Preliminary Engineering Report

BENCH ROAD OVER GRANT CREEK

Structure ID: 03761

JANUARY 2025

Prepared for:

Missoula County, Montana

Prepared by:

GreatWest ENGINEERING

MONTANA
KARL F. YAKAWICH
15133 PE
LICENSED
PROFESSIONAL ENGINEER
1/9/25

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

SECTION 1. GENERAL BACKGROUND

1.1 Project Description and Location

Missoula County intends to upgrade and replace the existing Bench Road Bridge with a new bridge meeting current design parameters.

The Bench Road Bridge crosses Grant Creek seven miles north of Missoula, Montana. Bench Road is a county-maintained thoroughfare, classified as a minor collector. Bench Road is paved south of the bridge and graveled to the north. The bridge is in the northwest ¼ of Section 15, Township 14 North, and Range 19 West at a latitude 46° 58' 31" North and longitude 113° 59' 41" West; and at an approximate elevation of 3,940 feet.

Please refer to Appendix A for the location map, site map, and topographic map included in this report.

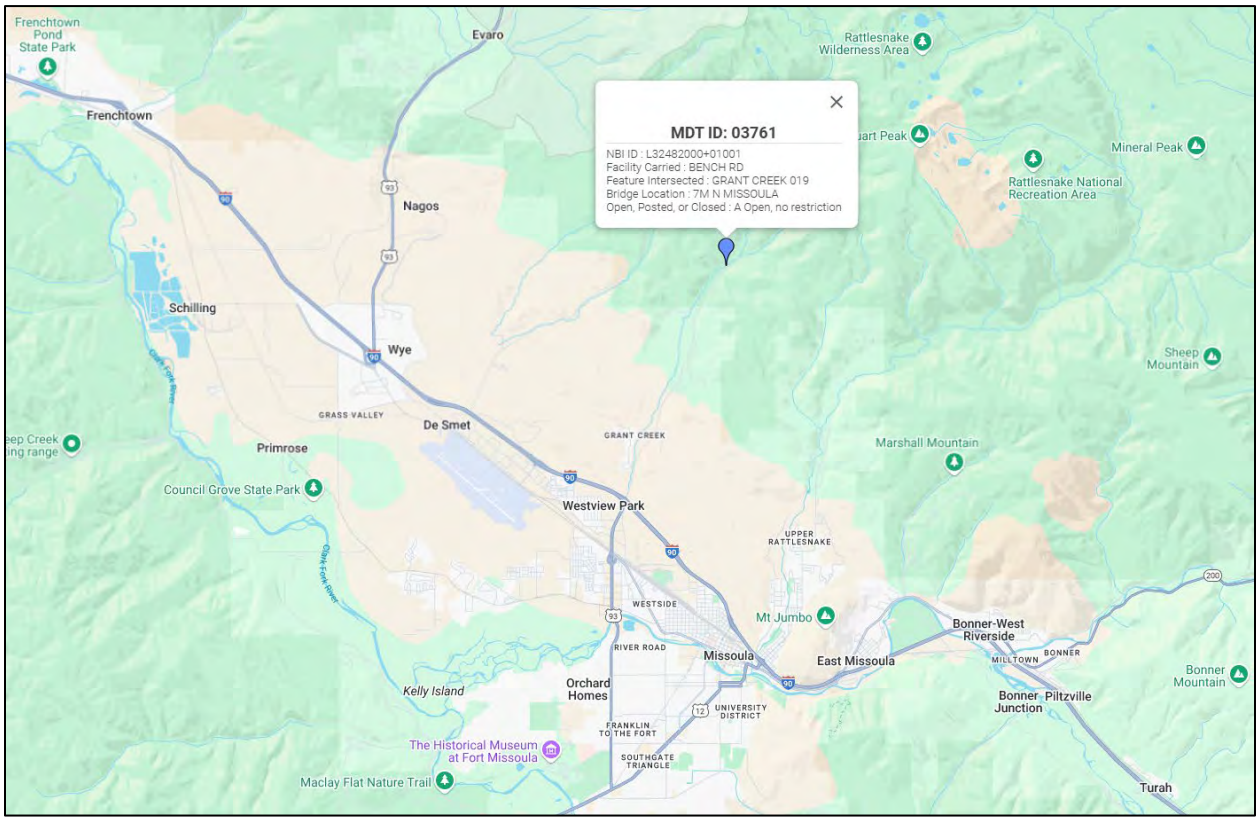


Figure 1*: Project location*

1.2 Users of the Bridge

The existing structure serves as the sole access for 24 full-time residences located north of the bridge. Residents typically cross the bridge daily to access their homes, utilize local services in Missoula, travel to work, and/or take children to school. No other detour is available to access the numerous residences and properties that exist north of the bridge. Bench Road also serves as a strategically important access for wildfire mitigation as the surrounding terrain is heavily forested.

1.3 Number of Users

Missoula County Engineer, Erik Dickson noted that a traffic count on Bench Road inventoried 150 vehicles per day (raw count) in 2007. The bridge provides the sole access for 24 registered addresses. Bench Road serves 24 residential addresses, and with an estimated 8 trips per day for each residence

(ITE Trip Generation), the total ADT at the bridge is estimated at approximately 190. The percentage of trucks is estimated at 1-3%.

1.4 Growth Areas and Population Trends

The Bench Road Bridge is primarily needed to help support and sustain access for local homeowners. According to the Missoula County Public Works Department, no projects are currently being proposed in the areas accessed by the bridge. It is anticipated the population will remain stable or slowly increase over the next several years as the crossing provides a sole access.

1.5 Existing Bridge Information

The existing Bench Road Bridge over Grant Creek was originally constructed in 1955 and then reconstructed in 1983. It is classified as a single-lane bridge. The bridge deck consists of 4-inch by 12-inch timber planks installed transversely across the bridge. An asphalt wearing surface is present on top of the transverse planks. The bridge rail system consists of steel w-beam rail attached with steel posts to the exterior girders. Flared approach guardrail extends approximately 12.5 feet at each corner. The roadway at the bridge is posted for a 25-mph speed limit.

The bridge superstructure consists of five steel girder members with steel diaphragm angles. The steel girders have splices with rough cuts and welds. The substructure consists of steel columns and a steel cap member. The steel members appear to be salvaged from another project and are likely older than the 1955 construction date.

The existing bridge is located between two horizontal curves on a tangent section of roadway. The approach from the main Grant Creek Road is located approximately 400 feet to the south.

Figure 2: View of the existing bridge approach looking from the south to north

Figure 3: View of the existing bridge looking downstream.

Please refer to Appendix B for additional photos of the existing bridge.

Table 1: Existing bridge properties

BRIDGE PARAMETER	EXISTING STRUCTURE
Total Span Length (out to out)	27’-6”
Skew	0 degrees
Usable Width (between rails)	15’-9”
Overall Deck Width	16’-1”
Superstructure Type	Steel Girder
Substructure Type	Steel Abutment
Structure Depth	2.50’

Table 2: Existing NBI Ratings from 9/25/2023 Inspection Report

NBI ITEM	NBI RATINGS
Deck	7
Superstructure	5
Substructure	5
Channel	8
Approach Bridge Rail	0
Structural Evaluation	5
Sufficiency Rating	46.6
Detour Length	Sole Access

Summary of bridge deficiencies include the following:

- Minimal paint remaining (paint failure) on steel girders and steel abutment members with surface corrosion.
- Splices on steel girders have rough cuts and welds with no paint remaining.
- Pack rust and swelling on steel abutment members. Members are salvaged from other bridges.
- Steel pier caps have corrosion with excess rotation.
- Asphalt on the bridge deck is rough with potholes.
- Impact damage on approach guardrail.

SECTION 2. PROPOSED BRIDGE CONFIGURATION

2.1 Proposed Bridge Location and Alignment

The proposed road and bridge alignment is approximately located in the same area as the existing bridge. A minor shift may be necessary to better align with the channel and existing right-of-way. During project scoping full realignment and relocation of the crossing was discussed; however, concerns include impact to private properties and wetlands. During the final design phase and once full right-of-way, wetland, and survey data is available, the County will reconsider alignment modifications to the east which may be advantageous from a geometric design perspective.

During construction, a temporary work/detour bridge will be utilized to provide uninterrupted access for local residents, emergency service providers, and other users of the bridge. The detour bridge will likely be located east (upstream) of the existing bridge. Placement of the replacement bridge is anticipated to occur within the County's 60-foot roadway easement, however, temporary easements or construction agreements will likely be required to construct the detour bridge. If these are required, the County will work with the adjacent landowners during the design phase to procure access.

2.2 Bridge Width Considerations

The existing bridge provides a 15'-9" usable width (single-lane) between rail faces. Initial discussions with Missoula County indicated a preference for another single-lane structure with a 16 to 18-foot usable width. Adding an additional lane and bridge width was considered by the County but would result in undesirable impacts to adjacent private properties and wetlands.

2.3 Span Considerations

A single-span configuration would be beneficial as it would eliminate the need for in-stream piers. This would maximize the hydraulic flow area and reduce the chance of debris getting caught on the bridge.

Additionally, as no instream piers are currently present at the crossing, constructing new piers in this segment of the Grant Creek would represent significant detrimental environmental impacts.

The total length of the bridge is determined by the proposed channel, hydraulic analysis, existing topography, and bridge design standards. The proposed bridge will be designed for the County Bridge Standard requirement of the 100-year event of 528 cfs with two feet of freeboard, based on previous guidance from the Missoula County Floodplain Administrator. In addition, the new structure will accommodate the normal width of the stream to minimize the occurrence of downstream erosion and allow organism passage through the structure. A spill-through channel configuration is well-suited for this application. This consists of matching the channel base width and utilizing riprap at a 2:1 slope tying into the abutment. A preliminary hydraulic analysis was performed and used to size the structure openings. Hydraulic sizing is difficult without field survey information; however, based on USGS basin characteristics and USGS LiDAR survey data published in 2024 a preliminary analysis has been completed. Site characteristics show that the existing channel base width is approximately 30 feet in the vicinity of the bridge. The preliminary hydraulic model has indicated that a new bridge with 2:1 riprapped slopes results in a structure span length of 55 feet and produces the following freeboard:

Storm Event	Flow (cfs)	Water Surface Elev. (ft)*	Proposed Low Chord Elev. (ft)	Freeboard (ft)
2-year	170	3952.19	3955.39	3.2
10-year	325	3952.78	3955.39	2.6
50-year	463	3953.20	3955.39	2.2
100-year	528	3953.39	3955.39	2.0

*Water surface elevations reported at the upstream cross section. Existing deck elevation is approximately 3957.17 and existing low chord elevation of 3954.67. Proposed deck elevation is approximately 3957.89 assuming a 30-inch deep superstructure.

The current road and bridge deck elevations do not provide adequate freeboard for the proposed structure and the road will likely have to be raised approximately 0.7 feet. The final design stage will involve a complete hydraulic analysis utilizing terrestrial topographic survey information and HEC-RAS hydraulic modeling. Refer to Appendix D for additional information on preliminary hydrology and hydraulics.

SECTION 3. SUPERSTRUCTURE ALTERNATIVES

Full structure replacement alternatives will be designed to optimize economics, stream channel hydraulics and roadway geometry while meeting (at a minimum) the County Bridge Standards for floodway passage, minimum freeboard and usable bridge width. A new bridge will offer upgraded superstructure performance/capacity to support legal loads. A new bridge would provide a useful life of 75 to 100 years and require substantially less maintenance. As such, alternatives (and components) for both full replacement of the existing structure (as well as present and future repair cost comparisons) will be analyzed in greater detail in the subsequent discussions.

In many cases, a culvert rather than a new bridge may best accomplish the replacement of an existing structure. Consideration was also given to replacing the existing structure with culverts. However, for the span requirements at the crossing, hydraulic requirements, site characteristics, and the stringent environmental requirements associated with Bull Trout in Grant Creek, make culvert alternatives unfeasible. For these reasons, culvert alternatives will not be examined further.

Repairing or rehabilitating the Bench Road Bridge was also considered to meet current standards. Repair would include replacement of the bridge substructure and superstructure due to deterioration; installation of standard bridge rail; and installation of bridge approach guardrail. Any efforts to remediate the existing

Bench Road Bridge through repairs and rehabilitation efforts should be considered extremely extensive due to the type and amount of work involved. Additionally, rehabilitation of the structure exhibits unknowns related to the steel substructure in terms of sufficient depth, adequate capacity and settlement potential. Because the original structure needs significant work on all bridge components, as well as addressing safety issues, it is in the best interest of the County to focus on replacing the entire bridge rather than simply conducting repairs or rehabilitating the bridge. For these reasons, this preliminary engineering report does not consider structure repair or rehabilitation further.

3.1 Prestressed Concrete Trideck Girders

This single span alternative would utilize precast, prestressed concrete trideck girders or voided slab members to form the superstructure system of the bridge. The deck is cast as an integral part of the girder; thus, alleviating the need to cast a concrete deck in the field. Matching the existing streambanks at 2:1 slope, a span of 55 feet is required. Three girders would be required to ensure a usable width of 18’-0”. The concrete girders would be approximately 2'-5" deep. The integration of asphalt and a membrane over the concrete girders will also be considered by Missoula County during the final design stage.

Proposed bridge rail systems should have a curb or solid parapet to prevent stormwater runoff directly in Grant Creek. Thus, options include curbed T101 steel barrier rail to meet TL-2 loading or W830 steel box beam rail to meet MASH TL-4 forces. The final bridge rail system will be dependent on final design requirements (MASH vs NCHRP 350).

This superstructure system simply involves setting the girders in place, welding them together, and grouting the seams between adjacent members. The final step involves casting concrete end diaphragms. The use of a prestressed, precast concrete deck system allows for a quick and efficient installation of the superstructure. The quality control of this alternative can also be closely monitored as the beams are cast and cured in a controlled environment.

Construction of the trideck superstructure, including placement and installation, can be completed in 1-2 weeks. This alternative is essentially maintenance free and has a projected service life of 75 years.

Figure 4: Example prestressed concrete girder system

3.2 Prefabricated Steel Girder System

This single span alternative would utilize a prefabricated steel girder system with a corrugated steel deck. A preliminary design indicates that two to three modular bridge sections would be necessary to ensure a usable bridge width of 18 feet. The decking system will consist of galvanized steel corrugated bridge panels which are welded to each steel girder. The steel decking would be filled with concrete or asphalt to match the adjacent approaches. Riprap placement at a 2:1 slope underneath the bridge requires the steel girders to span 55-feet.

This alternative would require a relatively minor amount of maintenance. The steel girders would be constructed with A588 weathering steel which will not require painting. Construction of the steel modular bridge system including placement and installation can be completed in 1-2 weeks. The projected service life for this alternative is 75 years, if maintained properly.

