Middle Fork Judith River Watershed Restoration Plan

Developed in partnership with Montana Trout Unlimited, The Helena-Lewis and Clark National Forest, and the Montana Department of Environmental Quality.

January 2022

MONTANA TROUT UNLIMITED

USDA FOREST SERVICE

DEQ MONTANA

TABLE OF CONTENTS

LIST OF TABLES

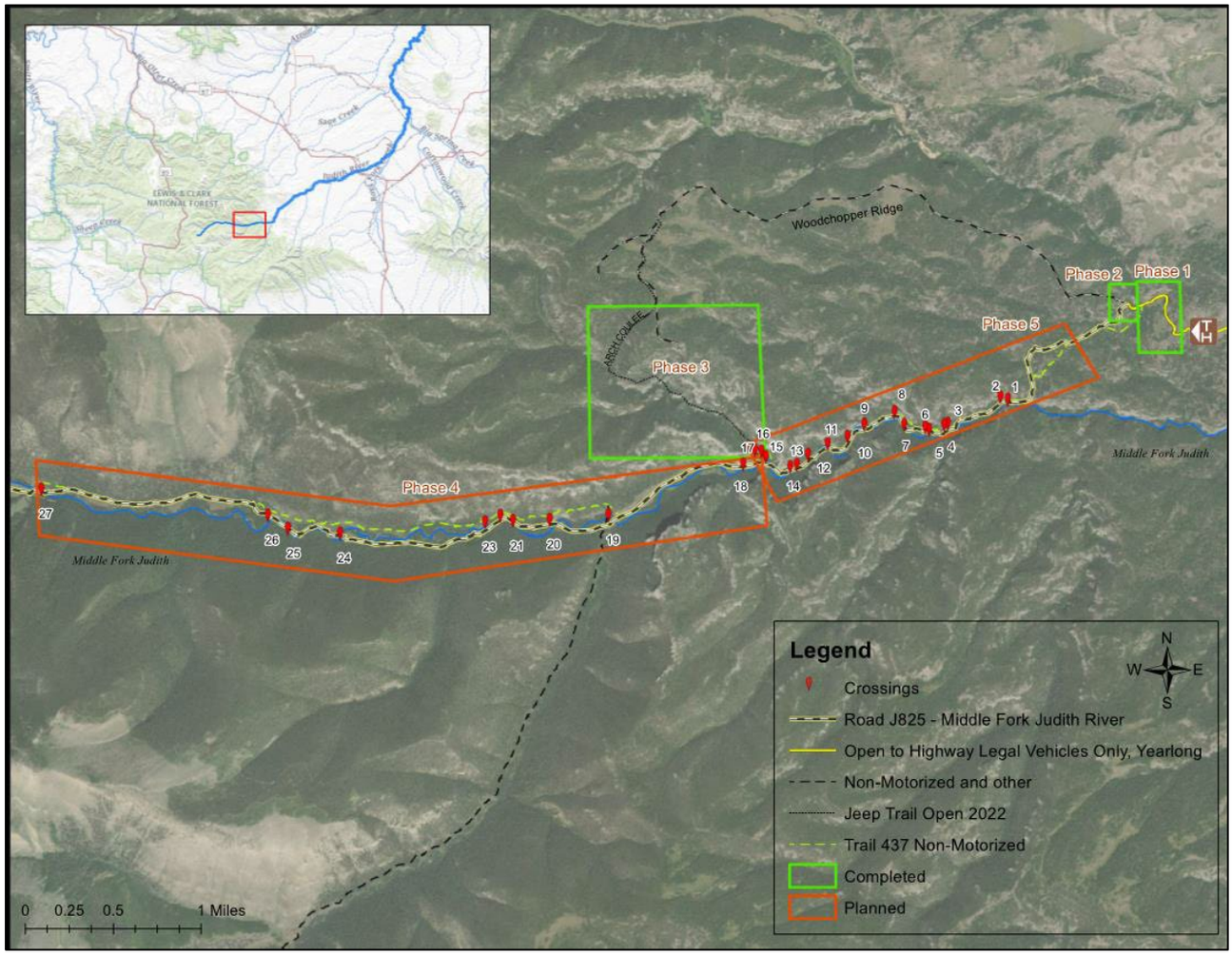
LIST OF FIGURES

ACRONYMS

AU – Assessment Unit
BANCS - Bank Assessment for Nonpoint Source Consequences of Sediment
BEHI – Bank Erosion Hazardous Index
BMI – Benthic Macroinvertebrate
HUC – Hydrologic Unit Code
HLC – Helena-Lewis and Clark National Forest
IR – Integrated Report
MTDEQ – Montana Department of Environmental Quality
MTU – Montana Trout Unlimited
NBS – Near Bank Stress
SOP – Standard Operating Procedure
TMDL – Total Maximum Daily Load
WPS – Water Protection Section
WRP – Watershed Restoration Plan

1.0 INTRODUCTION

The Middle Fork Judith River (MT41S002_090) in Central Montana is located in the Middle Fork Judith Wilderness Study Area (Figure 1). Current water quality and instream habitat conditions have been degraded due to ongoing off-highway vehicle travel both along and in the river, which is further reflected in extremely low native and wild trout populations. The Helena-Lewis and Clark National Forest in partnership with Montana Trout Unlimited developed a plan to re-route the existing road and restore the road and associated river crossings consistent with the decision in Forest Service's *2007 Travel Management Plan*. In 2020, Montana DEQ conducted monitoring to assess instream sediment and riparian habitat conditions. Data collected concluded that the Middle Fork Judith is impaired by sedimentation/siltation. This document details the water quality impairment causes, sources of sediment, and restoration plan to address these issues.



1.1 GEOLOGIC AND ECOLOGICAL SETTING

The Middle Fork Judith River (MFJ) is located on the Helena-Lewis and Clark National Forest (HLC), southeast of Great Falls in the Little Belt Mountain range (Figure 1). The river flows approximately 13.8 miles from its headwaters to its confluence with the South Fork Judith River. The two forks join at their confluence to form the mainstem Judith River, which flows into the Missouri River approximately 80 miles downstream of Great Falls. The Middle Fork Judith River watershed is 86,257 acres and is primarily on the Helena-Lewis and Clark National Forest. Ownership transitions to private at the downstream end near the confluence with the Judith River. It is in the 10-digit hydrologic unit code (HUC5) 1004010303.

The Middle Fork Judith River is located primarily within the Middle Rockies Level III ecoregion, with the lower reaches extending into Northwestern Great Plains Level III ecoregion (Figure 2). The primary lithology of the watershed is composed of sedimentary shale and sandstone with a transition to silt in the lower reaches within the Northern Great Plains Level III ecoregion.

1.2 LAND USE

The Middle Fork Judith River watershed is designated as a Wilderness Study Area (WSA) and Inventoried Roadless Area (IRA). There are 19 private in-holdings totaling 970 acres that includes 7 cabins near the upstream end of the Middle Fork Judith River. Dispersed recreation activities include motorized and nonmotorized trails, snowmobile trails, caves, and dispersed camping (USFS, 2020). There is limited documentation but is evidence of livestock grazing, historical timber harvest, and some placer mine exploration.

1.2.1 Middle Fork Judith Wilderness Study Area

In 1964, Congress enacted the Wilderness Act to permanently protect some of the most natural and undisturbed places in America. In 1982, the Forest Service released a Final Environmental Impact Statement (FEIS) and study of the Middle Fork Judith WSA in accordance with the 1977 Montana Wilderness Study Act. Wilderness study areas are to be administered by the Secretary of Agriculture "so as to maintain their presently existing wilderness character and potential for inclusion in the National Wilderness Preservation System". Based on extensive research and public input, the Forest Service recommended that the Middle Fork Judith should be managed as non-wilderness for primitive recreation, wildlife management, and development/timber management along Harrison Creek drainage (USFS, 2019).

The Helena-Lewis and Clark National Forest presented alternatives during the planning process for an updated Land Management Plan that included one recommending Wilderness Area designation and four that recommended non-designation (USFS, 2019). In May 2020, the Helena-Lewis and Clark finalized their Land Management Plan (USFS, 2020). The plan states that, "[u]ntil Congress makes a final decision on wilderness or non-wilderness designation, these areas will be managed per the plan direction identified for Wilderness Study Areas in this section. If Congress acts to designate one or both areas as wilderness, the Wilderness Study Area direction would no longer apply and Designated Wilderness plan direction would apply. If Congress acts to release one or both areas from the Act, the Wilderness Study Area direction will no longer apply and management of the released areas would continue under forest-wide, and applicable [geographic area] and designated area plan direction. See Table 21 for a description of the primary management direction for these areas should Congress act to release these areas without designating as wilderness." (USFS, 2020)

The Middle Fork Judith WSA is 82,127 acres and if released by Congress will be managed as an inventoried roadless area. As a WSA, the HLC Forest Plan articulates desired conditions, standards, and suitability of this area. Elements of particular relevance to this project have been **bolded** for emphasis.

Desired Conditions

01 Wilderness study areas are characterized by a natural environment where ecological processes such as natural succession, wildfire, avalanches, insects and disease function as the primary forces affecting the environment.

02 Wilderness study areas primarily offer opportunities for primitive recreation, although uses established and allowed prior to the enabling legislation are retained if they maintain the wilderness character and the potential for inclusion in the National Wilderness Preservation System that existed in 1977.

Standards

01 Within the wilderness study areas new leases for leasable minerals shall include a no surface occupancy stipulation.

Suitability

01 Wilderness study areas are not suitable for timber production or timber harvest.

02 Wilderness study areas are not suitable for new commercial communication sites or new utility corridors.

03 **Wilderness study areas are suitable for restoration activities (such as management ignited fires, active weed management) to protect and/or enhance the wilderness characteristics of these areas**.

