Muddy Creek Irrigation Efficiency Project

2022-2024 Teton County Targeted Implementation Plan (TIP)

The Primary Goal of this TIP is to reduce inefficient irrigation water use by converting flood and wheel line irrigation to more efficient sprinkler irrigation systems, while monitoring soil moisture throughout the growing season. The secondary resource concerns are nutrients and pesticides transported to surface water.

Inefficient irrigation can cause runoff and leaching, carrying nutrients and topsoil with it. Effectively managing soil moisture by modernizing irrigation systems and implementing management practices provides producers important farm management tools to better regulate and time irrigation applications to match the needs of their crop, reducing water and nutrient loss, and protecting resource concerns.

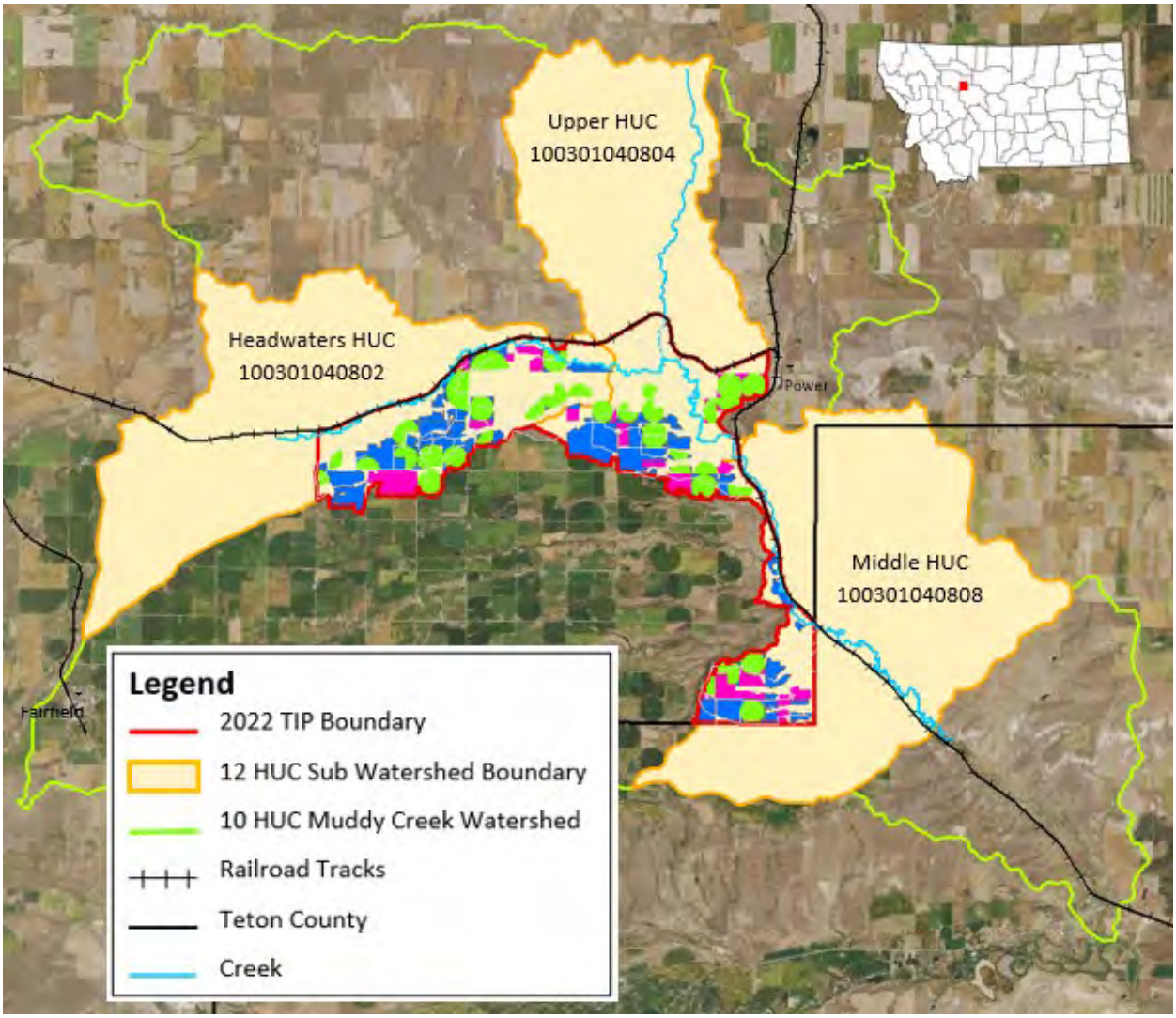

Figure 1. Map of TIP Project

Background Information

This TIP is in southeastern Teton County between the towns of Fairfield and Power. Most of the acres are within the Greenfields Irrigation District (GID). GID was established in 1926 to operate and maintain irrigation canals in the Greenfields division of the Sun River Project (US Bureau of Reclamation). GID irrigation water comes from Gibson reservoir and the Sun River and irrigates 82,230 acres.

