenance (Figure 4).

Figure 4. Cleaning out the Denil fish ladder in fall 2021.

Based on flow monitoring in 2021, up to 16 cfs is withdrawn to irrigate the existing cropland (Figure 5). When the upper two ditches were temporarily shut down in late August, Boulder River streamflow increased from about 22 cfs to 36 cfs. Streamflow and ditch monitoring in 2021 was intended to develop an understanding of baseline conditions

and to quantify project benefits before implementation. Pre-project monitoring will continue in 2022.

Replacing diversions and open ditches with pumps placed directly in the river and installing center pivots on flood irrigated croplands are expected to restore upstream fish movement, eliminate fish loss to irrigation ditches, and reduce the quantity of water withdrawal. Crop yields should improve, and labor costs should be minimized.

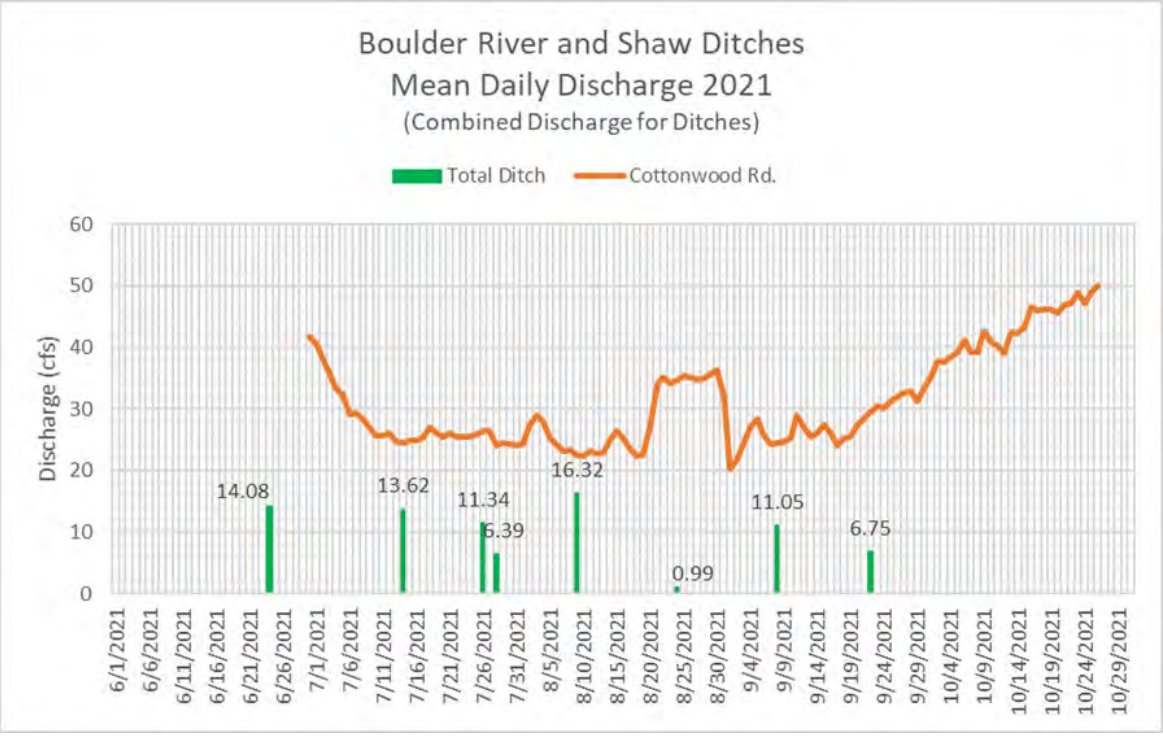

Figure 5. Summer 2021 Boulder River streamflow at Cottonwood Rd. Bridge (downstream of Shaw and Cardwell irrigation diversions). Eight ditch withdrawal measurements do not include the lower Huckaba Ditch which diverts approximately 1 to 3 cfs.

Secondary Resource Concerns:

1. Inefficient Water Use – Long distances across fields irrigated by the wild (uncontrolled) flood method require long set times. This, along with ditch losses result in losses to groundwater.

2. Elevated Water Temperature – The open ditch delivery system in place now causes the temperature of the water to be higher than it would be if left in the river. (Figure 6)

Other Resource Concerns: Surface Water Depletion, Nutrients, pathogens, sediment transported to surface and groundwater, and plant pest pressure.