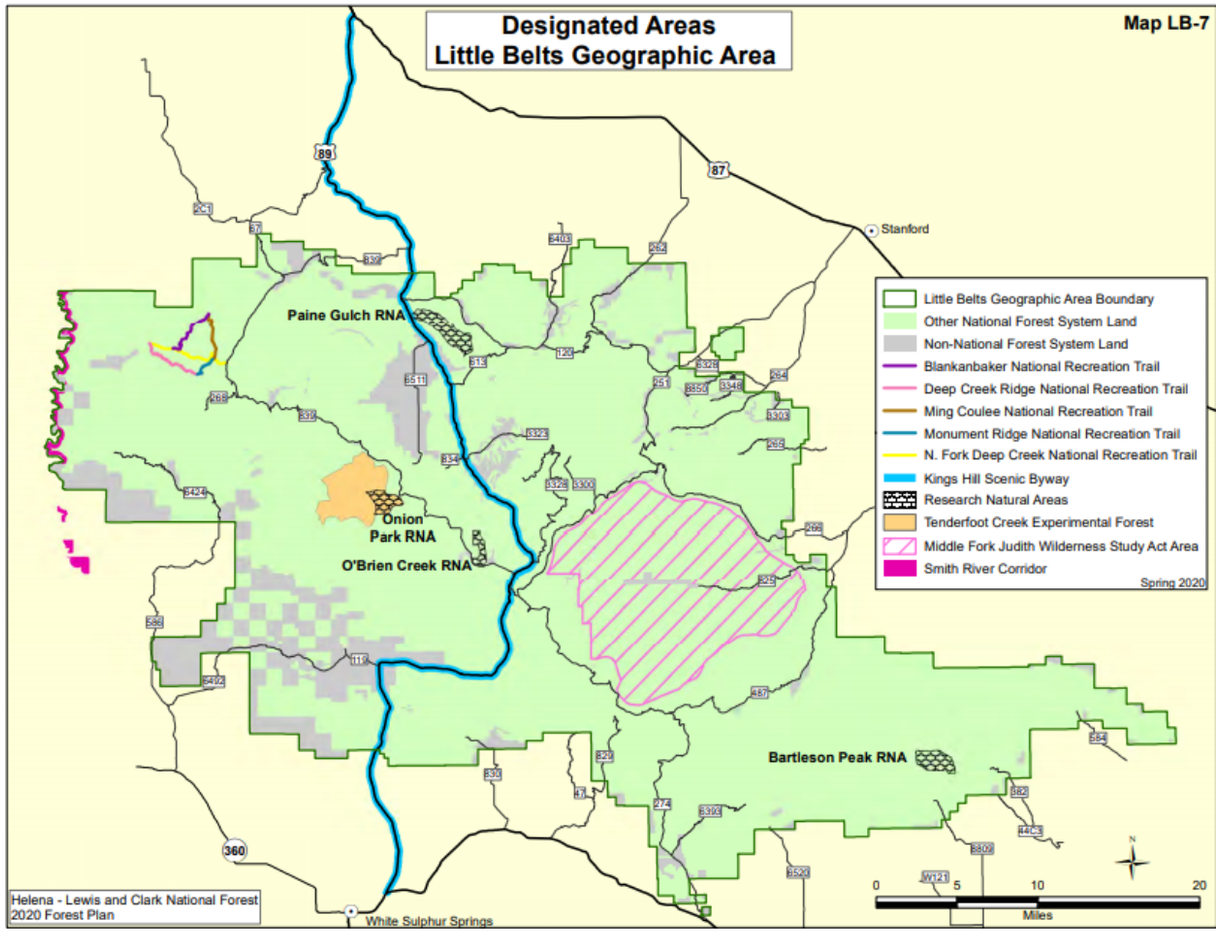
04 **Motorized and mechanized equipment (such as chain saws to clear trails) is suitable for accomplishing restoration activities and/or administrative work.**

05 New road construction or reconstruction is not suitable in wilderness study areas. However, **reconstruction or rerouting existing roads to eliminate impacts to natural or cultural resources is suitable provided abandoned routes are fully rehabilitated**.

06 Wilderness study areas are not suitable for new developed recreation facilities.

07 Wilderness study areas are suitable for existing livestock grazing allotments, but they are not suitable for new or expanded livestock grazing allotments.

08 **Wilderness study areas are suitable for motorized and mechanized means of transportation if allocated by forest travel plans, not precluded by other designations or policy, and retained the wilderness character and the potential for inclusion in the National Wilderness Preservation System that existed in 1977.**



1.2.2 Inventoried Roadless Area

The 2001 Roadless Area Conservation Rule (Roadless Rule) established prohibitions and permissions on road construction, road reconstruction, and timber harvesting on 58.5 million acres of NFS lands across the United States. The Roadless Rule prohibits activities that have the greatest likelihood of altering and fragmenting landscapes, resulting in immediate, long-term loss of roadless area values and characteristics, eliminates

permanent road construction and reconstruction. IRAs are important in maintaining habitats, natural processes, and remote recreation opportunities. Management activities follow direction found in the 2001 Roadless Rule (36 CFR 294 Subpart B, published at 66 Fed Reg. 3244-3273). The HLC Forest Plan identifies two IRAs in the project area: the Middle Fork Judith (9,707 acres) and the Middle Fork Judith WSA (81,069 acres). (USFS, 2020)

Desired Conditions

01 Inventoried roadless areas provide large, undisturbed, and unfragmented areas of land. **These large land areas sustain high quality or undisturbed soil, water, and air and a diversity of plant and animal communities**. They also provide for secure habitats for a variety of fish and wildlife species that are dependent upon large, undisturbed, unfragmented areas of land.

02 Within inventoried roadless areas, natural, ecological processes and disturbances (such as wildfire, insects, and disease) are the primary forces affecting the composition, structure, and pattern of vegetation. Inventoried roadless areas contribute to reference landscapes for future study and understanding of natural ecological processes.

03 Landscapes in inventoried roadless areas are naturally appearing with high scenic quality.

04 **Inventoried roadless areas provide remote primitive and semi-primitive recreation opportunities in natural settings.**

05 Inventoried roadless areas protect sources of public drinking water, traditional cultural properties and sacred sites, and locally identified unique characteristics, where they exist.

Suitability

01 Inventoried roadless areas are unsuitable for timber production. However, timber harvest is suitable within inventoried roadless areas outside of wilderness study areas and recommended wilderness areas to provide for other multiple use values when consistent with the 2001 Roadless Area Conservation Rule.

02 **Forest system roads (that are managed as part of the forest transportation system) in inventoried roadless areas are suitable for motorized and mechanized means of transportation**.

03 **Inventoried roadless areas are suitable for restoration activities (such as management ignited fires, active weed management) to protect and/or enhance the roadless area values and characteristics of these areas**.

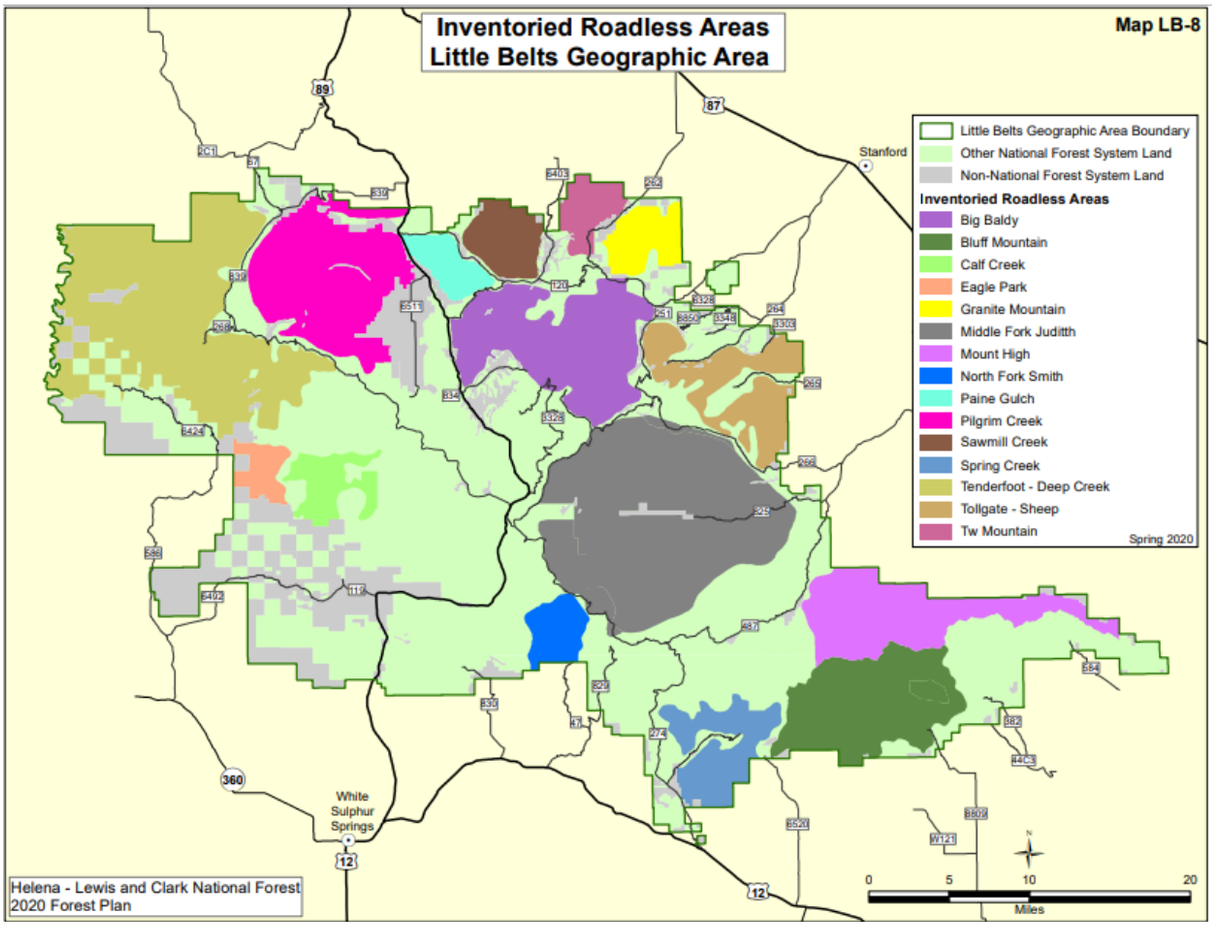


Figure 3 - Inventoried Roadless Areas from the 2020 Helena-Lewis and Clark Land Management Plan

1.3 Alternative Watershed Restoration Planning

The U.S. Environmental Protection Agency (EPA) administers Clean Water Act Section 319(h) funding to states to address nonpoint sources of pollution. In 2013, EPA developed guidelines for States' implementation of their nonpoint source management programs. These guidelines are requirements that Montana DEQ must implement as state recipient of §319 grants made with funds appropriated by Congress. These guidelines emphasize the development and use of nine-element watershed restoration plans (WRP), “in which local stakeholders join forces to develop and implement [WRPs] to address NPS pollution based on the particular conditions in their communities.” (EPA, 2013). A WRP is a requirement for local stakeholder to receive §319 funding to implement on-the-ground watershed projects. However, EPA recognizes that alternative WRPs may provide an effective roadmap to achieve the water quality goals of §319-funded restoration or protection efforts. In these cases, states must provide the EPA region with justification for why a complete, nine-element WRP is not necessary and why an alternative plan is sufficient to guide watershed project implementation. This plan provides that justification.

While Alternative WRPs are not required to include the nine elements, they must ensure the following planning elements are adequately addressed:

- Identification of the causes or sources of NPS impairment, water quality problem, or threat to unimpaired/high quality waters;
- Watershed project goal(s) and explanation of how the proposed project(s) will achieve or make advancements towards achieving water quality goals;
- Schedule and milestones to guide project implementation;

- Proposed management measures (including a description of operation and maintenance requirements) and explanation of how these measures will effectively address the NPS impairment identified above; and
- Water quality results monitoring component, including description of process and measures (e.g., water quality parameters, stream flow metrics, biological indicators) to gauge project success.

