2020 319 Application Form

PART A—GENERAL INFORMATION

Project Name: Lower Bitterroot Tributary Restoration

Sponsor Name: Clark Fork Coalition

Registered with the Secretary of State? Y

Registered with SAM? Y

Duns # 840737332

Does your organization have liability insurance? Y

Primary Contact: Jed Whiteley	Signatory: Karen Knudsen
Title: Project Manager	Title: Executive Director
Address: 140 S 4th St W #1	Address: 140 S 4th St W #1
City: Missoula State: MT Zip Code: 59801	City: Missoula State: MT Zip Code: 59801
Phone Number: 406-531-0256	Phone Number: 406-542-0539 ext 203
Email Address: jed@clarkfork.org	Email Address: karen@clarkfork.org
Signature:	Signature:

Technical and Administrative Qualifications

CFC brings an experienced technical and grant management team to these projects and a proven track record of performance on government funded projects during its 33 year history. The projects will be led and by CFC's PM Jed Whiteley. Jed has completed over $1 million dollars of road decommisioning work in Western Montana and the Idaho Panhandle. He regularly managed over $3 million/year of restoration projects as a PM in the private sector and is Rosgen Level III certified with 15 years experience in heavy equipment stream restoration. For the West Fork project InRoads Consulting, led by Adam Switalski, is under contract to assist with field oversight and quality control. Amy Sacry, from Geum Environmental Consulting is the lead designer on the Miller Creek projects and Gary Decker from River Design Group is the lead on the O'brien projects with assistance from Traci Sylte.

Past and Current Projects

Project Name	Grant or Contract Amount	Funding Entity *(entity name/program, contact person, phone, email)*	Completion Date
Lolo Ditch Fish Screen	$ 90,000.00	USFWS/ CFDA Program George Jordan 406-247-7365 george_jordan@fws.gov	November 2020
East Fork Lolo Sediment Reduction	$ 122,510.00	Montana DEQ/319 Louis Volpe 406-461-6737 LVolpe@mt.gov	October 2016
Lost Horse Creek Siphon	$ 93,500.00	Montana FWP/Future Fisheries Michelle McGree 406-444-2432 MMcGree@mt.gov	December 2015

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FUNDING REQUEST

319 Funds Requested *(**including** administrative fee)*	$ 336,500.00
State Cash Match	$ 77,000.00
Local Cash Match	$ 138,000.00
In-Kind Match	$ 10,000.00
Federal Funds	$ 10,000.00
Other Funds *(not 319, not match, not federal)*	$ 0.00
Total Project Cost	$ 571,500.00

Administrative Fee *(not to exceed 10% of total 319 funding request)*	$ 24,000.00
Total Non-Federal Match	$ 225,000.00

PART B—PROJECT INFORMATION

Part B must be filled out separately ***(including providing separate attachments)*** for each project included in your application. Use the following examples to help determine when to lump and when to split projects. If additional clarification is needed, contact Mark Ockey, at 406-444-5351 or mockey@mt.gov.

Splitting Examples (fill out multiple Part B's)

- Stream restoration work occurring on two separate streams, on parcels owned by two separate individuals
- Two projects with significantly different sets of project partners
- Two projects that address substantially different pollution sources (e.g., one project that moves a corral off of a stream, and another to remove mine tailings, with both projects being on the same 800-acre recreational property)

Lumping Examples

- Contiguous stream restoration work spanning multiple land parcels
- 3 projects that address similar sources of pollution on a single land parcel (e.g., moving a coral off a stream, implementing a grazing management plan, and relocating a manure storage facility out of the floodplain, all on the same ranch)
- A mini-grant program designed to address numerous failing septic systems scattered throughout a watershed

Project *(sub-project)* Name Lee Creek/West Fork Sediment Reduction

Total Project Cost *Include costs already incurred, as well as anticipated costs, from all sources, for all aspects of the project.* $ 571,500.00

Latitude 46.73709 Longitude -114.52961

Map Y

Latitude Longitude

Latitude Longitude

12 Digit HUC #(s) 170102051401

Waterbody Name from 2018 List of Impaired Waters Upper Lolo

Probable Causes of Impairment to be Addressed Sedimentation/siltation

Waterbody Name from 2018 List of Impaired Waters

Probable Causes of Impairment to be Addressed

Project Summary - Briefly describe the ***nature and extent*** of the problem, the ***root causes*** of the problem, and your ***proposed solution***.

In 2009 the Lolo National Forest acquired over 32 sections of forest lands in Upper Lolo Creek that were formerly under Plum Creek ownership through the Montana Legacy Project. The Upper Lolo Creek watershed is significantly impacted by sediment generated by forest roads and failing culverts and the Upper Lolo Sediment TIE sets goals of between 33 and 65% load reductions from forest roads. The Plum Creek lands created a checkboard pattern of land ownership in the Upper Lolo basin and until the Montana Legacy Project was finalized the Lolo National Forest was only able to carry out sediment reduction restoration on every other square mile of the area. The proposed project boundaries encompass the West Fork Lolo and Lee Creek watersheds, which are strongholds for native trout in the Lolo Creek watershed with a clear presence of bull trout that has been established through electrofishing and eDNA monitoring. The creeks are also listed as a critical Bull Trout area in need of sediment reduction and fish barrier removal in the Forest Service's 2013 "Conservation Strategy for Bull Trout on USFS lands in Western Montana".

To address the sediment coming from forest roads the Lee Creek/ West Fork Sediment Reduction Project will focus on decomissioning 11 miles of forest roads and their associated culverts that are negatively impacting the Upper Lolo watershed's water quality by adding large amounts of sediment to the areas streams. This project builds on two other major sediment mitigation projects already carried out in the Upper Lolo basin by CFC and funded in large part by DEQ 319. Decomissioning of roads will include up to 100% recontouring of topography, slash placement, and revegetation as needed. Sites where culverts are removed will be recountoured to match current stream geomorphology and large woody debris and boulders will be placed for grade control. Completion of this project will promote the natural ecological function of the watershed and eliminate ongoing need of maintaining costly BMPs.

All restoration activities for this project will take place on USFS property. Project activities are based on the recommendations stated in the Upper Lolo Sediment TMDL Implementation Evaluation (Section 2.0 TMDL-Recommended Activities), the Lolo Creek Watershed Restoration Plan (Chapter 4- needs in Lolo Creek) and USFS "Conservation Strategy for Bull Trout on USFS lands in Western Montana"(Lolo, West Fork Lolo Creek; pg 288-289). All roads proposed for decomissioning are non-system roads behind locked gates or barriers that have never been open to travel by public vehicles.

Continuation of previous or ongoing activity? If "Yes", please explain the relationship.

This project is the third phase of a major restoration effort by the Clark Fork Coalition to permanently reduce sediment entering the Upper Lolo watershed. In 2016 CFC decommissioned 17 miles of roads in the East Fork of Lolo Creek and then decommissioned another 10 miles in Granite Creek in 2018. This current phase will deal with the last major HUC 12 watershed in the Upper Lolo TMDL area.

Watershed Restoration Plan (WRP) and authoring entity

Lolo Creek - Lolo Watershed Group

Letter of support from WRP authoring entity? If "No", please explain.

Y

How will this project implement recommendations in the WRP?

The Lolo Creek WRP repeatedly recommends the reclamation of forest roads that are causing siltation of the the waterways. It specifically calls out road decomissioning as a restoration activity in Lee and West Fork Lolo Creek in order to mitigate sediment. These recommendations are in turn based on the Upper Lolo Sediment TMDL Implementation Evaluation issued by DEQ in 2011 that recommends that aims for a sediment load reduction of 33% in the West Fork of Lolo Creek and 65% load reduction in Lee Creek.

Nonpoint Source Goals

It is the projects goal to significantly reduce sediment in the Upper Lolo Creek TPA as well as opening up many miles of stream to fish for spawning and cold water refugia. Measurable objectives for the project include completing 100% recontouring of 11 miles of forest roads and the removal of at least 25 culverts, monitor stream cross-sections to assess project effectiveness and conduct outreach to educate community members and government agencies about the project. Using WEPP modeling on the field data gathered by the Coalition this summer shows this project will mitigate up to 6,950 tons of sediment from entering the Upper Lolo system in the next 30 years. This number will be significantly higher if the area experiences forest fire during the same time period. The TIE issued in 2011 states that the greatest sources of sediment in the West Fork and Lee Creek is from forest roads, with an existing sediment load calculated at 887 tons per year. The TMDL allocation is for 702 tons of sediment per year, or a reduction of 165 tons per year. This project is aimed directly at achieving that goal and will reduce sediment in the West Fork of Lolo Creek and Lee Creek by up to an average of 231 tons per year.

Partners and Roles

Landowner(s)

Name	Letter of Support Attached?
USFS-Lolo National Forest	Y
	N
	N

Other Partners

Name	Role	Letter of Support Attached?
Montana Fish Wildlife and Parks	Project funding through Future Fisheries and monitors the fishery	Y
Lolo Watershed Group	Project supporter and WRP author	Y
Westslope Chapter Trout Unlimited	Project supporter and funding contributor	Y
		N
		N
		N

Planning and Coordination

Planning and coordination includes permitting, design development, landowner agreements, volunteer labor recruitment, partnering and collaboration, alignment with watershed planning efforts, procurement and oversight of contractors, etc.

Planning Activities Already Completed	Documentation Attached?
Survey of forest roads	Y
Landowner agreement	Y
Coordination meetings with Lolo NF	N
Started NEPA process	N
	N
	N

Task Description

Contractor shall finalize identifying and mapping all forest roads to be decommissioned and culverts to be removed including restoration of drainage. Contractor will also work with the Lolo National Forest to ensure that all permits necessary for the project are procured. The Clark Fork Coalition will be responsible for procurement and oversight of implementation contractor.

Deliverables

- A complete, draft copy of project designs for review and comment.
- A complete, final copy of project designs. In the final designs, Contractor shall address all concerns raised by DEQ in the review of previous drafts.
- Copies of all permits necessary for implementation of the project designs.
- If changes to design plans require reopening ESA consultation, copies of ESA final determination and management recommendations.
- Procurement of implementation contractor

Funding

319 Funds	$ 10,000.00
Non-Federal Match	$ 2,500.00
Federal Funds	$ 0.00
Other Funds	$ 0.00
Total Cost	$ 12,500.00
Is Match Secured	N

Timeline July 2020-December 2021 Match Source Private Donors

Project Implementation

Task Description

CFC will implement the Lee Creek/ West Fork Sediment Reduction project in accordance with the designs, permits and other project planning documents submitted with the Lee Creek/ West Fork Sediment Reduction Project proposal. CFC will be responsible for procurement and oversight of construction contractor and completion of implementation tasks. CFC shall document implementation activities by providing the deliverables identified below. Lolo National Forest personnel are responsible for final project inspection and acceptance.

Deliverables

100% decomissioning of 11 miles of forest roads
-A minimum of 25 culverts removed and stream bed/drainage returned to before culvert grade
-Draft request for proposals (RFP) for DEQ review and comment. Contractor shall submit draft RFP prior to release and allow at least 30 days for DEQ review, comment, and subsequent modification prior to release
-A final copy of the RFP
-Lolo NF sign off on completed work
-Before and after photos of project areas

Funding

319 Funds	$ 112,000.00
Non-Federal Match	$ 30,500.00
Federal Funds	$ 10,000.00
Other Funds	$ 0.00
Total Cost	$ 152,500.00
Is Match Secured	N

Timeline July 2020-November 2020

Match Source Future Fisheries, Private Donors

Appropriate Next Step

When the Clark Fork Coalition and the Lolo National Forest started to collaborate in 2015 on permanently reducing sediment sources in the Upper Lolo watershed a phased approach splitting the watershed into 3 parts was decided on. These three parts were: East Fork Lolo Creek watershed, Granite Creek watershed and West Fork Lolo Creek watershed. The first two phases have been completed leaving the West Fork to be addressed. It is CFC and the Lolo National Forest's plan after completing the current proposed project on the West Fork and Lee Creek next year to take an inventory of all other possible sediment sources on National Forest land and address the highest priorities in a fourth phase using road decommissioning, culvert removals/upgrades and BMP's.

Sustainability

When forest roads and culverts are properly decommissioned or removed and the stream crossings restored they permanently no longer are sources of sediment. The result of this project will be long term, sustainable reduction in sediment in the Upper Lolo watershed by removing unneeded non-system forest roads and culverts and the sediment they produce.

Natural Processes

The entire goal of this project is to restore natural processes and to help the native species that depend on them. Through the decompaction and restoration of the natural prism on forest roads water will be able to percolate downwards instead of running off in a concentrated flow that carries sediment with it. Streams that were choked down into 24" culverts will regain their full width and floodplains.

Project Effectiveness Evaluation

Task Description

Contractor shall, in consultation with the DEQ Project Manager, develop a reasonable method or set of methods for evaluating and reporting on the effectiveness of the project in addressing water quality issues. Contractor shall complete the following monitoring activities:
-Evaluation: Evaluation shall consist of site documentation (narrative and photographic) of restoration actions during and after construction.
-Modeling: Estimate sediment load reductions achieved as a result of on-the-ground project implementation

Deliverables

- Sediment load under existing conditions, reported in tons of sediment/year.
- Sediment load reduction estimates, reported in tons of sediment/year.
- A description of the methods used to estimate loads, including but not limited to WEPP model input parameters.
- A description of the methods used to evaluate the effectiveness of the project at addressing sediment load to Granite Creek.
- Documentation of project site visit during and after construction, to include:
  - o PDF and hard copies of all field notes, site visit forms.
  - o Electronic copies of site photographs and photo-points, in JPEG format. A photo log identifying photo date, photographer name, photo subject, lat and long from which the photo was taken, approximate direction, and a brief description

Funding

319 Funds	$ 3,000.00
Non-Federal Match	$ 2,000.00
Federal Funds	$ 0.00
Other Funds	$ 0.00
Total Cost	$ 5,000.00
Is Match Secured	N

Timeline July 2020-December 2021 Match Source Private Donors

The Bigger Picture

Other Natural Resources

The proposed project will positively effect native fish including the threatened bull trout and Westslope cutthroat trout by reducing sediment that is presently choking out spawning areas and cobble substrate that houses macro invertebrates and opening up presently unavailable reaches of tributaries for spawning and cold water refugia.

Climate Resiliency

The West Fork of Lolo Creek is an area that has not burned in over 100 years. Under the impacts of climate change it is not a matter of if but when this landscape will burn again. By removing the "sediment bombs" that bad forest roads and culverts represent we are building resiliency into the system for when forest fire does happen. Also as stream temperatures climb due to climate change it is vitally important to open up access to cold water refugia that is presently blocked by culverts that are fish barriers.

Public Visibility

The project will virtually "erase" unsightly forest roads on the landscape and allow for a more natural experience for people recreating in the area in the years to come. One of the goals of th project is to positively affect the fishery, leading to more recreational opportunities in the project area and greater Lolo Creek watershed.

Point Source / Nonpoint Source Relationships

There is no permitted point source for sediment in the Lolo Creek watershed.

Source Water Protection

Through increased precipitation infiltration in the upper watershed groundwater wells lower in the watershed may see better recharge from Lolo Creek in the dry season of late summer.

Healthy Watersheds

The project will restore natural processes to the watershed in two ways. First this will occur though the removal of substantial present and future sources of sediment from the watershed, allowing the present sediment loading to flush out over time and restore the natural substrate to the streams. Secondly by removing road crossings that are barriers to aquatic organism passage more of the watershed can be utilized.

2020 319 Application Form

PART A—GENERAL INFORMATION

Project Name _____

Sponsor Name _____

Registered with the Secretary of State? N

Registered with SAM? N

Duns # _____

Does your organization have liability insurance? N

Primary Contact _____

Signatory _____

Title _____

Title _____

Address _____

Address _____

City _____ State MT Zip Code _____

City _____ State MT Zip Code _____

Phone Number _____

Phone Number _____

Email Address _____

Email Address _____

Signature _____

Signature _____

Technical and Administrative Qualifications

Past and Current Projects

Project Name	Grant or Contract Amount	Funding Entity *(entity name/program, contact person, phone, email)*	Completion Date

FUNDING REQUEST

319 Funds Requested *(**including** administrative fee)*		Administrative Fee *(not to exceed 10% of total 319 funding request)*	
State Cash Match			
Local Cash Match			
In-Kind Match		Total Non-Federal Match	$ 0.00
Federal Funds			
Other Funds *(not 319, not match, not federal)*	$ 0.00		
Total Project Cost	$ 112,500.00		

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Lumping Examples

- Contiguous stream restoration work spanning multiple land parcels
- 3 projects that address similar sources of pollution on a single land parcel (e.g., moving a coral off a stream, implementing a grazing management plan, and relocating a manure storage facility out of the floodplain, all on the same ranch)
- A mini-grant program designed to address numerous failing septic systems scattered throughout a watershed

Project *(sub-project)* Name O'Brien Creek at O'Brien Meadow

Total Project Cost *Include costs already incurred, as well as anticipated costs, from all sources, for all aspects of the project.* $ 112,500.00

Latitude 46.84915 Longitude -114.1117

Map Y

Latitude Longitude

Latitude Longitude

12 Digit HUC #(s) 170102051502

Waterbody Name from 2018 List of Impaired Waters O'Brien Creek

Probable Causes of Impairment to be Addressed Sedimentation/siltation

Waterbody Name from 2018 List of Impaired Waters

Probable Causes of Impairment to be Addressed

Project Summary - Briefly describe the ***nature and extent*** of the problem, the ***root causes*** of the problem, and your ***proposed solution***.

O'Brien Creek is located in Missoula County, Montana. The watershed encompasses 25.4 square miles and is an important tributary to the Lower Bitterroot River and cold-water fishery. The Creek has experienced extensive human uses for over a century, including a railroad in the valley bottom for timber extraction, a grain mill at the confluence with the Bitterroot, severe manipulation from ditching and irrigation withdrawals, road development and timber harvest in the uplands, among others uses. Landownership varies between public ownership on Forest Service land in the middle and headwaters to varied parcel sizes in the lower watershed and valley bottom. >>>>> In association with a larger integrated project proposal surrounding Missoula, the Lolo National Forest conducted a general longitudinal habitat assessment in October of 2019 to assist with O'Brien Creek WRP inclusion into the Bitterroot River WRP update. The assessment highlights ongoing issues that landowners are experiencing as the stream continues to heal from recent and historic impacts. O'Brien Creek clearly has undergone at least two series of significant down-cutting within the recent past (less than 100 years). Although the trend of habitat and water quality conditions appears to be improving, non-point source sediment pollution is sourced from low to high terrace bank failures, stream entrenchment and incision processes, road washouts, riparian vegetation reductions, and resultant bank erosion is prevalent in many reaches (please refer to the recently submitted draft WRP and Appendix A for photos and further detail). >>>>> Concurrently, bedload quantities are excessive and aggradation is present in several sections, which is causing lack of channel capacity and more frequent flooding. In several areas where roads encroach the stream or floodprone areas, road fills are actively eroding, and at least one washout needs immediate remediation.>>>>>Recent landowner issues and data collection is indicating a high likelihood that O'Brien Creek may not be achieving beneficial uses because of non-point source sediment pollution, although it's not listed as a 303(d) impaired waterbody. The need for restorative actions appears high throughout the drainage for two reasons related to the 319 Grant Call for Proposals and 2017 Montana Nonpoint Source Management Plan: 1) there's a very high probability that treatments are needed on multiple sources of non-point source sediment pollution so that O'Brien Creek conditions do not impact the recently de-listed sediment and nutrient status of the Bitterroot River reach immediately downstream; and 2) O'Brien Creek is undergoing a series of bank failures that may not have been as evident in the recent past. All indicators point towards the beneficial use of the cold-water fishery is likely very compromised. >>>>> The CFC was asked by the O'Brien Creek HOA to assist with bank erosion, incision, capacity, and avulsion problems on about 900 feet of O'Brien Creek immediately upstream of Blue Mountain road, which is the basis of this proposal. As such, the CFC proposes to work with the HOA to arrest both fine and coarse sediment source deliveries, restore channel form and stability to within natural ranges, enhance instream habitat, dissipate flood energies, and improve macroinvertebrate populations by channel reshaping and floodplain reconnection, riparian planting, large wood installations, and floodplain re-grading and channel re-alignment. Through these efforts we plan to significantly reduce sources of sediment and likely nutrient pollution from the subject reach, and begin communications and collaborations that work within a watershed context to assist other willing landowners to meet multiple objectives, including MT DEQ goals for water quality and beneficial uses.

Continuation of previous or ongoing activity? If "Yes", please explain the relationship.

Yes;this effort would continue ongoing work to assist restoration efforts identified within the Bitterroot Watershed Restoration Plan. O'Brien Creek is the most downstream large tributary in the Bitterroot River before the confluence with the Clark Fork River. The CFC has been asked for assistance by a landowner to perform rehabilitative stream work in a segment of O'Brien Creek. Over time and with additional landowner support, the Coalition would like to continue assisting landowners in meeting their needs and contributing to multiple landowner and agency goals that improve stream and structure and function to within natural ranges, reduce maintenance costs, reduce land loss and erosion, reduce sedimentation, and ultimately improve water quality. Achieving reductions in non-point source pollution such as sediment and nutrients is formative in our work within the Bitterroot Basin.

Watershed Restoration Plan (WRP) and authoring entity

O'Brien Creek - Clark Fork Coalition working with the Bitterroot Water Forum and Missoula Water Quality Conservation District

Letter of support from WRP authoring entity? If "No", please explain.

N

Because the CFC, with support of the Lolo National Forest and members of the O'Brien Creek HOA, submitted the WRP, we felt it redundant and somewhat awkward to submit a letter from the authors in support of our own proposal. We'd be happy to provide a letter from the CFC, if it would assist these efforts. We do have substantive support letters attached from other relevant stakeholders.

How will this project implement recommendations in the WRP?

The O'Brien Creek WRP submitted as a draft to the Bitterroot WRP update identifies several causes of impacts that lead to erosion and sedimentation, habitat degradation and fragmentation, likely degradation of macroinvertebrate populations, and possibly nutrient impacts to the cold water fishery of O'Brian Creek. Because O'Brien Creek is a primary tributary to the Bitterroot River, impacts within O'Brien Creek may have a high probability of impacting sedimentation and nutrient pollution to the Bitterroot River. This project proposal addresses severe bank erosion, channel incision and flood plain connectivity, channel capacity constriction, and loss of wood on approximately 900 feet, which hopefully through good example and communications will also serve as a foundation to begin a watershed approach to other very necessary work in the drainage. The O'Brien Creek Meadow HOA is committed to performing high-quality work that will be effective in the short- and long-term to reduce their channel maintenance issues. In doing so, the HOA and the Clark Fork Coalition will be directly contributing to both the O'Brien Creek and Bitterroot Watershed Restoration Plans.

Nonpoint Source Goals

- Return altered stream morphology so that stream dimensions and capacity, planform, gradient, bedform, floodplain connectivity, and in-channel structure is within natural ranges for the specific stream type and valley setting
- Reduce fine and coarse sediment delivery to the channel from bank erosion that is accelerated substantively higher than natural rates and processes
- Reduce landowner need and frequency to perform channel maintenance
- Increase connectivity between the channel and the floodplain.
- Enhance aquatic habitat and macroinvertebrate populations for the cold water fishery.
- Increase overall ecological function of the riparian corridor.

Partners and Roles

Landowner(s)

Name	Letter of Support Attached?
O'Brien Creek Home Owners Association - landowner and contributor to WRP, rehabilitation actions, and follow-up monitoring	Y
	Y
	N

Other Partners

Name	Role	Letter of Support Attached?
Trout Unlimited	Project supporter and potential funds contributor	N
Montana Fish Wildlife and Parks	Project funding through Future Fisheries program and monitors the fishery	N
Missoula Valley Water Quality District	Project Supporter	N
Bitter Root Water Forum	Project Supporter	N
	Due to the timing of writing this proposal we had not received letters of support from the above entities at the time of submittal. We plan to bring letters of support for all the above mentioned to the November 21 presentations.	N
		N

Planning and Coordination

Planning and coordination includes permitting, design development, landowner agreements, volunteer labor recruitment, partnering and collaboration, alignment with watershed planning efforts, procurement and oversight of contractors, etc.

Planning Activities Already Completed	Documentation Attached?
O'Brien Creek Habitat Assessment for WRP	Y
Letter of Support from landowner	Y
Coordination with Missoula Valley Water Quality District and Bitterroot Water Forum	N
Coordination with the Lolo National Forest	N
Letter of Support from Fish, Wildlife, and Parks	N
Letter of Support from the Missoula Valley Water Quality District	Y

Task Description

In 2019, the HOA received a 310 permit to return the subject avulsed stream segment to it's existing channel coupled with immediate follow-up efforts to rehabilitate natural stream structure and processes to help ensure that no further emergency actions will be needed beyond extreme circumstances. This proposal will operate under the conditions of this permit, as well as any additional permit requirements. A fluvial geomorphic and environmental river engineering consultant, River Design Group, Inc., RDG, has already conducted an initial site survey and is ready to assist. Details include:
- Survey/Design. A final stream channel survey and draft final design will be conducted by RDG as soon as funding is available. The draft final design, including alternatives, will be presented to the HOA and MT DEQ for final input, alternative selection, and all concerns will be addressed. At the utmost of considerations is that the HOA must have majority support for project actions.
- Permitting - Updated permitting will be addressed with appropriate regulatory agencies. The HOA will assist.
- Implementation. Working in collaboration and with both high quality and cost efficiency as priority, River Design Group, the Clark Fork Coalition, and members of the HOA will perform construction oversite. We would welcome support from MT DEQ as well.
  - Operation and Maintenance. The HOA will be responsible for stream maintenance needs, which should not be frequent.
  - Site Access. Access is readily available and supported by the landowners

Deliverables

Working with O'Brien Creek HOA and experienced consultants, CFC will provide a stream design and will implement approximately 900 feet of channel rehabilitation to achieve aforementioned goals. All concerns and comments raised by DEQ will be addressed within funding constraints, HOA approvals, and project goals.

Funding

319 Funds	$ 23,000.00
Non-Federal Match	$ 10,000.00
Federal Funds	$ 0.00
Other Funds	$ 0.00
Total Cost	$ 33,000.00
Is Match Secured	N

Timeline July 2020-December 2021

Match Source O'Brien Creek HOA, DNRC, CFC

Project Implementation

Task Description

The following treatments are proposed on approximately 900 feet of O'Brien Creek, which is primarily owned by the O'Brien Creek HOA with approximately 100-150 feet on Hillsdale Estates Property Owners Assoc..

- Channel Shaping and Realignment. Reshape the channel to proper bankfull dimensions and perform modest re-alignment to achieve appropriate gradient and curvature for within the given valley slope and stream energy dynamics.
- Floodplain Grading. Regrade streambanks and floodprone areas to increase floodplain area and reduce frequency of flooding issues with nearby road overtopping.
- Provide improved flood conveyance and decrease negative interactions between the roadway entrance to the O'Brien Creek subdivision and irrigation ditch by providing additional culvert or bridge capacity.
- Install streambank structures consisting of woody debris and transplants to enhance aquatic habitat and return streambank stability and erosion rates to natural levels. Selectively plant additional containerized riparian shrubs and trees. Planted trees and shrubs will require installation of small fences to prevent browse by ungulates.

Deliverables

- Rehabilitate stream structure and natural functions to within natural reference conditions on approximately 900 feet of O'Brien Creek.

-Draft design for HOA review and alternative decision/DEQ review and comment incorporated

-A final copy of the design

-Pre- and post-construction photos of project area

Funding

319 Funds	$ 43,000.00
Non-Federal Match	$ 32,000.00
Federal Funds	$ 0.00
Other Funds	$ 0.00
Total Cost	$ 75,000.00
Is Match Secured	N

Timeline July 2021-December 2021 Match Source Future Fisheries

Appropriate Next Step

Recent stream problems in O'Brien Creek and landowner requests for assistance has focused greater attention, assessment, and awareness of stream conditions. Understanding the Creek's history of historic uses has helped explain and reinforce the observations that the Creek's form and functions are significantly altered in many reaches from natural, reference conditions. Our work with the Lolo National Forest and HOA has lead us to believe that immediate actions are necessary because negative impacts and stream maintenance needs seem to be escalating.

While we are focusing on the most immediate landowner request for assistance, we are aware that the confluence section is unraveling, there is a large road washout on the road section under Missoula County jurisdiction that needs remedy, several terrace erosion sites are very large sediment sources (one, at least 20 foot vertical bank, poses an immediate public safety risk, and is addressed by this proposal), Missoula County in 2016 performed emergency stream work to stop flooding over Blue Mountain road, aggradation seems to be occurring under the Blue Mountain road crossing, decreasing flood conveyance under this primary roadway, other road-stream crossing culverts seem to have limited capacity, among other examples.

As typical of impacted streams, the majority of the issues directly or indirectly relate to non-point source sediment with remedies that directly relate to MT DEQ water quality goals and treatments addressing target reductions to fine sediment, channel form and stability improvement, instream habitat health, and the density, type, extent, and rigor of riparian vegetation.

According to the Habitat Assessment and recently submitted draft O'Brien Creek Watershed Restoration Plan, the reach that we are proposing to work on first is one of several priority stream segments to reduce erosion, sedimentation, frequent maintenance needs, and poor fisheries habitat.

By completing this project, CFC hopes to demonstrate how landowners, non-profits, and agencies can work together to attain multiple goals and ultimately healthier watersheds and improved water quality for downstream uses. We hope to demonstrate progressive collaboration between multiple stakeholders and interests and produce high quality results so other landowners are aware and motivated to reduce land loss and stream maintenance needs on their property while contributing to healthier water quality and stream conditions supporting downstream beneficial uses.

Sustainability

Our proposed treatments are designed with proven fluvial geomorphic and environmental river engineering approaches that align with natural processes, the current climate, and valley morphology. As with most infrastructure and/or human needs, goals are typically to maximize the project/structure life, minimize maintenance, and optimize safety. To achieve these outcomes with regards to streams and human values, natural stream functions must be accommodated. When natural stream functions are accommodated, the biological functions such as macroinvertebrate populations and fisheries are also supported. With recognition and incorporation of these fundamental goals and approaches to stream and floodplain design and implementation, sustainability is the ultimate outcome.

Natural Processes

The goal of this project is to restore natural processes to O'Brien Creek. Much of the creek's sediment issues originated from unnatural processes, such as historical residents straightening the creek to increase agricultural production, water for irrigation, and provide railroad access for timber extraction. Our proposed treatments will help return the creek to a more natural state by re-connecting the floodplain in entrenched segments, reshaping and re-aligning to the stream to dimensions, pattern, and a gradient that conforms to the current climate and valley setting, and replacing removed wood for energy dissipation and recovery of fisheries habitat.

Project Effectiveness Evaluation

Task Description

Project effectiveness monitoring will include photo points and planting success monitoring. Photo documentation will occur before, during, and after project implementation. Monitoring occur for 2 years after the project is implemented.

Because this project is designed to reduce sedimentation, CFC will also measure sediment load reductions at the project site. The Bank Erosion Hazard Index (BEHI) method will be used for reaches that include active bank stabilization, including sections of channel reconstruction or willow lifts. For reaches of this project that include passive restoration, such as riparian revegetation, we will use the mass balance equation. CFC will use these methods to estimate the sediment load before and after the project.

Deliverables

-Monitoring plan
-Sediment reduction report
-Photo documentation of site condition before and for 2 years after project completion
-Planting success report

Funding

319 Funds	$ 1,500.00
Non-Federal Match	$ 3,000.00
Federal Funds	$ 0.00
Other Funds	$ 0.00
Total Cost	$ 4,500.00
Is Match Secured	Y

Timeline May 2021- October 2022

Match Source CFC and O'Brien Creek HOA

The Bigger Picture

Other Natural Resources

The cold-water fishery of O'Brien Creek is important to the overall fishery of the Bitterroot and Clark Fork River systems. Our proposal directly improves stream conditions necessary for quality fisheries habitat, and would enhance migration, spawning, and rearing habitats. Increased woody debris creates quality pool habitat. Focus on vigorous, native riparian vegetation along the stream corridor assists with mammal movement and bird populations. Stream restoration work contributes directly to the local economy by employing Montana stream consultants and equipment operators, which in turn support other local businesses.

Climate Resiliency

These projects will increase climate change resiliency and adaptation in a few different ways. By allowing the creek to access its floodplain, adding woody debris, and enhancing riparian vegetation, there is opportunity for increased groundwater and surface water storage, which is important as Montana's summers get hotter and drier. The enhanced riparian vegetation will also act as shade to prevent water temperatures from increasing during drought and low-water years. Stream runoff is predicted to become flashier and more extreme - our proposal affords greater channel resiliency towards fluctuations in both flooding and drought conditions.

Public Visibility

The subject segment of O'Brien Creek is visible from O'Brien Creek and Blue Mountain Roads, which are relatively busy. The work is assisting approximately 30 members of an active Homeowners Association with members that are very active in the Missoula community and beyond. All stakeholders are operating in a very collaborative, positive, respectful, progressive, and constructive manner, which provides a good example for any public scrutiny we would receive.

