DEQ
Montana Department
of Environmental Quality

Ruby River Watershed TMDL Implementation Evaluation

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Cover photos:
Before and after photos of restoration efforts on the Miller Ranch
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ACRONYMS

AUID	Assessment Unit Identification (number)
BLM	United States Bureau of Land Management
BMP	Best Management Practice
CWA	Clean Water Act
DEQ	Montana Department of Environmental Quality
USFS	United States Forest Service
HUC	Hydrologic Unit Code
MCA	Montana Code Annotated
NRCS	Natural Resources Conservation Service
RVCD	Ruby Valley Conservation District
SAP	Sampling and Analysis Plan
TIE	TMDL Implementation Evaluation
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
USDA	United States Department of Agriculture
WLA	Wasteload Allocation

DOCUMENT SUMMARY

The Ruby River watershed encompasses approximately 623,000 acres in Madison County in southwest Montana. Land use in the watershed consists mostly of traditional agricultural operations, several small communities, and remnants of historical mining activities. The Ruby headwaters originates in the Snowcrest and Gravelly Mountain ranges and flows northward to the confluence of the Beaverhead River. Together, the Ruby and Beaverhead rivers create the headwaters of the Jefferson River.

As required by Montana state law and the federal Clean Water Act, the Montana Department of Environmental Quality (DEQ) develops total maximum daily load (TMDL) documents that provide water quality goals and criteria for impaired waterbodies to attain water quality standards (DEQ 2019). In 2006, the "Ruby River Watershed Total Maximum Daily Loads and Framework for A Water Quality Restoration Plan" document was published and provides TMDLs for sediment, temperature, metal, and nutrient impairments in the Ruby River and 18 of its tributaries.

DEQ periodically reviews the progress of restoration efforts and progress toward meeting TMDL water quality goals and documents the results in what is called a "TMDL implementation evaluation" (TIE) document. This Ruby River Watershed TIE provides that information as well as recommendations for potential next steps for addressing water quality impairments. This TIE addresses the waterbodies and impairments given in **Table DS-1** below.

Table DS-1. Waterbodies and Impairments Addressed by This TMDL Implementation Evaluation

Waterbody (Assessment Unit) and Location Description	Assessment Unit ID	Impairment(s)
Alder Gulch Creek, Headwaters to mouth (Ruby River)	MT41C002_040	Sediment
Basin Creek, Headwaters to mouth (Ruby River) T11S R3W S20	MT41C003_120	Sediment
Burnt Creek, Headwaters to mouth (Ruby River), T10S R3W S21	MT41C003_130	Sediment
California Creek, Headwaters to mouth (Ruby River) T5S R4W S30	MT41C002_090	Sediment
Coal Creek, Headwaters to mouth (Middle Fork Ruby River)	MT41C003_020	Sediment
Cottonwood Creek, Headwaters to mouth (Ruby River)	MT41C003_030	Sediment
Currant Creek, Headwaters to mouth (Ramshorn Creek), T4S R4W S35	MT41C002_060	Sediment
East Fork Ruby River, Headwaters to mouth (Ruby River)	MT41C003_040	Sediment
Garden Creek, Headwaters to mouth (Ruby Reservoir)	MT41C002_100	Sediment
Indian Creek, Headwaters to mouth (Leonard Slough)	MT41C002_030	Sediment
Middle Fork Ruby River,	MT41C003_090	Sediment

Table DS-1. Waterbodies and Impairments Addressed by This TMDL Implementation Evaluation

Waterbody (Assessment Unit) and Location Description	Assessment Unit ID	Impairment(s)
Divide Creek to mouth (Ruby River)		
Mill Creek, Headwaters to mouth (Ruby River)	MT41C002_020	Sediment Temperature
Mormon Creek, Headwaters to mouth (Upper end of Ruby River Reservoir)	MT41C002_110	Sediment
Poison Creek, Headwaters to mouth (Ruby River) T11S R3W S18	MT41C003_110	Sediment
Ramshorn Creek, Headwaters to mouth (Ruby River)	MT41C002_050	Sediment Lead
Ruby River (below reservoir), Ruby Dam to mouth (Beaverhead River)	MT41C001_010	Sediment Temperature
Ruby River (above reservoir), Confluence of East, West, and Middle Forks to Ruby Reservoir	MT41C001_020	Sediment
Shovel Creek, Headwaters to mouth (Cabin Creek)	MT41C003_150	Sediment
Sweetwater Creek, Headwaters to mouth (Ruby River)	MT41C003_060	Total Nitrogen Total Phosphorus Chlorophyll-a
Warm Springs Creek, Headwaters to mouth (Ruby River)	MT41C003_050	Sediment
West Fork Ruby River, Headwaters to mouth (Ruby River)	MT41C003_080	Sediment
Wisconsin Creek, Headwaters to mouth (Ruby River)	MT41C002_010	Sediment

This TIE will only evaluate impaired waters with completed TMDLs. **Table DS-1** does not contain Clear Creek and Hawkeye Creek. Clear Creek (a side channel of the lower Ruby River) was not listed as impaired however a TMDL was developed. Clear Creek is considered part of the Lower Ruby River and was therefore addressed in the 2006 "Ruby River Watershed Total Maximum Daily Loads and Framework For A Water Quality Restoration Plan" document (DEQ 2006) because it has all of the same primary sediment sources as the Lower Ruby River. Also not included in **Table DS-1**. is Hawkeye Creek. The 2006 TMDL document concluded that a sediment TMDL was not needed for Hawkeye Creek, based on the source assessments conducted at that time. An updated impairment determination was conducted following the completion of the TMDL document. This update included the use of DEQ nutrient guidance, which resulted in findings that adds Total Phosphorus as a new cause of impairment to Aquatic Life, and Cold Water Fisheries uses. Restoration of Clear Creek and Hawkeye Creek should be considered in restoration efforts of the Ruby River watershed.

Local, state, and federal entities have invested significant resources in restoration efforts that have the potential to improve water quality within the Ruby River watershed. The Ruby Valley Conservation District; the U.S. Forest Service, Beaverhead-Deerlodge National Forest; the Bureau of Land Management, Dillon Area Office; The Nature Conservancy; and some private entities have all worked to

restore functionality of portions of the Ruby River and a number of its tributaries. These monitoring, planning, and restoration efforts have laid the foundation for additional work that will be needed to attain water quality standards. This includes continued watershed-scale planning and restoration efforts that will mitigate impacts from pollutant sources. While water quality monitoring can provide additional information about pollutant sources and pathways, the primary focus in the Ruby River watershed should be on designing and implementing projects to reduce sediment, temperature, nutrients and metals loading.

1.0 PURPOSE OF THIS TMDL IMPLEMENTATION EVALUATION

As required by Montana state law, the DEQ develops TMDL documents to provide a framework for water quality restoration efforts. DEQ works with local, state, federal, and private partners to provide assistance to those entities conducting voluntary nonpoint source water quality improvement activities. DEQ periodically reviews the progress of restoration efforts, and documents the results in what is a called a "TMDL implementation evaluation" (TIE) document.

In 2006, the "Ruby River Watershed Total Maximum Daily Loads and Framework For A Water Quality Restoration Plan" document was published and provides TMDLs for sediment, temperature, metal, and nutrient impairments for the Ruby River watershed. This TIE is an evaluation of progress toward meeting the water quality goals of the 2006 TMDLs, as well as an evaluation of the success of on-the-ground efforts to address water quality impairments and DEQ's recommendations for potential next steps for addressing water quality impairments. The Ruby River Watershed TIE also accomplishes the goal of providing a TMDL implementation evaluation consistent with the requirements of the Montana Water Quality Act (75-7-703(9), Montana Code Annotated).

2.0 RUBY RIVER WATERSHED TMDL IMPLEMENTATION EVALUATION CONCLUSIONS

Currently, the impaired waterbodies in the Ruby River watershed (**Section 3.0**) continue to be impacted by pollution from a number of sources. Based on planning documents, reports, project implementation information, discussions with other state, federal agencies and nongovernmental organizations, DEQ has drawn the conclusion that reasonable land, soil and water conservation activities within the Ruby River watershed have resulted in some improvements in water quality. That being said, conditions in the impaired waterbodies have not likely improved to the point that water quality standards are being met and made these waterbodies likely candidates for removal from DEQ's list of impaired waters. To achieve water quality standards and fully restore support for beneficial uses, additional reductions in sediment, nutrients, temperature and metals loading are necessary. Additional focus is needed on funding and implementing projects and practices that reduce sediment, temperature, nutrients and metals loading from agricultural, roads, historical mining and other human activities. A summarized evaluation and conclusion for each impaired waterbody discussed in the 2006 Ruby River watershed TMDL document can be found in **Appendix B**, TIE Conclusions Summary Table.

Section 5.0 of this document, Indicators of Progress, outlines the planning efforts, restorative actions, and water quality monitoring that has taken place in the watershed to support the above conclusions, and **Section 8.1** provides a list of individuals from DEQ and other agencies and organizations contacted to discuss those efforts. **Sections 6.0** and **7.0** of this document provide DEQ's recommendations for next steps toward meeting the water quality goals of the 2006 TMDLs and attaining Montana's water quality standards.