There has been continual interest by producers in Teton County to improve irrigation efficiencies. During the summer of 2019, the NRCS Choteau field office partnered with Teton Conservation District (TCD) and the Sun River Watershed Group (SRWG) to hold community "town hall" style meetings to discuss natural resource concerns facing Teton County landowners. One of the most prevalent concerns was irrigation water management and water use efficiency. Irrigation water management has been one of the TCD's Local Working Group Priority Resource Concerns since 2015. This Irrigation Efficiency TIP proposal is in direct response to these landowner concerns. The practices in this TIP proposal address those concerns. *(Teton County's Long-Range Plan (LRP) (pages 39, 41, 42), Nutrient and Pest Management is referenced in the TMDL (pages 26-27)).*

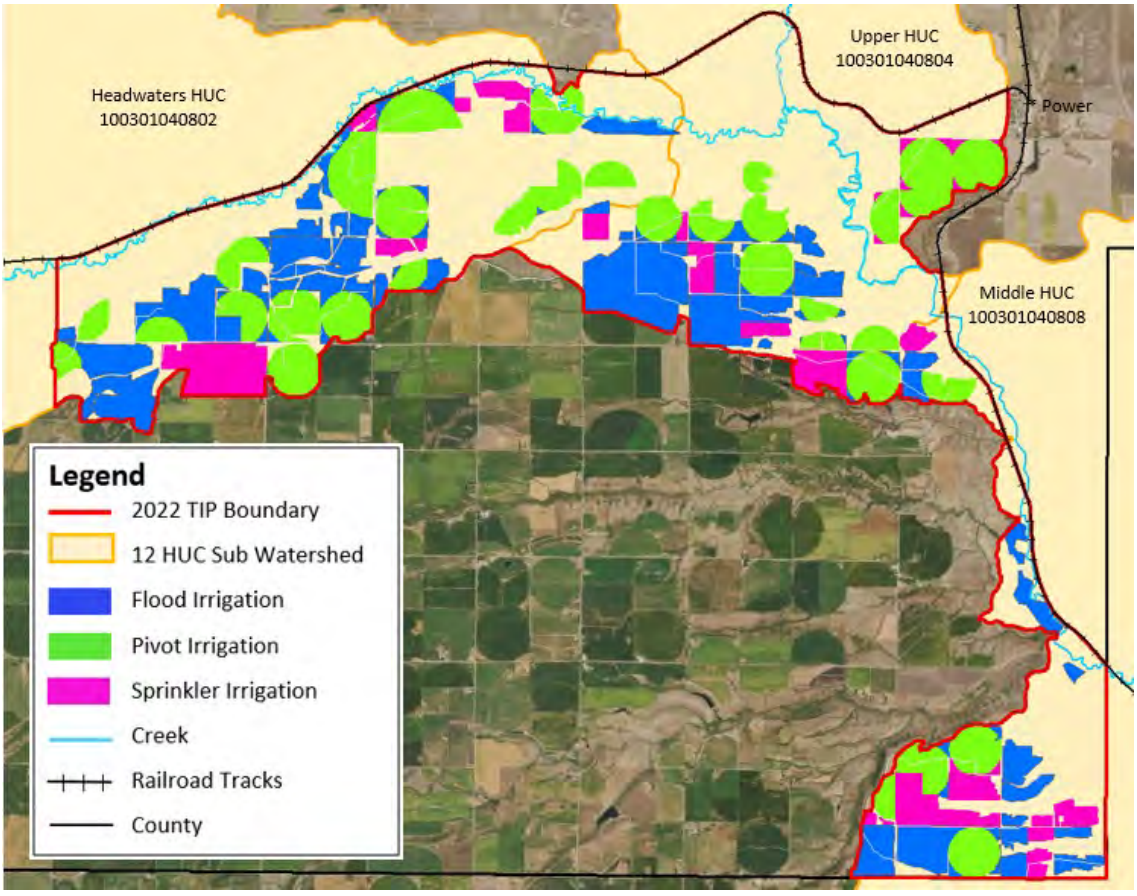

Figure 2. Current irrigation practices in Project Area

Project Area

Muddy Creek drainage is downstream from the majority of the 82,230 acres in the Greenfields Irrigation District. We worked with GID to identify the area south and west of the creek and railroad tracks in the Headwaters Muddy Creek, Upper Muddy Creek, and Middle Muddy Creek 12 HUC sub watersheds (Figure 2) as it ties into conservation projects of other agencies. Partner collaboration with other agencies enable us to have a shared responsibility and commitment to local resource concerns. With continued combined partnership efforts, this TIP can help these agencies and groups achieve their conservation goals, and each producer will have a much bigger impact on the resource concerns in the project area.