Point Source / Nonpoint Source Relationships

No permitted point source for sediment exists. Both coarse and fine non-point source sediment from O'Brien Creek very likely have additional repercussions. Closely downstream, the island in the Bitterroot River above Maclay Flats Bridge exists. This island is growing in part from back water influences from the undersized bridge, but also was very likely initially formed from historic manipulations from milling, as well as extreme bedload quantities originating from O'Brien Creek downcutting and bank erosion sequences. Further investigation and historic photo interpretation may verify O'Brien Creek's bedload influences to this observation and that the island continues to expand at rates likely greater than island formation rates would in this setting.

Source Water Protection

Understanding that this section is tied to projects that assist drinking water protections, our proposal likely only indirectly relates by improving water quality in general, and perhaps by reducing suspended and washload reductions that may be realized by downstream users.

Healthy Watersheds

O'Brien Creek flows into the Bitterroot River within one mile of the confluence with the Clark Fork River. O'Brien Creek is relatively cold, and as such, is a priority fishery, despite a long history of impairments. By reducing the source of sediment to the creek and improving stream conditions, this project, coupled with potential future projects, can provide substantive improvements to the overall health of both the Bitterroot and Clark Fork River fishery, stream conditions, and water quality. In addition, the knowledge and awareness gained by involving multiple landowners in positive, supportive collaborative processes that attain multiple goals, and that use restoration techniques that reduce land loss and maintenance costs while facilitating natural processes, will hopefully be helpful as others provide influences in protecting, conserving, and rehabilitating other watersheds towards healthy conditions locally, regionally, and perhaps nationally.

PART C—EDUCATION AND OUTREACH

Task Description

Deliverables

Funding

319 Funds	
Non-Federal Match	
Federal Funds	
Other Funds	
Total Cost	$ 0.00
Is Match Secured	N

Timeline _____ Match Source _____

PART D—PROJECT ADMINISTRATION

Task Description

Deliverables

Funding

319 Funds	
Non-Federal Match	
Federal Funds	
Other Funds	
Total Cost	$ 0.00
Is Match Secured	N

Timeline _____ Match Source _____

2020 319 Application Form

PART A—GENERAL INFORMATION

Project Name _____

Sponsor Name _____

Registered with the Secretary of State? N

Registered with SAM? N

Duns # _____

Does your organization have liability insurance? N

Primary Contact _____

Signatory _____

Title _____

Title _____

Address _____

Address _____

City _____ State MT Zip Code _____

City _____ State MT Zip Code _____

Phone Number _____

Phone Number _____

Email Address _____

Email Address _____

Signature _____

Signature _____

Technical and Administrative Qualifications

Past and Current Projects

Project Name	Grant or Contract Amount	Funding Entity *(entity name/program, contact person, phone, email)*	Completion Date

FUNDING REQUEST

319 Funds Requested *(**including** administrative fee)*		Administrative Fee *(not to exceed 10% of total 319 funding request)*	
State Cash Match			
Local Cash Match			
In-Kind Match		Total Non-Federal Match	$ 0.00
Federal Funds			
Other Funds *(not 319, not match, not federal)*	$ 0.00		
Total Project Cost	$ 245,000.00		

PART B—PROJECT INFORMATION

Part B must be filled out separately ***(including providing separate attachments)*** for each project included in your application. Use the following examples to help determine when to lump and when to split projects. If additional clarification is needed, contact Mark Ockey, at 406-444-5351 or mockey@mt.gov.

Splitting Examples (fill out multiple Part B's)

- Stream restoration work occurring on two separate streams, on parcels owned by two separate individuals
- Two projects with significantly different sets of project partners
- Two projects that address substantially different pollution sources (e.g., one project that moves a corral off of a stream, and another to remove mine tailings, with both projects being on the same 800-acre recreational property)

Lumping Examples

- Contiguous stream restoration work spanning multiple land parcels
- 3 projects that address similar sources of pollution on a single land parcel (e.g., moving a coral off a stream, implementing a grazing management plan, and relocating a manure storage facility out of the floodplain, all on the same ranch)
- A mini-grant program designed to address numerous failing septic systems scattered throughout a watershed

Project *(sub-project)* Name Wustner and MPG Ranch Stream Restoration Projects

Total Project Cost *Include costs already incurred, as well as anticipated costs, from all sources, for all aspects of the project.* $ 245,000.00

Latitude 46.775144 Longitude -113.952988

Latitude 46.753624 Longitude -113.944129

Map Y

Latitude Longitude

12 Digit HUC #(s) 170102051601

Waterbody Name from 2018 List of Impaired Waters Miller Creek

Probable Causes of Impairment to be Addressed Sedimentation/siltation

Waterbody Name from 2018 List of Impaired Waters

Probable Causes of Impairment to be Addressed

Project Summary - Briefly describe the ***nature and extent*** of the problem, the ***root causes*** of the problem, and your ***proposed solution***.

Miller Creek is located in Missoula County, Montana and is listed for temperature and sediment impairments on the 2016 Clean Water Act section 303(d) list. The watershed encompasses 47.9 square miles and supports a variety of land uses, from silviculture and agriculture, to residential subdivisions. The watershed has been undergoing many changes in land use and ownership in recent decades, and this presents challenges and opportunities for management and restoration.

The Clark Fork Coalition's Habitat Assessment of Miller Creek, completed in October of 2018, followed up on the WRP completed earlier in the year and found impacts from sediment throughout the watershed primarily due to channel incisement. Flow and temperature monitoring in 2018 corroborated past findings of high water temperatures and de-watering in the lower to mid reaches. The high levels of sediment are affecting landowners' infrastructure by constricting road culverts, filling irrigation diversions and adding to channel instability. Additionally, the high sediment load, high water temperatures and dewatering are negatively affecting the fishery, translating to lost angling opportunities on Miller Creek and the Bitterroot River. Miller Creek is a historically productive fishery and an important tributary for spawning Westslope cutthroat and rainbow trout in the lower Bitterroot River and contains pure strain Westslope cutthroat trout in at least two of its tributaries.

The source of much of the sediment to the creek is active erosion of the streambanks along the entirety of the creek. For this proposal, the Clark Fork Coalition would address this issue on two properties. These are the Wustner property, which includes approximately 0.35 miles of creek starting at river mile 8, and 1,000 ft of the MPG Ranch starting at river mile 10. On the Wustner property the stream is confined along the south side of the valley and most of the reach is characterized by a deeply incised channel, between 8 and 10 feet, and active lateral erosion. The lower portion of this reach has a more dynamic channel that has changed location several times in the last 15 years, but relatively stable since large changes occurred in the 2011 high flow event. These alterations have resulted in a loss of connectivity between the channel and floodplain, increased fine sediment delivery to the channel, reduced aquatic habitat diversity, and reduced riparian vegetation cover, all of which contributed to overall degraded conditions in the watershed.

CFC plans to restore two 1,000ft+ reaches of Miller Creek on the MPG Ranch using a multi-year phased approach. The first 1,000 ft In order to address the sedimentation issues and increase habitat on this section of creek, the Clark Fork Coalition will employ a variety of restoration techniques. Treatments such as channel realignment and side channel reconnection, floodplain grading, woody debris matrix, riparian shrub plantings with enclosure fences, and other treatments to re-connect the creek to its floodplain, slow and disperse high flows, and increase riparian habitat will be used.

Continuation of previous or ongoing activity? If "Yes", please explain the relationship.

Based on the WRP and the 2018 Habitat Assessment, the Clark Fork Coalition is embarking on a watershed scale restoration effort of Miller Creek. The Coalition's ultimate goal is to see Miller Creek removed from the Impaired Waters list. The Wustner and MPG projects will be the 2nd and 3rd properties that CFC plans on performing restoration activities on in the upper reaches of the creek. The MPG project is just 2 miles downstream from the Spooner Creek Ranch, a site which received 319 funding in 2019.

Watershed Restoration Plan (WRP) and authoring entity

Miller Creek - Missoula Valley Water Quality Protection District

Letter of support from WRP authoring entity? If "No", please explain.

Y

How will this project implement recommendations in the WRP?

The Miller Creek WRP, written in 2017 by the Missoula Valley Water Quality District, identifies temperature and sediment to be the main sources of pollution to Miller Creek. It concludes that the creek's high temperatures correspond directly to poor riparian vegetation conditions and reccomends riparian health and channel morphology improvements to be the best treatments for decreasing temperature on Miller Creek. The WRP also concludes that the major sources of sediment to Miller Creek are eroding banks, roads (including sanding and agricultural access and stormwater runoff). The WRP reccomends addressing sediment by improving channel structure, allowing the creek to access its floodplain, and improving riparian vegetation.

We have chosen our treatments to decrease temperature and sediment pollution on Miller Creek directly from the WRP.

Nonpoint Source Goals

The goals of restoration on the Wustner and MPG properties include:
- Reduce fine sediment delivery to the channel.
- Increase connectivity between the channel and the floodplain.
- Increase riparian corridor width and woody vegetation cover.
- Enhance aquatic habitat.
- Increase ecological function of the riparian corridor.

These projects target two nonpoint source pollutants: temperature and sediment. The WRP suggests that eroding banks are the biggest contributors of sediment to the creek. It also suggests that high temperatures on Miller Creek correspond directly to poor riparian vegetation conditions. Our goal in this project is to reduce temperature and sediment loads to the creek by implementing a suite of treatments.

Partners and Roles

Landowner(s)

Name	Letter of Support Attached?
Jacob Wustner	Y
MPG Ranch	Y
	N

Other Partners

Name	Role	Letter of Support Attached?
Westslope TU	Project supporter and funds contributor	Y
Montana Fish Wildlife and Parks	Project funding through Future Fisheries program and monitors the fishery	Y
Missoula Valley Water Quality District	Project supporter and WRP author	Y
		N
		N
		N

Planning and Coordination

Planning and coordination includes permitting, design development, landowner agreements, volunteer labor recruitment, partnering and collaboration, alignment with watershed planning efforts, procurement and oversight of contractors, etc.

Planning Activities Already Completed	Documentation Attached?
Miller Creek Assessment	Y
Wustner Property Conceptual Designs by Geum Environmental Consulting	Y
Coordination with Missoula Valley Water Quality District and Bitterroot Water Forum	N
Letter of Support from landowner	Y
	N
	N

Task Description

CFC will be responsible for overseeing all aspects of the projects. This includes design, permitting, implementation, monitoring, procurement and oversight of contractors and drafting landowner agreements. It is anticipated that the two projects will each equally utilize the funding listed below.

Deliverables

Working with experienced consultants and contractors, CFC will provide a stream design, obtain necessary permits and will implement approximately 2,800 feet of channel rehabilitation to achieve aforementioned goals. All concerns and comments raised by DEQ will be addressed within funding constraints and project goals.

Funding

319 Funds	$ 58,000.00
Non-Federal Match	$ 43,000.00
Federal Funds	$ 0.00
Other Funds	$ 0.00
Total Cost	$ 101,000.00
Is Match Secured	N

Timeline July 2020-December 2021 Match Source MPG Ranch

Project Implementation

Task Description

We are proposing the following treatments to be implemented on 2,800 ft of Miller Creek on the Wustner and MPG Properties:
• Channel Shaping and Realignment. Re-align the channel away from fine sediment sources (vertical eroding streambanks).
• Floodplain Grading. Lay back steep slopes and lower terraces to allow the stream to access additional floodplain
• Woody Brush Matrix Streambank Treatments. Install streambank structures consisting of woody debris and brush to enhance aquatic habitat and floodplain function.
• Woody Debris Habitat Structures. Install woody debris habitat structures to enhance floodplain connectivity and increase aquatic habitat diversity.
• Riparian Shrub Clump Planting. Selectively plant riparian shrubs and trees. Planted trees and shrubs will require installation of small fences to prevent browse by ungulates.
• Side Channels/Distributary Flow Channels. Construct side channels and distributary flow channels in areas where past flood disturbances have increased floodplain width and connectivity.

Deliverables

-Restore appoximately 2,800 ft of Miller Creek to reduce sediment and water temperatures while increasing habitat for aquatic organisms. This item includes installation of riparian plants, large woody debris, instream structures, floodplain grading, channel shaping and realignment and exclosure fencing
-Draft request for proposals (RFP) for DEQ review and comment
-A final copy of the RFP
-Before and after photos of project areas

Funding

319 Funds	$ 53,000.00
Non-Federal Match	$ 83,000.00
Federal Funds	$ 0.00
Other Funds	$ 0.00
Total Cost	$ 136,000.00
Is Match Secured	N

Timeline Juky 2021-December 2021

Match Source MPG Ranch,Jacob Wustner,WSCTU, Future Fisheries, CFC

Appropriate Next Step

According to the CFC's Miller Creek Assessment, these reaches of Miller Creek currently have fairly poor habitat and are significant sources of sediment. By focusing on the sediment and temperature issues in these reaches, CFC can make significant progress on removing two of the most detrimental pollutants to the creek.

This will be the second phase of Clark Fork Coalition restoration projects targeting these pollution sources on the creek that was started in 2018. The stream on the Wustner property has 8-10 foot encised banks. The WRP highlights active erosion as a main source of sediment to the creek and a CFC assessment completed on the creek in 2018 found that the Wustner stretch holds the worst encisement seen in the watershed and an entrenched creek channel on both reaches. Another result of the actively sloughing banks in this reach is a disconnection of the creek from the floodplain. This limits the amount of riparian vegetation that can grow here, which reduces shade and increases temperature on the creek.

Sustainability

Our proposed treatments are designed to reduce temperature and sediment to Miller Creek in the long term. By moving the channel away from the 8-10 foot eroding encisements, we will be removing a source of sediment to the creek and returning a more natural sinuosity to the creek. In addition to the channel realignment, we propose treatments such as floodplain lowering, native riparian plantings, and large woody debris matrixes. This will allow a better connection to the floodplain and support a more robust riparian community, leading to a reduction of sediment and temperature on the creek. The project will result in immediate positive impacts that will continue to be amplified,without maintenance, as the creek is allowed to heal itself.

Natural Processes

The goal of this project is to restore natural processes to Miller Creek. Much of the creek's sediment and temperature issues originated from unnatural processes, such as historical residents straightening the creek to increase agricultural production. We plan to restore the creek in such a manner that the natural process of channel migration can occur again away from the steep cut banks that are currently creating so much sediment. Our proposed treatments will help return the creek to a more natural state by re-connecting it to its floodplain, introducing woody debris into the creek, and planting riparian plants.

Project Effectiveness Evaluation

Task Description

Project effectiveness monitoring will include photo points and plant mortality monitoring. Photo documentation will occur before, during, and after project implementation. Plant mortality and photo documentation will occur for 2 years after the project is implemented.

Because this project is designed to reduce sediment to Miller Creek, CFC will also measure sediment load reductions at the project site. The Bank Erosion Hazard Index (BEHI) method will be used for reaches that include active bank stabilization, including sections of channel reconstruction or willow lifts. For reaches of this project that include passive restoration, such as riparian revegetation, we will use the mass balance equation. CFC will use these methods to estimate the sediment load before and after the project.

Deliverables

-Monitoring plan
-Sediment reduction report
-Photo documentation of site condition before and for 2 years after project completion
-Plant mortality report

Funding

319 Funds	$ 4,000.00
Non-Federal Match	$ 4,000.00
Federal Funds	$ 0.00
Other Funds	$ 0.00
Total Cost	$ 8,000.00
Is Match Secured	N

Timeline May 2021- October 2022

Match Source Private Donors

The Bigger Picture

Other Natural Resources

By reducing fine sediment and temperature on Miller Creek, these projects will greatly enhance Miller Creek as spawning ground for native Westslope Cutthroat and other fishes. Increased woody debris in the stream will enhance instream habitat. By reconnecting the creek to the floodplain and improving the riparian corridor, this project will provide enhanced riparian habitat for birds and mammals.

Climate Resiliency

These projects will increase climate change resiliency and adaptation in a few different ways. By allowing the creek to access its floodplain, adding woody debris, and enhancing riparian vegetation, there is opportunity for increased groundwater and surface water storage, which is important as Montana's summers get hotter and drier. The enhanced riparian vegetation will also act as shade to prevent water temperatures from increasing during drought and low-water years.

Public Visibility

Both stretches of Miller Creek are extremely visible from Upper Miller Creek Road, a busy dirt road that provides Forest Service access for Missoulians. The drainage has been receiving much attention lately, and has new mountain bike trails, conservation easements, a handicapped accessible trail, and many miles of hiking, skiing, and hunting opportunities. Additionally, we hope to engage with other landowners in the watershed by hosting walk-throughs and tours of this project.

Point Source / Nonpoint Source Relationships

There is no permitted source for sediment in the Miller Creek Watershed.

Source Water Protection

Many homeowners in the Miller Creek watershed use wells for their drinking water supply. By reconnecting Miller Creek to the floodplain, downstream groundwater wells may see increased recharge due to increased infiltration through the floodplain.

Healthy Watersheds

Miller Creek flows into the Bitterroot River, just miles upstream of the confluence with the Clark Fork. By reducing the source of sediment to the creek, these projects can help prevent excess sediment loads from flowing into those downstream rivers.

PART C—EDUCATION AND OUTREACH

Task Description

Deliverables

Funding

319 Funds	$ 0.00
Non-Federal Match	$ 0.00
Federal Funds	$ 0.00
Other Funds	$ 0.00
Total Cost	$ 0.00
Is Match Secured	N

Timeline _____ Match Source _____

PART D—PROJECT ADMINISTRATION

Task Description

Deliverables

Funding

319 Funds	$ 0.00
Non-Federal Match	$ 0.00
Federal Funds	$ 0.00
Other Funds	$ 0.00
Total Cost	$ 0.00
Is Match Secured	N

Timeline _____ Match Source _____

PART C—EDUCATION AND OUTREACH

Task Description

CFC plans to carry out E&O in Miller and O'brien Creek, two key watersheds of the Lower Bitterroot. The goal of all E&O activities is to create opportunities for further restoration projects leading to the reduction of TMDL's in the respective watersheds. In Miller Creek CFC will be targeting landowner outreach to landowners between creek miles 6 to 14. On O'brien Creek landowner outreach will encompass landowners on the creek in the approximately 5 miles downstream from the Forest Service boundary and will include CFC presenting the project at a HOA meeting that other landowners on the creek have been invited to. The outreach on both creeks will include site visits by CFC staff to walk perspective restoration reaches with landowners while discussing restoration alternatives. In addition CFC will continue to work with the Lolo National Forest in both watersheds looking for opportunities to reduce sediment through coordination meetings and site visits.

Deliverables

-Using aerial photos and drive bys to identify at least 4 additional landowners on the 2 creeks to contact about potential restoration projects
-Make contact with at least 4 new landowners with goal of contact resulting in at least 1 new project
-Raise awareness of 319 restoration activities on Lolo, Miller and O'brien Creek through social media posts and CFC newsletters
-Send copies and electronic links to all media coverage of projects to DEQ staff

Funding

319 Funds	$ 5,000.00
Non-Federal Match	$ 5,000.00
Federal Funds	$ 0.00
Other Funds	$ 0.00
Total Cost	$ 10,000.00
Is Match Secured	Y

Timeline July 2020-December 2021 Match Source CFC

PART D—PROJECT ADMINISTRATION

Task Description

This task covers all the project administration on 4 separate 319 projects and CFC anticipates incurring substantial time and costs doing so. CFC will oversee and be accountable for the completion of all tasks stipulated by the 319 grant contract including maintaining regular contact as defined by the DEQ project manager and the preparation and submittal of Attachment B-billing statements, status reports, annual reports, and a final report. CFC's in-kind match for this task includes all of the overhead incurred as incidental costs of carrying out these projects including facilities, organizational management, insurance, bookkeeping and audits.

Deliverables

Description: status reports, annual reports, Attachment B-billing statements, and a final report. Contractor shall ensure that all reports are written clearly, with appropriate grammar, punctuation, and level of detail.

Funding

319 Funds	$ 24,000.00
Non-Federal Match	$ 10,000.00
Federal Funds	$ 0.00
Other Funds	$ 0.00
Total Cost	$ 34,000.00
Is Match Secured	Y

Timeline July 2020-December 2021 Match Source CFC

ATTACHMENT D – GOVERNOR'S EXECUTIVE ORDER NO. 15-2018

STATE OF MONTANA
OFFICE OF THE GOVERNOR
EXECUTIVE ORDER No. 15-2018

EXECUTIVE ORDER REQUIRING DISCLOSURE OF DARK MONEY SPENDING FOR ENTITIES DOING BUSINESS WITH THE STATE OF MONTANA

WHEREAS, in 2010, the U.S. Supreme Court's *Citizens United* decision allowed unlimited direct spending by corporations in elections;

WHEREAS, two years later, the Supreme Court invalidated Montana's own Corrupt Practices Act, which had banned direct corporate spending in elections;

WHEREAS, following *Citizens United*, there was an explosion in corporate spending in elections, much of which was funneled through so-called "dark money" organizations that conceal the source of funds used to influence an election;

WHEREAS, at the same time, the Supreme Court has endorsed the salving power of transparency in elections, holding that public disclosure can increase public confidence in government decision-making and prevent corruption from taking hold;

WHEREAS, since *Citizens United*, states—including Montana through its Disclose Act—have created innovative disclosure programs to shine light on dark money in elections;

WHEREAS, the Supreme Court in *Citizens United* observed that "[w]ith the advent of the Internet, prompt disclosure of expenditures can provide shareholders and citizens with the information needed to hold corporations and elected officials accountable for their positions and supporters. Shareholders can determine whether their corporation's political speech advances the corporation's interest in making profits, and citizens can see whether elected officials are '"in the pocket" of so-called moneyed interests.'" 558 U.S. 310, 370-71 (2010) (citing *McConnell v. FEC*, 540 U.S. 93, 259 (2003) (opinion of Scalia, J.); *FEC v. Mass. Citizens for Life, Inc.*, 479 U.S. 238, 261 (1986));

WHEREAS, the Supreme Court also praised the role of commercial relationships in promoting disclosure, noting that shareholder objections "can be more effective today because modern technology makes disclosures rapid and informative," and that "[t]he First Amendment protects political speech; and disclosure permits citizens and shareholders to react to the speech of corporate entities in a proper way. This transparency enables the electorate to make informed decisions and give proper weight to different speakers and messages." *Id.*;

WHEREAS, disclosure promotes First Amendment values by keeping the public informed and enabling the public to make informed assessments of their government, and at the same time disclosure fights corruption in government;

WHEREAS, Montanans also enjoy a constitutional right to know, which entitles Montanans to examine both the decisions of government and the forces brought to bear on those decisions;

WHEREAS, while the Montana legislature has a set of lobbying rules, there are fewer pay-to-play restrictions for entities seeking to do business with state government;

WHEREAS, disclosure rules for state procurement are essential to secure Montanans' right to know surrounding these important government functions;

WHEREAS, disclosure rules for state procurement prevent corruption, promote confidence in government, and inform the public of the operations of government;

WHEREAS, the public has an interest in comprehensive, aggregate information about government contractors' participation in elections;

WHEREAS, federal courts have routinely upheld anti-corruption measures, including contribution prohibitions and disclosure requirements, for entities doing business in front of the government;

WHEREAS, both before and after *Citizens United*, the Supreme Court has endorsed the importance of strong disclosure rules and questioned whether "'uninhibited, robust, and wide-open' speech can occur when organizations hide themselves from the scrutiny of the voting public"—rather, the Court has stated that disclosure favors the "First Amendment interests of individual citizens seeking to make informed choices in the political marketplace." *McConnell*, 540 U.S. at 197;

WHEREAS, it is the responsibility of government to ensure the integrity of its institutions;

WHEREAS, the public must have confidence that decisions made by government are not subject to undue political influence;

WHEREAS, the government of Montana purchases millions of dollars in services each year with public dollars; and

WHEREAS, as Governor, I have a responsibility to oversee executive branch procurement, I have an obligation to the public to ensure procurement decisions are freely and fairly made without any undue influence, and I have a duty to supervise the official conduct of all executive and ministerial officers.

NOW, THEREFORE, I, STEVE BULLOCK, Governor of the State of Montana, pursuant to the authority vested in me under the Constitution and the laws of the State of Montana, including Title 2, Chapter 15 and Title 18, Chapter 4, do hereby order and direct the implementation of disclosure rules for executive branch contracting as follows:

I. POLICY

It is the policy of the executive branch that entities seeking to do business with the State of Montana must disclose contributions or expenditures they have made in elections, as detailed in this Executive Order.

II. DEFINITIONS

As used in this Executive Order, the following definitions apply:

1. "electioneering communication" means a paid communication that is publicly distributed by radio, television, cable, satellite, internet website, mobile device, newspaper, periodical, billboard, mail, or any other distribution of printed or electronic materials, that is made within 60 days of the initiation of voting in an election in Montana, that can be received by more than 100 recipients in the district in Montana voting on the candidate or ballot issue, and that:
   a. refers to one or more clearly identified candidates in that election in Montana;
   b. depicts the name, image, likeness, or voice of one or more clearly identified candidates in that election in Montana; or
   c. refers to a political party, ballot issue, or other question submitted to the voters in that election in Montana.

   The term does not mean:
   a. a bona fide news story, commentary, blog, or editorial distributed through the facilities of any broadcasting station, newspaper, magazine, internet website, or other periodical publication of general circulation unless the facilities are owned or controlled by a candidate or political committee;
   b. a communication by any membership organization or corporation to its members, stockholders, or employees;
   c. a commercial communication that depicts a candidate's name, image, likeness, or voice only in the candidate's capacity as owner, operator, or employee of a business that existed prior to the candidacy; or
   d. a communication that constitutes a candidate debate or forum or that solely promotes a candidate debate or forum and is made by or on behalf of the person sponsoring the debate or forum.

2. "covered expenditure" means:
   a. A contribution, expenditure, or transfer made by the contracting entity, any of its parent entities, or any affiliates or subsidiaries within the entity's control, that:
      i. is to or on behalf of a candidate for office, a political party, or a party committee in Montana; or
      ii. is to another entity, regardless of the entity's tax status, that pays for an electioneering communication, or that makes contributions, transfers, or expenditures to another entity, regardless of its tax status, that pays for electioneering communications; and
   b. The term does not include an expenditure made by the contracting entity, any of its parent entities, or any affiliates or subsidiaries within the entity's control made in the ordinary course of business conducted by the entity making the

expenditure; or investments; or expenditures or contributions where the entity making the expenditure or contribution and the recipient agree that it will not be used to contribute to candidates, parties, or electioneering communications.

3. "executive branch" refers to the departments and agencies subject to the Governor's executive authority as described in Article VI, Section 4 of the Montana Constitution and § 2-15-103, MCA.

III. DISCLOSURE REQUIREMENT

1. When soliciting for state procurement contracts, every contracting department and agency shall require all entities submitting offers for state government contracts with a total contract value of over $25,000 for services or $50,000 for goods to disclose "covered expenditures" that the contracting entity has made within two years prior to submission of their bid or offer. Certification that disclosure of this information has been made in a manner consistent with Department of Administration policies shall be required as a condition of submitting a bid or offer.

2. The disclosure of "covered expenditures" shall only be required whenever the aggregate amount of "covered expenditures" made within a 24-month period by the bidding or applying entity, any parent entities, or any affiliates or subsidiaries within the entity's control exceeds $2,500.

3. The final form of the disclosure required by this Executive Order shall be defined by the Department of Administration, but must include at a minimum:

    a. the full name and address of the person or entity to whom each expenditure is made;
    b. the date and amount of each expenditure;
    c. the purpose and description of each expenditure;
    d. in the case of an expenditure made for a direct campaign expenditure for express advocacy, if known at the time that the expenditure is reported, the name of each candidate, including the office held and office sought as applicable, whose election or defeat the expenditure advocates, or each ballot measure the passage or defeat of which the expenditure advocates; and
    e. in the case of an expenditure made to an entity that purchases electioneering communications, if known at the time that the expenditure is reported, the name of each candidate, including the office held and office sought as applicable, to whom the communication refers or each ballot measure to which the communication refers.

4. Any disclosure under this Executive Order must be made to the Department of Administration, or to the contracting department or agency, at the time of the contract bid or offer. If the disclosure is made to a department or agency other than the Department of Administration, the recipient department or agency must forward the disclosure to the Department of Administration. The Department of Administration will compile this

information and make it available in a searchable database on a public website, such as transparency.mt.gov.

5. For contracts that are 24 months or longer, the Department of Administration or the contracting department or agency will require an updated disclosure form from successful contracting entities every 12 months.

6. No contracting department or agency may discriminate between bidding or applying entities because of the content of an entity's expenditures or contributions disclosed under this Executive Order; however, departments or agencies may not award a contract with a total contract value of more than $25,000 for services or $50,000 for goods to any entity that does not complete the required certification under this Executive Order.

7. By September 1, 2018, the Department of Administration shall prepare such policies and issue such orders as are deemed necessary and appropriate to carry out this Executive Order. Such policies and orders must minimize the costs of compliance for contractors and shall not interfere with the ability of contractors, or their officers, or employees to engage in political activities to the extent otherwise permitted by law.

8. Each contracting department or agency shall cooperate with the Department of Administration in implementing this Executive Order and provide such information and assistance as the Department of Administration may require in the performance of its functions under this Executive Order.

Severability: if any provision, clause, or implementing policy ("provisions") of this Executive Order or application thereof to any person or circumstances is held invalid, such invalidity shall not affect other provisions or applications of the Executive Order which can be given effect without the invalid provision or application, and to this end the provisions of this Executive Order are declared to be severable.

This Order is effective immediately and its disclosure provisions shall apply to contracts resulting from solicitations and applications received on or after October 1, 2018.

GIVEN under my hand and the GREAT SEAL of the State of Montana this 8th day of June, 2018.

STEVE BULLOCK, Governor

ATTEST:

Corey Stapleton by Alisa Cottell, dep

COREY STAPLETON, Secretary of State

ATTACHMENT E – DECLARATION FORM

Declaration Form
Dark Money Spending Disclosure Requirements

Contracting Entity shall comply with the State of Montana Executive Order No. 15-2018 requiring the disclosure of dark money spending.

Definitions. As used in this declaration form, the following definitions apply:

Electioneering Communication: A paid communication that is publicly distributed by radio, television, cable, satellite, internet website, mobile device, newspaper, periodical, billboard, mail, or any other distribution of printed or electronic materials, that is made within 60 days of the initiation of voting in an election in Montana, that can be received by more than 100 recipients in the district in Montana voting on the candidate or ballot issue, and that:

a. refers to one or more clearly identified candidates in that election in Montana;

b. depicts the name, image, likeness, or voice of one or more clearly identified candidates in that election in Montana; or

c. refers to a political party, ballot issue, or other question submitted to the voters in that election in Montana.

The term does not mean:

a. a bona fide news story, commentary, blog, or editorial distributed through the facilities of any broadcasting station, newspaper, magazine, internet website, or other periodical publication of general circulation unless the facilities are owned or controlled by a candidate or political committee;

b. a communication by any membership organization or corporation to its members, stockholders, or employees;

c. a commercial communication that depicts a candidate's name, image, likeness, or voice only in the candidate's capacity as owner, operator, or employee of a business that existed prior to the candidacy; or

d. a communication that constitutes a candidate debate or forum or that solely promotes a candidate debate or forum and is made by or on behalf of the person sponsoring the debate or forum.

In this definition, the phrase "made within 60 days of the initiation of voting in an election" means:

a. in the case of mail ballot elections, the initiation of voting occurs when official ballot packets are mailed to qualified electors pursuant to 13-19-206, MCA; or

b. in other elections the initiation of voting occurs when absentee ballot packets are mailed to or otherwise delivered to qualified electors pursuant to 13-13-214, MCA.

Contracting Entity: A bidder, offeror, or contractor.

Covered Expenditure means:

a. A contribution, expenditure, or transfer made by the Contracting Entity, any of its parent entities, or any affiliates or subsidiaries within the entity's control, that:

   i. is to or on behalf of a candidate for office, a political party, or a party committee in Montana; or

   ii. is to another entity, regardless of the entity's tax status, that pays for an Electioneering Communication, or that makes contributions, transfers, or expenditures to another entity, regardless of its tax status, that pays for Electioneering Communication; and

b. The term excludes an expenditure made by the Contracting Entity, any of its parent entities, or any affiliates or subsidiaries within the entity's control made in the ordinary course of business conducted by the entity making the expenditure; investments; or expenditures or contributions where the entity making the expenditure or contribution and the recipient agree that it will not be used to contribute to candidates, parties, or Electioneering Communication.

Solicitation Requirements. The Contracting Entity shall disclose Covered Expenditures that the Contracting Entity has made within two years prior to submission of its bid or offer.

The disclosure of Covered Expenditures is only required by the bidder/offeror whenever the aggregate amount of Covered Expenditures made within a 24-month period by the bidder/offeror, any parent entities, or any affiliates or subsidiaries within the bidder/offeror's control exceeds $2,500.

If the bidder/offeror meets the disclosure requirements, the bidder/offeror shall submit this signed declaration form indicating "Yes" AND the required disclosure form with its bid/proposal.

If the bidder/offeror does NOT meet the disclosure requirements, the bidder/offeror shall submit this signed declaration form with its bid/proposal indicating "No".

Annual Contract Requirements. The Contracting Entity agrees that if awarded a contract and the contract term exceeds, or has the potential to exceed 24

months, it must annually review and complete a new declaration form and disclosure form, if necessary.