3.0 IMPAIRMENTS ADDRESSED IN THIS DOCUMENT

DEQ periodically reviews the progress of restoration efforts and any progress that has been made toward meeting the TMDL the associated water quality goals. The "TMDL implementation evaluation"

(TIE) summarizes the efforts of local, state and federal collaborators in addressing water quality concerns in the watershed. This section describes those waterbodies that are covered in this TIE, their impairment causes and the sources of pollutants causing those impairments.

The Ruby Watershed is a large (623,000 acres) rural valley containing traditional agricultural operations, a few small communities and business that revolve around the recreational and tourism industry. The Ruby River begins high in the Snowcrest and Gravelly Mountains in southwest Montana and flows north through the Ruby Valley until it joins the Beaverhead and Big Hole Rivers creating the headwaters of the Jefferson River. The Ruby River watershed is broken up into 5 subbasins (**Table 1**).

Table 1. Ruby River Watershed Subbasins

Subbasin	Hydrologic Unit Code (HUC)
Upper Ruby	1002003010
Sweetwater Creek	1002003020
Middle Ruby	1002003030
Alder Gulch	1002003040
Lower Ruby	1002003050

Pollutants in the Ruby River watershed are linked to particular sources. In the case of sediment pollution, the primary sources include roads, grazing, historical mining impacts, and other human caused land disturbances. In the case of temperature, the main sources are those associated with irrigation practices, typically withdrawals and return flows. The main nutrient source is attributable to grazing, and metals tend to be linked to historical mining and other human caused land disturbances. As each pollutant is linked to a source/sources, each source will need to be addressed before waterbodies can achieve water quality standards.

Total Maximum Daily Loads (TMDLs) have been developed in the Ruby River watershed for various pollutant water body combinations. The main causes of impairment include sediment, temperature, metals and nutrients (**Table 2**). These impairments are addressed within a 2006 TMDL document (DEQ 2006). **Map A-1** in **Appendix A** shows the location of the streams in **Table 2** below.

Table 2. Waterbody Impairments and Probable Sources in the Ruby River Watershed

Waterbody Name and AUID	Impairment(s)	Sources
Alder Gulch Creek, MT41C002_040	Sediment	Unpaved roads, riparian grazing, historic placer mining
Basin Creek, MT41C003_120	Sediment	Riparian grazing and natural sources
Burnt Creek, MT41C003_130	Sediment	Riparian grazing and natural sources
California Creek, MT41C002_090	Sediment	Roads, riparian grazing, historic placer mining
Coal Creek, MT41C003_020	Sediment	Riparian grazing and natural sources
Cottonwood Creek, MT41C003_030	Sediment	Unpaved roads, rangeland grazing, channel alterations
Currant Creek, MT41C002_060	Sediment	Unpaved roads, riparian grazing
East Fork Ruby River, MT41C003_040	Sediment	Riparian grazing and natural sources
Garden Creek, MT41C002_100	Sediment	Unpaved roads and riparian grazing

Table 2. Waterbody Impairments and Probable Sources in the Ruby River Watershed

Waterbody Name and AUID	Impairment(s)	Sources
Indian Creek, MT41C002_030	Sediment	Unpaved roads, riparian grazing, irrigated crop production, channel alterations
Middle Fork Ruby River, MT41C003_090	Sediment	Unpaved roads, riparian grazing
Mill Creek, MT41C002_020	Sediment	Unpaved roads, riparian grazing, historical (abandoned) mines
	Temperature	Irrigated crop production (withdrawals and return flows)
Mormon Creek, MT41C002_110	Sediment	Riparian grazing and natural sources
Poison Creek, MT41C003_110	Sediment	Placer mining
Ramshorn Creek, MT41C002_050	Sediment	Unpaved roads, riparian grazing, crop production (irrigation diversions), channel alterations, placer mining
	Lead	Historical mining (tailings) and natural sources
Ruby River below reservoir, MT41C001_010	Sediment	Riparian grazing
	Temperature	Channel alterations, riparian grazing, irrigated crop production (withdrawals and return flows)
Ruby River above reservoir, MT41C001_020	Sediment	Unpaved roads, riparian grazing
Shovel Creek, MT41C003_150	Sediment	Rangeland grazing
Sweetwater Creek, MT41C003_060	Total Nitrogen, Total Phosphorus, Chlorophyll-a	Agricultural (rangeland grazing, irrigated crop production) and natural sources
	Sediment	Unpaved roads, riparian grazing, crop production (irrigated), riparian grazing
Warm Springs Creek, MT41C003_050	Sediment	Unpaved roads, rangeland grazing
West Fork Ruby River, MT41C003_080	Sediment	Rangeland grazing and natural sources
Wisconsin Creek, MT41C002_010	Sediment	Unpaved roads, rangeland grazing

4.0 TMDL IMPLEMENTATION RECOMMENDATIONS

As described in the Ruby River Watershed TMDL document, excess sediment, temperature, metals and nutrients loading to waterbodies in the Ruby River watershed (**Table 2**) is creating conditions where water quality standards are not being achieved. Excess pollutant loading can lead to conditions that negatively impact a number of beneficial uses in each waterbody, as described in the 2006 TMDL document (DEQ 2006). Sediment, temperature, nutrients and metals pollution in the Ruby River watershed comes from a wide variety of sources and include:

- Improperly constructed and maintained road networks (over steepened cut and fill slopes, etc.) and associated road features (culverts, stream crossings etc.)
- Historical mining
- Stream channel alterations resulting from human activity
- Agriculture, including impacts from livestock and irrigation

The 2006 TMDL document outlines general and site-specific recommendations to reduce sediment, temperature, nutrient and metals pollution to acceptable levels. The Ruby River Watershed TMDL document includes the general recommendations described below:

- Reduce sediment contributions from roads
    - Improving road crossings and culverts that contribute large quantities of sediment
    - Improve road maintenance and construction methods
- Restore mining impacted areas
    - Passive and active restoration to achieve all reasonable land water and soil conservation practices
- Improve stream channel flood plain restoration efforts
    - Reduce and repair straightened stream channels
    - Improve riparian vegetation health and abundance
    - Limit bank armoring
    - Develop a flood plain management plan
- Improve grazing best management practices (BMPs)
    - Design grazing management plans that use optimal forage type, intensity, frequency, duration, and season of grazing
    - Provide off-site waters sources
    - Place salt and other minerals in the uplands to encourage cattle away from riparian areas
    - Create hardened stream crossings for cattle crossings
    - Create and improve riparian buffers
    - Create exclosures of sensitive riparian areas
- Irrigation management
    - Prioritize streams that are in need of more instream flow
    - Implement BMPs that improve the quality of water that is returned to surface waters
    - Improve irrigation efficiency
- Maintain optimal performance of Montana Pollutant Discharge Elimination System (MPDES) permitted facilities
    - Discharges should meet any permit limits, conditions and waste load allocations (WLA) outlined in the TMDL document and MPDES permit.

5.0 INDICATORS OF PROGRESS

Local, state, and federal entities have invested resources in restoration efforts that have the potential to improve water quality within the Ruby River watershed. The Ruby Valley Conservation District (RVCD); the U.S.D.A. Forest Service (USFS), Beaverhead-Deerlodge National Forest; the Bureau of Land Management (BLM), Dillon Area Office; The Nature Conservancy (TNC); and private entities have all worked to restore functionality of portions of the Ruby River and a number of its tributaries.

The USFS and the BLM have been active in the watershed overseeing projects such as road maintenance and reconstruction, stream channel stabilization and restoration, culvert removals, riparian conifer removal, and livestock management improvements and monitoring. State government and nonprofit partners have also worked with individual landowners to fund and implement practices that reduce pollution from livestock.

The RVCD has been influential in a number of projects throughout the watershed. This is evident in work in Ramshorn Creek and California Creek (**Map A-1** in **Appendix A**). Work in these watersheds includes installing vegetative buffers along the steam channels, installing instream flow control structures to increase sinuosity, bank stabilization projects, and efforts to reconnect streams with their flood plains. The RVCD has also been conducting tributary monitoring for flow and temperature.

Instrumental to the work completed by the RVCD and its partners is federal 319 grant funding through the Clean Water Act (CWA). Section 319 of the CWA allows federal funding to address nonpoint source pollution. Under Section 319, states and tribes receive grant money to support locally-led voluntary activities to reduce nonpoint source water pollution. **Table 3** identifies projects that received 319 funding in the Ruby River watershed.

Table 3. Federal 319 Grants Awarded in the Ruby River Watershed

319 Contract Number	Project Name	Project Sponsor	Funding Year	319 Funds	Project Description
216038	Ramshorn Creek Restoration Project	Ruby Valley Conservation District	2016	$120,000	Reduce sediment pollution from nonpoint sources and anthropogenic alterations in stream-side vegetation.
216021	Ramshorn Creek Site Investigation	Ruby Valley Conservation District	2016	$4,900	Design and implement a site investigation to evaluate the potential for metals contamination as a result of the proposed Ramshorn Creek restoration project.
212058	Miller Ranch Ruby River Channel Restoration	Ruby Valley Conservation District	2012	$76,500	Restored a portion of the Ruby River on the Miller Ranch by relocating livestock corrals, increasing vegetative cover, and stabilizing banks. The RVCD also developed a community volunteer monitoring program with Big Sky Watershed Corps.
210114	Miller Ranch Ruby River Channel Restoration Design	Ruby Valley Conservation District	2010	$18,700	Restoration of natural channel processes and ecological function in a straightened reach of the Ruby River. Approximately 2,200 feet of new channel and 4,400 feet of new bank.