Figure 5*: Example prefabricated steel girder system*

SECTION 4. GEOTECHNICAL & PROPOSED SUBSTRUCTURE

The soil and stream characteristics in the project area typically determine the most suitable substructure alternative(s). Prior to final design, a geotechnical evaluation will be performed at the site to determine the most efficient foundation system. Generally, round steel piles are used for friction bearing, steel H piles are used for end bearing, and shallow bedrock requires spread footings. Due to site, geologic, stream channel and environmental constraints, this alternative analysis will continue to examine only pile supported foundations. The cost difference between different steel pile types is reasonably similar and therefore H piles will be examined based on suspected soils in the site.

4.1 Deep Foundation System – Driven Piles with a Concrete Cap (Alternative A)

Based on information gathered from site visits, soils in the area primarily consist of gravelly loam and gravelly sand (depending on depth and location). Based on the engineer's experience, steel H-piles are best suited for these conditions. Based on anticipated loading, four piles per abutment at an average driven depth of 40 feet will be assumed.

Installation of steel piles is a fast and efficient process that typically takes one to two days per abutment. Following installation of the piles, a cast-in-place concrete cap will be installed to provide bearing for the superstructure and wingwalls. Once the superstructure is in place, the concrete wingwalls can be formed and poured integrally with the concrete backwall. It is estimated that the wingwalls will be around 5 feet long.

Riprap underlain with a geotextile fabric will be placed against each abutment and wingwall in order to protect against scour. As typically requested by Army Corps of Engineers, riprap outside the bridge template will be infilled with topsoil and planted with native species and seeded. This alternative will require minimal maintenance and has a projected service life of 75 years.

4.2 Shallow Foundation System – Spread Footing Abutments (Alternative B)

A cast-in-place concrete spread footing may be a viable alternative, if good bearing materials are encountered. However, driven steel piles may be necessary should the geotechnical investigation determine that there is a significant amount of clay, silt, or sand in the site vicinity.

The construction of spread footings typically has a greater impact on the stream than driven pile foundations as the footings must be placed 3 to 6 feet below the streambed for proper scour protection. The site must be properly dewatered for proper installation of the concrete, which is a costly endeavor for a stream the size of Grant Creek. The construction of concrete spread footings and abutments walls is labor intensive and time consuming as the footings and walls must be formed and poured separately. Additionally, the curing period required for the concrete following each pour adds to the total construction time. Following installation of the superstructure, the wingwalls can be formed and poured. It is estimated that the wingwalls will be around 6 feet tall and 8 feet long for this alternative.

Riprap underlain with a geotextile fabric will be placed against each abutment in order to protect against scour. As requested by Army Corps of Engineers, riprap outside the bridge template will be infilled with topsoil and planted with native species and seeded. This alternative will require minimal maintenance and has a projected service life of 75 years.

SECTION 5. SUMMARY OF SELECTED ALTERNATIVE

Present worth economic analysis reveals the precast, prestressed concrete trideck superstructure is less costly to construct than the comparable length steel modular bridge alternative. This superstructure alternative has an anticipated minimum useful life of 75 years and reveals a present worth savings of over the Prefabricated Steel Girder System (Alternative 2).

Upon examining the bridge substructure alternatives, the driven pile foundation (Alternative A) is substantially less expensive than the concrete spread footing foundation (Alternative B). The construction of a spread footing foundation would also involve more disturbances to the stream channel. Ultimately, the decision of the preferred substructure is largely based on anticipated soil conditions, environmental concerns and cost concerns. A complete geotechnical analysis will be performed during the final design process to determine the most efficient and cost-effective alternative.

Thus, largely based on long term viability and capital cost, the preferred alternative for the replacement of the Bench Road Bridge utilizes precast, prestressed concrete trideck girders with a driven pile foundation. The estimated total cost for the preferred alternative with roadway costs is approximately $950,000. The entire project will be contracted out to an experienced bridge contractor. Refer to the following table for a summarization of the selection process.

Table 3: Proposed bridge properties

BRIDGE PARAMETER	PROPOSED STRUCTURE
Total Span Length (out to out)	55’
Skew	0 degrees
Usable Width (between rails or curbs)	18’-0”
Overall Deck Width	20’-4”
Superstructure Type	Prestressed Concrete Trideck Girders (Integral Deck)
Substructure/Foundation Type	Driven Piles with a Concrete Cap
Structure Depth	30”
Proposed Deck Elevation	3957.89’

SECTION 6. RIGHT-OF-WAY

The existing right-of-way is approximately 30-ft each side of the centerline (60.46’ total width) at Bench Road. Improvements are anticipated to occur within the existing county road right-of-way.

Regardless of the selected alternative, the replacement structure will be constructed in essentially the same location as the existing bridge. Since a feasible detour route is not available, a bypass bridge and road will be installed adjacent to the existing structure to provide access to residences throughout construction operations. If temporary easements or construction agreements are required to construct the improvements, the County will work with the adjacent landowners to procure access during the design phase. The County has contacted adjacent landowners and they have stated they are in support of the project.

Grant Creek at the project site is not considered a navigable river by the State of Montana.

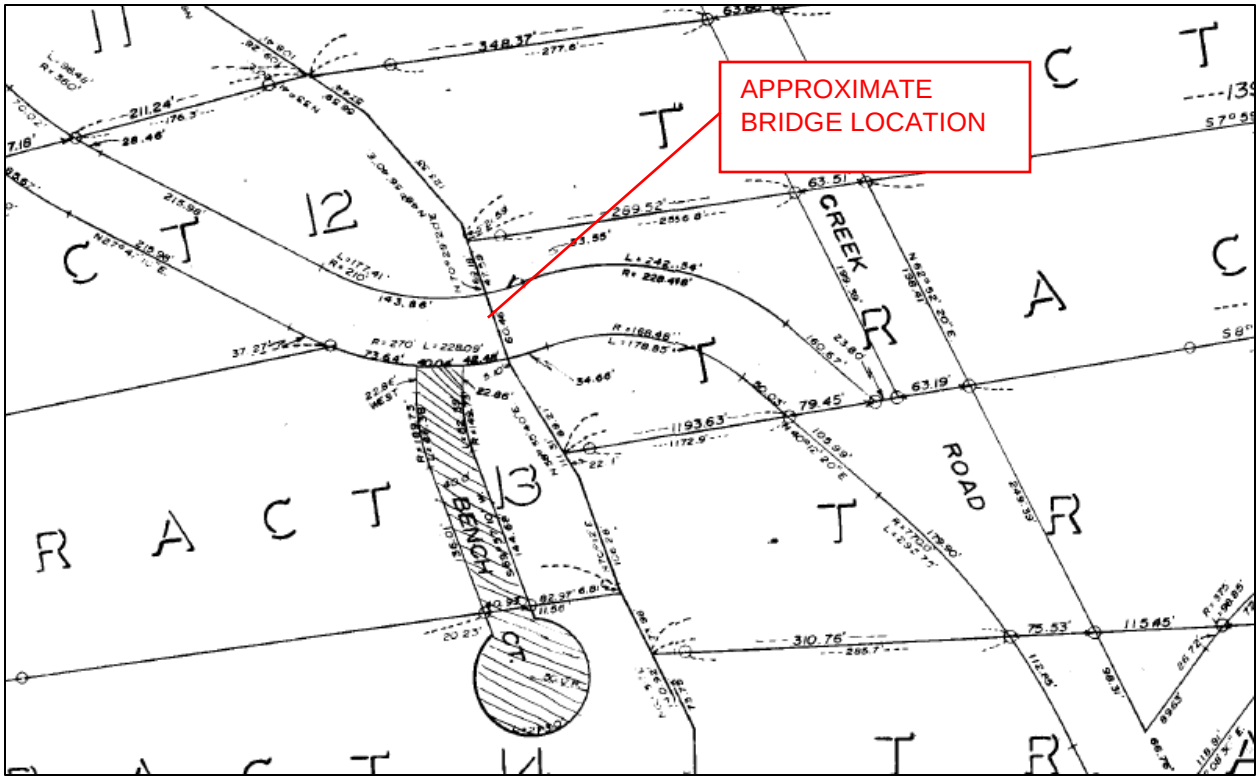


Figure 6*: Right-of-way map in bridge vicinity*

SECTION 7. ENVIRONMENTAL CONSIDERATIONS

7.1 NEPA Compliance and Permitting

Upon review of the United States Fish and Wildlife (USFWS) Information for Planning and Conservation (IPaC) Resources List for the project location (Attachment A), there are (4) species Listed as Threatened, (1) species as a Candidate for Listing, and also (1) Critical Habitat. This location overlaps the Critical Habitat of Threatened Bull Trout, and due to the likelihood for in-stream work, the proposed bridge replacement has the potential to affect Bull Trout and Critical Habitat. In addition, Montana Fish Wildlife and Parks fisheries biologist Ladd Knotek confirmed the location is inhabited by bull trout and genetically pure Westslope Cutthroat Trout with active spawning in the spring and fall.

To minimize turbidity and avoid impacts to spawning Bull Trout (and other species), the in-stream construction activities should be performed between July 1st and August 25th (during low water conditions).

The level of NEPA review is likely a Biological Assessment for potential affects to listed species and Critical Habitat.

7.2 Wetlands

Upon review of the USFWS National Wetland Inventory Mapping (Attachment B), no wetland habitat occurs within the project area. A wetland delineation may still be necessary to verify the presence/absence of wetland habitat, as well as defining the Ordinary High-Water Mark (OHWM).

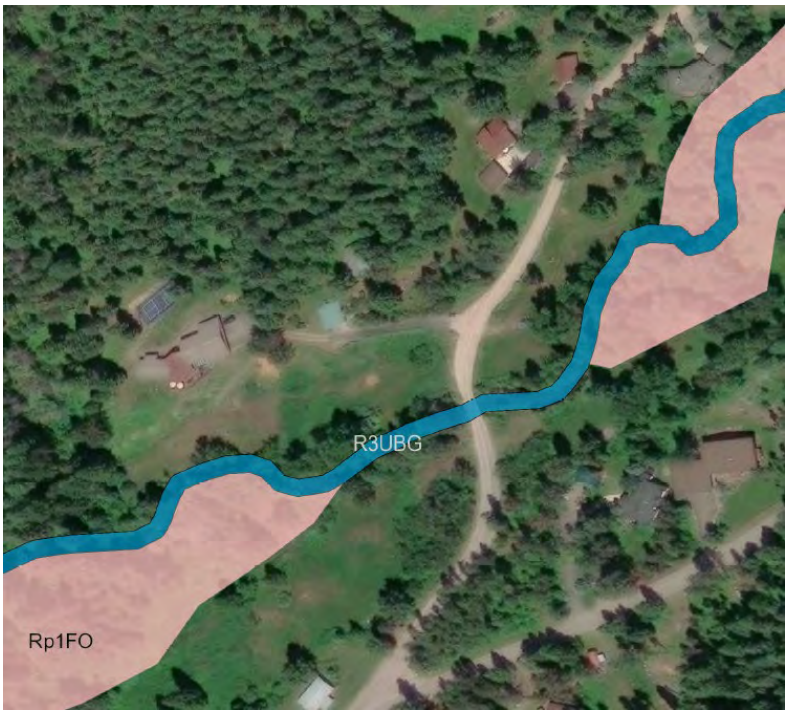


Figure 7: National Wetland Inventory mapping in bridge vicinity

7.3 Floodplains

The project area lies within Flood Zone A according to the FEMA-Flood Insurance Rate Map (Attachment C), and a County Floodplain Permit will likely be required.

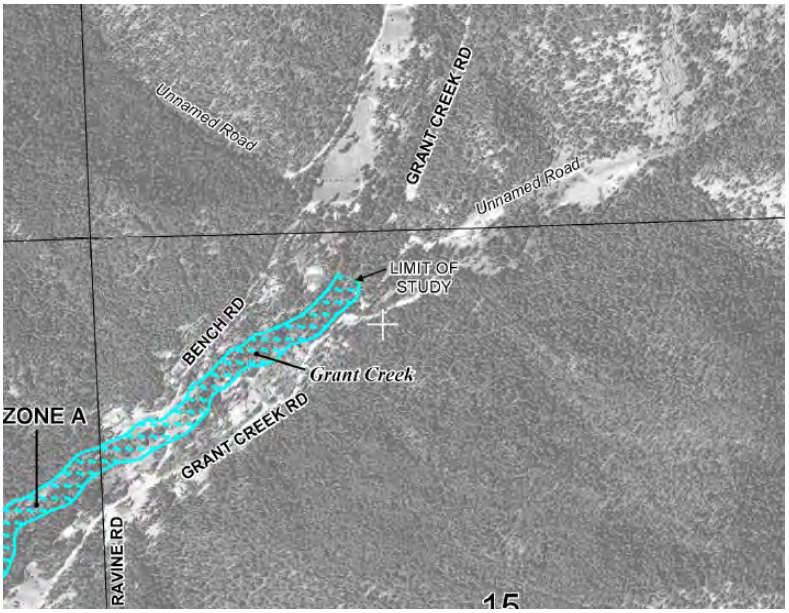


Figure 8: Floodplain map in bridge vicinity

7.4 Cultural/Historic Properties

According to the State Historic Preservation Office, “There have been no previously recorded sites within the designated search locales. The absence of cultural properties in the area does not mean that they do

not exist but rather may reflect the absence of any previous cultural resource inventory in the area, as our records indicated none.

It is SHPO's position that any structure over fifty years of age is considered historic and is potentially eligible for listing on the National Register of Historic Places. If the existing bridge to be replaced is over fifty years old, we would recommend that it be recorded, and a determination of their eligibility be made prior to any disturbance taking place." The Bench Road Bridge was originally built in 1955 and reconstructed in 1983. The reconstruction in 1983 substantially altered the structure. Consultation with Bridge Historian, Jon Axline indicated the bridge does not appear to be National Register eligible.

7.5 Anticipated Permits

Anticipated permits for the project include the following:

- Army Corps of Engineers (ACOE) Clean Water Act Section 404 permit or Nationwide
- Montana Fish, Wildlife, and Parks (FWP) Stream Protection Act 124
- Montana Department of Environmental Quality (DEQ) 318 Authorization
- Montana Department of Environmental Quality (DEQ) Demolition Permit

All necessary stream permits will be acquired prior to construction and the contractor will be required to abide by the conditions set forth by these permits. All disturbed areas will be re-seeded at the end of the project to promote re-vegetation and reduce erosion.