The boundary of this TIP proposal encompasses 7,184.9 irrigated acres, including flood, wheel line, and pivot acres as described in Table 1.

Table 1. Total irrigated acres by irrigation delivery method in this TIP Project area

12 HUC Sub Watershed	Flood	Wheel Line	Pivot	Total Acres
Headwaters Muddy Creek 100301040802	1,438.9	462.7	1,562.9	3,464.5
Upper Muddy Creek 100301040804	686.9	350.8	963.4	2,001.1
Middle Muddy Creek 100301040808	707.4	421.7	590.2	1,719.3
Total	2,833.2	1,235.2	3,116.5	**7,184.9**

Problem Statement

When more water is applied than the soil can hold, the excess can runoff or leach through the soil profile and below the normal root zone. This is an expensive waste of water, labor, fertilizer, and energy. Inefficient irrigation can impact a producer downslope, or cause runoff or leaching which can transport pesticides, fertilizers, salts, and sediments to GID drains and Muddy Creek which feeds into the Sun River. Although many producers realize the benefits of improved irrigation efficiency, irrigation water management, nutrient management, and pest management, without the technical and financial contributions of NRCS, most are unable to implement these conservation practices on their own or in a timely manner.

The SRWG and Department of Environmental Quality (DEQ) developed the Sun River Watershed Restoration Plan. The plan lists irrigation water management, using efficient irrigation methods, switching from flood to pivot irrigation, preventing on-farm surface irrigation water runoff and implementing farm-specific nutrient management plans for irrigated lands, as management measures needed to address impairments in Muddy Creek. All these practices correlate directly with this TIP. *(Sun River Watershed Restoration Plan (Section 3.0 - pages 17, 18)).*

The 2018 Farm Bill added a provision for the protection of drinking/source water through conservation practices in local priority areas. Montana has five Source Water Priority Protection Areas (SWPPA) designated by the Montana NRCS. The 10 HUC 1003010408 Muddy Creek Watershed has two of these Source Water Priority Protection Areas (SWPPA) (Fairfield-Teton County SWPPA - nitrates) and (Muddy Creek-Sun River SWPPA - sedimentation) (Figure 3).

Figure 3. Fairfield-Teton County SWPPA and Muddy Creek-Sun River SWPPA project watershed boundary (MT NRCS).

Significant potential contaminant sources for Fairfield, MT public water supply are: Agricultural chemicals, nitrates, and pathogens on cultivated cropland; over-application or improper handling of agricultural chemicals; excessive irrigation causing transport of contaminants or sediments to groundwater/surface water through runoff. *(Montana DEQ - Fairfield Public Water System - Source Water Delineation and Assessment Report (pages 22, 27)).*

Significant potential contaminants sources for Power, MT public water supply include fertilizers, pesticides, nitrates, pathogens, and contaminants in surface water runoff or irrigation return flows on cropped agricultural land. *(Montana DEQ - Power Teton County Water District Public Water Supply System - Source Water Delineation and Assessment Report (pages 14, 20)).*

Nitrogen (N) is an essential nutrient for plant and animal growth and is one of the most important nutrients necessary for crop production. However, nitrogen is easily moved by water and is often associated with the impairment of quality of groundwater and surface water. *(NRCS Agronomy Technical Note MT-91 (page 1)).*

Sprinkler systems with an Irrigation Water Management plan (IWM) have a low potential for N leaching from the site. If farming practices are maintained at the current level, there should be a low probability of an adverse impact to surface resources. Flood irrigation without IWM has a high potential for N leaching from the site. There is a very high probability for an adverse impact to groundwater. Remedial action should be taken to reduce the risk of N movement. Soil and water conservation practices and a nitrogen management plan are needed to reduce the potential of water quality degradation. *(NRCS Agronomy Technical Note MT-91 (pages 4, 6)).*

Irrigation improvements, Irrigation Water Management, Nutrient Management, and Integrated Pest Management address those threats to drinking/source water in both Fairfield-Teton County and Muddy Creek-Sun River Source Water Priority Protection Areas.