Table 3. Federal 319 Grants Awarded in the Ruby River Watershed

319 Contract Number	Project Name	Project Sponsor	Funding Year	319 Funds	Project Description
209060	Ruby Three Forks Corral Replacement	Ruby Valley Conservation District	2009	$65,000	New corrals and fenced pastures were built on the Upper Ruby Cattle and Horse Allotment to reduce sediment associated with livestock operations. Hardened crossings were also installed on several small tributaries, as well as a French drain to direct flow under road.
208032	Saubrier Feedlot Reclamation	Ruby Valley Conservation District	2008	$22,644	Reclamation of Saubrier Feedlot site, including elimination of the tons of animal waste, removal of a water gap, and improved riparian vegetation.
207042	Ruby Water Quality Restoration Project Implementation Plan	Ruby Valley Conservation District	2007	$20,200	Construction completed for hardened livestock crossings on Shovel Creek and Corral Creek. Development of a Watershed Restoration Plan and monitoring of project site.
212080	Ruby Watershed Restoration Review Projects	U.S. Forest Service	2007	$6,442	Review of past projects and assessment of potential projects on Forest Service lands. Focused on the Upper Ruby.
206050	Ruby Groundwater/Surface Water Interaction Model	Ruby Valley Conservation District	2006	$73,096	Groundwater flow modeling and GIS interface for Lower Ruby Valley. Results used to develop a long-range plan to protect water quality and education and outreach.

The monitoring, planning, and restoration efforts described above have laid the foundation for additional work that will be needed to attain water quality standards. This includes continued watershed-scale planning and restoration efforts that will mitigate impacts from pollutant sources. While water quality monitoring can provide additional information about pollutant sources and pathways, the primary focus in the Ruby River watershed should be on designing and implementing projects to reduce sediment, temperature, nutrients and metals loading.

Addressing water quality impairments requires project planning implementation and monitoring of water quality improvements. In preparing the Ruby TIE, DEQ staff reached out to local, state, and federal entities involved in water quality improvement efforts. From these contacts, DEQ compiled a list of planning, restoration, and monitoring activities that provide an indication of progress addressing sediment, temperature, nutrients, and metals pollution sources in the Ruby River watershed. However,

these indicators do not account for all the efforts by private citizens to reduce nonpoint source water pollution.

State and federal agencies, local conservation organizations, and some private citizens have already contributed significant resources towards reducing pollution in the Ruby River watershed. This has led to reductions in sediment, nutrient, and metals pollution from some of the most prominent sources in the watershed and improved overall water quality and watershed health. All the cooperating parties should take stock in the fact that these efforts have been successful, and the relationships built through these initial efforts serve as a building block for continued efforts in the watershed.

In early 2012, the USFS prepared a report documenting some of the improvements in the watershed that could be linked to improved water quality. This report was a compilation of restoration projects and their descriptions, watershed improvement efforts and some trends of monitoring in the Upper Ruby River watershed from 2004 to 2012. This report suggested that overall the water quality conditions have started to improve and many of the TMDL targeted streams are assumed to be progressing toward meeting TMDLs because of the restorative efforts (USFS 2012).

Indicators of progress towards achieving Ruby River watershed targets generally fall into one of three major categories: 1) Planning, 2) Restoration, and 3) Monitoring. Below is a summary of actions taken in the Ruby River watershed under these broad categories. **Appendix C** also provides a summary of those projects that were completed on impaired waters (covered in the 2006 TMDL) and recommendations for future water quality monitoring.

5.1 PLANNING

- Ruby Valley Conservation District Ruby Watershed Sampling and Analysis Plan: In 2014, the RVCD developed a sampling and analysis plan for its voluntary monitoring efforts (Ruby 2014). The objective of the sampling plan is to collect basic flow and sediment data (turbidity), with the intent of expanding on these efforts for future monitoring.
- Groundwater Surface Water Interaction Model: In 2006, the RVCD funded development of a groundwater/surface interactions model for the Lower Ruby Valley that helps the RVCD predict changes in hydrology linked to irrigation practices.
- Renewal of Cooperative Agreement: The BLM has contributed funding and expertise to the RVCD annually since 2014. In 2017, the BLM renewed this cooperative agreement with the RVCD which will continue through 2022.
- Induced Meander Project: The BLM will partner with RVCD to implement multiple phases of this project. Induced meanders establish stream channel structure that promotes proper stream function.
- Conifer Removal: Over the next three years the BLM will work with RVCD to implement approximately 10 miles of conifer removal treatments in adjacent reaches on the west side of the Tobacco Root Mountains. The goal of conifer removal is to decrease riparian species' competition for soil moisture and light. The USFS is also working to remove encroaching conifers in the riparian area of the mainstem of the Ruby River.
- Road Closures: The USFS is working with local partners to assess future travel management needs and improve water quality. Road closures are a portion of this plan. Closing forest roads will reduce loading from sediment sources associated with roads.

- Road Relocation: The BLM is considering re-routing the Warm Springs Creek road to the other side of the drainage via a bridge. The new road would connect with the existing one at the recreation area avoiding most of the springs area and bridge.
- Ruby Habitat Foundation: The foundation is planning to restore approximately 9,000 feet of stream channel (realignment, reestablishing flood plain connectivity, and riparian vegetation planting) on Clear Creek. The foundation is in partnership with the NRCS through the Agricultural Land Easement Program. The project is expected to begin in 2020.

5.2 ON-THE-GROUND RESTORATIVE ACTIONS

- Riparian Conifer Removal in Middle Ruby: In 2017, the BLM treated approximately 15 acres on Jack Creek, Barton Gulch, and Idaho Creek, above Ruby Reservoir. Many of the treated reaches rated poorly during the 2014 Middle Ruby Watershed Assessment due to conifer encroachment.
- Riparian Conifer Removal Mainstem Ruby: The USFS has initiated removal of a large number of encroaching conifers in the riparian area of the Mainstem of the Ruby River as part of a wildlife project.
- In-Stream Restoration:
    - Lower Ruby River: TNC has completed flood plain reconnection, flood plain reactivation and riparian vegetation planting at a number of locations along the Lower Ruby River.
    - California Creek: In 2018, the BLM collaborated with RVCD to complete a headcut stabilization project on California Creek. California Creek is one of the most impacted streams from historic placer mining in the southern Tobacco Roots.
    - Mainstem Ruby River (Downstream of Lazymand Creek): In 2007, the USFS constructed 9 pools to enhance river volume and provide habitat, approximately 3,500 feet of river bank was re-sloped and planted with willows.
    - Ramshorn Creek Induced Meander Project: The BLM is partnering with RVCD to implement the first phase of this project in 2019. The goal of this treatment is to encourage natural sinuosity and dissipation of stream energy, resulting in streambank building and reduction of sediment loading.
- BLM Public Land Livestock Management: Improvements have included reducing season of use, reducing number of cattle per allotment, teaching permittees when to move cattle off pastures, constructing off-site watering, installing hardened crossings and fencing riparian areas
    - Livestock Management Improvements in Middle Ruby: In 2017, the BLM completed the second phase of a riparian improvement project on Cottonwood Creek (tributary to Mormon Creek). Phase one involved installing off-site water and riparian fencing to alleviate livestock pressure on a sensitive riparian zone (completed in 2016). Phase two involved installing a hardened water gap using crushed gravel. Collectively, these improvements will reduce sediment loading into the Ruby River and enhance riparian function.
    - Livestock Management Revisions Impacting Alder Gulch: On the Hungry Hollow allotment, several reaches rated as “functional at risk” (FAR) in 2016, based on Proper Functioning Condition monitoring. Revisions to grazing included changing grazing season from May 15 through October 28 to July 20 through October 28. Increased attention to horseback riding will be completed on the Williams Creek tributaries in the upper portion of the Williams Creek pasture. On the McGovern allotment, Browns Gulch (reach 1202) rated FAR in 2016. Revisions to grazing included season of use changed from 6/1 – 10/15 (season long use) to alternating use up to 30 days between 6/16 – 7/30 and 8/30 to 10/15. On the Alder Gulch allotment, reach 1261 rated FAR in 2016.

Revisions to grazing management included reconfigured fencing to move the impacted reach into the Sheep Flats pasture that is rested every third year. Pasture use was also limited to 30 days during grazed years. Livestock exclosure fence added around reach 1252 in Water B pasture.

- Livestock Management Revisions Impacting Wisconsin Creek: In the Georgia Gulch allotment, Wet Georgia Gulch (reach 1240) rated FAR in 2016. Revisions to grazing included season of use changed from May 1 through September 1 to June 1 through September 1; animal unit months reduced from 232 to 220; rest incorporated allowing complete rest every 4th year in each pasture.
- Sweetwater Creek Livestock Enclosures: In 2017, three livestock exclosures were constructed in the Belmont allotment (Little Brown Bat, Belmont Sec. 12, and Belmont Sec. 24 springs). Several reaches in this allotment did not meet riparian standards in 2013 due to livestock management.
- Mormon Creek Livestock Enclosures: In 2017, two livestock exclosures were constructed in the Garden Creek allotment (Left Fork Mormon Spring, South Fork Mormon Spring). Several reaches in this allotment did not meet the BLM's riparian standards in 2013 due to livestock management.