A project Biological Assessment (BA) will be completed to determine potential to affect Bull Trout and Critical Habitat. An asbestos assessment will be completed on the bridge prior to demolition activities to meet Montana Department of Environmental Quality (DEQ) requirements. Air or Noise Studies are not anticipated due to the proposed scope of work and project limits.

SECTION 8. UTILITY IMPACTS

Utility conduits with communications lines are located along the upstream and downstream edges of the bridge. In addition, an overhead power line is located along the west edge of the roadway crossing to the south. The County will coordinate with the utility owner(s) prior to construction so that the lines can be permanently moved or temporarily relocated and reattached to the new bridge.

SECTION 9. CONSTRUCTION PHASING/TIMING

Design and bidding are anticipated to occur over a 12-month timeframe. Construction is anticipated to occur over a 2 to 3-month timeframe. Construction of this project should be scheduled to begin in the late summer when flows in Grant Creek are minimal, turbidity is not an issue to spawning fish and outside of noise construction windows for Bull Trout.

The County intends to contract all of the associated bridge and road work for this project to an experienced contractor.

Completion date is dependent on funding availability. The project schedule will be refined as funding is secured.

SECTION 10. RECOMMENDATIONS AND COST SUMMARY

After considering the issues and constraints for the type, size, and location, a single-span prestressed concrete trideck girder achieves all project goals and fits site constraints with as few concessions as possible. The proposed bridge layout and probable cost estimate are presented as appendices to this report.

APPENDIX A:
PROJECT EXHIBITS

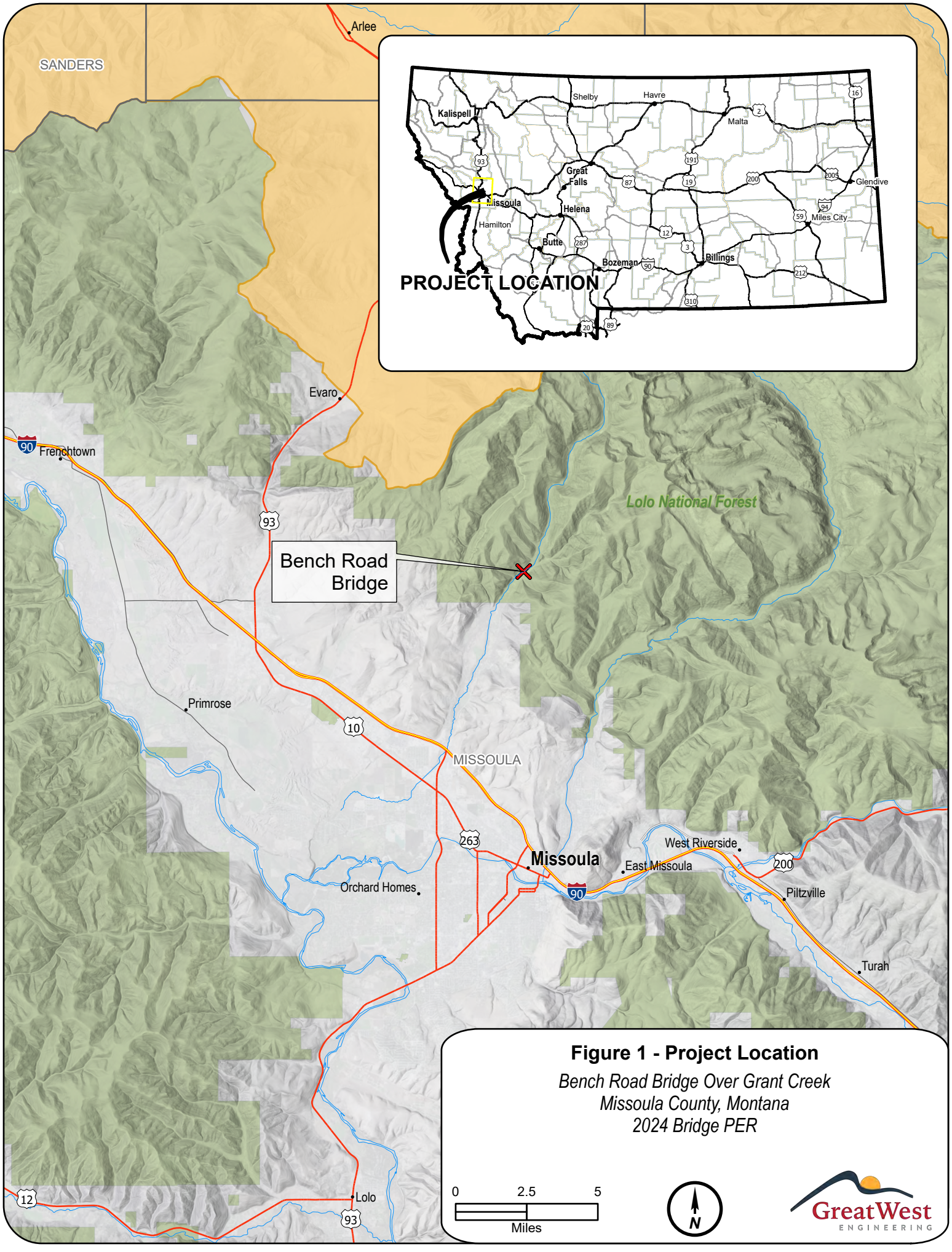


Figure 1 - Project Location

Bench Road Bridge Over Grant Creek
Missoula County, Montana
2024 Bridge PER

GreatWest ENGINEERING

Figure 2 - Site Map

Bench Road Bridge Over Grant Creek
Missoula County, Montana
2024 Bridge PER

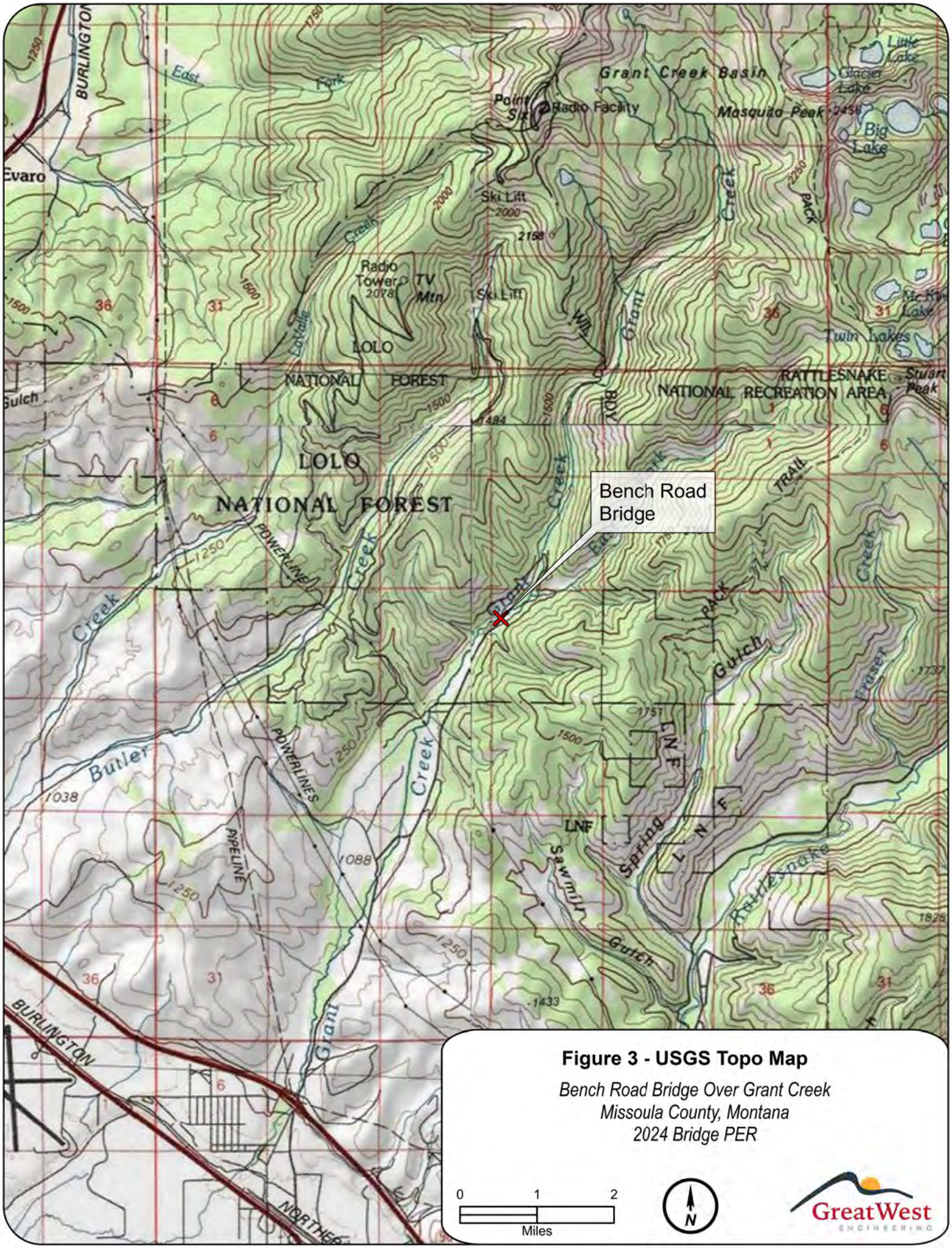
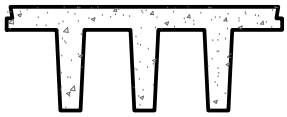