Please refer to the **Jefferson County Long Range Plan** for the following:

Long-time NRCS partners collaborating on this project are listed on Page 1, and include Montana Fish, Wildlife and Parks, Montana Trout Unlimited, Barrick Gold/Golden Sunlight Mine, Jefferson River Watershed Council, and the Jefferson Valley Conservation District.

Jefferson River and Boulder River 303d list impairments, including flow regime modification, sedimentation/siltation, temperature, and fish passage barrier are on page 14 and 15.

Resource concerns on irrigated croplands include water quality, irrigation efficiency and infrastructure, late season water quantity in streams, and the need to pump irrigation water directly from streams rather than diverting it into ditches. These items are on page 20 and 21.

Also on page 21, the county-wide resource concern of noxious weed invasion is listed.

Section V., Prioritization of Natural Resource Problems on page 22 lists Noxious Weeds and Cheatgrass as Number 2, with the desired outcome of containment and control, and the need for weed control to be included in all TIPs. Page 23 lists Irrigation Improvements as Number 4, specifically citing the Boulder River, the Shaw Diversion, and Cold Springs. Desired outcomes listed are elimination of fish entrainment in ditches, increased efficiency on fields, and improved fish migration.

Section VI., relating to potential TIPs, refers to irrigation improvements on the Jefferson and Boulder Rivers on page 24.

NRCS, MTU, and FWP collaborated during the summer of 2021 to collect information to substantiate resource concerns in the project area. The resource data included:

Fisheries and aquatic resource data collection related to the irrigation system and irrigation diversions in the lower Boulder River began in 2007 and the sampling effort was increased in 2021. The following information provides a means to evaluate aquatic resource trends prior to project implementation.

1. Streamflow

In 2021, extreme low flows were observed throughout Southwest Montana. The Boulder River discharge was less than 10 cfs at the Boulder Cutoff Road upstream of Cold Springs. Cold Springs consistently provides 41-45 cfs of inflow to the Boulder River upstream of the project area. This groundwater source is a significant portion of the streamflow of the lower Boulder River in the project area. Streamflow of the Boulder River downstream of the two upper irrigation diversions remained over 20 cfs during the difficult summer of 2021 (Figure 5).

2. Water Diversion

Water diverted into the two upstream canals was monitored approximately weekly during 2021. The flow was generally between 10-15 cfs during the summer with a maximum diversion measurement of 16.3 cfs. Water diverted into the third irrigation canal located downstream near I-90 was not measured. Based on casual observations, it appeared that the canal carried between 1-3 cfs.

3. Water Temperature

The cooler water of the Boulder River provides benefits to the Jefferson River fishery. During 2021, Mountain Whitefish mortality was observed in the Jefferson River canyon about 20 miles downstream of the Boulder River confluence. In contrast, no fish kills were observed in the Cardwell area where the Boulder River enters the Jefferson River, and biweekly summer average temperature in the Boulder River was generally at least 2 degrees cooler than the Jefferson River (Figure 6).

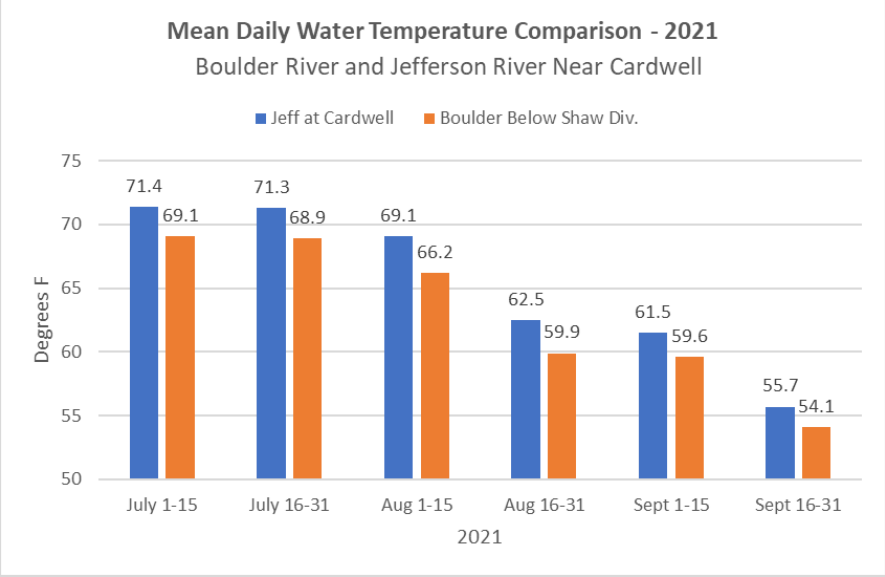

Figure 6. Biweekly average water temperature of the Boulder River and Jefferson River upstream of Cardwell.