☐ Yes- I have read, understand, and meet the disclosure requirements for the 24 months immediately preceding the submission of this form. I will complete the necessary disclosure form and submit it with this form.

Company Name (Clearly Printed):

_____

Authorized Signature:

_____

Date: _____

☒ No- I have read, understand, and do NOT meet the disclosure requirements. I certify that the Contracting Entity has not made Covered Expenditures in excess of $2,500 in the 24 months immediately preceding the submission of this form.

Company Name (Clearly Printed):

CLARK FORK COALITION

Authorized Signature:

Karen Knudsen

Date: 10/31/19

ATTACHMENT F – DISCLOSURE TEMPLATE

The Disclosure template only exists as a Microsoft Excel spreadsheet, compatible with a database operated by the Montana Department of Administration. To obtain a copy of the template, please visit the NPS Program website at http://deq.mt.gov/Water/SurfaceWater/NonpointSources. You may also contact Dean Yashan (406-444-5317, dyashan@mt.gov) for assistance.

Letters of Support

October 21, 2019

TO: Hannah Riedl
Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901

RE: Lee Creek/ West Fork Sediment Reduction project

Dear Hannah,

Lolo Creek has been classified as impaired due to sedimentation throughout many tributaries and the main stem of Lolo Creek. In the upper reaches of Lolo Creek, sedimentation sources include forest roads, some of which are no longer needed, with failing erosion control structures, and failing or undersized culverts. The Lolo Creek Watershed Restoration Plan specifies opportunities for improving the Lolo Creek cold-water fisheries and aquatic life and for reducing sedimentation. Those opportunities include removing roads that are no longer needed and removing inadequate culverts.

The project proposed by the Clark Fork Coalition will address sedimentation and fisheries concerns identified in the Lolo Creek Watershed Restoration Plan, and works towards completing the plan's suggestions for restoration projects on forest roads by mitigating sediment on another 11 miles. The Lolo Watershed Group supports this project proposal as a means to work toward meeting goals set in the Lolo Creek WRP.

Sincerely,

Kascie Herron

Kascie Herron
Lolo Watershed Group
P.O. Box 1354
Lolo, MT 59847
kherron@lolowatershed.org

USDA United States Department of Agriculture | Forest Service | Lolo National Forest Missoula Ranger District | Building 24A, Fort Missoula Missoula, MT 59804-7297 406 329-3750

Date: 10/18/2019

Dean Yashan
Water Quality Planning Bureau
Department of Environmental Quality
1520 E. Sixth Avenue
P.O. Box 200901
Helena, MT 59620-0901

Dear Mr. Yashan,

The Lolo National Forest supports the Clark Fork Coalition's grant application for the West Fork Lolo Creek watershed restoration work. The Clark Fork Coalition is applying for grant funds from the Clean Water Act Section 319 Nonpoint Source (NPS) Program to work with the US Forest Service to reduce human-caused sediment sources and improve habitat fragmentation. Primary goals are native fish connectivity and fulfilling TMDL responsibilities to reduce sediment deliveries to these streams. The Lolo National Forest fulfilled previous work to address TMDL responsibilities with the Upper Lolo Restoration project. This included 11 culvert replacements and nearly 100 miles of road decommissioning; however, more work is necessary to address needs on newly acquired industrial forest lands.

The Clark Fork Coalition and the Lolo National Forest have been working on cooperative projects for several years, including decommissioning 22 miles of roads in the East Fork Lolo and Granite Creek drainages, establishing nearly 80 permanent temperature monitoring stations across the forest, collecting stream discharge data for instream flow management, working to understand beaver habitat feasibility and reintroduction, and a completed climate change watershed vulnerability assessment. The Lolo National Forest continues to provide funding to these efforts when possible. As such, the Clark Fork Coalition and the Lolo National Forest have a track record of proven success and are now continuing the partnership with the West Fork Lolo Creek project. Our ongoing focus in West Fork Lolo Creek is because of TMDL responsibilities and its significance to cold water native fisheries.

Funds from the NPS Program are essential to completing on-the-ground reclamation projects and will be matched by state, federal, and private funds.

Thank you for the funding opportunity and your continued work for conserving natural resources. Please do not hesitate to contact me if you have any questions.

Sincerely,

Jen Hensiek
Missoula District Ranger

28 October 2019

TO: Jed Whiteley, Project Manager
Clark Fork Coalition
Box 7593
Missoula, MT 59807

FROM: Beau Larkin, Property and Research Manager
MPG Ranch, Missoula County, upper Miller Creek

RE: LETTER OF SUPPORT FOR MILLER CREEK SEDIMENT REDUCTION PROJECT

I represent a landowner on upper Miller Creek, downstream of the National Forest boundary. We support improvements to water quality, fisheries habitat, riparian condition and stream channel stability on this reach of Miller Creek. Conserving fish and wildlife habitat is important to our land management goals.

The Miller Creek Sediment Reduction Project led by Clark Fork Coalition (CFC) is proposing restoration on a 1 mile reach of Miller Creek starting at the MPG Ranch boundary in order to reduce fine sediments, increase connectivity, enhance aquatic habitat and to increase ecological function of the riparian and floodplain corridor. We support this project and will coordinate with CFC, DEQ, Fish Wildlife and Parks, and contractors on granting permission for access to the site. Thank you.

Beau Larkin, 406-396-1790, blarkin@mpgranch.com Date: 28 October 2019

Missoula City-County Health Department
WATER QUALITY DISTRICT
301 W Alder | Missoula MT 59802-4123
www.missoulacounty.us/wqd
Phone | 406.258.4890
Fax | 406.258.4781

October 24, 2019

319 Review Committee
Montana Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620

RE: Clark Fork Coalition Wustner and MPG Ranch Proposals

Dear 319 Review Committee,

The Missoula Valley Water Quality District would like to extend our support for the Clark Fork Coalition's 319 application. As part of our mission to protect and improve surface and groundwater quality in the Missoula Valley, we recently developed the Miller Creek Watershed Restoration Plan. The Clark Fork Coalition was an important partner in the process through their thoughtful input, feedback, and identification of restoration projects crucial to decreasing nonpoint source pollution in the Miller Creek Watershed. In the Watershed Restoration Plan, we elaborated on the importance of restoring riparian vegetation, increasing woody debris, and modifying channel structure to create more stable banks and access to floodplain. The proposed work of the Clark Fork Coalition strives to meet these restoration objectives through the Wustner and MPG Ranch reachs. Furthermore, all aspects of the project are identified as Measurable Milestones (EPA Element G). Our history in collaborating with the Clark Fork Coalition and the success of their previous work make us confident this project will decrease temperatures and sediment in Miller Creek.

Thank you for the opportunity to demonstrate our support for this project.

Sincerely,

Ellen Evans

Hydrogeologist
Missoula Valley Water Quality District
eevans@missoulacounty.us

O'Brien Creek Meadow HOA, INC
PO Box 3502
Missoula, MT 59806-3502

O'Brien Creek Meadow HOA, Inc.
PO Box 3502
MT 59806-3502

October 29, 2019

Department of Environmental Quality – 319 Program
P.O. Box 200901
Helena, MT 59620-0901

To Whom It May Concern:

Please accept this letter as the O'Brien Creek Meadow HOA's endorsement of the proposed rehabilitation work for the segment of O'Brien Creek that flows through our common area. We understand that the Clark Fork Coalition is working on our behalf to assist with funding support for necessary rehabilitation that will fulfill both our 310 stream permit requirements and contribute to the overall watershed restoration planning efforts.

We have learned a lot about O'Brien Creek since our segment of stream jumped its banks this year (and two years prior). We have a diverse group of landowners that largely are genuinely interested in helping to improve stream conditions, and as importantly, we realize that stream maintenance and associated costs will return until the stream is functioning better. The process of grant writing and all the parties involved to make projects happen is very complex, and we welcome the assistance from the Clark Fork Coalition. We also have several landowners that have helped with the stream work this year, and we plan to provide additional assistance as we have the expertise, time, resources, and majority support.

We are just learning of the Montana Department of Environmental Quality's role in managing streams to improve water quality and perform watershed restoration planning and funding. We greatly appreciate your support of this important proposal. As we've also come to understand, funding support is very limited, making funding from your 319 Program critical to our success. To help ourselves and our mutual success, we want to hire very experienced stream professionals and will do all that we can to produce a very high quality product. With this in mind, we hope that restoration work on our property may also provide the state and local agencies with an example that can be used on other work in O'Brien Creek and perhaps other watersheds. Thank you for your consideration.

Sincerely,

Michael Burks
President
O'Brien Creek Meadow Home Owners Association, Inc

WestSlope Chapter
Trout Unlimited

October 24th, 2019

Re: Lee Creek/West Fork Sediment Reduction Project

To Whom It May Concern:

I am writing on behalf of WestSlope Chapter of Trout Unlimited in order to show our support of the Lee Creek/West Fork Sediment Reduction Project.

We have always been in favor of the decommissioning of roads and their associated culverts that have historically added sediment to the Clark Fork and surrounding watersheds. We have supported many such projects financially as part of our work. When a large-scale well planned project such as this one has objectives that include monitoring for project effectiveness and outreach to educate members of the community and government agencies, we couldn't be more pleased.

The main goals of WestSlope Chapter of Trout Unlimited are to conserve, protect and restore our area's cold-water fisheries and their watersheds. These goals also include educating the public on the importance of clean cold water and healthy fisheries. For these reasons WestSlope Chapter of Trout Unlimited supports the Lee Creek/West Fork Sediment Reduction Project, both philosophically and financially.

Sincerely,

Mark Kuipers
President, WestSlope Chapter of Trout Unlimited

PO Box 7165, :\1issoula, Mon1a11a 59807-7 l(iS | \Vcst.SlopcChaplcr.Tl·@gmail.m m | \VcsL5lopcChaplcrTl·.org

WestSlope Chapter
Trout Unlimited

October 24th, 2019

Re: Ongoing restoration efforts in the Miller creek drainage

Dear Miller Creek Restoration Partners and Sponsors,

I am writing on behalf of WestSlope Chapter of Trout Unlimited in order to show our support for the ongoing restoration efforts on Miller Creek. Specifically, the proposed projects on the Wustner and MPG properties are projects that will greatly benefit fisheries and watershed health. Miller Creek is considered a key tributary to the Bitterroot river and provides important habitat for westslope cutthroat trout, a species of concern in Montana.

In a system that has been negatively impacted by past management practices, the potential for restoration of key fish habitat to enhance production and improve recruitment, is very valuable. Both the Wustner and MPG projects will benefit fish habitat immensely. These actions will help reduce fine sediment delivery, increase connectivity, improve aquatic habitat, and increase ecological function of the riparian corridor.

The WestSlope Chapter of Trout Unlimited fully supports the ongoing restoration efforts in the Miller creek drainage and commends the partners, landowners and other entities that have made these important efforts possible.

Sincerely,

Mark Kuipers
President, WestSlope Chapter of Trout Unlimited

October 20, 2019

TO: Jed Whiteley, Project Manager
Clark Fork Coalition
Box 7593
Missoula, MT 59807

FROM: Jacob Wustner, Landowner
Missoula County, upper Miller Creek

RE: LETTER OF SUPPORT FOR WUSTNER-MILLER CREEK SEDIMENT REDUCTION PROJECT

I am a landowner on upper Miller Creek, downstream of the National Forest boundary. I would like to support improvements to water quality, fisheries habitat, riparian condition and stream channel stability on this reach of Miller Creek. Conserving fish and wildlife habitat is important to my land management.

The Miller Creek Sediment Reduction Project led by Clark Fork Coalition (CFC) is proposing restoration on a 1/3 mile reach of Miller Creek running through our property in order to reduce fine sediments, increase connectivity, enhance aquatic habitat and to increase ecological function of the riparian and floodplain corridor. I support this project and will coordinate with CFC, DEQ, Fish Wildlife and Parks, and contractors on granting permission for access to the site. Thank you.

_____ Date: 10/20/2019

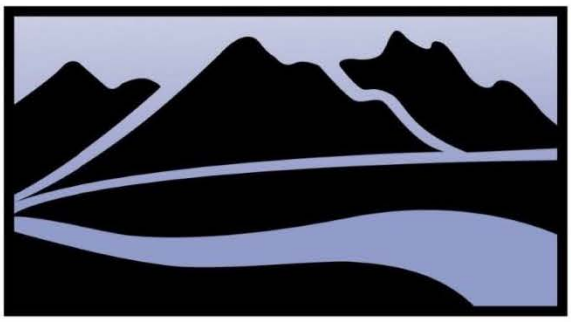
Maps, Designs, Other Attachments

Habitat Assessment for Miller Creek

Missoula County, Montana

Prepared by:

CLARK FORK



COALITION

October 2018

Table of Contents

Introduction

This report presents the results of a habitat assessment completed for Miller Creek, tributary to the lower Bitterroot River, near Missoula, Montana. There are four primary objectives for this report:

1. Evaluate the condition of instream and riparian habitat in Miller Creek.
2. Evaluate the condition of all non-bridge stream crossings.
3. Evaluate stream temperature and flow at selected locations along Miller Creek.
4. Identify reach-specific problems, and opportunities for watershed restoration and improvements.

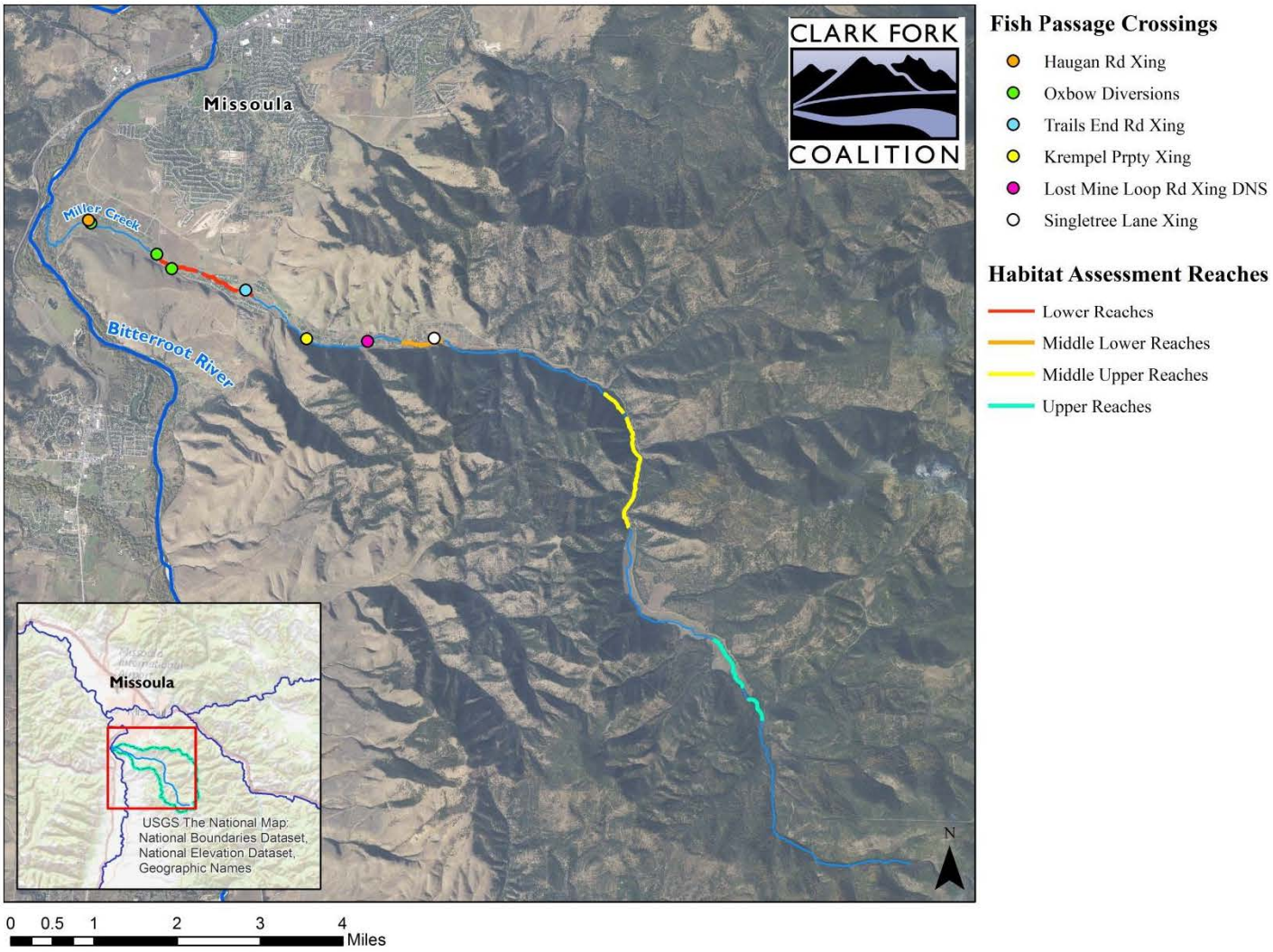


Figure 1. Map depicting the habitat assessment reaches and crossings surveyed for fish passage in Miller Creek.

Habitat Assessment

There were 17 reaches surveyed in the habitat assessment portion of this report, which can be broken up into four categories based on their location in the watershed: lower, lower-middle, upper-middle, and upper reaches (Figure 1). Reaches were defined by property boundary, changes in land-use, changes in geomorphic setting, and changes in riparian community structure. In total, approximately 28% of the mainstem Miller Creek stream length was surveyed for this habitat assessment. Tributaries were not included in this initial assessment.

Fish Passage Surveys

All known non-bridge stream crossings and diversion dams were surveyed for fish passage (Figure 1), with the exception of all USFS crossings and one crossing where access was not granted (Miller Creek Meadows LLC property). All USFS crossings have already been surveyed by the USFS and results from those analyses are presented in Appendix x. Additionally, three diversions dams in the Oxbow Cattle Company property were surveyed for fish passage.

Streamflow Assessment

Streamflow was measured at 2 monitoring locations in the watershed from June to October. The 2 sites on the mainstem of Miller Creek are above and below the Oxbow Diversions (see Figure 1) and were chosen to evaluate water availability on the lower stretch of creek. A synoptic run was also completed in August of 2018.

Stream Temperature Assessment

Stream temperature was measured at 6 locations from July to October. Five of temperature loggers were installed in the Upper, Middle-Upper, and Lower reaches of the habitat assessment (Figure 1). One temperature logger was installed below the Lower reach.

Previous Studies

This report builds from the 2018 Watershed Restoration Plan by the Missoula Valley Water Quality District. From this plan, Miller Creek has been identified as impaired for sediment and temperature. The two major factors impacting stream water temperatures are shading from riparian vegetation and instream flow volume (MVWQD, 2018). Additionally, the WRP states that fish passage obstructions in the watershed need to be assessed and a plan for mitigation developed and implemented. This report also builds from the Department of Environmental Quality's TMDL document (DEQ, 2011), which outlined that the most influential non-point source restoration strategy for Miller Creek will be restoring shade-producing vegetation along the whole segment (DEQ, 2011).

Methods

NRCS Riparian Assessment Protocol and Fish Habitat Scores

The 'USDA Riparian Assessment using the NRCS Riparian Assessment Method' protocol (USDA, 2004) was used for the stream habitat assessment. The NRCS method scores each reach based on stream

channel condition, floodplain condition, riparian vegetation, and land use issues which can be assessed during a stream walk. Scores from the ten questions on this form are tallied together and then divided by the total possible points to develop an overall NRCS Assessment Score for each reach. Percentage scores for each reach fall into the following three categories: 'Sustainable' (80 to 100%), 'At Risk' (50 to 80%), or 'Not Sustainable' (0 to 50%).

Fish Habitat Scores were calculated via the supplemental attributes questions 1, 2, 3, and 5 in the NRCS Riparian Assessment protocol to assess the condition of the aquatic habitat and water quality associated with the reach. Question 4 was removed from the analysis because flow characteristics of the stream were assessed using other, more in depth methods. Answers to the supplemental questions 1, 3, and 5 had four potential scores: 10, 7, 3, or 0. Answers to supplemental question two had potential scores of 20, 10, and 0 because of the importance of this question to our assessment. Question scores were added together and then a percentage of the total potential score was calculated, leading to a final score for the reach. Scores fell into three categories: poor fish habitat (0% to 30%), fair fish habitat (31% to 79%), and good fish habitat quality (80% to 100%).

Fish Passage Surveys

All non-bridge and non-USFS crossings were surveyed using the USFS National Inventory and Assessment Procedure for Identifying Barriers to Aquatic Organism Passage at Road-Stream Crossings protocol (USFS, 2005). Metrics collected at these crossings include: pipe diameter, pipe length, pipe gradient, road width, outlet drop height, and pool depth were measured. Distance from the outlet pool to the first resting habitat upstream of the crossing was also measured. At the three Oxbow Cattle Co. diversion dams, water surface slope and fish jump height were measured.

Fish passage barrier determination was made using definitions outlined in the Assessment of Aquatic Organism Passage at Road/Stream Crossings for the Northern Region of the USDA Forest Service report (USFS, 2008). A "Red" (total) fish passage barrier is a crossing that prohibits the upstream passage of all species and life stages throughout the entire year. A "Gray" (partial) fish passage barrier is a barrier to upstream migration during a portion of the year to any species.

Streamflow Assessment

Streamflow was measured using HOBO Water Level Loggers at 2 locations in the Lower Reach and below the Lower Reach. The loggers recorded water level and barometric pressure every hour from June through October. Using a Hach flowmeter, flow measurements were taken at the sites while the loggers were deployed. The water level and flow measurements were used to create a rating curve and hydrograph of each site.

Stream Temperature Assessment

Stream temperature was measured at locations of streamflow assessment using HOBO Water Level Loggers, and at 4 additional locations along mainstem Miller Creek using Hobo TidbiT v2 Temperature Loggers.

Results

Habitat Assessment Results: Lower Reaches

Reach NWE_1

Figure 2. Conditions in the upstream end of reach NWE_1.

Table x. Reach NWE_1 data summary.

Reach	NRCS Score	Category	Rosgen Channel Type	BFD (ft)	BFW (ft)	W/D (ft)	Substrate	Slope (%)	Fish Habitat Score	Fish Habitat Rating
NWE_1	23%	Not Sustainable	G tending towards C	0.93	12.5	13.5	Cobble	2	40%	Fair

This reach of Miller Creek flows through property that is owned by Northwestern Energy and contains one streamflow diversion at the upstream end of the reach, where the water right is owned and operated by Oxbow Cattle Company. Reach length is 0.26 miles. The stream appears to have been straightened throughout most of the reach, as the sinuosity is very low, the slope of the stream is very steep for the location within the watershed, and there are very few pools within the reach. This reach is dominated by fast water (riffles). This section is clearly a sediment transport reach, as the dominant substrate is cobble and there are very few depositional zones. There is a definitive lack of riparian hardwood vegetation in this reach and the dominant riparian vegetation is grasses. The stream is incised one to two feet throughout the reach.

Reach NWE_2

Figure 3. Conditions in reach NWE_2.

Table 1. Reach NWE_2 data summary.

NRCS Score	Score Category	Rosgen Channel Type	BFD (ft)	BFW (ft)	W/D (ft)	Substrate	Slope	Fish Habitat Score	Fish Habitat Rating
23%	Not Sustainable	G	0.88	14	15.9	Cobble	2%	40%	Fair

This reach of Miller Creek flows through property that is owned by Northwestern Energy. Reach length is 0.33 miles. The stream appears to have been straightened throughout most of the reach, as the sinuosity is very low, the slope of the stream is very steep for the location within the watershed, and there are very few pools within the reach. This reach is dominated by fast water (riffles). This section is clearly a sediment transport reach, as the dominant substrate is cobble and there are very few depositional zones. There is a definitive lack of riparian hardwood vegetation in this reach and the dominant riparian vegetation is grasses. The stream is incised one to two feet throughout the reach.

Reach Stillwater_1

Figure 4. Conditions in Stillwater_1 reach.

Table 2. Reach Stillwater_1 data summary.

NRCS Score	Score Category	Rosgen Channel Type	BFD (ft)	BFW (ft)	W/D (ft)	Substrate	Slope	Fish Habitat Score	Fish Habitat Rating
27%	Not Sustainable	B	0.95	10.7	11.26	Cobble	1.5%	34%	Fair

This reach of Miller Creek flows through property that is owned by Stillwater Addition Homeowners. Reach length is 0.5 miles. The stream appears to have been straightened throughout most of the reach, as the sinuosity is very low, the slope of the stream is steep for the location within the watershed, and there are no pools within the reach. This reach is one long continuous riffle. This section is clearly a sediment transport reach, as the dominant substrate is cobble and there are very few depositional zones. There is a definitive lack of riparian hardwood vegetation in this reach and the dominant riparian vegetation is grasses. The stream is slightly incised throughout the reach. Lateral bank erosion was visible along the outside bends where banks were 4-5' tall and eroded.

Reach Capon_1

Figure 5. Conditions in Capon_1 reach.

Table 3. Reach Capon_1 data summary.

NRCS Score	Score Category	Rosgen Channel Type	BFD (ft)	BFW (ft)	W/D (ft)	Substrate	Slope	Fish Habitat Score	Fish Habitat Rating
27%	Not Sustainable	B	1.03	11.2	10.87	Cobble	1%	34%	Fair

This reach of Miller Creek flows through property that is owned by a private entity and Missoula County. Reach length is 0.12 miles. The stream appears to have been straightened throughout most of the reach, as the sinuosity is very low, the slope of the stream is steep for the location within the watershed, and there are no pools within the reach. This reach is one long continuous riffle. This section is clearly a sediment transport reach, as the dominant substrate is cobble and there are very few depositional zones. There is a definitive lack of riparian hardwood vegetation in this reach and the dominant riparian vegetation is grasses. The stream is incised 2 to 3 feet throughout the reach, and there was minimal lateral bank erosion.

Habitat Assessment Results: Lower-Middle Reaches

Reach Singletree_1

Figure 6. Conditions in Singletree_1 reach.

Table 4. Reach Singletree_1 data summary.

NRCS Score	Score Category	Rosgen Channel Type	BFD (ft)	BFW (ft)	W/D (ft)	Substrate	Slope	Fish Habitat Score	Fish Habitat Rating
13%	Not Sustainable	G	1.2	9.8	8.2	Cobble	0.75%	66%	Fair

This reach of Miller Creek flows through property that is owned by two private entities. Reach length is 0.19 miles. There are few pools (4) within the reach, and there is a definitive lack of riparian hardwood vegetation in this reach and the dominant riparian vegetation type is grasses. The stream is incised an average of 5 feet throughout the reach, and lateral bank erosion was evident throughout the reach as the channel is actively widening. There was an increased amount of fine sediment observed in this reach.

Reach Singletree_2

Figure 7. Conditions in Singletree_2 reach.

Table 5. Reach Singletree_2 data summary.

NRCS Score (%)	Score Category	Rosgen Channel Type	BFD (ft)	BFW (ft)	W/D (ft)	Substrate	Slope (%)	Fish Habitat Score	Fish Habitat Rating
57%	At Risk	C	0.65	10	15.4	Gravel	1.5	74%	Fair

This reach of Miller Creek flows through property that is owned by a private entity and Missoula County. Reach length is 0.19 miles. There are six pools within the reach, and there was an increased amount of fine sediment observed in this reach. Channel incision observed in this reach begins with a 4 foot average on the downstream end, and generally decreases as you move upstream, giving an average of 3 feet throughout the reach. Lateral bank erosion was evident throughout the reach as the channel is actively widening. Riparian vegetation increased in this reach, with cottonwood, chokecherry, aspen, and willow as the dominant hardwood riparian vegetation present.

Reach Singletree_3

Figure 8. Photo A: Sediment deposition and channel avulsion occurring downstream of the Singletree Lane crossing. Photos B&C: Large sediment plug that has deposited approximately 4 ft of sediment for 400 ft upstream of the crossing. Photo D: Channel spanning log causing a potential fish passage barrier with a 1.8 ft fish jump height.

Table 6. Reach Singletree_3 data summary.

NRCS Score	Score Category	Rosgen Channel Type	BFD (ft)	BFW (ft)	W/D (ft)	Substrate	Slope	Fish Habitat Score	Fish Habitat Rating
70%	At Risk	C	0.9	13.1	14.6	Gravel	1.5%	68%	Fair

This reach of Miller Creek flows through property that is owned by two private entities and Missoula County. Reach length is 0.25 miles. The crossing with Singletree Lane has caused major sediment issues in this reach. A large plug of sediment has deposited upstream and downstream of the crossing due to

the fact that the aged, double barrel culverts at the crossing are severely undersized and partially plugged (see fish passage survey results and photos). Based off of the size of the sediment plug, this issue appears to have been ongoing for decades. Approximately 1185 cubic yards of sediment have been deposited upstream of the crossing, and much more has been deposited downstream. The channel has avulsed downstream of the crossing, and a portion of the water was flowing into Singletree Lane at the time of survey (July 18, 2018). Although there were sandbags placed in the stream to prevent this from happening, some flow was still escaping into the road and traveling 500 feet along the road before flowing back into Miller Creek. Based off of visual assessment, it appears the elevation of Singletree Lane is lower than the stream channel, which explains why the stream flows here (as the road is in the floodplain). The channel is braided and extremely widened downstream of the stream crossing due to the sediment deposition. There were nine pools in the reach, and overall are shallow due to the excess sediment. The slope of the stream ranged throughout the reach from 0.5-6.0%, with an average of 1.5%.

Restoration recommendations for this reach are to:

1. Replace the Singletree Lane culverts with a bridge.
2. Reconstruct the channel upstream and downstream of the culvert to control the grade and prevent the sediment plug from eroding and delivering downstream. This includes the removal of the fish passage barrier shown in photo D (Figure x).
3. Move Singletree Lane out of the floodplain.
4. Revegetate open areas in the riparian zone that have been covered in years of depositional gravel.

Habitat Assessment Results: Upper-Middle Reaches

Reach Wustner_1

Figure 9. Conditions in the Wustner_1 reach. Note person standing on bank for scale of incision.

Table 7. Reach Wustner_1 data summary.

NRCS Score	Score Category	Rosgen Channel Type	BFD (ft)	BFW (ft)	W/D (ft)	Substrate	Slope	Fish Habitat Score	Fish Habitat Rating
33%	Not Sustainable	C	0.85	19.6	23.1	Cobble	1%	34%	Fair

This reach of Miller Creek flows through property that is owned by a private entity. Reach length is 0.35 miles. The stream has been relocated to the south side of the valley and straightened throughout most of the reach. This section of stream in very incised and is actively widening. Banks were actively sloughing throughout the reach. The stream is incised 8-10 ft on average throughout the reach – the worst seen in the watershed. The floodplain is disconnected throughout the reach, and dead riparian vegetation was visible because of this. An inset floodplain is forming inside the incised channel (see photo). Pools were minimal in this reach, and there was minimal shade and cover for fish.

Reach DNRC_1

Figure 10. Conditions in the DNRC_1 reach.

Table 8. Reach DNRC_1 data summary.

NRCS Score (%)	Score Category	Rosgen Channel Type	BFD (ft)	BFW (ft)	W/D (ft)	Substrate	Slope (%)	Fish Habitat Score	Fish Habitat Rating
62%	At Risk	G	1.28	23.1	18.1	Gravel	2	60%	Fair

This reach of Miller Creek flows through property that is owned by the MT Department of Natural Resources and Conservation. Reach length is 0.13 miles. This reach can be characterized as an incising channel with a thick riparian zone. Although not shown well in the photo for the reach, incision is approximately 6-7 ft on average throughout the reach, with very few bars and low sinuosity in most places. It appears that the channel has been moved to the west side of the valley. The reach consists of mostly fast water, with a slope of 2%, however some wood formed pools were present. Shade is not a limiting factor in this reach, but if incision continues, the floodplain could become more disconnected and the riparian zone could die off.

Reach DNRC_2

Figure 11. Conditions in the DNRC_2 reach.

Table 9. Reach DNRC_2 data summary.

NRCS Score (%)	Score Category	Rosgen Channel Type	BFD (ft)	BFW (ft)	W/D (ft)	Substrate	Slope (%)	Fish Habitat Score	Fish Habitat Rating
63	At Risk	C	1.1	15	13.6	Gravel	1	54%	Fair

This reach of Miller Creek flows through property that is owned by the MT Department of Natural Resources and Conservation. Reach length is 0.22 miles. This reach can be characterized as an actively incising and widening channel with a thick riparian zone. Incision is approximately 2-3 ft on average throughout the reach and there was an extensive amount of lateral bank erosion occurring. The channel moves away from the valley edge, overall is wider, has an inset floodplain, and a decreased slope. However, there were few pools observed in this reach. Shade is not a limiting factor, but if incision continues, the floodplain could become disconnected.

Reach DNRC_3

Figure 12. Conditions in the DNRC_3 reach.

Table 10. Reach DNRC_3 data summary.

NRCS Score (%)	Score Category	Rosgen Channel Type	BFD (ft)	BFW (ft)	W/D (ft)	Substrate	Slope (%)	Fish Habitat Score	Fish Habitat Rating
88	Sustainable	B	1.05	11.9	11.3	Gravel	1.5	74%	Good

This reach of Miller Creek flows through property that is owned by the MT Department of Natural Resources and Conservation. Reach length is 0.25 miles. This reach can be characterized as an incised and widened channel with a thick riparian zone growing on the inset floodplain. The stream here appears to be recovering from a historic incision and widening event. Incision is approximately 5-6 ft on average throughout the reach and there was a minimal amount of active lateral bank erosion occurring. There was an even mix of deep, shallow, large, and small pools observed in this reach. Gravels were partially embedded, and shade was not a limiting factor.