Figure 3 - USGS Topo Map

Bench Road Bridge Over Grant Creek
Missoula County, Montana
2024 Bridge PER

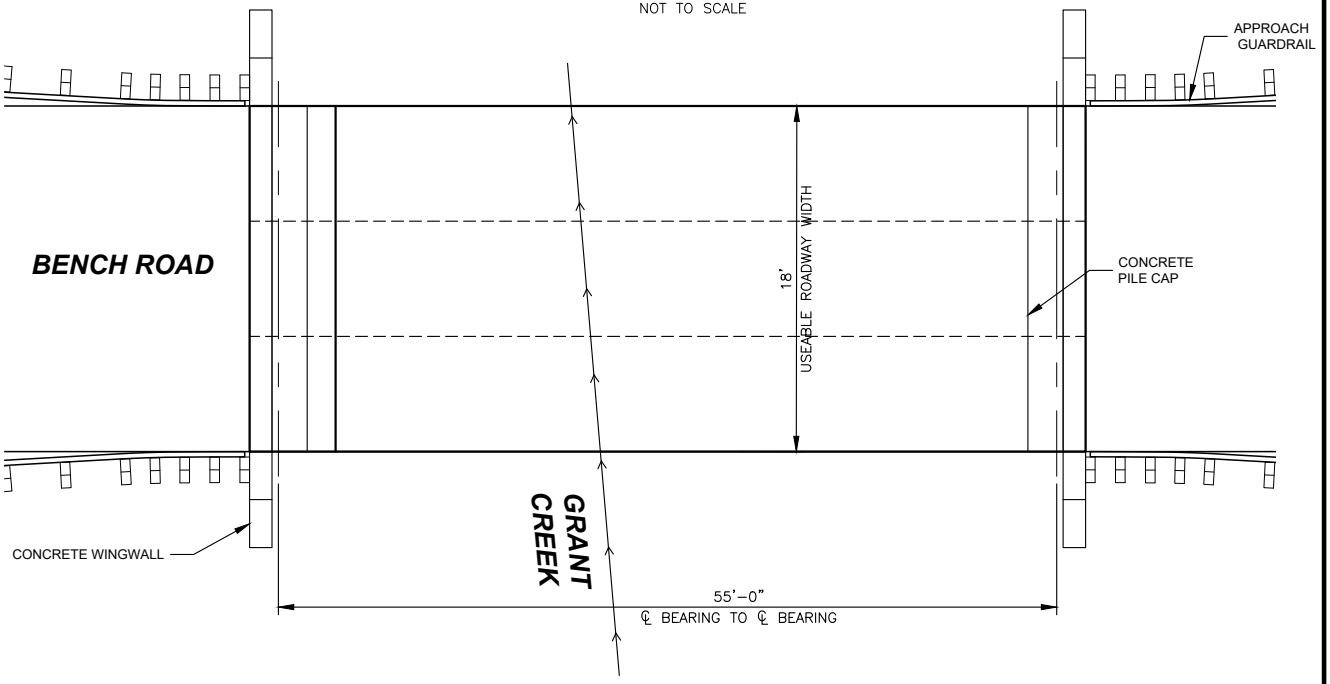
Figure 4 - Land Ownership Map

Bench Road Bridge Over Grant Creek
Missoula County, Montana
2024 Bridge PER



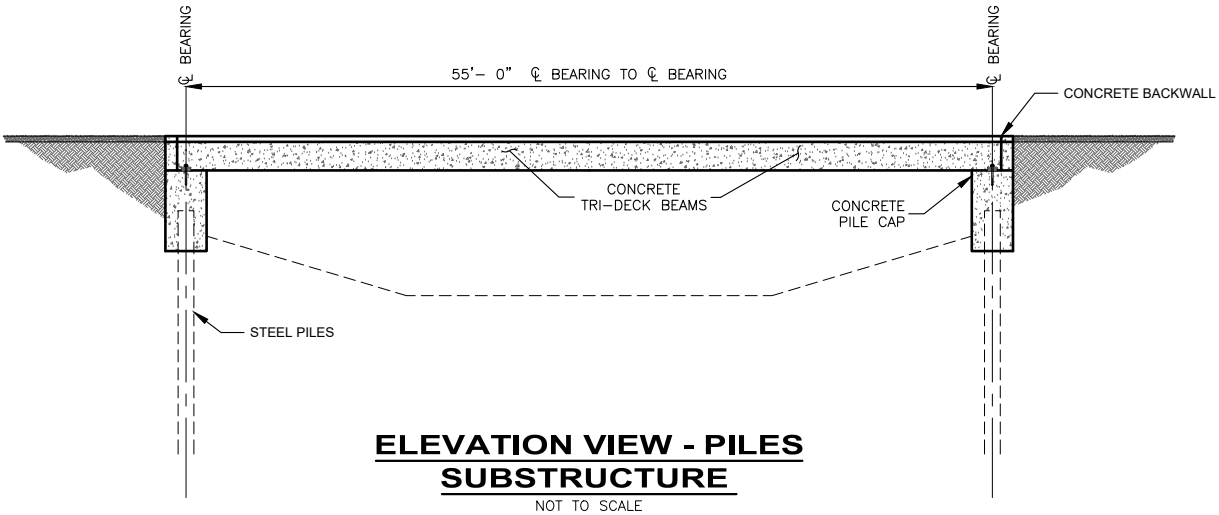
TYPICAL TRIDECK BEAM SECTION

NOT TO SCALE



PLAN VIEW - CONCRETE TRI-DECK BEAM BRIDGE SUPERSTRUCTURE ALTERNATIVE 1

NOT TO SCALE



ELEVATION VIEW - PILES SUBSTRUCTURE

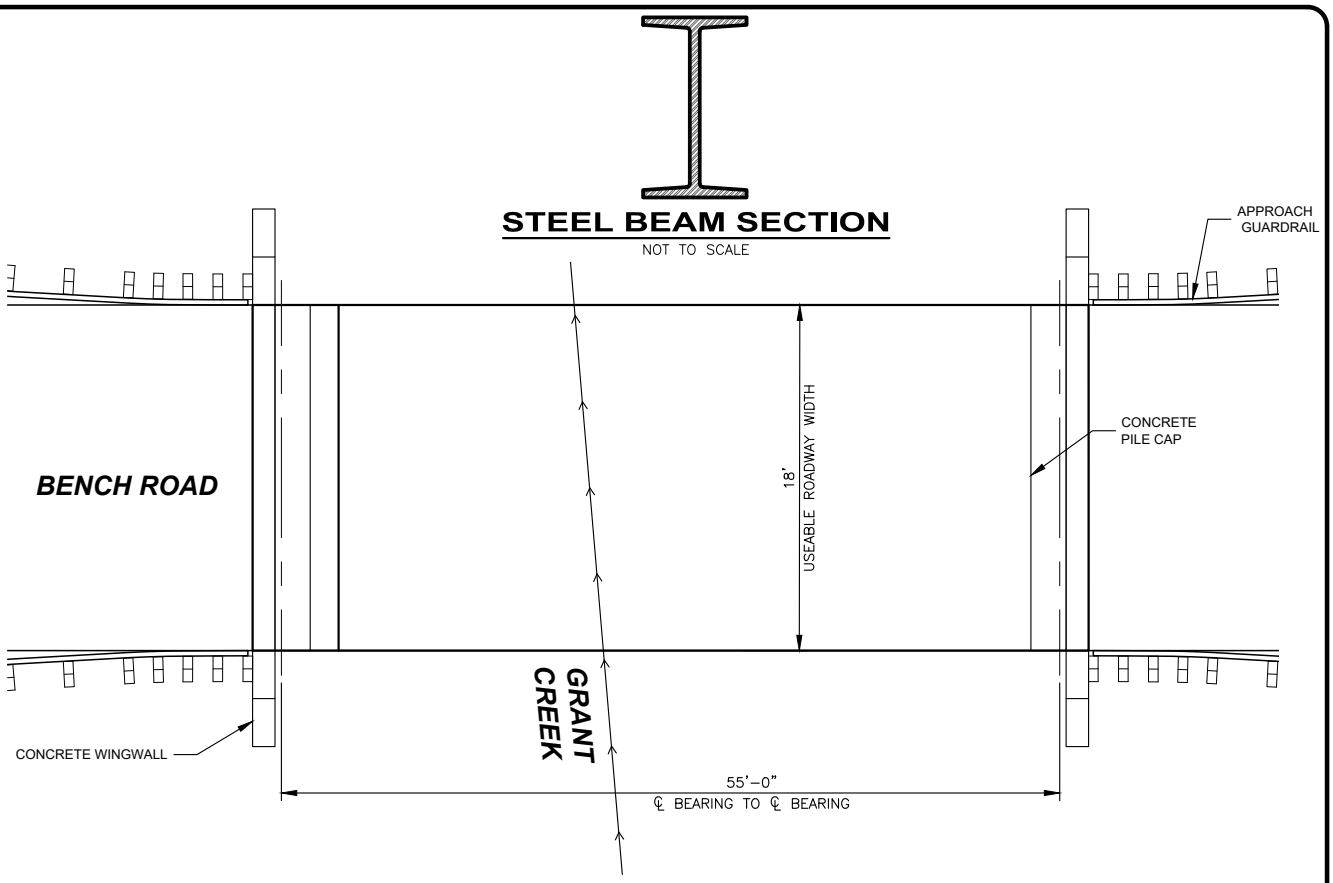
NOT TO SCALE

BENCH ROAD BRIDGE REPLACEMENT
FIGURE 5 - PRESTRESSED CONCRETE GIRDERS

MISSOULA COUNTY
2025 BRIDGE PER

GreatWest ENGINEERING

Y:\Shared\Helena Projects\1-24217-Missoula Co 2024 Bridge PER\CADD X-XXXXX\Exhibits\Figure 5-Prestressed Concrete Girder.dwg

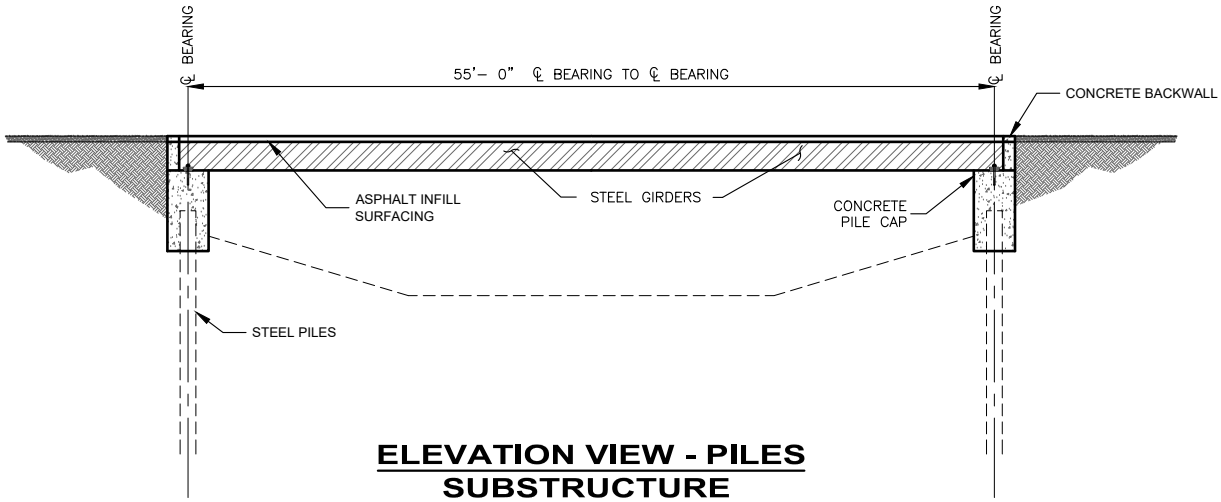


STEEL BEAM SECTION

NOT TO SCALE

PLAN VIEW - PREFABRICATED STEEL GIRDERS SUPERSTRUCTURE ALTERNATIVE 2

NOT TO SCALE



ELEVATION VIEW - PILES SUBSTRUCTURE

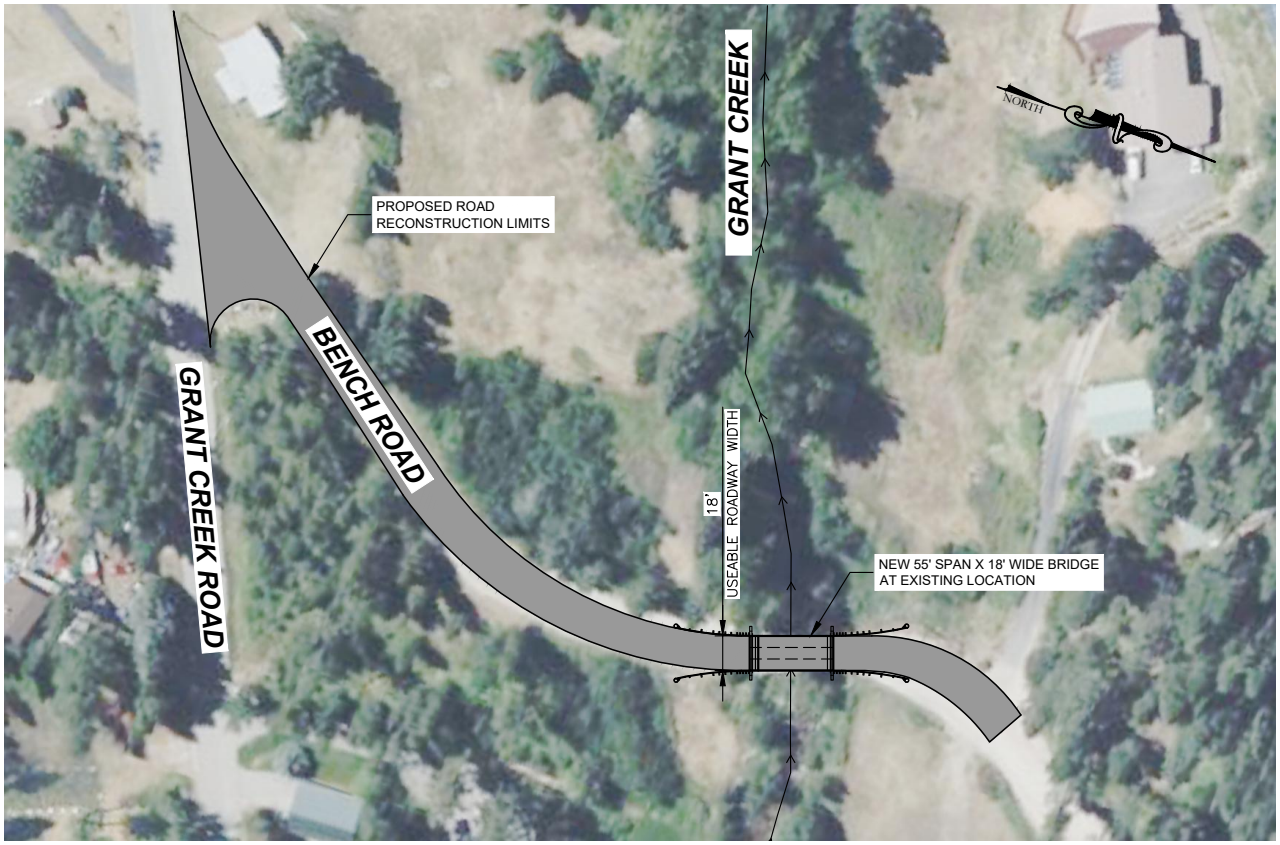
NOT TO SCALE

BENCH ROAD BRIDGE REPLACEMENT
FIGURE 6 - PREFABRICATED STEEL GIRDERS

MISSOULA COUNTY
2025 BRIDGE PER

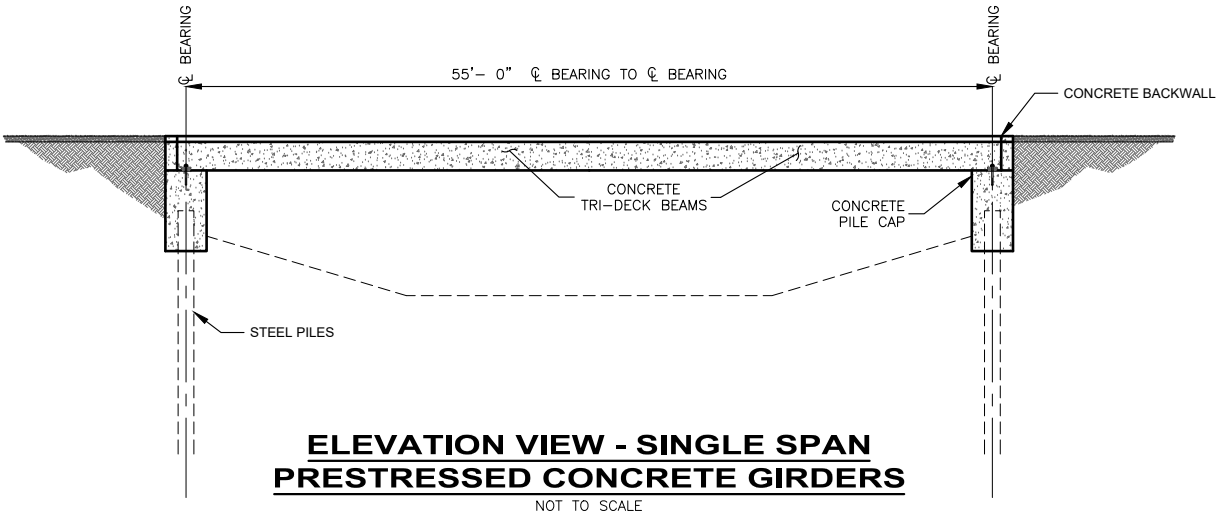
GreatWest ENGINEERING

Y:\Shared\Helena Projects\1-24217-Missoula Co 2024 Bridge PER\CADD X-XXXXX\Exhibits\Figure 6-Fabricated Steel Girder.dwg



PLAN VIEW - SINGLE SPAN PRESTRESSED CONCRETE GIRDERS ALTERNATIVE

NOT TO SCALE



ELEVATION VIEW - SINGLE SPAN PRESTRESSED CONCRETE GIRDERS

NOT TO SCALE

BENCH ROAD BRIDGE REPLACEMENT
FIGURE 7 - PREFERRED ALTERNATIVE

MISSOULA COUNTY
2025 BRIDGE PER

GreatWest ENGINEERING

Y:\Shared\Helena Projects\1-24217-Missoula Co 2024 Bridge PER\CADD X-XXXXX\Exhibits\Figure 7-Preferred Alternate.dwg

APPENDIX B:

MDT BRIDGE INSPECTION REPORT

Bridge ID: **03761 - Bench Road Bridge** Feature Intersected: **Grant Creek**
Location: **7M North Missoula**

SITE PHOTOS

Photo #1 – Approach Looking Ahead on Station

Photo #2 – Approach Looking Back on Station

Bridge ID: **03761 - Bench Road Bridge** Feature Intersected: **Grant Creek**
Location: **7M North Missoula**

SITE PHOTOS

Photo #3 – Looking upstream – Bridge Elevation Profile

Photo #4: Looking downstream – Bridge Elevation Profile

Bridge ID: **03761 - Bench Road Bridge** Feature Intersected: **Grant Creek**
Location: **7M North Missoula**

SITE PHOTOS

Photo #5 – Looking Upstream from Deck

Photo #6: Looking Downstream From Deck

Bridge ID: **03761 - Bench Road Bridge** Feature Intersected: **Grant Creek**
Location: **7M North Missoula**

SITE PHOTOS

Photo #7 – View of Abutment 1

Photo #8: View of Abutment 2

Bridge ID: **03761 - Bench Road Bridge** Feature Intersected: **Grant Creek**
Location: **7M North Missoula**

SITE PHOTOS

Photo #9 – Underside of deck (typical).