- Warm Springs Creek Road Maintenance: The USFS has completed significant maintenance to reduce sediment loading at roadside spring locations.
- USFS Road 100 Maintenance: The USFS plans to provide continual maintenance to the 100 road there by limiting sediment inputs to tributaries of the Ruby River.
- Mainstem Ruby Road Stabilization: The USFS has completed stabilization work on a road segment near the headwaters to reduce sediment and protect the infrastructure.
- Hardened Stream Crossings: The USFS installed hardened stream crossings on the following waterbodies:
  - Shovel Creek (2009 and 2010)
  - West Fork of the Ruby River (2000's to 2004)
  - Cottonwood Creek (2017)
- Ruby Three Forks Corral Replacement and Stream Reclamation: From 2009 to 2010, the USFS in conjunction with the RVCD decommissioned the old corral and constructed a new corral away from Tributary Creek (tributary to East Fork of the Ruby River). The project included installation of a hardened water gap at a stream crossing, construction of new roads, and improvements to existing roads.
- Reclamation of Saubrier Feedlot: In 2008, the RVCD removed animal waste from the feed lot, installed water gaps, and improved riparian vegetation.
- Miller Ranch Ruby River Channel Restoration: In 2012, the RVCD restored a stretch of the Ruby River on the Miller Ranch by relocating livestock corrals, increasing vegetative cover, and stabilizing banks.
- Upper Ruby River Beaver Augmentation: The USFS has been active in enhancing beaver habitat and population in the headwaters of the Ruby River. Beaver dams trap sediment, reduce peak flows, and increase summer flows. Waterbodies include Coal Creek and the mainstem of the upper Ruby River.
- Reclamation of the Buckeye Mine and Mill site: In 2006, DEQ completed reclamation on a significant portion of the Buckeye Mine and Mill site (MT DEQ Waste Management and Remediation Division project ID MT029451- Buckeye) on Mill Creek. This project focused on removing solid media contaminant sources located at the mine and mill sites and those materials eroding into Mill Creek and disposal of this waste.

- Reclamation of the Northern Madison Mine site: DEQ oversaw reclamation of a portion of the Northern Madison Mine (MT002901 – Northern Madison).

5.3 MONITORING

- The BLM assesses watersheds on a 10-year cycle. The Middle Ruby River watershed was assessed in 2013 and the South Tobacco Roots Watershed in 2016. The BLM continues to conduct watershed assessments and proper functioning condition (PFC) assessments throughout the watershed.
- From 2017 to2018, the BLM assisted the RVCD with the development of a comprehensive strategy to monitor discharge and water temperature in select tributaries of the Ruby River. Shared objectives include an improved understanding of the processes that are adversely impacting water quantity and quality within the Upper Missouri Basin and the development of projects that improve water resource conditions across the public and private domain. This includes data from Wisconsin Creek, Mill Creek, Ramshorn Creek, Indian Creek, California Creek, Alder gulch Creek and Clear Creek. All data collected by RVCD is available at https://rvcd.org/monitoring-drought-resilience/.
- The RVCD has been working with the BLM to delineate wetlands in the Ramshorn and California Creek watersheds.
- The RVCD developed a community volunteer monitoring program with Big Sky Watershed Corp to monitor water quality in the Middle and Upper Ruby Watershed.
- The RVCD has been monitoring flow and temperature for a number of tributaries in the Lower Ruby River watershed. These include Wisconsin, Indian, Mill, Ramshorn, Clear, Alder and California Creeks.
- In 2019 the USFS conducted a sediment delivery survey of USFS road 10 and identified 47 sediment delivery sites. This information will be used to help prioritize road maintenance in the future and address road derived sediment into the Ruby River and tributaries.
- In 2019 the USFS conducted 14 stream surveys in the upper Ruby watershed in as part of an effort to characterize the effects of sheep grazing and trailing on project streams. Wetlands, amphibians, and Pearlshell Mussels were also evaluated as part of this effort. Additional inventories both vegetative and morphological will continue to evaluate grazing condition throughout the Upper Ruby.
- In 2018, the USFS completed a number of sediment and habitat stream surveys in the Upper Ruby River watershed including the mainstem of the Upper Ruby River, Coal Creek, Perkins Creek, Basin Creek, Poison Creek, East Fork Ruby River, Iron Creek, and the North Fork of Cottonwood Creek.
- In 2008, the USFS conducted the Upper Ruby River bank stabilization photo comparison assessment.
- The USFS has been conducting stream condition trend monitoring throughout the watershed. This includes streambank cross sections and photo point monitoring at numerous locations. Cross sections are intended to be surveyed for several years to assess any improvements in stream health. The USFS will also continue to conduct PACFISH/INFISH Biological Opinion (PIBO) stream surveys.
- Stream temperature data has been collected by Montana Fish, Wildlife and Parks and the USFS.

- TNC has conducted flow, temperature, wetland delineation, and endangered species monitoring on the Lower Ruby River.

6.0 RECOMMENDATIONS FOR ADDITIONAL RESTORATION EFFORTS

Below are specific recommendations to address sediment, nutrient and metals pollutant reductions from the more prevalent sources in the Ruby River watershed.

6.1 AGRICULTURE

Agricultural land in the Ruby River watershed is most commonly used for the rearing of livestock and production of crops. Pollution from agriculture comes from a number of nonpoint sources. Some nonpoint sources of pollution related to agricultural include such things as sediment contributions from stream bank trampling and direct deposition of fecal matter in stream by livestock. Other nonpoint sources of pollution from agriculture include reduction in riparian vegetation resulting from grazing, hillside erosion exacerbated by compaction and stream flow manipulation because of irrigation. The following subsections discuss recommendations for each of the most prominent agricultural practices contributing pollution.

6.1.1 Grazing Management

Riparian areas and wetlands offer livestock abundant sources of food, water, and shelter. Allowing livestock to congregate near these areas can provide a means for pollutants to enter the water. While grazing is prolific throughout the watershed, there are a few subbasins that contain significantly more near sources of sediment including Warm Springs, Alder, Indian, Burnt and Coal Creek watersheds. A restoration strategy reducing impacts of grazing on water quality, riparian health and channel condition should include implementation of all reasonable land, soil and water conservation practices or best management practices (BMPs) prescribed on a site-specific basis. BMPs are most effective as part of a management strategy that focuses on critical areas within the watershed, which are those areas contributing the largest pollutant loads or are especially susceptible to impacts from grazing.

Recommendations:

- State and federal land management agencies should work with livestock owners to plan and implement grazing management practices that determine intensity, frequency, duration and seasonality of grazing to promote riparian and wetland health, as well as soil health. This may be achieved through high intensity, low duration grazing.
- Provide off-stream watering in areas with sensitive streambanks and riparian health.
- Construct hardened stream crossings (in conjunction with fencing) to minimize the number of crossing areas to reduce erosion.
- Encourage the growth of riparian vegetation to prevent accelerated soil erosion, protect streambanks and provide filtration of sediment.
- Livestock owners should work with grazing management professionals from MSU Extension, NRCS, and private industry to develop and implement voluntary riparian and rangeland health monitoring.
- Local community, government agencies, conservation districts, and watershed groups should help identify specific sources of financial and technical assistance to improve livestock

management for the benefit of water quality and expand outreach efforts to livestock owners to encourage and assist with restoration projects.

6.1.2 Irrigation Management

Farmers have made significant strides helping improve water quality and should continue to evaluate irrigation practices to minimize the impacts to water quality. Irrigation practices play a key role in surface water quality and quantity in the Ruby River watershed. For example, fertilizer over-applied to crops during irrigation can cause nutrients to reach nearby surface waters via overland flow. Irrigation practices also play a key role in determining how much fertilizer leaves the targeted soil horizon (root zone) and enters the groundwater/surface water system. Over land flows of return water can also contribute sediment to nearby waterways and cause increase instream temperatures.

The ability to maintain instream flows is also a major consideration in determining impacts to surface water quality and quantity. Direct withdrawals from a waterbody lesson its ability to stay fully functional and polluted return flows (temperature, sediment, nutrients and in some cases metals) have a direct impact on surface water quality. Irrigation withdrawals from groundwater also have the potential to reduce in-stream flows because of groundwater surface water connectivity.

Recommendations:

- Local water users should do their best to maintain instream flows adequate to maintain water quality and healthy riparian areas.
- Investigate irrigation return flows and associated water quality to understand nutrient, sediment and temperature dynamics on water bodies with irrigation returns. Work with federal and state funding sources to convert less efficient means of irrigation to more efficient ones.
- Plant and maintain deep-rooted, permanent vegetative buffers between fields and adjacent waterways.
- Avoid placing irrigation infrastructure (pivots/canals/ditches/etc.) in areas with a high-water table (floodplains, riparian areas, and wetlands).
- Evaluate nutrient and water application rates to prevent over-application.

6.2 ROADS

Sediment loading to streams from roads has been significantly reduced in the watershed, but the vast road network should continue to be evaluated for maintenance or closure.

Recommendations:

- Use construction, restoration, and maintenance techniques that minimize sediment delivery to nearby surface waters.
- In those instances where water and associated sediments leave the road corridor, provide adequate sediment filtration between the road and stream. If possible and practicable, increase the distance between the road and stream. Encourage plant growth in riparian buffer areas and install slash filters and spreader structures.
- Prevent the disturbance of vulnerable slopes or other areas that will be difficult to maintain.

