



FUTURE FISHERIES IMPROVEMENT PROGRAM GRANT APPLICATION

All sections must be addressed, or the application will be considered invalid



I. APPLICANT INFORMATION

A. Applicant Name: Ruby Valley Conservation District Attn Audra Bell

Mailing Address: PO Box 295

City: Sheridan State: MT Zip: 59749

Telephone: 406-842-5741 ex 101 E-mail: audra@rvcd.org

B. Contact Person (if different than applicant): Gary Giem

Address: PO Box 295

City: Sheridan State: MT Zip: 59749

Telephone: 406-596-0920 E-mail: giem@3rivers.net

C. Landowner and/or Lessee Name
(if different than applicant): Ruby Valley Ranch

Mailing Address: PO Box 1200

City: Choteau State: MT Zip: 59422

Telephone: 406-466-3678 E-mail: aoborny@unitedstatescc.com

II. PROJECT INFORMATION

A. Project Name: Upper Ruby River Restoration Project: Phase 2

River, stream, or lake: Upper Ruby River

Location: Township: 7S Range: 4W Section: 30

Latitude: 45.19243 Longitude: -112.14264 *within project (decimal degrees)*

County: Madison County

B. Purpose of Project:

RVCD plans to restore 1.7 miles of the Ruby River to enhance the recruitment, survival, and prosperity of native and non-native fish species within the Ruby River and Ruby Reservoir. The Upper Ruby watershed provides essential habitat for brown trout, rainbow trout, mountain whitefish, and arctic grayling. Currently, this section of river is marked by a single-thread channel that is actively downcutting and abandoning the current floodplain. The objective of RVCD's project is to restore vital habitat for the fishery by reconnecting the Ruby River to its historic floodplain, addressing highly erosive banklines, and improving the streamside vegetation array. To achieve floodplain connectivity, RVCD plans to reconnect the old river meanders, increase channel complexity and create seasonal overflow channels. The RVCD will use brush matrix to enhance instream and streamside habitat while also improving erosion and sedimentation within the project reach and downstream.

C. Brief Project Description (attach additional information to end of application):

RVCD is requesting funding for Phase 2 of the Upper Ruby River Restoration Project. In 2020, the landowner, Ruby Valley Ranch, came to the RVCD with an interest in restoring 2.3 miles of riparian habitat. Ruby Valley Ranch fully funded Phase 1 to restore 0.6 miles of Ruby River in 2021. RVCD is hoping to secure funding for Phase 2 to restore an additional 1.7 miles of the Ruby River. With the help of RVCD, FWP, TNC and USFWS, the ranch would like to address habitat degradation concerns by improving erosive streambank with brush matrix treatments, adding channel length, and improving riparian and aquatic habitat.

To slow lateral erosion and transport of fine sediment into the Ruby River and Reservoir, ~3,200 ft of bankline will be restored using three types of woody debris matrix treatments depending on the current erosion rate. Where banklines are too high to use woody debris matrixes or the channel is over-widened, an inset floodplain will be created. These bank treatments methods will improve aquatic habitat by slowing erosion rates, increasing instream habitat diversity, and promoting the establishment of woody riparian vegetation for overhead cover. To ensure the success of bank treatments and vegetation recruitment, RVCD has worked with the landowner to develop a riparian fencing and grazing management plan for the years following implementation.

The project will also add channel length, access to the floodplain, and wetland habitat. Channel length will be added by plugging the current main channel and moving the river back into abandoned meanders. Within the design, there will be an additional ~8,000 ft of seasonal channels activated at various discharge flows; flows were determined with guidance from the local FWP Fisheries Biologist. Bed aggradation structures will be placed throughout the project area to elevate the water surface elevation and encourage bedload aggradation. Aggradation structures will be placed on top of existing riffles preventing further downcutting and encouraging floodplain connectivity. The project is intended to increase floodplain connectivity leading to groundwater infiltration and the return of cool, clean water to the fishery during low flows and drought. Native fish in the Ruby River and Ruby Reservoir will have access to increased spawning gravels, deep pool refugia, and slack water.

By completing this project, RVCD hopes to create a more functional, sustainable, and ecologically beneficial riverscape for the fishery and wildlife.

D. Length of stream or size of lake that will be treated (project extent): 1.7 miles

Length/size of impact, if larger than project extent (e.g. stream miles opened): _____

E. Project Budget:

Grant Request (Dollars):	\$	50,000
Matching Dollars:	\$	408,948
Matching In-Kind Services:*	\$	10,000
<i>*salaries of government employees are not considered matching contributions</i>		
Other Contributions (not part of this app)	\$	0
Total Project Cost:	\$	477,088.90

F. Attach itemized (line item) budget – see *budget template*

G. Insert or attach a project location map showing the project area in relation to a major landmark or town. Please indicate if the project location is on public or private property.

This project will occur on private land in the Upper Ruby River Valley. Please see the attached location and project area maps with this application.

H. Attach specific project plans (e.g. detailed sketches, plan views [showing location and type of channel modifications], example photographs), current condition photographs, and maps. *If project involves water leasing or water salvage complete and attach a supplemental questionnaire (fwp.mt.gov/habitat/futurefisheries/supplement2.doc).

I. Attach letters or statements of support. This includes landowner consent, community or public support, and fish biologist support.

J. The project agreement includes a 20-year maintenance commitment. Please indicate (yes or no) that you will ensure project protection for 20 years. Discuss your ability to meet this commitment.

Yes No

The RVCD has drafted an LOA with the Landowner to maintain the investment for a minimum of 20 years. Additionally, project monitoring will be completed by the RVCD, FWP, and the landowner for the duration of this contract. Parameters to be monitored will include bank stabilization, erosion rates, photo-monitoring, fishery response, aggradation behind structures, vegetation response, and acres of wetland improvement.

K. Describe or attach land management & maintenance plans, including changing to grazing regimes, that will ensure protection of the restored area.

The landowner is strongly invested in improving the riverscape and protecting all restoration efforts related to this project. A Ruby Valley Ranch Management Plan was developed with insight from the DEQ 319 panel and outlines requirements for stocking rates, riparian fencing, and revegetation efforts post-restoration. The landowner runs cattle for short durations in the spring and fall. Years one and two following project implementation, the landowner will install electric fencing to create a riparian buffer to support vegetation development and succession of bank stabilization efforts. In the third through fifth years, livestock will be allowed in the riparian corridor only during times outside of the growing season (May-July) at an appropriate stocking rate. Additionally, the management plan requires all ground disturbed by construction to be revegetated using native seed mix.

III. PROJECT BENEFITS (attach additional information to end of application):

- A. What species of fish will benefit from this project?

Brown Trout, Rainbow Trout, Arctic Grayling, Mountain Whitefish

- B. How will the project protect or enhance wild fish habitat?

This project will address major sediment and temperature concerns along this section of the Ruby River and in the Ruby Reservoir. Without intervention, the high erosive bankline will continue to excessively erode, further degrading aquatic habitat and floodplain function. Brush matrix bank treatments will slow the rate of erosion, increase channel roughness and promote woody vegetation recruitment along the treated banklines. Additionally, the project will improve connectivity to the floodplain and create a wetland habitat encouraging groundwater recharge. Improving groundwater supply will help with preserving late season flows and flows during drought years. Overall, the project will enable native and non-native species survival.

- C. Will the project improve fish populations and/or fishing? To what extent? What are the expected short term and long term benefits to the fishery?

Once completed, this project will provide lasting improvements to the Upper Ruby River fishery. The first benefit of this project is the addition of channel length and construction of ~8,000 ft of overflow channels. The added channel length will increase access for river and reservoir fish to spawning gravels, large deep pools, and slack water for juvenile fish. The creation of refugia for the fishery will create a sustainable ecosystem for the recruitment and survival of native fish within the Ruby River and Ruby Reservoir. This project will promote a healthy fishery leading to an enhanced fishing experience within the Upper Ruby watershed.

- D. Will the project increase public fishing opportunity for wild fish and, if so, how?

Yes. This section of the Ruby River is privately owned with a public access point at the lower end of the project reach. Fishing access at the upstream reach is allowed with landowner permission. Restoration efforts will restore essential habitat, resulting in an improved fishery that will benefit anglers recreating in the project area.

- E. What was the cause of habitat degradation in the area of this project and how will the project correct the cause?

The Upper Ruby Valley was once a patchwork of wetlands and floodplain channels promoting healthy aquatic and riparian habitats. Beaver was the keystone species that worked to maintain a healthy riverscape. Aggressive trapping of beavers in the mid-1800s led to a reduction of channel complexity as the river transformed from a multi-threaded system into a single channel. The early 1900s brought alterations to the landscape as ranchers turned the floodplain into irrigated cropland. To improve crop production, the river meanders were intentionally cut off by straightening the channel; channel straightening further promoted destabilization of the bankline and initiated a migration of headcuts. The new development left the river vulnerable to flooding, and when a ~500-year flood hit in 1984, three more meanders were disconnected. Since the late 1800s, ~6,500 feet of the Ruby River has been lost in the project area due to intentional and natural meander cutoffs. As a result, the Ruby River abandoned its floodplain, causing the water table to drop below the sustainable threshold for riparian vegetation roots. This led to the loss of 9,200 ft of woody vegetation from 1961 to 2015. Degradation of riparian vegetation and downcutting has caused high, unvegetated banks to rapidly erode, resulting in high fine sediment

The RVCD would like to address the degradation of the riparian and aquatic ecosystems by reconnecting the floodplain, treating erosive banklines, and boosting channel complexity.

F. What public benefits will be realized from this project?

The project will improve the watershed's ability to support a healthy fishery and allow anglers to catch native species. Additionally, the project will create a functional floodplain that will ecologically strengthen the watershed's ability to adapt to climate change by improving the interaction between surface water and groundwater. This interaction will allow for the storage and release of clean, cool water back onto the landscape during times of low flows and drought.

This project is inspired by a field trip to a similar project completed on the Miller Ranch downstream of the Ruby Reservoir. The Upper Ruby River has 4 private ranches bordering the Ruby River upstream from the project that see similar impairments along their sections of the river. RVCD hopes to inspire the upstream landowners to implement similar restoration projects that will benefit the fishery and watershed.

G. Will the project interfere with water or property rights of adjacent landowners? (explain):

The project will not have any impact on the water rights or property rights of the adjacent landowners.

H. Will the project result in the development of commercial recreational use on the site? (explain):

No. The project will not result in the creation of commercial recreational use.

I. Is this project associated with the reclamation of past mining activity?

No. This project is not associated with the reclamation of past mining activity.

Each approved project applicant must enter into a written agreement with Montana Fish, Wildlife & Parks specifying terms and duration of the project. The applicant must obtain all applicable permits prior to project construction. A competitive bid process must be followed when using State funds.

IV. AUTHORIZING STATEMENT

I (we) hereby declare that the information and all statements to this application are true, complete, and accurate to the best of my (our) knowledge and that the project or activity complies with rules of the Future Fisheries Improvement Program.

Applicant Signature:

Audra Bell

Date: 11/15/21

Sponsor (if applicable):

Submittal: **Applications must be signed and received on or before November 15 and May 15 to be considered for the subsequent funding period.** Late or incomplete applications will be rejected.

Mail to: FWP Future Fisheries Fish Habitat Bureau PO Box 200701 Helena, MT 59620-0701	Email: Future Fisheries Coordinator FWPFFIP@mt.gov (electronic submissions must be signed) For files over 10MB, use https://transfer.mt.gov and send to mmcgree@mt.gov
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Applications may be rejected if this form is modified.

BUDGET TEMPLATE SUBJECT TO REVISIONS FOR PROGRAM APPLICATIONS

Both tables must be completed or the application will be returned

013-2022

BUDGET TEMPLATE SHEET FOR RFP/RFQ/FUNDING REQUEST PROGRAM APPLICATIONS

013-2022

OTHER REQUIREMENTS:

All of the columns in the budget table and the matching contribution table MUST be completed appropriately or the application will be invalid. Please see the example budget sheet for additional clarification.

*Units = feet, hours, inches, etc. Do not use lump sum unless there is no other way to describe the costs.

**Can include in-kind materials. Justification for in-kind labor (e.g. hourly rates used). Do not use government salaries as match. Describe here or in text.

***The Review Panel suggests that design and oversight costs associated with a proposed project not exceed 15% of the total project budget. If design and oversight costs are in excess of 15%, applications must include a justification or minimum of two competitive bids for the cost of undertaking the project.

****The Review Panel recommends a maximum fencing cost of \$1.50 per foot. Additional costs may be the responsibility of the applicant and/or partners.

Additional details:

APPLICATION MATCHING CONTRIBUTIONS

(do not include requested funds or contributions not associated with the application)

CONTRIBUTOR	IN-KIND	CASH	TOTAL	Secured? (Y/N)
Landowner Alternatives/Design/Permitting	\$ -	\$ 68,448.00	\$ 68,448.00	Yes
MT DEQ 319 Application	\$ -	\$ 200,000.00	\$ 200,000.00	No
Landowner Construction	\$ -	\$ 130,000.00	\$ 130,000.00	Yes
The Nature Conservancy	\$ -	\$ 3,000.00	\$ 3,000.00	Yes
RVCD	\$ 10,000.00	\$ -	\$ 10,000.00	Yes
USFWS	\$ -	\$ 7,500.00	\$ 7,500.00	Yes
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
TOTALS	\$ 10,000.00	\$ 408,948.00	\$ 418,948.00	

OTHER CONTRIBUTIONS

(contributions not associated with the application)

CONTRIBUTOR	IN-KIND	CASH	TOTAL	Secured? (Y/N)
	\$ -	\$ -	\$ -	-
	\$ -	\$ -	\$ -	-
	\$ -	\$ -	\$ -	-
	\$ -	\$ -	\$ -	-
	\$ -	\$ -	\$ -	-
	\$ -	\$ -	\$ -	-
	\$ -	\$ -	\$ -	-
	\$ -	\$ -	\$ -	-
	\$ -	\$ -	\$ -	-
TOTALS	\$ -	\$ -	\$ -	

ATTACHMENT C

UPPER RUBY RIVER RESTORATION PROJECT - RUBY VALLEY HYDROELECTRIC
AUTHORITY MANAGEMENT PLAN

This plan outlines the management requirements referred to in the Landowner Agreement between Ruby Valley Hydroelectric Authority, ATTN: Regina Lasko, Landowner, and Ruby Valley Conservation District (RVCD). By signing the Landowner Agreement, all parties agree to the contents of this management plan. This management plan is not a set of recommendations. Where recommendations are made they are explicitly noted as such. The Upper Ruby Restoration Project has largely been funded through the MT DEQ's Nonpoint Source Pollution program. This document details the management practices which will ensure the success of river restoration work on the Upper Ruby River over time. There are two management strategies prescribed here for which RVCD will provide guidance to the landowner. RVCD staff will assist the landowner with land management as it relates to the success of river restoration work and the benefit of the riparian area surrounding the Ruby River. These strategies include: 1) improved riparian grazing management; 2) revegetation post-restoration construction.

Best management practices (BMPs) for enacting each of these strategies are included below. RVCD staff will be available to advise on the best implementation of these practices. Many of the BMPs described in this plan are essential for the success of this plan. Not following BMPs may result in the termination of the Restoration Agreement between the Landowner and RVCD. Recommendations are explicitly noted as such and are included for the benefit of the landowner – not as requirements of this management plan.

Upper Ruby River Restoration Project

This management plan supplements restoration work planned for the Ruby River on the Ruby Valley Hydroelectric Authority property and helps ensure the success of the project.

This section of the river has been altered by early irrigation practices, removal of beavers from the ecosystem, and large flooding events. Today, this section of the river is marked by high, fine-grain banklines that are quickly receding, washing fine sediment into the river, degrading instream habitat, and assisting with the reduction of storage in the Ruby Reservoir. This project will address prior concerns by adding an additional 3850 ft of length to the Ruby River and improving 5,590 ft of banks with willow and brush matrix treatments. Channel length will be added by plugging the current main channel and moving the river back into cut-off meanders. Bed aggradation structures will be placed throughout the project area to elevate the water surface elevation and encourage bedload aggradation. Raising the water surface elevation in combination with creating approximately 3,000 ft of overflow and seasonal channels will decrease the erosive power of the main channel and promote fine sediment deposition. Adding back stream length, creating and activating overflow and seasonal channels, and restoring banklines with woody debris matrix treatments will help to reduce fine sediment loading as well as create a more functional, sustainable, and ecologically beneficial riparian area.

Project work on the river will occur in two phases. Phase 1 will involve approximately 1600 ft of project construction outlined in the Ruby River RVHA Restoration Project Design, attachment B. Phase 1 is funded by resources acquired by the property owner. Phase 1 will occur during 2021.

Phase 2 will be a continuation of the previous phase and will complete the design described in the Ruby River RVHA Restoration Project Design. RVCD will obtain funding for restoration work following the completion of Phase 1.

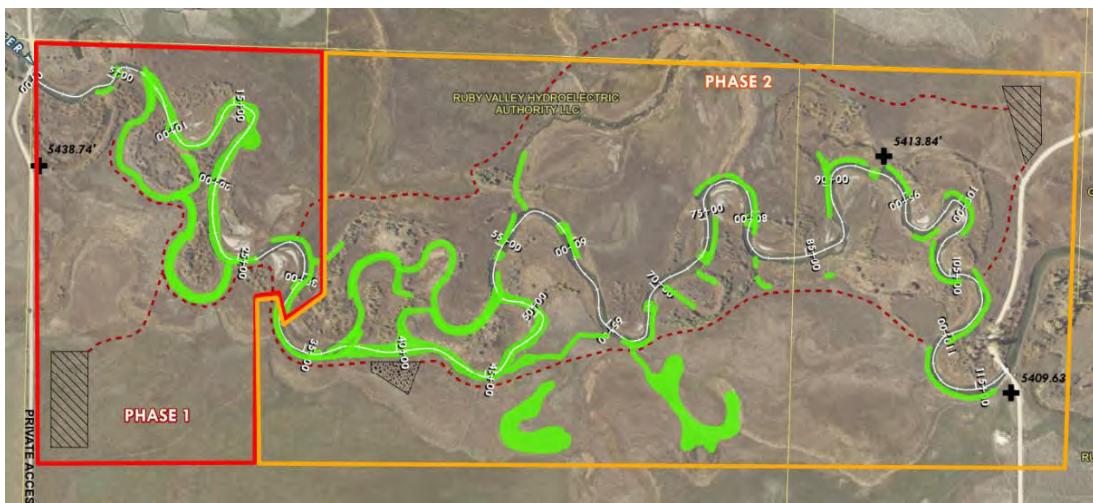


Image 1: Two phases identified. See Attachment B for further information about project designs.