The soils in the proposed TIP area include a mix of gravelly, coarse textured soils and soils with higher clay content as well. The gravelly soils have low Available Water Holding Capacity and are better suited to sprinkler irrigation for most efficient use of water. These soils are prone to leaching of nitrates which can end up in surface and ground water (Figure-4). The clayey textured soils have higher water holding capacity but due to high clay content in the surface they are prone to ponding and runoff under flood irrigation. The combination of these different soil types would suggest that a conversion to sprinkler irrigation would help reduce the potential for leaching and runoff into Muddy Creek.

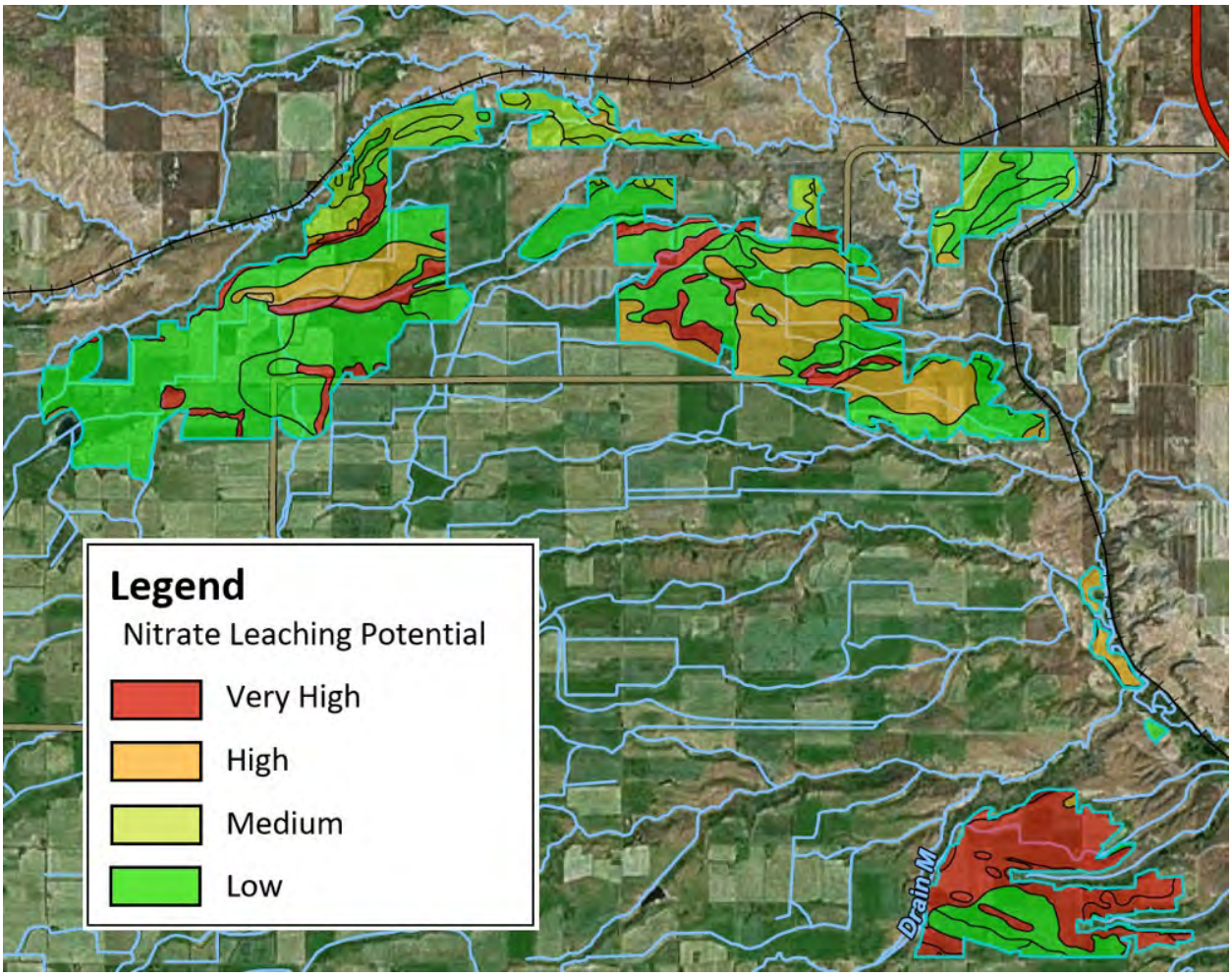

Figure 4. Nitrate Leaching Potential for Irrigated Acres in the Project Area

An ancillary benefit to increasing irrigation efficiency is likely to be improved water quality in Muddy Creek during the irrigation season. Muddy Creek is identified on the Montana DEQ's 303(d) list of impaired streams for a wide range of impairments including nutrients *(DEQ 2004)*. Agriculture is cited as probable sources for much of this impairment. The DEQ Total Maximum Daily Load (TMDL) recommends increasing on-farm and delivery efficiency. *(Water Quality Restoration Plan - DEQ 2004 (section 9.4.5 page 173)).* This is stated, in part, below.