Daily water temperature data in the Lower Boulder and the Jefferson River shows the variability of the daily water temperature trend, but the Boulder River was always cooler than the Jefferson River during summer, 2021 (Figure 7). The Boulder River provides thermal refuge for coldwater fish species, and improving streamflow by implementing the proposed project will increase this refuge benefit.

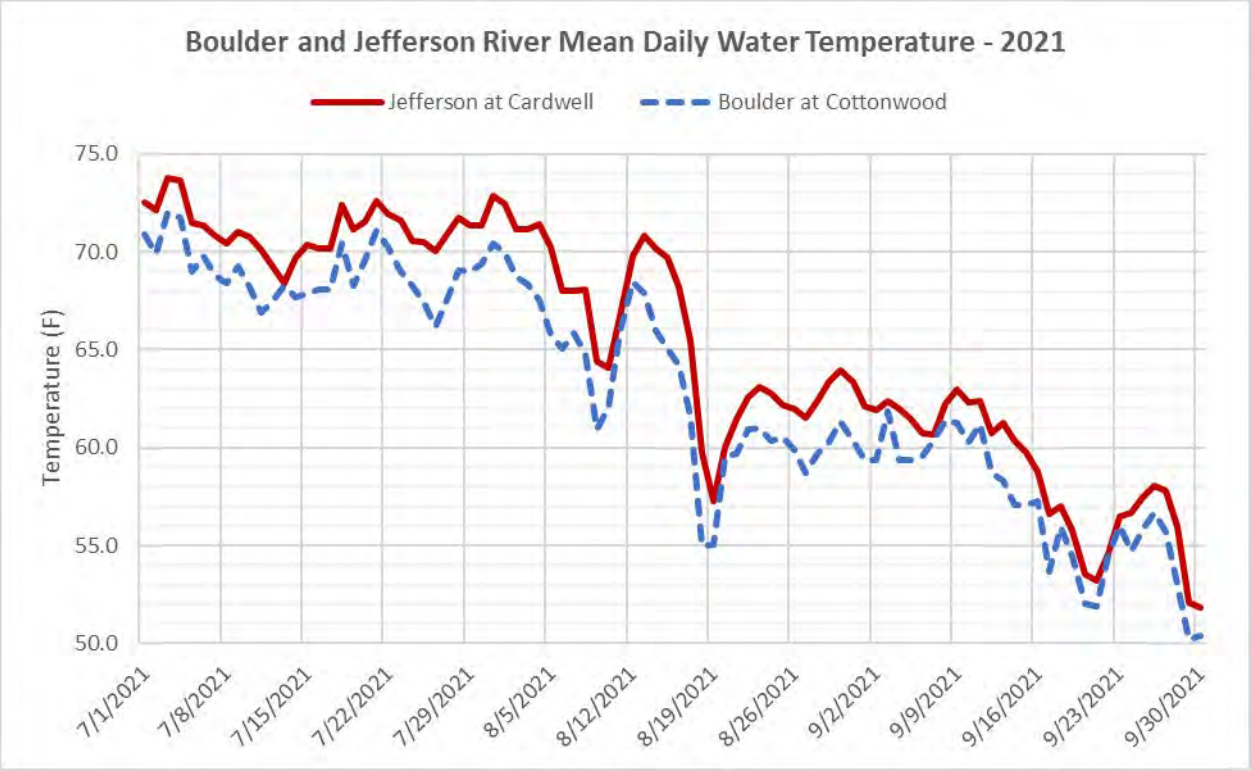

Figure 7. Mean daily water temperature of the Boulder River at Cottonwood Rd. Bridge and the Jefferson River at Cardwell Bridge during summer 2021.