EPA guidelines further articulate specific circumstances where an Alternative WRP may be used. These are:

a. ***When the impairment is not specific to a pollutant.***
The current WBP approach places emphasis on identifying major NPS pollutant sources in critical areas as well as planning for and achieving NPS pollutant load reductions. In scenarios where the impairment is not caused by a pollutant, but rather by a non-pollutant-based water quality problem (e.g., obstructions for migratory fish or addressing flow regime alterations), an alternative plan may be sufficient to guide § 319 funded watershed projects. In such cases, the state should provide assurance that appropriate watershed analyses were conducted to ascertain that the water quality problem will be fully addressed by dealing with the non-pollutant source of impairment.

b. ***When responding to a NPS pollution emergency or urgent NPS public health risk.***
In scenarios when the proposed § 319 project(s) responds to an urgent, unplanned NPS pollution emergency or urgent NPS public health risk in an area for which a WBP does not exist (e.g., efforts to control erosion and re-establish vegetation in the immediate aftermath of a forest fire, to reduce pollution affecting drinking water safety), an alternative plan may be developed to ensure the timely, targeted use of watershed project funds.

c. ***When protecting assessed unimpaired/high quality waters.***
Where a watershed includes both impaired and unimpaired/high quality waters, a WBP should be developed to address all actions needed to maintain and restore water quality. In scenarios where a state has assessed waters that are largely or fully attaining water quality standards and are located in watersheds where only protection actions are needed (i.e., measures to prevent future degradation), an alternative to a WBP may be warranted.

d. ***When addressing an isolated, small-scale water quality problem resulting from one or a few sources of pollution.***
An alternative plan may be acceptable when the NPS problem and solution are extremely limited in scope and scale, such that the water quality problem is caused by one or a very few pollution sources (e.g., a failing septic system). In such cases, the state must demonstrate (through up- and downstream monitoring, watershed characterization studies, etc.) that this impairment is isolated from other potential contributing causes/sources of pollution in the watershed. Additionally, the state must provide assurance that the proposed watershed project will fully address the water quality problem within one grant period. In meeting these conditions, the state will ensure that multiple smaller problems are not dealt with in a piecemeal fashion when they are actually part of a larger water quality problem involving multiple pollution sources in the watershed.

In the case of the Middle Fork Judith River, Montana DEQ and partners have determined that the water quality issues are fairly isolated and the result of one or a few sources of pollution. Specifically, sedimentation and geomorphic alterations are the effects of OHV use on a forest jeep trail (FS J825) that traverses the Middle Fork Judith River for approximately 8 miles and includes 27 river crossings or fords with 82 discrete entrances to the river.

2.0 CAUSES AND SOURCES OF IMPAIRMENT

Identification of the causes or sources of NPS impairment, water quality problem, or threat to unimpaired/high quality waters;

Montana classifies its waterbodies according to the present and future beneficial uses they can support. Middle Fork Judith River (AUID MT41S002_090) has a B-1 use classification, which means it is to be maintained suitable for drinking, culinary, and food processing purposes, after conventional treatment; bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply (ARM 17.30.623).

In 2020, Montana DEQ in partnership with Montana Trout Unlimited (MTU) and the Helena-Lewis and Clark National Forest (HLC) initiated a project to monitor and assess the water quality conditions of the Middle Fork Judith River. The primary objective of this project was to document sediment and sediment-related characteristics of Middle Fork Judith River to determine and compare stream conditions to reference targets. The second objective was to document habitat characteristics at the same locations. The third objective was to identify the primary sources of sediment and riparian habitat degradation to inform future restoration efforts. The Montana Department of Environmental Quality (DEQ) completed an assessment of the Middle Fork Judith River and determined that it will be listed as impaired by sediment/siltation in the next Integrated Report.

2.1 WATER QUALITY MONITORING

In August 2020, DEQ conducted fieldwork with MTU and HLC to monitor sediment and habitat conditions in the Middle Fork Judith River using DEQ's Sediment Assessment Methodology (Kusnierz et al., 2013). The assessment of Middle Fork Judith River uses a probability-based sampling design, where statistical conclusions are determined following water quality data collection and analysis. The objective of the sampling plan was to evaluate the functionality of stream health and compare those data to established reference target values. The sampling activities also measured streambank erosion and evaluated vehicle road crossings.

2.1.2 Monitoring Locations

Before site locations were determined within the Middle Fork Judith River assessment unit (AU), the waterbody was stratified to divide it into categorical reaches. The stream stratification process (DEQ, 2008) is a GIS-based approach that subdivides waterbodies into reaches based on physical geography attributes. The divisions are classified into reach types, according to their specific ecoregion, valley gradient, stream order, and confinement for that individual reach. For example, MR-0-3-U is the reach type that represents the Middle Rockies Level III ecoregion (MR-0-3-U), 0-<2% gradient (MR-0-3-U), stream order 3, (MR-0-3-U), and unconfined channel (MR-0-3-U). Much of the Middle Fork Judith River is above 5% gradient in a confined valley.

Three monitoring sites (**Table 1; Figure 4**) were selected due to similar reach types (Middle Rockies ecoregion, reach slope < 2 percent, Strahler 3rd or 4th stream order, and unconfined valley). The sites represented a diversity of anthropogenic impacts, which increased from upstream to downstream. Monitoring sites captured downstream effects of OHV travel but did not incorporate direct measurements of jeep trail stream-crossings, where the greatest instream impacts occurred, into their assessment.

In addition to the assessment monitoring sites. MTU identified, categorized, and photographed all 27 river fords and 83 discrete entrances. DEQ and MTU further quantified sediments loads from these crossings (**Appendix C and D)**.

Table 1. Monitoring Locations

Site Name	Monitoring Date	Downstream Latitude	Downstream Longitude	River Mile	Reach Type
MFJD00-01	8/26/2020	46.84672	-110.2951	1.5	MR-0-4-U
MFJD01-01	8/24/2020	46.84116	-110.3696	5.8	MR-0-3-U
MFJD03-01	8/25/2020	46.83617	-110.3999	7.7	MR-0-3-U

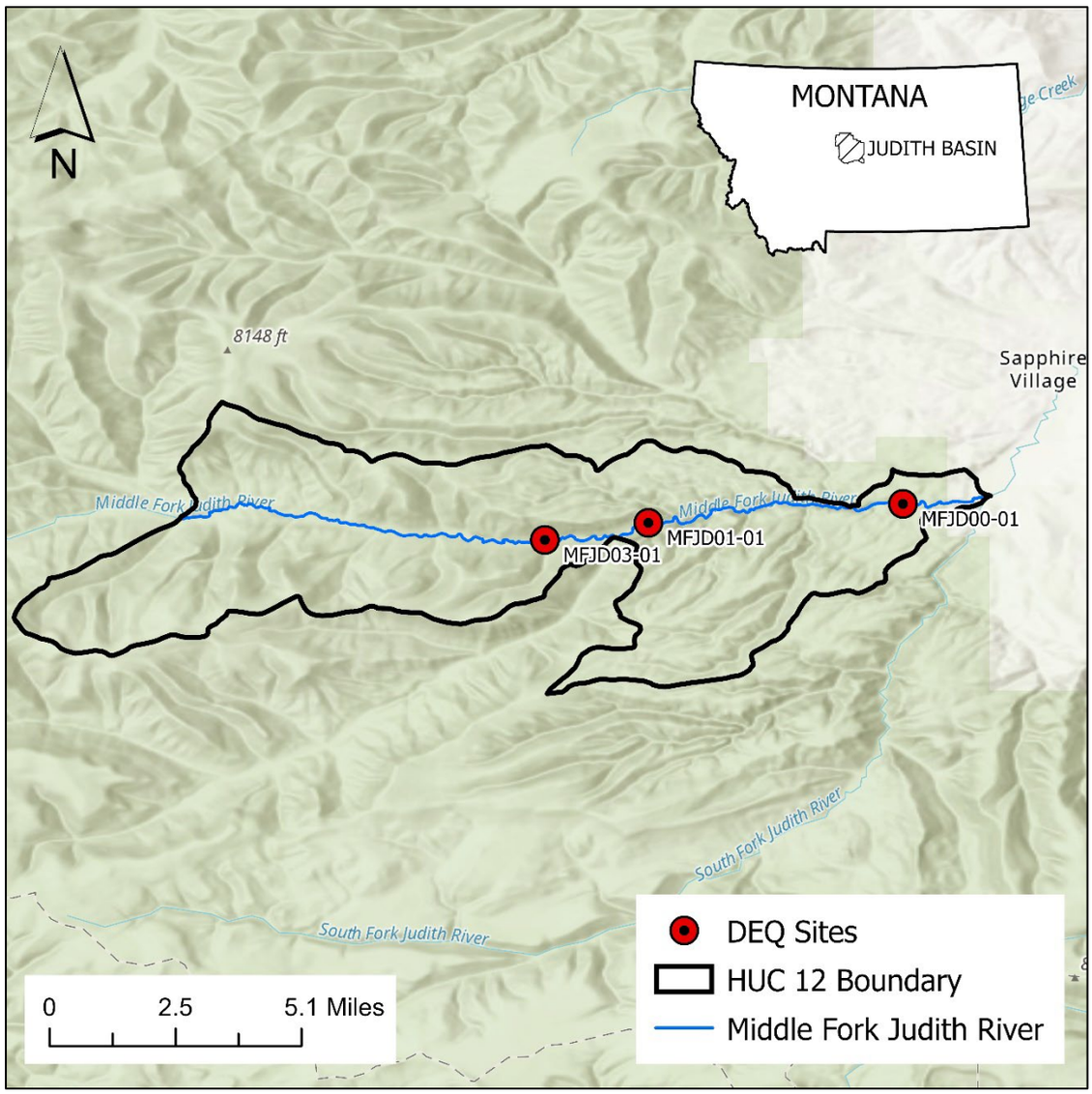


Figure 4 - Location of Middle Fork Judith River and DEQ Sediment Sampling Sites in Judith Basin County, Montana

2.1.1 Monitoring Design

Data collection procedures for sediment follow methods outlined in DEQ's SOP for sediment beneficial use assessment monitoring (Makarowski, 2020b). The method considers effects of sediment on the most sensitive beneficial use (i.e., aquatic life), thereby protecting all uses against sediment impairment. Using narrative water quality standards for sediment, DEQ's Sediment Assessment Method is used to determine whether the aquatic life beneficial use is being supported (Kusnierz, et al., 2013). The primary monitoring parameters that are evaluated for this assessment include:

- percent riffle fines (< 6 mm and < 2 mm)
- percent pool tail fines (< 6 mm)
- residual pool depth
- pool frequency
- width/depth ratio
- riffle stability index
- entrenchment ratio

Fine sediment parameters (riffle and pool tail fines) and coarse sediment and habitat parameters (pool depth and frequency, width/depth ratio, entrenchment ratio, and riffle stability index) are evaluated separately to determine whether streams are impaired by "sediment" as the impairment cause. Data are evaluated against a reference dataset to determine attainment of water quality standards for sediment.

Data collection procedures for habitat assessment entail performing a qualitative evaluation to rate riparian and instream habitat using WQPB's habitat indicator guide and associated response form (**Appendix B**). These qualitative ratings (ranging from optimal to poor) are coupled with other available habitat-related data (e.g., site photos and observations, aerial analyses, greenline measurements, etc.) and used to inform aquatic life beneficial use support decisions.

Data collection procedures for benthic macroinvertebrates (BMI) follow methods outlined in DEQ's Macroinvertebrate SOP (Feldman, 2012). The methods are used for collecting and analyzing macroinvertebrate data from wadeable streams (1st order or higher) by or for the DEQ. BMI samples were collected along the stream segment. Macroinvertebrate samples at two monitoring sites (MFJD-00-01; MFJD-01-01) were collected from 11 transects following the EMAP reach-wide procedure (Peck et al., 2006). A kick net with 500 µm mesh was used to collect the sample at each transect and kick samples from each transect was composited in 1 L HDPE bottles and preserved with 95% ethanol (EtOH). Currently, DEQ employs Observed/Expected (O/E) BMI metrics for use during sediment assessment. These same macroinvertebrate samples are used to produce a Hilsenhoff Biotic Index (HBI) value at each site for comparison to similar streams. The biological data may be examined in cases where physical data does not provide clear evidence of use support or impairment.