Reach MPG_1

Figure 13. Conditions in the MPG_1 reach.

Table 11. Reach MPG_1 data summary.

NRCS Score (%)	Score Category	Rosgen Channel Type	BFD (ft)	BFW (ft)	W/D (ft)	Substrate	Slope (%)	Fish Habitat Score	Fish Habitat Rating
78	At Risk	C	0.93	12.4	13.3	Gravel	1.5	94%	Good

This reach of Miller Creek flows through property that is owned by the MPG Ranch. Reach length is 0.54 miles. This reach can be characterized as a slightly incised and widened channel with a thick riparian zone growing in the floodplain. Incision is approximately 1-2 ft on average throughout, and an inset floodplain is in the formation process here. The riparian zone was very diverse and thick, with all age classes present. There was an even mix of deep, shallow, large, and small pools observed in this reach. Gravels were partially embedded, and shade was not a limiting factor.

Reach MPG_2

Figure 14. Conditions in the MPG_2 reach.

Table 12. Reach MPG_2 data summary.

NRCS Score (%)	Score Category	Rosgen Channel Type	BFD (ft)	BFW (ft)	W/D (ft)	Substrate	Slope (%)	Fish Habitat Score	Fish Habitat Rating
75	At Risk	C	1.05	12.5	11.9	Gravel	0.5	74%	Fair

This reach of Miller Creek flows through property that is owned by the MPG Ranch. Reach length is 0.33 miles. This reach can be characterized as a slightly incised and widened channel with a sparse riparian zone. The riparian zone was dominated by conifer and grass, with very little hardwoods present. Incision is approximately 1-2 ft on average throughout, and increases to 4 ft at the upstream end of the reach (as shown in Figure x). There was an even mix of deep, shallow, large, and small pools observed in this reach. Gravels were partially embedded, and shade was not a limiting factor.

Habitat Assessment Results: Upper Reaches

Reach Spooner_1

Figure 15. Conditions in the Spooner_1 reach.

Table 13. Reach Spooner_1 data summary.

NRCS Score (%)	Score Category	Rosgen Channel Type	BFD (ft)	BFW (ft)	W/D (ft)	Substrate	Slope (%)	Fish Habitat Score	Fish Habitat Rating
53	At Risk	G	1.4	8.6	6.14	Gravel	0.5	54%	Fair

This reach of Miller Creek flows through property that is owned by a private entity. Reach length is 0.73 miles. This reach can be characterized as an actively incising and widening channel with a riparian zone beginning to establish in an inset floodplain. Incision is approximately 4-5 ft on average throughout the reach and there was an extensive amount of active lateral bank erosion occurring. There is a definitive lack of riparian hardwood vegetation in this reach and the dominant riparian vegetation is grasses.

Reach USFS_1

Figure 16. Conditions in the USFS_1 reach.

Table 14. Reach USFS_1 data summary.

NRCS Score (%)	Score Category	Rosgen Channel Type	BFD (ft)	BFW (ft)	W/D (ft)	Substrate	Slope (%)	Fish Habitat Score	Fish Habitat Rating
66	At Risk	C	0.95	8.5	8.95	Gravel	0.75	74%	Fair

This reach of Miller Creek flows through property that is owned by the U.S. Forest Service. Reach length is 0.19 miles. This reach can be characterized as an actively incising narrow channel with minimal lateral bank erosion. Incision is approximately 2 ft on average throughout the reach. The riparian zone consists mainly of alder with a conifer overstory. Shade is not a limiting factor in this reach. Gravels were embedded in fine sediment and there was a lack of bars present. The instream habitat in this reach was homogenized with few pools present, likely due to incision.

Reach USFS_2

Figure 17. Conditions at the upstream end of the USFS_2 reach.

Table 15. Reach USFS_2 data summary.

NRCS Score (%)	Score Category	Rosgen Channel Type	BFD (ft)	BFW (ft)	W/D (ft)	Substrate	Slope (%)	Fish Habitat Score	Fish Habitat Rating
60	At Risk	DA to D	N/A	N/A	N/A	Gravel	--	74%	Fair

This reach of Miller Creek flows through property that is owned by the U.S. Forest Service. Reach length is short, at 0.11 miles. This reach is recovering from a large input of sediment. It can be characterized as a highly braided network of channels with a decadent riparian zone. As you move upstream, the channel type goes from a DA with 2-3 gravel bed channels, to a D type with many unstable, newly formed, soil bottom channels. The sediment plug causing this was clearly visible at the upstream end of the reach (shown in Figure x). The source of the sediment was not easily found, and the reason for its deposition is suspected to be the location in the watershed. The valley walls widen in this section, so perhaps this is a naturally occurring location for sediment deposition. The riparian zone consists mainly of alder with a conifer overstory, which is dying in the upstream end of the reach (shown in Figure x). Shade is not a limiting factor in this reach.

Reach USFS_3

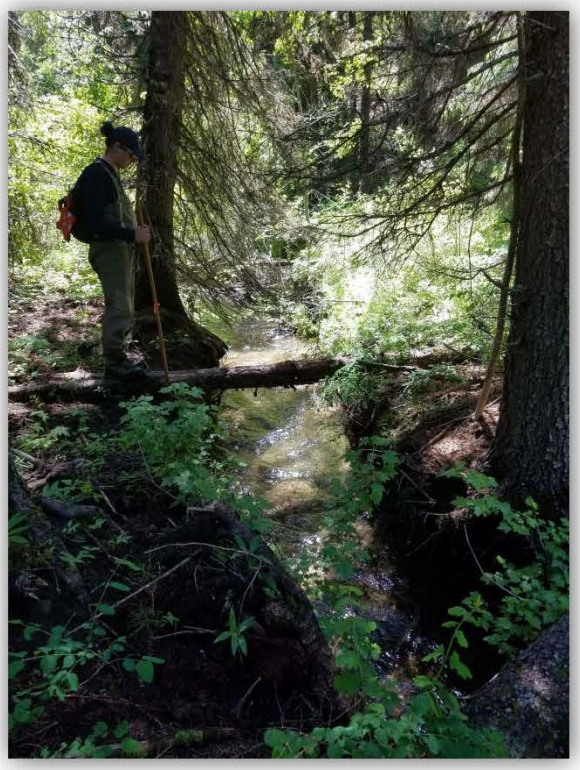


Figure 18. Conditions in the USFS_3 reach.

Table 16. Reach USFS_3 data summary.

NRCS Score (%)	Score Category	Rosgen Channel Type	BFD (ft)	BFW (ft)	W/D (ft)	Substrate	Slope (%)	Fish Habitat Score	Fish Habitat Rating
46	Not Sustainable	G	1.12	7.1	6.3	Gravel	0.5	60%	Fair

This reach of Miller Creek flows through property that is owned by the U.S. Forest Service. Reach length is 0.07 miles. This reach can be characterized as an actively incising narrow channel that is beginning to widen in portions of the reach. Incision is approximately 3 ft on average throughout the reach and was as high as 6' in some places. The lowermost 30-40 ft of the reach was dammed up with water, and the channel was filled to bankfull as a backwater effect from the sediment plug at the upstream end of reach USFS_2. Fish were observed in this backwater section. The riparian zone consists mainly of snowberry, with an alder understory and conifer overstory in some places. Gravels were embedded in fine sediment. The instream habitat in this reach was homogenized with few pools present, likely due to incision.

Habitat Assessment Results Summary

The channel appears to have been moved and straightened throughout many of the surveyed reaches. This has led to widespread incision of the stream channel, floodplain disconnection, riparian degradation, and homogenization of instream habitat. Thirteen out of seventeen (76%) of the surveyed reaches were incised. Our results concur with the 2011 DEQ report that states the major source of sediment to Miller Creek is the eroding banks.

Forty-one percent (41%) of the reaches surveyed for this assessment received a 'Not Sustainable' NRCS rating, 52% received an 'At Risk' NRCS rating, and only 6% (one reach) received a 'Sustainable' NRCS rating. 29% of the reaches surveyed received a 'Poor Habitat Quality' fish habitat rating, 59% received a 'Fair Habitat Quality' fish habitat rating, and only 12% (2 reaches) received a 'Good Habitat Quality' fish habitat rating.

Lower Reaches

The reaches surveyed for this section of Miller Creek were a combined 1.2 miles of stream and were dominated by fast water. Overall, the stream is very straight (exhibited low sinuosity) and contained some of the highest recorded gradients (1.5-2%) in the watershed. Very few pools were present and there was a definitive lack of riparian hardwood vegetation in this section of Miller Creek. All of the reaches in this section received a 'Not Sustainable' NRCS rating, and 'Poor Habitat Quality' fish habitat score (Table x). All of the reaches in this section were excessively or moderately impaired for sediment, temperature, and vegetation (Table x).

Table 17. Assessment scores for all lower reaches surveyed in Miller Creek.

Reach Name	Length of Reach (miles)	Total Assessment Score %	Total Fish Habitat Score %	Impairments			Principal Sources	Other Sources
				Sed	Temp	Veg		
NWE_1	0.26	23%	40%	E	E	E	Channel straightening & incisment	Degraded riparian habitat
NWE_2	0.33	23%	40%	E	E	E	Channel straightening & incisment	Degraded riparian habitat
Stillwater_1	0.50	27%	34%	M	E	E	Channel straightening	Degraded riparian habitat
Capon_1	0.12	27%	34%	M	E	E	Channel straightening & incisment	Degraded riparian habitat

KEY				Impairments:
Total Assessment Score:		Total Fish Habitat Score:		Not Impaired/At Risk
Sustainable	80-100%	Good Habitat Quality	80-100%	Slightly Impaired
At Risk	50-80%	Fair Habitat Quality	51-79%	Moderately Impaired
Not Sustainable	1-50%	Poor Habitat Quality	1-50%	Excessively Impaired

Lower-Middle Reaches

The reaches surveyed in this section of Miller Creek were a combined 0.63 miles of stream. The stream channel in this section is incised in the lower portion, and braided in the upper section due to a large deposition of sediment that is caused by the Singletree Lane road crossing that contains undersized, aged, concrete culverts. This issue appears to have been ongoing for decades, as the amount of sediment that has deposited in this area is extensive.

Table 18. Assessment scores for all lower-middle reaches surveyed in Miller Creek.

Reach Name	Length of Reach (miles)	Total Assessment Score %	Total Fish Habitat Score %	Impairments			Principal Sources	Other Sources
				Sed	Temp	Veg		
Singletree_1	0.19	13%	66%	E	E	E	Channel incisement	Degraded riparian habitat
Singletree_2	0.19	57%	74%	M	S	S	Channel incisement	Channel widening
Singletree_3	0.25	70%	68%	E	S	S	Channel avulsion and braiding due to sediment deposition	Channel widening

KEY				Impairments:
Total Assessment Score:		Total Fish Habitat Score:		Not Impaired/At Risk
Sustainable	80-100%	Good Habitat Quality	80-100%	Slightly Impaired
At Risk	50-80%	Fair Habitat Quality	51-79%	Moderately Impaired
Not Sustainable	1-50%	Poor Habitat Quality	1-50%	Excessively Impaired

Upper-Middle Reaches

The reaches surveyed in this section of Miller Creek were a combined 1.82 miles of stream. The upper-middle reaches contained the best habitat observed in this study. The only reach in this study that received a 'Sustainable' NRCS assessment rating fell in this area (DNRC_3 reach). Conversely, all reaches in this section of stream were incised, and the worst incision that was observed in this study also fell in this section of Miller Creek, in the Wustner_1 reach. Incision in this reach was an average of 8-10 ft.

Fish habitat scores in the DNRC_3 and MPG_1 reaches were the highest observed in the watershed, rated at 94% and 'Good Habitat Quality'. These two reaches contained an even mix of deep, shallow, large, and small pools and were not impaired for sediment or temperature.

Table 19. Assessment scores for all upper-middle reaches surveyed in Miller Creek.

Reach Name	Length of Reach (miles)	Total Assessment Score %	Total Fish Habitat Score %	Impairments			Principal Sources	Other Sources
				Sed	Temp	Veg		
Wustner_1	0.35	33%	34%	E	E	E	Channel incisement, widening & straightening	Degraded riparian habitat
DNRC_1	0.13	62%	60%	M	N	N	Channel incisement & straightening	Channel widening
DNRC_2	0.22	63%	54%	M	N	N	Channel incisement & straightening	Channel widening
DNRC_3	0.25	88%	94%	S	N	N	Channel incisement & straightening	Channel widening
MPG_1	0.54	78%	94%	S	N	N	Channel incisement	--
MPG_2	0.33	75%	74%	S	M	M	Degraded riparian habitat	Channel incision

KEY				Impairments:
Total Assessment Score:		Total Fish Habitat Score:		Not Impaired/At Risk
Sustainable	80-100%	Good Habitat Quality	80-100%	Slightly Impaired
At Risk	50-80%	Fair Habitat Quality	51-79%	Moderately Impaired
Not Sustainable	1-50%	Poor Habitat Quality	1-50%	Excessively Impaired

Upper Reaches

The reaches surveyed in this section of Miller Creek were a combined 1.1 miles of stream. Although the 2007 TMDL report completed by the Department of Environmental Quality (DEQ) found that the channel morphology in this section of Miller Creek was largely intact with no active erosion identified, the results of our 2018 habitat assessment show otherwise. The stream channel throughout the upper reaches was either incised or recovering from a large input of sediment (see individual reach results).

Three of four reaches in this section of Miller Creek received an NRCS assessment rating of 'At Risk', and one reach received a 'Not Sustainable' rating (Table x). All reaches received a 'Fair Habitat Quality' fish habitat rating, and all reaches were impaired for sediment and vegetation.

Table 20. Assessment scores for all upper reaches surveyed in Miller Creek.

Reach Name	Length of Reach (miles)	Total Assessment Score %	Total Fish Habitat Score %	Impairments			Principal Sources	Other Sources
				Sed	Temp	Veg		
Spooner_1	0.73	53%	54%	E	M	M	Channel incisement and widening	Minimal riparian zone
USFS_1	0.19	67%	74%	M	N	S	Channel incisement	Degraded riparian habitat
USFS_2	0.11	60%	74%	E	N	M	Channel braiding and avulsion due to sediment deposition	Degraded riparian habitat
USFS_3	0.07	47%	60%	M	N	M	Channel incisement and widening	Degraded riparian habitat

KEY				Impairments:
Total Assessment Score:		Total Fish Habitat Score:		Not Impaired/At Risk
Sustainable	80-100%	Good Habitat Quality	80-100%	Slightly Impaired
At Risk	50-80%	Fair Habitat Quality	51-79%	Moderately Impaired
Not Sustainable	1-50%	Poor Habitat Quality	1-50%	Excessively Impaired

Fish Passage Survey Results

Oxbow Cattle Company Stream Diversions

Lower

The fish jump height at the lower Oxbow Cattle Company stream diversion was measured at 2.2 ft and the water surface slope from downstream of the diversion to upstream of the diversion was measured at 4.5%.

Figure 19. The lower Oxbow Cattle Company stream diversion.

Middle

The fish jump height at the middle Oxbow Cattle Company stream diversion was a combined 2.7 ft and the water surface slope from downstream of the diversion to upstream of the diversion was measured at 4.0%.

Figure 20. The middle Oxbow Cattle Company stream diversion.

Upper

The fish jump height at the upper Oxbow Cattle Company stream diversion was measured to have a combined fish jump height of 3.4 ft and the water surface slope from downstream of the diversion to upstream of the diversion was measured at 7.0%.

Figure 21. The upper Oxbow Cattle Company stream diversion.

Haugan Drive Crossing

The Haugan Drive culvert is an open bottom arch culvert that was placed at grade, as there was no fish jump at the outlet. The gradient of the stream through the culvert was 0.5%. Based off of USFS fish passage evaluation criteria (USFS, 2008), this crossing was rated as "Gray" because the culvert width to bankfull width ratio was less than 0.7 and there was no resting habitat immediately upstream of the crossing. Further analysis will have to determine the exact barrier type, but this crossing is likely a velocity barrier to juvenile salmonids at high flows.

Figure 22. The outlet of the Haugan Drive crossing.

Trails End Road Crossing

The Trails End Road crossing is a double barrel style crossing consisting of two corrugated metal pipes that are 3.9 (right bank) and 4.8 ft (left bank) in diameter. The outlet of the left bank culvert had a fish jump height of 2.1 ft and the gradient of the culvert was measured to be 2.5%. The outlet of the right bank culvert had a fish jump height of 2.3 ft and the gradient of the culvert was measured to be 3.7%. Based off of USFS fish passage evaluation criteria (USFS, 2008), both culverts were rated as total barriers to all life stages of salmonids due to the fish jump height at the outlets, and the slope, length, and diameter of the culverts.

Figure 23. The outlet (top photo) and inlet (bottom photo) of the Trails End Road crossing.

Private Drive – Krempel Property

The Krempel Private Drive culvert is a 4.3 ft diameter concrete culvert with a concrete apron at the outlet. While there was no change in elevation at the outlet of the culvert, there was a 0.9 ft change in elevation (i.e. fish jump height) at the outlet of the apron. The gradient of the culvert was measured to be 1.2%. This crossing did not appear to be a fish passage barrier at the outlet of the apron at these flows (date of survey was July 23, 2018), but at base flows the apron could be an impediment to fish passage. There was visual evidence of water ponding up at the inlet, causing scour of the road fill, indicating that this culvert is undersized. Based off of USFS fish passage evaluation criteria (USFS, 2008), this crossing was rated as "Red" (total barrier) to juvenile salmonids based off of the fish jump height at the apron outlet, and the slope, length, and diameter of the culvert.

Figure 24. The outlet (left) and inlet (right) of the Krempel Private Drive crossing.

Lost Mine Loop Road – Lower Crossing

The Lost Mine Loop Road has two crossings with Miller Creek. The lower crossing is a 5.5 ft diameter squashed corrugated metal pipe (the upper crossing is a bridge and was not surveyed). While there was no drop in water at the outlet of the culvert at these flows, there was a 0.3 ft change in elevation from the outlet of the culvert to the channel bed. The slope of the culvert was measured to be 4.4%. Based off of USFS fish passage evaluation criteria (USFS, 2008), this crossing was rated as "Gray" because the culvert width to bankfull width ratio was less than 0.7 and the residual inlet depth is less than 0.34 ft. Further analysis will have to determine the exact barrier type, but this crossing is likely a velocity barrier to juvenile salmonids at high flows.

Figure 25. The outlet (top photo) and inlet (bottom photo) of the lower culvert on Lost Mine Loop Road.

Singletree Lane

The Singletree Lane crossing consists of two aged double barrel concrete culverts that are 3.5 ft in diameter each. Both culverts are partially plugged with sediment (Figure x) and are clearly undersized as there is an extremely large amount of sediment (~1185 cy) deposited upstream of the crossing, and much more has been deposited downstream. Based off of the size of the sediment plug, this issue appears to have been ongoing for decades. Due to the large amount of sediment deposited downstream of the crossing, the channel has avulsed there, and a portion of the water was flowing into Singletree Lane at the time of survey (July 18, 2018). Although there were sandbags placed in the stream to prevent this from happening, some flow was still escaping into the road and traveling 500 feet along the road before flowing back into Miller Creek. Additionally, upstream of the crossing, during high flows, the stream has formed a side channel that flows over the road, and into the avulsion downstream along the road. Sandbags were also placed around the inlet to prevent erosion of the road fill (Figure x). Based off of USFS fish passage evaluation criteria (USFS, 2008), this crossing was rated as "Gray" because the culvert width to bankfull width ratio was less than 0.7 and there was no resting habitat immediately upstream of the crossing. Further analysis will have to determine the exact barrier type, but this crossing is likely a velocity barrier to juvenile salmonids at high flows.

Figure 26. The outlet (left photo) and inlet (right photo) of the Singletree Lane crossing.

Fish Passage Survey Results Summary

Of the five stream crossings that were surveyed for fish passage, three were rated as Gray (partial) barriers and two were rated as Red (total) barriers to fish passage. All three diversion dams that were surveyed were total fish passage barriers.

Table 21. Fish passage survey results summary.

Crossing	Fish Jump Height (ft)	Gradient (%)	Fish Passage Barrier Type
Oxbow Diversion - Lower	2.2	4.5	Red (Total)
Oxbow Diversion - Middle	2.7	4.0	Red (Total)
Oxbow Diversion - Upper	3.4	7.0	Red (Total)
Haugan Road	0.0	0.5	Gray (Partial)
Trails End Road - LBK Culvert	2.1	2.5	Red (Total)
Trails End Road - RBK Culvert	2.3	3.7	Red (Total)
Krempel Private Road	0.9	1.2	Red (Total)
Lost Mine Loop Road - Lower	0.3	4.4	Gray (Partial)
Singletree Lane - LBK Culvert	0.0	6.2	Gray (Partial)
Singletree Lane - RBK Culvert	0.0	10.5	Gray (Partial)

Stream Temperature Results

Miller Creek 2018 Temperature Data Summary					
Site	Reach	Seasonal Maximum		Days> 15˚C	Days> 21 °C
		Date	Value˚C		
Spooner Creek (sites averaged)	Upper	8/12/2018	12.5	0	0
Wustner (sites averaged)	Middle-upper	7/25/2018	15.1	2	0
MPG	Middle-upper	7/25/2018	15.8	18	0
Above Oxbow	Lower	8/10/2018	25.8	82	38
Below Oxbow	Below Lower	8/10/2018	28.6	85	46

Table 22: Stream temperature data on the main stem of Miller Creek

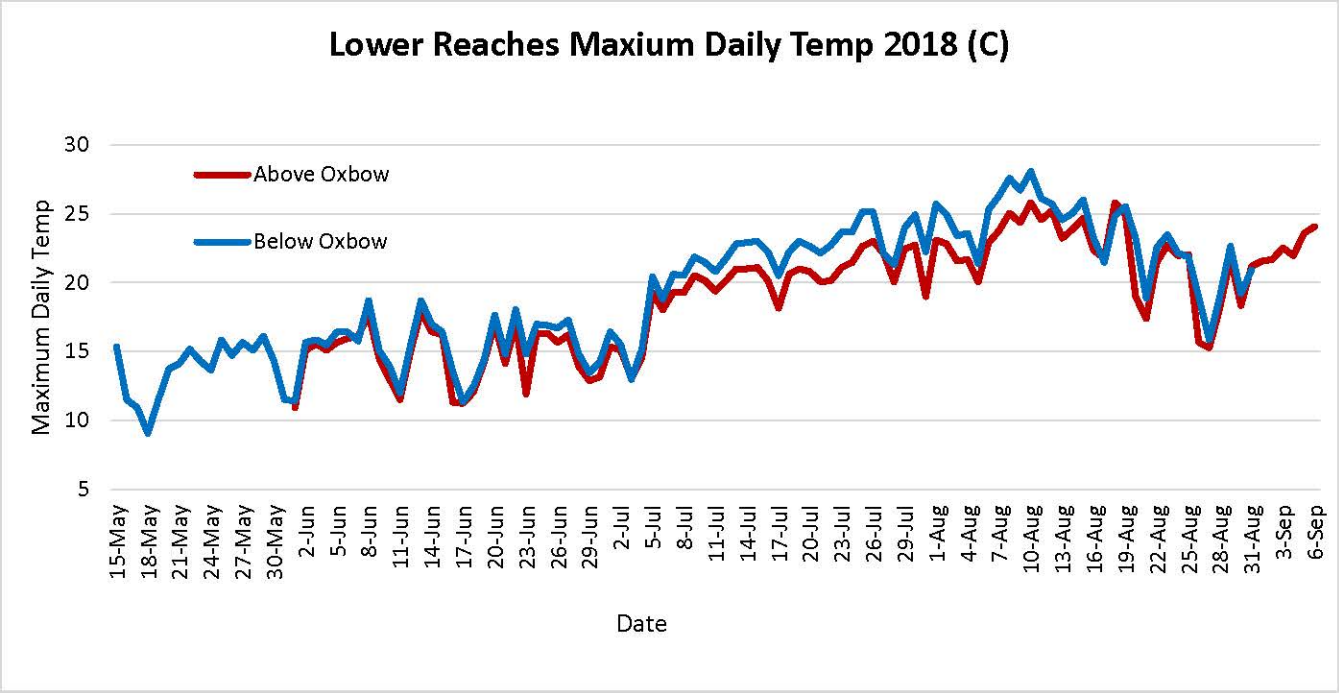


Figure 27: Maximum daily temperature recorded on the lower reaches of Miller Creek in summer, 2018.

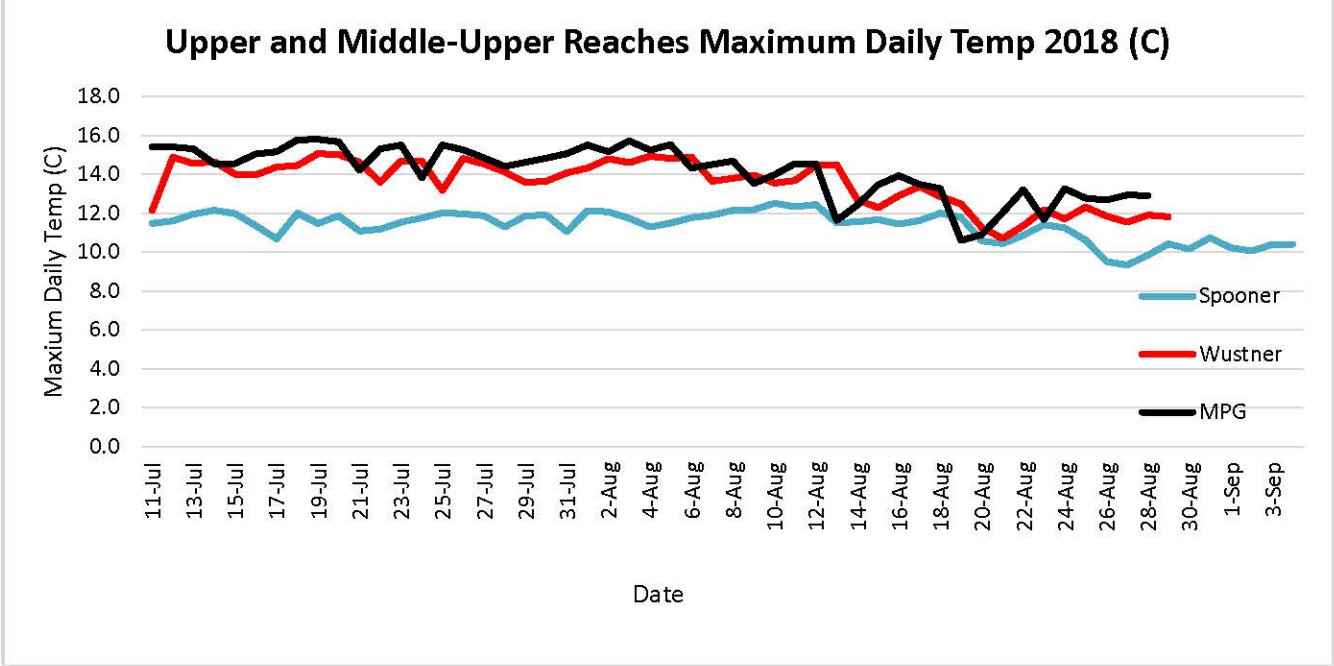


Figure 28: Maximum daily temperatures recorded on the upper and middle-upper reaches of Miller Creek in summer, 2018.

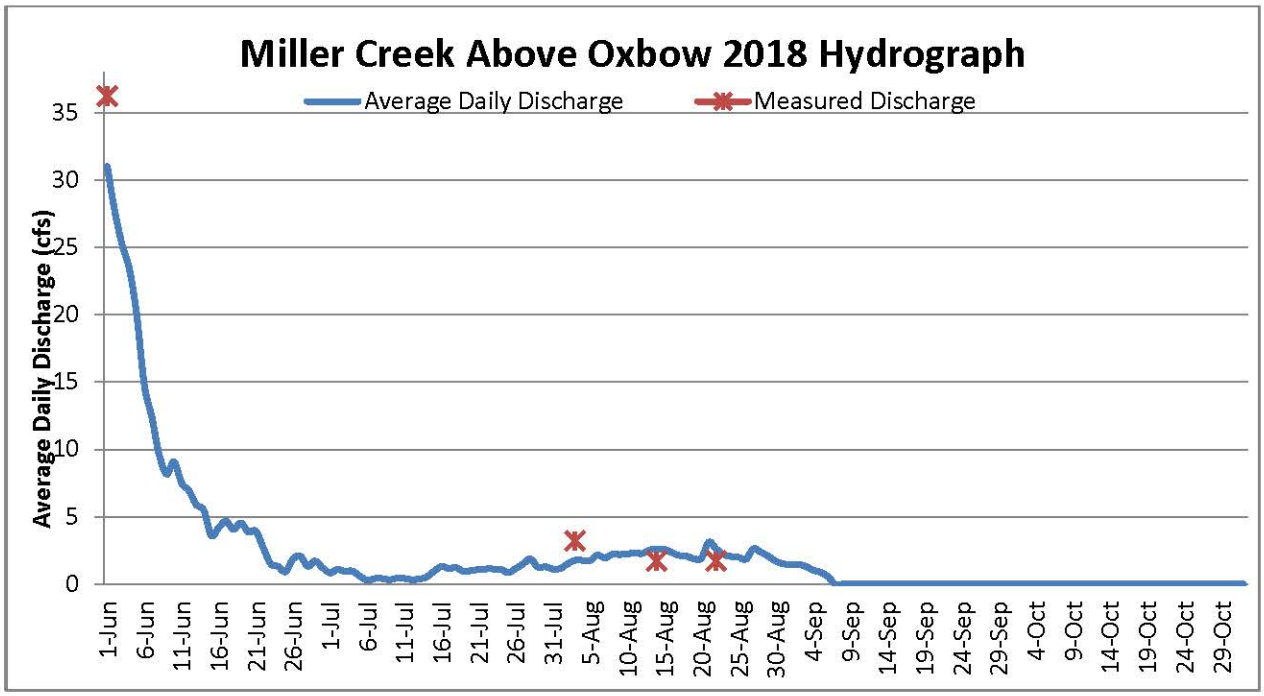


Figure 29: Hydrograph showing daily discharge at a Miller Creek flow monitoring site in the lower reach of the assessment.

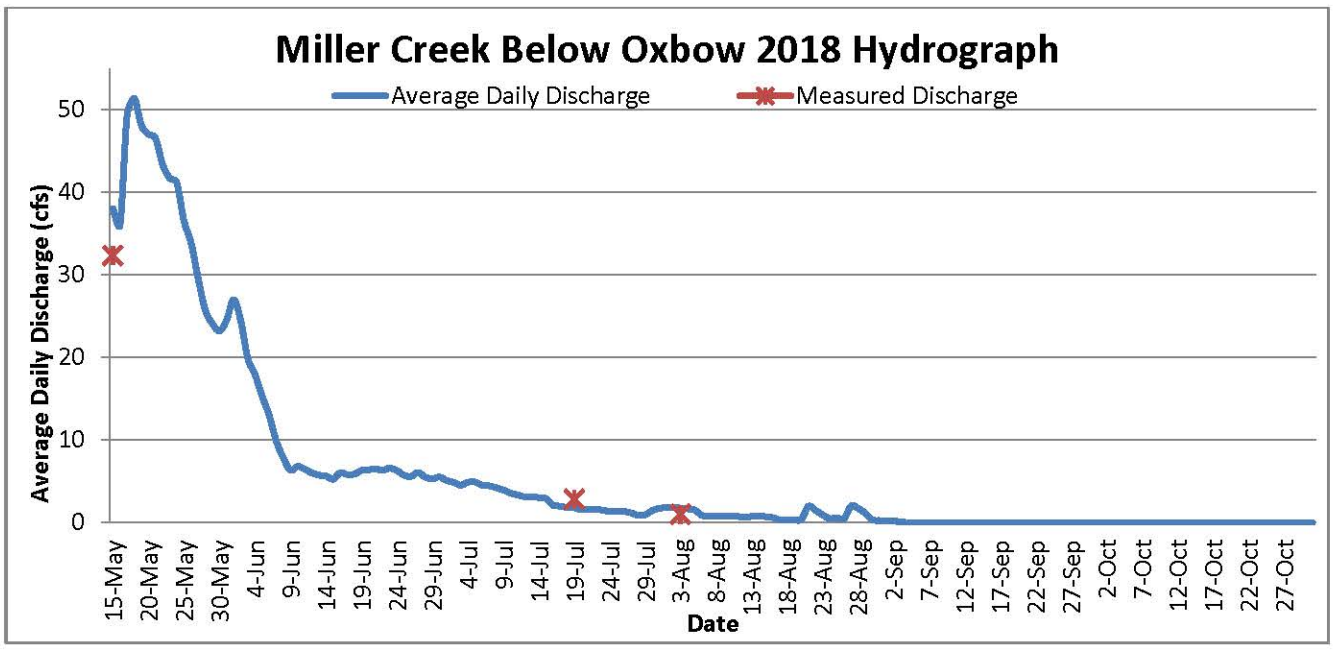


Figure 30: Hydrograph showing daily discharge at a Miller Creek flow monitoring site below the lower reach of the assessment.