4. Fish Population Trend

Fish population surveys were conducted four times in the project area between 2008-2021. Brown Trout were the dominant sport fish species observed, and adult Brown Trout density ranged from about 100 to 200 fish per mile of age of III+ (approximately 12 inches total length or more) (Figure 8). The baseline adult population level below Shaw Diversion provides a reliable pre-project population density.

The high number of age II (8-11.9 inches) Brown Trout observed in 2013 are likely due to the favorable flow conditions observed in 2011, which resulted in a very strong year class of Brown Trout throughout several Southwest Montana rivers after the remarkable 2011 summer flow conditions.

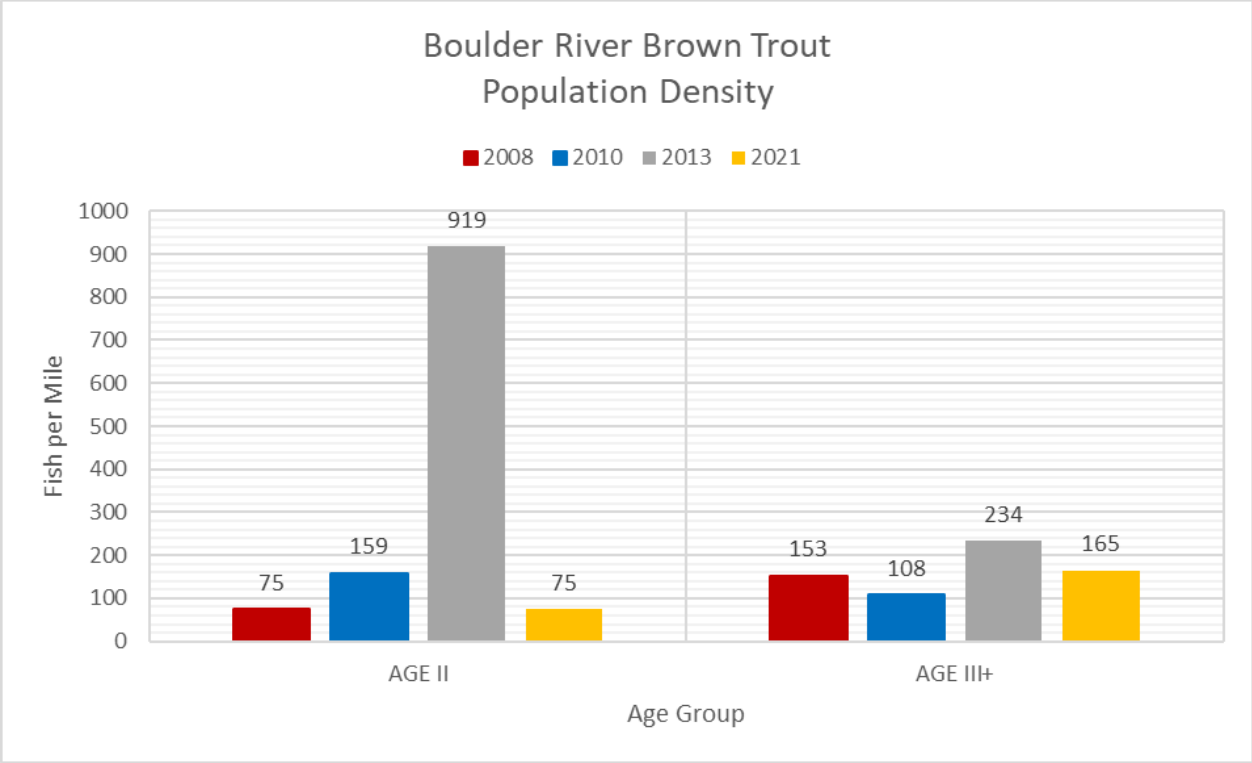

Figure 8. Brown Trout population estimate trend in the Boulder River, 2008-21.

Brown Trout Spawning Use of the Boulder River

During the 1970's, tagging studies were conducted in the Boulder River to document the spawning run from the Jefferson River. Spawning Brown Trout were concentrated below Shaw Diversion due to passage issues, and fish were tagged to track movement patterns. Most tag recoveries were from the lower Jefferson River approximately 15 miles downstream of the Boulder, and one tagged individual was recovered in the Missouri River approximately 40 miles downstream of the Boulder River.