Data collection procedures for sediment and habitat source assessment follow methods outlined in DEQ's Field Methodology for Sediment and Habitat Source Assessment (WPS, 2017). The methods are used for assessing sediment loading attributable to streambank erosion and its contribution to a sediment impairment. The methods also include a greenline riparian assessment for evaluating riparian conditions as a potential source of streambank erosion. The primary monitoring parameters evaluated for this assessment include:

- Bankfull width and elevation
- Bank height
- Root depth and density
- Bank angle
- Surface protection
- Bank material

The parameters are used to estimate the bank erosion hazard index (BEHI) rating. Additionally, near bank stress is measured as a ratio of near-bank maximum depth to bankfull mean depth, at the point along the eroding bank that is receiving the most amount of energy (stream force). BEHI and NBS ratings are the inputs to the bank assessment for nonpoint source consequences of sediment (BANCS) model for estimating sediment loads contributed by eroding streambanks. The source or underlying cause of streambank erosion were evaluated based on current or observed human disturbances within the riparian corridor adjacent to each bank, as well as historical land-use practices in the surrounding landscape. Causes were estimated as percentages in established source categories.

Finally, during August 2020 sampling, road crossings up to MFJD-03-01 were identified and qualitative measures of their condition and likely effect on instream and riparian conditions were documented along with photos (**Appendix A**). In August 2021, MTU and DEQ revisited these road crossings to conduct Water Erosion Prediction Project (WEPP) measurements to quantify annual effects of the road to the Middle Fork Judith River (**Appendix C**).

2.2 WATER QUALITY AND SOURCE ASSESSMENT

Assessment of data collected indicate that the Middle Fork Judith River is impaired for sediment but is not impaired for habitat. The stream was characterized as over widened with low abundance of pools that lacked adequate spawning gravels. However, riparian communities were robust with assemblages of willows, alders, dogwood, and conifers in all age classes. Ongoing OHV travel adjacent to and within the river is the primary anthropogenic source of impairment but legacy contributions from historical placer mining and grazing may also play a minor role in the lower reach.

2.2.1 Sediment

The assessment indicates that the Middle Fork Judith River is impaired by sediment/siltation. DEQ's assessment method for making sediment impairment listing decisions involves a comparison of study site data against reference conditions using the one-sample Wilcoxon Signed Rank Test ($\alpha \leq 0.25$). Additional qualitative observations, scientific professional judgment, and other factors are considered when making impairment listing determinations; divergence of one parameter from the reference dataset does not necessarily equate to a determination of impairment. The reference data used were collected from previous years by DEQ, the Bitterroot National Forest, and the Pacfish/Infish Biological Opinion Effectiveness Monitoring program (PIBO). Criteria for reference data were:

- State of Montana
- Middle Rockies Ecoregion
- Gradient ≤ 2 %
- Strahler 3rd or 4th Order
- Sedimentary Lithology
- Excluded upper and lower 2.5 %

Fine sediment parameters (riffle and pool tail fines) and coarse sediment and habitat parameters (width/depth ratio, residual pool depth, and pool frequency,) were evaluated separately to determine whether streams are impaired by sediment. Sediment and habitat parameters were averaged for all sites (MFJD00-01, MFJD01-01, and MFJD03-01). These data were compared to data collected from the reference sites of comparable streams using specific nonparametric statistical tests.

Pool frequency (pools/1000 ft), width to depth ratio, and percent pool tail fines < 6 mm did not meet reference conditions. Percent riffle fines (< 2 mm and < 6 mm) and residual pool depths met all reference conditions. Two of three parameters (width to depth ratio and pool frequency) for coarse sediment and habitat failed in the decision process.

Table 2. Wilcoxon One-Sided Rank Sum Test Results

Reach/Site ID	Assessment Year	Stream Type	% Riffle Fines <6mm	% Riffle Fines <2mm	% Pool Tail Fines <6mm	Median Width/Depth Ratio	Mean Residual Pool Depth (ft)	Pools/1000 ft.
MFJD00-01	2020	C4	6.0	3.0	4.0	23.8	2.0	2.5
MFJD01-01	2020	C5	6.0	1.0	13.0	18.3	2.0	1.0
MFJD03-01	2020	C4	6.0	6.0	11.0	18.9	2.8	5.2
Decision Process			**Fine Sediment Assessment**			**Coarse Sediment and Habitat Assessment**		
Average			6.0	3.3	9.3	20.3	2.3	2.9
Alpha Value			0.97	0.99	0.08	0.02	1.0	< 0.01
PASS/FAIL			PASS	PASS	FAIL	FAIL	PASS	FAIL

2.2.2 Habitat

The assessment indicates that the Middle Fork Judith River is not impaired for habitat. Habitat indicators were rated at three sites in 2020 for riparian condition, substrate and cover, and stream morphology (**Appendix B**). Rating conditions are categorized as optimal, sub-optimal, marginal, or poor. Fifteen of 18 high weight conditional totals were rated as optimal for riparian condition and three as sub-optimal. Twelve of 15 high weight conditional totals were rated optimal for substrate and cover, one sub-optimal, and two marginal. Thirteen of 18 high weight conditional totals were rated optimal for morphology and five sub-optimal. The majority of high weight indicators for aquatic habitat on Middle Fork Judith River were rated as optimal. Marginal ratings referred to fish cover availability and stability.

Table 3. Habitat Assessment Metrics

HIGH WEIGHT INDICATORS	CONDITION TOTALS				POTENTIAL TOTALS			
	OPTIMAL	SUB-OPTIMAL	MARGINAL	POOR	OPTIMAL	SUB-OPTIMAL	MARGINAL	POOR
RIPARIAN	15	3	0	0	18	0	0	0
SUBSTRATE AND COVER	12	1	2	0	15	0	0	0
MORPHOLOGY	13	5	0	0	18	0	0	0
LOW WEIGHT INDICATORS	**CONDITION TOTALS**				**POTENTIAL TOTALS**			
	OPTIMAL	SUB-OPTIMAL	MARGINAL	POOR	OPTIMAL	SUB-OPTIMAL	MARGINAL	POOR
RIPARIAN DEGREDATION	17	1	0	0	18	0	0	0
SUBSTRATE AND COVER	7	4	1	0	12	0	0	0

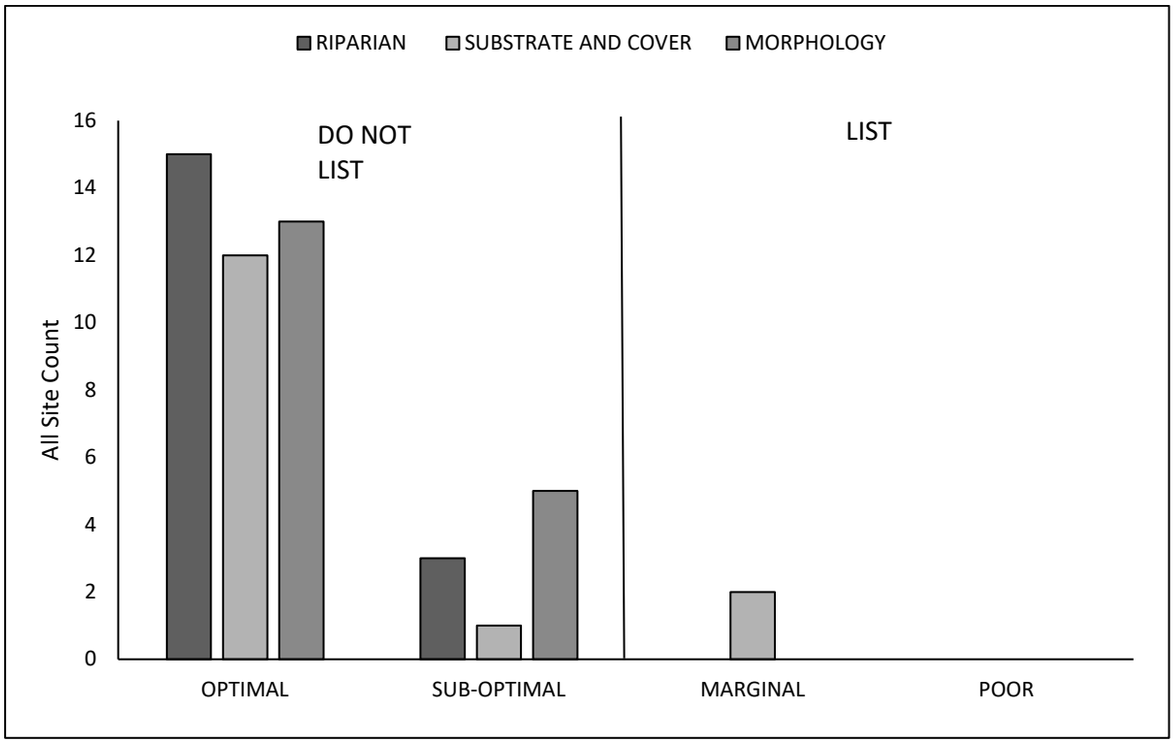


Figure 5 - Habitat Assessment Results

2.2.3 Macroinvertebrates

Benthic macroinvertebrate (BMI) data were not used to support an assessment determination because physical sediment data provided clear evidence of impairment. However, these data provide a good baseline for assessing conditions in the future. A total of 910 individual BMIs were collected, sorted, and identified from the Middle Fork Judith River (MFJD00-01 and MFJD03-01). A conservative estimate of total species richness is 72 separate species (many taxa are only identified to family or genus level; therefore, true species richness is likely higher). The upper and lower sites had an excellent (< 3.75) Hilsenhoff Biotic Index (HBI), which indicates an increased presence of sensitive BMI groups; therefore, a lower level of pollution. Observed vs. expected ratios of biodiversity at the uppermost site was 0.74 and did not pass the reference threshold of ≥ 0.90 for mountainous/transitional stream conditions. The lowermost site (MFJD00-01) was rated at 0.90 and met the reference threshold for Montana's mountainous/transitional stream conditions. Although water quality is rated healthy, there appears to be a lower level of biodiversity of BMIs in the Middle Fork Judith.

2.2.4 Sources

Bank erosion data were collected at the assessment monitoring sites to help determine sediment loading from bank erosion and estimate allocations from natural and anthropogenic sources. The assessment sites where BEHI data were collected intentionally excluded and jeep trail crossings as described in the SOP (Makarowski, 2020b). These data show that sediment within sampled assessment reaches is primarily from natural sources of streambank erosion. Based on results from the BANCS model within the three sampled sites the average sediment load from bank erosion was 29.4 tons per year, with 74% from natural sources. Legacy impacts from historical placer mining followed by grazing, irrigation, and timber harvest are minimal but make up the remainder of likely sources of streambank erosion. These impacts occur primarily in the lower site (MFJD-00-01), which has large irrigation dam at the upstream end and appears to have been the site of localized historical placer mining activities. No specific documentation of historical placer mine locations has been found. However, gold was discovered by placer miners in the late 19th century in Yogo Creek, a tributary to the Middle Fork Judith. The discovery of sapphires further fueled a mining boom that "apparently had little spillover effect" (http://deq.mt.gov/Land/abandonedmines/linkdocs/92atech) but likely resulted in some exploration within the Middle Fork Judith. The lower monitoring site (MFJD-00-01) is located below the confluence with Yogo Creek reflecting sediment contributions from it.