6.3 MINING

While a number of hard rock and placer mines have been reclaimed, there is still significant reclamation/restoration work needing to take place in the Ruby River watershed.

Recommendations:

- Reclamation/restoration is still needed in those areas that have not seen restorative activities. Stakeholders should continue efforts to reclaim abandoned hard rock mine sites and seek assistance from the DEQ Abandoned Mine Lands program.
- Restoration efforts should focus on stream bank and floodplain disturbances at and downstream of the mining source and should address:
    - Channel straightening
    - Lack of riparian vegetation
    - Bank hardening, riprap, revetments, etc.
- In placer-mined areas, it is important to introduce and maintain beaver populations and protect riparian vegetation and allow natural floodplain building and recovery to continue. Alternatively, consider the use of beaver mimicry structures and induced meandering techniques where feasible to restore natural stream form and function.
- All new mining must apply all reasonable land, soil and water conservation practices to protect water quality and channel condition.
- Conduct water quality, sediment, and temperature monitoring to refine source area locations.

7.0 MONITORING RECOMMENDATIONS

A number of monitoring efforts have taken place throughout the watershed. The RVCD has collected flow and temperature data in Ramshorn, California, Alder Gulch, Clear, Mill, Indian and Wisconsin Creeks. The USFS and the BLM have also been quite active in the Ruby River watershed. Monitoring efforts conducted by the USFS include stream surveys conducted in Basin Creek, Poison Creek, Cottonwood Creek and Coal Creek. The BLM monitoring efforts include watershed assessments in the Upper Ruby, Rams Horn Creek, Indian Creek, Wisconsin Creek, Currant Creek and Cottonwood Creek. While these efforts have provided significant data, continued water quality monitoring is necessary.

Water quality, biologic, stream morphology and photo point monitoring are necessary to gather information about pollutant sources and pathways. Monitoring should be conducted in a manner that will aid in determining restoration project effectiveness and provide information on future restoration activities. The primary focus in the Ruby River watershed should be on designing and implementing projects to reduce sediment, temperature, nutrient, and metals loading.

Future sediment, temperature, nutrients, and metals related monitoring could focus on the list of below items. These efforts would ideally be in collaboration with Montana DEQ's Monitoring and Assessment Section or other state and federal agencies that are active in data collection in the watershed (USFS, BLM, MT FWP, etc.)

- Conduct monitoring to better determine baseline conditions, more accurately characterize contributing sources, and establish trends in water quality data for assessment and restoration planning.

- Conduct monitoring in those watersheds that have seen restorative activities and are showing improvement in water quality or have the potential to improve in water quality.
- Conduct sampling in accordance with approved sampling protocols and methodologies and using methods of quality assurance and quality control that will ensure data will be of known quality.
- Conduct sampling that targets particular pollutants of concern (sediment, nutrients, temperature, and metals).
- Select monitoring locations that can serve as long-term monitoring stations

Table 4 below prioritizes the impaired waters in the Ruby River watershed which should be considered for future monitoring efforts. A high, medium, and low ranking system is used to suggest the order in which these waterbodies might receive consideration. Ranking is based on: the degree to which the watershed is impacted, how much restoration work has been completed (lack or presence of sources), if the waterbody has the potential to show improvement, and if partners are active in the watershed. **Appendix C** summarizes a number of these attributes and includes the rank designation included in this table.

Table 4. Ruby River Monitoring Prioritization

Ruby River Watershed Streams	Assessment Unit	Monitoring Prioritization Scale
Alder Gulch Creek	MT41C002_040	Low
Basin Creek	MT41C003_120	Medium
Burnt Creek	MT41C003_130	Medium
California Creek	MT41C002_090	High
Clear Creek	No Assessment Unit	Medium/Low
Coal Creek	MT41C003_020	Medium
Cottonwood Creek	MT41C003_030	Medium
Currant Creek	MT41C002_060	Low
Garden Creek	MT41C002_100	Low
Indian Creek	MT41C002_030	Low
Mill Creek	MT41C002_020	Low
Mormon Creek	MT41C002_110	Low
Poison Creek	MT41C003_110	Medium
Ramshorn Creek	MT41C002_050	High
Upper Ruby River (above reservoir)	MT41C001_020	High
Lower Ruby River (below reservoir)	MT41C001_010	Medium
Ruby River, East Fork	MT41C003_040	Medium
Ruby River, Middle Fork	MT41C003_090	Low
Ruby River, West Fork	MT41C003_080	Medium
Shovel Creek	MT41C003_150	Low
Sweetwater Creek	MT41C003_060	Low
Warm Springs Creek	MT41C003_050	High
Wisconsin Creek	MT41C002_010	Low

Montana's water quality standards (DEQ 2019) often serve as the water quality target to be attained for a waterbody to be considered unimpaired. For each pollutant, water quality standards are applied to the parameters that link directly to the impaired beneficial use(s) and applicable water quality standard(s). Comparing existing stream conditions to target values allows for a better understanding of

the extent and severity of the problem. Most waterbodies in the Ruby River watershed have sediment and temperature impairments and therefore narrative targets. How narrative standards were applied to individual waterbody and source combinations is complex. To determine how targets were applied to a specific waterbody, it is best to reference DEQs Ruby River Watershed TMDL document (DEQ 2006).

8.0 Information Sources and References

8.1 Communication Sources

A number of individuals provided information in support of TIE development. A significant amount of information to support this document was gathered through personal conversations with individuals from other agencies and non-governmental organizations working in the watershed. Their names and associations are described in **Table 5**.

Table 5. Ruby River Watershed Contacts

Name	Title	Organization
Kevin Weinner	Hydrologist	US Forest Service, Beaverhead-Deerlodge National Forest
Gwen Davies	Hydrologist	Bureau of Land Management, Dillon Field Office
Darin Watschke	Fish Biologist	US Forest Service, Beaverhead-Deerlodge National Forest
David Stout	Stewardship Director	Ruby Valley Conservation District
Bob Flesher	Senior Environmental Project Officer	Montana Department of Environmental Quality, Waste Management and Remediation Division
Matt Jaeger	Fisheries Biologist	Montana Department of Fish Wildlife and Parks
Nathan Korb	Freshwater Program Director	The Nature Conservancy
Les Gilman	Executive Director	Ruby Habitat Foundation

8.2 Document References

Montana Department of Environmental Quality. December 2006. Ruby River Watershed Total Maximum Daily Loads and Framework For A Water Quality Improvement Plan 2006.

Montana Department of Environmental Quality. 2019. Circular DEQ-7: Montana Numeric Water Quality Standards. Helena, MT: Montana Department of Environmental Quality. http://deq.mt.gov/wqinfo/Circulars.mcpx. Accessed 1/15/2013.

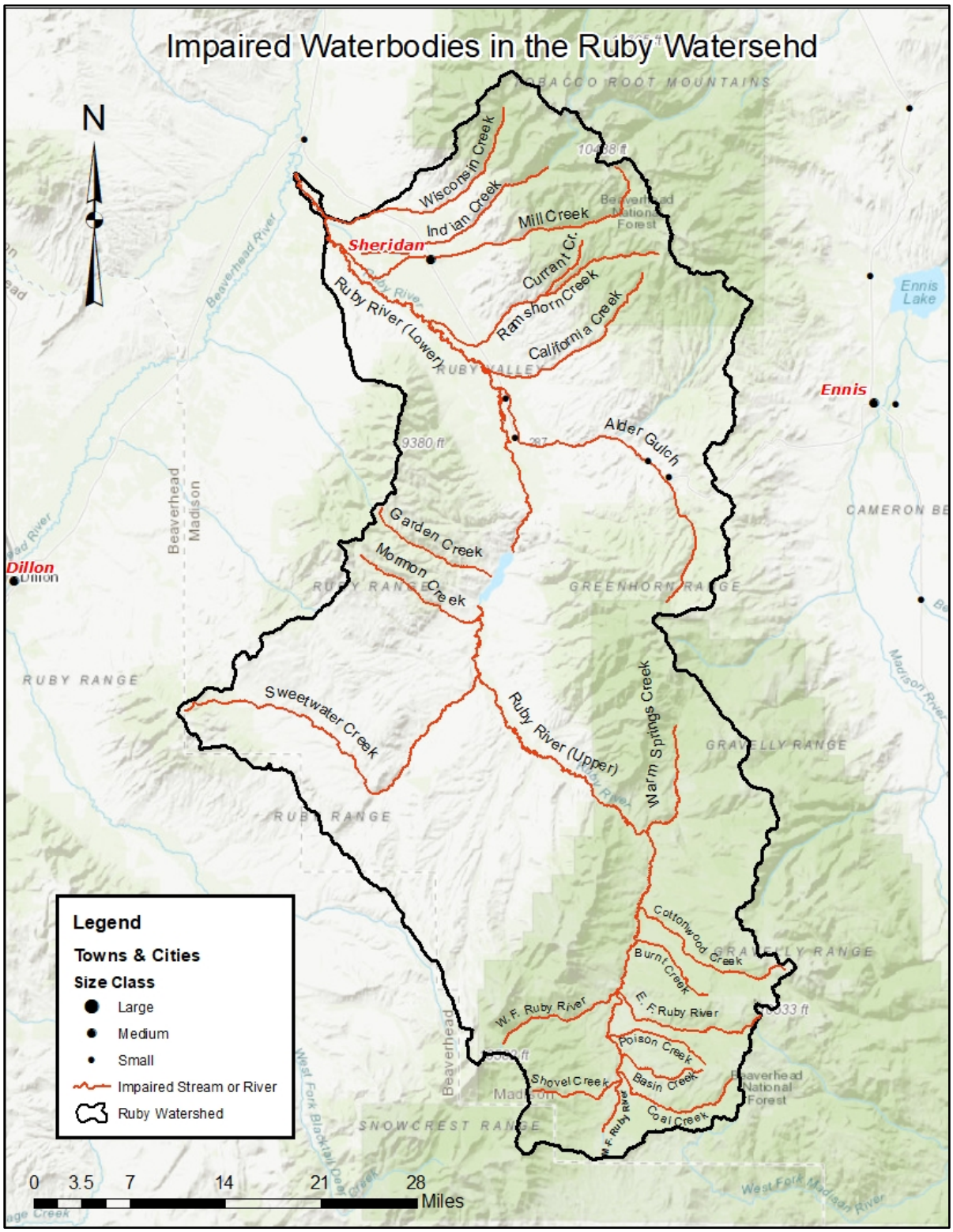
Ruby Valley Conservation District. 2014 Ruby Watershed Volunteer Monitoring Program Discharge, Turbidity, and Photo Point Sampling and Analysis Plan. 2014