Photo #10: View of poor quality spliced girder members

Bridge ID: **03761 - Bench Road Bridge** Feature Intersected: **Grant Creek**
Location: **7M North Missoula**

SITE PHOTOS

Photo #11 – View of Abutment 2 with member separation and rotation.

Photo #12: View of deck condition with previous asphalt loss.

Bridge ID: **03761 - Bench Road Bridge** Feature Intersected: **Grant Creek**
Location: **7M North Missoula**

SITE PHOTOS

Photo #13 – View of upstream utility conduits

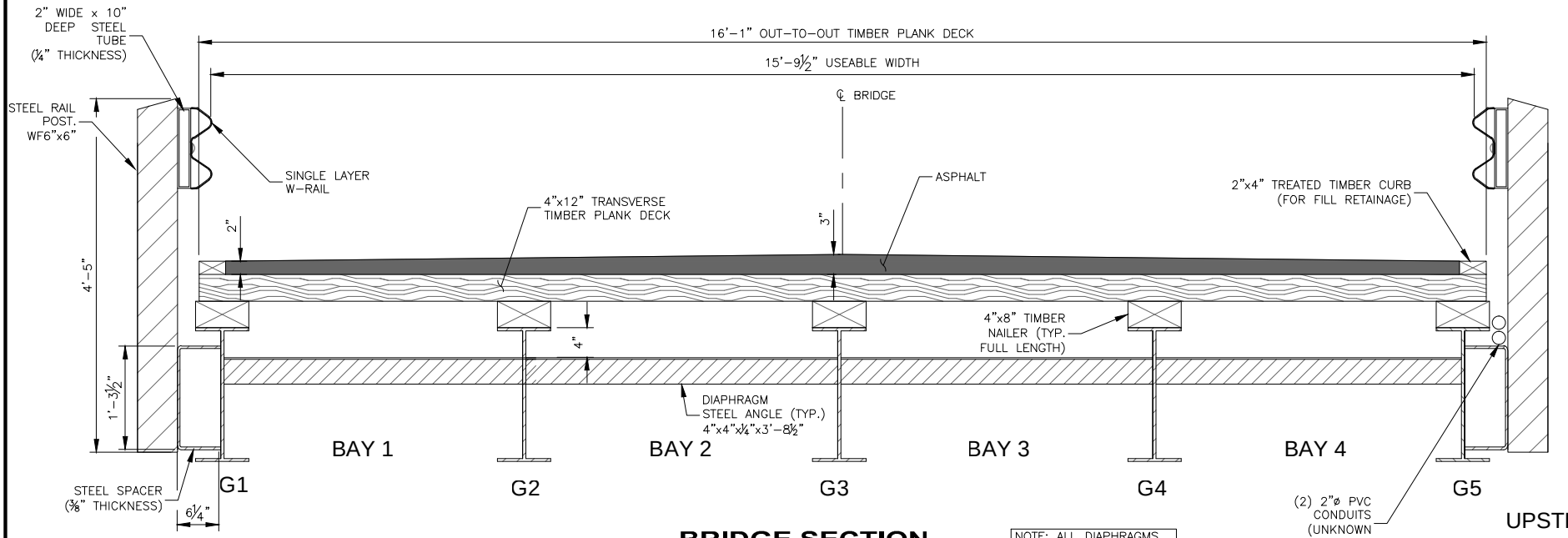
Photo #14: View of downstream utility conduit

Bridge ID: **03761 - Bench Road Bridge** Feature Intersected: **Grant Creek**
Location: **7M North Missoula**

SITE PHOTOS

Photo #15 – View of poor quality asphalt condition at Grant Creek Road

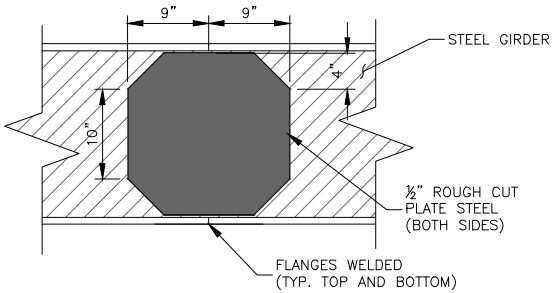
Photo #16: View of asphalt cracking and failure near Grant Creek intersection



BRIDGE SECTION

LOOKING AHEAD ON-LINE
NOT TO SCALE

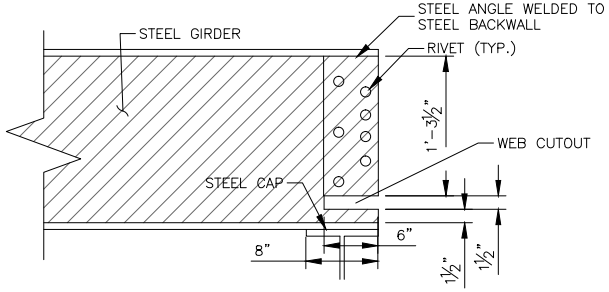
NOTE: ALL DIAPHRAGMS WELDED TO GIRDER WEB



TYPICAL SPLICE DETAILS

NOT TO SCALE

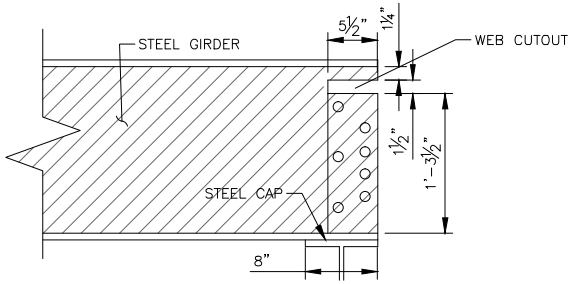
NOTE: SPLICES SHOWN ARE REPRESENTATIVE AND MINOR VARIATIONS EXIST



TYPICAL BOTTOM WEB CUTOUT

NOT TO SCALE

NOTE: BOTTOM GIRDER WEB CUTOUT PRESENT AT G4, ABUTMENT #1.



TYPICAL UPPER WEB CUTOUT

NOT TO SCALE

NOTE: UPPER GIRDER WEB CUTOUT PRESENT AT G1-A1, G2-A1, G3-A2

Bridge Rating Exhibit

MDT#L32482000+01001

MONTANA Department of Transportation

STRUCTURE INSPECTION REPORT

MDT ID - 03761
NBI ID - L32482000+01001
Feature Intersected - GRANT CREEK 019
Facility - BENCH RD

Inspector - Kurt Maart
Inspection Type - Regular NBI
Inspection Date - 09/25/2023
Inventory Direction -

General Bridge Data

(22) Owner	County Hwy Agency
(6A) Feature Intersected	GRANT CREEK 019
(9) Location	7M N MISSOULA
(MDT058)Bridge Condition	2-Fair
(SR) Sufficiency Rating	46.60
(27) Year Built	1955
(58) Deck Rating	7 Good
(59) Superstructure	5 Fair
(60) Substructure	5 Fair
(61) Channel	8 Protected
(62) Culvert	N N/A (NBI)
(MDT145) Inv Direction:	

Location Data

(MDT001) Agency Structure Name	CF-22	**(MDT031) Railroad Over/Underpass**	0 - Not Applicable
(001A) FIPState	30 Montana	**(MDT032) Railroad Owner**	NA - Not Applicable
(001B) FHWA Region	Region 8-Denver	**(MDT014) Interchange Indictator**	0 - Not an Interchange
(MDT027) On/Off System	Off System	**(MDT015) Interstate Ramp Indicator**	0 - Not a Ramp
(112) NBIS Bridge Length	Long Enough	**(MDT078) Maintenance Section**	none - Not a State Maint
(2) MDT Inspection District	01 - MISSOULA	**(MDT020) Maintenance Division**	N - Not a State Maintain
(3) County Code	063 - MISSOULA	**(MDT146) Reservation Boundary**	1 - No
(4) Place Code	Rural Area	**(MDT115) Administrative District**	1 - Missoula
(7) Facility Carried by Structure	BENCH RD	**(MDT116) Financial District**	1 - Missoula
(21) Maintenance Responsibility	County Hwy Agency	**(MDT117) Neighbor County Code**	000 - NONE

Bridge GIS Location

(16) Latitude (DMS)	46d 58' 30.74"	**(17) Longitude (DMS)**	-113d 59' 41.03"
Precise Latitude	46.975205	**Precise Longitude**	-113.994730

Construction Data

(27) Year Built	1955	**(MDT017) MDT Original Construction Project**	
(106) Year Reconstructed	1983	**(MDT099) MDT Rehab Proj Nbrs**	
(MDT102) Year Rehabilitated		**(MDT018) MDT Original Construction Station**	+0
(MDT019) MDT Original Drawing Number		**(MDT100) MDT Rehab Stations**	
(MDT103) MDT Rehab Drawing Nbrs		**(MDT021) MDT UPN**	
(MDT097) Plans in SMS?	Y - Measurement Forms	**(MDT101) MDT Rehab UPNs**	
(MDT098) Shop Drawings in SMS?	3 - Not Applicable		

Span and Dimensional Data

(33) Bridge Meridian	0 No median	**(101) Parallel Structure Designation**	No || bridge exists
(34) Skew	0	**(103) Temporary Structure Designation**	Not Temporary
(35) Structure Flared	0 No flare	**(38) Navigation Control**	Permit Not Required
(42A) Type of Service on Bridge	1 Highway	**(39) Navigation Vertical Clearance**	0.0 ft
(48) Length of Maximum Span	26.0 ft	**(40) Navigation Horizontal Clearance**	0.0 ft
(49) Structure Length	26.5 ft	**(116) Minimum Navigation Vertical Clearance**	ft
(53) Min Vertical Clearance over Bridge Roadway	100.0 ft	**(MDT008) Depth of Cover**	2.00 in

Main Span

(43A) Main Span Material	3 Steel	**(45) Number of Main Spans**	1
(43B) Main Span Design Type	02 - Stringer|Multi-beam		

Approach Span

(44A) Approach Span Material	0 Not Applicable	**(46) Number of Approach Spans**	0.00
(44B) Approach Span Design Type	00 - Not Applicable		

Deck Information

(50A) Left Curb/SIdewalk Width	0.0 ft	**(107) Deck Structure Type**	8 Wood or Timber
(50B) Right Curb/SIdewalk Width	0.0 ft	**(108A) Type of Wearing Surface**	6 Bituminous
(52) Out-to-Out Deck Width	16.0 ft	**(108B) Type of Membrane**	0 None
(MDT006) Deck Area	424.00 sq ft	**(108C) Deck Protection**	None

Under Bridge Service

(42B) Type of Service Under	5 Waterway	**(55B) Min Lat Underclear on Rt**	0.0 ft
(54A) Min Vert Underclear - Ref Feat	N Feature not hwy or RR	**(56) Min Lat Underclear on Lt**	0.0 ft
(54B) Min Vertical Underclearance	0.0 ft	**(111) Pier/Abutment Protect**	
(55A) Min Lat Underclear on Rt Ref Feat	N Feature not hwy or RR	**(113) Scour Critical Status**	8 Stable Above Footing

General Bridge Notes
Stationing south to north

Roadway Information (Route On Structure)

Identification

(MDT035) Road Name	BENCH ROAD	**(6B) Critical Facility Indicator**	
(5A) Inventory Route - Record	Route On Structure	**(MDT087) Mile Post**	.099
(5B) Route Signing Prefix	4 County Hwy	**(5D) Route Number**	32482
(5C) Desginated Level of Ser	1 Mainline	**(MDT007) Departmental Route**	L32482
(5E) Directional Suffix	3 South		

Traffic Data

(28A) Lanes on the Structure	1	**(29) Average Daily Traffic**	100	**(114) Future Average Daily Traffic**	100
(28B) Lanes Under the Structure	0	**(30) Year of Average Daily Traffic**	2023	**(115) Year of Future Avg Daily Traffic**	2038
(MDT030) Roadway Speed	35	**(109) Average Daily Truck Traffic (%)**	3		

Roadway Clearances

(10) Minimum Vertical Clearance	99.99 ft	**(72) Approach Roadway Alignment**	7 Above Min Criteria
(47) Total Horizontal Clearance	15.30 ft	**(42B) Type of Service Under**	5 Waterway
(32) Approach Roadway Width	22.00 ft	**(51) Bridge Roadway Width Curb-to-Curb**	16.00 ft

Highway Networks and Service Classification

(12) Base Highway Network	Not on Base Network	**(20) Toll**	3 On free road
(11) Accumulated Miles	0.08	**(26) Functional Classification**	09 Rural Local
(13A) LRS Number	C229932A	**(102) Direction of Traffic**	3 1-lane Br for 2-way

Alternate Classifications

(100) STRAHNET Highway Designation	0 Not a STRAHNET hwy	**(110) National Truck Network**	0 Not part of natl netwo
(104) NHS Indicator	0 Not on NHS	**(105) Federal Lands Highways**	0 N/A (NBI)

Detour

(19) Bypass/Detour Length	124.00 mi	**(MDT009) Detour Speed**	-1 mi/hr

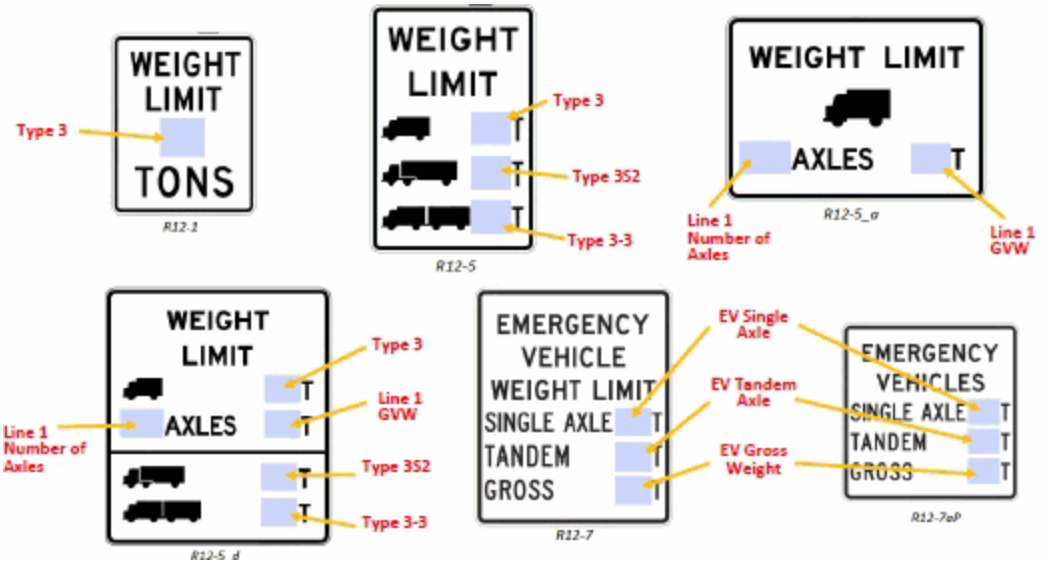
Load Rating

Event Name: INIT03761
Rating Date: 08/13/2015
Load Rater: DJR
Reviewer:
Software Used: AASHTOWare BrR
Secondary Software:
Notes: Transferred from SMS
Wearing Surface or Fill Depth:
Category: Routine