To complete this work successfully and ensure the best possible outcomes for restoration work the following strategies should be employed.

- 1) Alteration to riparian grazing management
- 2) Revegetation post-restoration construction

Descriptions of how these best management practices should be implemented are outlined below:

1) Alteration to Riparian Grazing Management

RVCD will collaborate with the landowner to develop a grazing management plan for limiting livestock disturbances in the riparian area. Phase 1 and Phase 2 will follow the grazing plan outlined below. The landowner will install temporary livestock fencing around the Ruby River Restoration riparian corridor while livestock is present in the surrounding pasture land.

- 1) For the first two years following the restoration implementation, exclusion fencing will be placed to ensure cattle will not enter the riparian corridor. Exclusion fencing will enhance vegetation recruitment by creating an initial browse barrier for newly planted seeds.
- 2) Years 3-5 following the restoration implementation, livestock grazing will be allowed in the riparian pasture, but should be limited to a time of the year outside of the growing season (May - July).
- 3) After year 5, livestock grazing can return to the terms outlined in the agreement between landowner and lessee.

Stocking Rates will be added before December 31st, 2022



Image 2: Exclusion fencing border.

2) Revegetation Plan Post Restoration Efforts

The purpose of the project is to increase the overall ecological function of the Ruby River and associated riparian floodplain habitat. All treatments are expected to enhance riparian ecological function. Construction of streambank benches, inset floodplains, and channel activations are intended to create areas and conditions for natural colonization and expansion of riparian and wetland vegetation. Extensive salvage and transplant of native riparian shrubs and wetland sod will be done throughout the project area. Streambanks will be constructed with whole, live, dormant willow clumps, and over 20,000 dormant willow cuttings will be used in streambanks and channel realignments. All disturbed areas will be seeded with a native grass and forb seed mix. No supplemental irrigation for the project is planned. Transplanted vegetation, willow clumps, and willow cuttings will be installed in locations where late-season moisture is anticipated to be sufficient to support vegetation establishment.



Region 3 Fisheries

730 N. Montana, Dillon, MT 59725

406-683-9310

October 8, 2021

RE: Ruby Valley Conservation District Upper Ruby River 319 application

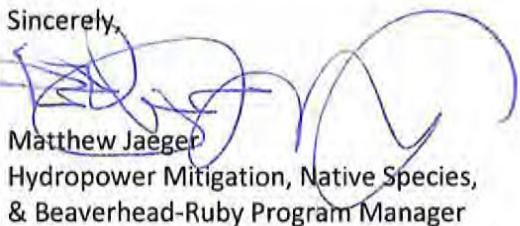
Dear Mark and 319 selection panel,

Montana Fish, Wildlife & Parks (FWP) strongly supports the Ruby Valley Conservation District 319 application to reduce sediment input and restore riparian health and floodplain connectivity to the upper Ruby River.

The section of the upper Ruby River targeted for restoration has a degraded and disconnected riparian community and over-widened and simplified channel that combine to result in high sediment input, degraded aquatic habitat, and reduced trout abundances. Although many historic stressors have been removed, natural recovery is anticipated to take decades due to present channel dimensions and rapidly eroding streambanks composed primarily of fines and vegetated by introduced pasture grasses. Strong landowner commitment to restoration and complimentary stewardship in conjunction with prolonged natural recovery make this reach ideal for targeted intervention. This project has a high likelihood of success; the proposed techniques have been implemented elsewhere in the Ruby River to successfully establish and stabilize streambanks with woody riparian species, reconnect relict channels, reduce erosion, and promote floodplain reconnection and sediment storage. Preliminary fisheries monitoring there suggests improved trout spawning and rearing following the project and similar responses are anticipated in the upper Ruby River. As part of a stakeholder group convened to assess and implement long-term solutions, FWP is strongly supportive of the Ruby Valley Conservation District proposal to restore this reach of the Ruby River and expects the proposed approach will maximize aquatic habitat benefits and fish abundances by reducing sediment input and improving riparian health.

FWP is committed to ensuring a successful outcome to this project and believes the aforementioned proposal is an essential part of achieving one. Please don't hesitate to contact me if you have further questions. Thank you for the opportunity to comment on the upper Ruby River 319 project and your continuing dedication to restoring and conserving Montana resources.

Sincerely,


Matthew Jaeger
Hydropower Mitigation, Native Species,
& Beaverhead-Ruby Program Manager



**The Nature Conservancy of
Montana**
32 South Ewing Street
Helena, MT 59601

Tel (406) 443-0303
Fax (406) 443-8311
nature.org

November 9, 2021

Michelle McGree
Montana Fish, Wildlife & Parks
Future Fisheries Improvement Program
1420 E. Sixth Ave.
P.O. Box 200701
Helena, MT 59620-0701

Re: Upper Ruby River Restoration

Dear Michelle,

The Nature Conservancy strongly supports the Ruby Valley Conservation District's proposal to restore the mainstem Ruby River upstream of Ruby Reservoir. The project is along an ecologically important reach of the river where several landowners and agencies are working together to protect and restore over ten miles of the upper Ruby River and associated floodplains and wetlands. This river probably represents the most successful re-establishment of a fluvial Arctic grayling populations in the state thanks to the long-term efforts of FWP and partners. In addition to improving aquatic habitats locally in the project reach, reducing sediment production and restoring floodplains will benefit the popular fishery in the Ruby Reservoir, as well as streamflows downstream. Floodplain and wetland restoration will extend the life of the reservoir and slow the spring inflows. Thank you for considering this project for Future Fisheries Improvement Program support.

Sincerely,

A handwritten signature in blue ink, appearing to read "Nathan Korb".

Nathan Korb
Freshwater Director



United States Department of the Interior

FISH AND WILDLIFE SERVICE

420 Barrett St.

Dillon MT, 59725



In Reply Refer to:
FWS/IR05/IR07

To whom it may concern,

Please accept this letter of support for the Upper Ruby River Restoration Project on RVHA. This project will focus on increasing quality stream habitat that is essential to a multitude of species.

The USFWS Partners for Fish and Wildlife Program collaborates with private landowners, agencies, and interest groups to implement landscape scale conservation, and identify long-term strategies that protect and maintain resiliency in Southwest Montana. The restoration work that is occurring on the Ruby River will further those efforts and will benefit watershed health, fish and wildlife habitat, and sustainable working landscapes. There has been a significant effort put forth to work across boundary lines, regardless of landownership or agency, to create and sustain quality fisheries habitat. This project will help create a quality fishery in the Ruby watershed, which will not only provide quality habitat, but will also provide for increased recreation opportunities. Furthermore, this project will create quality habitat for a variety of upland and waterfowl species, while maintaining a sustainable working ranch.

The USFWS Montana Partners for Fish & Wildlife Program fully supports this project proposal, and looks forward to collaborating with the Ruby Valley Conservation District and its partners on future efforts in Southwest Montana. The Partners Program is committed to investing time and allocated funds to leverage greater success with this project.

Sincerely,

A handwritten signature in black ink that reads "Adam Braddock".

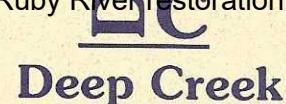
Adam Braddock
MT Partners for Fish and Wildlife Program
U.S. Fish and Wildlife Service

INTERIOR REGION 5 Missouri Basin

Kansas, Montana*, Nebraska, North Dakota, South Dakota
*PARTIAL

INTERIOR REGION 7 Upper Colorado River Basin

Colorado, New Mexico, Utah, Wyoming



Montana Fish, Wildlife & parks
Future Fisheries Improvement Program
1420 E. Sixth Ave.
P.O. Box 200701
Helena, MT 59620-0701

Re: Ruby River 319 Proposal

On behalf of the property owners of Ruby Valley Ranch I would like to express our continued support for the Ruby Valley Conservation District's 319 proposal focusing on the restoration of the Upper Ruby River ecosystem.

As responsible landowners we are committed to restoring stream function, improving water quality, improving fish and wildlife habitat as well as reducing stream bank erosion and the resultant sedimentation of the Ruby Reservoir. This project is a continuation the property owner's strong support for and belief in Montana land stewardship.

Our interest in restoring this reach of the Ruby River began more than two years ago. Our goal is that this restoration improves all aspects of this reach of the Ruby River. It is also our desire that this restoration become a shining example of what can be accomplished when applying the best available science to the health of an ecosystem. We further desire this project be viewed as The FLAGSHIP project for future restoration of the Ruby and all compromised waterways across Montana.

Through continued support of the landowners, Phase 1 of the restoration has been recently completed.

We would like to ask for your support in implementing and completing Phase 2.

With your support the owners are committed to continuing further restoration.

We and the Ruby River Sincerely Thank You!

Alan Oborny,
Property Manager

LANDOWNER AGREEMENT

This Agreement dated _____ between the **Ruby Valley Conservation District (RVCD)**, and **Ruby Valley Hydroelectric Authority** ATTN. **Regina Lasko, landowner**, is entered to authorize repairs on the Ruby River RVHA Restoration along the Ruby River. This restoration project is in Township 07, Range 04, Section 31. Planning work performed will be as outlined in Attachment A of Montana Department of Environmental Quality (DEQ) Contract No. 221019 between the DEQ and RVCD. Future work performed will be as described in attachment B the **Ruby River RVHA Project Design Plans** submitted by **Geum Environmental Consulting**.

This project is intended to address sedimentation rates and loss of riparian vegetation along a 2.3 mile stretch of the Upper Ruby River. The two-phase restoration plan includes placement of brush matrices and willow plants to revegetate ~5,000 ft of streambank and restore floodplain connectivity by plugging the existing channel and encouraging channel migration into abandoned meanders to add length and wetland habitat. Therefore, the landowner agrees to protect and maintain the investment of this project for a minimum of 20 years.

RVCD will assist landowners with infrastructure on their property according to the Upper Ruby River Restoration Project - Ruby Valley Hydroelectric Authority Management Plan (see Attachment C) to contribute to the goals of this project. Access will be granted to RVCD or its agents at all reasonable times for the purposes of project planning, implementation, maintenance, and project effectiveness monitoring. The project area will be used as the site for at least one public demonstration of the restoration work performed on the Upper Ruby River. The restoration project area is illustrated in the attached map. This agreement will expire on

(20 years later).

Notwithstanding the foregoing, it shall not be the landowner's responsibility to repair or replace project improvements should they be damaged, changed, or destroyed by circumstances outside of the landowner's control; such as, but not limited to, natural means and damage by other individuals not under the control and supervision of the landowner. The landowner guarantees ownership of the above-described land and warrants that there are no outstanding rights that will interfere with this cooperative agreement. Further, if the land ownership is transferred, this agreement will remain valid for the period of this agreement.

This Agreement is contingent upon funding procured by RVCD, which may include a single source or multiple sources, including, but not limited to: DEQ, Fish Wildlife & Parks, and DNRC funds. This Agreement may be terminated in writing by either party by providing thirty (30) days advance notice. If terminated by the Landowner or the restoration site is degraded due to purposeful or negligent activities of the Landowner, the Landowner agrees to reimburse the RVCD for the costs of the needed repair work or the original cost of the project.

Ruby Valley Conservation District does not assume jurisdiction over private property as a result of this agreement. The private property owner retains all normal property rights including the right to control trespass. The landowner agrees to allow RVCD, its employees, agents, and contractors access to the site for purposes contemplated in this Agreement. By entering into this agreement the landowner is not required to provide public access to the restoration project area, above and beyond any existing legal requirements.

By: _____
Gary Giem
RVCD Chairman
Date

By: _____
Regina Lasko
Landowner
Date

Upper Ruby River Project Monitoring Report

- RVCD is responsible for conducting pre- and post-construction BEHI and NBS measurements throughout the project area (to facilitate DEQ calculation of sediment load reductions). Monitoring data is collected at each significant meander within the project boundaries. RVCD will conduct BEHI and NBS evaluations.
- Vegetation response monitoring. RVCD will record vegetation response by setting up 2 representative, 100-foot transects along the project reach. Each Transect will be located near bank stabilizing treatments and will record vegetation response to project implementation. RVCD will provide transect data.
- Photo-point monitoring. Pre- and post-construction photo point monitoring consistent with the "Oregon Watershed Enhancement Board Guide to Photo Monitoring" methodologies, or a similar published photo point monitoring method accepted by DEQ. The U.S. Forest Service provides additional photo point monitoring guidance in the "United Stated Forest Service Photo Point Monitoring Handbook" that may be useful toward enhancing the quality of photo point monitoring, or providing more information for specific photo point monitoring situations. RVCD will collect photo points.
- A recorded number of Stakeholders involved in each of the Outreach events completed under application Education and Outreach task. RVCD will provide will provide these numbers.

Monitoring Years			
Parameter	Goal	Monitoring Period	Frequency
BEHI & NBS	bank stability and sediment load reduction	July- August	Years 0, 1, 5
Vegetation Response	Vegetation resiliency post project	July- August	Years 0, 1, 3, 5
Photo-Point	Documenting project effects and sustainability	Mid- August	Years 0-5
Stakeholders Engaged	Local stakeholder engaged	Post Construction	Post Construction

RUBY RIVER RVHA RESTORATION PROJECT

Madison County, Montana

PREPARED FOR:

**Ruby Valley
Hydroelectric Authority**

PREPARED BY:



oeum
Environmental Consulting
Gemi Environmental Consulting Inc.
307 State Street
Hamilton, Montana 59840
(406) 363-2353

Upper Ruby River restoration phase 2

April 2021

SHEET INDEX

- | | |
|--|--|
| 1.0 COVER SHEET | 2.0 EXISTING CONDITION |
| 2.1 EXISTING CONDITION: FLOODPLAIN CONNECTIVITY | 2.2 EXISTING CONDITION: FLOODPLAIN VEGETATION COMMUNITIES |
| 2.3 RESTORATION TREATMENT OVERVIEW | 3.0 SITE PLAN |
| 3.1 RESTORATION TREATMENT SUMMARY | 3.2 CHANNEL ACTIVATION TEMPLATES |
| 3.3 PROFILE and STRUCTURE HEIGHTS | 4.0 CHANNEL ACTIVATION PLANVIEW |
| 4.1 ACTIVATION CHANNEL SEASONAL 1 DETAILS | 4.2 ACTIVATION CHANNEL MAIN CHANNEL RELOCATION 1 DETAILS |
| 4.3 ACTIVATION CHANNEL MAIN CHANNEL RELOCATION 2 DETAILS | 4.4 ACTIVATION CHANNEL OVERFLOW 1 DETAILS |
| 4.5 ACTIVATION CHANNEL MAIN CHANNEL RELOCATION 3 DETAILS | 4.6 ACTIVATION CHANNEL OVERFLOW 2 DETAILS |
| 4.6 ACTIVATION CHANNEL MAIN CHANNEL RELOCATION 4 DETAILS | 4.7 ACTIVATION CHANNEL OVERFLOW 3 DETAILS |
| 4.7 ACTIVATION CHANNEL MAIN CHANNEL RELOCATION 5 DETAILS | 4.8 ACTIVATION CHANNEL OVERFLOW 4 DETAILS |
| 4.8 ACTIVATION CHANNEL MAIN CHANNEL RELOCATION 6 DETAILS | 4.9 ACTIVATION CHANNEL OVERFLOW 5 DETAILS |
| 4.9 ACTIVATION CHANNEL MAIN CHANNEL RELOCATION 7 DETAILS | 4.10 ACTIVATION CHANNEL OVERFLOW 6 DETAILS |
| 4.10 ACTIVATION CHANNEL MAIN CHANNEL RELOCATION 8 DETAILS | 4.11 ACTIVATION CHANNEL SEASONAL 2 DETAILS |
| 4.11 ACTIVATION CHANNEL MAIN CHANNEL RELOCATION 9 DETAILS | 4.12 ACTIVATION CHANNEL OVERFLOW 7 DETAILS |
| 4.12 ACTIVATION CHANNEL MAIN CHANNEL RELOCATION 10 DETAILS | 4.13 STREAMBANK TREATMENT & INSET FLOODPLAIN DESIGN ELEVATIONS |
| 4.13 STREAMBANK TREATMENT & INSET FLOODPLAIN DESIGN ELEVATIONS | 5.0 BED AGGRADATION STRUCTURE DETAIL |
| 5.1 MAIN CHANNEL PLUG DETAIL | 5.2 WOODY DEBRIS MATRIX TYPE 1 and INSET FLOODPLAIN DETAIL |
| 5.3 WOODY DEBRIS MATRIX TYPE 2 and TYPE 3 DETAIL | 5.4 BEAVER DAM ANALOG DETAIL |
| 5.4 BEAVER DAM ANALOG DETAIL | 6.0 BORROW and MATERIALS SOURCES |
| 6.1 MATERIAL SUMMARY | |

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PROJECT LOCATION

PROJECT DESCRIPTION

The Ruby River watershed is located in southwest Montana. The Ruby River is a tributary to the Beaverhead River and enters the Beaverhead River between the Snowcrest and Gravelly Mountain Ranges. The Ruby River flows in a northerly direction for approximately 76 miles. The Ruby River RVHA Restoration Project includes a 2.2 mile long reach of the Ruby River upstream of the Ruby River Reservoir. The RVHA section of the Ruby River is located in Township 7 South, Range 4 West, Sections 30 and 31.