The assessment sites where BEHI data were collected intentionally excluded and jeep trail crossings as described in the SOP (Makarowski, 2020b). However, bank erosion was accelerated downstream (and in some instances upstream) of the crossing sites as a result of the road crossing entries and the additional erosive force from OHV driving through and displacing the river flow.

Quantitative measures of large woody debris (LWD) are not assessment parameters of DEQ's SOP for sediment beneficial use assessment monitoring (Makarowski, 2020b). However, the influence and benefits of LWD is well documented for development and maintenance of mountain stream geomorphology (Montgomery, et al., 1995) and is captured through narrative observation as part of the habitat assessment (**Appendix B**). Observations at sites MFJD-00-01 and MFJD-01-01 indicate a lack of LWD that could promote instream habitat diversity (pools and sinuosity) and sort fine sediment. The only pool with the MFJD-01-01 site was formed by a woody debris jam. The uppermost site had significantly more LWD, which resulted in greater instream habitat diversity as well as more natural streambank erosion. Riparian habitat was generally robust and it is not clear if the lack of LWD was the result of locally channelized conditions or a lack of recruitment. Presence of roads within 60 meters of stream channels has been documented to significantly reduce LWD recruitment. Recruitment further decreases with closer proximity to roads (Meredith et al., 2016).

The Middle Fork Judith River jeep trail (J825), observed as the primary source of disturbance and excess instream sediment, parallels and traverses the Middle Fork Judith River for approximately 8 miles and provides access to 19 private in-holdings with 7 cabins totaling 970 acres. J825 crosses the Middle Fork Judith River 27 times with 83 discrete entrances over the 8 miles (**Figure 6**). While none of the assessment monitoring sites included OHV river crossings, observations at these crossing noted that the river channel was over-widened with deeply eroded stream banks at entrance and exit points. Bank erosion downstream of each crossing was accelerated downstream (and in some instances upstream) of the crossing sites as a result of the road crossing entries and the additional erosive force from OHV driving through and displacing the river flow. The over-widened channel conditions (**Figure 7**) appeared to reduce gradient and store greater amounts of fine sediment. The entrances to each of the crossings have been deeply eroded into the banks over time. Coarse measurements of the banks and entrances along with photos (**Appendix A**) were taken at these crossings. In order to develop a better estimate of sediment loading from these crossings, DEQ conducted additional sampling in 2021. These included measures of the crossing entrances and channel cross sections at four different crossings.

Road Survey Data

A survey of the project area was completed in August 2021 for the 27 stream crossings (Table or Appendix) in the lower Middle Fork Judith River, below the private land inholdings along approximately 8 miles of jeep road J825 that runs through the river corridor and canyon. 83 discrete access points were inventoried where vehicles have created fords and access points over the streambanks. The photos below show the typical conditions of the ford access points in this section of the river.

Figure 6 - Typical entrances observed on the road survey

The survey started at the upstream end of Phase 4, crossing 27, and proceeded downstream to the lowest jeep road crossing, crossing 1. For the purposes of documenting the sites, all stream fords were given a unique identifying number, starting with 1 and progressing upstream to 27, and given a location with a handheld GPS. The letters L (left) and R (right) were used to describe which streambank the access point was located on (looking downstream). Finally, if there were multiple access points at a ford, the letters A, B, C, etc. were used to describe relative location (starting upstream) as shown below. For example, 5LB would be the fifth ford location on the left bank and the second access. Finally, measurements were taken to characterize the scale of impact at each site as shown below to calculate historic bank loss (**Figure 7, Table?**). Additional Water Erosion Prediction Project (WEPP) measurements were taken to estimate yearly sediment contributions to the river from the road (Table). Photos of each discrete access points with identification are presented in the Appendix to this document.

Figure 7 - (L) Crossings were given a unique identifying number. (R) Measurements were taken to calculate historical bank/sediment loss

WEPP:Road

The Watershed Erosion Prediction Project (WEPP) is a physically-based soil erosion prediction technology. WEPP has a number of customized interfaces developed for common applications such as roads, managed forests, forests following wildfire, and rangelands. WEPP:Road, used to estimate sediment loading to streams from unpaved road surfaces, was applied to the jeep trail crossing entrances in August 2021. There are 27 total crossings and a total of 83 discrete entrances. There are at least two entrances per crossing with up to seven at crossing 19.

The data inputs for WEPP:Road are soil texture, road design, percent gradient, length (feet), width (feet), road surface type, and traffic level (**Appendix C**). The model incorporates precipitation using local climate stations. The climate station at UTICA 11WSW MT was applied in the model runs for the Middle Fork Judith. This station is located southeast of Utica, MT and approximately 13 miles northeast of the Middle Fork Judith River at the USFS boundary. The total sediment load coming from all of the crossing entrances was modeled at 4.38 tons/year.

Bulk Density

Each road entrance was measured to calculate the sediment already lost to the river over time. and provide an estimate of the volumes of materials needed for restoration.

Figure 8 - Proximity of J825 to the Middle Fork Judith River and active OHV crossings contribute to degraded conditions

Figure 9 - Example stream crossings showing over-widened stream channel

Using the volumetric measures of a triangular prism collected at each road crossing entrance, we calculated the sediment load lost over time. The estimated sediment volume lost from each road crossing was 1292 cubic yards, which equals approximately 1680 tons of sediment. If we apply this loading over the last 100 years, it would average 16.8 tons per year, which is more than the 4.38 tons/year calculated using WEPP:Road. However, this seems to validate the high levels of sediment loading calculated using the WEPP model, which only takes into account active erosion from existing crossing and does not factor new crossing entrances likely to develop over time with continued OHV use. MTU documented four such new crossing entrances between August 5 and September 15 alone.

2.3 Fisheries Monitoring

In 2015, Montana Fish, Wildlife and Parks (FWP) conducted fisheries monitoring in the Middle Fork Judith at four sample sites (FWP, 2017). Their longitudinal sampling showed low fish densities within the Middle Fork Judith River (Figure 8) as compared to the smaller South Fork Judith River, which they attributed to "severe water quality issues caused by sedimentation stemming from numerous road/trail crossings" (FWP, 2017). **Figure 10** illustrates the low catch rates within sections most impacted by crossings and the improvement in the fishery above the majority of the road crossings.

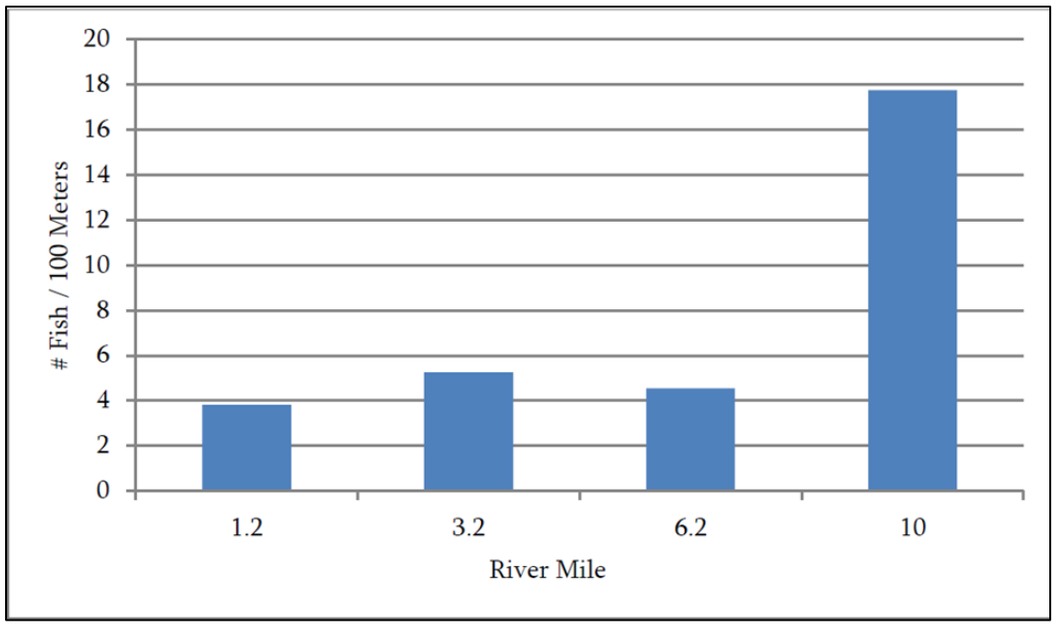


Figure 10 - Catch per unit effort of all trout at four sections of the Middle Fork Judith River (FWP, 2017)

3.0 WATERSHED PROJECT GOALS

Watershed project goal(s) and explanation of how the proposed project(s) will achieve or make advancements towards achieving water quality goals;

The goal of this restoration project is to eliminate existing sources of sediment and improve instream habitat conditions in Middle Fork Judith River by reducing the overall width to depth ratio, increasing pool frequency, and reducing fine sediment accumulation in pool tail outs. This is expected be achieved by restoring OHV related impacts to the stream and riparian corridor while also restoring the channel and riparian habitat to a more natural condition.

Reducing the anthropogenic sediment sources will allow the benthic macroinvertebrates to reestablish populations. This will improve the availability of wild trout's primary food source, increasing the trout's fitness. A decrease of sediment in the system will improve spawning habitat, increasing the survivability of wild trout eggs and fry. The result will be that more trout survive to spawning age with an increase in fecundity. This positive feedback loop will increase the wild trout population until it reaches the new carrying capacity for the Middle Fork Judith River system. A reference population for a stream of this size and character is between 200 and 400 fish per mile. FWP will monitor the population trend over time. The partnership is looking into the feasibility of a native Westslope cutthroat trout restoration while fish populations are depressed.

The Helena-Lewis and Clark Forest Travel Management plan (2007) documented the decision to replace the riparian jeep trail J825 with an alternate access to inholdings via Arch Coulee. The Arch Coulee connector was constructed in September 2021 with the aid of an FWP-Recreational Trails Program grant. The HLC has proposed eliminating 17 of the 27 stream crossings in Phase 5 and duplicative entrances to the remaining crossings in Phase 4. Treatment of trail crossings will include barriers to prevent future use; the addition of large wood to fill road approaches at the crossings and provide immediate instream structure and habitat; and backfilling of the eroded trail approaches. Specific treatments at each crossing have been developed in consultation with resource professionals from Helena-Lewis and Clark National Forest, Montana Fish Wildlife and Parks, Montana DEQ, and Montana Trout Unlimited (**Appendix D**).

4.0 PROJECT SCHEDULE AND MILESTONES

Schedule and milestones to guide project implementation

The USFS and partners have scheduled this project to occur over 5 phases. The first three phases will provide an alternate route, via Woodchopper Ridge and down Arch Coulee, for vehicles accessing private in-holdings in the upper watershed and the surrounding public land. Phase 3, which was constructed in September 2021, will effectively end the need to ford the Middle Fork Judith River in the most severely degraded 2.5 miles in the Middle Fork Judith Canyon, Phase 5. Phase 4, scheduled for 2022 will realign jeep trail J825 from the outlet of Arch Coulee to the upper watershed including the private in-holdings. Duplicative stream entrances will be obliterated and remaining entrances will be hardened where possible. The 5th and final phase will eliminate the existing riparian road in the Middle Fork Judith Canyon and restore stream 17 stream crossings with 49 discrete entrances. This on-the-ground implementation is expected to be completed by fall 2023. Follow up monitoring and outreach will take place over the next decade with the goal of conducting a reassessment to determine if actions have led to a non-impairment determination.