A synoptic monitoring run was performed on August 22, 2018. The purpose of the synoptic run was to assess baseline flows during low flows, and show the inputs and outputs of the creek from the upper to lower reaches. The following map and table illustrate the flows at the end of August.

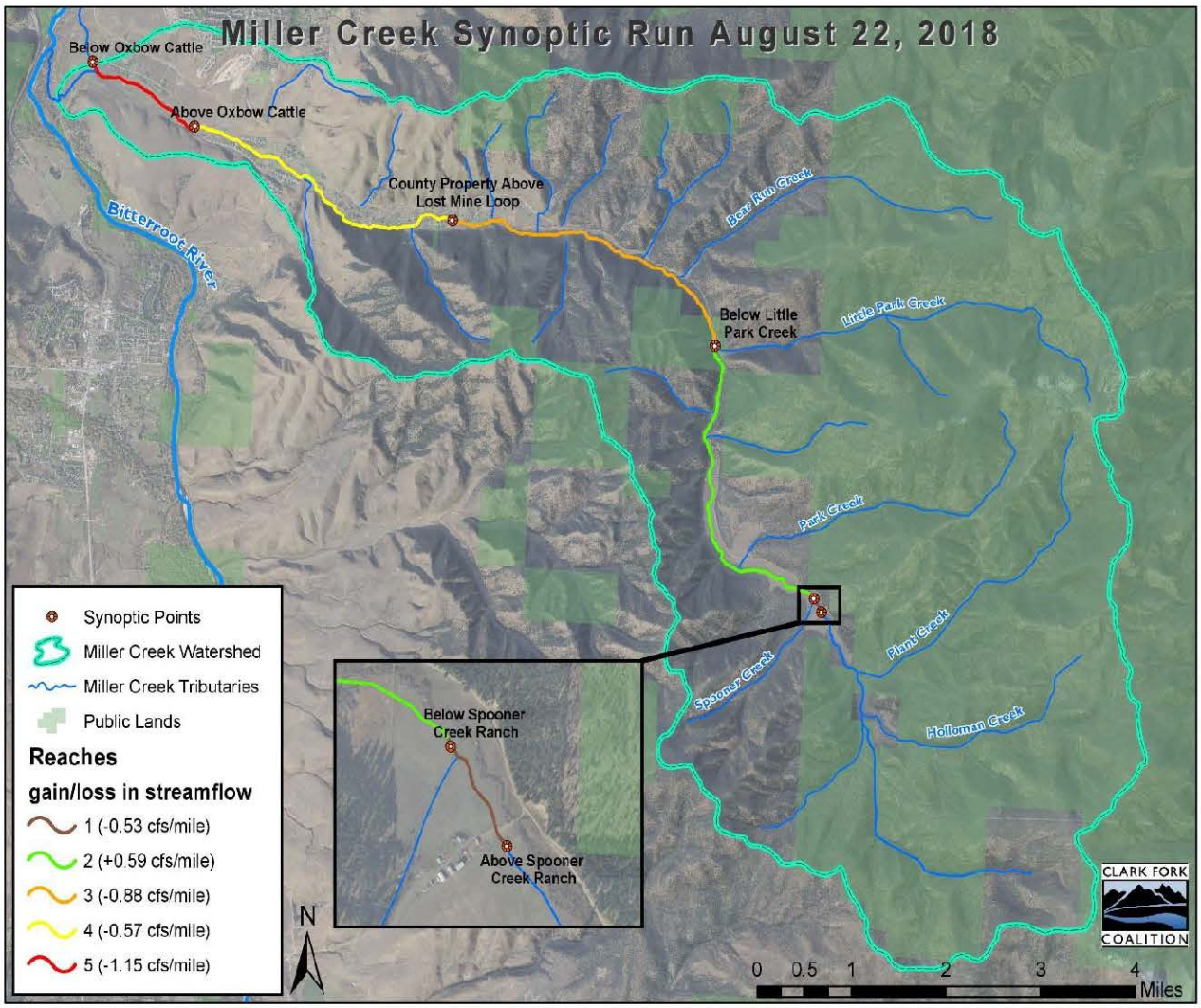


Figure 31: Map of Miller Creek synoptic flow run, August 2018.

Miller Creek Synoptic Run August 22, 2018	
Site	Discharge
Spooner Creek Ranch Above Spooner Creek	4.6
Spooner Creek Ranch Below Spooner Creek	4.5
Below Little Park Creek	6.5
County Property Above Lost Mine Loop	3.4
Above Oxbow	1.7
Below Oxbow	0.5

Table 23: Flows taken at during the August 22, 2018 synoptic run. See Figure X for map of sites.

Discussion and Restoration Recommendations

As this report was a 'first look' at the Miller Creek watershed more in depth data will needed to be collected as projects are developed. It is important to note that 2018 was considered a good water year, due to above average snowpack in winter 2017/2018. As such, flows could be considered to be higher than normal, and based on anecdotal local knowledge of the stream, the lower reaches of Miller Creek dried up later than normal during 2018.

In 2018, temperatures on the upper reaches of Miller Creek are sufficient to sustain trout species throughout the summer, while the lower reaches surpassed the lethal temperature for most trout by mid-July. The chart below shows optimum growth and lethal temperature for Montana trout species.

Species	Optimum Growth Temperature (°C)	Upper Incipient Lethal Temperature °C)
Rainbow Trout	13.1	24.3
Brown Trout	16.9	24.7
Brook trout	14.0	24.5
Cutthroat Trout	13.6	19.6
Bull Trout	13.2	20.9

Table 24: Optimum growth and lethal tempertures for Montana trout species. The data for this table was pulled from the Clark Fork Coalition April blog post, Some like it Hot, Trout do not. Link: https://clarkfork.org/4481-2/

Based off of the 28% of the stream length that was surveyed for this report, it is Clark Fork Coalition's recommendations that restoration actions in Miller Creek are prioritized as follows:

1. Based on data collected the upper and middle upper reaches contain the highest quality habitat with good base flows and water temperatures for salmonids. It is our recommendation to prioritize projects that reduce sediment and enhance fish habitat in these reaches.
2. Protect present pure-strain cutthroat populations in the tributaries of Miller Creek. More data is needed on these populations.
3. Repair all "Red" fish passage barriers and secondly "Gray" fish passage barriers to ensure migration for all life stages of fish at all times.
4. Address connectivity issues (dewatering/ multi-thread channels/large sediment deposits) in the lower watershed to ensure the maximum amount of migration for all life stages as much as possible (environmental limits apply).
5. Address channel incision/ sediment issues throughout the watershed to reconnect the floodplain and improve stream temperatures and instream habitat quality and quantity.
6. Address fish entrainment issues in the lower watershed.
7. Improve riparian health by reconnecting the floodplain via the implementation of beaver dam mimicry projects, revegetation, and riparian fencing to reduce the impacts of grazing. Improving riparian health could help combat some of the temperature issues seen on the lower reaches of creek.

References

Beechie, T., G. Pess, P. Roni, and G. Giannico. 2008. Setting river restoration priorities: a review of approaches and a general protocol for identifying and prioritizing actions. North American Journal of Fisheries Management 28:891-905.

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Montana Department of Environmental Quality. 2011. Bitterroot Temperature and Tributary Sediment Total Maximum Daily Loads and Framework Water Quality Improvement Plan.

Natural Resources Conservation Service. 2004. Riparian Assessment Using the NRCS Method.

United States Forest Service. 2008. Assessment of Aquatic Organism Passage at Road/Stream Crossings for the Northern Region of the USDA Forest Service.

United States Forest Service. 2005. National Inventory and Assessment Procedure for Identifying Barriers to Aquatic Organism Passage at Road-Stream Crossings.

Appendix 1: Habitat Assessment Summary Data

Reach	Date	Observers	Rosgen Channel Type	BFD (ft)	BFW (ft)	W/D (ft)	Substrate	Slope (%)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total Score	NRCS Score
NWE_1	6/12/2018	WM, FC, JW	G	0.93	12.5	13.5	Cobble	2.0	2	3	3	2	0	0	0	0	4	0	14	23%
NWE_2	6/12/2018	WM, FC, JW	G	0.88	14	15.9	Cobble	2.0	2	3	3	2	0	0	0	0	4	0	14	23%
Stillwater_1	6/22/2018	TP, FC	B	0.95	10.7	11.26	Cobble	1.5	5	5	3	1	0	0	0	0	2	0	16	27%
Capon_1	6/22/2018	TP, FC	B	1.03	11.2	10.87	Cobble	1.0	3	6	3	2	0	1	0	0	1	0	16	27%
Singletree_1	8/3/2018	TP, FC	G	1.2	9.8	8.2	Gravel	0.7	0	0	2	0	0	2	0	0	4	0	8	13%
Singletree_2	8/3/2018	TP, FC	C	0.65	10	15.4	Gravel	1.5	2	3	4	6	4	2	0	5	4	4	34	57%
Singletree_3	8/3/2018	TP, FC	C	0.9	13.1	14.6	Gravel	1.5	8	5	2	4	6	2	0	5	4	6	42	70%
Wustner_1	6/20/2018	TP, FC	C	0.85	19.6	23.1	Cobble	1.0	2	2	2	3	1	2	2	5	1	0	20	33%

USFS_3	USFS_2	USFS_1	Spooner_1	MPG_2	MPG_1	DNRC_3	DNRC_2	DNRC_1	**Reach**
6/20/2028	6/20/2018	6/20/2018	6/19/2018	6/19/2018	6/19/2018	6/12/2018	6/18/2018	6/18/2018	**Date**
TP,FC	TP,FC	TP,FC	TP,FC	TP,FC	TP,FC	TP,FC	TP,FC	TP,FC	**Observers**
G	DA to D	C	G	C	C	B	C	G	**Rosgen Channel Type**
1.12	N/A	0.95	1.4	1.05	0.93	1.05	1.1	1.275	**BFD (ft)**
7.1	N/A	8.5	8.6	12.5	12.4	11.9	15	23.1	**BFW (ft)**
6.3	N/A	8.95	6.14	11.9	13.3	11.3	13.6	18.1	**W/D (ft)**
Gravel	Gravel	Gravel	Gravel	Gravel	Gravel	Gravel	Gravel	Gravel	**Substrate**
0.5	--	0.8	0.5	0.5	1.5	1.5	1.0	2.0	**Slope (%)**
1	4	6	2	7	6	6	2	3	**Q1**
5	0	5	3	6	3	5	1	0	**Q2**
2	1	3	3	5	5	6	2	6	**Q3**
2	2	3	5	4	6	6	6	6	**Q4**
2	6	6	1	1	6	6	6	6	**Q5**
3	2	2	2	2	2	2	2	2	**Q6**
3	3	3	3	3	3	2	3	3	**Q7**
6	6	4	8	6	8	8	8	7	**Q8**
4	4	4	4	4	4	4	4	3	**Q9**
0	8	4	1	7	4	8	4	1	**Q10**
28	36	40	32	45	47	53	38	37	**Total Score**
47%	60%	67%	53%	75%	78%	88%	63%	62%	**NRCS Score**

Appendix 2: USFS Fish Passage Survey Results

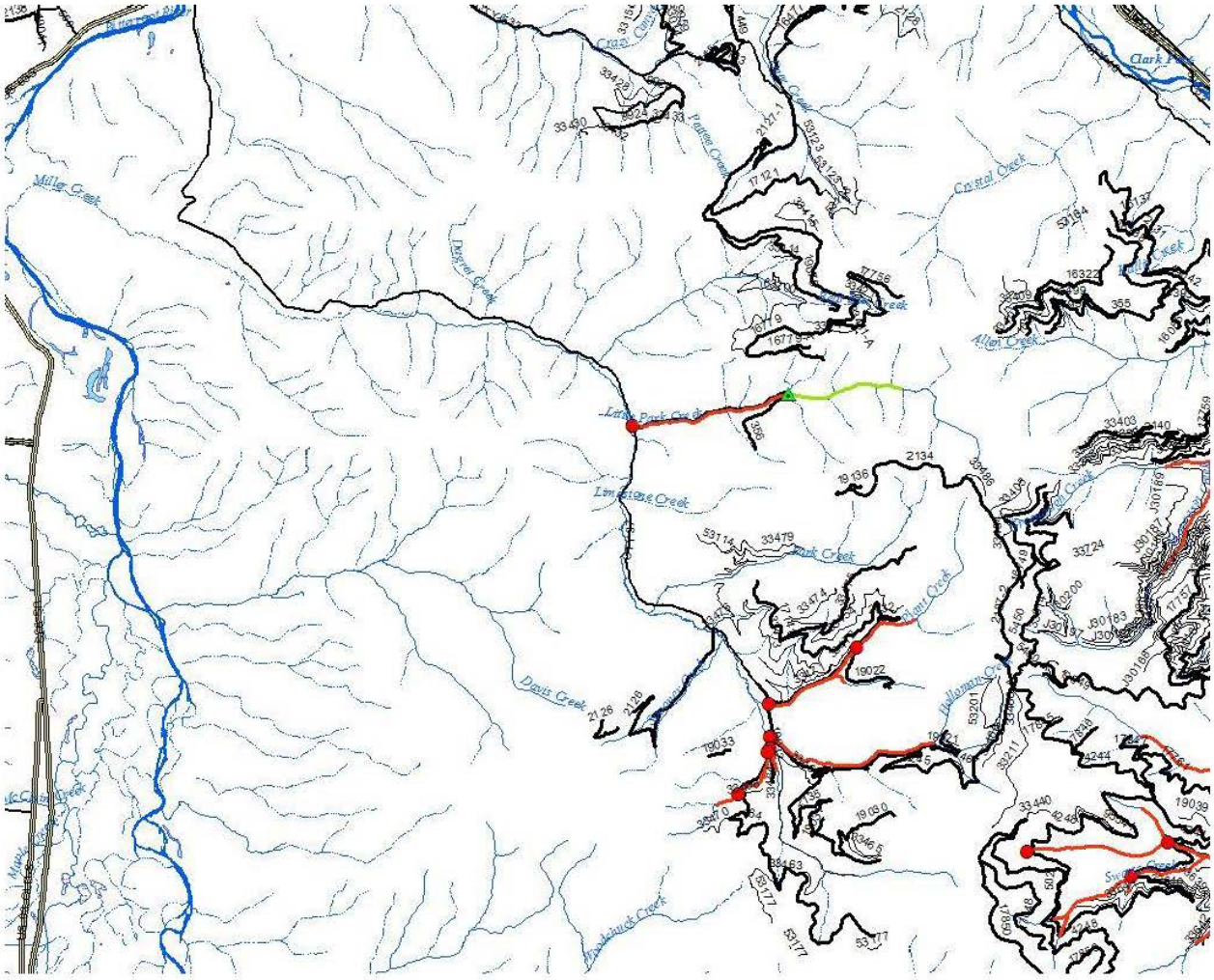

Figure x. Fish passage survey results for all USFS stream crossings in the Miller Creek watershed (red = total barrier, green = no barrier).


Wustner Property Proposed Restoration Project
Landowner: Jacob Wustner
Polluted Waterbody: Miller Creek
Bottom of reach
Lat/Long:46.776490, -113.956403
Miller Creek
Bear Run Creek
N
Top of reach
Lat/Long:46.774092, -113.951397
0
700 Feet
CLARK FORK
COALITION

Wustner Property Pictures

Miller Creek, Missoula County, Montana

Figure 1: Picture taken Summer, 2018. This reach of Miller Creek is characterized by 8-10 foot incised banks.

Figure 2: Picture taken October, 2019. Sloughing banks on the lower stretch of the Wustner Property reach of Miller Creek.

Figure 3: Photo taken October, 2019. Miller Creek has been straightened in this stretch. The system is incised and has a simplified habitat, with little riparian vegetation.

Geum Environmental Consulting

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Hamilton, Montana 58940
Phone: 406-363-2353, Fax: 406-363-3015
http://www.geumconsulting.com

TO: Jed Whiteley, Clark Fork Coalition

FROM: Amy Sacry, Geum Environmental Consulting

DATE: March 13, 2019

RE: DRAFT Miller Creek Restoration Design Concept – Wustner

This memo outlines restoration design concepts for the Wustner property on Miller Creek. The purpose of this memo is to support funding acquisition for the work. Restoration concepts were developed primarily through aerial photo interpretation with limited site review.

Wustner Property Restoration Design Concept

Approximately 0.35 miles of Miller Creek flows through the Wustner Property. The stream is confined along the south side of the valley and most of the reach is characterized by a deeply incised channel, between 8 and 10 feet, and active lateral erosion. The lower portion of this reach has a more dynamic channel that has changed location several times in the last 15 years, but relatively stable since large changes occurred in the 2011 high flow event. These alterations have resulted in a loss of connectivity between the channel and floodplain, increased fine sediment delivery to the channel, reduced aquatic habitat diversity, and reduced riparian vegetation cover, all of which contributed to overall degraded conditions in the watershed.

The goals of restoration on the Spooner Property include:

- Reduce fine sediment delivery to the channel.
- Increase connectivity between the channel and the floodplain.
- Increase riparian corridor width and woody vegetation cover.
- Enhance aquatic habitat.
- Increase ecological function of the riparian corridor.

Restoration Concept Elements

A general conceptual approach to stream and riparian restoration was developed for the Wustner Property. The conceptual restoration approach includes extensive channel realignment to move the channel away from active fine sediment sources, maximize floodplain connectivity, and increase aquatic habitat diversity. The approach also includes construction of side or distributary channels to maximize floodplain connectivity where there is room. Both approaches achieve restoration goals.

Conceptual Design includes the following elements:

- **Channel Shaping and Realignment.** Re-align the channel away from fine sediment sources (vertical eroding streambanks).

- **Floodplain Grading.** Grade steep slopes to increase floodplain area and reduce risk of further toe erosion.
- **Woody Brush Matrix Streambank Treatments.** Install streambank structures consisting of woody debris and brush to enhance aquatic habitat and floodplain function.
- **Woody Debris Habitat Structures.** Install woody debris habitat structures to enhance floodplain connectivity and increase aquatic habitat diversity.
- **Riparian Shrub Clump Planting** Selectively plant riparian shrubs and trees. Planted trees and shrubs will require installation of small fences to prevent browse by ungulates.
- **Small Exclosure Fences**. In areas where natural regeneration is suppressed by deer and elk browse, install small exclosure fences to encourage vegetative growth.
- **Side Channels/Distributary Flow Channels.** Construct side channels and distributary flow channels in areas where past flood disturbances have increased floodplain width and connectivity.

Figures showing conceptual treatment locations are provided by reach In Attachment A. Estimated costs for implementing the conceptual restoration design are provided in Attachment A. Typical detail drawings of streambank and channel structures are provided in Attachment C.

Attachment 2: Wustner Conceptual Restoration Design & Costs

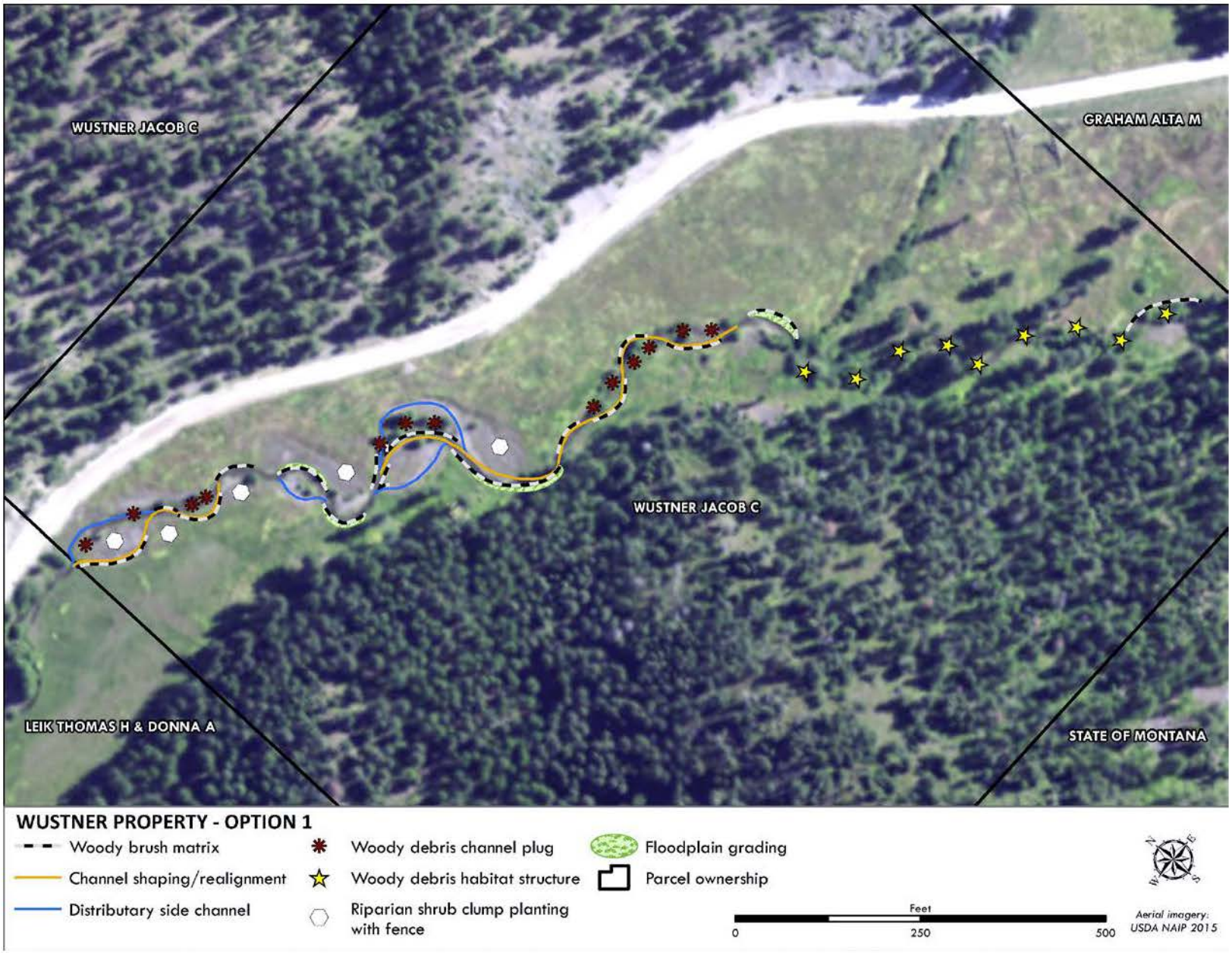

WUSTNER JACOB C
GRAHAM ALTA M
WUSTNER JACOB C
LEIK THOMAS H & DONNA A
STATE OF MONTANA
WUSTNER PROPERTY - OPTION 1
Woody brush matrix
Channel shaping/realignment
Distributary side channel
Woody debris channel plug
Woody debris habitat structure
Riparian shrub clump planting with fence
Floodplain grading
Parcel ownership
Feet
0
250
500
Aerial imagery: USDA NAIP 2015

Table 1. Estimated Treatment Quantities for Wustner Property Conceptual Restoration Design	
Treatment	**Estimated Quantity**
Woody Brush Matrix Streambank Treatment	1,300 linear feet
Woody Debris Habitat Structure/Channel Plug	22
Channel Shaping/Realignment	1,000 linear feet
Distributary Side Channel Construction	600 linear feet
Floodplain Grading and Roughness	2,000 square feet (350 cubic yards)
Riparian Shrub Planting with 6-ft Fence	5 locations approx. 20' x 20' each, 50 plants each
Small Exclosure Fences (to protect existing vegetation)	200 feet (no conceptual locations identified)

Table 2. Estimated Costs for Wustner Property Option 1 Conceptual Restoration Design					
Item	**Description**	**Quantity**	**Units**	**Unit Cost**	**Cost**
1	Mobilization and Demobilization (5% of total cost)	1	Lump Sum	$2,500.00	$2,500.00
2	Water Management	1	Lump Sum	$500.00	$500.00
3	***Acquire Trees (min dbh 12")***	***30***	***Trees***	***$150.00***	***$4,500.00***
4	Acquire Rock (6 inch for toe material along steep streambanks)	50	Cubic Yards	$30.00	$1,500.00
5	Channel Realignment/Construction	1,000	Linear Feet	$15.00	$15,000.00
6	Distributary Side Channel Construction	600	Linear Feet	$5.00	$3,000.00
7	Woody Brush Matrix Streambank Treatment	1,300	Linear Feet	$10.00	$13,000.00
8	Woody Debris Habitat Structures/Channel Plugs	22	Each	$200.00	$4,400.00
9	***Willow Cuttings for Streambank Treatments***	***4,000***	***Each***	***$0.50***	***$2,000.00***
10	Floodplain Grading	350	Cubic Yards	$3.00	$1,050.00
11	Floodplain Roughness Treatment	0.50	Acre	$500.00	$250.00
12	Containerized Woody Plants	250	Each	$3.50	$875.00
13	***Install Containerized Woody Plants (30 cubic inch)***	***250***	***Each***	***$4.00***	***$1,000.00***
14	Fencing: small 6-ft wire fences to protect planted shrubs or existing vegetation	600	Linear Feet	$2.00	$1,200.00
15	***Install Fencing***	***600***	***Linear Feet***	***$2.00***	***$1,200.00***
16	Native Seed	30	Lb	$12.00	$360.00
17	***Apply Seed***	***1***	***Acre***	***$85.00***	***$85.00***
	Estimated Construction Sub-total				**$52,420.00**
	10% Contingency				$5,000.00
	Estimated Construction Total				**$57,420.00**
	Estimated Construction Sub-total Minus In-Kind Costs				**$43,635.00**

[1] Items in ***BOLD ITALICS*** indicate where the landowner or Clark Fork Coalition can provide in-kind services as funding match.

Table 2 Continued. Wustner Property Additional Project Costs		
Item	**Description**	**Estimated Cost**

1	Design (analysis, plan set, permitting, bid support, logistics)	$15,000.00
2	Construction Oversight (staking, 1 week oversight)	$10,000.00
3	Engineer: No-rise certification	$5,000.00
4	***Labor Support for Construction***	***$2,500.00***
5	***Construction Completion Documentation***	***$2,500.00***
6	***Monitoring and Maintenance (5%)***	***$2,750.00***
	Sub-total Other Costs	**$37,750.00**
	Sub-total Other Costs Minus In-Kind Costs	$30,000.00
	TOTAL PROJECT ESTIMATE	**$95,170.00**
	TOTAL PROJECT ESTIMATE MINUS IN-KIND COSTS	**$73,635.00**

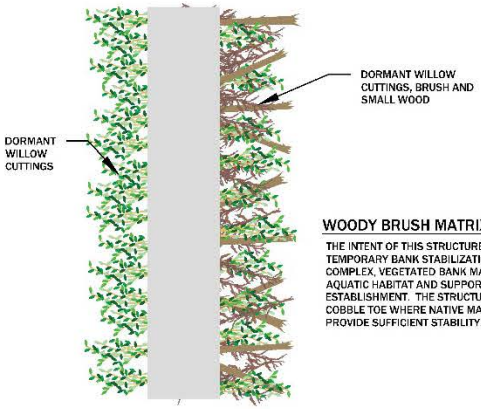
[1] Items in ***BOLD ITALICS*** indicate where the landowner or Clark Fork Coalition can provide in-kind services as funding match.

Assumptions for Construction Cost Estimate

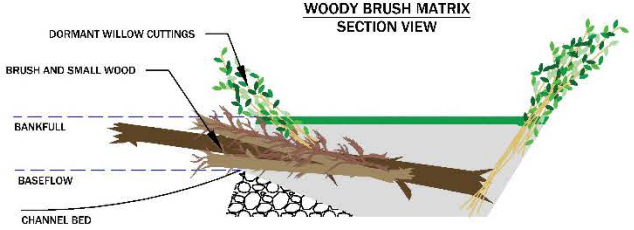
1. Costs are based on Conceptual Estimates – a 10% contingency was added for uncertainty
2. Mobilization and Demobilization could be significantly less for local contractor
3. Costs assume that permits will allow construction to occur in the wet or by isolating the work area

Attachment 3: Typical Structure Treatment Details

WOODY BRUSH MATRIX PLAN VIEW



WOODY BRUSH MATRIX SECTION VIEW



WOODY BRUSH MATRIX IMAGES

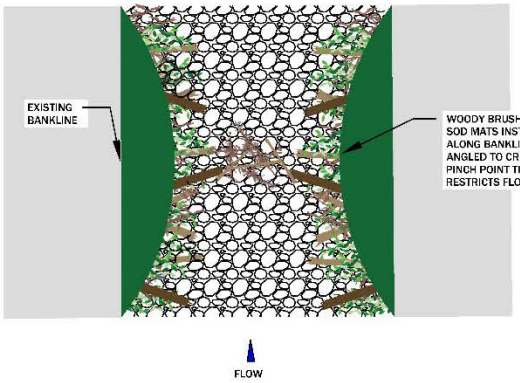
WOODY BRUSH MATRIX DESCRIPTION

THE INTENT OF THIS STRUCTURE IS TO PROVIDE TEMPORARY BANK STABILIZATION AND CREATE A COMPLEX, VEGETATED BANK MARGIN THAT CREATES AQUATIC HABITAT AND SUPPORTS VEGETATION ESTABLISHMENT. THE STRUCTURE MAY BE BUILT ON A COBBLE TOE WHERE NATIVE MATERIALS DO NOT PROVIDE SUFFICIENT STABILITY.

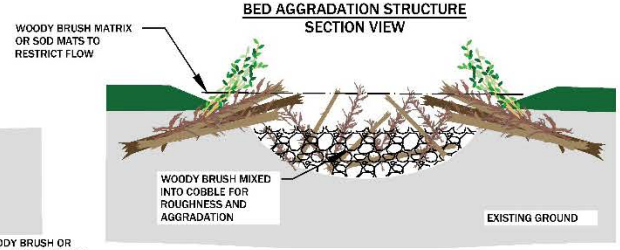
CONSTRUCTION NOTES

1. EXCAVATE STREAMBANK TO SUBGRADE ELEVATIONS.
2. CONSTRUCT COBBLE TOE WHERE NEEDED AND ACCORDING TO SPECIFIED DIMENSIONS.
3. INSTALL A MATRIX OF SMALL LOGS IN THE STREAMBANK AT A DOWNWARD ANGLE TO THE STREAMBANK. LOGS MAY OVERLAP, BUT SHOULD BE PLACED BELOW THE TOP OF BANK ELEVATION.
4. PLACE BRUSH WITHIN THE MATRIX OF SMALL LOGS.
5. PLACE WILLOW CUTTINGS INTO THE MATRIX OF LOGS AND BRUSH AS SHOWN IN THE DRAWING WITH STEMS IN CONTACT WITH THE BASEFLOW WATER TABLE AND TOPS EXTENDING A MINIMUM OF 2' ABOVE BANKFULL ELEVATION.
6. BACKFILL STREAMBANK WITH STREAMBANK FILL. WASH FINES WITH WATER FROM ON-SITE INTO THE STREAMBANK FILL TO SEAL VOIDS. LEAVE AREA FOR SOD MAT PLACEMENT 0.5' BELOW THE FINISH GRADE ELEVATION IF SOD MATS ARE AVAILABLE. BACKFILL THE REST OF THE BANK TO THE DESIGN TOP OF BANK ELEVATION AND BLEND INTO ADJACENT GROUND. IF NO SOD MATS ARE AVAILABLE, FILL TO DESIGN ELEVATION WITH STREAMBANK FILL.
7. PLACE SALVAGED SOD MATS BEHIND PLACED BRUSH AND WILLOW CUTTINGS. ENSURE MATS HAVE GOOD CONTACT WITH ADJACENT MATS AND BACKFILL GAPS WITH SOIL AS NEEDED. BUCKET COMPACT MATS TO DESIGN ELEVATION AND ENSURE GOOD SOIL CONTACT.

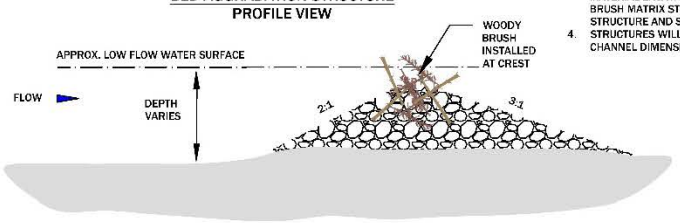
BED AGGRADATION STRUCTURE PLAN VIEW



BED AGGRADATION STRUCTURE SECTION VIEW



BED AGGRADATION STRUCTURE PROFILE VIEW



BED AGGRADATION STRUCTURE DESCRIPTION

THE INTENT OF THIS STRUCTURE IS TO INCREASE FLOODPLAIN CONNECTIVITY. THE STRUCTURE WILL CREATE CONDITIONS FOR ACCUMULATION OF SEDIMENT (COARSE AND FINE) WITHIN THE CHANNEL AND ENCOURAGE OUT OF BANK FLOW AT HIGH FLOW AND RAISE THE ELEVATION OF BASE FLOWS.