Brown Trout spawning beds, also known as redds, were counted upstream of Shaw Diversion on five occasions from 2007-2021. The large concentration of redds located immediately below Cold Springs reflects the attraction of the springs for spawning, and the reduced concentration of redds downstream reflect a more typical count of Brown Trout redds in the Boulder River (Table 1). These redd counts will be useful for future monitoring of the spawning run after the Shaw Diversion is modified or removed to improve fish passage.

Table 1. Brown Trout redd counts upstream of Shaw Diversion, 2007-21.

Section	Year	Total Redds	Redds per Mile
Cold Springs to Ford Crossing (0.71 Miles)	2007	80	113
	2018	92	130
	2019	102	144
	2020	180	254
	2021	137	193
Ford Crossing to Gavin Bridge (0.85 miles)	2007	30	35
	2018	18	21
	2019	35	41
	2020	36	42
	2021	34	40

Providing fish passage at Shaw Diversion and eliminating three open ditches has the potential to improve the upstream Brown Trout population. In addition, native species such as Mountain Whitefish are expected to have much-improved access to the Boulder River above the Shaw Diversion. Also, fish sampling of a 1000 ft section of the Shaw Diversion ditch found 157 brown trout and three rainbow trout stranded when the canal was shut down on October 3, 2007. The total annual entrainment of the three ditches is not known, as small fish are difficult to quantify with electroshocking, but screened pumps located on the Boulder River will result in no fish entrainment in ditches.

The irrigation improvement project is important to implement in the near future for two reasons: 1. Repair and improve the aging irrigation infrastructure before a catastrophic failure of the Shaw Diversion dam occurs; 2. Provide an example of irrigation system upgrades that may be useful under increasingly frequent drought conditions. The low flow, high water temperature conditions observed in 2021 provide fresh insight into the need to upgrade our water management systems.

Goals and Objectives

*Restore upstream fish passage above Shaw Diversion (primary)

*Eliminate fish loss to open ditches (primary)

*Improve streamflow and water temperature entering the Jefferson River (secondary)

*Maintain or improve current crop yield with less labor and lower water consumption (secondary)

All of the goals listed above will be accomplished by removing diversions, abandoning ditches, and pumping irrigation water directly from the river.

Alternatives

Alternative 1. Leave the diversions and ditches in place, screen the ditches and continue to irrigate as in the past.

This alternative is not chosen due to the high cost and maintenance requirement for fish screens, and the continued resource concerns of irrigation inefficiency, elevated water temperature, surface water depletion, and nutrients, pathogens and sediment transported to surface and groundwater. The threat of structure failure could leave cropland with no means to be irrigated.

Alternative 2. Maximum fish passage for all species and age classes, and maximum irrigated acres.

The most aggressive and costly approach to diversion removal and irrigation pivot installation provides 270 acres of cropland under new pivots with minimal buffer areas between irrigated lands and the streambank. In addition, the Shaw Diversion modification would be constructed to simulate a long, hardened riffle that ensured upstream fish passage of virtually all species including small minnows and sculpin. This alternative is not chosen due to cost considerations.

Alternative 3. Adult sport fish passage and irrigated acres that leave a buffer between pivot boundaries and river channel corridor. **This is the chosen alternative.**

This alternative removes three open ditch diversions, installs three screened pump sites on the Boulder River, and provides 233 acres of cropland under new pivots with adequate buffer strips between irrigation items and the streambank. This alternative provides 37 fewer acres of irrigated cropland than Alternative 2 to allow for future river migration without armoring the Boulder River channel. This slightly reduced acreage also provides minor water savings compared to Alternative 2. The Shaw Diversion modification would not be a complete riffle restoration, but rather, construction of a small grade control structure below the modified existing concrete structure which will be partially removed. This structure will be set to allow modest drops in elevation where adult fish can move

upstream. The grade will also be appropriate for a future natural streambed construction should that be needed.

Practices offered through NRCS for this TIP include:

587- Structure for Water Control (screened inlets for pumps, flow meters)
533- Pumping Plant
430- Irrigation Pipeline
442- Sprinkler System
449- Irrigation Water Management
315- Herbaceous Weed Treatment

Removal of the diversions and grade stabilization of the stream are being planned and installed by the partners.

Inventory data collected and shown in the figures and tables in this document were carefully considered in choosing this alternative.