Prior to the General Land Office Survey of 1871, the Ruby River probably supported a mosaic of wetlands and floodplains that were supported by beaver activity. Beaver were trapped out of this region by the mid-1800's, followed by intensive livestock grazing and conversion of floodplain to pasture and agricultural land. These actions resulted in concretion of flows into a single channel, vertical erosion of the river bed, and accelerated erosion of streambanks resulting in an over-widened channel, a perched floodplain and degraded aquatic habitat.

In 2017, Applied Geomorphology, Inc. and Gillian Associates were asked to evaluate the geomorphic history of the Ruby River, and to provide practical restoration alternatives to help address historic impacts, improve ecological function, and provide ecological function.

RUBY RIVER RVHA RESTORATION PROJECT

MADISON COUNTY, MONTANA

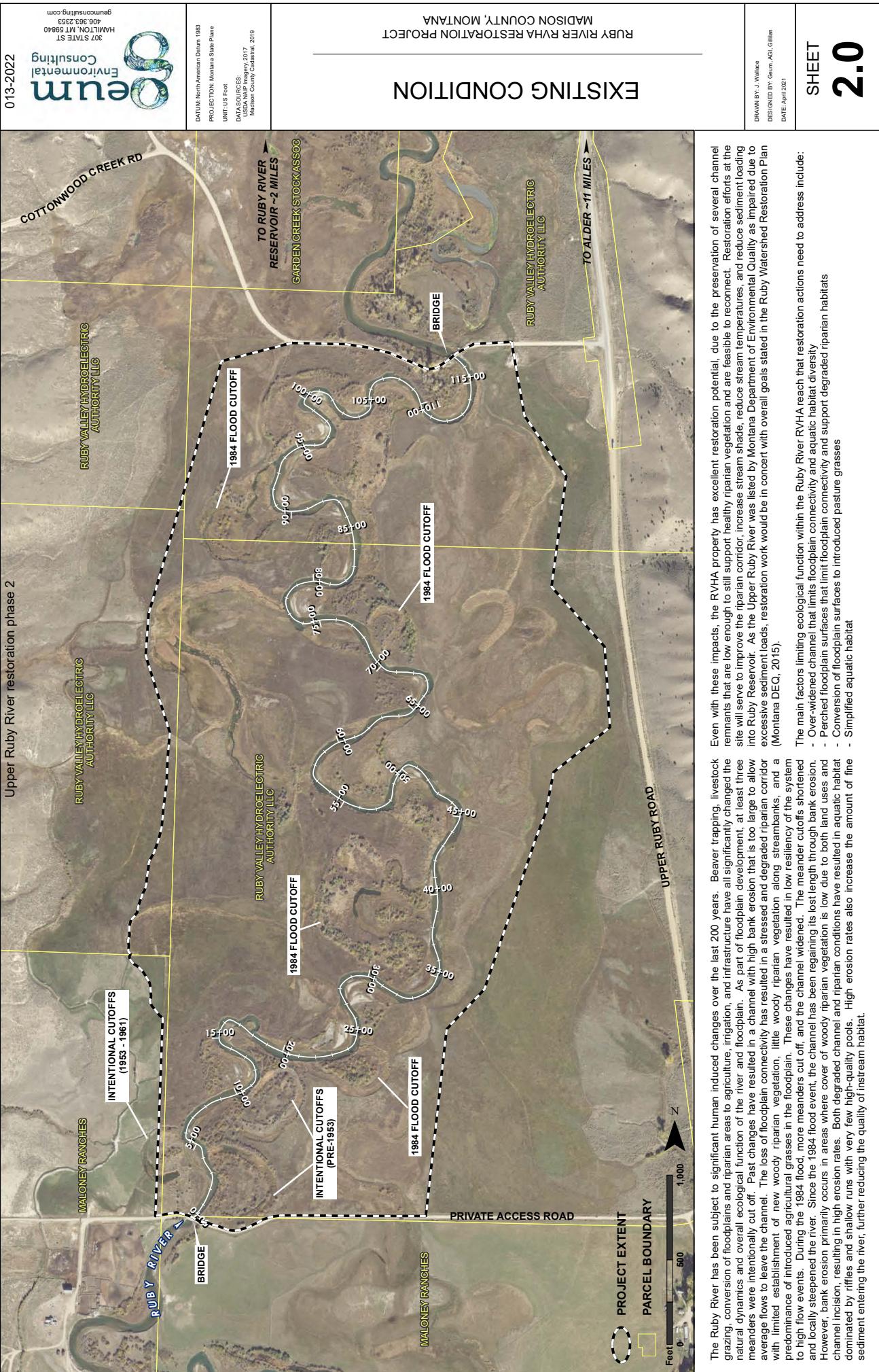
DATA SOURCES:
USDA NASS Imagery - 2017
NRCS Hydrology
NHD Stream
MSL Roads, Towns, Borders

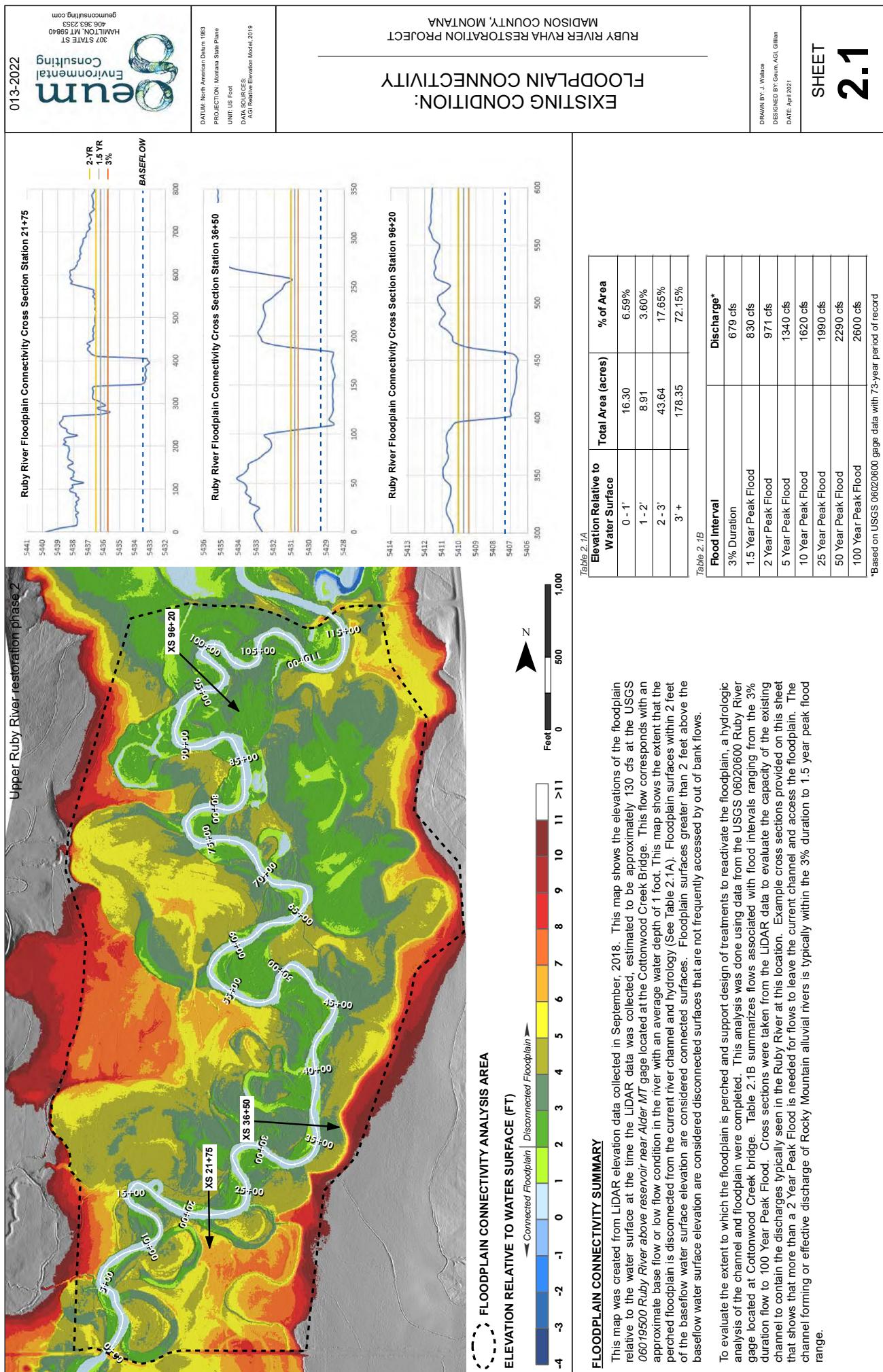
PROJECTION: Montana State Plane
UNIT: US Foot

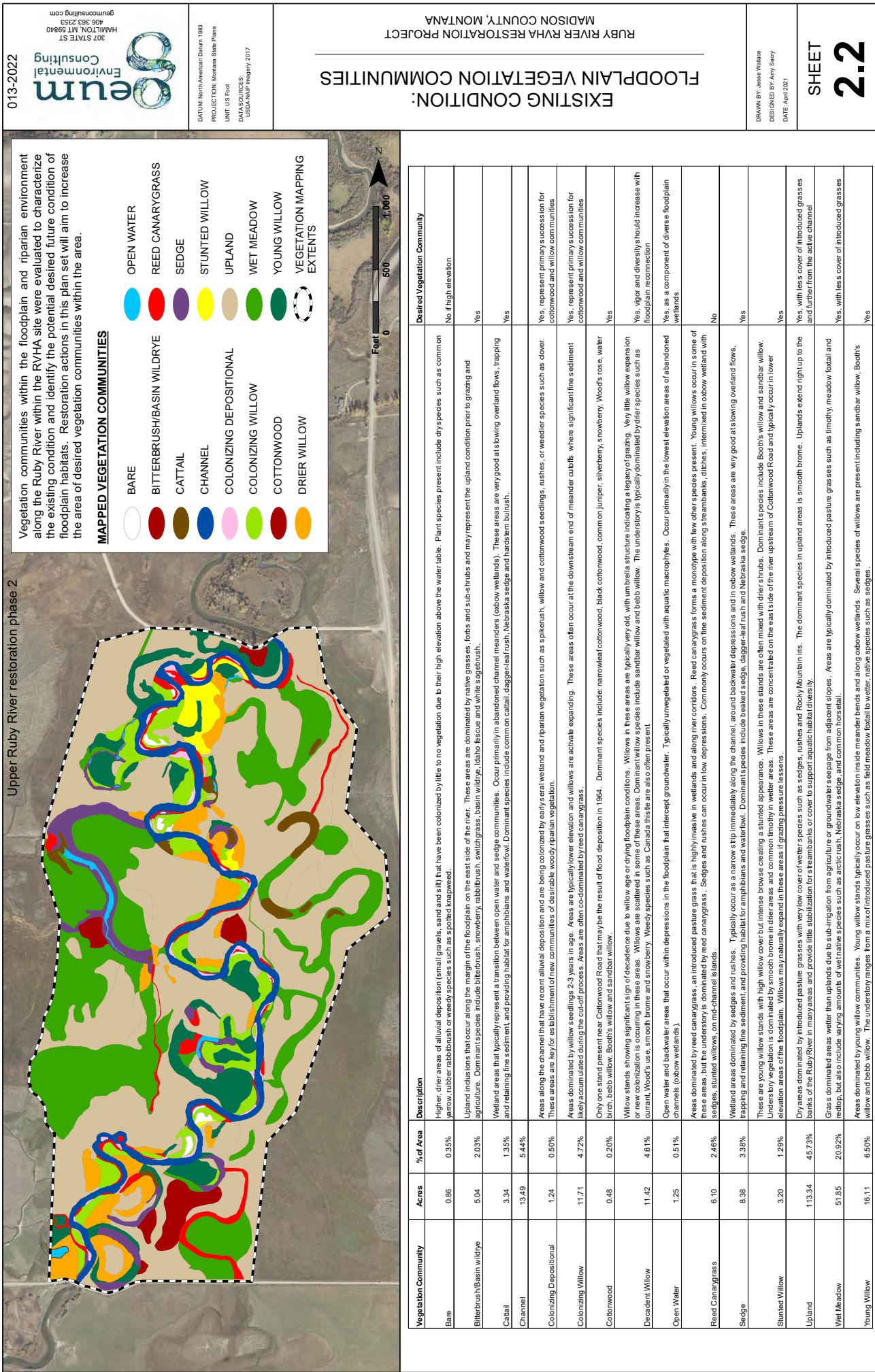
DATE: April 2021

SHEET

1.0







013-2022

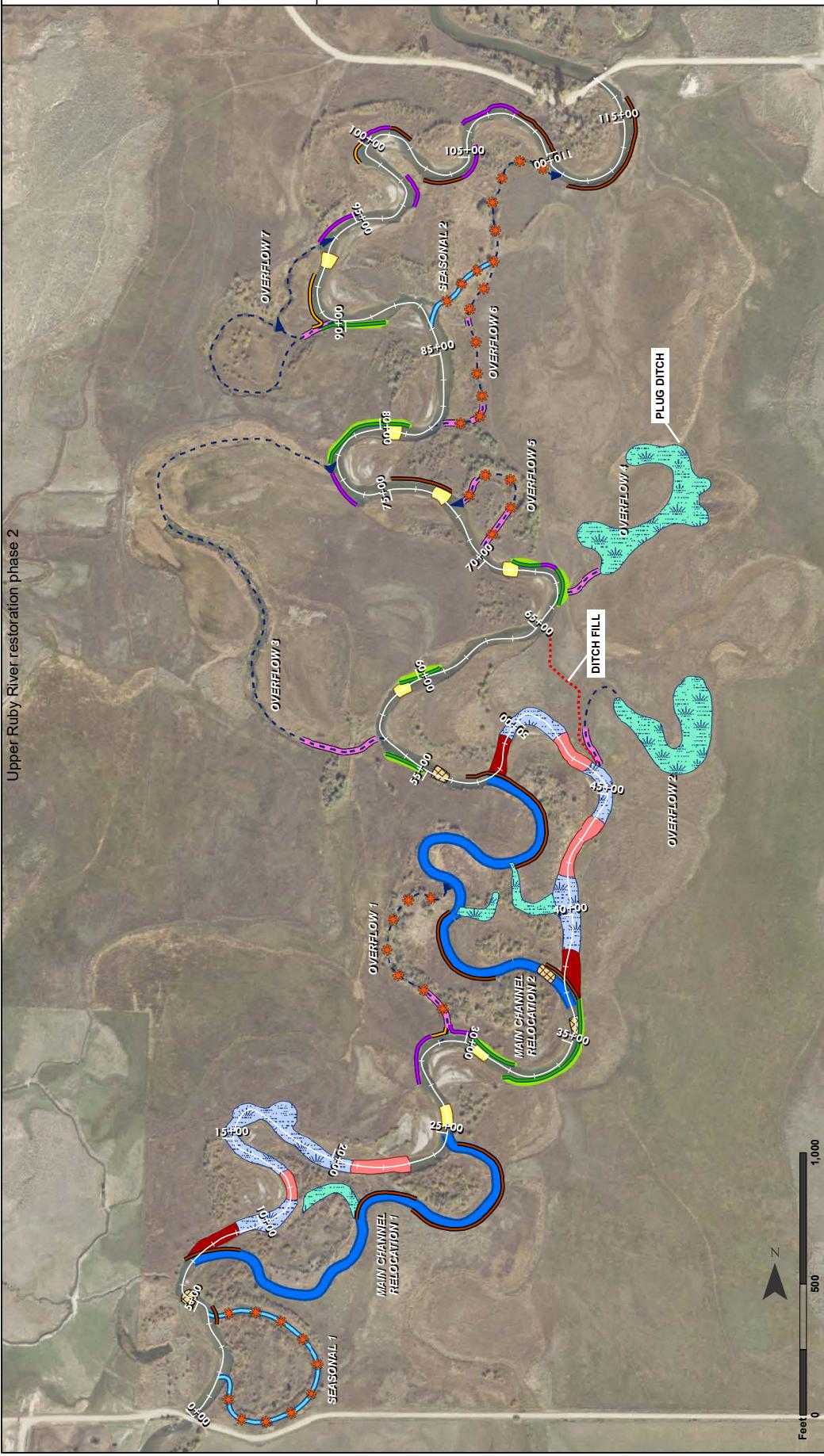


DATUM: North American Datum 1983
PROJECTION: Montana State Plane
UNIT: US Foot
DATA SOURCES:
USDA/NAP Imagery, 2017

RUBY RIVER RYHA RESTORATION PROJECT
MADISON COUNTY, MONTANA

RESTORATION TREATMENT OVERVIEW

Upper Ruby River restoration phase 2



DESIGN RESTORATION TREATMENTS

- MAIN CHANNEL RELOCATION
- SEASONAL CHANNEL
- OVERFLOW CHANNEL
- OVERFLOW CHANNEL EXCAVATION
- BRUSH MATRIX W/ INSET FLOODPLAIN BANK TREATMENT
- BRUSH MATRIX BANK TREATMENT - TYPE 1
- BRUSH MATRIX BANK TREATMENT - TYPE 2
- BRUSH MATRIX BANK TREATMENT - TYPE 3
- BED AGGRAVATION STRUCTURE
- COARSEN RIFFLE
- MAIN CHANNEL PLUG
- WETLAND ENHANCEMENT
- BEAVER DAM ANALOG
- DITCH FILL