> "Restoration approaches that address inefficient irrigation water delivery are vital. Increasing on-farm irrigation and delivery system efficiency will be useful to reduce summer irrigation water return flow to tributaries."

On Muddy Creek, excess water during the irrigation season also contributes to erosion due to greater flows and increased stream energy. Bank erosion is increased along Muddy Creek as return flows increase *(DEQ 2004).*

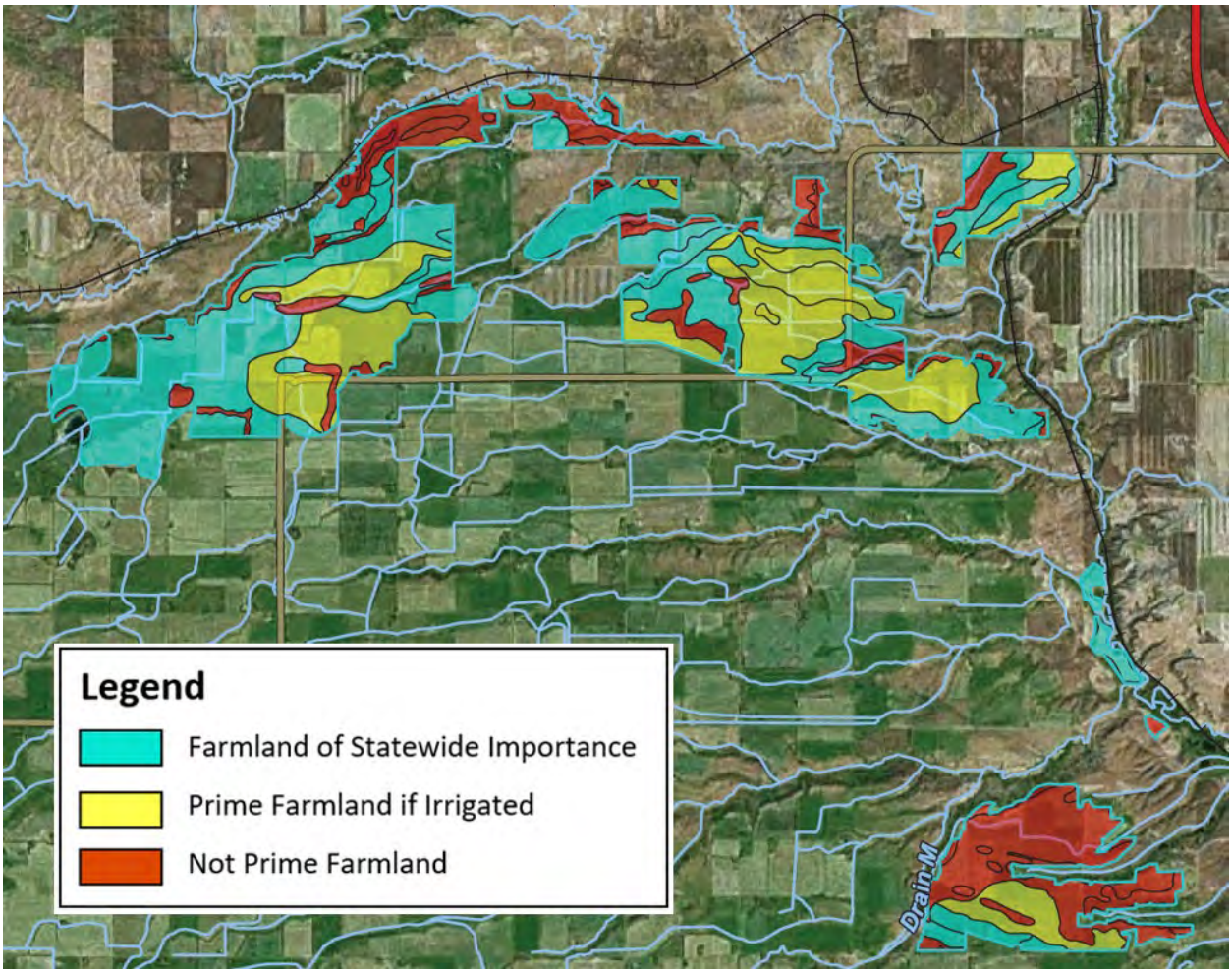

Figure 5. Farmland Classification for Irrigated Acres Soils in the Project Area

The majority of the cropland soils in this TIP are either Farmland of Statewide Importance or Prime if Irrigated (Figure 5). It is vital to the continued success of agriculture in Teton County that these soils remain productive through proper irrigation water management.