CONSTRUCTION NOTES

1. INSTALL COBBLE WITHIN CHANNEL. WHILE FILLING WITH COBBLE INCORPORATE WOODY BRUSH TO PROVIDE ROUGHNESS AT CREST OF STRUCTURE AND CREATE INTERSTITIAL SPACES TO NATURALLY TRAP FINE SEDIMENT. COBBLE AND WOODY BRUSH SHOULD SPAN THE CHANNEL AND REACH THE DESIRED CREST HEIGHT FOR THE SPECIFIED LOCATION.
2. CREATE A 2:1 COBBLE SLOPE EXTENDING FROM THE CREST OF THE STRUCTURE UPSTREAM UNTIL EXISTING CHANNEL BED IS REACHED. CREATE A 3:1 SLOPE EXTENDING FROM THE CREST OF THE STRUCTURE DOWNSTREAM UNTIL EXISTING CHANNEL BED IS REACHED.
3. EXCAVATE A SMALL BENCH ALONG THE STREAMBANK AT A SLIGHT ANGLE FROM THE TOP OF BANK DOWNWARD EXTENDING TOWARD THE FLOODPLAIN TO BASEFLOW WATER TABLE. INSTALL A MATRIX OF SMALL LOGS, BRUSH, AND WILLOW CUTTINGS TO CREATE THE WOODY BRUSH MATRIX TREATMENT. BACKFILL THE STREAMBANK TO THE TOP OF BANK ELEVATION WITH THE NATIVE MATERIAL EXCAVATED TO CREATE THE BENCH. THIS WILL CREATE A WOODY BRUSH MATRIX STREAMBANK TO SLOW FLOW OVER THE CREST OF THE STRUCTURE AND SUPPORT NATURAL REVEGETATION.
4. STRUCTURES WILL VARY IN HEIGHT, WIDTH, AND DEPTH DEPENDING ON CHANNEL DIMENSIONS IN CONSTRUCTION LOCATIONS.

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HAVRE, MT 59501
406.265.2253
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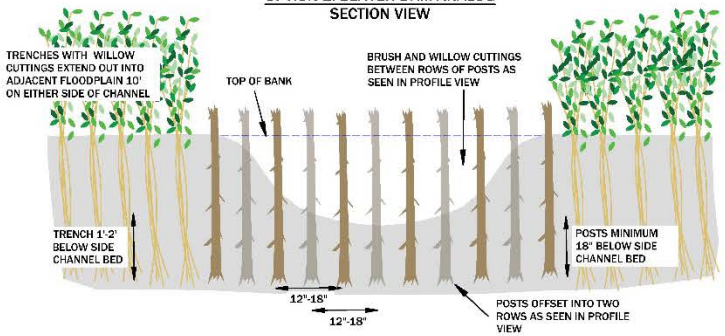
WOODY BRUSH MATRIX AND BED AGGRADATION STRUCTURE DETAILS

MILLER CREEK

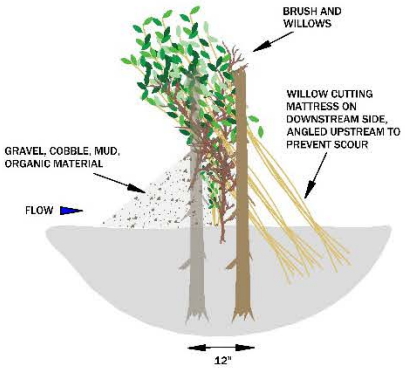
DRAWN BY: A GILLEY
DESIGNED BY: A BACRY
DATE: FEBRUARY 2019

SHEET
1.0

OPTION 1: BEAVER DAM ANALOG
SECTION VIEW



OPTION 1: BEAVER DAM ANALOG
PROFILE VIEW



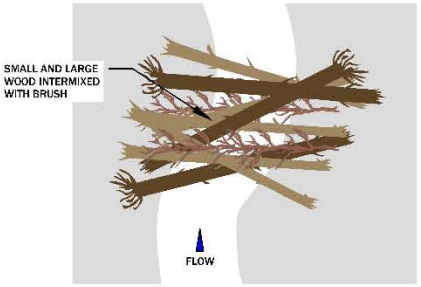
BEAVER DAM ANALOG DESCRIPTION

THE INTENT OF THIS STRUCTURE IS TO INCREASE FLOODPLAIN CONNECTIVITY AND DIVERSITY. THE STRUCTURE WILL CREATE CONDITIONS FOR ACCUMULATION OF SEDIMENT AND ENCOURAGE OUT OF BANK FLOWS.

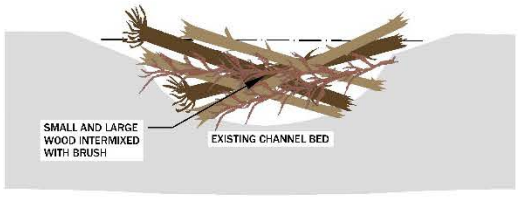
CONSTRUCTION NOTES

1. EXCAVATE A TRENCH EXTENDING INTO THE FLOODPLAIN ON EITHER SIDE OF THE STAKED BEAVER DAM ANALOG LOCATION. THE TRENCH SHOULD EXTEND APPROXIMATELY 1-2 FT BELOW THE BED OF THE SIDE CHANNEL. PLACE WILLOW CUTTINGS AT A SPACING OF 5/LINEAR FOOT INTO THE TRENCH AND BACKFILL WITH EXCAVATED NATIVE FLOODPLAIN FILL.
2. INSTALL TWO ROWS OF POSTS SPANNING THE WIDTH OF THE SIDE CHANNEL BETWEEN THE TWO FLOODPLAIN TRENCHES. SPACE ROWS 12 IN APART. SPACE POSTS IN EACH ROW APPROXIMATELY 12-18 IN APART AND ENSURE THAT AT LEAST ONE ROW OF STAKES HAS ONE STAKE INSTALLED IN THE BANK OF THE SIDE CHANNEL. STAKES SHOULD BE DRIVEN A MINIMUM OF 18 IN BELOW THE BED OF THE SIDE CHANNEL.
3. INSTALL BRUSH (GREEN CONIFER BRANCHES PREFERRED) AND WILLOW CUTTINGS IN THE 12 IN SPACE BETWEEN THE TWO ROWS OF POSTS. INSTALL BRUSH AND CUTTINGS IN 0.5 FT LAYERS AND COMPACT EACH LAYER AFTER INSTALLATION.
4. PRIOR TO INSTALLING THE FINAL LAYER (0.5 FT) OF BRUSH, INSTALL A MATTRESS OF WILLOW CUTTINGS ON THE DOWNSTREAM SIDE OF THE BEAVER DAM ANALOG. ORIENT CUTTINGS IN AN UPSTREAM DIRECTION WITH THE CUT ENDS BURIED INTO THE SIDE CHANNEL BED AND THE BRANCH TIPS EXTENDING UPSTREAM AND ON TOP OF THE LAST PLACED LAYER OF BRUSH BETWEEN THE POSTS. INSTALL THE FINAL LAYER OF BRUSH BETWEEN THE POSTS ON TOP OF THE WILLOW MATTRESS CUTTINGS TO SECURE THEM.
5. INSTALL A WEDGE OF COBBLE, GRAVEL, MUD AND ORGANIC MATTER ALONG THE UPSTREAM ROW OF POSTS. COMPACT MATERIAL TO ENSURE GOOD CONTACT WITH THE POSTS, BRUSH, CHANNEL BED AND CHANNEL BANKS.

OPTION 2: LARGE WOOD HABITAT STRUCTURE
PLAN VIEW



OPTION 2: LARGE WOOD HABITAT STRUCTURE
SECTION VIEW



LARGE WOOD HABITAT STRUCTURE IMAGES

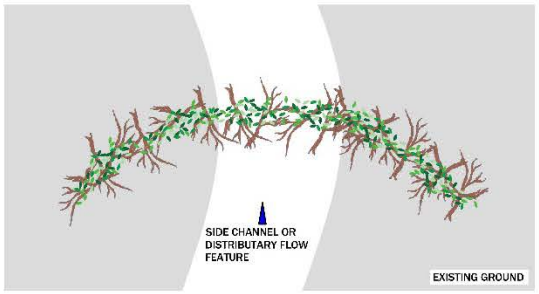
LARGE WOOD HABITAT STRUCTURE DESCRIPTION

THE INTENT OF THIS STRUCTURE IS TO PROVIDE DIVERSE AQUATIC HABITAT. HABITAT STRUCTURES AIM TO MIMIC NATURAL ACCUMULATIONS OF WOOD THAT CREATE VARIABLE HYDRAULICS THAT RESULT IN SCOUR, DEPOSITION AND ORGANIC MATTER ACCUMULATION. THESE STRUCTURES ARE PLACED WHERE THERE IS MATURE WOODY VEGETATION OR LOW FLOODPLAIN BENCHES TO MINIMIZE RISK OF LOCALIZED STREAMBANK EROSION.

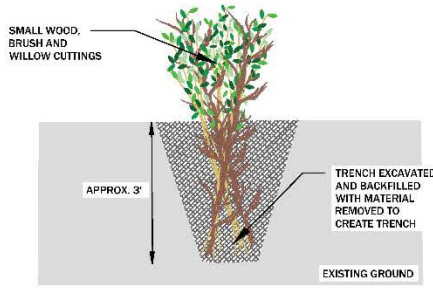
CONSTRUCTION NOTES

1. STOCKPILE LOGS AND BRUSH NEEDED FOR EACH STRUCTURE SITE.
2. INSTALL LARGE LOGS SO THAT ONE END EXTENDS INTO THE ADJACENT FLOODPLAIN AND THE OTHER END ANGLES DOWN TOWARD THE CHANNEL. LARGE LOGS SHOULD BE INSTALLED AT DIFFERENT ORIENTATIONS AND ANGLES TO FORM THE MATRIX OF THE STRUCTURE. WHERE POSSIBLE, LOGS SHOULD BE PASSIVELY ANCHORED INTO STREAMBANKS AND FLOODPLAINS BY BRACING THE LOG AGAINST TREES OR MATURE SHRUBS. ONE OR BOTH ENDS MAY BE BURIED INTO THE CHANNEL BANKS TO INCREASE STABILITY AND HABITAT DIVERSITY.
3. ONCE THE LARGE LOG MATRIX IS INSTALLED, INSTALL BRUSH AND SMALL LOGS WITHIN THE MATRIX.

OPTION 3: VEGETATED BRUSH TRENCH
PLAN VIEW



OPTION 3: VEGETATED BRUSH TRENCH
SECTION VIEW



VEGETATED BRUSH TRENCH DESCRIPTION

THE INTENT OF THIS STRUCTURE IS TO INCREASE FLOODPLAIN CONNECTIVITY BY INCREASING FLOODPLAIN ROUGHNESS TO DISPERSE SURFACE FLOWS AND ALLOW WOODY RIPARIAN VEGETATION TO ESTABLISH.

CONSTRUCTION NOTES

1. EXCAVATE A TRENCH APPROXIMATELY 3' DEEP AND EXTENDING THE LENGTH OF THE TREATMENT LOCATION.
2. WILLOW CUTTINGS AND BRUSH WILL BE PLACED IN THE TRENCH SUCH THAT THEY ARE INTERMIXED AND ORIENTED AT A NEAR VERTICAL ANGLE.
3. THE TRENCH WILL THEN BE BACKFILLED WITH THE SAME MATERIAL REMOVED TO CREATE THE TRENCH AND SHOULD MATCH THE ELEVATION OF THE SURROUNDING FLOODPLAIN GRADE.

oeum Environmental Consulting
307 E 7TH ST
HAILEY, ID 83333
406.360.2253
permissions.org.com

WOODY DEBRIS HABITAT STRUCTURE OPTIONS

MILLER CREEK

DRAWN BY: A GILLEY
DESIGNED BY: A BACRY
DATE: FEBRUARY 2019

SHEET
2.0


MPG Property Proposed Restoration Project
Landowner: MPG Ranch Holdings LLC
Polluted Waterbody: Miller Creek
Bottom of Reach
Lat/Long: 46.7556,-133.9424
Top of Reach
Lat/Long: 46.7542,-113.9439
CLARK FORK
COALITION
0
500 Feet
N

MPG Ranch Property Pictures

Miller Creek, Missoula County, Montana

Figure 1: Picture taken October, 2019. This reach of Miller Creek is channelized, entrenched and lacking riparian vegetation.

Figure 2: Photo taken October, 2019. This reach of Miller Creek is channelized, entrenched, and lacking riparian vegetation.

Figure 3: Photo taken October, 2019. This reach of Miller Creek is channelized, entrenched, and lacking riparian vegetation.

Figure 4: Photo taken October, 2019. This reach of Miller Creek is channelized, entrenched, and lacking riparian vegetation.


O'Brien Creek Proposed Restoration Project
Landowner: O'Brien Creek Meadows HOA
Bottom of Reach
Lat/long: 46.8497,-114.1102
Top of Reach
Lat/Long: 46.8485, -114.1128
O'Brien Creek
Bitterroot River
0
0.3 Miles
N
CLARK FORK
COALITION

O’brien Creek 2019: O’brien Creek Meadows HOA Reach Pre-Project Photos

Large cut bank at the top of the reach

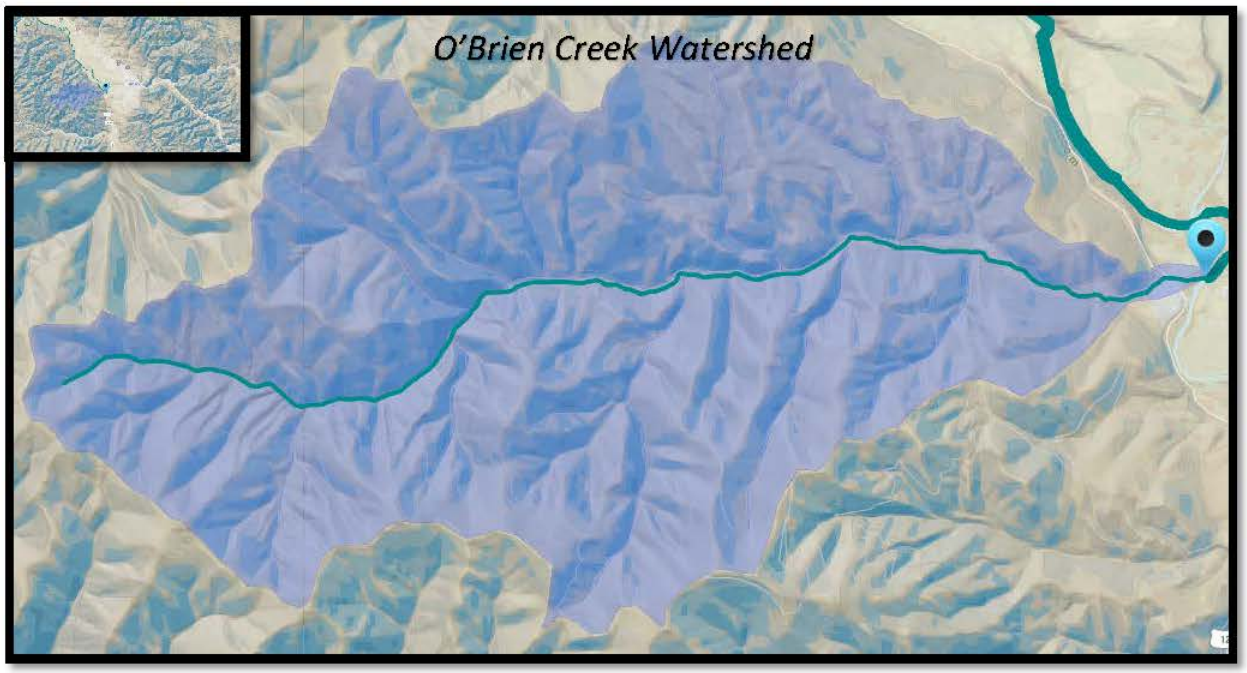
O’brien Creek left it’s banks this spring and flooded large areas due to massive sediment aggradation

Spawning out migrating Westslope Cutthroat trout stranded due to massive sediment choking creek

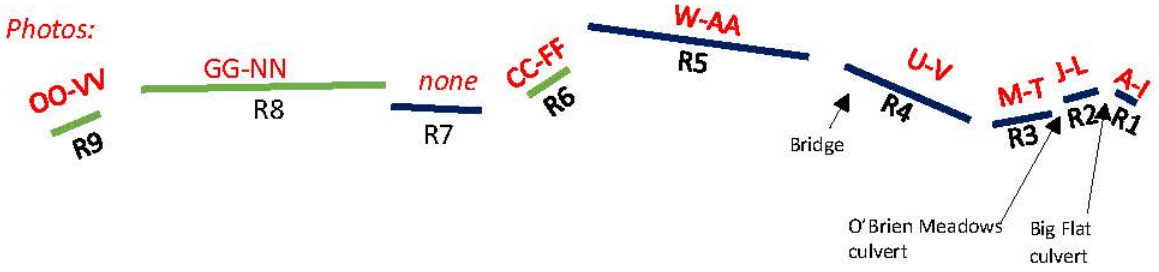
O'Brien Creek Data and Language for Bitterroot WRP

Field work: Deana DeWire and Lauren Herbine
Report prepared by: Lauren Herbine and Deana DeWire

Map

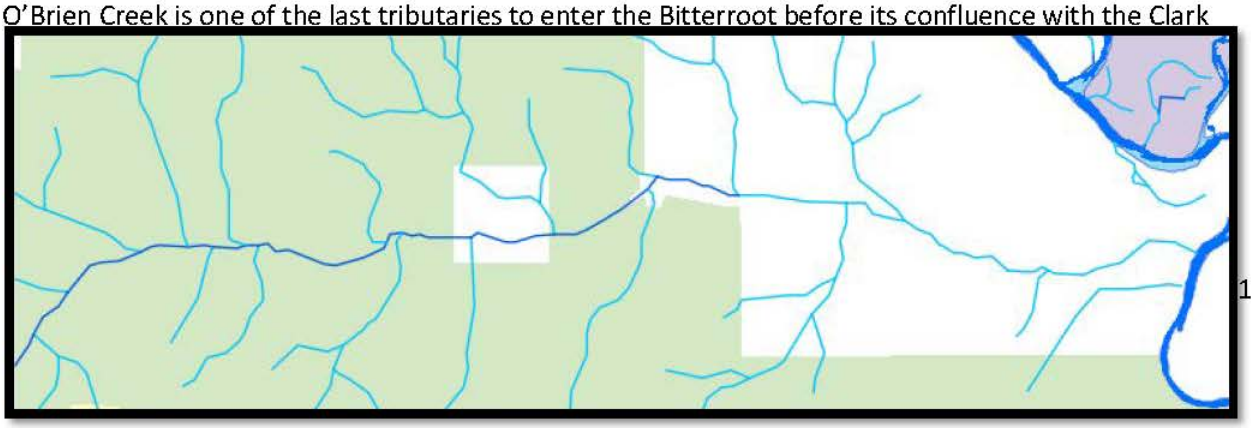


O'Brien Creek Reaches



Watershed Overview

O'Brien Creek is one of the last tributaries to enter the Bitterroot before its confluence with the Clark



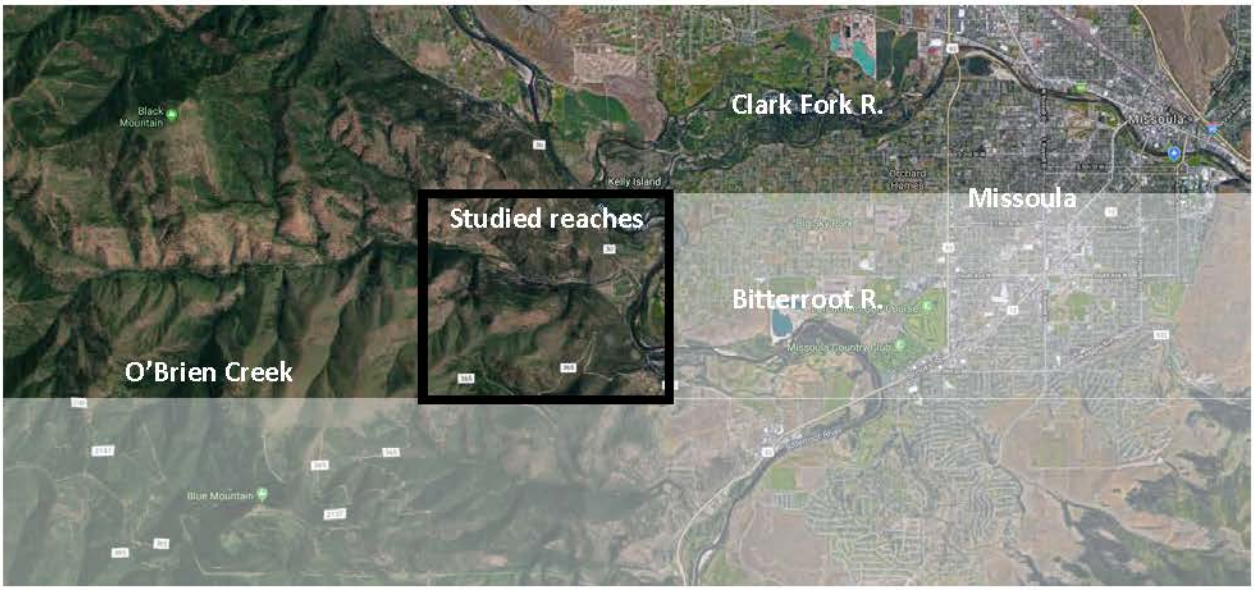
Fork River. Its headwaters are in the Northern Bitterroots, originating on the east face of the Grave Creek sub-range. Headwater basins are primarily composed of the Belt Supergroup, while the lower reaches of the stream flow through alluvium. The creek is transport dominated and flows east alternately through relatively low-gradient montane valleys and confined narrow valleys, with very few depositional reaches (one at the confluence and one upstream of an undersized culvert). The majority of the watershed is within Forest Service land, though much of it has a high road density and high levels of past timber harvest; some areas show evidence of other activities, including farming, livestock grazing, and mining. A settlement once existed, and evidence of an old railroad grade can be seen today. There are at least two stretches where the stream has captured the old road/rail bed. The lower reaches are privately owned, with a mix of small-scale agriculture, subdivisions, and single family homes spaced throughout. A very cold tributary, O'Brien Creek is one of the most important tributaries in the lower Bitterroot for rainbow and cutthroat habitat. There is no TMDL listed for O'Brien Creek, however, stream alteration, erosion and sedimentation are known issues.

Human History

O'Brien creek has been heavily used and manipulated by early Missoula settlers since the late 1800s. Unpublished historic records note early homesteading, tick epidemics and a large "tick vat" carved near the creek as a treatment facility, several grain mills (one large one at the confluence of O'Brien Creek and the Bitterroot River), miles of diversion and manipulation, rail lines projecting up valley bottom and providing wood to Missoula, and more (Crawford, 2019). The creek went dry for years because of diversion manipulation and withdrawals. An entire book could written on the happenings within, and use of, Obrien Creek. Recent days find human use intermingled with multiple parcels and conditions that vary from heavily grazed and encroached upon to landowners that are actively allowing riparian vegetation and stream conditions to heal.

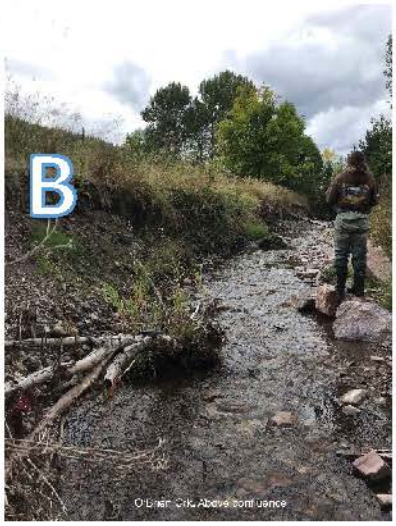
Overview of Stream Conditions

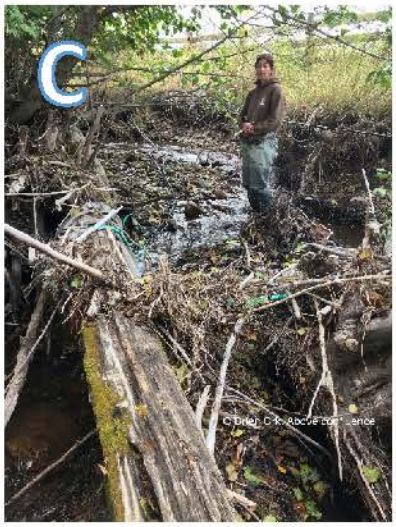
In early Fall of 2019, a general characterization of O'Brien Creek was conducted on private, county, and Forest Service land in sections spanning from the confluence with the Bitterroot River (east) to above the upper terminus of Forest Service road 123. There were nine main sections observed, dictated by private land permissions and county land locations. From east to west (going upstream) stream segments assessed are labeled 1-9 (see figure 2).



Reach 1 *(moving upstream from confluence)*

At the confluence with the Bitterroot River there is a relatively large gravel bar (A). Moving upstream, large erosive banks (B) are contributing slump blocks to the creek. PVC pipes, associated with landowner irrigation, are present in active erosion areas (C). Large woody debris (LWD) is present in some segments where streamside vegetation has sloughed (D). Several large angular boulders and wood structures from previous rehabilitation efforts have failed. Overall, there is very little habitat, a large amount (and variety of) trash, and the channel is very entrenched with tall, eroding banks (E). Some large wood used for bank stabilization and weir construction remains in place beginning approximately 250' above the mouth (F). These structures are at risk of failure should erosion continue upstream.





Reach 1 *(moving [illegible] ng)*

There is a 20' wide concrete box culvert at the crossing with Blue Mountain Road (G). Stream substrates exist throughout the culvert, which should accommodate fish passage at most flows. At the inlet the average stream bed elevation to the culvert is 4.5'. Average spring runoff water depth (measured by the stain line on the inside of the culvert) to the culvert is 2.9'. At the outlet, the mean streambed elevation to culvert is 4.2' and freeboard above the water stain line is 2.2'. As such, there may be minimal freeboard to accommodate bedload and debris during very large flood flows.

Heading downstream from the culvert towards the confluence, a representative reach of 730 feet was surveyed. Thirty-five pieces of LWD and one aggregate log jam were counted. Pools ranged from 6.2' to 18.5' feet long, averaging 13.5'. The total length of the pools over the reach was 189', which was 26% of total reach length.

Bankfull (ft)	DMax (ft)	Flood prone width (ft)	Entrenchment Ratio
39.5 at overbank/erosion area			
13.1	1.9	26.6	2.0
16.4	1.9	37.9	2.3
10.2	1.3	21.2	2.1
9.6	2.2	46+ (went into yard, couldn't measure)	>3.0
16.7	1.1	52	3.1

There was one major bank failure (I). Though there was not as much trash or irrigation infrastructure present, one long piece of PVC pipe was lodged in the creek bed (H).

G


Blue mountain outlet, OBrienCrk


O'Brien Crk reach 1


H
O'Brien Crk reach 1

Reach 2

This reach spans from the O'Brien Meadow subdivision road crossing to the Blue Mountain Road crossing. The reach was slightly to moderately entrenched (ratios ranged from 1.8 to 3.3) and actively incising. As one moves downstream it becomes increasingly entrenched. There were zero pieces of LWD between the crossings and the stream flow is very funneled. Three pools were noted but not measured.

Fish were spotted, and a possible old redd from this past fish spawning was identified.

Bankfull (ft)	DMax (ft)	Flood prone width (ft)	Entrenchment Ratio
13.6	1.4	44.4	3.3
8.5	1.6	15.7	1.8
7.5	1.5	13.2	1.8
7.7	1.6	20.8	2.7

Reach 3

This reach starts at the road crossing at O'Brien Creek Meadow. The culvert here was a 9.6' round culvert with 6.2' from the water surface (near mean bed elevation) to the top of the culvert and 6.3' from the bed to the top of culvert. The culvert has a slight curvature and stream flow is pushed to the left side of the culvert at the outlet. Stream substrates exist throughout the culvert, so fish passage is likely achieved at most flows, but should be verified. There is a tributary culvert from an irrigation ditch approximately 10' downstream on the right bank, perched 1.8' (see pic J from reach 2).

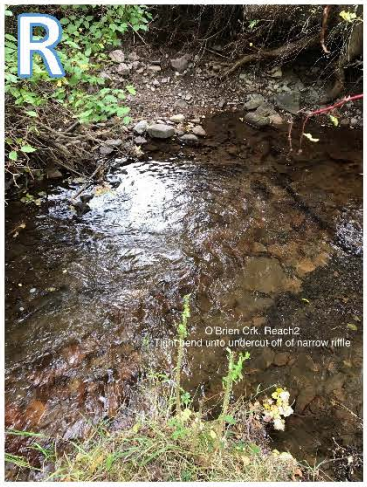
We counted 31 pieces of LWD, 14 of those pieces were manually placed next to a bank failure in spring 2019 to provide bank protection (O). Pools ranged from 10.8' to 23.5' downstream of the entrenchment reach, averaging 15.5'. Pools ranged from 6.9' to 24' in the entrenched reach, averaging 14.8'. There were 11 pools counted overall, 6 in the section below the entrenchment and 5 in the entrenched reach. The total length of the pools was 167.2', which was 17% of the total length of the reach.

Old beaver chews were noted in the lower sections of the reach. This area includes a long depositional reach with banks composed of loose cobbles and sand from a high flow event that occurred during the spring of 2019 (M, N).

Moving upstream, the creek became increasingly entrenched. A large failure on the right bank had 10' of exposed (vertical) bank. The stream flows all the way to the toe of the failure, with manually-placed LWD offering some protection (O, O2). Upstream of this, the creek undergoes many >90 degree bends with steep, tall (~12') erosive banks. The stream is too entrenched for a natural avulsion or overflow channel and the outside bends of these meanders are undercutting at the toes of the steep banks (P-S, S2). The upper stretch of this reach has points where the toe of the road fill is the left bank of the stream with obvious delivery of road sediment and gravels into the stream. This occurred continuously along ~240' of road.

Bankfull (ft)	DMax (ft)	Flood prone width (ft)	Entrenchment ratio
12.1	1.9	>100	>8.3
14	1.2	38.5	2.8
12	1.5	17.3	1.4
11.9	1.7	12.7	1.1
10.6	1.4	12.1	1.1

*double line indicates boundary starting entrenched stretch



Reach 4

Reach 4 includes private property along O'Brien Creek Road in its paved section. Observations were made mostly from the road, and often several hundred yards from the creek. Some sections were more easily observed and therefore provide a more complete picture of the stretch.

Above the crossing at the upstream end of the second HOA, the stream goes from the right valley wall to the left valley wall. Barbed wire crosses the stream here. From the road, it appears that the stream is

moderately entrenched and there was no wood visible. There is a manicured lawn on both banks with a footbridge (V).

Below that same crossing, there is more shade and riparian vegetation. The stream is still moderately entrenched. A pipe runs across the stream ~30' below the crossing.

Before the road turns to gravel, there were a few sediment pulses visible in the stream. These were seen

across fields, though, so no measurements or up close inspection could be made (U).

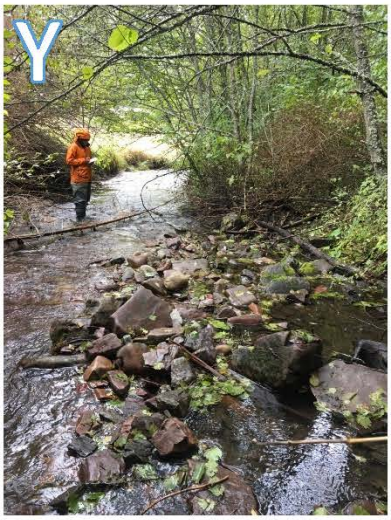
Reach 5

Reach 5 spans private property along the gravel portion of O'Brien Creek Road until the first boundary with Forest Service land. This section was also visual inspection from the road. At the address 11025 O'Brien Creek Rd there are two crossings that look undersized. For ~400' above the driveway the left bank of the stream is the toe of the road fill. The road is adjacent to the stream and contributing sediment to the creek for the entire stretch between 11025 and 11781 O'Brien Creek Rd. The stream is well shaded with some LWD and pools. One instance of a >90 degree bend cutting into the fill of the road was noted (X).

Access to private property just downstream from the Forest Service boundary was granted; an in-stream survey was possible. Here the stream was along the toe of the right valley wall and the bed load became immediately large and angular, exceptional to the bedload upstream. It was hypothesized that this was the result of the stream capturing the old road that runs along the toe of the right valley wall (Y, Z). The road bed is intact upstream. This large, angular load dominates the stream for about 25 meters, at which point the stream meanders slightly away from the toe of the right valley wall and the road bed reappears. The bedload returns to being similar to reaches upstream.

There is a section of the creek that flows along the backside of a pasture. There is little to no riparian vegetation here and the left bank has erosive, slumping banks (AA). The stream suddenly becomes over

widened, reaching a bankfull of 21.2'. When the riparian vegetation returns at the bottom of the field, the stream also returns to typical bankfulls.