United States Forest Service. May 2012. Upper Ruby River Watershed Restoration Project, Improvements Descriptions, and Monitoring Data Outcome Report.

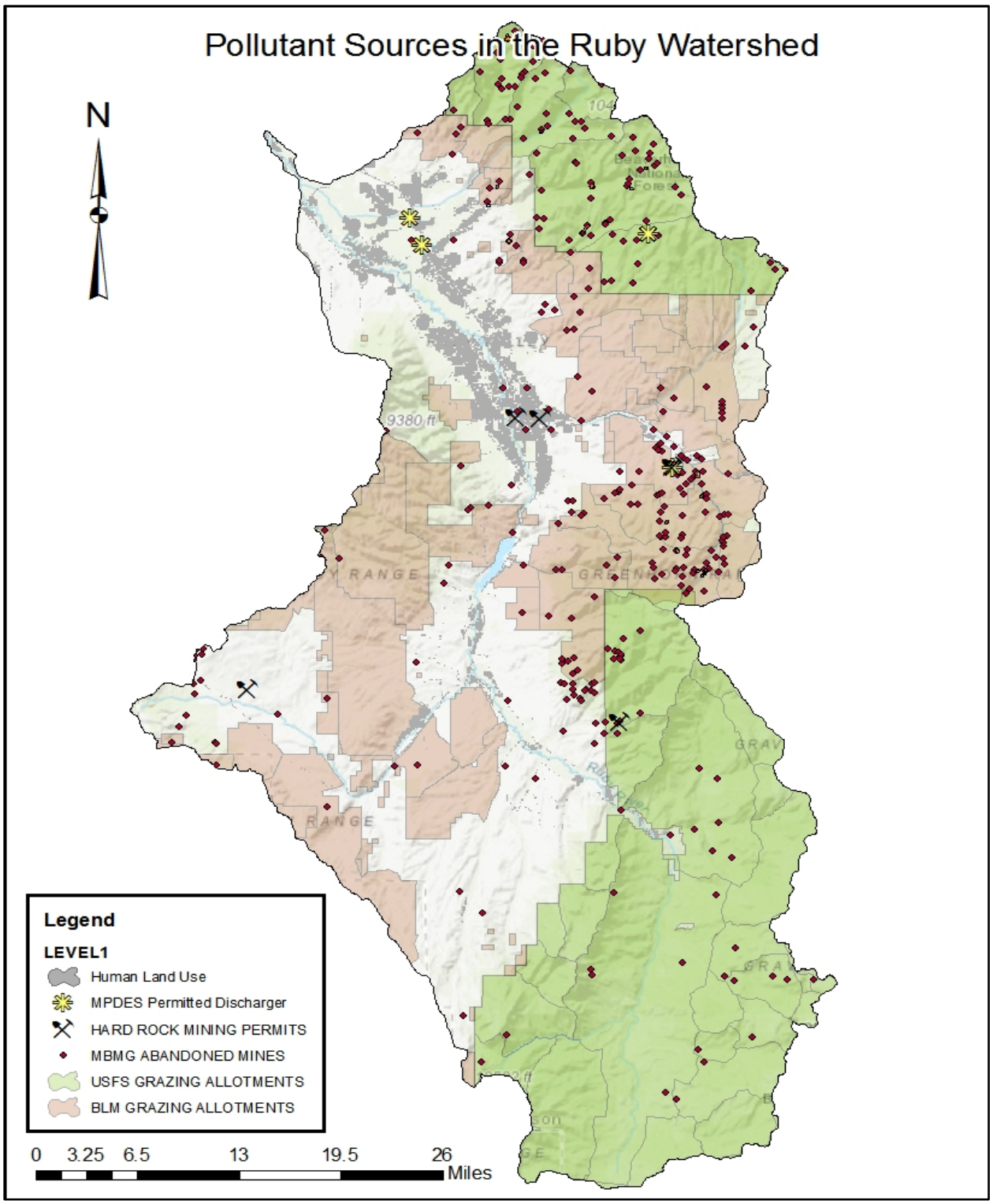
APPENDICES

Appendix A – Maps
Appendix B – TIE Conclusions Summary Table
Appendix C – Project Summaries and Monitoring Recommendations

APPENDIX A – MAPS



Map A-1. Impaired Waterbodies in the Ruby River Watershed



Map A-2. Locations of Pollutant Sources in the Ruby River Watershed

APPENDIX B – TIE CONCLUSION SUMMARY TABLE

RUBY RIVER WATERSHED STREAMS	TMDL IMPAIRMENT	BMP STATUS	DATA SUMMARY	TIE CONCLUSION
Alder Gulch Creek, MT41C002_040	Sediment	Minimal BMPs implemented. Significantly more BMPs are needed.	Some data available for estimating conditions/trends. Insufficient data for reassessment.	Additional restorative efforts are needed. Reassessment to evaluate water quality and assess sources is recommended.
Basin Creek, MT41C003_120	Sediment	Some BMPs implemented. Additional BMPs are needed.	Insufficient data available for estimating conditions/trends or reassessment.	Additional restorative efforts are needed. Reassessment to evaluate water quality and assess sources is recommended.
Burnt Creek, MT41C003_130	Sediment	Some BMPs implemented. Additional BMPs are needed.	Insufficient data available for estimating conditions/trends or reassessment.	Additional restorative efforts are needed. Reassessment to evaluate water quality and assess sources is recommended.
California Creek, MT41C002_090	Sediment	Some BMPs implemented. Significantly more BMPs are needed.	Some data available for estimating conditions/trends. Insufficient data for reassessment.	Additional restorative efforts are needed. Reassessment to evaluate water quality and assess sources is recommended.
	Nutrients (Total Phosphorus)	Some BMPs implemented. Significantly more BMPs are needed.	No nutrient data being collected, insufficient data available for estimating conditions/trends or reassessment.	Additional restorative efforts are needed. Reassessment to evaluate water quality and assess sources is recommended.
Clear Creek	Sediment (Clear Creek is not listed on the 303(d) list. However, it was given allocations in the TMDL document)	DEQ is not aware of any BMP or other restoration activities on this waterbody to address the sediment impairment	Some data available for estimating conditions/trends. Insufficient data for reassessment.	Restorative efforts are needed. Evaluation of water quality and sources assessment is recommended.

RUBY RIVER WATERSHED STREAMS	TMDL IMPAIRMENT	BMP STATUS	DATA SUMMARY	TIE CONCLUSION
Coal Creek, MT41C003_020	Sediment	Some BMPs implemented. Additional BMPs are needed.	Insufficient data available for estimating conditions/trends or reassessment.	Restorative efforts have been implemented and improvements made. Continued restoration and monitoring efforts are needed.
Cottonwood Creek, MT41C003_030	Sediment	Some BMPs implemented. Additional BMPs are needed.	Insufficient data available for estimating conditions/trends or reassessment.	Additional restorative efforts are needed. Reassessment to evaluate water quality and assess sources is recommended.
Currant Creek, MT41C002_060	Sediment	DEQ is not aware of any BMP or other restoration activities on this waterbody to address the sediment impairment	Insufficient data available for estimating conditions/trends or reassessment.	Restorative efforts are needed. Evaluation of water quality and sources assessment is recommended.
Garden Creek, MT41C002_100	Sediment	Minimal BMPs implemented. Significantly more BMPs are needed.	Insufficient data available for estimating conditions/trends or reassessment.	Additional restorative efforts are needed. Reassessment to evaluate water quality and assess sources is recommended.
Indian Creek, MT41C002_030	Flow and habitat alterations (addressed through sediment TMDL)	DEQ is not aware of any BMP or other restoration activities on this waterbody to address the Flow and habitat alteration (sediment) impairment	Some data available for estimating conditions/trends.	Restorative efforts are needed. Evaluation of water quality and sources assessment is recommended.
Mill Creek, MT41C002_020	Sediment	DEQ is not aware of any BMP or other restoration activities on this waterbody to address the sediment impairment	Some data available for estimating conditions/trends. Insufficient data for reassessment.	Restorative efforts are needed. Evaluation of water quality and sources assessment is recommended.
	Temperature (addressed through sediment TMDL)	DEQ is not aware of any BMP or other restoration activities on this waterbody to address the sediment impairment	Some data available for estimating conditions/trends.	Restorative efforts are needed. Evaluation of water quality and sources assessment is recommended.
Mormon Creek, MT41C002_110	Sediment	Some BMPs implemented. Significantly more BMPs are needed.	Insufficient data available for estimating conditions/trends or reassessment.	Additional restorative efforts are needed. Reassessment to evaluate water quality and assess sources is recommended.