Vehicle Name	Current	Load Rating (Tons)	Method	Analysis	Limit State	Location	Notes
HS 20-44 Inventory	T	18.00	2 AS Allowable Stress	Design	NA		SMS Design Transfer
HS 20-44 Operating	T	24.00	2 AS Allowable Stress	Design	NA		SMS Design Transfer
Type 3 Inventory Rating	T	21.00	2 AS Allowable Stress	Legal	NA		Transferred from SMS
Type 3 Operating Rating	T	29.00	2 AS Allowable Stress	Legal	NA		Transferred from SMS
Type 3S2 Inventory Rating	T	33.00	2 AS Allowable Stress	Legal	NA		Transferred from SMS
Type 3S2 Operating Rating	T	45.00	2 AS Allowable Stress	Legal	NA		Transferred from SMS
Type 3-3 Inventory Rating	T	36.00	2 AS Allowable Stress	Legal	NA		Transferred from SMS
Type 3-3 Operating Rating	T	48.00	2 AS Allowable Stress	Legal	NA		Transferred from SMS
SU4 Inventory Rating	T	22.00	2 AS Allowable Stress	Legal	NA		Transferred from SMS
SU4 Operating Rating	T	29.00	2 AS Allowable Stress	Legal	NA		Transferred from SMS
SU5 Inventory Rating	T	24.00	2 AS Allowable Stress	Legal	NA		Transferred from SMS
SU5 Operating Rating	T	33.00	2 AS Allowable Stress	Legal	NA		Transferred from SMS
SU6 Inventory Rating	T	25.00	2 AS Allowable Stress	Legal	NA		Transferred from SMS
SU6 Operating Rating	T	37.00	2 AS Allowable Stress	Legal	NA		Transferred from SMS
SU7 Inventory Rating	T	28.00	2 AS Allowable Stress	Legal	NA		Transferred from SMS
SU7 Operating Rating	T	42.00	2 AS Allowable Stress	Legal	NA		Transferred from SMS

Load Posting Information

Operational Status		Load Posting Requirements	
(41) Open/Posted/Closed	A Open, no restriction	(70) Legal Load Status	5 At/Above Legal Loads
(MDT135) Posting Sign Type		Load Posting Authorization Date	
(MDT067) Type 3 Truck Posting		Required Posting Sign Type	
(MDT073) Truck 3S2 Posting		Required Type 3 Truck Posting	
(MDT070) Truck 3-3 Posting		Required Type 3S2 Truck Posting	
(MDT136) Line 1 Number of Axles Posting		Required Type 3-3 Truck Posting	
(MDT137) Line 1 GVW Posting		Required Line 1 Number of Axles Posting	
(MDT142) EV Single Axle Posting		Required Line 1 GVW Posting	
(MDT143) EV Tandem Axles Posting		Required EV Single Axle Posting	
(MDT144) EV Gross Weight Posting		Required EV Tandem Axles Posting	
(MDT148) Load Posting Basis		Required EV Gross Weight Posting	



Repair Suggestions

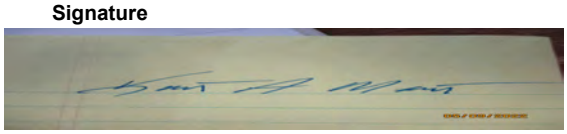
Recommended By:	Date Recommended	Type	Status	Suggested Priority
	08/31/2018	Repair Suggestion	Repair Suggestion	Low

Comments
Install Type 3 object markers (hazard panels) on all four corners of bridge

Inspection Activities

Inspector
Kurt Maart

Signature



Start Date	End Date	Weather	Temperature	Comments
09/25/2023	09/25/2023	Cloudy	56	Kmaart team leader with BK assisting in inspection.

Quality Control Reviewer
Justin Smith

Inspection Information

Inspection Notes

Kmaart team leader with BK assisting in inspection.
2023: all steel has little to no paint left and all parts of structure are form different bridges
Deleted element 950 as there is not enough rail to have end rail and approach rail. KM
All quantities rounded to the nearest whole ft/ft2. Some defect quantities may overlap, water at abutment 2 was well under 2 ft deep and the column footing/steel sill was fully inspectable.

	Current Inspection (09/25/2023)	Previous Inspection (09/15/2021)
(36A) Bridge Rail	0 Substandard	0 Substandard
(36B) Transition Rail	0 Substandard	0 Substandard
(36C) Approach Rail	N N/A or not required	N N/A or not required
(36D) Guardrail Ends	0 Substandard	0 Substandard
(41) Structure Open, Posted, or Closed	A Open, no restriction	A Open, no restriction
(58) Deck Rating	7 Good	7 Good
(59) Superstructure	5 Fair	5 Fair
(60) Substructure	5 Fair	5 Fair
(61) Channel	8 Protected	8 Protected
(62) Culvert	N N/A (NBI)	N N/A (NBI)
(67) Structural Evaluation	5 Above Min Tolerable	5 Above Min Tolerable
(68) Deck Geometry	7 Above Min Criteria	7 Above Min Criteria
(69) Underclear, Vertical and Horizontal	N Not applicable (NBI)	N Not applicable (NBI)
(71) Waterway Adequacy	7 Above Minimum	7 Above Minimum
(MDT058) FHWA Bridge Condition	2-Fair	2-Fair
(MDT034) Request Review of Load Rating	No	No
(MDT050) UBIV Required	N - UBIV Required	N - UBIV Required
(MDT010) FC Inspection Details		
(MDT008) Depth of Cover		

Inspection Schedule

Inspection Type	Most Recent Inspection Date	Frequency (Months)	Next Inspection Date
Routine	09/25/2023	24	09/25/2025

Element Inspection

Note: Only elements inspected during this inspection will appear in this report.

M Main Span (0)

31 - Timber Deck	Total Quantity	Condition State 1	Condition State 2	Condition State 3	Condition State 4
		QTY (PCT)	QTY (PCT)	QTY (PCT)	QTY (PCT)
	420.00 sq.ft	420.00 (100.00%)	0.00 (0.00%)	0.00 (0.00%)	0.00 (0.00%)
Environment: Low					

Comments:
2023 Timber deck is covered with plant mix surfacing with areas of potholing/ patching. No significant defects noted.

510 - Wearing Surfaces	***Total Quantity***	***Condition State 1***	***Condition State 2***	***Condition State 3***	***Condition State 4***
		QTY (PCT)	*QTY (PCT)*	*QTY (PCT)*	*QTY (PCT)*
	420.00 sq.ft	*270.00 (64.30%)*	*0.00 (0.00%)*	*150.00 (35.70%)*	*0.00 (0.00%)*

Comments:
plant mix surfacing on timber deck.

3210 - Del/Spall/Patch/Pot(Wear Surf)	***Total Quantity***	***Condition State 1***	***Condition State 2***	***Condition State 3***	***Condition State 4***
		QTY (PCT)	*QTY (PCT)*	*QTY (PCT)*	*QTY (PCT)*
	24.00 sq.ft	*0.00 (0.00%)*	*0.00 (0.00%)*	*24.00 (100.00%)*	*0.00 (0.00%)*

Comments:
CS1:
CS2:
CS3:2023 previous potholing has been patched but is considered an unsound patch. No change to previous quantity. See pic (4) example.
CS4:

The wearing surface has (2) potholes up to 6' x 3' beginning to form in the right wheel path.

3220 - Crack (Wearing Surface)	***Total Quantity***	***Condition State 1***	***Condition State 2***	***Condition State 3***	***Condition State 4***
		QTY (PCT)	*QTY (PCT)*	*QTY (PCT)*	*QTY (PCT)*
	150.00 sq.ft	*24.00 (16.00%)*	*0.00 (0.00%)*	*126.00 (84.00%)*	*0.00 (0.00%)*

Comments:
CS1:
CS2:
CS3:2023: The wearing surface has moderate transverse cracks up to 1/4" W concentrated in right wheel line. reduced quantity by 24 feet for newer plant mix patches.
CS4:

M Main Span (0)

107 - Steel Opn Girder/Beam	Total Quantity	Condition State 1	Condition State 2	Condition State 3	Condition State 4
		QTY (PCT)	QTY (PCT)	QTY (PCT)	QTY (PCT)
	131.00 ft	0.00 (0.00%)	130.00 (99.20%)	1.00 (0.80%)	0.00 (0.00%)
Environment: Low					

Comments:
2023: all steel has little to no paint left and all part of structure are form different bridges .
Note:Girders have welded splices at approximately 1/3 point of each girder, no signs of distress were noted in the welded splice.

515 - Steel Protective Coating	***Total Quantity***	***Condition State 1***	***Condition State 2***	***Condition State 3***	***Condition State 4***
		QTY (PCT)	*QTY (PCT)*	*QTY (PCT)*	*QTY (PCT)*
	600.00 sq.ft	*0.00 (0.00%)*	*0.00 (0.00%)*	*200.00 (33.33%)*	*400.00 (66.67%)*

Comments:
2023: paint failure and cs3 coating issues.

3440 - Eff (Stl Protect Coat)	***Total Quantity***	***Condition State 1***	***Condition State 2***	***Condition State 3***	***Condition State 4***
		QTY (PCT)	*QTY (PCT)*	*QTY (PCT)*	*QTY (PCT)*
	600.00 sq.ft	*0.00 (0.00%)*	*0.00 (0.00%)*	*200.00 (33.33%)*	*400.00 (66.67%)*

Comments:
CS1:
CS2:
CS3:2023:200ftsq cs 3 ineffective.
CS4:2023:Few areas of paint remain on webs but is ineffective.400ftsq failed,

1000 - Corrosion	***Total Quantity***	***Condition State 1***	***Condition State 2***	***Condition State 3***	***Condition State 4***
		QTY (PCT)	*QTY (PCT)*	*QTY (PCT)*	*QTY (PCT)*
	131.00 ft	*0.00 (0.00%)*	*130.00 (99.24%)*	*1.00 (0.76%)*	*0.00 (0.00%)*

Comments:
CS1:
CS2:2023:All girders have surface corrosion
CS3: Girder 5 right side top of bottom flanges for an length of 4 inches has .10" of section loss (0.455 - 0.370 rounded up).1ft
CS4:

1900 - Distortion	***Total Quantity***	***Condition State 1***	***Condition State 2***	***Condition State 3***	***Condition State 4***
		QTY (PCT)	*QTY (PCT)*	*QTY (PCT)*	*QTY (PCT)*
	1.00 ft	*0.00 (0.00%)*	*1.00 (100.00%)*	*0.00 (0.00%)*	*0.00 (0.00%)*

Comments:
CS1:
CS2:2023:Girder 5 exterior bottom flange has 1/4" of distortion over a 12" length.
CS3:
CS4:

M Main Span (0)

202 - Steel Column	**Total Quantity**	**Condition State 1**	**Condition State 2**	**Condition State 3**	**Condition State 4**
		QTY (PCT)	QTY (PCT)	QTY (PCT)	QTY (PCT)
	8.00 each	0.00 (0.00%)	8.00 (100.00%)	0.00 (0.00%)	0.00 (0.00%)

Environment: Mod.

Comments:
2023: all steel has little to no paint left and all part of structure are form different bridges

515 - Steel Protective Coating	***Total Quantity***	***Condition State 1***	***Condition State 2***	***Condition State 3***	***Condition State 4***
		QTY (PCT)	*QTY (PCT)*	*QTY (PCT)*	*QTY (PCT)*
	110.00 sq.ft	*0.00 (0.00%)*	*0.00 (0.00%)*	*0.00 (0.00%)*	*110.00 (100.00%)*

Comments:
2023:No effective paint remains.

3440 - Eff (Stl Protect Coat)	***Total Quantity***	***Condition State 1***	***Condition State 2***	***Condition State 3***	***Condition State 4***
		QTY (PCT)	*QTY (PCT)*	*QTY (PCT)*	*QTY (PCT)*
	110.00 sq.ft	*0.00 (0.00%)*	*0.00 (0.00%)*	*0.00 (0.00%)*	*110.00 (100.00%)*

Comments:
CS1:
CS2:
CS3:
CS4:2023: No effective paint remains.

1000 - Corrosion	***Total Quantity***	***Condition State 1***	***Condition State 2***	***Condition State 3***	***Condition State 4***
		QTY (PCT)	*QTY (PCT)*	*QTY (PCT)*	*QTY (PCT)*
	8.00 each	*0.00 (0.00%)*	*8.00 (100.00%)*	*0.00 (0.00%)*	*0.00 (0.00%)*

Comments:
CS1:
CS2:2023:Steel columns have surface corrosion and negligible section loss/full length cs 2 corrosion throughout.
CS3:
CS4:

M Main Span (0)

219 - Stl Abutment	**Total Quantity**	**Condition State 1**	**Condition State 2**	**Condition State 3**	**Condition State 4**
		QTY (PCT)	QTY (PCT)	QTY (PCT)	QTY (PCT)
	89.00 ft	0.00	84.00	5.00	0.00
Environment: Mod.		(0.00%)	(94.38%)	(5.62%)	(0.00%)

Comments:
2023: all steel has little to no paint left and all part of structure are form different bridges.

515 - Steel Protective Coating	***Total Quantity***	***Condition State 1***	***Condition State 2***	***Condition State 3***	***Condition State 4***
		QTY (PCT)	*QTY (PCT)*	*QTY (PCT)*	*QTY (PCT)*
	445.00 sq.ft	*0.00 (0.00%)*	*0.00 (0.00%)*	*0.00 (0.00%)*	*445.00 (100.00%)*

Comments:
2023: coating is no longer effective.

3440 - Eff (Stl Protect Coat)	***Total Quantity***	***Condition State 1***	***Condition State 2***	***Condition State 3***	***Condition State 4***
		QTY (PCT)	*QTY (PCT)*	*QTY (PCT)*	*QTY (PCT)*
	445.00 sq.ft	*0.00 (0.00%)*	*0.00 (0.00%)*	*0.00 (0.00%)*	*445.00 (100.00%)*

Comments:
CS1:
CS2:
CS3:
CS4:2023: No effective paint remains.