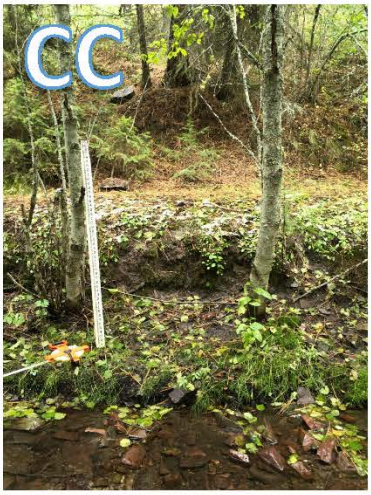
Reach 6 (PIBO)

Reach 6 is a 195 meter PIBO reach that starts just upstream of the boundary between private and Forest Service. Evidence of beaver was noted, but there were no dams within the reach. Approximately 25 m of the left bank of the creek was along the Forest Service road or near the toe of the fill. The creek area near the trailhead is heavily used by recreationists with a user created trail and bridge over the creek. Very few, if any, high quality pools were found. Most of the pools noted in the PIBO data are low quality scour pools created by lateral constriction or are located at a bend. Along many reaches erosive banks were up to 4 feet high (DD), with at least two local failures (EE) and two slides of road fill directly into the creek (FF). There appears to be an old road bed near one or both banks in old/potential floodplain (CC). This could possibly be a legacy railroad. The slope of the entire reach was 1.7%.

Large Woody Debris	
LWD total	13
LWD in pools	2
LWD in riffles	11

Habitat	
Average pool tail depth	17.5 cm
Average pool depth	33.5 cm
Average pool length	4.8 m
Average riffle length	17.1 m

Entrenchment	
Average bankful width	4.0 m
Average entrenchment ratio	0.18
Range of entrenchment ratios	0.11-0.28



Reach 7

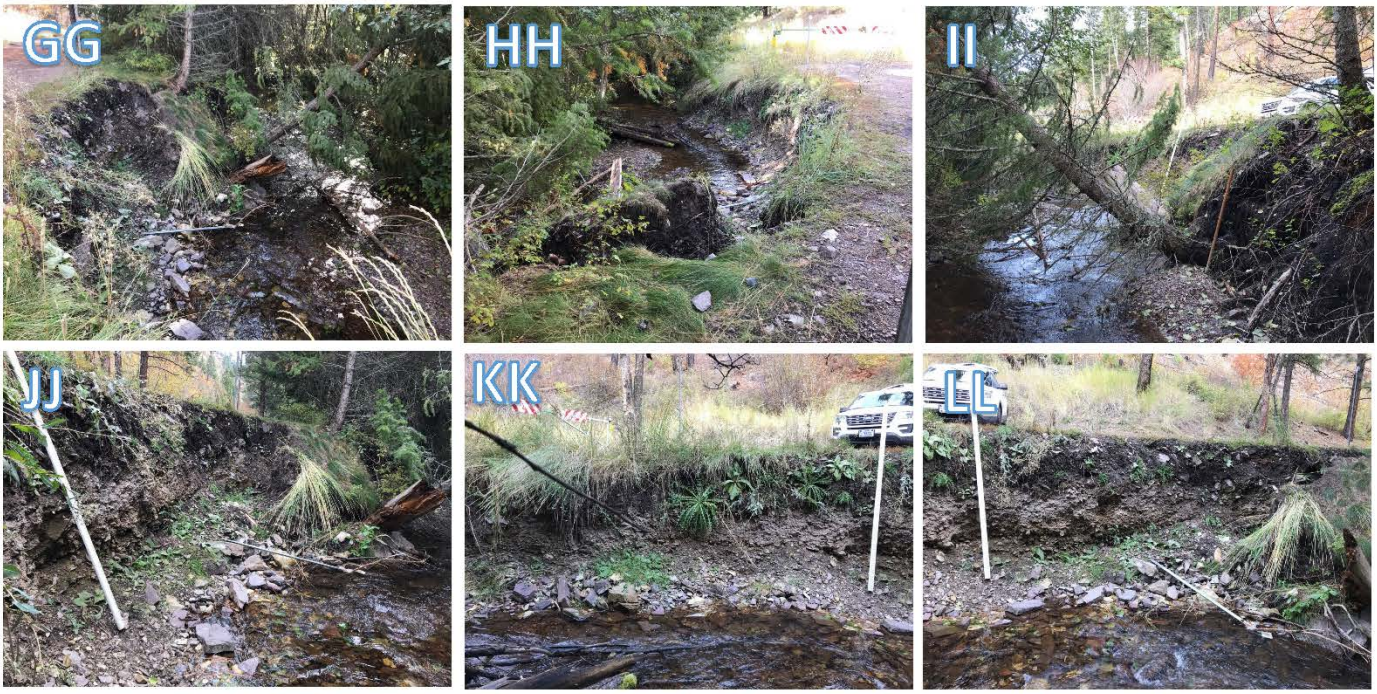
Reach 7 spans the length of the private inholding and was only assessed from the road. The creek appears to become braided, with some channels becoming intermittent. Some sections had the left bank of the creek as the toe of the fill. No pictures were taken along this reach.

Reach 8

Reach 8 starts from the second border with Forest Service property and continues past the gate to the end of Forest Service Road 123 (now a non-motorized trail). The data from this reach comes from road surveys completed earlier in the summer of 2019 (except for gate failure measurements).

Gate failure

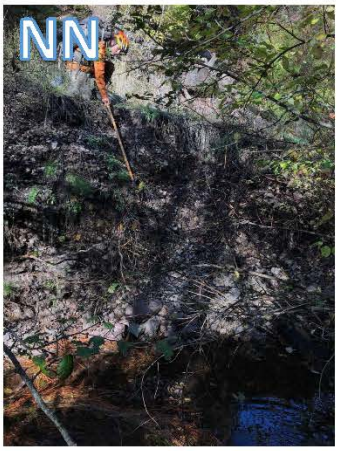
Directly before the locked Forest Service gate on FS road 123, a large road failure is actively slumping into O'Brien Creek. As of early October 2019, the dimensions were measured to be 54 x 6 x 6.2 ft (approximately 2,678 ft^3). A newly fallen tree and road sign was present in the stream. Parking is limited to one car, with the road bed remaining at 12 ft mostly due to a user-created turnaround off to the right (and directly opposite of the failure). See photos GG-LL.



Road 123 (non-motorized trail)

Heading up-valley past the gate, road 123 crosses decommissioned road number 19244. This road crosses O'Brien Creek with a bridge. The bankfull width here is 10.2 feet. Engineers should check the bridge for structural integrity, as it does not appear sound and there is over widening at the inlet with 19 ft between the bridge abutments and a definite hourglass shape to stream.

Upstream of here, before a second confluence with a mapped intermittent stream, there is 35 feet of fill unraveling directly into the creek. Similar instances occur periodically throughout the reach (MM, NN). We mapped 10 obvious sections of road/fill slumping. Nine of those sections were measured, and lengths of failures ranged from 10 to 100 feet, with a total of 345 feet. The average length of a failure was 38 feet. One instance of ponding on the road was found.



Reach 9

Reach 9 is a 175 meter PIBO reach that has its bottom of reach marker near the mapped end of road 123 and its top of reach marker just downstream of O'Brien Creek's confluence with a major scree-slope spring (OO, PP). There was no evidence of beaver found. The stream goes dry above this reach were the valley narrows and a steep scree slope develops on the south facing valley wall. Because of this, we were unable to sample outside of the influence of the road. There was a good amount of habitat forming, small diameter wood in the stream. One large fish was found in a pool. Erosive, high banks are typical of the reach (QQ, RR). Some meander bends are very sharp (possibly unnaturally so), resulting in deep pools (SS, TT). Ten meters of the stream in this reach seems to have captured the old road, as evidenced by a sharp change in grade, change in bed load, and dead trees in the bed (UU, VV). The slope of the entire reach was 2.7%.

PIBO data from the reach:

Large Woody Debris	
LWD total	43
LWD in pools	14
LWD in riffles	29

Entrenchment	
Average bankful width	4.5 m
Average entrenchment ratio	0.18
Range of entrenchment ratios	0.12-0.24

Habitat	
Average pool tail depth	13.4 cm
Average pool depth	35.9 cm
Average pool length	5.2 m
Average riffle length	7.9 m

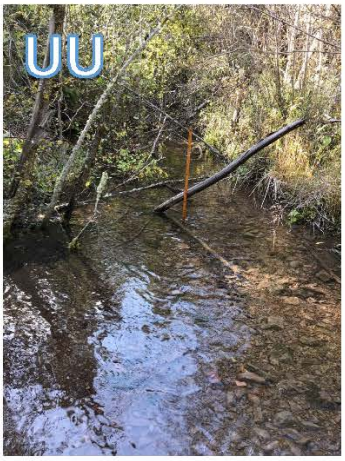
Pool Tail Fines		
	Sum	Average
<2	58	3.22
<6	130	7.22
Non measured	24	1.33


QQ


RR


SS


TT


UU


VV

Pre-project conditions on the West Fork of Lolo Creek and Lee Creek

Summer 2019

Tributary confluence with West Fork

Sediment below project culvert

Partially blocked culvert to be removed

InRoads Consulting, LLC

One Stop Forest Road Management

West Fork Lolo and Lee Watershed Road Sediment Reduction Monitoring

October 2019

Introduction/Summary

This report summarizes the potential reduction of road-generated sediment delivered to streams following road decommissioning and stream crossing restoration efforts in the West Fork Lolo and Lee watersheds. West Fork Lolo and Lee watersheds are a checkerboard of heavily roaded and logged former industrial timberlands and Forest Service lands. Recently, the industrial timberlands were purchased by the Nature Conservancy through the Legacy Lands Program and transferred to the Lolo National Forest. This consolidation has provided opportunities for the restoration of ecologically damaging and un-needed roads which are chronically delivering sediment into streams. This restoration will significantly improve water quality and aquatic habitat West Fork Lolo and Lee Creeks.

Field data was collected in July and August 2019 and included recording characteristics of the road, an inventory of road-stream crossings, and measurements of stream crossing fill volume. The Water Erosion Prediction Project (WEPP) model was run to estimate the amount of sediment currently generated from the roads, and the amount of sediment that may potentially reach streams. Additionally, the amount of fill at each road-stream crossing was estimated. Road-stream crossings can catastrophically fail during high flow events and deliver large amounts of sediment to streams.

A total of 11.1 miles of roads were identified in the field as having high levels of stream connection and in need of restoration treatment. WEPP modeling estimated that 99.6 tons of sediment was produced along roads each year, and that 49.8 tons of sediment was leaving the road buffer each year and being delivered into West Fork Lolo and Lee Creeks.

Twenty-nine road-stream crossings with culverts were recorded including 24 perennial streams and five intermittent streams. A total of 5,519 yds^3 of road fill was present at these crossings ranging from 27 yds^3 to 655 yds^3. This is the *maximum* amount of fill that could be lost in a catastrophic failure and would be excavated during stream crossing restoration. Additionally, 11 probable log culverts were inventoried on "jammer" roads where there was no culvert present, but water was flowing under the road. Baseline photo points were taken at 14 larger, perennial stream crossings which will be re-taken after restoration treatments.

Previous road decommissioning monitoring in the region has found a 97% reduction in chronic fine sediment delivery from roads, and that road-stream crossing failure risk was eliminated (Cissel et al. 2011). Using this as a guide, **road restoration in the West Fork Lolo and Lee watersheds will result in a reduction of 48.3 tons of road sediment delivered to streams each year. Additionally, up to of 5,519 yds^3 of vulnerable fill at stream crossings will be prevented from entering West Fork Lolo and Lee Creeks.**

Sediment Load Reduction Estimates

Roads built on granitic sediments are inherently unstable and highly susceptible to erosion – especially in areas that receive high precipitation such as the West Fork Lolo and Lee watersheds. This area has a very large road system which if left un-mitigated would continue to degrade water quality and aquatic habitat especially if there was a fire or additional forestry activities. However, this project will greatly reduce the amount of road-generated sediment reaching stream, and eliminate the risk of any stream crossing catastrophic failing in the future.

While forest roads have been found to be a major source of anthropogenic stream sediment (Al-Chokhachy et al. 2016), restoring roads has been found to reduce erosion and stream sedimentation to natural levels (Madej 2001, Switalski et al. 2004; Cissel et al. 2011, Sosa Pérez and MacDonald 2017). Recontouring roads improves water quality and benefits fish and other aquatic species. For example, reducing the amount of road-generated fine sediment deposited on salmonid nests can increase the likelihood of egg survival and spawning success (McCaffery et al. 2007). In addition, strategically removing or mitigating barriers such as culverts has been shown to restore aquatic connectivity and expand habitat (Erkinaro et al. 2017). Restoring roads in riparian areas may provide further benefits to fish and aquatic organisms by permitting reestablishment of streamside vegetation, which provides shade and maintains a cooler, more moderated microclimate over the stream (Meridith et al. 2014).

Long-term monitoring of decommissioned roads in granitic geology has resulted in dramatic declines in road-generated sediment. A study on the Lolo Creek Watershed on the adjacent Clearwater National Forest has found a 97% reduction in in road/stream connectivity (Cissel et al. 2011). Using the Geomorphic Roads Analysis and Inventory Package (GRAIP), they found a reduction of fine sediments from 38.1 tonnes/year to 1.3 tonnes/year along 3.5 miles of road. Furthermore, they found that restoring road/stream crossings eliminated the risk of culverts plugging, stream diversions, and fill lost at culverts (Table 1). The amount of sediment delivered to streams after road restoration is assumed to be reduced by 97%, and WEPP results were multiplied by 0.97 to determine how much sediment was prevented from entering streams.

Table 1. Summary of GRAIP road risk predictions for a watershed on the Clearwater National Forest road decommissioning treatment project (reprinted from Cissel et al. 2011).

IMPACT/RISK TYPE	EFFECT OF TREATMENT: INITIAL GRAIP PREDICTION
Road-stream hydrologic connectivity	-97%, -2510 m
Fine Sediment Delivery	-97%, -36.8 tonnes/yr.
Landslide Risk	Reduced to near natural condition
Gully Risk	Reduced from very low to negligible
Stream Crossing Risk -plug potential -fill at risk -diversion potential	 -100% eliminated at 9 sites -100%, 268 m^3 fill removed -100%, eliminated at 3 sites
Drain Point Problems	17 problems removed, 4 new problems

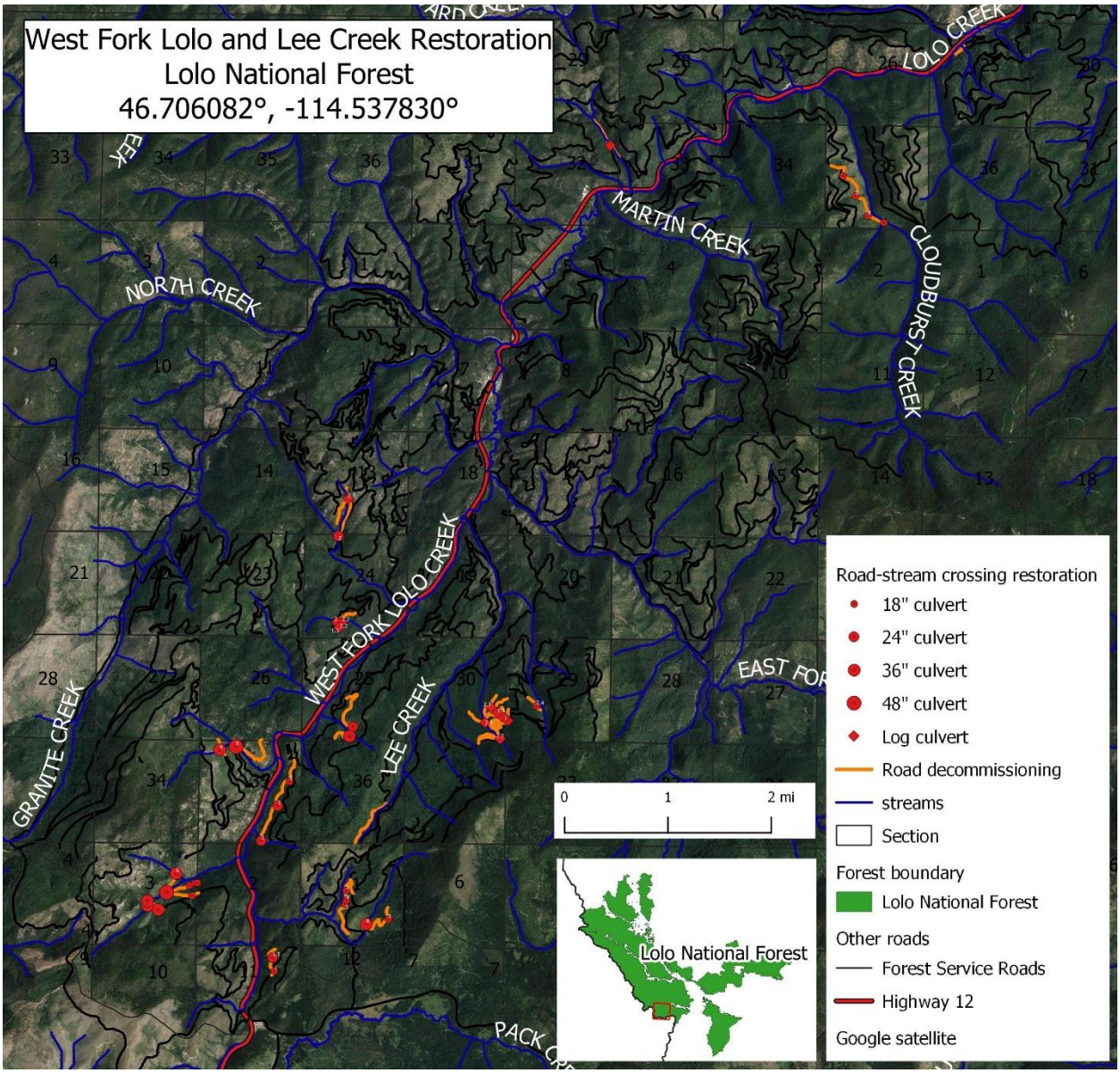


Figure 1: Overview map of the West Fork Lolo and Lee watershed restoration. Proposed roads for decommissioning are in orange while other Forest Service roads are in black. Metal culverts and log culverts proposed for restoration are in red. US Hwy 12 bisects the project and is displayed in red. The center of the project area is it roughly 46.706082°, -114.537830° at the confluence of Lee and West Fork Creeks. Maps at the 1:12,500 scale are included in Appendix B.

Modeling Road Sediment Production and Delivery to Streams Using WEPP

In order to estimate the reduction of road sediment production and delivery following restoration efforts, we used a physically-based erosion simulation model to estimate road erosion. WEPP (Water Erosion Prediction Project) predicts erosion from multiple forest road segments by inputting climate and soils information along with a number of road related characteristics (Laflen et al. 1997).

During field surveys, we identified 11.1 miles of road that were found to contribute significant amounts of sediment, or posed a high risk of road-stream crossing failure (Figure 1). Road characteristics were collected in the field and GIS (geographic information system) data was used to extrapolate the road grade and buffer grade. Data recorded on each segment included the road design, road surface, traffic level, road gradient, road segment length, road width, fill gradient, fill length, buffer gradient, buffer length, and percent of rock fragments. Some road segments on the map did not exist on-the-ground and other roads were identified during road surveys. These mapping errors were given to the Forest Service to update their INFRA road database.

Collected data was entered into the WEPP model online (http://forest.moscowfsl.wsu.edu/cgi-bin/fswepp/wr/wepproadbat.pl). A custom climate station was created at 5,409 ft elevation in the West Fork Lolo watershed which was estimated to receive 54.62 inches of precipitation (Table 2). The soil type was identified as sandy loam. Thirty years were simulated to estimate the annual sediment generated by the road (produced) and delivered beyond the road buffer - potentially delivering sediment into a stream. Conditions during log haul were modeled with insloped, bare ditch road design, and high levels of traffic.

Table 2: Summary of WEPP modeling input.

Parameter	Input
Average rainfall (in)	54.62
Elevation (ft)	5,409
Soil type	sandy loam
Years simulated	30
Total length of road (mi)	11.1

Sediment leaving the road (produced) and sediment leaving road buffer (delivered to stream) are the two main outputs for WEPP. Sediment leaving the road is an estimate of all erosion that takes place on the roadbed. Sediment leaving the road buffer is the sediment that is estimated to actually reach the stream. So while a road may be very erosive, if the buffer is big enough, very little sediment is modeled to reach the stream. Alternatively, you can have limited sediment production on a stream-side road, but the model would calculate that most of the sediment produced is being delivered to the stream. Table 3 summarizes the WEPP model output.

Table 3: Summary of WEPP modeling output for average annual sediment leaving road and buffer on 11.3 miles of roads proposed for decommissioning. Total and per mile sediment loss is reported.

	Total (tons/yr.)	Per Mile (tons/mi/yr.)
Average annual sediment leaving road	99.6	8.3
Average annual sediment leaving buffer	49.8	4.1

Estimating Road/Stream Crossing Fill Volume

Road-stream crossings create a major hazard in road systems and can be a significant source of road-derived sediment (Al-Chokhachy et al. 2016). If culverts are undersized or not maintained, they can become partially or fully blocked. During a high flow event such as a rain-on snow event they can over-top or fail entirely. When this happens, much or all of the fill over the culvert can be delivered into the stream system. Restoring road-stream crossings eliminates the risk of catastrophic stream crossing failures, has been found to significantly reduce sediment delivery to streams (Madej 2001, McCaffery et al. 2006), and restore aquatic connectivity (Erkinaro et al. 2017).

Twenty-nine culverts were measured in the field to estimate their fill volume (Table 5). This included 24 perennial streams and five intermittent streams. Fill volume was calculated to estimate the amount of fill that could erode into the stream system if the crossing fails. For restoration treatments, all of this fill will be removed and placed on a stable location, and no longer pose harm to aquatic resources. We used methods modified from Spreiter (1992) to calculate fill volume (see Appendix A).

Road-stream crossings fill volume ranged from 27 to 745 yds^3 and a total of 5,519 yds^3 of fill was found to be vulnerable to delivery to streams. This method represents the *maximum* amount of sediment that may erode if the road-stream culvert failed. Additionally, 11 probable log culverts were inventoried on "jammer" roads where there was no culvert present, but water was flowing under the road. These crossings were not included in the fill volume estimates, but would provide additional sediment reductions following full recontour.

Table 5: Estimated amount of road fill at each road-stream crossing.

Culvert #	Road #	Total fill (yds^3)	Fish Barrier
1	53442	194	
2	53442	114	
3	43119-E	655	Yes
4	43119-E	59	
5	43119-A	230	
6	43119-A	27	
7	43317	285	
8	43317	135	
9	43317	63	
10	43318	155	
11	43318	408	
12	43299	87	
13	43343	122	
14	43343	149	
15	43343	35	
16	17903	167	Yes
17	43264	47	
18	43321	745	Yes
19	43322	156	
20	43332	126	
21	43332	231	
22	43332	255	
23	43330	98	
24	43330	125	Yes
25	43330	81	
26	43330	60	
27	43331	261	
28	43331	171	
29	43331	276	Yes
Total		**5,519**	

Fish Barriers

Five fish and other aquatic organism passage barriers were identified during road surveys (Table 5, Figure 2). Removing these culverts and restoring these road-stream crossings will restore aquatic connectivity and the length of available habitat for fish and other aquatic species (Erkinaro et al. 2017).

Photo-Points at Road/Stream Crossings

Photo-points were taken at 14 larger, perennial stream crossing adapted from Hall (2001). The smart phone application "Solocator - GPS Field Camera" was used for photo-points. This application takes photos with GPS coordinates, compass direction, altitude, and timestamp overlay. Photos were systematically taken from the downstream side of the road-stream crossing from a vantage point that clearly shows the entire restoration area (Figure 2). Photos will be re-taken after restoration efforts.

Figure 2: Examples of a road-stream crossing baseline photopoint.

QA/QC

InRoads Consulting, LLC Principal, Adam Switalski went into the field with Jed Whiteley (Clark Fork Coalition Monitoring Coordinator) and reviewed the field sites and monitoring protocol. Adam trained an InRoads Consulting, LLC field technician and two Forest Service hydrology field technicians. The data was collected on iPad tablets using ArcGIS collector. Field supervision, analysis, and reporting were conducted by Adam Switalski.

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Appendix A: Protocol for estimating stream crossing fill volume (reprinted from Bagley 1998, adapted from Spreiter 1992)

To estimate the amount of fill that could erode into the stream system if a crossing fails:

1. Measure the following with a tape measure:

- **CW1:** Natural channel width on upstream side of stream crossing fill
- **CW2:** Natural channel width on downstream side of stream crossing fill
- **W1:** Width of crossing on inside edge of road (perpendicular to stream)
- **W2:** Width of crossing on outside edge of road (perpendicular to stream)
- **L2:** Width of road bed in middle of crossing (parallel to stream)
- **S1:** Length of fillslope on upstream side of crossing
- **S2:** Length of fillslope on downstream side of crossing

2. Measure the following with a slope meter (in degrees):

(slope meters are available at outdoor gear stores)

- **FS1:** Angle of fillslope on upstream side of crossing
- **FS2:** Angle of fillslope on downstream side of crossing

3. Draw the crossing to scale on grid paper using a protractor and ruler

(use measurements acquired in the field)

4. Estimate the following from the scale drawing:

- **L1:** Horizontal distance from inside edge of road to bottom of upstream side of fill
- **L3:** Horizontal distance from outside edge of road to bottom of downstream side of fill
- **D1:** Vertical distance from inside edge of road to natural channel bottom
- **D2:** Vertical distance from outside edge of road to natural channel bottom

5. Calculate volume using the equations below:

First: Cross-sectional area calculation

$$A1 = \frac{D1\,(W1 + CW1)}{2} = \_\_\_\_\_ ft^2$$

$$A2 = \frac{D2\,(W2 + CW2)}{2} = \_\_\_\_\_ ft^2$$

Second: Volume calculation

$$V1 = \frac{A1 \times L1}{2.5} = \_\_\_\_\_ ft^3$$

$$V2 = \frac{(A1 + A2)\,L2}{2} = \_\_\_\_\_ ft^3$$

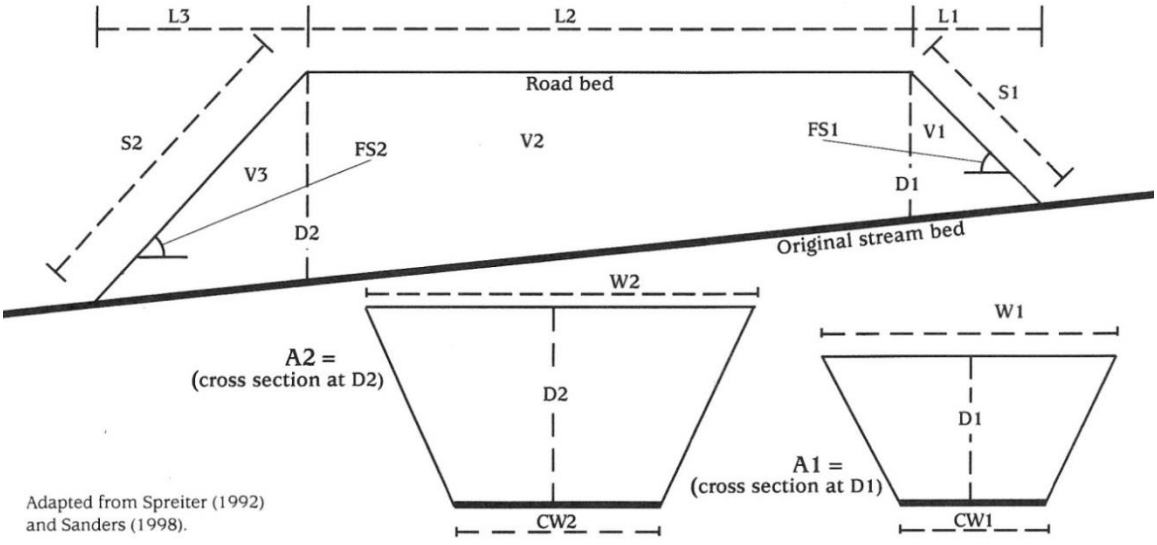
$$V3 = \frac{A2 \times L3}{2.5} = \_\_\_\_\_ ft^3$$

Third: Total estimated volume

$$VT = V1 + V2 + V3 = \_\_\_\_\_ ft^3$$

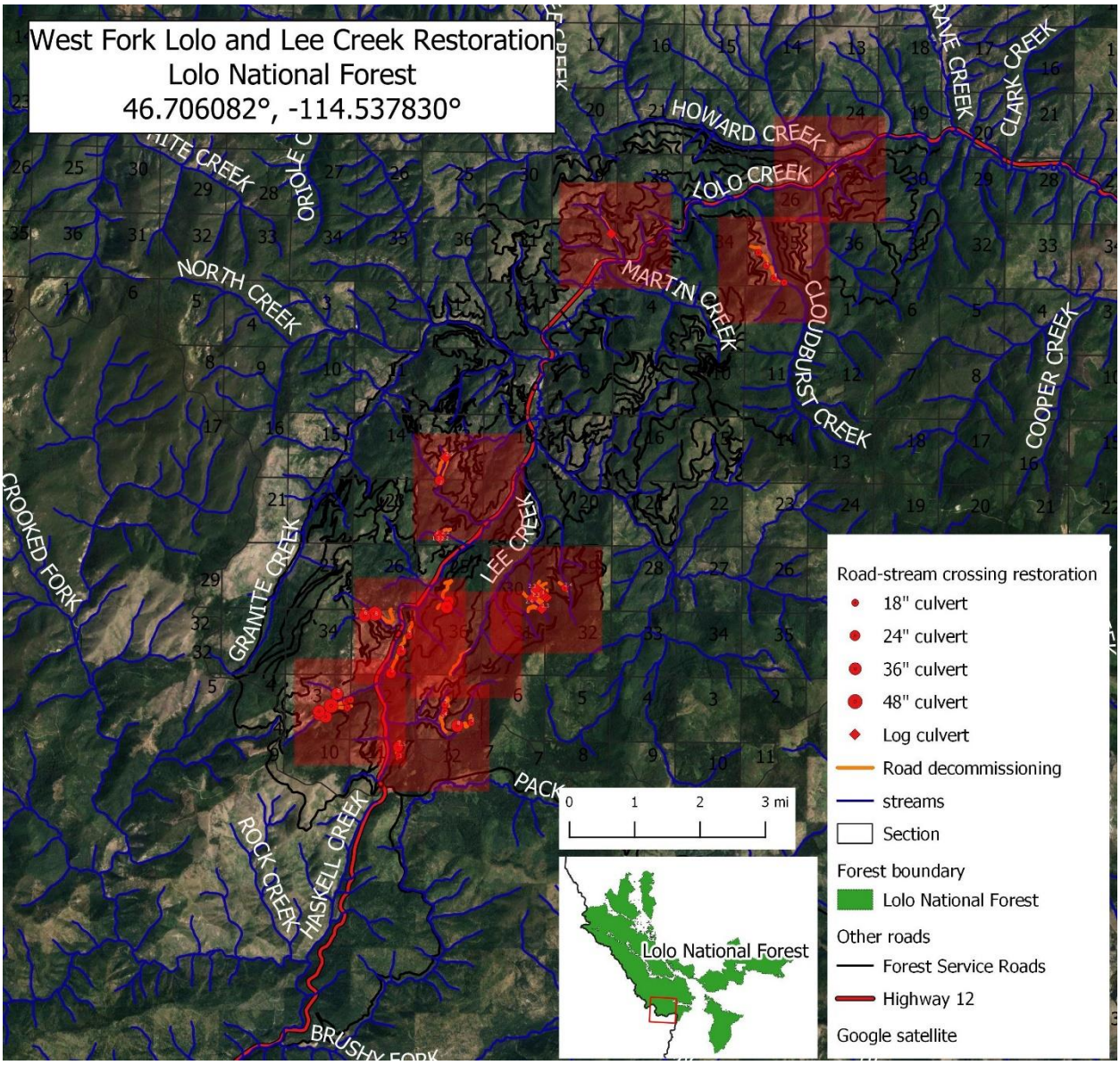
Total estimated volume in cubic yards

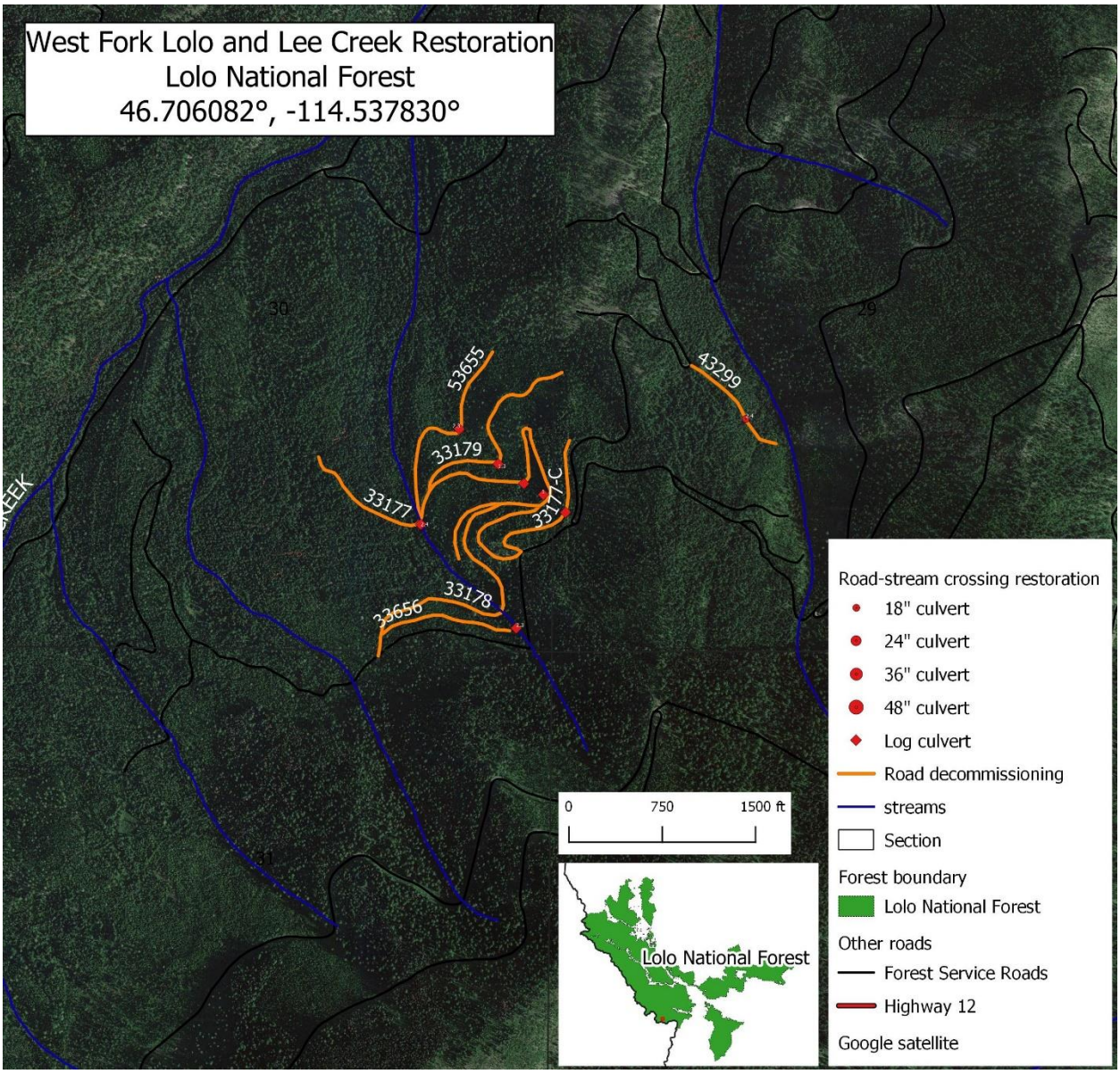
$$\frac{VT}{27} = \_\_\_\_\_ yds^3$$



Adapted from Spreiter (1992) and Sanders (1998).