SHEET
3.0

DRAWN BY: J. Wallace
DESIGNED BY: Geum, AGL, Gillan
DATE: April 2021

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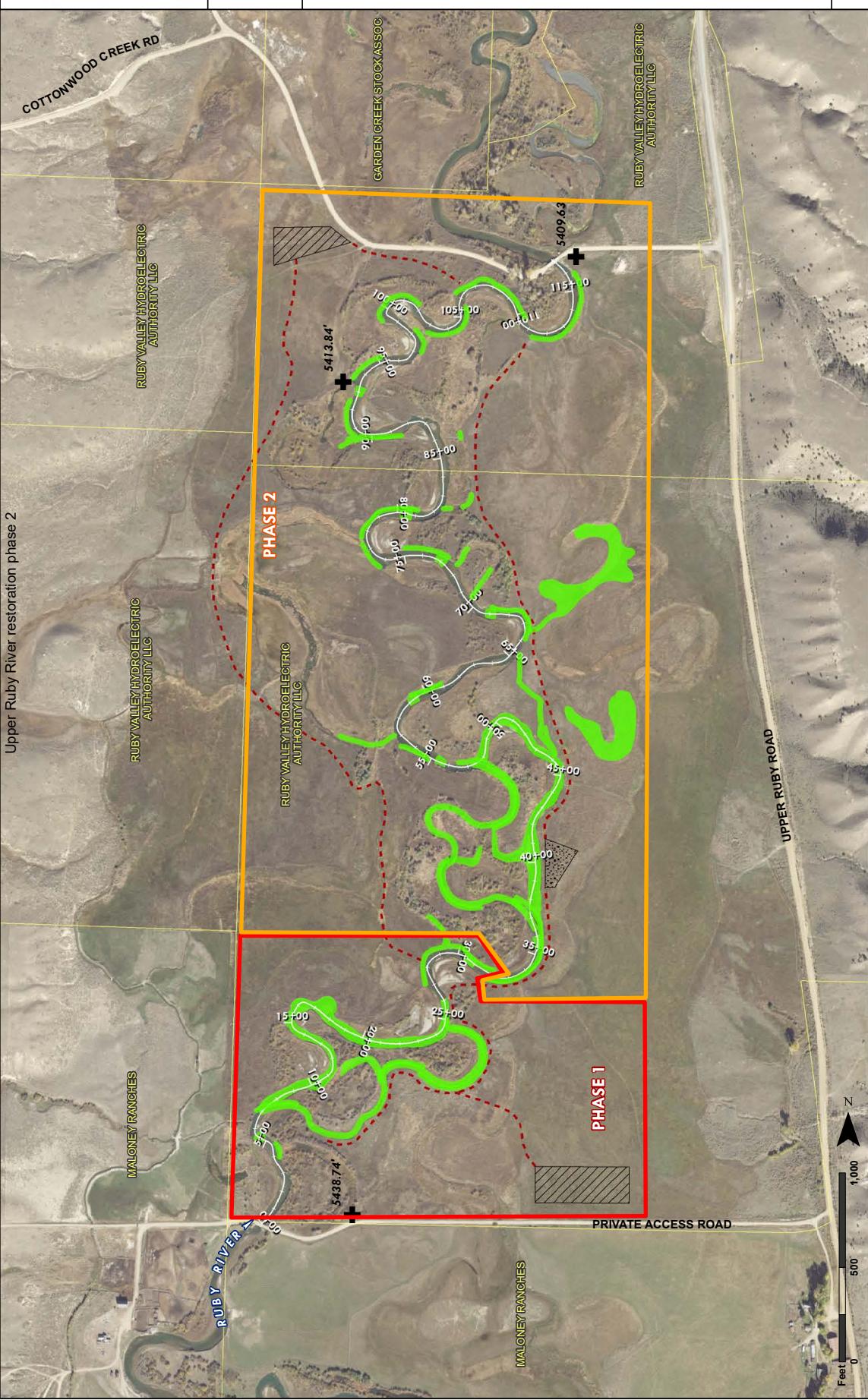


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307 SITE ST
HAMILTON, MT 59840

DATA: North American Datum 1983
PROJECTION: Montana State Plane
UNIT: US Feet
DATA SOURCES:
USDA NAP Imagery, 2017, 2019
Madison County Cadastre, 2019

RUBY RIVER RESTORATION PROJECT
MADISON COUNTY, MONTANA

SITE PLAN



SHEET
3.1

RESTORATION GOAL AND TREATMENTS

Upper Ruby River restoration phase 2

The goal for the Ruby River RWA project is to optimize ecological functions within the river and the floodplain. To achieve this goal, the restoration actions included in this plan set include reactivating old channel meanders, locally raising the bed of the river to raise the groundwater table in the adjacent riparian and floodplain environments, constructing channels to activate floodplain surfaces, creating streambanks to restore woody shrub cover, and increasing floodplain diversity. Restoration treatment locations are shown on Sheet 3.0, and each type of restoration treatment is described below.

CHANNEL REACTIVATION

Channel reactivation aims to reconnect the Ruby River with the perched floodplain and improve instream fish habitat. Several types of channel reactivations are proposed, including: reactivations of the entire main channel (Main Channel Relocation), reactivations that just provide overflow into existing channels and depressions in the floodplain (Overflow Channel), and construction of new floodplain channels (Seasonal Channel). Channel reactivation will be done by locally checking up the elevation of the channel bed in most places. Reactivations that include the entire main channel will be done by plugging the main channel and constructing new channels through the floodplain in each Main Channel Relocation area. Details on the types of channel reactivations are provided on Sheet 3.2. All channel reactivations will incorporate aquatic habitat enhancement features such as: pools and riffles, streambank treatments aimed at increasing cover and woody riparian vegetation, preservation of existing high-quality habitat and/or vegetation, and incorporation of roughness elements as needed. Channel spanning woody debris structures that mimic beaver dams (Beaver Dam Analog) and help retain water and route high flows onto adjacent floodplains would also be constructed in some overflow channels and seasonal channels.

BED AGGRADEMENT STRUCTURE

To reactive channels and increase floodplain connectivity, structures will be built on the channel bed to raise the water surface elevation allowing some of the channel flow to route into old channel meanders or floodplain features. Bed Aggradation Structures are built on existing riffles using layers of cobble and rock.

CHANNEL PLUG

In areas where most main channel flows will be routed into a new channel, a full channel plug will be constructed across the main channel. These plugs are constructed using layers of cobble, gravel, and riprap. The upstream face of channel plugs will consist of woody debris matrix streambank treatment that will form the bank of the new channel.

WOODY DEBRIS MATRIX STREAMBANK

This treatment is used to build new streambanks or restore existing, actively eroding streambanks. The intent of these structures is to create conditions directly along the channel that increase roughness to slow erosion, provide cover and shade, and allow desirable woody, riparian vegetation to establish. Woody debris matrix streambanks are constructed using layers of salvaged willow clumps or other woody debris, and alluvium. Dormant willow cuttings may be incorporated as needed. Three types of Woody Debris Matrix Streambank Treatments will be used: Type 1 is used in areas with little active toe erosion and preserves the existing streambank toe material; Type 2 is used where there are deep pools and adds roughness, such as juniper branches or small trees to the toe for aquatic habitat enhancement; and Type 3 is used along poorly vegetated banklines, and where the toe is actively eroding and adds large cobble toe protection.

INSET FLOODPLAIN

This treatment is used to build new streambanks or restore existing, actively eroding streambanks. The intent of these structures is to create conditions directly along the channel that increase roughness to slow erosion, provide cover and shade, and allow desirable woody, riparian vegetation to establish. These structures consist of a low bench built in front of an existing bank line to reduce channel capacity in over-widened streams. They are built using gravel and cobble and a Woody Debris Matrix Streambank Treatment is constructed along the face of each inset floodplain to form the new bankline.

WETLAND CREATION and ENHANCEMENT

Wetlands will be created as part of restoration actions. Wetlands will be created and enhanced in abandoned channel segments and in along seasonal and overflow channel activation areas. Wetland creation and enhancement includes creating surfaces with varying depths and gradual slopes to create a wide range of habitats capable of supporting a wide range of plant communities. Wetland enhancement may also include varying substrates, placing woody debris, and transplanting salvaged wetland sod and riparian shrubs. In some areas, wetland enhancement will be done by increasing how much water is routed to an area. Increasing the hydrology of an area will increase wetland area and allow introduced grass species to convert to native wetland species.

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RUBY RIVER RWA RESTORATION PROJECT
MADISON COUNTY, MONTANA

SUMMARY OF RESTORATION TREATMENT QUANTITIES

Restoration Treatment	Number of Structures	Unit	Quantity
Main channel relocation	N/A	Linear ft	3,830
Seasonal channel construction	N/A	Linear ft	1,515
Overflow channel (constructed)	N/A	Linear ft	1,360
Bed aggradation structure	N/A	Linear ft	7,580
Coarsen riffles	7	Each	7
Main channel plug	4	Each	4
Main channel plug - Low profile	3	Square ft	26,735
Abandoned channel wetland shaping	4	Square ft	39,305
Wetland enhancement	N/A	Square ft	111,715
Inset Floodplain	N/A	Square ft	179,735
Brush Matrix with Inset Floodplain	8	Linear ft	18,815
Brush Matrix Type 1	3	Linear ft	1,917
Brush Matrix Type 2	9	Linear ft	1,388
Brush Matrix Type 3	12	Linear ft	3,787
Beaver Dam Analog	38	Each	38

RESTORATION TREATMENT SUMMARY

FLOODPLAIN TREATMENT

Floodplain treatment includes increasing topographic diversity and roughness of floodplain surfaces to reduce erosion and increase retention of fluvially transported sediment and plant propagules. Floodplain treatment includes constructing small depressions and hummocks on the floodplain surface and scattering and burying woody debris across the surface. Floodplain treatment locations are not shown on Sheet 3.0. Floodplain treatments will be used on inset floodplains and in wetland enhancement areas.

VEGETATION PRESERVATION, SALVAGE & TRANSPLANT

Preservation of desirable floodplain vegetation will be maximized to the extent possible. Desirable vegetation located within areas to be disturbed during streambank construction or channel activations will be salvaged and transplanted along new channel activations, within streambanks, on floodplain surfaces, or within created wetlands.

DRAWN BY: J. Wallace
DESIGNED BY: Gunn, AG, Gillian
DATE: April 2021

SHEET
3.2

CHANNEL ACTIVATION SUMMARY

Identifying an appropriate channel forming/effective discharge is key to achieving the restoration goal. This flow is used to determine channel design dimensions and how much flow can be routed down seasonal activation and overflow channels. USGS stream gage data for a 73-year period, along with existing channel dimensions, were evaluated to select the discharge to target for channel activations and to develop a template for main channel relocations. The table below represents the flood return flow intervals and corresponding discharges commonly used in stream restoration channel design. 700 cfs was selected as the effective discharge for the Ruby River Restoration Project design. It is both the flow that is met or exceeded 3% of the annual record which has been correlated to effective discharge in snowmelt driven gravel bed rivers. It is expected to occur at an approximate 1.2-year return interval. This return frequency is also desirable as it suggests all channels will be wetter on an almost annual basis.

Flood Return Flow Interval	Estimated Discharge (cfs)
Q2	939 - 389 cfs
Q1.5	800 - 335 cfs
Q1.2 (3% duration or 11 days)	690 cfs
Baseline	130 cfs

CHANNEL ACTIVATION DESCRIPTIONS

MAIN CHANNEL RELOCATION

These activations will carry the bulk of flows up to about 500 cfs, at which point flows will split into both the new and old channels. These channels will require some excavation and shaping to create outlet and effectively route the main flow through them. Flows above ~500 cfs will route down both the new and the abandoned current main channel. The existing main channel will be plugged with a full channel plug with a top height equivalent to the stage height of the effective flow discharge. The abandoned main channel will be shaped into a series of wetland ponds and diverse floodplain features. Main channel reactivations will incorporate aquatic habitat enhancement features such as: shaping of pools and riffles, streambank treatments aimed at increasing cover and woody riparian vegetation, preservation of existing high-quality habitat and/or vegetation, and incorporation of roughness elements where needed for stability. The table and cross-sections provide design dimensions for the main channel relocations.

	Pool 1	Pool 2	Pool 3	Riffle 1	Riffle 2
Bottom width	4	4	10	36	37
Top width at ~500 cfs	70	64	64	56	56
Max Depth at ~500 cfs	5.3	5.8	4.6	2.5	3
Cutbank Slope	3	2.8	2.8	2.00	7.90
Point Bar Slope	10.9	10.5	15.5	5	2.90
Width to /Depth Ratio	13.2	11.0	13.9	22.4	18.70

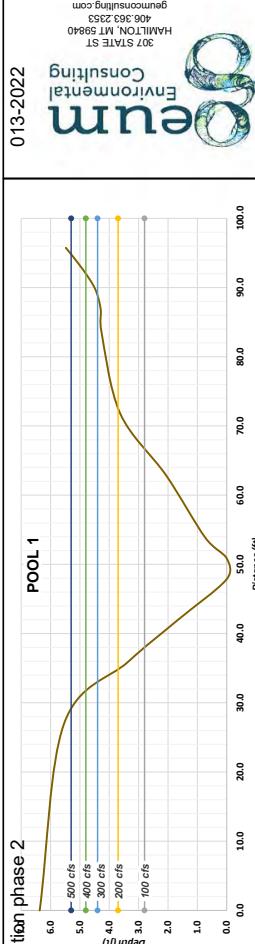
SEASONAL FLOW CHANNEL

This activation requires excavation of a channel to route flows through the feature. The amount of flow and number of days activated varies by location and depends on the existing elevation of the feature to be activated relative to the bed elevation of the main channel. One seasonal flow activation constructs a channel through an abandoned meander (see Sheet 4.0). Seasonal flow channel activations will incorporate aquatic habitat enhancement features such as: shaping of pools and riffles, streambank treatments aimed at increasing cover and woody riparian vegetation, preservation of existing high-quality habitat and/or vegetation, channel spanning woody debris structures to route high flows into adjacent floodplains, and incorporation of roughness elements where needed for stability.

OVERFLOW CHANNEL

This type of channel activation will be done by lowering a channel to route flows through the feature. The amount of flow and number of days activated varies by location and number of days activated varies by location and depends on the existing elevation of the feature to be activated relative to the bed elevation of the main channel. These areas will be activated through construction of pilot channels or swales. Once flows enter the activated feature beyond the pilot channel they will disperse throughout the feature following existing flow paths. The dimensions of each pilot channel varies depending on the activation stage and activation discharge (see Sheet 4.0). Overflow channel activations will incorporate aquatic habitat enhancement features such as: shaping of pools and riffles, streambank spanning woody debris structures to route high flows into adjacent floodplains, and incorporation of roughness elements where needed for stability.

Upper Ruby River restoration phase 2



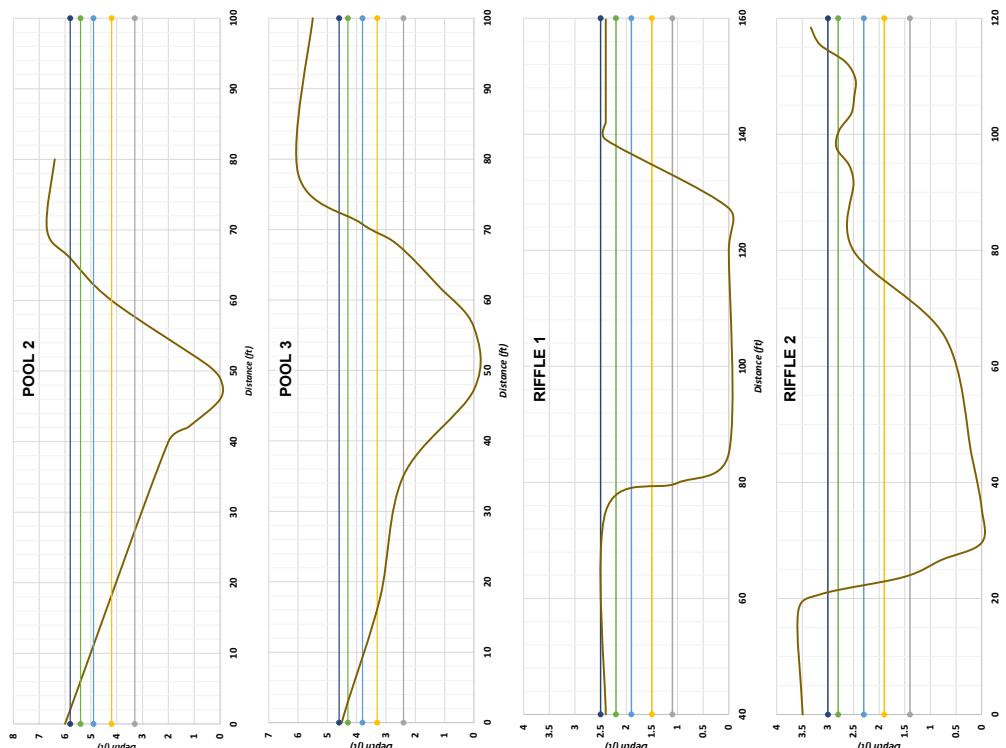
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PROJECTION:
UNIT: NTL FT
DATA SOURCES:

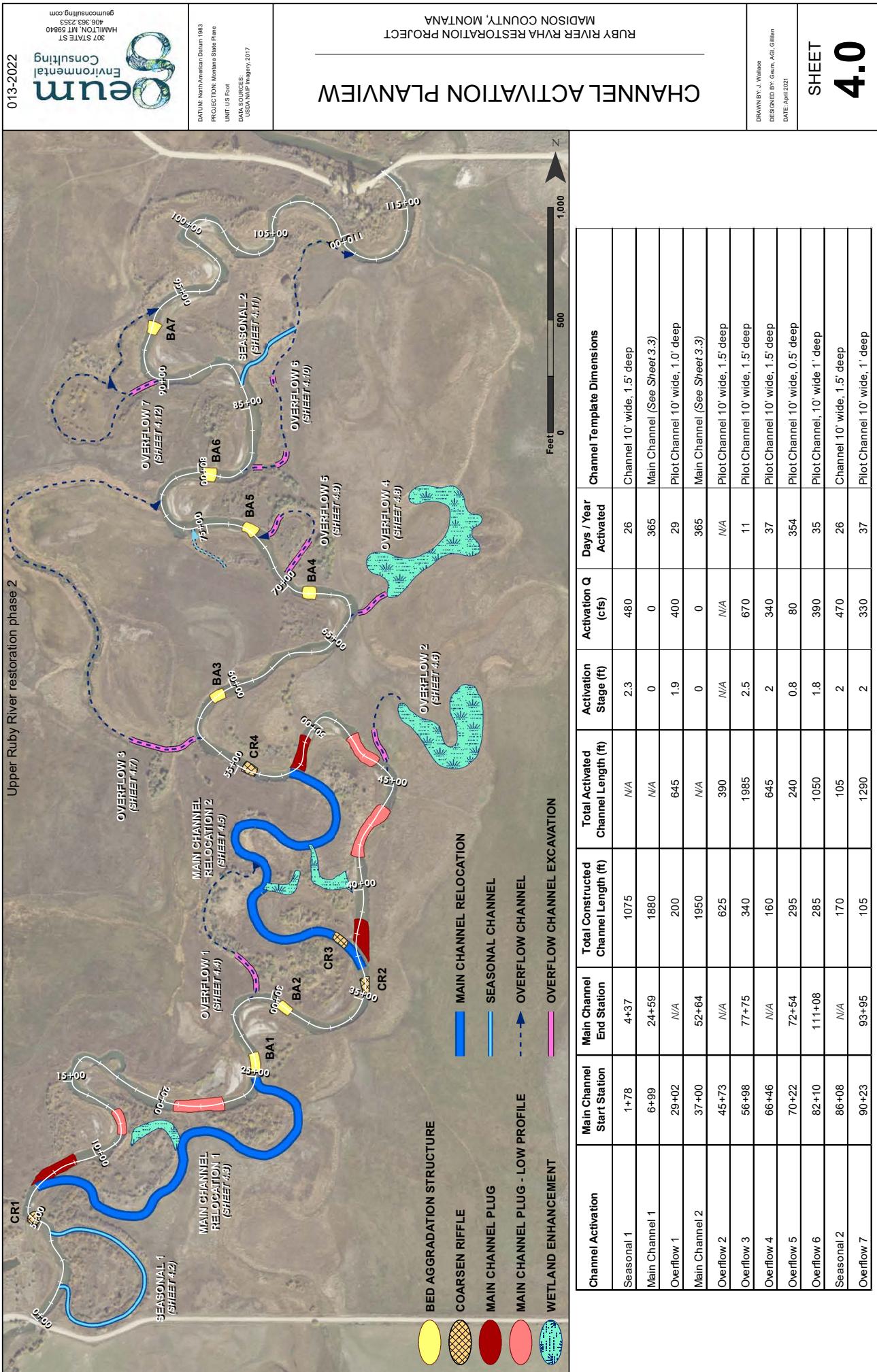
RUBY RIVER RYHA RESTORATION PROJECT
MADISON COUNTY, MONTANA

CHANNEL ACTIVATION TEMPLATES



DRAWN BY: J. Wallace
DESIGNED BY: Genn, A.G., Gillian
DATE: April 2021

SHEET **3.3**



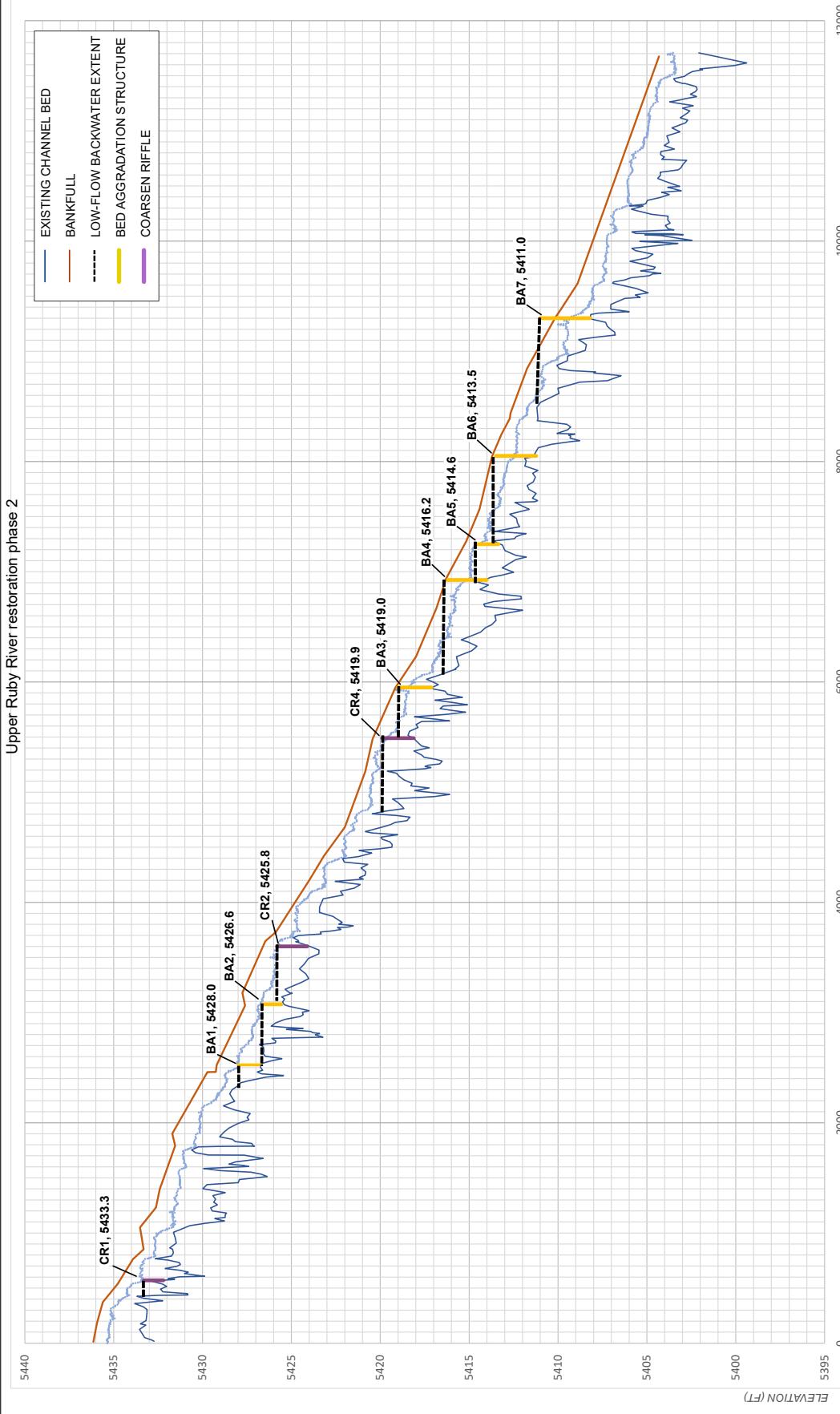
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RUBY RIVER/RVHA RESTORATION PROJECT
MADISON COUNTY, MONTANA

PROFILE and STRUCTURE HEIGHTS



12000

10000

8000

6000

4000

2000

0

CHANNEL STATION (ft)

ELEVATION (ft)

10000

8000

6000

4000

2000

0

ELEVATION (ft)

12000

10000

8000

6000

4000

0

ELEVATION (ft)

Structure	Station	Target Elevation	Max Structure Height (ft)	Mean Structure Height (ft)	Mean Structure Height (ft)
Coarsen Riffle 1 (CR1)	5+70	5433.3	1.1	0.6	0.6
Bed Aggradation 1 (BA1)	25+25	5428	1.3	0.5	1.4
Bed Aggradation 2 (BA2)	30+75	5426.6	1.2	0.4	0.7
Bed Aggradation 3 (BA3)	59+50	5419	1.9	1.2	1.6
Coarsen Riffle 2 (CR2)	36+00	5425.8	2.3	2.0	2.1
Coarsen Riffle 3 (CR3)*	38+50*	5425.5	1.5	1	

*Structure CR3 is located on the MC2 realignment channel and is not shown in the chart above.

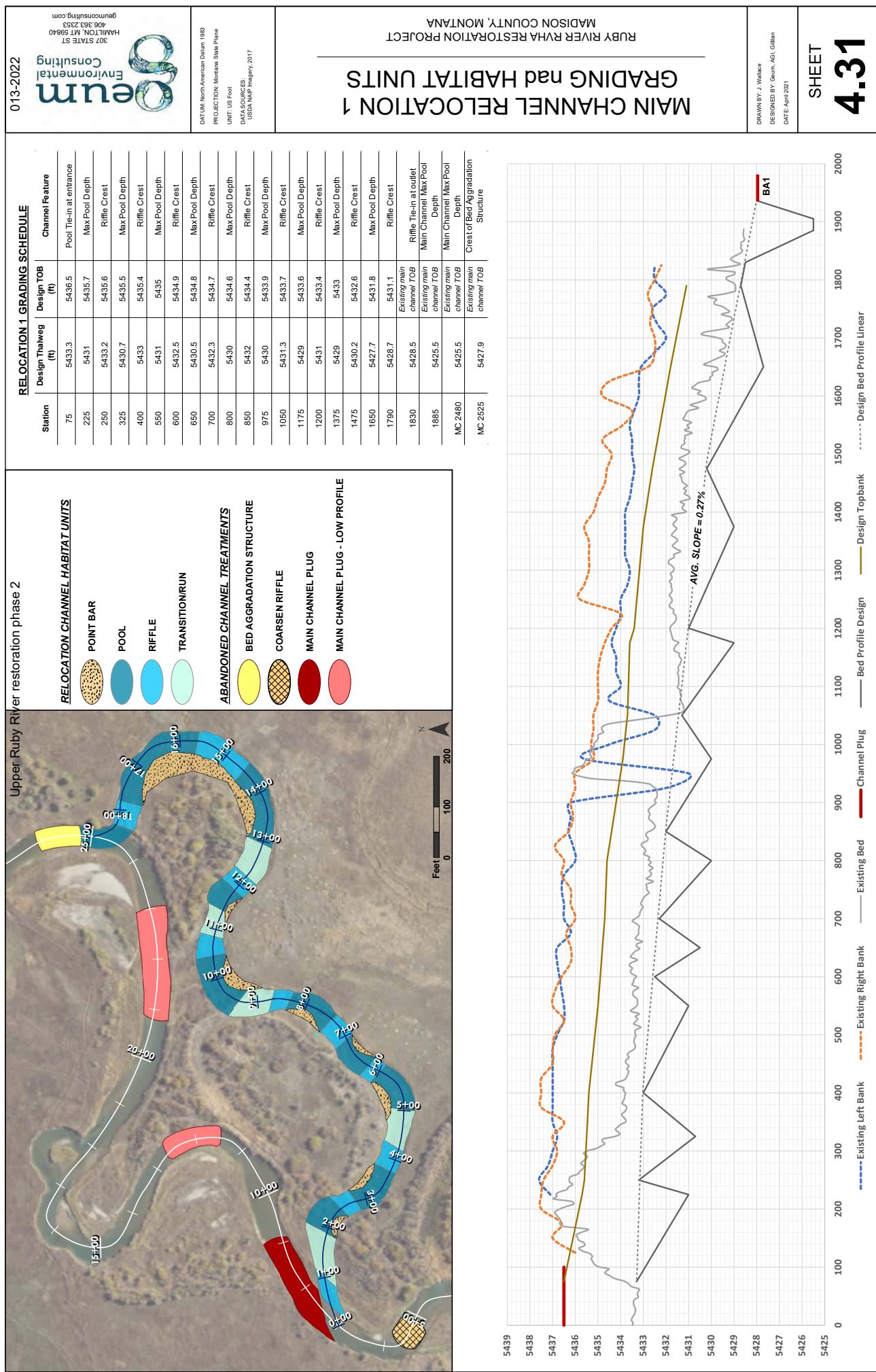
Structure	Station	Target Elevation	Max Structure Height (ft)	Mean Structure Height (ft)	Mean Structure Height (ft)
Coarsen Riffle 4 (CR4)	54+90	5419.9	1.8	1.8	0.6
Bed Aggradation 4 (BA4)	69+25	5416.2	2.2	2.2	1.4
Bed Aggradation 5 (BA5)	72+50	5414.6	1.2	1.2	0.7
Bed Aggradation 6 (BA6)	80+50	5413.5	2.3	2.3	1.6
Bed Aggradation 7 (BA7)	93+00	5411	2.8	2.8	2.1

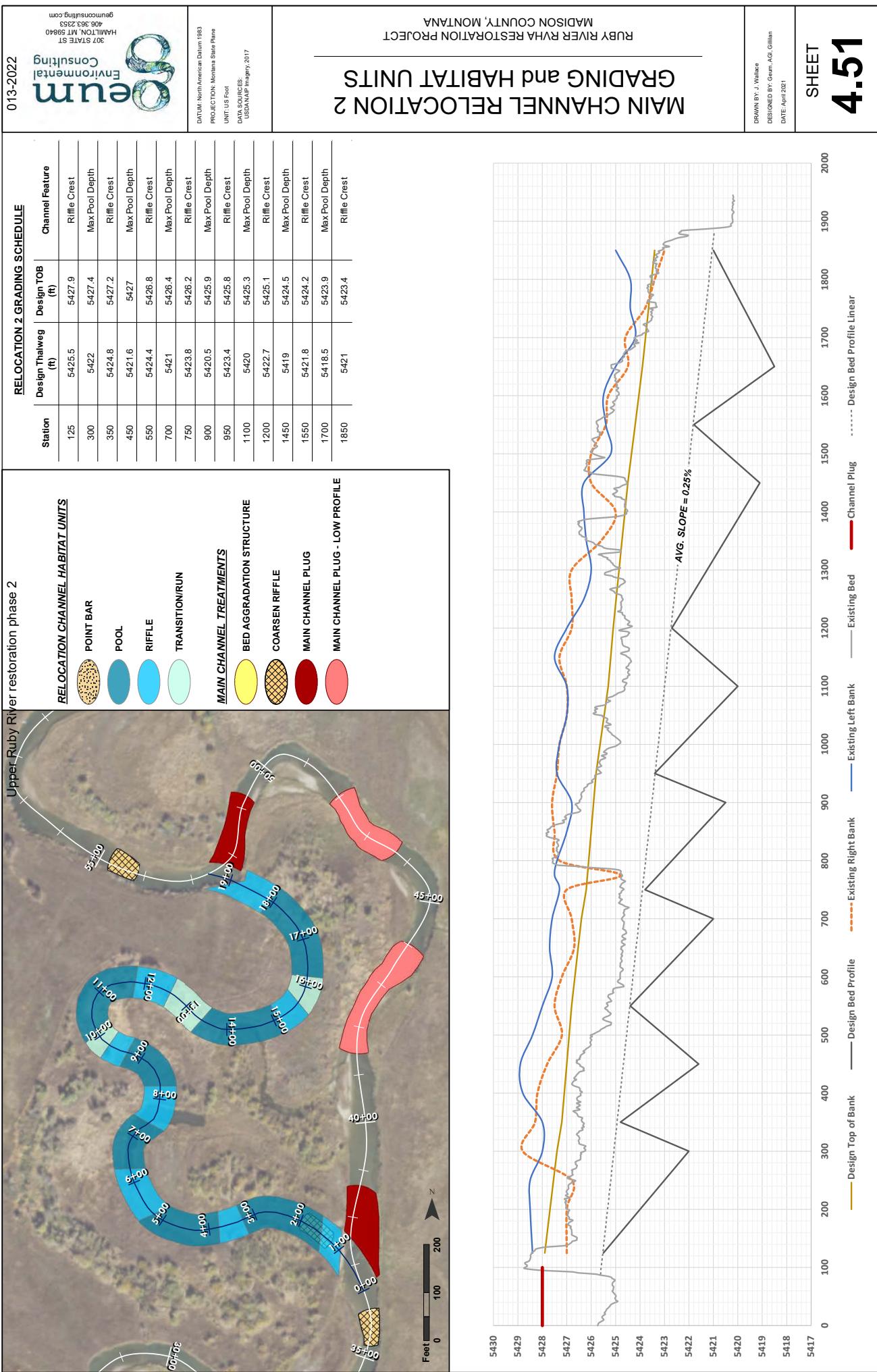
CHANNEL STATION (ft)

ELEVATION (ft)

DRAWN BY: J. Wallace
DESIGNED BY: Geum, AGI, Gillan
DATE: 4/4/2021

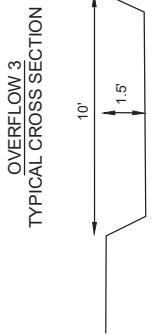
SHEET 4.1





ACTIVATION CHANNEL OVERFLOW 3 DETAILS

ACTIVATION CHANNEL DETAILS	
MAIN CHANNEL START STATION	56+98
MAIN CHANNEL END STATION	77+75
ACTIVATED CHANNEL LENGTH (FT)	1985
CONSTRUCTED CHANNEL LENGTH (FT)	340
TARGET INLET ELEVATION (FT)	5421.5
TARGET OUTLET ELEVATION (FT)	N/A
ACTIVATION STAGE ABOVE BED (FT)	2.5
ACTIVATION Q (CFS)	670
DAY'S PER YEAR ACTIVATED	11
SLOPE	0.31%
BED AGGRADATION STRUCTURE BA3 ELEVATION	5419.0
BED AGGRADATION STRUCTURE BA6 ELEVATION	5413.5