The USFS and partners have scheduled this project to occur over 5 phases. The first 3 phases will provide an alternate route for vehicles accessing private inholdings in the upper watershed. Phase 4 will eliminate

duplicative stream entrances and phase 5 will obliterate 2.5 miles of jeep trail and rehabilitate 17 stream crossings.

- **Phase 1:** Relocation and realignment of J825 from the MFJ trailhead to Yogo Crossing. Survey and design work were completed in 2017. Road improvements occurred during the fall of 2020. Gravel was added in May 2021.
- **Phase 2:** A re-route including sustainable trail design from Yogo crossing to the top of Yogo hill to bypass a bedrock hill. In 2020, after completing phase 1, equipment operators obliterated a steep hill-climb and built 6 switchbacks with appropriate drainage to minimize sedimentation of Yogo Creek.
- **Phase 3:** The Arch Coulee connector. This phase will convert motorcycle trail #434 to jeep trail #N31 down Arch Coulee that reconnects with J 825. Construction of this phase was performed from September 13-24, 2021. . A *Recreational Trails Program* grant was successfully applied for by Montana Trout Unlimited in February 2021. The RTP grant covered the full cost estimate of $21,583, of Phase 3.
- **Phase 4**: Improvement of J825 between Arch Coulee and private in-holding. This phase will eliminate 13 duplicative stream entrances, and harden the remainder where possible. NEPA was signed early summer 2021. This phase is expected to cost >$40,000. Upon approval of this WRP, funding for this phase will be eligible for 319 project funding through Montana DEQ.
- **Phase 5:** includes the obliteration and restoration of J825 between phase 2 and Arch Coulee (Phase 3) that runs parallel to the Middle Fork Judith River. This includes eliminating and restoring 17 stream crossings. NEPA was signed early summer 2021. This phase is expected to cost $100,000. The completed new route will be known as **#J825.**

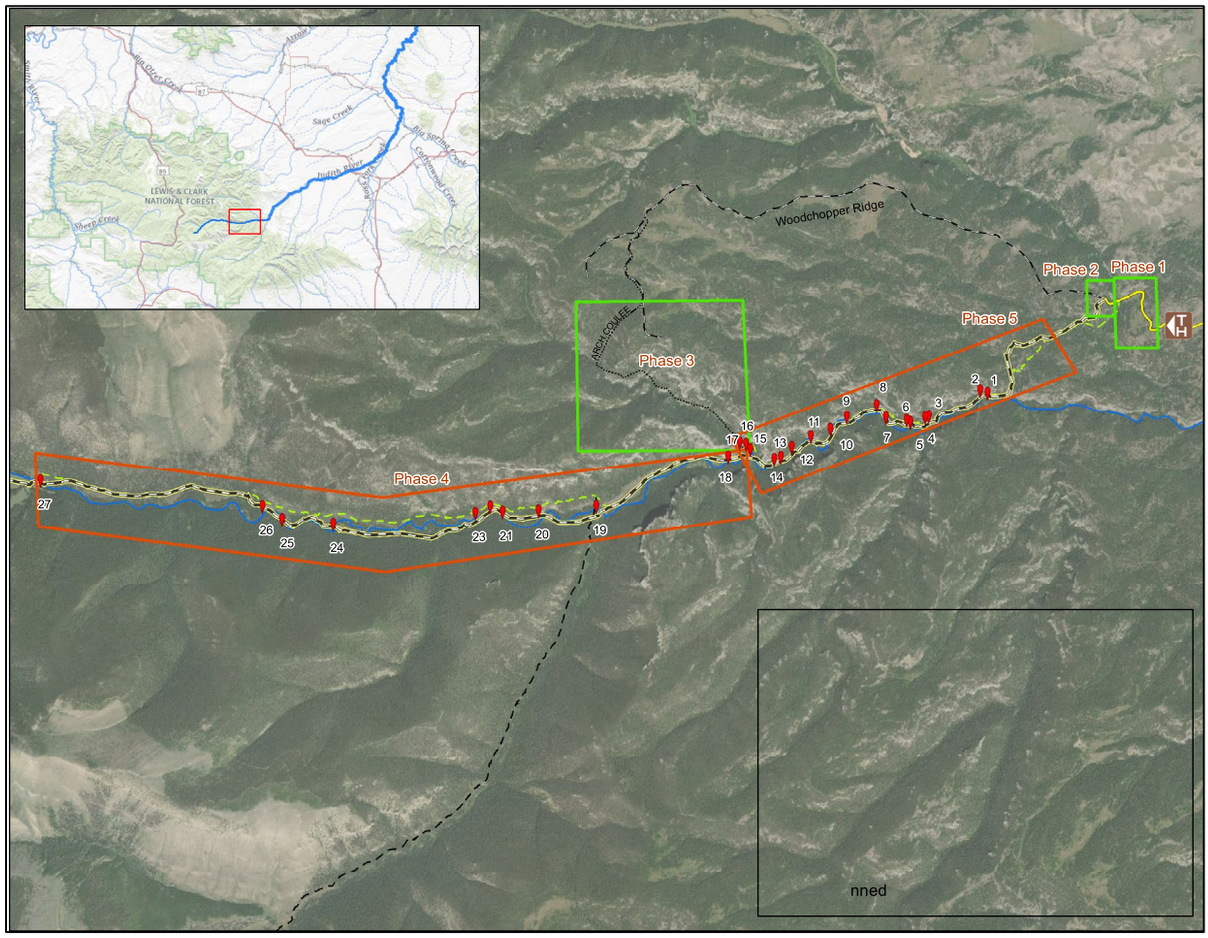


Figure 11 - Site map of completed and planned restoration phases 1-5

4.1 PHASE 1

Phase 1, partial-implementation in September 2020, relocated and recontoured J825 from the trailhead to Yogo Crossing. This was necessary to allow access to the following phases by heavy machinery. Survey and design work were completed in 2017 by Great West Engineering of Helena, MT. Gravel was added in May 2021.

Figure 12 - Relocating and recontouring of FS 825 in phase 1 in September 2020

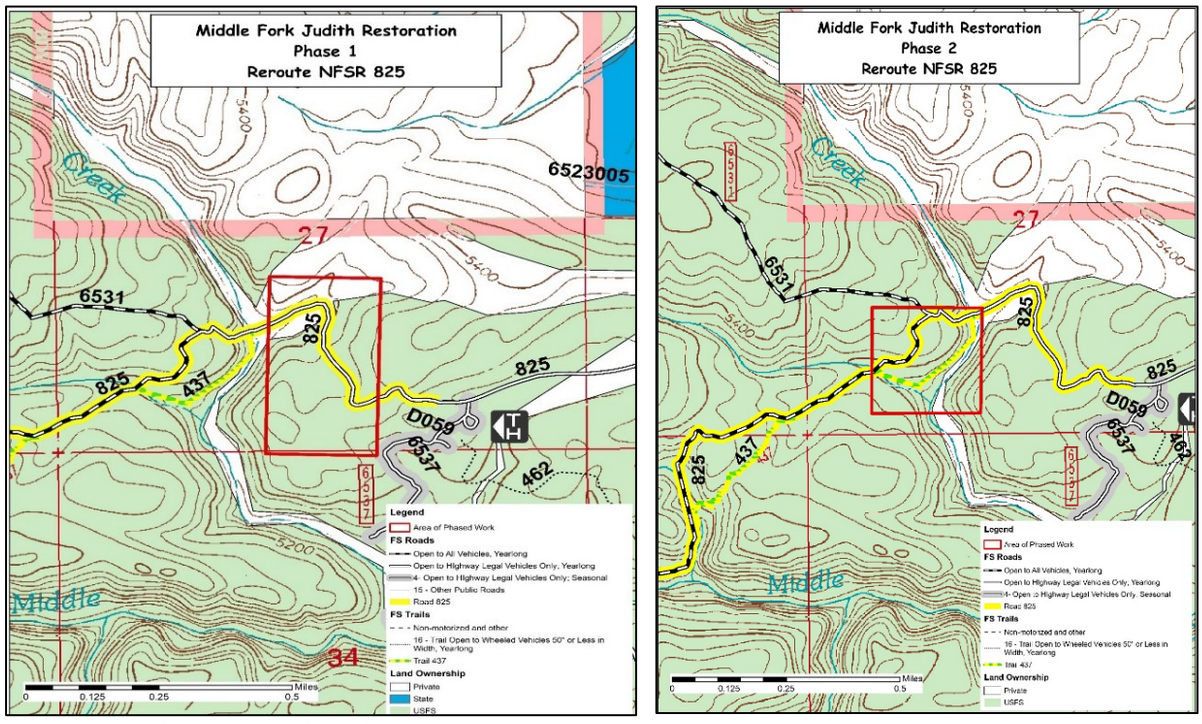


Figure 13 - Phases 1 and 2 of Restoration

4.2 PHASE 2

Phase 2 involved re-route including sustainable trail design from Yogo crossing to the top of Yogo hill to bypass a bedrock hill. In 2020, after completing phase 1, equipment operators obliterated a steep hill-climb and built six switchbacks with appropriate drainage to minimize sedimentation of Yogo Creek.

4.3 PHASE 3

Phase 3 was the conversion of motorcycle trail #434 to jeep trail #N31 down Arch Coulee that reconnects with J825. Construction of this phase was performed from September 13-24, 2021. A Recreational Trails Program grant was successfully applied for by Montana Trout Unlimited in February 2021. The RTP grant covered the full cost estimate of $21,583, of Phase 3, although the cost incurred was $25,168. The $3,585 overage was covered by the cost-share agreement.

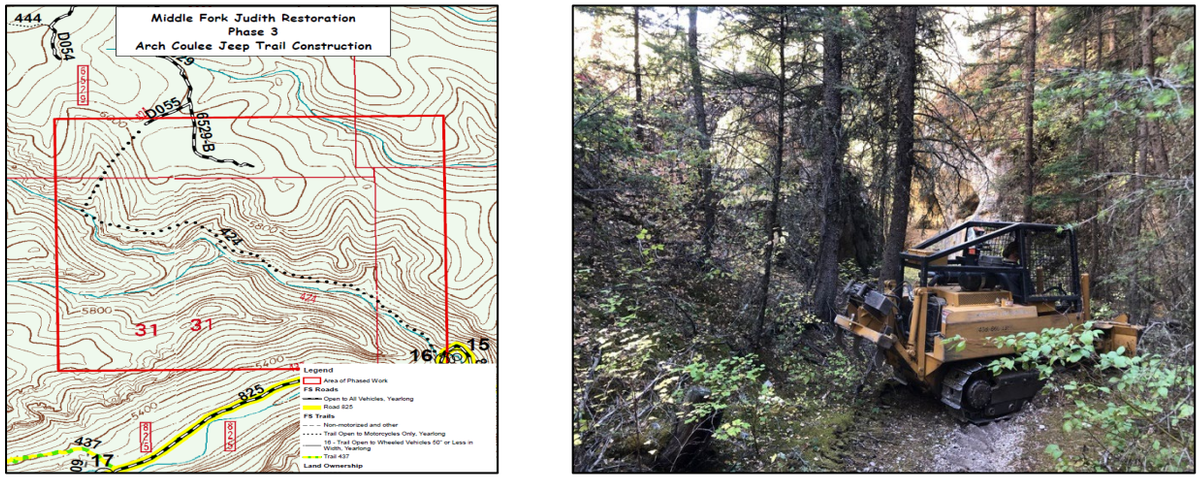


Figure 14 - (L) Phase 3 restoration map. (R) Trail dozer, with Arch Coulee in the upper left

Figure 15 - View from the newly constructed route down Arch Coulee in Phase 3

4.4 PHASE 4

Phase 4 will improve J825 between the bottom of Phase 3-Arch Coulee connector and the private in-holdings. This phase will eliminate 13 duplicative stream entrances on 10 crossings, and harden the remainder where

possible. NEPA was signed early summer 2021. This phase is expected to cost >$40,000. Upon approval of this WRP, funding for this phase will be eligible for 319 project funding through Montana DEQ.