RUBY RIVER WATERSHED STREAMS	TMDL IMPAIRMENT	BMP STATUS	DATA SUMMARY	TIE CONCLUSION
Poison Creek, MT41C003_110	Sediment	Some BMPs implemented. Significantly more BMPs are needed.	Insufficient data available for estimating conditions/trends or reassessment.	Additional restorative efforts are needed. Reassessment to evaluate water quality and assess sources is recommended.
Ramshorn Creek, MT41C002_050	Sediment	Some BMPs implemented. Significantly more BMPs are needed.	Some data available for estimating conditions/trends. Insufficient data for reassessment.	Additional restorative efforts are needed. Reassessment to evaluate water quality and assess sources is recommended.
	Metals (lead)	Some BMPs implemented. Significantly more BMPs are needed.	Some data available for estimating conditions/trends. Insufficient data for reassessment.	Additional restorative efforts are needed. Reassessment to evaluate water quality and assess sources is recommended.
Upper Ruby River (above reservoir), MT41C001_020	Sediment	Some BMPs implemented. Significantly more BMPs are needed.	Some data available for estimating conditions/trends. Insufficient data for reassessment.	Additional restorative efforts are needed. Reassessment to evaluate water quality and assess sources is recommended.
Lower Ruby River (below reservoir), MT41C001_010	Sediment	Minimal BMPs implemented. Significantly more BMPs are needed.	Some data available for estimating conditions/trends. Insufficient data for reassessment.	Additional restorative efforts are needed. Reassessment to evaluate water quality and assess sources is recommended.
	Temperature	Minimal BMPs implemented. Significantly more BMPs are needed.	Some data available for estimating conditions/trends. Insufficient data for reassessment.	Additional restorative efforts are needed. Reassessment to evaluate water quality and assess sources is recommended.
Ruby River, East Fork, MT41C003_040	Sediment	Some BMPs implemented. Significantly more BMPs are needed.	Some data available for estimating conditions/trends. Insufficient data for reassessment.	Additional restorative efforts are needed. Reassessment to evaluate water quality and assess sources is recommended.
Ruby River, Middle Fork, MT41C003_090	Sediment	Some BMPs implemented. Significantly more BMPs are needed.	Some data available for estimating conditions/trends. Insufficient data for reassessment.	Additional restorative efforts are needed. Reassessment to evaluate water quality and assess sources is recommended.
Ruby River, West Fork, MT41C003_080	Sediment	Some BMPs implemented. Significantly more BMPs are needed.	Some data available for estimating conditions/trends. Insufficient data for reassessment.	Restorative efforts have been implemented and improvements made. Continued restoration and monitoring efforts are needed.

RUBY RIVER WATERSHED STREAMS	TMDL IMPAIRMENT	BMP STATUS	DATA SUMMARY	TIE CONCLUSION
Shovel Creek, MT41C003_150	Sediment	Some BMPs implemented. Significantly more BMPs are needed.	Insufficient data available for estimating conditions/trends or reassessment.	Additional restorative efforts are needed. Reassessment to evaluate water quality and assess sources is recommended.
Sweetwater Creek, MT41C003_060	Sediment	Some BMPs implemented. Significantly more BMPs are needed.	Some data available for estimating conditions/trends. Insufficient data for reassessment.	Additional restorative efforts are needed. Reassessment to evaluate water quality and assess sources is recommended.
	Nutrients	Some BMPs implemented. Significantly more BMPs are needed.	Some data available for estimating conditions/trends. Insufficient data for reassessment.	Additional restorative efforts are needed. Reassessment to evaluate water quality and assess sources is recommended.
Warm Springs Creek, MT41C003_050	Sediment	Minimal BMPs implemented. Significantly more BMPs are needed.	Some data available for estimating conditions/trends. Insufficient data for reassessment.	Restorative efforts have been implemented and improvements made. Continued restoration and monitoring efforts are needed.
Wisconsin Creek, MT41C002_010	Sediment	Minimal BMPs implemented. Significantly more BMPs are needed.	Some data available for estimating conditions/trends. Insufficient data for reassessment.	Additional restorative efforts are needed. Reassessment to evaluate water quality and assess sources is recommended.

APPENDIX C – PROJECT SUMMARY AND MONITORING RECOMMENDATIONS

RUBY RIVER WATERSHED STREAMS	PREVIOUS MONITORING / PROJECTS[1]	ONGOING PROJECTS[1]	PLANNING[1]	2018 LIST OF IMPAIRED WATERS	RECOMMENDED SAMPLING	MONITORING PRIORITIZATION SCALE
Alder Gulch Creek, MT41C002_040	RVCD: Stream flow and temperature data (https://rvcd.org/monitoring-drought-resilience/)	BLM: Livestock management revisions: (season of use change; fencing enclosures)		Alteration in stream-side or littoral vegetative covers, Chlorophyll-a, Lead, Manganese, Mercury, Total Nitrogen, Substrate and Habitat Alterations, Sediment	Flow, Sediment, Metals, Nutrients	Low
Basin Creek, MT41C003_120	USFS: Cross-sections and point photos, bank comparison photos, stream surveys in 2018	USFS: Stream Surveys. Following BDNF riparian grazing guideline and trailing cattle with improved methods to minimize impacts to soil and streams	USFS: Data collection to characterize the effects of sheep grazing and trailing on project streams. Wetlands, Amphibians, and Pearlshell mussels will also to be evaluated	Total Nitrogen, Total Phosphorous, Sediment, Alteration in stream-side or littoral vegetative covers	Flow, Sediment, Nutrients	Medium
Burnt Creek, MT41C003_130	USFS: PIBO surveys, cross-sections and photo points	USFS: Following BDNF riparian grazing guideline and trailing cattle with improved methods to minimize impacts to soil and streams		Total Nitrogen, Total Phosphorous, Sediment, Alteration in stream-side or littoral vegetative covers	Flow, Sediment, Nutrients	Medium

RUBY RIVER WATERSHED STREAMS	PREVIOUS MONITORING / PROJECTS[1]	ONGOING PROJECTS[1]	PLANNING[1]	2018 LIST OF IMPAIRED WATERS	RECOMMENDED SAMPLING	MONITORING PRIORITIZATION SCALE
California Creek, MT41C002_090	RVCD: Stream flow and temperature data by (https://rvcd.org/monitoring-drought-resilience/), and wetland delineation. BLM: 2016 watershed assessment.	BLM & RVCD: 2017-2018 head cut stabilization project and channel stabilization, phase 1 of an induced meander project in 2019.	BLM & RVCD: Over the next three years (2019-2021), the BLM working with RVCD to implement approximately 10 miles of riparian conifer removal treatments. RVCD working to restore stream channel and flood plain function.	Total Phosphorous, Sediment, Alteration in stream-side or littoral vegetative covers	Flow, Sediment, Metals, Nutrients	High
Clear Creek	RVCD: Stream flow and temperature data (https://rvcd.org/monitoring-drought-resilience/)		Ruby Habitat Foundation: 9000' of proposed stream channel reconstruction scheduled for 2020	NA	Flow, Sediment, Metals, Nutrients	Medium/Low
Coal Creek, MT41C003_020	USFS: 2007-2009 beaver reintroduction as part of the Ruby River Beaver Augmentation Project. Bank comparison photos (1978 to 2008). Stream surveys 2018.	USFS: Stream surveys. Following BDNF riparian grazing guideline and trailing cattle with improved methods to minimize impacts to soil and streams.	USFS: Data will be collected to characterize the effects of sheep grazing and trailing on project streams. Wetlands, Amphibians, and Pearlshell mussels will also be evaluated as part of this effort. Beaver habitat enhancement & introduction	Sediment, Alteration in stream-side or littoral vegetative covers	Flow, Sediment, Nutrients	Medium