1000 - Corrosion	***Total Quantity***	***Condition State 1***	***Condition State 2***	***Condition State 3***	***Condition State 4***
		QTY (PCT)	*QTY (PCT)*	*QTY (PCT)*	*QTY (PCT)*
	89.00 ft	*0.00*	*84.00*	*5.00*	*0.00*
		(0.00%)	*(94.40%)*	*(5.60%)*	*(0.00%)*

Comments:
CS1:
CS2:2023:
Steel abutments have surface corrosion and negligible section loss throughout.
CS3:2023:
Pack rust swelling between the built-up areas of the back walls. up to 5/8"-5 ft total for bent 1 and bent 2.
CS4:

M Main Span (0)

231 - Steel Pier Cap	**Total Quantity**	**Condition State 1**	**Condition State 2**	**Condition State 3**	**Condition State 4**
		QTY (PCT)	QTY (PCT)	QTY (PCT)	QTY (PCT)
	33.00 ft	0.00	33.00	0.00	0.00
Environment: Low		(0.00%)	(100.00%)	(0.00%)	(0.00%)

Comments:
2023: all steel has little to no paint left and all parts of structure are form different bridges

515 - Steel Protective Coating	***Total Quantity***	***Condition State 1***	***Condition State 2***	***Condition State 3***	***Condition State 4***
		QTY (PCT)	*QTY (PCT)*	*QTY (PCT)*	*QTY (PCT)*
	151.00 sq.ft	*0.00*	*0.00*	*0.00*	*151.00*
		(0.00%)	*(0.00%)*	*(0.00%)*	*(100.00%)*

Comments:
2023: No effective paint remains.

3440 - Eff (Stl Protect Coat)	***Total Quantity***	***Condition State 1***	***Condition State 2***	***Condition State 3***	***Condition State 4***
		QTY (PCT)	*QTY (PCT)*	*QTY (PCT)*	*QTY (PCT)*
	151.00 sq.ft	*0.00*	*0.00*	*0.00*	*151.00*
		(0.00%)	*(0.00%)*	*(0.00%)*	*(100.00%)*

Comments:
CS1:
CS2:
CS3:
CS4:2023: No effective paint remains.

1000 - Corrosion	***Total Quantity***	***Condition State 1***	***Condition State 2***	***Condition State 3***	***Condition State 4***
		QTY (PCT)	*QTY (PCT)*	*QTY (PCT)*	*QTY (PCT)*
	33.00 ft	*0.00*	*33.00*	*0.00*	*0.00*
		(0.00%)	*(100.00%)*	*(0.00%)*	*(0.00%)*

Comments:
CS1:
CS2:2023:Steel caps have corrosion with non measurable section loss throughout.
CS3:
CS4:

M Main Span (0)

330 - Metal Bridge Railing	**Total Quantity**	**Condition State 1**	**Condition State 2**	**Condition State 3**	**Condition State 4**
		QTY (PCT)	QTY (PCT)	QTY (PCT)	QTY (PCT)
	52.00 ft	0.00	52.00	0.00	0.00
Environment: Low		(0.00%)	(100.00%)	(0.00%)	(0.00%)

Comments:
2023:Metal rail has been flattened .

515 - Steel Protective Coating	***Total Quantity***	***Condition State 1***	***Condition State 2***	***Condition State 3***	***Condition State 4***
		QTY (PCT)	*QTY (PCT)*	*QTY (PCT)*	*QTY (PCT)*
	156.00 sq.ft	*156.00 (100.00%)*	*0.00 (0.00%)*	*0.00 (0.00%)*	*0.00 (0.00%)*

Comments:
2023:No significant defects noted.

1900 - Distortion	***Total Quantity***	***Condition State 1***	***Condition State 2***	***Condition State 3***	***Condition State 4***
		QTY (PCT)	*QTY (PCT)*	*QTY (PCT)*	*QTY (PCT)*
	52.00 ft	*0.00 (0.00%)*	*52.00 (100.00%)*	*0.00 (0.00%)*	*0.00 (0.00%)*

Comments:
CS1:
CS2:2023: Flattened rail full length left and right, cs2 full length. See photo (3)
CS3:
CS4:

M Main Span (9)

960 - Steel Approach Guardrail Ends	**Total Quantity**	**Condition State 1**	**Condition State 2**	**Condition State 3**	**Condition State 4**
		QTY (PCT)	QTY (PCT)	QTY (PCT)	QTY (PCT)
	4.00 each	2.00 (50.00%)	2.00 (50.00%)	0.00 (0.00%)	0.00 (0.00%)

Environment: Low

Comments:

7000 - Damage	***Total Quantity***	***Condition State 1***	***Condition State 2***	***Condition State 3***	***Condition State 4***
		QTY (PCT)	*QTY (PCT)*	*QTY (PCT)*	*QTY (PCT)*
	2.00 each	*0.00 (0.00%)*	*2.00 (100.00%)*	*0.00 (0.00%)*	*0.00 (0.00%)*

Comments:
CS1:
CS2:2023:The northwest and southeast approach rail ends have minor impact damage and scrapes.
CS3:
CS4:

Inspection Photos:

Photo Name:
03761_ (12).JPG

Comments:

Looking upstream-grant creek

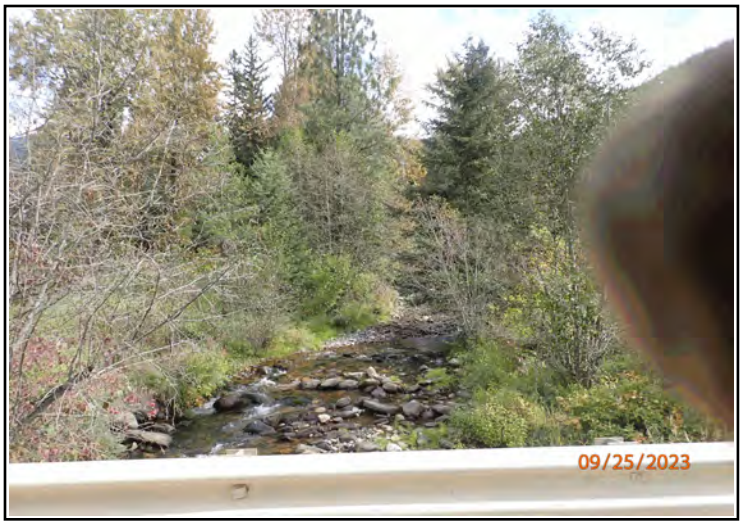


Photo Name:
03761_ (13).JPG

Comments:

Looking downstream-grant creek .

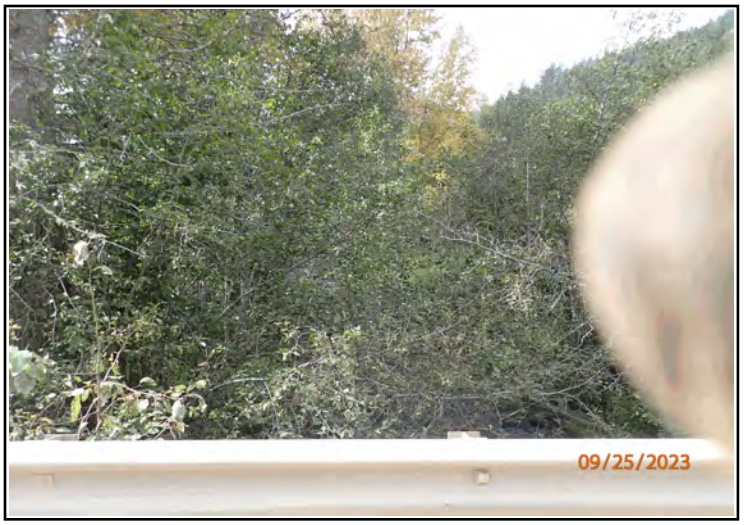


Photo Name:
03761_ (2).JPG

Comments:

AOL flow is from right to left, looking NW

Photo Name:
03761_ (5).JPG

Comments:

Profile right and looking down stream.

Photo Name:
03761_ (6).JPG

Comments:

Under looking AOL looking at bent.

Photo Name:
03761_ (10).JPG

Comments:

Steel abutment at bent 1 and 2 have areas of pack rust swelling between built up areas. all sections of structure are from different bridges.

Photo Name:
03761_ (3).JPG

Comments:

Flattened and rusty rail full length left and right, cs2 full length.

Photo Name:
03761_ (4).JPG

Comments:

Areas of patching of 2-inch-deep plant mis surfacing. Near bent 2 end.

Photo Name:
03761_ (7).JPG

Comments:

Typical of steel girder splices girder 5 shown.

Photo Name:
03761_ (9).JPG

Comments:

Abutment, column and sill make up all steel no paint remaining. Some pack rust between built up areas in back walls.

APPENDIX C:

PRELIMINARY PROBABLE COST ESTIMATE

TABLE 1-1
OPINION OF PROBABLE COST
Superstructure Alternative 1 - Prestressed Concrete Trideck Girders

Item No.	Description	Unit	Quantity	Price	Amount
1	Prestressed Concrete Trideck Girders (55' Span, 18' usable width)	SF	1,118	$150	$167,723
2	Steel Bridge Barrier Rail (Includes Curb)	LF	114	$250	$28,500
3	Approach Guardrail	EA	4	$5,000	$20,000
TOTAL CONSTRUCTION COST					**$216,223**

PRESENT WORTH ANALYSIS

Maintenance Description	Frequency (years)	Cost per Repair	Total Cost
Patching and Repair of Beam Joints/Deck	25	$1,875	$5,625
Maintenance and Replacement of Bridge Rail	25	$3,200	$9,600
Maintenance and Replacement of Approach Guardrail	25	$1,500	$4,500
Useful Life (years)	75		
Superstructure O & M			$19,725
CAPITAL COSTS			$216,223
TOTAL (75 YEAR COST)			**$235,948**

TABLE 1-2
OPINION OF PROBABLE COST
Superstructure Alternative 2 - Prefabricated Steel Girder Bridge System

Item No.	Description	Unit	Quantity	Price	Amount
1	Steel Modular Bridge w/SIP Form (55' span, 18' usable width)	SF	1,118	$155	$173,313
2	Cast-In-Place Concrete Deck (8" Depth)	CY	28	$2,000	$55,217
3	Steel Bridge Barrier Rail (Includes Curb)	LF	114	$250	$28,500
4	Approach Guardrail	EA	4	$5,000	$20,000
5	Additional Road Embankment/Base Course (from Additional Road Raising of 10" compared to Alternative 1)	CY	200	$40	$8,000
TOTAL CONSTRUCTION COST					**$285,031**

PRESENT WORTH ANALYSIS			
Maintenance Description	**Frequency (years)**	**Cost per Repair**	**Total Cost**
Repair and Renovation of Deck	25	$1,875	$5,625
Maintenance and Replacement of Bridge Rail	25	$3,200	$9,600
Maintenance and Replacement of Approach Guardrail	25	$1,500	$4,500
Useful Life (years)	75		
Superstructure O & M			$19,725
CAPITAL COSTS			$285,031
TOTAL (75 YEAR COST)			**$304,756**

TABLE 2-A
OPINION OF PROBABLE COST
Substructure Alternative A - Driven Piles with a Concrete Cap

Item No.	Description	Unit	Quantity	Price	Amount
1	Structural Excavation	CY	180	$40	$7,200
2	Structural Backfill (Imported)	CY	120	$75	$9,000
3	Cast-in-Place Concrete	CY	32	$1,600	$51,200
4	Furnish and Drive Steel Piles (8 @ 45' [40' Driven])	LF	360	$225	$81,000
5	Random Riprap	CY	180	$130	$23,400
TOTAL CONSTRUCTION COST					**$171,800**

PRESENT WORTH ANALYSIS			
Maintenance Description	**Frequency (years)**	**Cost per Repair**	**Total Cost**
Patching and Renovating Concrete	25	$8,000	$24,000
Repair and Restructuring of Riprap	25	$4,500	$13,500
Useful Life (years)	75		
Substructure O & M			$37,500
CAPITAL COSTS			$171,800
TOTAL (75 YEAR COST)			**$209,300**

TABLE 2-B
OPINION OF PROBABLE COST
Substructure Alternative B - Spread Footing Abutments

Item No.	Description	Unit	Quantity	Price	Amount
1	Structural Excavation	CY	350	$40	$14,000
2	Structural Backfill (Imported)	CY	300	$75	$22,500
3	Cast-in-Place Concrete	CY	55	$1,600	$88,000
4	Dewatering	LS	1	$55,000	$55,000
5	Random Riprap	CY	225	$130	$29,250
TOTAL CONSTRUCTION COST					**$208,750**

PRESENT WORTH ANALYSIS			
Maintenance Description	**Frequency (years)**	**Cost per Repair**	**Total Cost**
Patching and Renovating Concrete	50	$13,750	$20,625
Repair and Restructuring of Riprap	25	$5,625	$16,875
Useful Life (years)	75		
Substructure O & M			$37,500
CAPITAL COSTS			$208,750
TOTAL (75 YEAR COST)			**$246,250**

TABLE 3
OPINION OF PROBABLE COST
Common Costs

Item No.	Description	Unit	Quantity	Price	Amount
1	Removal and Disposal of Existing Bridge	LS	1	$20,000	$20,000
2	Temporary Detour Bridge	LS	1	$40,000	$40,000
3	3" Asphalt Pavement (Grant Creek Rd to 100'	TON	200	$210	$42,000
4	3/4" Minus Aggregate Course	CY	110	$55	$6,050
5	Roadway Embankment/Base Course	CY	120	$40	$4,800
6	Seeding & Revegetation	LS	1	$2,500	$2,500
TOTAL CONSTRUCTION COST					**$115,350**

TABLE 4
Basis For Selection

	Superstructure Alternatives		Substructure Alternatives		
	1	2	A	B	
	Prestressed Concrete Trideck Beams	Prefabricated Steel Girder Bridge System	Driven Pile Foundation	Concrete Spread Footing Foundation	Common Costs
Construction Cost	$216,223	$285,031	$171,800	$208,750	$115,350
O & M Costs	$19,725	$19,725	$37,500	$37,500	-
Useful Life	75 years	75 years	75 years	75 years	75 years
75 Year Present Worth	$235,948	$304,756	$209,300	$246,250	$115,350
Cost Effectiveness	+1	0	0	0	-
Technical Feasibility	+1	+1	+1	0	-
Environmental Impacts	0	0	0	-1	-
Construction Time	+1	+1	+1	0	-
Total	+3	+2	+2	-1	-

Replacement Alternative	Total Initial Cost	75 Year PW w/Common
1A: Prestressed Concrete Trideck Beams w/ a Driven Pile Foundation	$503,373	$560,598
1B: Prestressed Concrete Trideck Beams w/Spread Footing Foundation	$540,323	$597,548
2A: Modular Steel Bridge w/Concrete Deck & Driven Pile Foundation	$572,181	$629,406
2B: Modular Steel Bridge w/Concrete Deck & Spread Footing Foundation	$609,131	$666,356