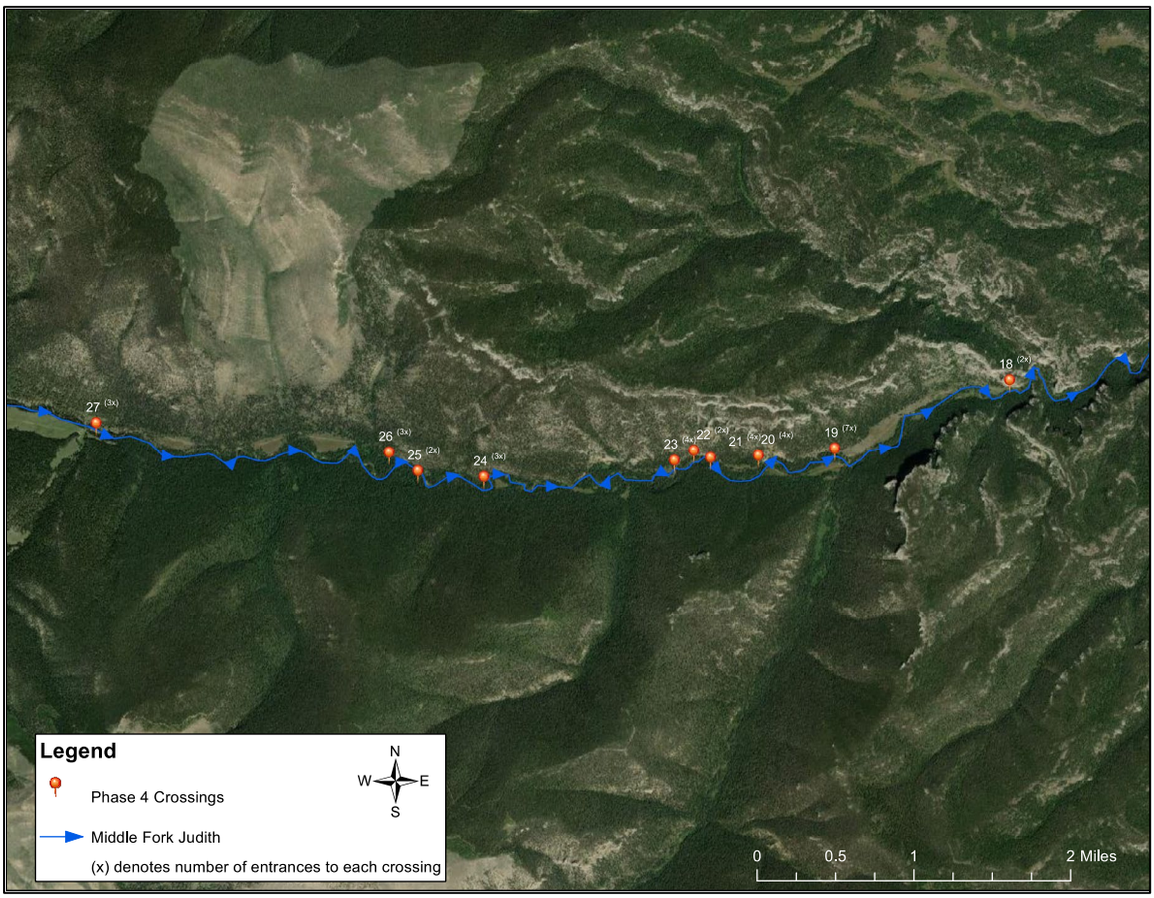
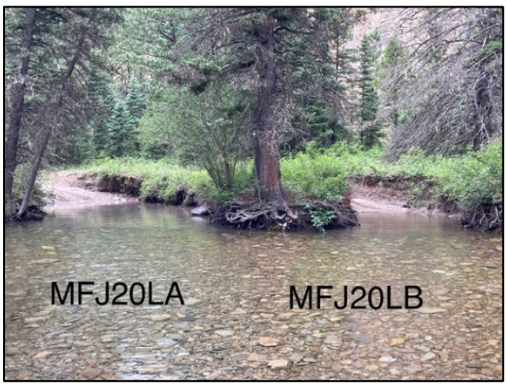


Figure 16 - Phase 4 of restoration with identified crossings



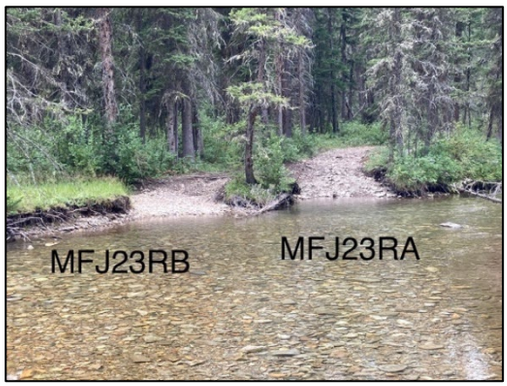


Figure 17 - Example of stream crossing in Phase 4 with unique identifying number

4.5 PHASE 5

Phase 5 includes the obliteration and restoration of J825 between phase 2 and Arch Coulee (Phase 3) that runs parallel and through the Middle Fork Judith River. This includes eliminating and restoring 17 stream crossings. NEPA was signed early summer 2021. This phase is estimated to cost $114,300. Upon approval of this WRP, funding for this phase will be eligible for 319 project funding through Montana DEQ. The completed new route will be known as **#J825.**

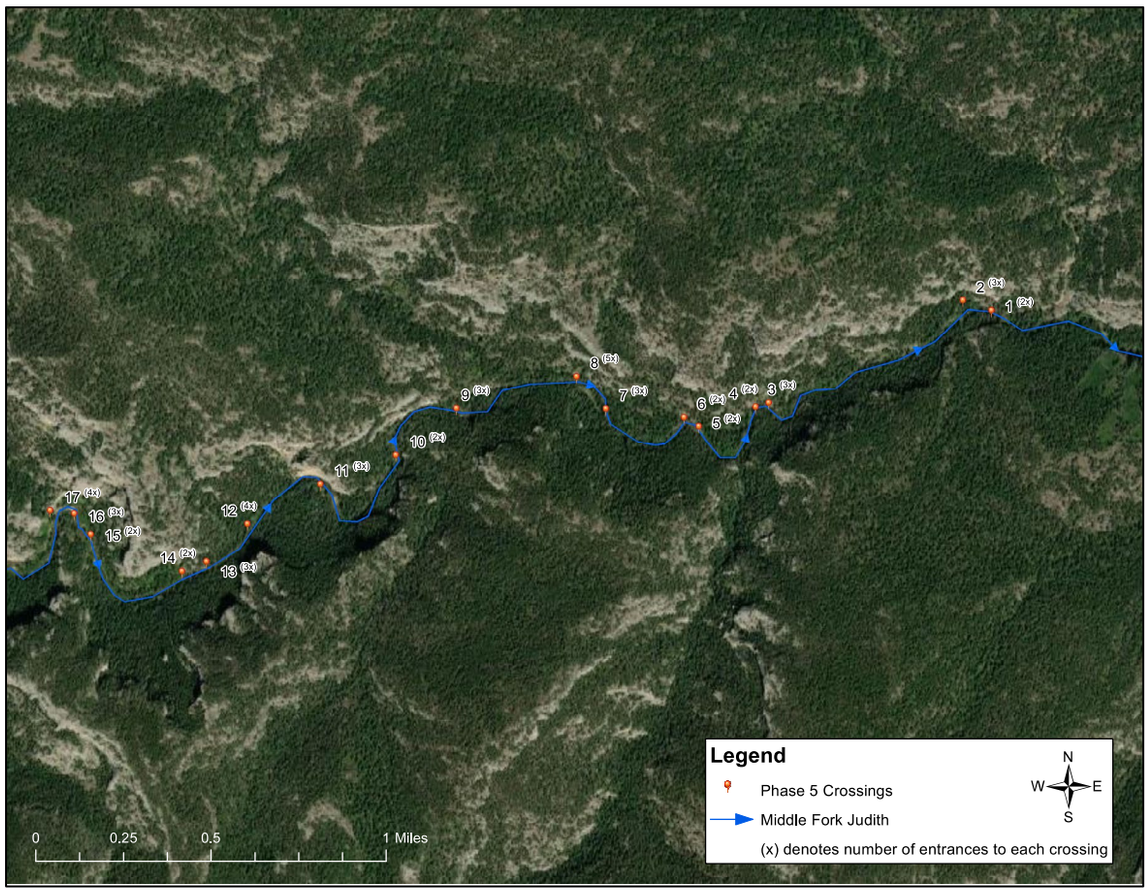


Figure 18 - Phase 5 of restoration with identified crossings

Figure 19 - Example of stream crossing with multiple entrances and a road capture

5.0 Proposed Management Measures

Proposed management measures (including a description of operation and maintenance requirements) and explanation of how these measures will effectively address the NPS impairment identified above;

Completion of the five proposed phases of restoration is expected to address the primary sources of impairment affecting the Middle Fork Judith River. Once completed, this area will be managed as a Wilderness Study Area (WSA) (**Section 1.2**). Congress would need to pass legislation to designate this a Wilderness Area. If Congress releases this area from WSA designation it will be managed as an Inventoried Roadless Area.