RUBY RIVER WATERSHED STREAMS	PREVIOUS MONITORING / PROJECTS[1]	ONGOING PROJECTS[1]	PLANNING[1]	2018 LIST OF IMPAIRED WATERS	RECOMMENDED SAMPLING	MONITORING PRIORITIZATION SCALE
Cottonwood Creek, MT41C003_030	BLM: Completed phase II of riparian improvement project in 2017 (hardened water gaps). Phase I was completed in 2016 (installed off-site watering and riparian fencing, salting upland, herding cow away from streams; shortening season of use). BLM watershed assessment. USFS: Stream Surveys 2018 (cross sections, greenline transect, and photo points)	USFS: Stream Surveys		Total Nitrogen, Sediment, Flow, Alteration in stream-side or littoral vegetative covers	Flow, Sediment, Nutrients	Medium
Currant Creek, MT41C002_060	BLM: 2016 watershed assessment			Total Nitrogen, Total Phosphorous, Sediment, Alteration in stream-side or littoral vegetative covers	Flow, Sediment	Low
Garden Creek, MT41C002_100		BLM: reduced number of cows per allotment, developed watering tanks, salting upland, herding cow away from streams. Noted by NRCS that appears degraded. (Tributary to the reservoir)		Copper, Lead, Total Nitrogen, Total Phosphorous, Sediment, Alteration in stream-side or littoral vegetative covers	Flow, Sediment, Nutrients	Low
Indian Creek, MT41C002_030	RVCD: Stream flow and temperature data (https://rvcd.org/monitoring-drought-resilience/). BLM 2016 watershed assessment	RVCD: Stream flow and temperature data by RWC (https://rvcd.org/monitoring-drought-resilience/).		Flow, Sediment, Alteration in stream-side or littoral vegetative covers	Flow, Sediment, Metals, Nutrients	Low
Mill Creek, MT41C002_020	RVCD: Stream flow and temperature data (https://rvcd.org/monitoring-drought-resilience/)	RVCD: Stream flow and temperature data by RWC (https://rvcd.org/monitoring-drought-resilience/). 2016 BLM watershed assessment. MT DEQ: Reclamation of the Buckeye Mine and Mill site		Total Nitrogen, Total Phosphorus, Flow, Temperature, Substrate and habitat Alterations, Alteration in stream-side or littoral vegetative covers,	Flow, Sediment, Metals, Nutrients	Low

RUBY RIVER WATERSHED STREAMS	PREVIOUS MONITORING / PROJECTS[1]	ONGOING PROJECTS[1]	PLANNING[1]	2018 LIST OF IMPAIRED WATERS	RECOMMENDED SAMPLING	MONITORING PRIORITIZATION SCALE
Mormon Creek, MT41C002_110	BLM: Installed watering tanks, salting upland, herding cows away from streams. 2 livestock exclosures constructed in 2017 in tributaries (Left fork Mormon Spring and South Fork Mormon Spring) See Cottonwood Cr. and Garden Cr. Both are tribes to Mormon Cr.			Total Phosphorus, Sediment, Alteration in stream-side or littoral vegetative covers	Flow, Sediment, Nutrients	Low
Poison Creek, MT41C003_110	USFS: Stream surveys 2018. Cross-sections and riparian photo points.	USFS: 2018 Stream Surveys. Following BDNF riparian grazing guideline and trailing cattle with improved methods to minimize impacts to soil and streams.	USFS: Data will be collected to characterize the effects of sheep grazing and trailing on project streams. Wetlands, Amphibians, and Pearlshell mussels will also be evaluated as part of this effort.	Cadmium, Lead, Manganese, Total Nitrogen, Total Phosphorous, Sediment, Alteration in stream-side or littoral vegetative covers	Flow, Sediment, Metals, Nutrients	Medium
Ramshorn Creek, MT41C002_050	RVCD: Stream flow and temperature data by RWC (https://rvcd.org/monitoring-drought-resilience/). Wetland delineations (RVCD). BLM: 2016 watershed assessment.	BLM & RVCD: Stream channel/flood plain restoration, installation of riparian vegetation buffer, bank stabilization.	Ramshorn Creek Stream Restoration Project (RVCD), and associated monitoring	Flow, Lead, Total Phosphorous, Sediment, Alteration in stream-side or littoral vegetative covers	Flow, Sediment, Metals, Nutrients	High

RUBY RIVER WATERSHED STREAMS	PREVIOUS MONITORING / PROJECTS[1]	ONGOING PROJECTS[1]	PLANNING[1]	2018 LIST OF IMPAIRED WATERS	RECOMMENDED SAMPLING	MONITORING PRIORITIZATION SCALE
Upper Ruby River (above reservoir), MT41C001_020	BLM: 2013 watershed assessment. USFS: 2005 began re-introduction of beavers as part of the Ruby River Beaver Augmentation Project. In 2007, 9 pools constructed and 3,500' of river bank was re-sloped and planted with willows. Stabilization work on a road segment near the headwaters in 2018. Road closures. Stream Surveys 2018. Temperature monitoring. Various bank stabilization, sloping back banks and securing with planted riparian vegetation, riparian fencing and grayling habitat enhancement projects.	USFS: Stream Surveys. Extensive sediment delivery survey on the 100 road as part of a NEPA analysis in 2019. Removing a large number of encroaching conifers in the riparian area of the main Ruby as part of a wildlife. These treatments will continue over the next couple of years. Grazing: following BDNF riparian grazing guideline and trailing cattle with improved methods, rest-rotation, moving cattle when utilization thresholds are met; more efficient irrigation systems, river bottom diversification and stream bank stabilization.	USFS: Data to be collected to characterize the effects of sheep grazing and trailing on project streams. Wetlands, Amphibians, and Pearlshell mussels will also be evaluated as part of this effort.	Total Phosphorous, Sediment, Alteration in stream-side or littoral vegetative covers	Flow, Sediment, Metals, Nutrients	High
Lower Ruby River (below reservoir), MT41C001_010	RVCD: 2014 Ruby watershed volunteer monitoring program SAP for turbidity sampling. 2006 groundwater modeling and GIS Interface project. RVCD & F.S: 2008 Saubrier Feedlot relocation, removal of animal waste, removal of water gap, improved wetland vegetation, 2012 Miller Ranch channel restoration (included approximately 2,200 ft of new channel and 4,400 ft of new river bank). TNC: Flood plain reconnection, willow, cottonwood and riparian brush planting along 2 miles of lower Ruby. BLM: 2016 watershed assessment	TNC: vegetation monitoring. USFS: Following BDNF riparian grazing guideline and trailing cattle with improved methods, rest-rotation, moving cattle when utilization thresholds are met; more efficient irrigation systems, river bottom diversification and stream bank stabilization.	TNC: On going riparian restoration based on monitoring efforts. USFS: Data will be collected to characterize the effects of sheep grazing and trailing on project streams. Wetlands, Amphibians, and Pearlshell mussels will also be evaluated as part of this effort.	Temperature, Flow, Total Phosphorous, Sediment, Alteration in stream-side or littoral vegetative covers	Sediment, Temperature	Medium

RUBY RIVER WATERSHED STREAMS	PREVIOUS MONITORING / PROJECTS[1]	ONGOING PROJECTS[1]	PLANNING[1]	2018 LIST OF IMPAIRED WATERS	RECOMMENDED SAMPLING	MONITORING PRIORITIZATION SCALE
Ruby River, East Fork , MT41C003_040	RVCD & F.S: Ruby Three Forks Corral relocation and hardened crossings on (Tributary Cr). Temperature monitoring	US FS: stream Surveys. Following BDNF riparian grazing guideline and trailing cattle with improved methods to minimize impacts to soil and streams.		Temperature, Flow, Total Phosphorous, Sediment, Alteration in stream-side or littoral vegetative covers	Flow, Sediment, Metals, Nutrients	Medium
Ruby River, Middle Fork, MT41C003_090	USFS: PIBO, temperature		USFS: Hardened crossings on tributaries	Total Nitrogen, Total Phosphorous, Sediment, Alteration in stream-side or littoral vegetative covers	Flow, Sediment, Nutrients	Low
Ruby River, West Fork, MT41C003_080	USFS: PIBO, temperature monitoring. Completed a considerable amount of restoration work on the trail network north of the stream and re-routed some of the tributary crossings to improve water quality. 8-10 hardened stream crossings, pre-2004.		USFS: Restoration work on the trail network north of the stream and re-routed some of the tributary crossings to improve water quality,	Sediment	Flow, Sediment, Metals, Nutrients	Medium
Shovel Creek, MT41C003_150	RVCD: 2008 hardened stream crossings completed. USFS: Installation of hardened crossing 2012. Closed roads with stream crossings (2009)			Sediment	Flow, Sediment, Metals, Nutrients	Low
Sweetwater Creek, MT41C003_060	BLM: In 2017, three livestock exclosures were constructed. 3 new culverts on main road. Watershed assessment. NRCS: Photo points and riparian vegetation transects			Chlorophyll-a, Total Nitrogen, Total Phosphorous, Temperature, Flow, Sediment, Alteration in stream-side or littoral vegetative covers,	Flow, Sediment, Metals, Nutrients	Low
Warm Springs Creek, MT41C003_050	BLM: 2013 watershed assessment. USFS: PIBO, temperature	USFS: Significant maintenance has been completed at the roadside springs location that have alleviated resource impacts		Sediment, Alteration in stream-side or littoral vegetative covers	Flow, Sediment, Metals, Nutrients	High

RUBY RIVER WATERSHED STREAMS	PREVIOUS MONITORING / PROJECTS[1]	ONGOING PROJECTS[1]	PLANNING[1]	2018 LIST OF IMPAIRED WATERS	RECOMMENDED SAMPLING	MONITORING PRIORITIZATION SCALE
Wisconsin Creek, MT41C002_010	RVCD: stream flow and temperature data (https://rvcd.org/monitoring-drought-resilience/) BLM: 2016 watershed assessment.			Arsenic, Copper, Lead, Mercury, Flow, Sediment, Alteration in stream-side or littoral vegetative covers,	Flow, Sediment, Metals, Nutrients	Low

NA = Not Applicable

[1] **Green highlighted text** is intended to aid readers in identification of U.S. Forest Service initiatives. **Brown highlighted text** is intended to aid readers in identification of Bureau of Land Management initiatives