Goals and Objectives

Primary Resource Concern: Inefficient Irrigation Water Use.

Secondary Resource Concern: Nutrients and Pesticides Transported to Surface Water.

As per Teton County's Long-Range Plan *(page 42),* water use efficiency and irrigation management are identified resource concerns. This TIP will target irrigated fields that do not follow an Irrigation Water Management plan, especially those currently under flood irrigation. By increasing irrigation efficiency and monitoring the soil moisture throughout the growing season the producer will have better on farm management that can improve scheduling and uniformity of applied water, minimize runoff, and optimize crop productivity.

Sprinkler irrigation allows for increased control of water application to field crops compared to flood irrigation. Established sprinkler infrastructure with flowmeters and sprinklers allow for greater control of the amount of water being applied during irrigation, as well as allowing for more uniform application of irrigation water to crops.

One of the ways producers can increase their irrigation efficiency is to not flood irrigate any of their field corners. Many producers lose the infrastructure to flood corners after conversion to a sprinkler system because they plow in their ditches. The main reason producers may keep flooding a corner is to recharge the well for their house, or they have a windbreak and they irrigate those corners for conservation measures. We have extra ranking points for producers who do not flood irrigate any of their corners.

Flood irrigation can leach out nutrients from the soil when the water level rises and falls, which can lead to decreased crop yield. Pivot irrigation and the increased control of water application reduces the possibility of nutrients and fertilizers being removed from the soil and the crops. This allows for healthier crops and increased yield.

NRCS lists Nutrient Management as a practice for greenhouse gas emission reduction and carbon sequestration. Precisely managing the amount, source, timing, placement, and form of nutrient and soil amendments to ensure ample nitrogen availability and avoid excess nitrogen application reduces N2O emissions to the atmosphere.
(Green House Gas and Carbon Sequestration Tool - NRCS)

Following an Integrated Pest Management Plan producers can reduce pesticide environmental risks, reduce pesticide transport to ground and surface water, reduce pesticide drift, reduce overall amount of pesticide applied, can increase efficacy, and allow lower application rates. *(NRCS Agronomy Technical Note No. 5 (page 9)).*

Alternatives

Alternative 1: Producers will install a Flow Meter (587), implement and follow an Irrigation Water Management Plan (449), Nutrient Management Plan (590), and Integrated Pest Management Plan (595) on existing sprinkler system acres included in this TIP.

Preferred Alternative 2: Producers will convert from flood or wheel line irrigation to more efficient sprinkler irrigation systems. (Sprinkler System (442) practices funded through this TIP project must provide for a net water savings of 10% or more). Producers will install a Flow Meter (587), implement and follow an Irrigation Water Management Plan (449), Nutrient Management Plan (590), and Integrated Pest Management Plan (595) on all irrigated acres included in this TIP. (Note that NRCS conservation practice numbers are shown in parentheses above).

Alternative 3: No Action: Doing nothing does not address the resource concerns in this area. Irrigation efficiency not only affects water movement but nutrients in the soil as well. Without more efficient sprinkler irrigation systems and proper management, inefficient irrigation can cause nutrients that are not effectively used by crops or retained in the soil to enter surface or ground water through runoff or leaching. Modernizing irrigation systems, Irrigation Water Management, Nutrient Management, and Integrated Pest Management play an important role in addressing these resource concerns, as well as protecting ground and surface water.

Practices offered through NRCS for this TIP include:

Primary Practices:

- (442) Sprinkler System
- (587) Structure for Water Control - Flow Meter
- (449) Irrigation Water Management (IWM)
- (590) Nutrient Management
- (595) Integrated Pest Management

Supporting Practices:

- (553) Pumping Plant
- (430) Irrigation Pipeline
- (587) Structure for Water Control - Intake Structures, Sumps

Technical assistance and engineering designs will be provided primarily by NRCS staff in the Helena work units and Missoula Area with some designs provided by Technical Service Providers (TSPs).