6.0 EFFECTIVENESS MONITORING

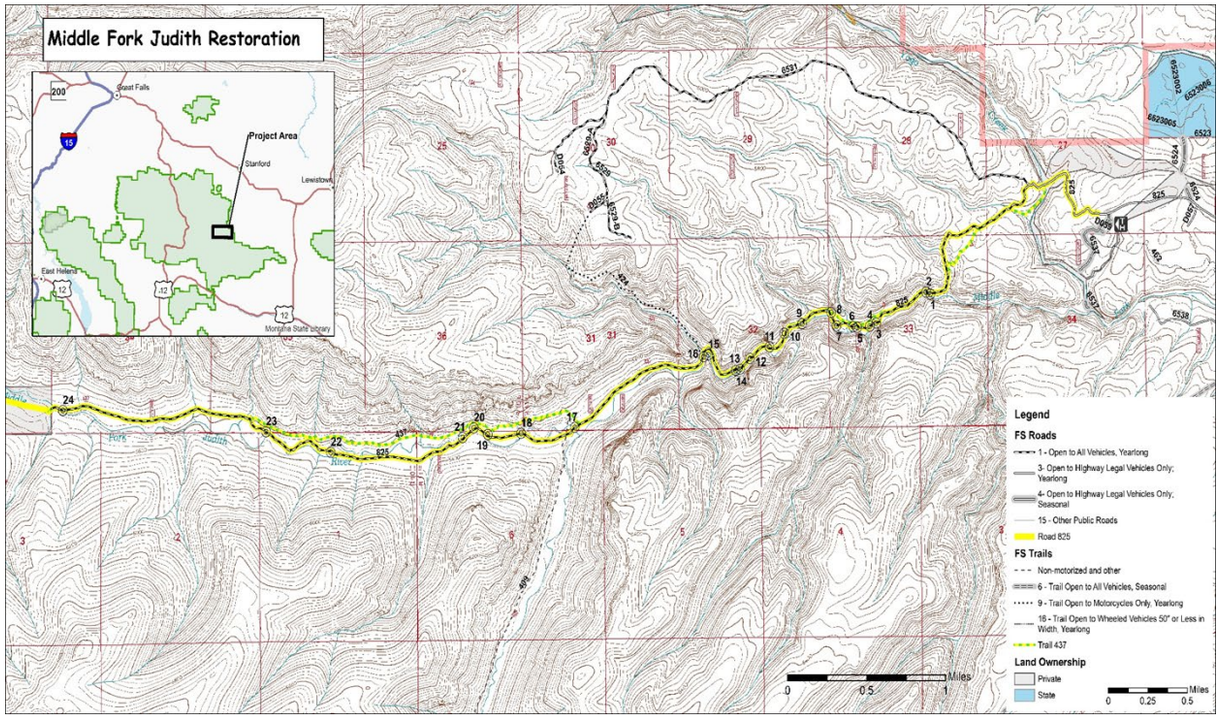


Figure 20 - Site overview of proposed relocation of FS 825 and stream restoration

Upon completion pf phase 4 and 5, which will obliterate 2.5 miles of J825, and rehabilitate 62 stream entrances the Middle Fork Judith River will require time to recover instream sediment and habitat conditions. The USFS will monitor the road decommissioning work to ensure that there is no continued motorized access, besides snowmobile access by in-holders as described in the *2007 Travel Management Plan*, and decommissioned roads are revegetating and no weeds are invading. There are no plans to conduct instream work to mechanically restore reference conditions to those crossings. Channel forming flows during spring runoff are expected to restore sufficiently without the disturbance associated with bringing heavy machinery into the river. Over time instream geomorphology (coarse sediment) and fine sediment metrics will begin to move towards reference conditions but it is not clear how much time will be required.

Targets were developed based on the reference data set applied to the assessment. DEQ set the targets using the median value of the reference data set from assessment parameters. While this is different than the statistics applied for assessment decision-making, these values align with the assessment decision and provide a target for instream sediment conditions. The WQPB's habitat indicator guide and associated response form (**Appendix B**) also provide qualitative targets categorized as optimal, sub-optimal, marginal, or poor. These targets may change as more readily available reference data is collected from cooperating agencies and incorporated into DEQ's future decision-making process.

In addition to the targets presented, there is a PIBO monitoring site located just upstream of the confluence with Yogo Creek (**Figure 16**). The site did not meet DEQ stratification parameters; therefore, was not included in the assessment process. However, future monitoring of this site is likely to inform trends on parameters collected, including sinuosity, pool frequency, residual pool depth, width to depth ratio, and large woody debris. These data are presented along with sediment targets, average of data collected at DEQ assessment sites, and assessment results; however, these should not be compared to one another.

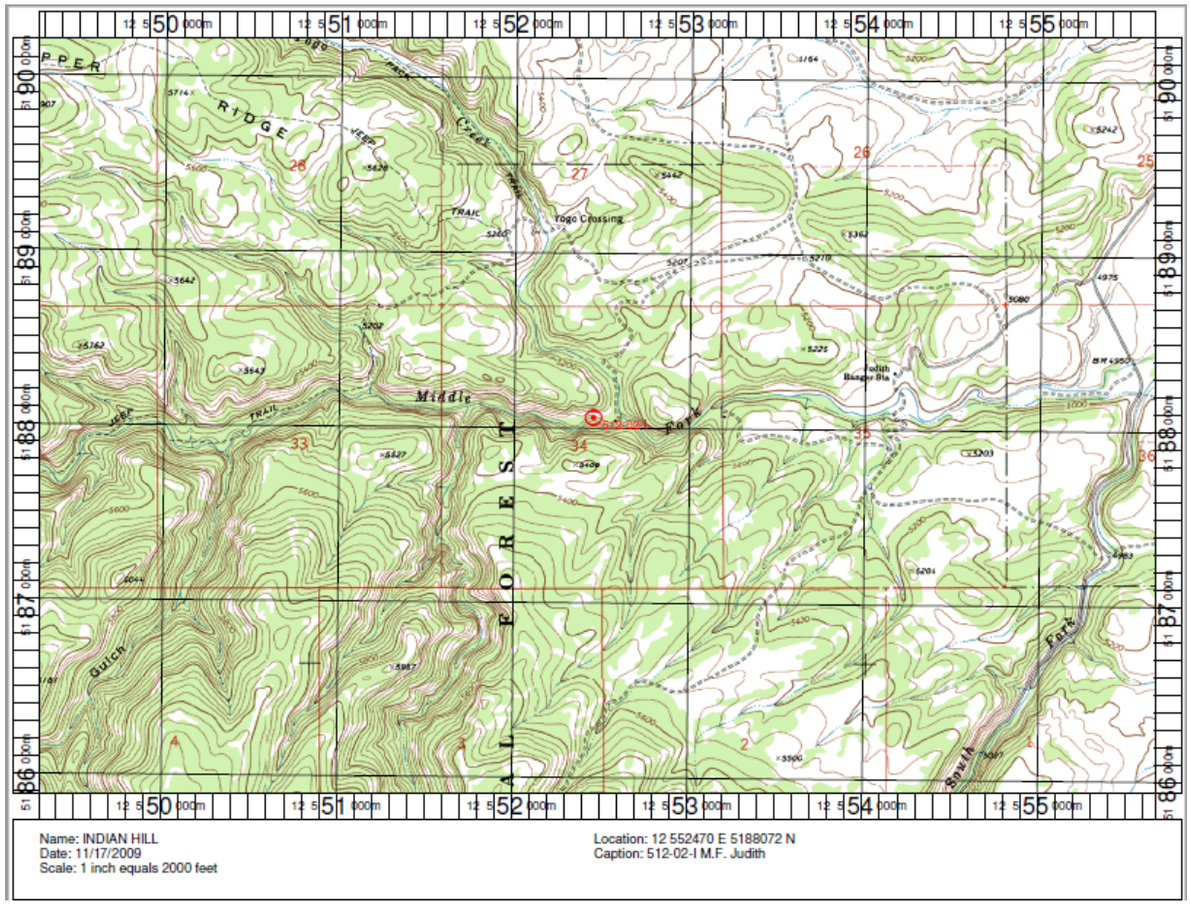


Figure 21 - PIBO Effectiveness Monitoring Program Site on Middle Fork Judith River

Table 4. Sediment Targets and PIBO Site Data

	% Riffle Fines <6mm	% Riffle Fines <2mm	% Pool Tail Fines <6mm	Median Width/Depth Ratio	Mean Residual Pool Depth (ft)	Pools/1000 ft.	LWD Frequency (Pieces/ 1000 ft)
MF Judith Average	6.0	3.3	9.3	20.3	2.0	2.9	N/A
Sediment Targets (Reference Median)	11.1	9.2	7.1	17.6	1.4	10.8	N/A
Assessment Result	PASS	PASS	FAIL	FAIL	PASS	FAIL	N/A
PIBO Site 2007	N/A	N/A	11.2	31.9	4.0	7.1	54.6
PIBO Site 2018	N/A	N/A	2.8	13.0	4.5	7.4	49.4
PIBO Average	N/A	N/A	7.0	22.5	4.3	7.3	52.0

Montana FWP established baseline fish abundance data in 2015 (**Figure 8**) showing a range from approximately 19 to 160 fish per mile. Reference fish population for a stream the size of Middle Fork Judith is between 200 and 400 fish per mile. FWP will continue to monitor these sites on the Middle Fork Judith over the next several years.

9.0 REFERENCES

DEQ (Montana Department of Environmental Quality). 2008. Watershed Stratification Methodology for TMDL Sediment and Habitat Investigations. Helena, MT: Montana Dept. of Environmental Quality.

Feldman, D. 2012. Sample Collection, Sorting, and Taxonomic Identification of Benthic Macroinvertebrates Standard Operating Procedure. WQPBWQM-009, Revision 3. Helena, MT: Montana Department of Environmental Quality, Water Quality Planning Bureau.

FWP (Montana Fish, Wildlife and Parks). 2017. Lewistown Area Fisheries Management 2015-2016 Annual Report. Great Falls, MT: Montana Dept. of Fish, Wildlife and Parks.

Kusnierz, P., A. Welch, and D. Kron. 2013. The Montana Department of Environmental Quality Western Montana Sediment Assessment Method: Considerations, Physical and Biological Parameters, and Decision Making. Helena, MT: Montana Dept. of Environmental Quality.

Makarowski, K. 2020a. Standard Operating Procedure: Field Data Collection Activities, Draft, Version 1. Document ID TBD. Helena, MT: Montana Department of Environmental Quality Water Quality Planning Bureau.

Makarowski, K. 2020b. Standard Operating Procedure for Sediment Beneficial Use Assessment Monitoring: Wadeable Streams in Mountainous and Transitional Ecoregions. WQPBMAS-Draft, Version 1.0. Helena, MT: Montana Department of Environmental Quality, Water Quality Planning Bureau.

Meredith, C., Roper, B. and Archer, E., 2014. Reductions in instream wood in streams near roads in the interior Columbia River basin. *North American Journal of Fisheries Management*, *34*(3), pp.493-506.

Montgomery, D.R., Buffington, J.M., Smith, R.D., Schmidt, K.M. and Pess, G., 1995. Pool spacing in forest channels. *Water Resources Research*, *31*(4), pp.1097-1105.

Peck, D. V., A. T. Herlihy, B. H. Hill, R. M. Hughes, P. R. Kaufmann, D. J. Klemm, J. M. Lazorchak, F. H. McCormick, S. A. Peterson, P. L. Ringold, T. Magee, and M. Cappaert. 2006. Surface Waters Western Pilot Study: Field Operations Manual for Wadeable Streams. Environmental Protection Agency. Report EPA 620-R-06/003.

Rosgen, D.L. 1996. Applied River Morphology. Pagosa Springs, CO: Wildland Hydrology Books.

USFS (Unites States Forest Service). 1982. Final Environmental Impact Statement: Middle Fork Judith and Big Snowies Montana Wilderness Study Act Areas. Great Falls, MT: Lewis and Clark National Forest.

USFS. 2019. Wilderness Study Areas located on national forest system lands in MT. https://leg.mt.gov/content/Committees/Interim/2019-2020/EQC/Meetings/Sept-2019/wsa-in-mt.pdf.

USFS. 2020. 2020 Land Management Plan: Helena-Lewis and Clark National Forest. Helena, MT.
Watershed Protection Section (WPS). 2017. Field Methodology for Sediment and Habitat Source Assessment. Document ID WQPBWMSSOP-05. Helena, MT: Montana Department of Environmental Quality Water Quality Planning Bureau.