Alternative 4: No Action
This alternative maintains the current situation where adult fish occasionally pass through an unreliable fish ladder or wait until irrigation shut down in late October when boards are removed. Fish will continue to be entrained by three irrigation diversions. Labor-intensive flood irrigation and wheel line operation will continue, and current water use will be maintained. The threat of structure failure could leave the cropland with no means to be irrigated. This alternative is not chosen as it does not meet the goals and objectives of the project.

Implementation of Alternative 3

Project development began in 2021 by collecting data and evaluating alternatives for diversion dam removal and replacing antiquated irrigation systems. Development of a conceptual project design to remove the diversion dam is under contract between MTU and River Design Group. Three conceptual designs were delivered to the partners on December 15, 2021. The preliminary irrigation system design was completed by AquaTech in 2020 but will be updated and approved by NRCS once funding is secured.

These tasks, except the irrigation design, will be completed by March 1, 2022. A more detailed budget will be available then to prepare remaining grant applications by July 1, 2022. Irrigation practice installation will start after the 2023 irrigation season, and before irrigation begins in 2024.

Three screened pumping stations will be installed in the Boulder River to supply center pivots for crop irrigation. The new water system is expected to reduce irrigation withdrawals. Flow meters will be installed and irrigation water management plans will be followed to document water use. The landowners will not expand irrigated acreage. In order to protect historic water rights and ensure that water savings translate to benefits for instream flow and fishery enhancement, both FWP and MTU are interested in leasing unused water served by these senior water rights. Landowners will have the option to lease to either entity after project details have been defined and are finalized. Following irrigation practice installation, Shaw Diversion and two smaller diversions will be retired. Shaw Diversion will be removed or modified to allow upstream fish movement.

PROJECT COST

Irrigation improvements – 233 acres of cropland requiring Structures for Water Control, Pumping Plants, Irrigation Pipelines, Herbaceous Weed Treatment, Irrigation Water Management plans and Sprinkler Systems – NRCS: **$299,292.02** requested for Fiscal Year 2023 and Fiscal Year 2024 as follows, based on NRCS Fiscal Year 2022 payment schedule:

Practice	Component	Quantity	Rate	Total for Item
587 Structure for Water Control	Flow meters	7	$222.50 per inch	$12,015.00
587	Misc. small structures	3	$7426.96	$22,281.00
533 Pumping Plant	30 hp turbine pump	1	$266.26/hp	$7,987.80
533	30 hp soft start	1	$56.37/hp	$1,691.10
533	40 hp turbine pump	1	$266.26/hp	$10,650.40
533	40 hp VFD	1	$100.57/hp	$4,022.80
533	20 hp electric pump	1	$415.02/hp	$8,300.40
430 Irrigation Pipeline	</=8” PVC	22,634 lb.	$2.58/lb.	$58,395.72
430	>/=10” PVC	8,971 lb.	$2.06/lb.	$18,480.26
449 Irrigation Water Mgt.	Basic plan	9	$347.11/plan	$3,123.99
442 Sprinkler System	Pivot 801-1200 ft.	115 ac, 4 fields	$611.13/ac	$70,279.95
442	Pivot <600 ft.	32 ac, 3 fields	$1,215.39/ac	$38,892.48

442	Pivot 600-800 ft.	12 ac, 1 field	$912.95/ac	$10,955.40
442	Pivot>/=1,200 ft.	64 ac, 1 field	$474.13/ac	$30,344.32
315 Herbaceous Weed Treatment	Spot treatment	20 ac	$93.57/ac	$1,871.40
NRCS total:				**$299,292.02**

Funding for this project is being requested for FY23 and FY 24. Contract development for the TIP will be completed within this timeframe. Implementation of contracts will begin in FY23 with all contracts obligated by the end of FY24.
Applicants will be financially responsible for costs not covered by NRCS funding to implement the irrigation practices.

Actual NRCS costs may change in the Fiscal Year 2023 payment schedule, from the Fiscal Year 2022 rates used for the estimate.

Surveying, planning, design and implementation of diversion removal and grade control will be implemented by MTU, FWP, Barrick Golden Sunlight Mine (GSM): **$200,000** through ARPA, Future Fisheries, Cross Foundation, TU grants, and private funding.

Screening and Ranking

Screening tools and ranking questions will be used to prioritize applicants in the project area.

Ranking Questions:

1. Does the application include practices for an efficient sprinkler system pumped directly from the river?
2. Does the application include flow meters and an irrigation water management plan for tracking water use and crop yields?