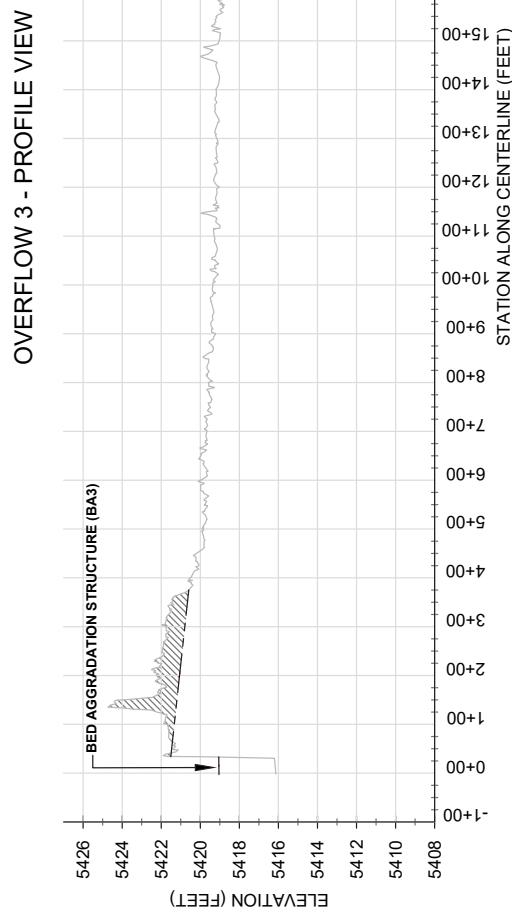
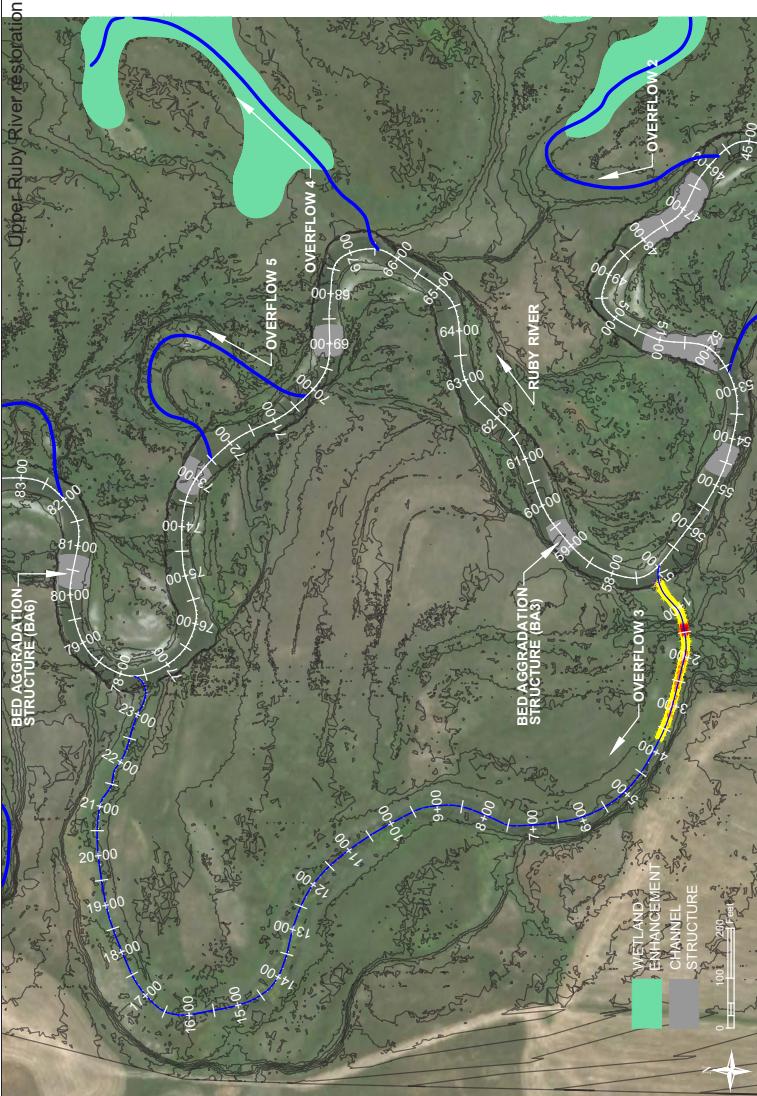
CUT/FILL		ESTIMATED EARTHWORK VOLUMES FOR CONSTRUCTED CHANNEL	
COLOR	MIN. ELEVATION	MAX. ELEVATION	CUT (CY)
[Dark Brown]	-5.00	-4.00	
[Medium Brown]	-4.00	-3.00	
[Red]	-3.00	-2.00	
[Orange]	-2.00	-1.00	
[Yellow]	-1.00	0.00	
[Green]	0.00	1.00	

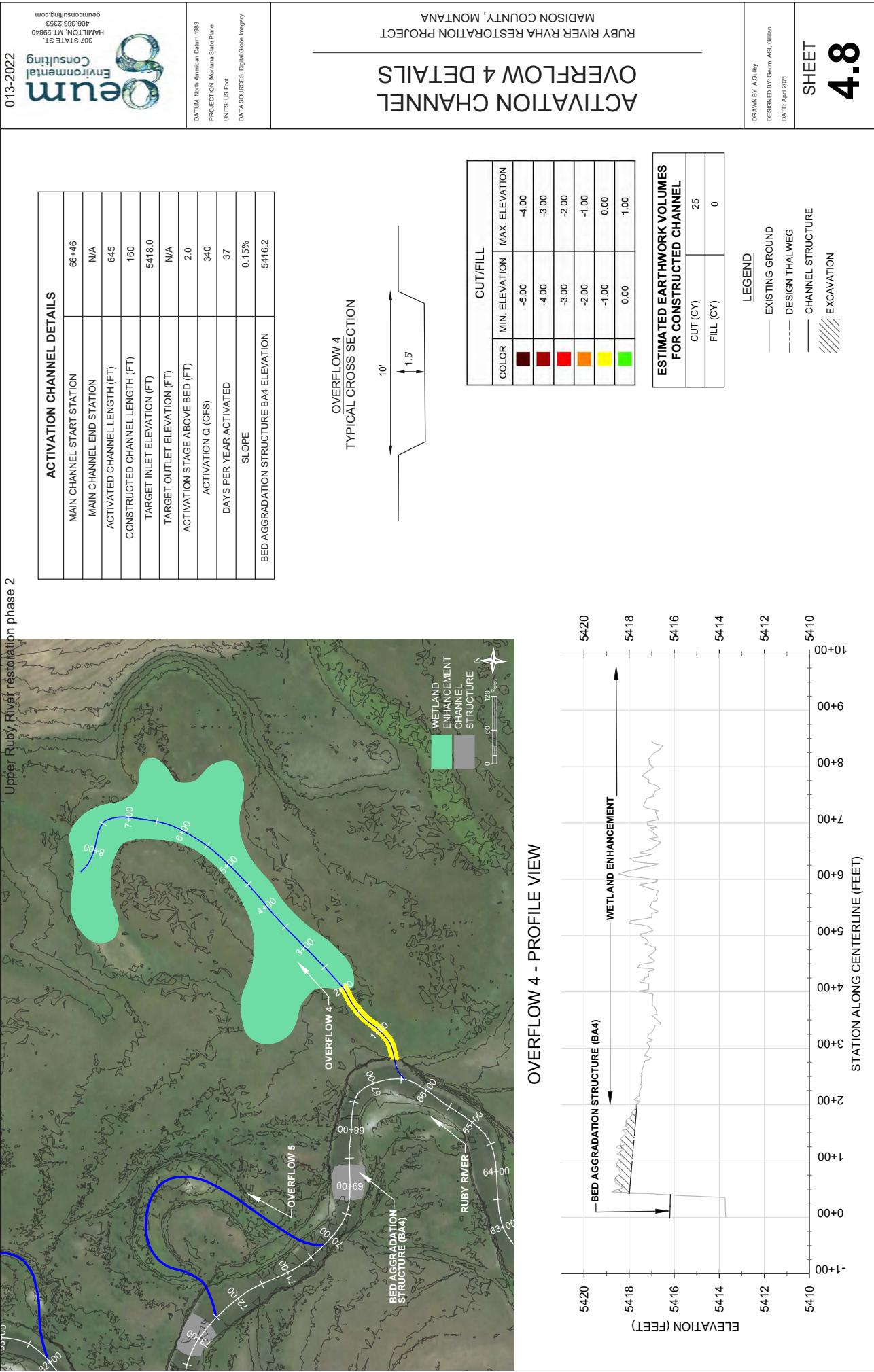
LEGEND

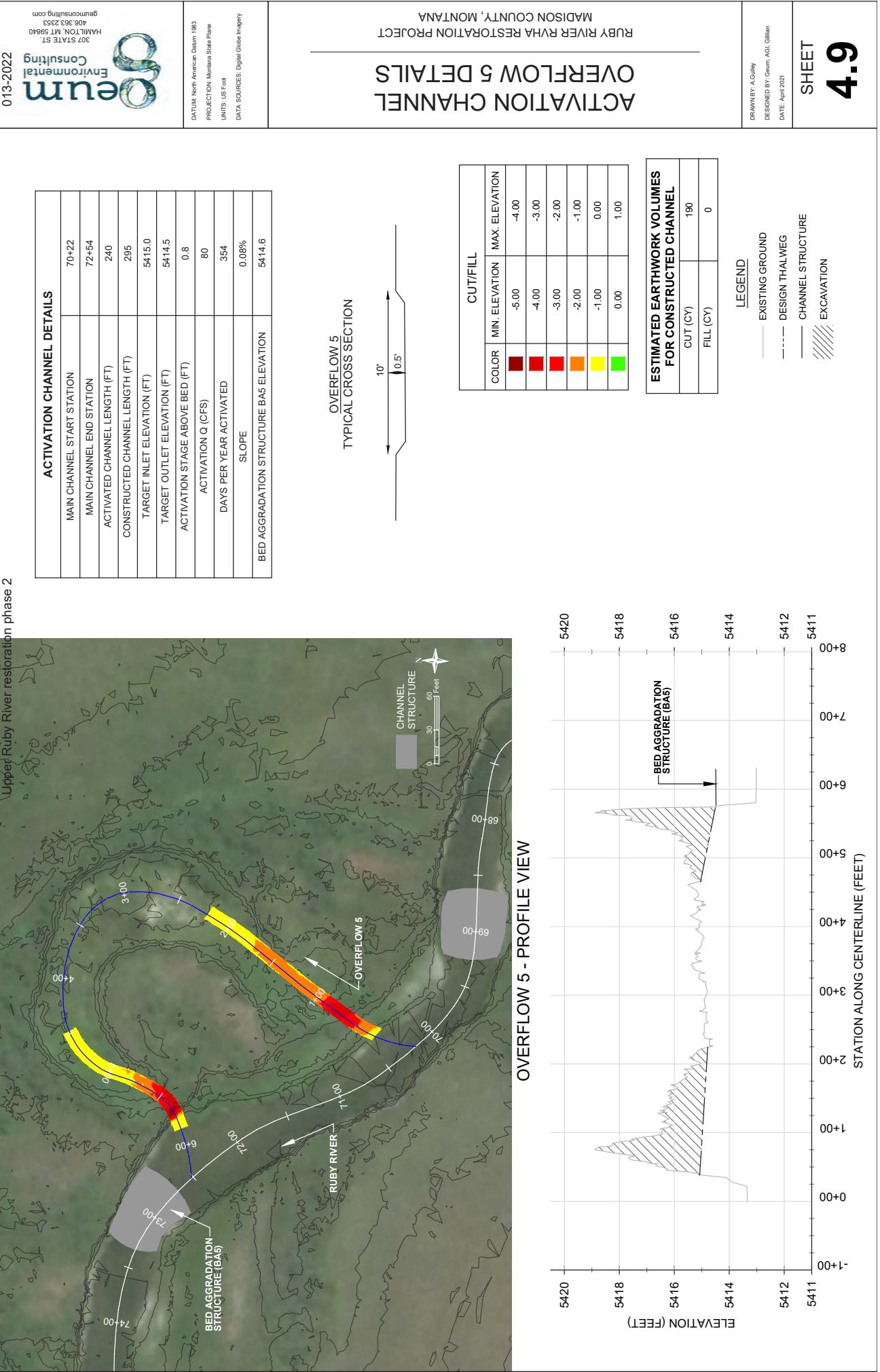
- EXISTING GROUND SURFACE
- - - DESIGN THALASSA LEVEL
- CHANNEL SYSTEM
- EXCAVATION



DRAWN BY: A.Gulley
DESIGNED BY: Gauth, AGI, GILL
DATE: April 2021







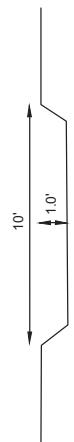
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ACTIVATION CHANNEL DETAILS

MAIN CHANNEL START STATION	82+10
MAIN CHANNEL END STATION	111+08
ACTIVATED CHANNEL LENGTH (FT)	1050
CONSTRUCTED CHANNEL LENGTH (FT)	285
TARGET INLET ELEVATION (FT)	5413.0
TARGET OUTLET ELEVATION (FT)	N/A
ACTIVATION STAGE ABOVE BED (FT)	1.8
ACTIVATION Q (CFS)	390
DAYS PER YEAR ACTIVATED	35
SLOPE	0.42%

ACTIVATION CHANNEL

OVERFLOW 6 DETAILS

OVERFLOW 6
TYPICAL CROSS SECTION

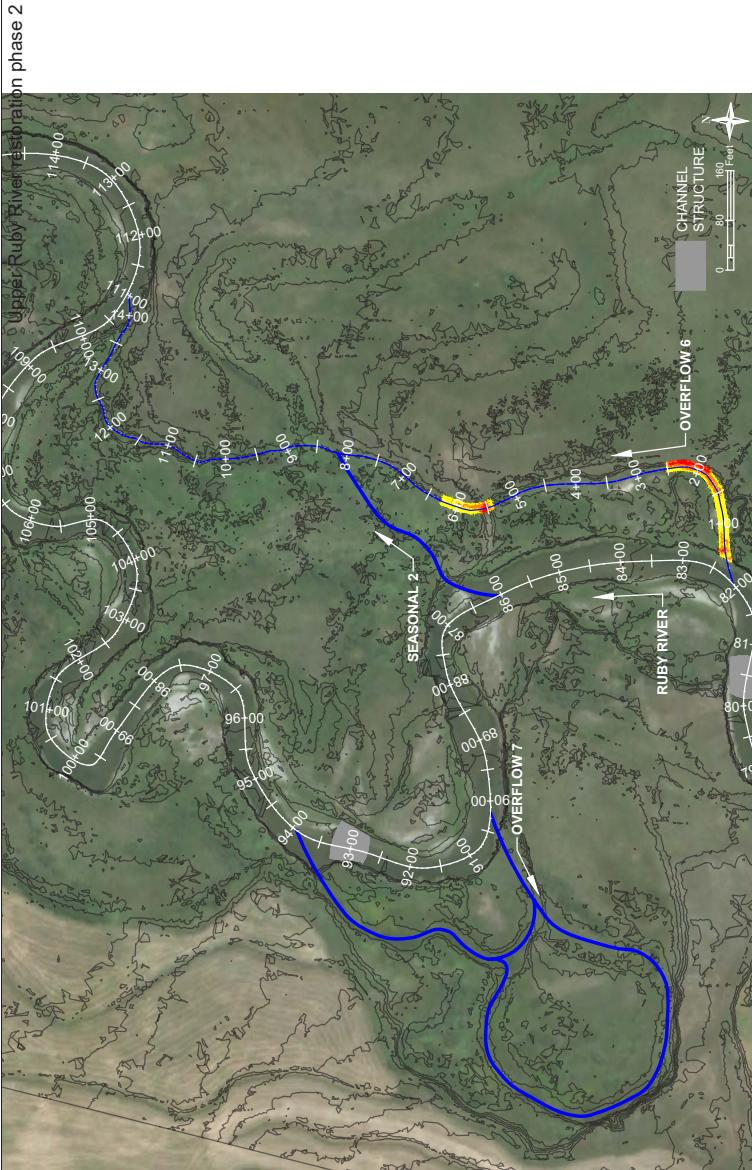
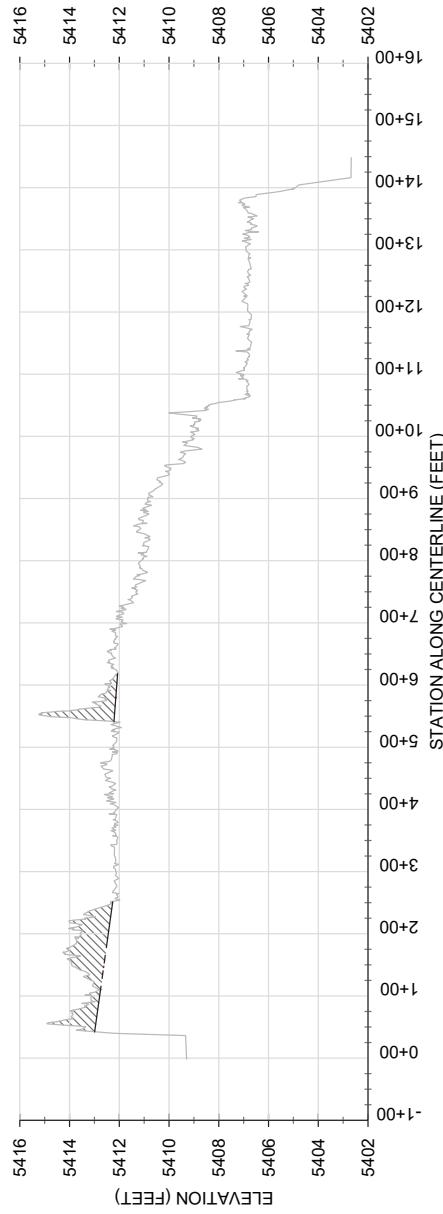
CUT/FILL		
COLOR	MIN ELEVATION	MAX ELEVATION
■	-5.00	-4.00
■	-4.00	-3.00
■	-3.00	-2.00
■	-2.00	-1.00
■	-1.00	0.00
■	0.00	1.00