Appendix B: Maps of proposed activities at 1:12,500 scale. All restoration work is on the Lolo National Forest.

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Road decommissioning
streams
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Forest boundary
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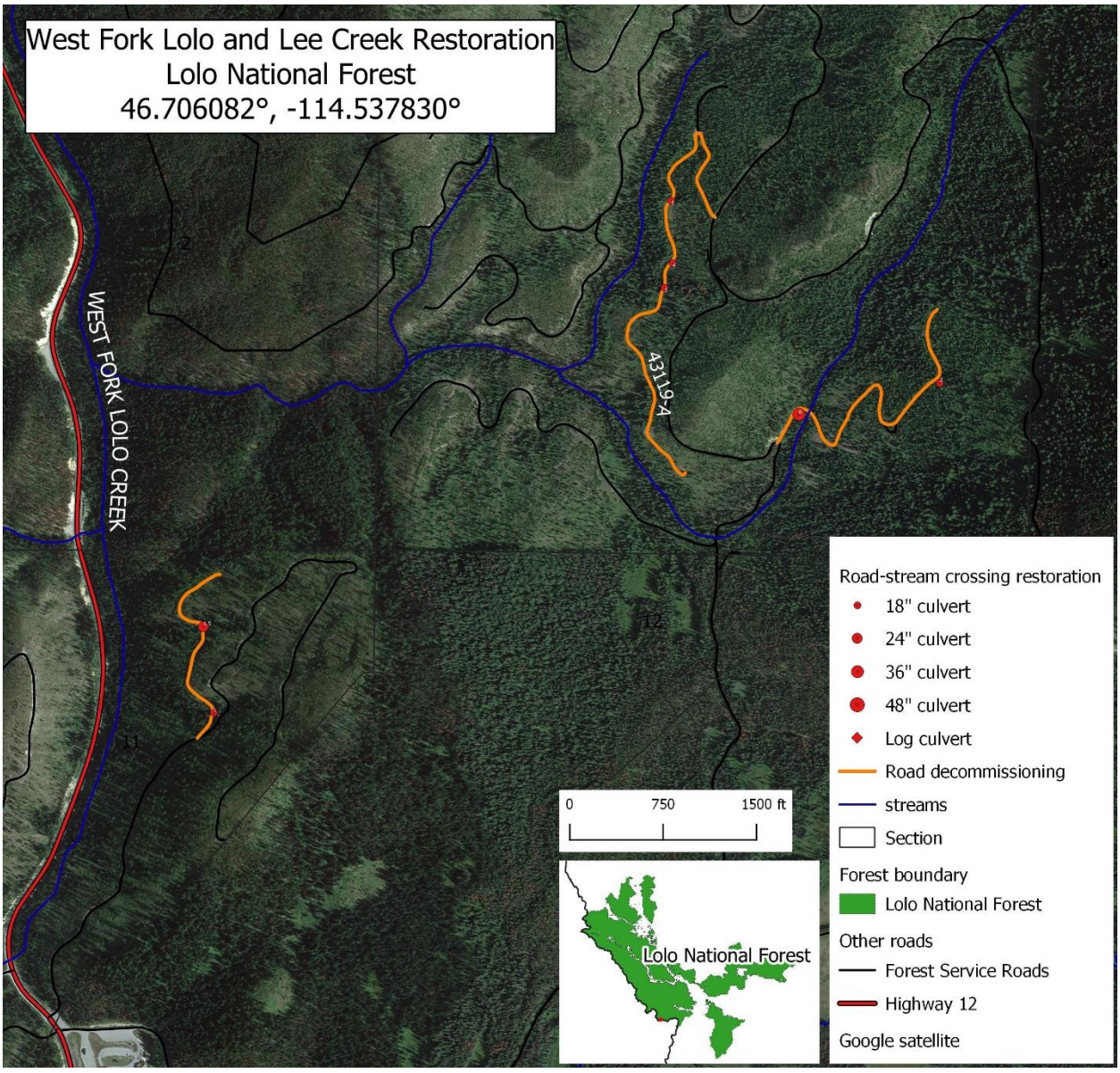
Other roads
Forest Service Roads
Highway 12
Google satellite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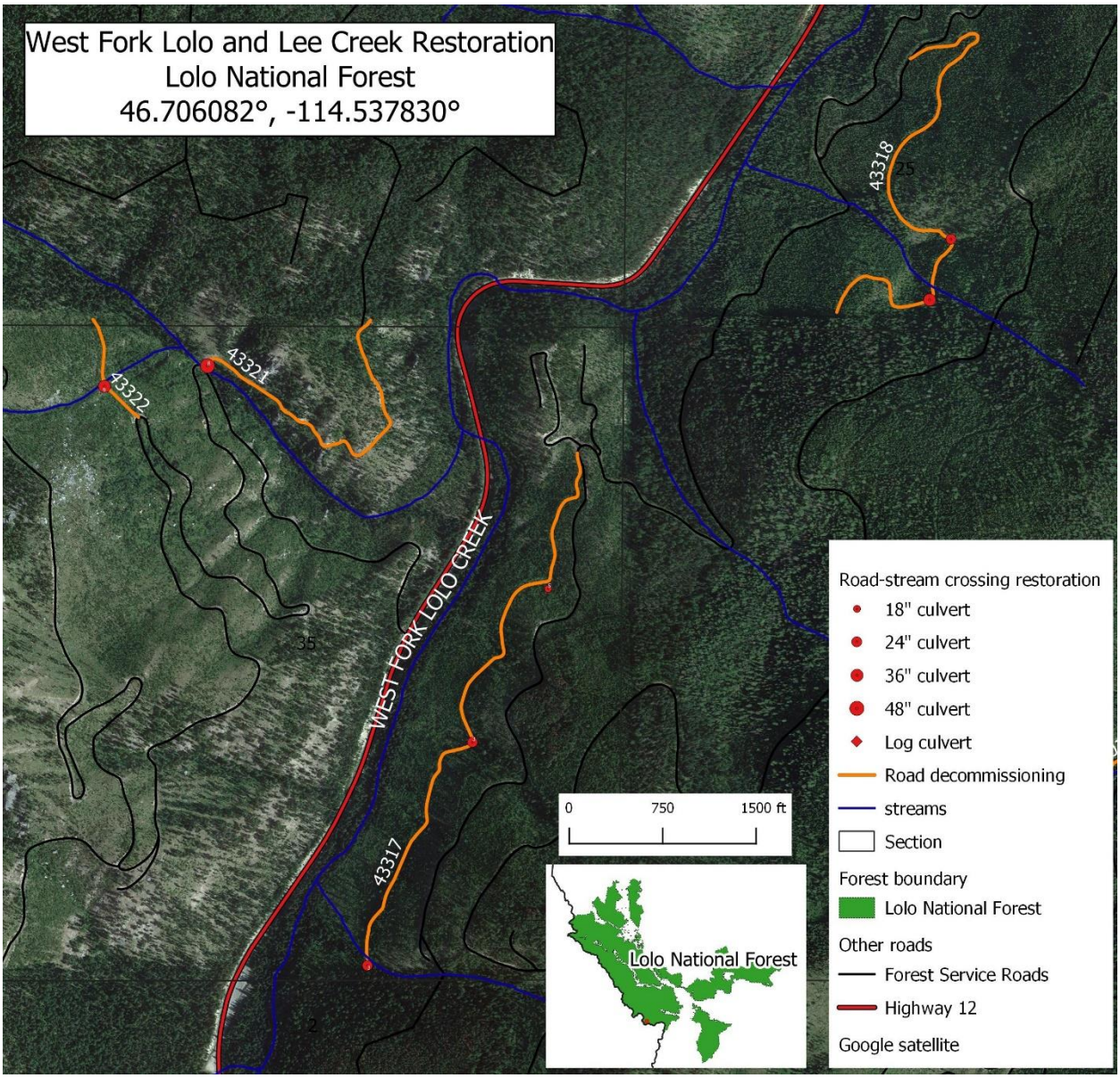
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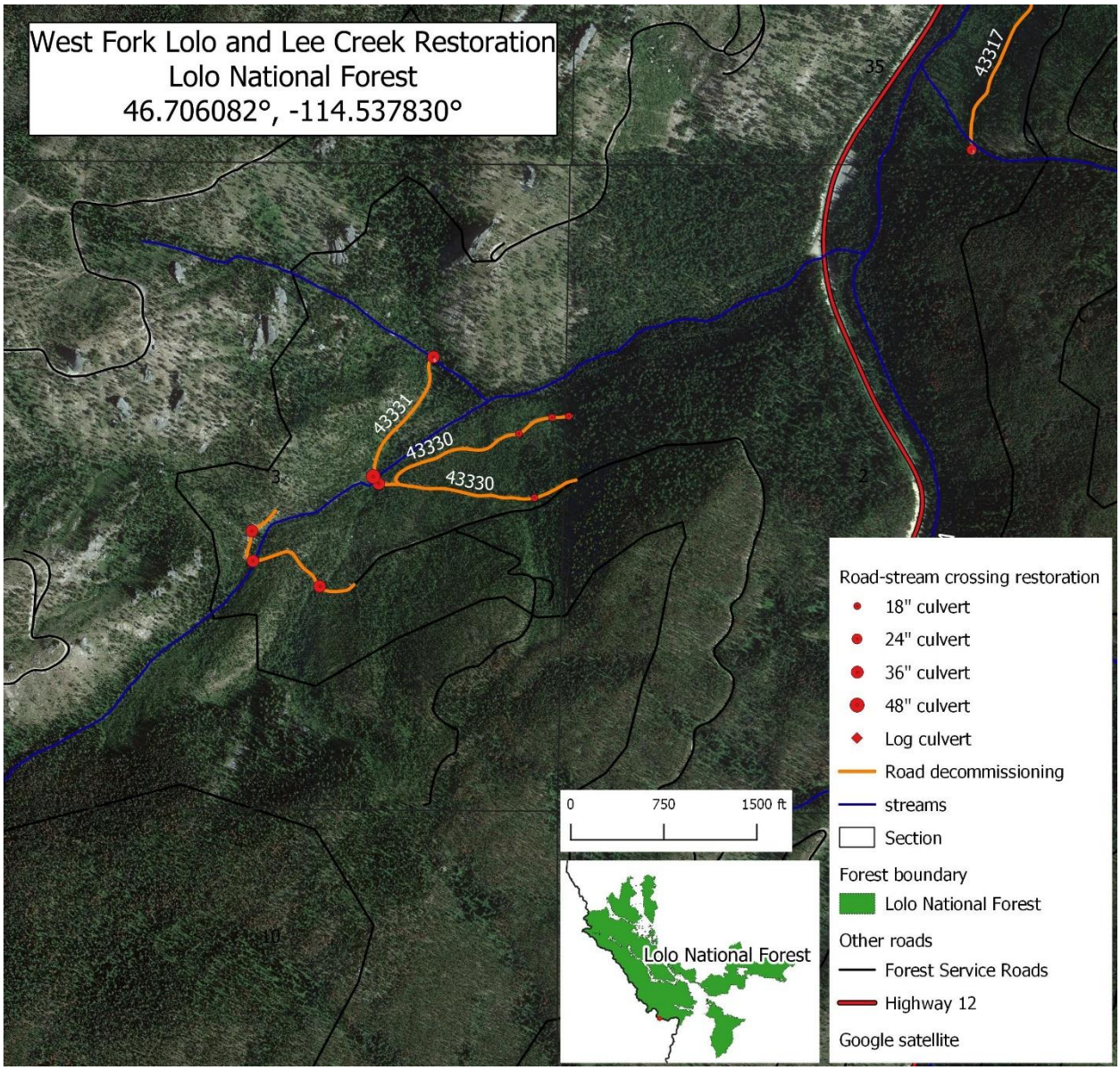
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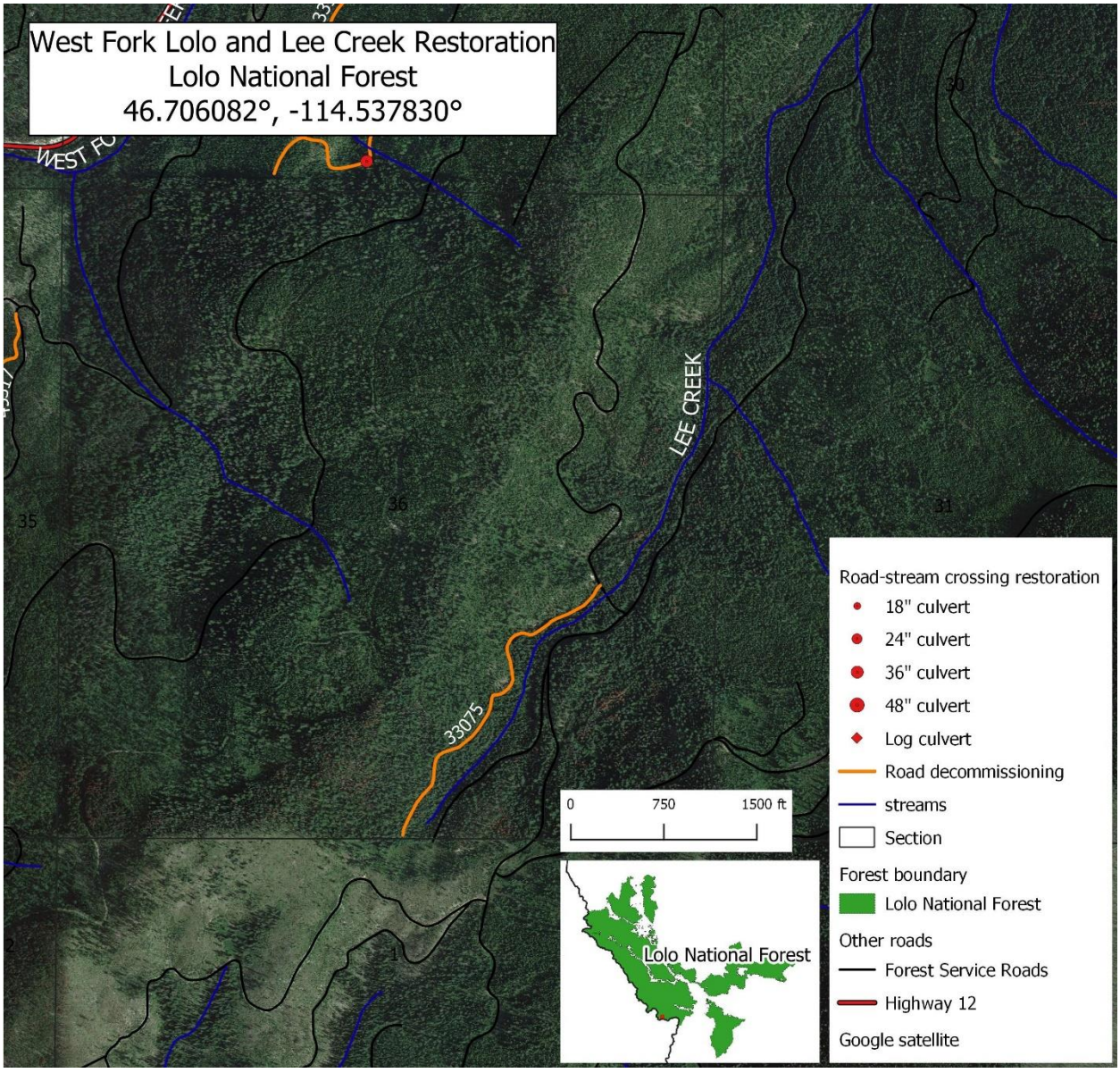
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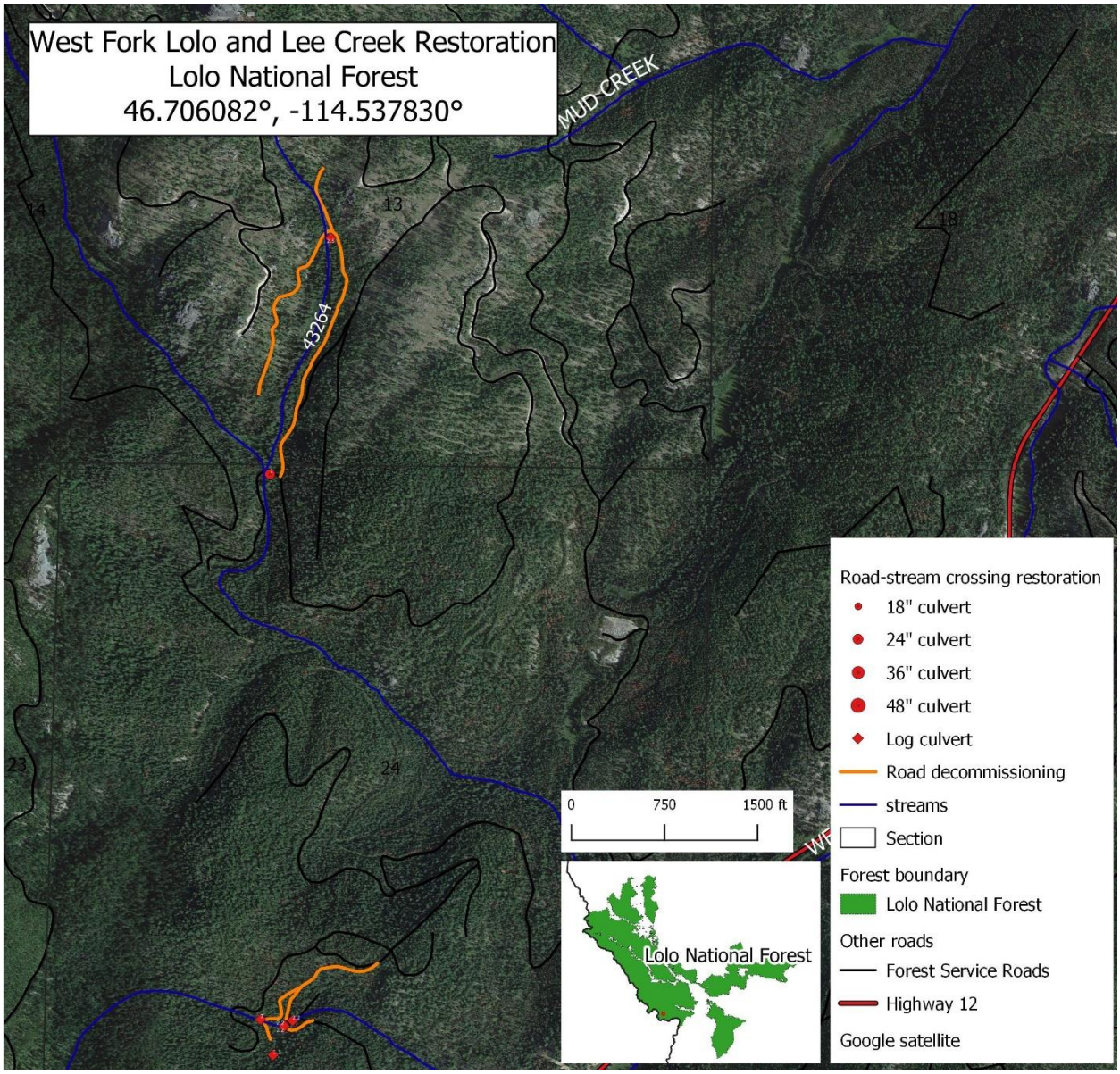
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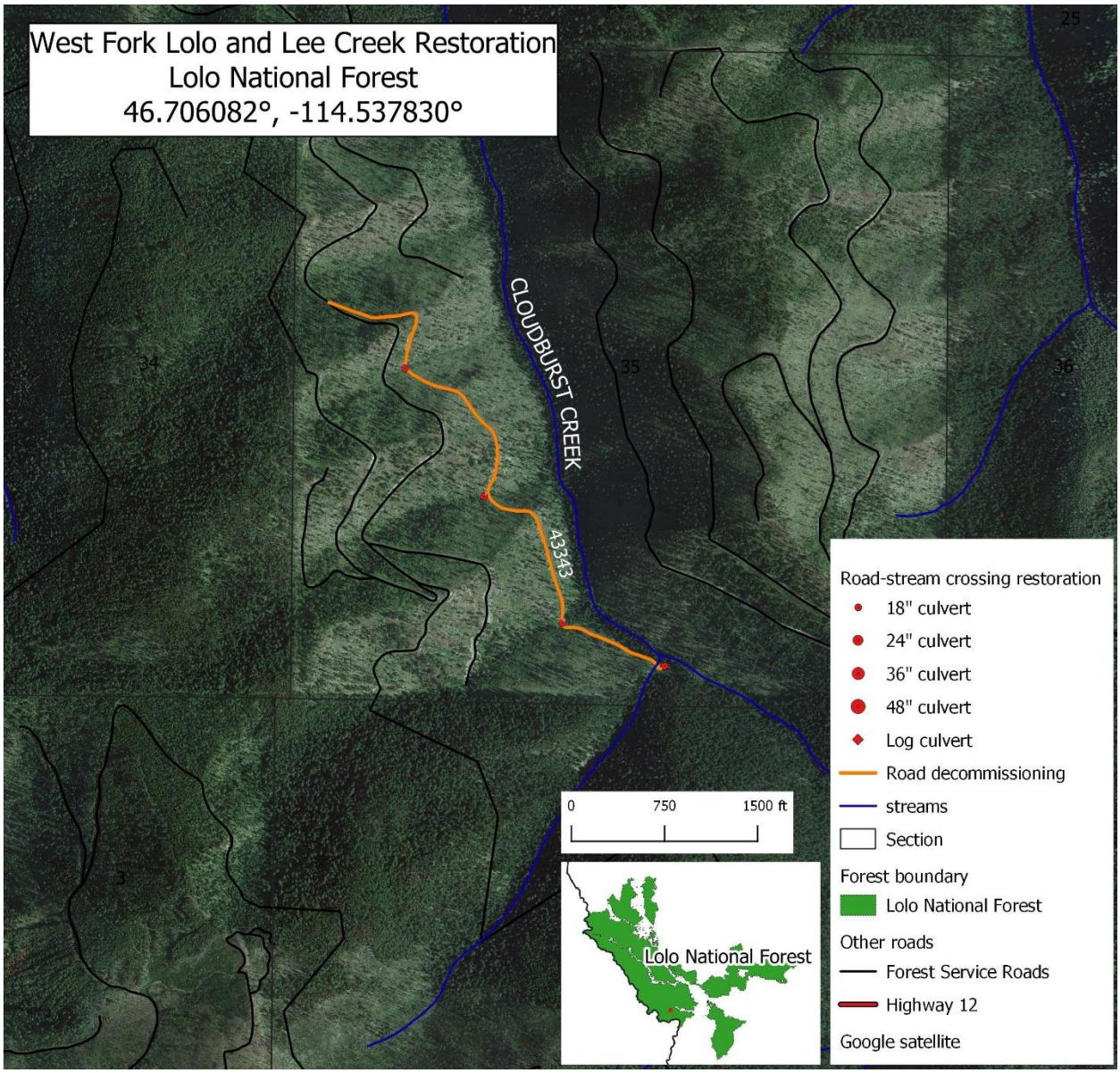
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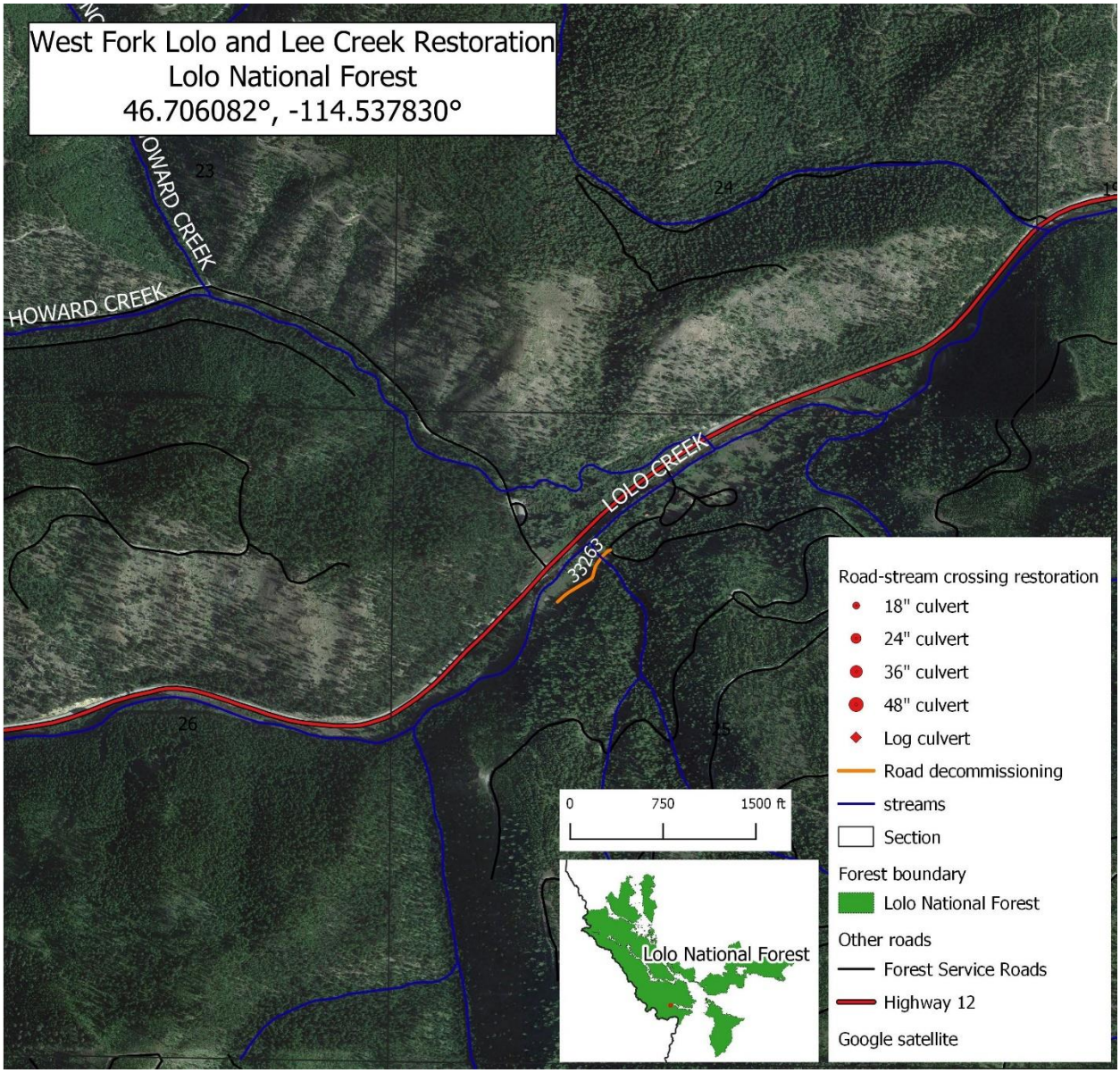
West Fork Lolo and Lee Creek Restoration
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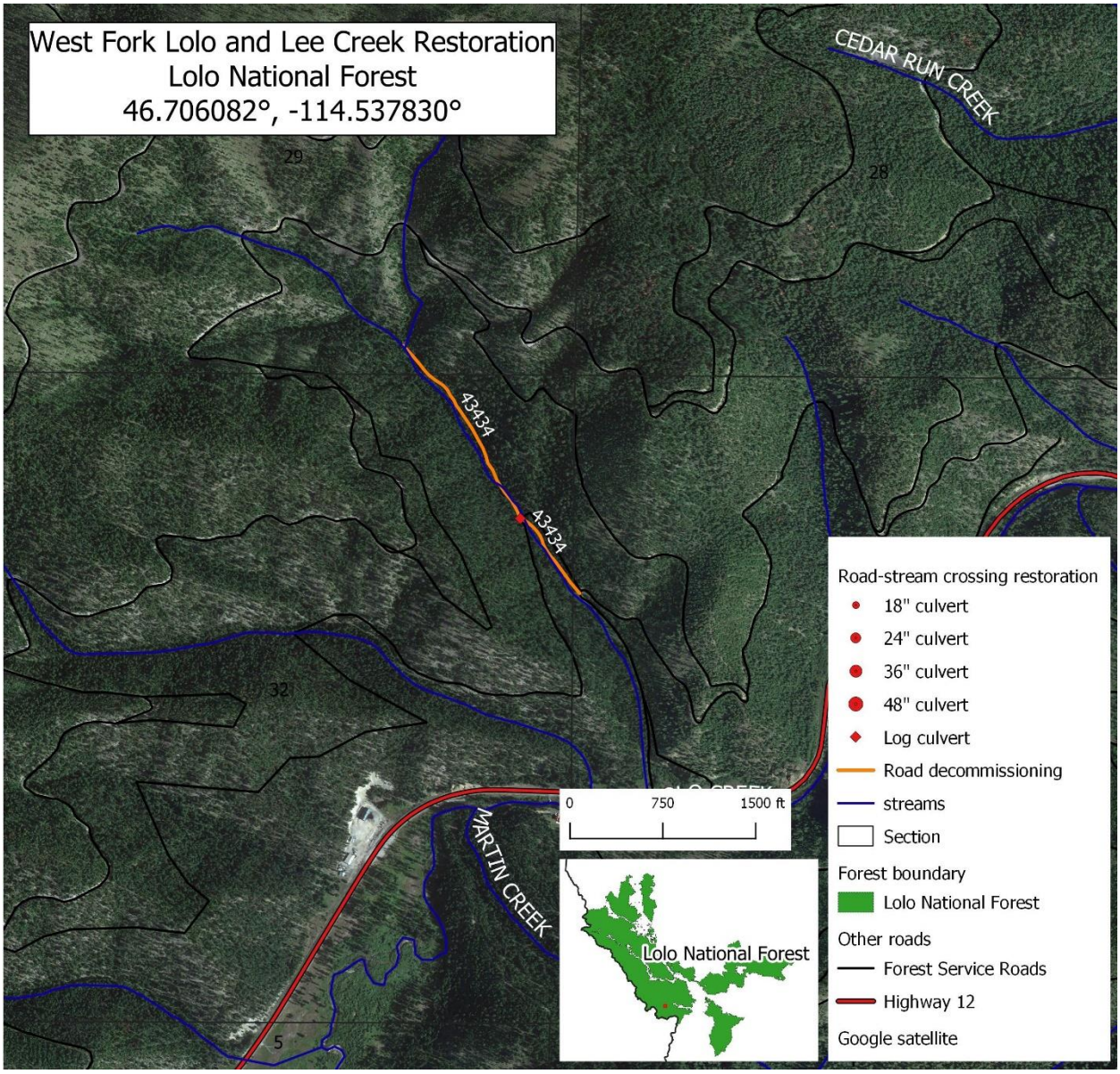
West Fork Lolo and Lee Creek Restoration
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