Schedule:

January 14, 2022:	ARPA grant was submitted
Feb. 1, 2022:	Conceptual Design Completed for diversion removal, grade control
Spring 2022:	Apply for Point of Diversion changes immediately upon TIP approval
June 1, 2022	Final Design Completed for diversion removal, grade control

July 1, 2022	All remaining Grant Applications Submitted (Future Fisheries, Cross Foundation, Mt. Trout Unlimited mini-grant, George Grant Chapter of Trout Unlimited funding)
October 1, 2023	Irrigation practice installation
Fall, 2024	Remove diversions, abandon ditches, install grade control
2024 through 2026	Irrigation Water Management, weed control

The construction and installation of new infrastructure are expected to be relatively straightforward. The primary challenge with the proposed project relates to legal water rights point of diversion changes for the new system. FWP water resource specialist, Andy Brummond, has reviewed the water rights details and is working on this aspect of the project. Although obstacles are not expected, time delays are possible working through the water right details that will be necessary.

Phase I, implementation of irrigation practices, will be coordinated and managed by the Whitehall NRCS Field Office. Phase II, the removal of the dam and grade stabilization will be coordinated and managed by MTU and FWP and installed by River Design Group.

The local NRCS field office and the NRCS area office will be coordinating to make sure the project practices meet our specifications and the applicant's needs.

Partnerships

Montana Trout Unlimited and **Montana Department of Fish, Wildlife & Parks** are the primary partners for the Fish Migration Improvement on the Boulder River TIP, along with Barrick **Golden Sunlight Mine**. These partners have committed substantial staff time and financial resources toward achieving the goals of this TIP, as well as applying for funding from ARPA, Future Fisheries, Cross Foundation, and TU grants.

Supporting partners include the **Jefferson River Watershed Council,** the **Jefferson Valley Sportsmen's Association,** and the **Jefferson Valley Conservation District,** providing items such as tours and interpretive signs.

NRCS and landowners will implement the irrigation components to the project, while MTU, FWP and GSM will implement the diversion modifications at three points of diversion to allow fish passage and prevent fish loss to open ditches.

Outcomes

Fisheries data, including population trends and redd counts, streamflow information, water temperature trends in the Boulder and Jefferson Rivers, and agricultural yield information will have three years of pre-project information available for future comparison. Each of these outcomes is measurable. Table 2 provides monitoring parameters to evaluate effectiveness of the project.

Table 2. Pre-project monitoring of fishery and water quality parameters.

Monitoring Parameter	Available Pre-project Data	Post Project Quantitative Goal
Brown Trout and Mountain Whitefish Abundance Above and Below Shaw Diversion	Four Estimates from 2008-21 (Plan 22&23)	Monitor for Long-Term Improving Trend, particularly above Shaw Diversion after it is removed
Brown Trout Redd Count Upstream of all three Diversion Structures	Five Redd Counts in 1.5 Mile Reach Above Diversion 2008-21 (Plan 22&23)	Monitor for Long-Term Improving Trend after diversion removal
Water Temperature	Summer 2008 and 2021 (Plan 22&23)	Monitor for Long-Term Improving (cooling) Trend after removal of diversions
Water Diversion Rate	Summer 2021 (Plan 22&23)	Document Decreased Water Diversion From Pumps Compared to Three Open Ditches After Project Completion

Measurable impacts to the data in Figure 5 – streamflow, Figures 6 and 7 – water temperature, Figure 8 – fish population, and Table 1 – redd counts, will be updated with post-project data for three years by MTU and FWP.

The project will reconnect the lower Boulder River and an 11-mile section of the Jefferson River with no diversions, with 10 miles of important spawning habitat below Cold Springs, and another 50 miles of the Boulder River above Cold Springs.

A lease agreement is being prepared for the water that this project saves to remain in the stream but could take some time to finalize.

During a period of challenging drought and declining cold water brown trout populations, this project provides a contemporary model of diverse partners attempting to give fish a

break while maintaining economically important irrigated agriculture. Evaluating the long-term acceptance of water-user participation in this project will be fundamental to passing on the word that win-win projects exist on the landscape when partners are willing to look for them. This project's effectiveness will be very high, and post-project monitoring and outreach will be a priority for the landowners and all three partners.