National Environmental Policy Act (NEPA) concerns will be addressed through environmental evaluations. Projects will comply with all other required local, state, and federal permits and permissions.

Proposed Solutions and Actions

The proposed solution to address the resource concerns described in this TIP is providing technical and financial support to producers. By implementing irrigation efficiency and management practices individual producers can make a positive difference to help address resource concerns in Teton County.

(Table 3) lists the cost share estimate for a typical center pivot irrigation system and management practices in Teton County. Some projects may cost more or less depending on practices contracted, and size of irrigation system installed for this TIP.

Table 3. Cost Share Estimate of Typical Center Pivot Irrigation System and Management Practices (based on NRCS EQIP Source Water Protection payment rates for Fiscal Year 2021)

Practice	Unit	Amount	Rate	Total Cost
(442) Sprinkler System (Lifespan: 15 Years) **Center Pivot, >/=1,300 feet,**	AC	140	$531.78	$74,449.20
(430) Irrigation Pipeline (Lifespan: 20 Years) **(PVC) Pipe, >/= 10-inch**	LB	7002	$1.62	$11,343.24
(533) Pumping Plant (Lifespan: 15 Years) **Electric-Powered Pump, > 30-74 HP**	HP	50	$226.48	$11,324.00
(587) Structure for Water Control (Lifespan: 20 Years) **Miscellaneous Structure, Extra Small**	IN	1	$2973.81	$2,973.81
(587) Structure for Water Control (Lifespan: 20 Years) **Flow Meter with Electronic Index**	EA	10”	$253.23	$2,532.30
(449) Irrigation Water Management (Lifespan: 1 Year) **Intermediate IWM, year 1**	EA	1	$1180.75	$1,180.75
(449) Irrigation Water Management (Lifespan: 1 Year) **Intermediate IWM, Years 2 and 3**	EA	2	$631.44	$1,262.88
(590) Basic NM (Non-Organic) **Nutrient Management**	AC	140	$7.64	$1,069.60
(595) Pest Management **Integrated Pest Management**	AC	140	$12.80	$1,792.00
Total	-	-	-	$107,927.78

Funding for this project is being requested for FY22-24. Contract development for the TIP will be completed within this timeframe. Implementation of contracts will begin in FY22 with all contracts obligated by the end of FY24.

Through outreach over the past several months, NRCS staff has identified five producers interested in converting from flood to sprinkler irrigation within this TIP boundary. Initial field assessments have been completed on these fields. This TIP is requesting money for 1300 acres. The primary focus of this TIP is flood to sprinkler conversions as that will have the greatest impact on the resource. This TIP will be considered successful if 65% (845 acres) of the 1300 acres are flood irrigation conversions. We will be holding outreach events throughout the summer to reach out to the producers in the TIP area, including producers currently using sprinkler irrigation to target management practices. We want the producers to realize that implementing more efficient irrigation practices and minimizing off-farm flows of nutrients and pesticides will not only have a positive impact their operation but the environment as well. In year two, SRWG will hold a workshop to demonstrate the practices, goals, and benefits to producers, partners, and the public. The workshop will focus on practices featured in this TIP and will facilitate applications for new projects under this TIP. One of the potential participants has offered to host the workshop at his property.

Budget projections are based on the NRCS EQIP Source Water Protection payment rates for Fiscal Year 2021 (Table 4). Actual costs may vary from year to year based on changes to the cost list and individual practices selected. Future budget projections have been conservatively estimated using anticipated producer interest, average property sizes and engagement with landowners.

Table 4. Estimated Annual NRCS budget projections

Year	Contracts	Acres	NRCS Cost Share
2022	3	400	300,000
2023	4	500	400,000
2024	3	400	300,000

Screening and Ranking

Screening tools and ranking questions will be used to prioritize applicants in the project area. Screening tools will be the state-wide mandatory questions references in MT Bulletin 300-19-23.

Ranking Questions:

1. Will the application improve irrigation efficiency using Farm Irrigation Rating Index (FIRI) by 25% or greater?

2. Will applicant **only** be installing a (587) Flow Meter, and implementing management practices (449) Irrigation Water Management, (590) Nutrient Management and (590) Integrated Pest Management?

3. Will the application improve irrigation efficiency (FIRI) by 10% to <25%?

4. Will no corners be flood irrigated?

Progress Evaluation and Monitoring

Each project will be overseen by field office staff. NRCS will conduct field checks after installation of sprinkler systems and check all management practices prior to payment to ensure standards and specifications were met.