ESTIMATED EARTHWORK VOLUMES FOR CONSTRUCTED CHANNEL		
CUT (CY)	FILL (CY)	
140	0	

LEGEND

- EXISTING GROUND
- - - DESIGN THALWEG
- CHANNEL STRUCTURE
- ////// EXCAVATION

4.10

**OVERFLOW 6 - PROFILE VIEW**

DRAWN BY: A. Gallay

DESIGNED BY: Geom. Agt. Gallay

DATE: Apr 2021

SHEET

013-2022



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307 STATE ST
HAMILTON MT 59840
DATA: North American Datum 1983
PROJECTION: Montana State Plane
UNITS: US Foot
DATA SOURCES: Digital Globe Imagery

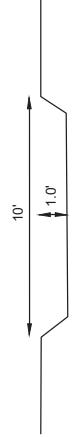
MADISON COUNTY, MONTANA
RUBY RIVER RYHA RESTORATION PROJECT

ACTIVATION CHANNEL OVERFLOW 7 DETAILS

ACTIVATION CHANNEL DETAILS

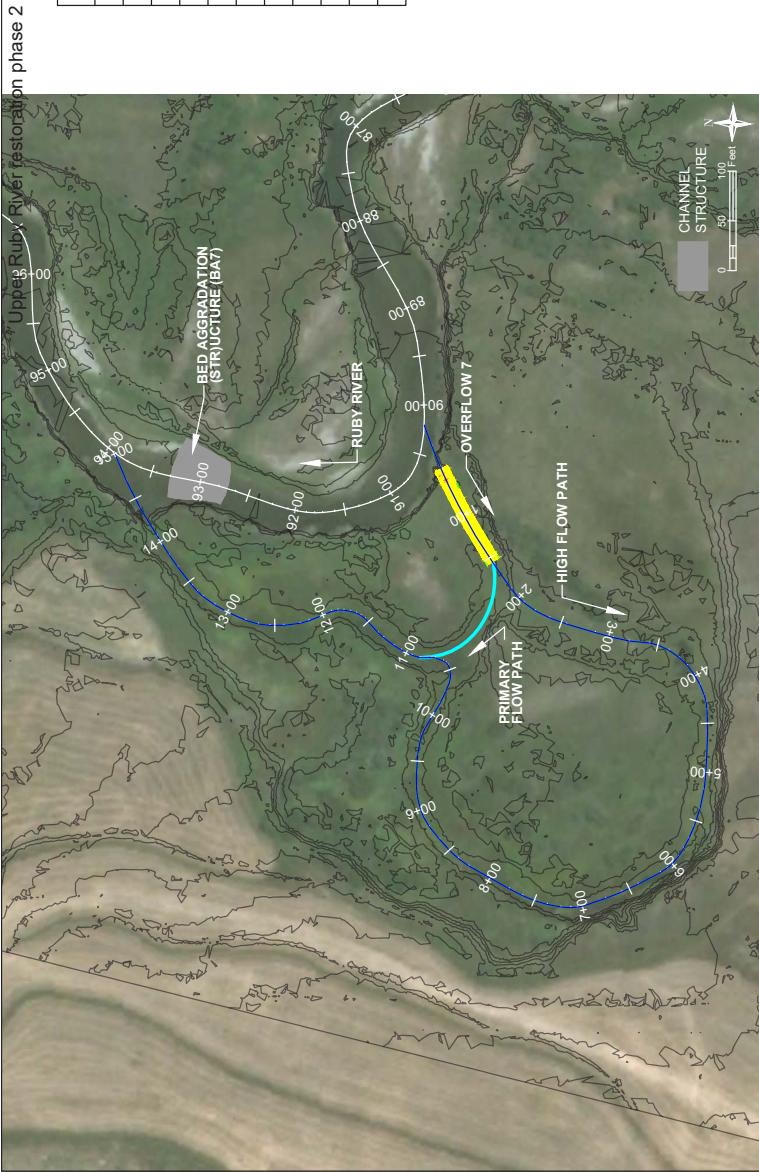
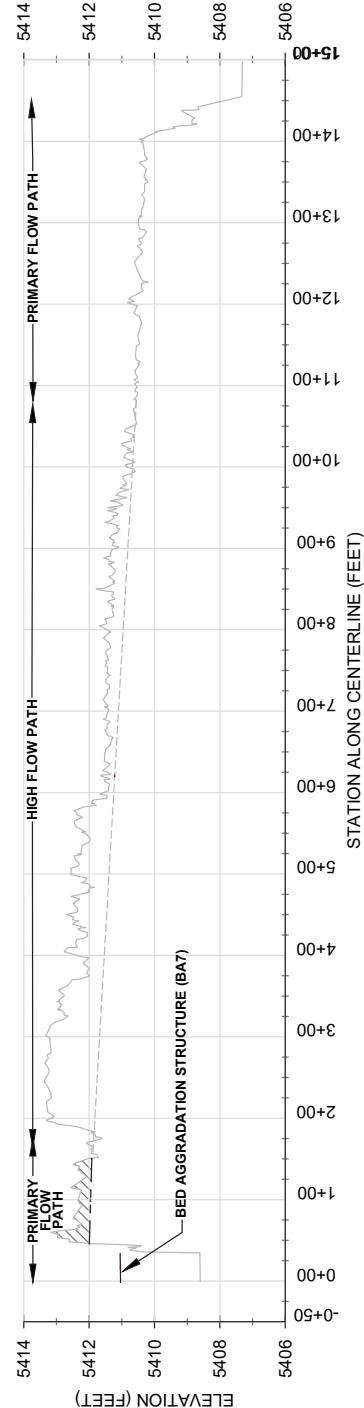
MAIN CHANNEL START STATION	90+23
MAIN CHANNEL END STATION	93+95
ACTIVATED CHANNEL LENGTH (FT)	1290
CONSTRUCTED CHANNEL LENGTH (FT)	105
TARGET INLET ELEVATION (FT)	5412.0
TARGET OUTLET ELEVATION (FT)	N/A
ACTIVATION STAGE ABOVE BED (FT)	2.0
ACTIVATION Q (CFS)	330
DAY'S PER YEAR ACTIVATED	37
SLOPE	0.13%
BED AGGRADATION STRUCTURE BAT ELEVATION	5411.0

OVERFLOW 7 TYPICAL CROSS SECTION



CUT/FILL		
COLOR	MIN. ELEVATION	MAX. ELEVATION
Black	-5.00	-4.00
Red	-4.00	-3.00
Orange	-3.00	-2.00
Yellow	-2.00	-1.00
Green	-1.00	0.00
White	0.00	1.00

ESTIMATED EARTHWORK VOLUMES FOR CONSTRUCTED CHANNEL		
CUT (CY)	FILL (CY)	LEGEND
20	0	— EXISTING GROUND - - - DESIGN THALWEG / \ CHANNEL STRUCTURE // \ EXCAVATION

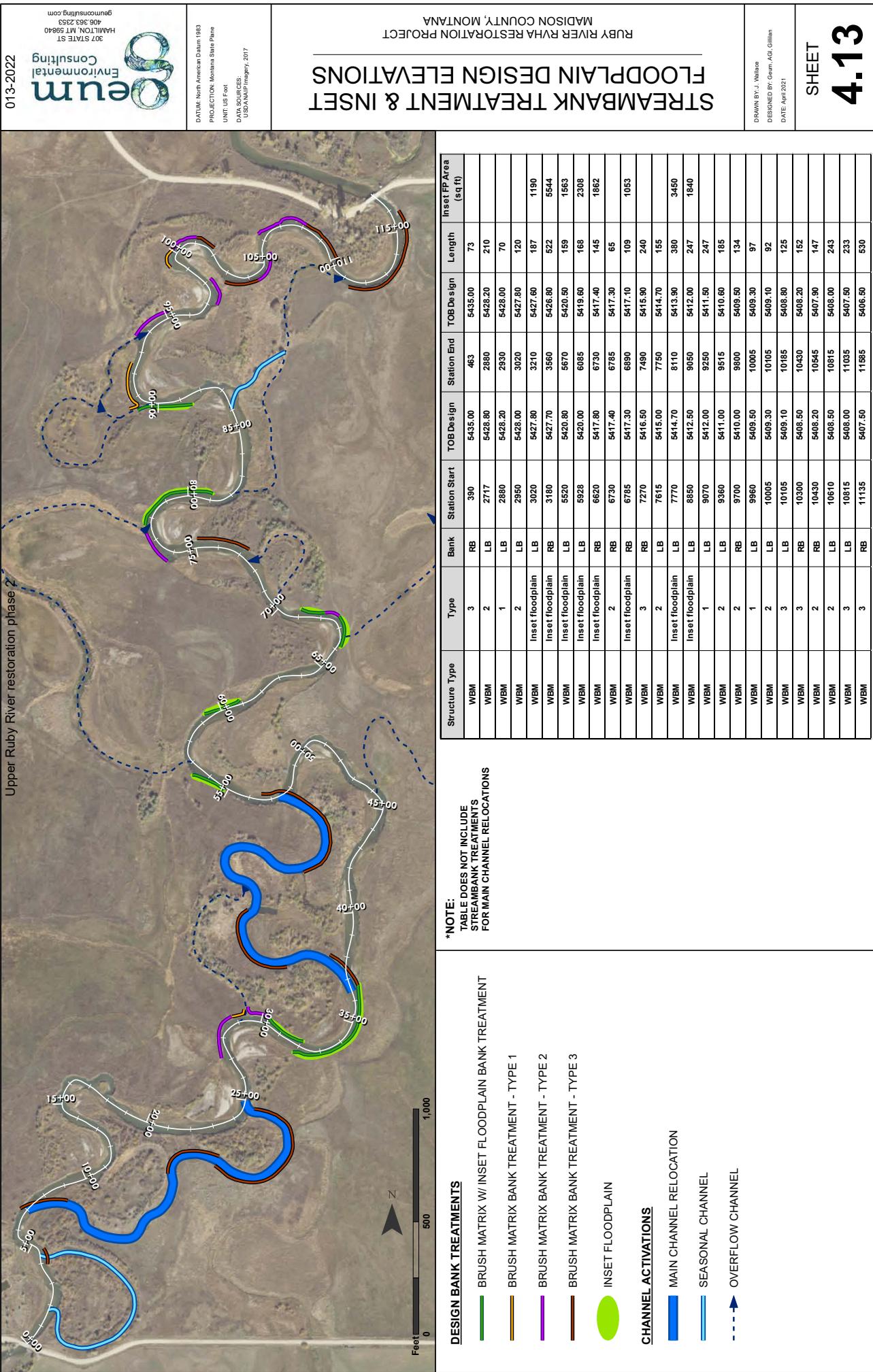


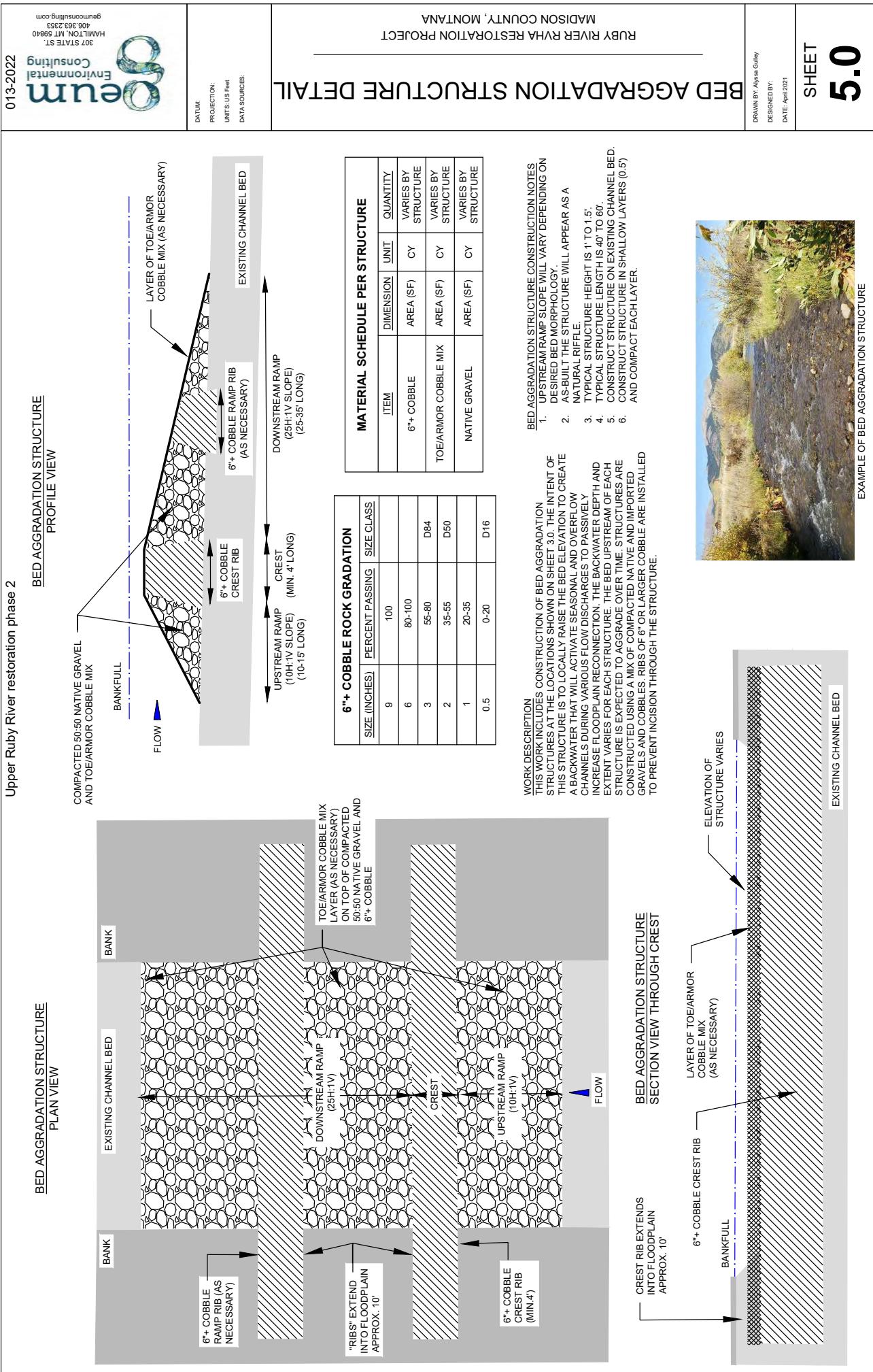
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DRAWN BY: A. Gillen

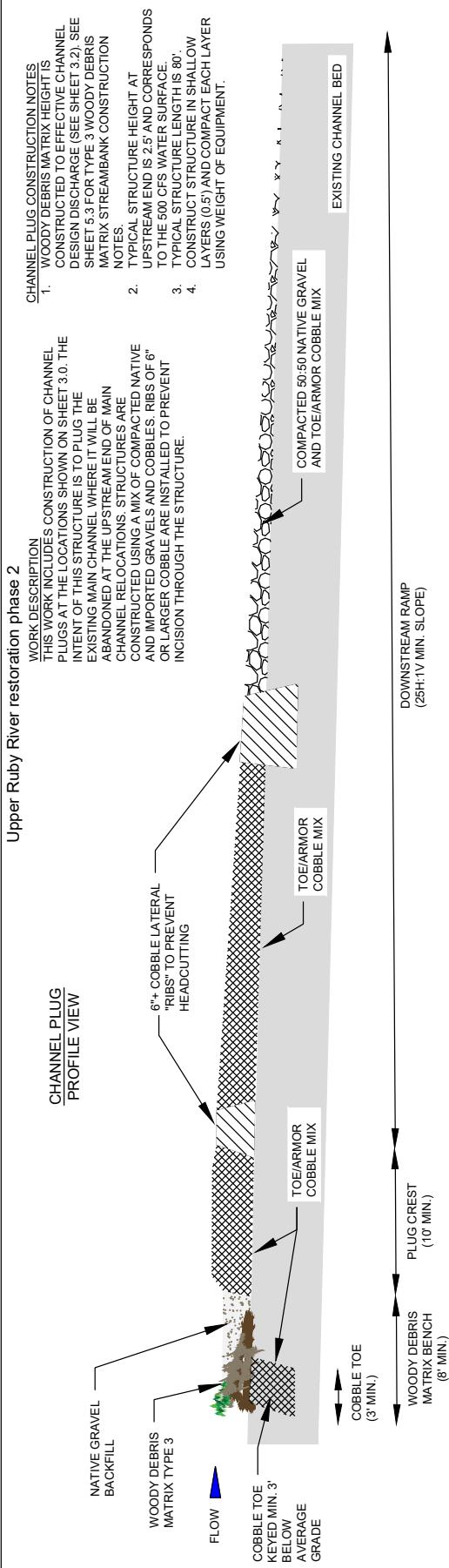
DESIGNED BY: Geum, A.G., Gillen

DATE: April 2021

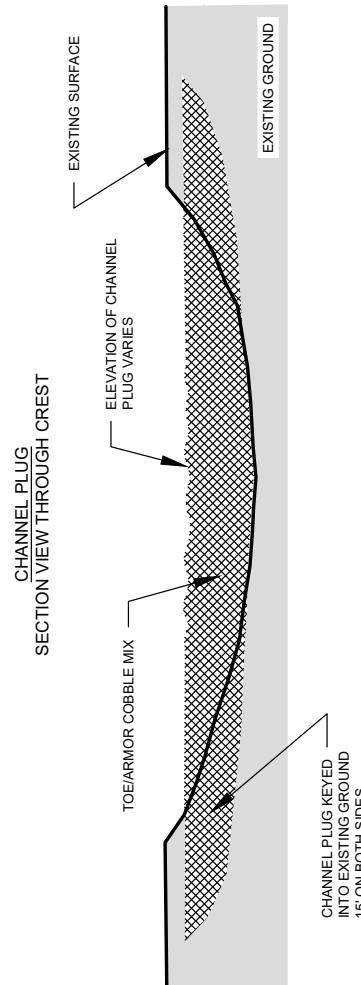




MAIN CHANNEL PLUG DETAIL



6"+ COBBLE ROCK GRADATION		
SIZE (INCHES)	PERCENT PASSING	SIEVE CLASS
9	100	
6	80-100	
3	55-80	D84
2	35-55	D50
1	20-35	
0.5	0-20	D16



EXAMPLE OF CHANNEL PLUG (PHOTO LOOKING UP PLUG FROM DOWNSTREAM RAMP DURING HIGH FLOWS)

MATERIAL SCHEDULE PER STRUCTURE			
ITEM	DIMENSION	UNIT	QUANTITY
NATIVE GRAVEL	AREA (SF)	CY	VARIABLE BY STRUCTURE
6+ COBBLE	AREA (SF)	CY	VARIABLE BY STRUCTURE
TOE/ARMOR COBBLE MIX	AREA (SF)	CY	VARIABLE BY STRUCTURE

*SEE SHEET 5.3 FOR WOODY DEBRIS MATRIX MATERIAL SCHEDULE

DRAWN BY: Alysa Galley
 DESIGNED BY:
 DATE: Apr 2021

Upper Ruby River restoration phase 2

WORK DESCRIPTION

THIS WORK INCLUDES INSTALLATION OF TYPE 1 WOODY DEBRIS MATRIX STRUCTURES AND PRESERVE THE NATIVE STREAMBANK TOE. THE INTENT OF THESE STRUCTURES IS TO PROVIDE TEMPORARY BANK STABILIZATION AND CREATE A COMPLEX, VEGETATED BANK MARGIN THAT CREATES AQUATIC HABITAT AND SUPPORTS A VEGETATION ESTABLISHMENT. IN SELECT LOCATIONS WOODY DEBRIS MATRIX STRUCTURES WILL INCLUDE AN INSET FLOODPLAIN DESIGNED TO NARROW THE CHANNEL DIMENSIONS AND PROVIDE FLOODPLAIN CONNECTIVITY.