Producers will be required to install flow meters, soil moisture sensors, and follow an Irrigation Water Management (IWM) plan for a minimum of one year. The producer will monitor the soil moisture throughout the irrigation season so adjustments can be made to keep soil moisture between Field Capacity and the Management Allowed Depletion (MAD) level. NRCS or TSPs will assist producers with determining initial field moisture levels, water holding capacity of the soil and protocols for IWM practices.

Producers will submit IWM records and crops acres to NRCS at the end of the irrigation season. The producer will participate in a year-end feedback session with NRCS staff to review the effective management of soil moisture through the growing season. NRCS will compare the amount of water applied to the field to the seasonal consumptive use of the crop.

Producers will submit district irrigation records from the prior year for that individual field. This will allow NRCS to compute irrigation amounts applied to the field pre-project. NRCS will do a comparison of the water applied to the field before and after the practices were installed to show a positive change in irrigation efficiency.

Producers will work with NRCS on evaluating a nutrient budget to minimize nutrient leaching and runoff. Producers will submit prior year crop yield and fertilization records to compare with the crop yield and fertilization rates after implementation. Positive changes in nutrient application will be tracked at the field level by comparing old records with fertilization taking place after the irrigation efficiency improvements are installed. With irrigation infrastructure in place, the opportunity to manage nutrient runoff and leaching will be greatly increased.

Producers will turn in herbicide and monitoring records to NRCS so that environmentally sensitive areas can be addressed. Producers will work with NRCS to run WinPst, evaluate and monitor environmental and human risks associated with their custom management programs and mitigate management where necessary. With improved irrigation infrastructure in place, Pest Management will be further customized to reduce potential for non-point pesticide leaching and runoff.

Partnerships and other Funding Sources

Applicants. Private landowners will be financially responsible for costs not covered by NRCS cost share to implement the irrigation efficiency measures. Applicants will be solicited to participate in events and presentations to educate other landowners, the community, and the general public about inefficient irrigation water use.

Teton Conservation District (TCD). TCD assisted in the preparation of this TIP and will assist producers with their financial needs related to this project within the scope of their respective District Board direction. The Conservation District can provide assistance to applicants for acquiring applicable permits, if any are required. This project will also use the Conservation District to engage landowners who may be interested in applying for this program and support NRCS staff as needed.

Sun River Watershed Group (SRWG). SRWG assisted in the preparation of this TIP and will be helping engage applicants. They will also provide public education and outreach associated with this project. SRWG is working with partners on a Regional Conservation Partnership Program (RCPP) application that will incorporate elements of this TIP, to be submitted this year. (RCCP promotes coordination of NRCS conservation activities with partners that offer value added contributions to expand our collective ability to address on farm, watershed, and regional natural concerns).

Greenfields Irrigation District (GID). GID was instrumental in defining the TIP boundary in identifying critical areas where the proposed practices would have the greatest impact in the area. They will be an important partner for promoting this project and reaching out to potential applicants.

This TIP ties directly into the irrigation efficiency projects in progress or already completed by GID. They are in the process of upgrading control structures on several canals. In 2020, GID completed the J-Lake Reregulation pond. This project converted the "constant-level" J-Lake into a reregulation pond, the pond allows GID to capture the water in J-Lake before it leaves GID and installed a new "smart-gate" to regulate releases from the reregulation pond to Spring Coulee to reduce water losses to Muddy Creek. They are planning more regulation ponds and "smart gates" in the future to enhance water management within their water delivery system for producers.

NRCS Staff. NRCS is the leading partner for this TIP. The local field office and the area office will be coordinating to make sure the project practices meet our specifications and the applicant's needs. The local field office staff will also conduct outreach to promote this TIP.

References

GID Interview, December 2020, May 2021 Erling Juel General Manager

Green House Gas and Carbon Sequestration Ranking Tool | NRCS (usda.gov)

Montana Department of Environmental Quality - Fairfield Public Water System PWSID #MT0000212. Source Water Delineation and Assessment Report. (Report Date: 06/03/04)

Montana Department of Environmental Quality - Power Teton County Water District Public Water Supply System PWSID #MT0000311. Source Water Delineation and Assessment Report. (Report Date: 12/12/02)

Montana Department of Environmental Quality - Water Quality Restoration Plan (DEQ 2004)

Nitrogen Risk Assessment - NRCS Agronomy Technical Note MT-91

Pest Management in the Conservation Planning Process – NRCS Agronomy Tech Note No. 5

Sun River Watershed Restoration Plan – January 2012

USDA NRCS Choteau Field Office - 2020 Teton County Long Range Plan