WOODY DEBRIS MATRIX STREAMBANK CONSTRUCTION NOTES

1. EXCAVATE STREAMBANK TO SUBGRADE ELEVATIONS.
2. INSTALL WHOLE WILLOW CLUMPS IN THE STREAMBANK AT A DOWNWARD ANGLE TO THE STREAMBANK. CLUMPS CAN OVERLAP AND CAN BE ORIENTED FACING UPSTREAM OR DOWNSTREAM, BUT SHOULD BE PLACED BELOW THE BANKFULL ELEVATION.
3. IF OUTSIDE OF DORMANCY PLACE WILLOW CUTTINGS INTO THE MATRIX AS SHOWN IN THE DRAWING WITH THE STEMS IN CONTACT WITH THE BASEFLOW WATER TABLE AND TOPS AT OR ABOVE THE BANKFULL ELEVATION.
4. BACKFILL STREAMBANK WITH FLOODPLAIN BACKFILL TO DESIGN ELEVATIONS. WASH FINES INTO THE FLOODPLAIN BACKFILL TO SEAL Voids. IN LOCATIONS WITH AN INSET FLOODPLAIN, FLOODPLAIN BACKFILL WILL EXTEND BEYOND THE WOODY DEBRIS MATRIX. THE WIDTH OF INSET FLOODPLAINS VARIES AND WILL BE DEFINED FOR EACH FEATURE.
5. WHERE THE EXISTING BANKLINE ABUTS THE FLOODPLAIN BACKFILL, LAY BACK THE GROUND BY EXCAVATING MATERIAL TO FORM A SLOPE AT A MINIMUM OF 4H:1V TO BLEND THE WOODY DEBRIS MATRIX STREAMBANK AND INSET FLOODPLAIN WITH THE ADJACENT EXISTING GROUND.
6. THE FLOODPLAIN BENCH SHOULD BE ROUGHENED AND RIPARIAN TRANSPLANTS INSTALLED IF AVAILABLE.

SECTION VIEW

MATERIAL SCHEDULE PER LINEAR FOOT

ITEM	DIMENSION	UNIT	QUANTITY
WHOLE WILLOW CLUMPS	10' MIN. HEIGHT W/ ROOTBALL	EA	0.2 (1 PER 8FT)
DORMANT WILLOW CUTTINGS	MIN. 1/2" D, 6'-8' L	EA	3
RIPARIAN SHRUB TRANSPLANTS (AS AVAILABLE)	VARIABLE	EA	0.2 (1 PER 8FT)
FLOODPLAIN BACKFILL (TYPE 1 WOODY DEBRIS MATRIX)	NATIVE	CY/LF	1.1
FLOODPLAIN BACKFILL (WOODY DEBRIS MATRIX WITH INSET FLOODPLAIN)	NATIVE	CY/LF	VARIABLE

WOODY DEBRIS MATRIX SECTION VIEW

EXAMPLES OF WOODY DEBRIS MATRIX STREAMBANK TREATMENTS

WOODY DEBRIS MATRIX WITH INSET FLOODPLAIN

DEBRIS MATRIX MATRIX WITH INSET FLOODPLAIN DETAIL

RUBY RIVER RESTORATION PROJECT

MADISON COUNTY, MONTANA

DATA SOURCE:
307 STATE ST.
MILLITON MT 59840
406-393-2253
genuconsulting.com

DRAWN BY:
Alysa Galle

DESIGNED BY:
DATE: Apr 2021

SHEET

5.2

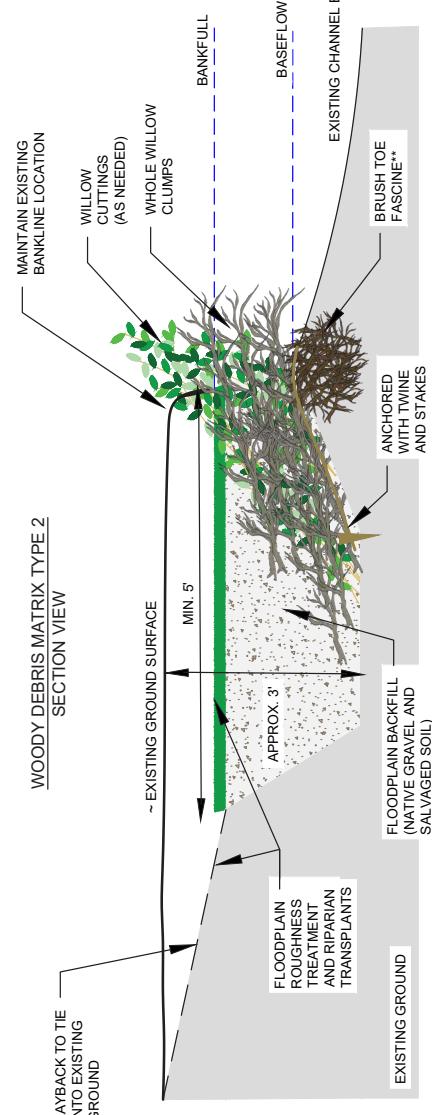
013-2022

406-393-2353
307 STATE ST.
HAMILTON, MT 59801
gemconsulting.com



RUBY RIVER RIVER RESTORATION PROJECT
MADISON COUNTY, MONTANA

Upper Ruby River restoration phase 2



WOODY DEBRIS MATRIX TYPE 2
** BRUSH TOE FASCINE CONSTRUCTED WITH BUNDLES OF JUNIPER BRANCHES (OR OTHER) PLACED PARALLEL TO STREAMFLOW AND ANCHORED BENEATH WHOLE WILLOW CLUMPS USING BIODEGRADABLE TWINE AND 2FT WOODEN STAKES

MATERIAL SCHEDULE PER LINEAR FOOT

ITEM	DIMENSION	UNIT	QUANTITY
WHOLE WILLOW CLUMPS	10' MIN. HEIGHT W/ ROOTBALL	EA	0.2 (1 PER 8FT)
DORMANT WILLOW CUTTINGS	MIN. 1/2" D. 6-8' L	EA	3
TOE/ARMOR COBBLE MIX	TBD	CY/LF	0.3
RIPARIAN SHRUB TRANSPLANTS (AS AVAILABLE)	VARIABLE	EA	0.2 (1 PER 8FT)
FLOODPLAIN BACKFILL	NATIVE	CY/LF	1.1
BRUSH TOE FASCINES	1-2' WIDE. 8-10' L	EA	0.2

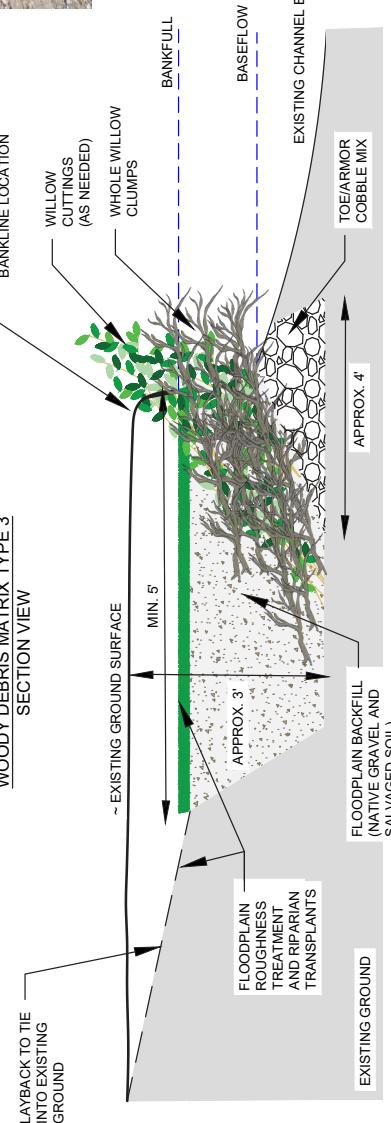
WOODY DEBRIS MATRIX TYPE 2 AND TYPE 3 DETAIL

DATUM:
PROJECTION:
UNITS: US Feet
DATA SOURCES:

- WOODY DEBRIS MATRIX STREAMBANK CONSTRUCTION NOTES**
1. EXCAVATE STREAMBANK TO SUBGRADE ELEVATIONS.
 2. FOR TYPE 2, INSTALL BRUSH TOE FASCINE AND ANCHOR TO BACK OF EXCAVATION. FOR TYPE 3, CONSTRUCT STREAMBANK TO WHERE NEEDED AND ACCORDING TO SPECIFIED DIMENSIONS.
 3. INSTALL WHOLE WILLOW CLUMPS IN THE STREAMBANK AT A DOWNWARD ANGLE TO THE STREAMBANK. CLUMPS CAN OVERLAP AND CAN BE PLACED ORIENTED FACING UPSTREAM OR DOWNSTREAM, BUT SHOULD BE PLACED BELOW THE BANKFULL ELEVATION.
 4. IF OUTSIDE OF DORMANCY PLACE WILLOW CUTTINGS INTO THE MATRIX AS SHOWN IN THE DRAWING WITH THE STEMS IN CONTACT WITH THE BASEFLOW WATER TABLE AND TOPS AT OR ABOVE THE BANKFULL ELEVATION.
 5. BACKFILL STREAMBANK WITH FLOODPLAIN BACKFILL TO DESIGN ELEVATIONS. WASH FINES INTO THE FLOODPLAIN BACKFILL TO SEAL Voids. IN LOCATIONS WITH AN INSET FLOODPLAIN, FLOODPLAIN BACKFILL WILL EXTEND BEYOND THE WOODY DEBRIS MATRIX. THE WIDTH OF INSET FLOODPLAINS VARIES AND WILL BE DEFINED FOR EACH FEATURE.
 6. WHERE THE EXISTING BANKLINE ABUTS THE FLOODPLAIN BACKFILL, LAY BACK THE GROUND BY EXCAVATING MATERIAL TO FORM A SLOPE AT A MINIMUM OF 4H:V TO BLEND THE WOODY DEBRIS MATRIX STREAMBANK AND INSET FLOODPLAIN WITH THE ADJACENT EXISTING GROUND.
 7. THE FLOODPLAIN BENCH SHOULD BE ROUGHENED AND RIPARIAN TRANSPLANTS INSTALLED IF AVAILABLE.

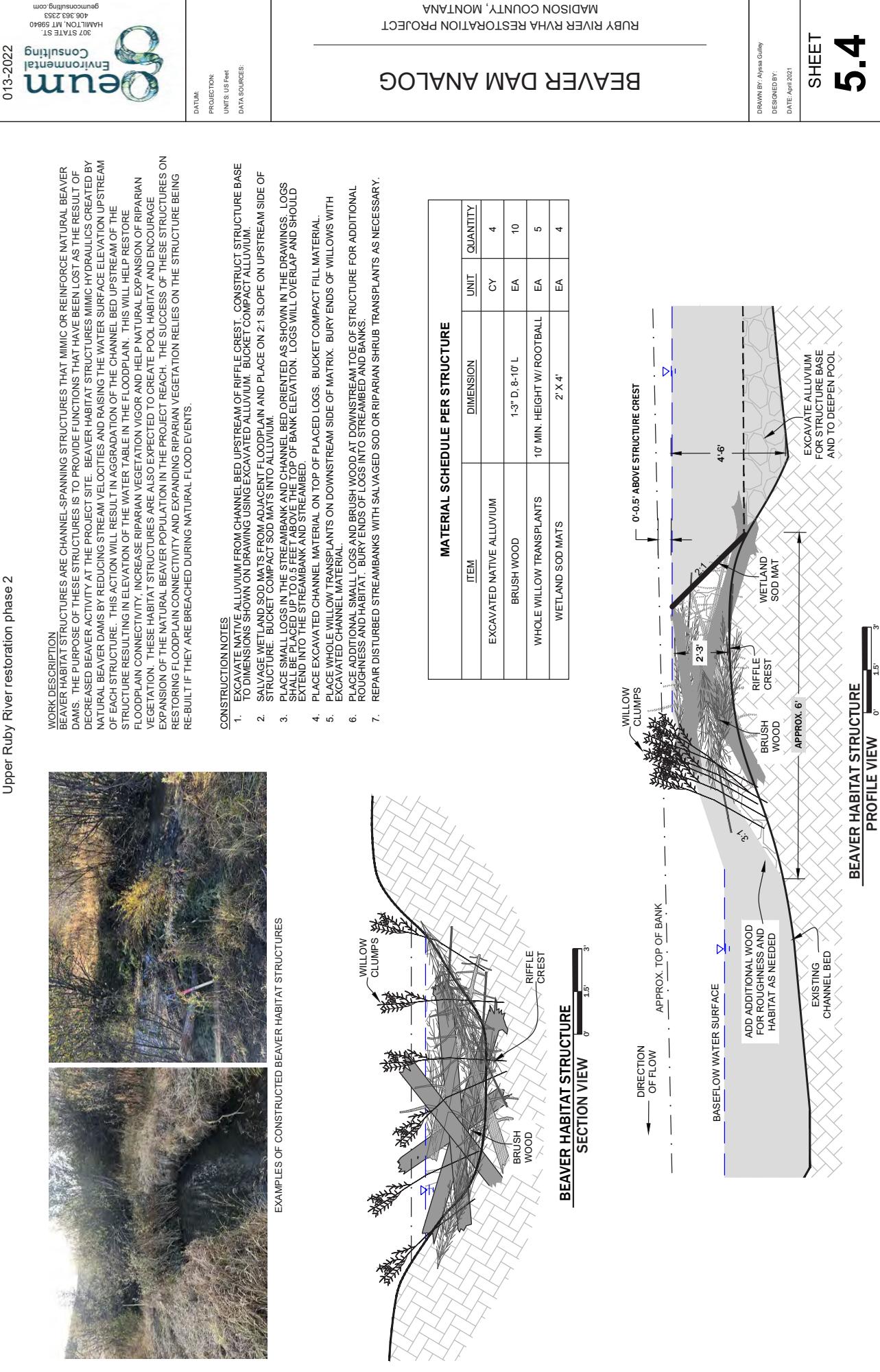


EXAMPLES OF WOODY DEBRIS MATRIX STREAMBANK TREATMENTS



DRAWN BY: Alyssa Gillery
DESIGNED BY:
DATE: Apr 2021

SHEET
5.3





MATERIAL SUMMARY

Materials List	Dimensions	Unit	Estimated Total Quantity
Toe/Armor Cobble Mix / 6" Cobble	TBD	cubic yard	1,970
Whole Willow Clumps	10' min. height w/ rootball	each	900
Dormant Willow Cuttings	1/2" min. diameter x 6'-8' length	each	24,400
Juniper Conifers	30-40 tree with branches	each	60
Brush	1-3" diameter x 4'-9' length	each	114

Total Estimated Excavation by Treatment (cy)

Channel Activation (Seasonal)	600		
Channel Activation (Overflow)	640		
Channel Activation (Main)	25,070		
Brush Matrix Streambank Treatments	7,320		
Total	33,630		

Total Estimated Fill by Treatment (cy)	Native Gravel	Native Gravel or Floodplain	Imported Cobble
Bed Aggradation Structures	730	0	180
Main Channel Plugs	1,260	0	540
Riffle Control Structures	430	0	110
Main Channel Plugs - low profile	2,180	0	0
Brush Matrix Streambank Treatments	0	8,500	1,140
Main Channel Relocations	0	1,350	0
Total	4,600	9,850	1,970

Summary of Total Estimated Excavation and Fill Volumes	Unit	Estimated Total Quantity
Estimated Excavation	cubic yards	33,630
Estimated Fill	cubic yards	14,460
Net	cubic yards	+19,170

Note: Excavation quantities are approximate and channel/locations will be fit in the field to reduce excess material volume.

SHEET
6.1

DRAWN BY: J. Wallace
DESIGNED BY: Genn, AGI, Genn
DATE: Apr 2021