Recommended Alternative: Prestressed Concrete Trideck Beams with a Driven Pile Foundation

TABLE 5
OPINION OF PROBABLE COST
Bench Road Bridge Total Project Costs

Item No.	Description	Unit	Quantity	Price	Amount
1	Mobilization	LS	1	$56,000	$56,000
2	Prestressed Concrete Trideck Girders (55' Span, 18' usable width)	SF	1,118	$150	$167,723
3	Steel Bridge Barrier Rail (Includes Curb)	LF	114	$250	$28,500
4	Approach Guardrail	EA	4	$5,000	$20,000
5	Structural Excavation	CY	180	$40	$7,200
6	Structural Backfill (Imported)	CY	120	$75	$9,000
7	Cast-in-Place Concrete	CY	32	$1,600	$51,200
8	Furnish and Drive Steel Piles (8 @ 45' [40' Driven])	LF	360	$225	$81,000
9	Random Riprap	CY	180	$130	$23,400
10	Removal and Disposal of Existing Bridge	LS	1	$20,000	$20,000
11	Temporary Detour Bridge	LS	1	$40,000	$40,000
12	3" Asphalt Pavement (Grant Creek Rd to 100' past bridge)	TON	200	$210	$42,000
13	3/4" Minus Aggregate Course	CY	110	$55	$6,050
14	Roadway Embankment/Base Course	CY	120	$40	$4,800
15	Seeding & Revegetation	LS	1	$2,500	$2,500
	DIRECT CONSTRUCTION SUBTOTAL				**$559,373**
	2028 Construction Cost[2]				**$629,219**
	Construction Contingency				**$125,844**
	Engineering (PE)				**$125,844**
	Construction Engineering (CE)				**$50,338**
	Administration/Legal				**$18,878**
	TOTAL				**$950,123**

1. Estimated unit costs are based upon estimates from suppliers and bid tabs for similar projects throughout Montana.

2. Capital costs are projected to an anticipated construction date in 2028 using a 4% inflation rate.

3. The construction contingency (approximately 20%) was applied to consider potential constructability issues and the potential for unknown factors to arise, such as unforeseen geotechnical conditions. Cost estimating guidance from the Montana Department of Transportation recommends and substantiates the use of a 20% contingency allowance for low-risk bridge projects.

APPENDIX D:

PRELIMINARY HYDROLOGIC AND HYDRAULIC ANALYSIS SUMMARY

TECHNICAL MEMORANDUM

Preliminary Hydrologic and Hydraulic Memo

Bench Road PER – Missoula County, Montana

PREPARED FOR:	Karl Yakawich, Great West Engineering
PREPARED BY:	Raychel Hoerner, E.I.
REVIEWED BY:	Justin Evertz, P.E.
DATE:	12/31/2024
GWE PROJECT NUMBER:	1-24217

1.0 Introduction

Missoula County intends to upgrade and replace the existing Bench Road Bridge with a new bridge meeting current design parameters. The Bench Road Bridge crosses Grant Creek seven miles north of Missoula, Montana. The project site is located within a FEMA Zone A floodplain and does not have Base Flood Elevations determined.

This memo summarizes preliminary hydrologic and hydraulic analyses that were conducted to estimate water surface elevations (WSELs) at the Bench Road Bridge, to assist in the preparation of a Preliminary Engineering Report. The results presented in this memo should not be assumed adequate for project design.

2.0 Hydrologic Analysis

Current and historic hydrologic data sources were reviewed, as described in the following paragraphs.

The project basin was analyzed for streamgage data. No current or historic streamgages were identified within the project basin.

The effective Flood Insurance Study (FIS) for Missoula County (October 5, 2023) was consulted for hydrologic data regarding Grant Creek. Grant Creek was included in the FIS study, and peak flow data is listed for Grant Creek at the intersection with Interstate 90 (drainage area of 25 sq. mi.). Peak flows listed in the report are included in Table 1.

StreamStats V4.25.0 was used to calculate peak flow values using regional regression equations. The results of the basin characteristics and remote sensed width computational methods were weighed to produce peak flow values. The peak flow values that weight basin characteristics and remote sensed channel width were selected for use in the hydraulic model. The weighted StreamStats flows are conservative when compared to the flows listed in the FIS and are calculated for the site-specific location (drainage area of 14.6 sq. mi.). Peak flows calculated using only basin characteristics and using the weighted values are included in Table 1.

Table 1: Peak Flow Data

Return Interval	Probability of Exceedance	FIS Peak Flows (CFS)	StreamStats - Basin Characteristics (CFS)	StreamStats - Weighted w/ Remote Sensed Width (CFS)
Drainage Area (Sq. Mi.)	***~***	***25***	***14.6***	***14.6***
Q2	50%	*	160	170
Q10	10%	245	296	325
Q50	2%	380	412	463
Q100	1%	465	465	528

**2-year flood event not included in FIS Data.*

3.0 Hydraulic Analysis

The hydraulic characteristics of Grant Creek were analyzed to estimate WSELs for the Grant Creek Bridge. The U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center's River Analysis System (HECRAS) computer program, version 6.4.1 steady state option, was used for the hydraulic analysis.

Cross-section data was obtained from publicly available LiDAR. USGS 1 Meter LiDAR, published in 2024, was obtained through the USGS National Map Data Collection service. The preliminary hydraulic analysis of the stream crossing consists of four (4) cross-sections, and the existing and proposed structure. The existing channel slope in the vicinity of the crossing is approximately 2.7%.

Manning's 'n' values used in the hydraulic computations were selected by engineering judgement using photos and topographic maps and then calibrated based on anticipated channel velocities, bankfull flow capacity, and engineering judgment. A channel roughness value of n=0.060 and an overbank roughness of n=0.080 were selected.

Two hydraulic models were constructed: Existing Conditions and Proposed Conditions models. The Existing Conditions model depicts the current site conditions and structure. The Proposed Conditions model assumes a new spill through channel configuration through the crossing and the installation of a new bridge structure. The Proposed Conditions structure consists of a 55-foot span, 18-foot width single-lane bridge. The following table displays a comparison of existing and proposed conditions' WSELs at the 100-year flood event. The recommended 100-year design WSEL (3,953.39 ft) is computed at the approach cross section (266) of the proposed conditions model, as highlighted in Table 2 below.

Table 2: HECRAS Results – Q100 Water Surface Elevation (WSEL)

Cross Section	301	266	236 BR U	236 BR D	199	130
Existing Conditions WSEL (ft)	3,955.06	3,954.68	3,953.84	3,952.76	3,951.97	3,950.17
Proposed Conditions WSEL (ft)	3,955.06	3,953.39	3,953.13	3,953.02	3,951.97	3,950.17

Note: All WSEL values are listed in the NAVD88 vertical datum.

Attachments

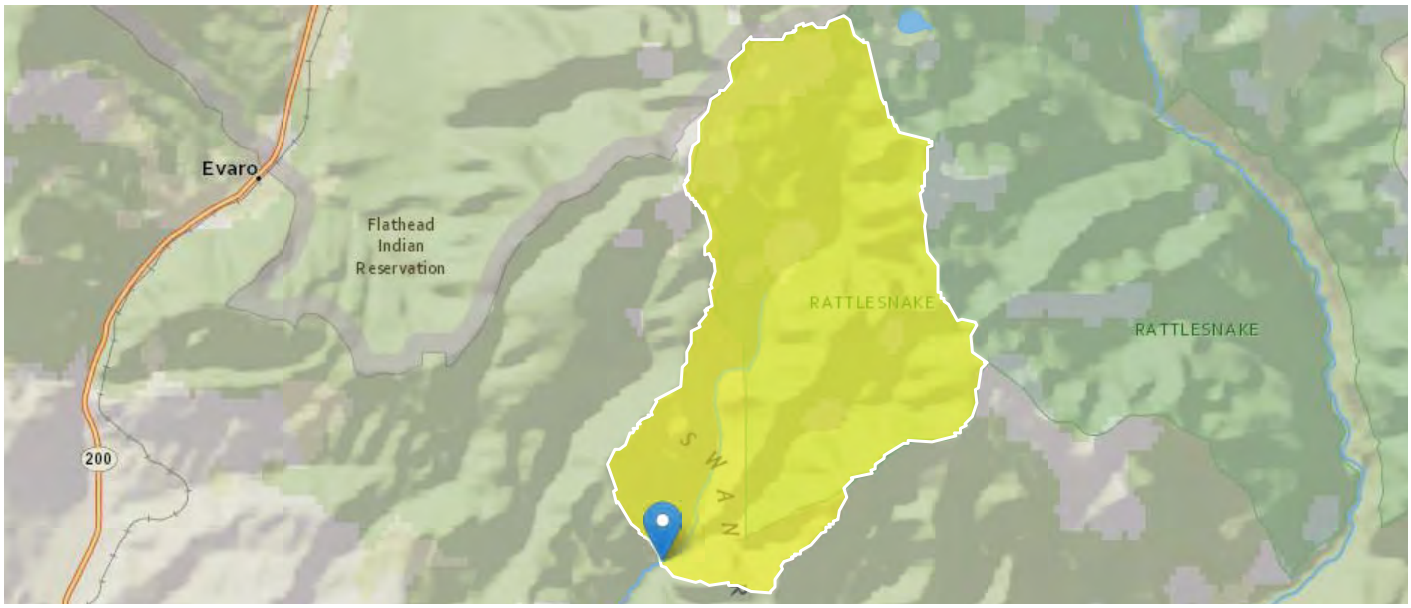
Attachment 1: StreamStats Reports

Attachment 2: HECRAS Outputs

Attachment 1 – StreamStats Reports

StreamStats Report w. RS

Region ID: MT
Workspace ID: MT20241218175447848000
Clicked Point (Latitude, Longitude): 46.97505, -113.99501
Time: 2024-12-18 10:54:01 -0700



Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
CHANWD_RS	Channel width determined from remotely sensed data sources, including aerial imagery	22.88	feet
CONTDA	Area that contributes flow to a point on a stream	14.6	square miles
FOREST	Percentage of area covered by forest	87.7	percent
PRECIP	Mean Annual Precipitation	43.11	inches
WACTCH	Width of active channel	0	feet
WBANKFULL	Width of channel at bankfull	0	feet

General Disclaimers

Parameter values have been edited, computed flows may not apply.

Upstream regulation was checked for this watershed.

Peak-Flow Statistics

Peak-Flow Statistics Parameters [W Region BasinC 2015 5019F]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
CONTDA	Contributing Drainage Area	14.6	square miles	0.6	2470
FOREST	Percent Forest	87.7	percent	20.4	99.1
PRECIP	Mean Annual Precipitation	43.11	inches	14.6	62.1

Peak-Flow Statistics Parameters [W Region Active Channel SIR 2020 5142]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
WACTCH	Width Of Active Channel	0	feet	3	213

Peak-Flow Statistics Parameters [W Region Bankfull SIR 2020 5142]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
WBANKFULL	Width Of Bankfull Channel	0	feet	5	246

Peak-Flow Statistics Parameters [W Region Aerial Photo SIR 2020 5142]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
CHANWD_RS	Channel_Width_remotely_sensed	22.88	feet	2.3	203.8

Peak-Flow Statistics Flow Report [W Region BasinC 2015 5019F]

PIL: Lower 90% Prediction Interval, PIU: Upper 90% Prediction Interval, ASEp: Average Standard Error of Prediction, SE: Standard Error, PC: Percent Correct, RMSE: Root Mean Squared Error, PseudoR^2: Pseudo R Squared (other -- see report)

Statistic	Value	Unit	PIL	PIU	ASEp
66.7-percent AEP flood	132	ft^3/s	53.7	325	59.4
50-percent AEP flood	160	ft^3/s	67.3	381	56.5
42.9-percent AEP flood	173	ft^3/s	73.3	408	55.7
20-percent AEP flood	233	ft^3/s	102	531	53.4
10-percent AEP flood	296	ft^3/s	131	670	52.8
4-percent AEP flood	359	ft^3/s	158	814	53.2
2-percent AEP flood	412	ft^3/s	178	953	54.2
1-percent AEP flood	465	ft^3/s	197	1100	56
0.5-percent AEP flood	519	ft^3/s	214	1260	58
0.2-percent AEP flood	579	ft^3/s	229	1460	61.4

Peak-Flow Statistics Disclaimers [W Region Active Channel SIR 2020 5142]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Peak-Flow Statistics Flow Report [W Region Active Channel SIR 2020 5142]

Statistic	Value	Unit
Active chan width 66.7 percent AEP flood	0	ft^3/s
Active Channel Width 50-percent AEP flood	0	ft^3/s

Statistic	Value	Unit
Active chan width 42.9 percent AEP flood	0	ft^3/s
Active Channel Width 20-percent AEP flood	0	ft^3/s
Active Channel Width 10-percent AEP flood	0	ft^3/s
Active Channel Width 4-percent AEP flood	0	ft^3/s
Active Channel Width 2-percent AEP flood	0	ft^3/s
Active Channel Width 1-percent AEP flood	0	ft^3/s
Active Channel Width 0.5-percent AEP flood	0	ft^3/s
Active Channel Width 0.2-percent AEP flood	0	ft^3/s

Peak-Flow Statistics Disclaimers [W Region Bankfull SIR 2020 5142]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Peak-Flow Statistics Flow Report [W Region Bankfull SIR 2020 5142]

Statistic	Value	Unit
Bankfull width 66.7 percent AEP flood	0	ft^3/s
Bankfull Width 50-percent AEP flood	0	ft^3/s
Bankfull width 42.9 percent AEP flood	0	ft^3/s
Bankfull Width 20-percent AEP flood	0	ft^3/s
Bankfull Width 10-percent AEP flood	0	ft^3/s
Bankfull Width 4-percent AEP flood	0	ft^3/s
Bankfull Width 2-percent AEP flood	0	ft^3/s
Bankfull Width 1-percent AEP flood	0	ft^3/s
Bankfull Width 0.5-percent AEP flood	0	ft^3/s
Bankfull Width 0.2-percent AEP flood	0	ft^3/s

Peak-Flow Statistics Flow Report [W Region Aerial Photo SIR 2020 5142]

PIL: Lower 90% Prediction Interval, PIU: Upper 90% Prediction Interval, ASEp: Average Standard Error of Prediction, SE: Standard Error, PC: Percent Correct, RMSE: Root Mean Squared Error, PseudoR^2: Pseudo R Squared (other -- see report)

Statistic	Value	Unit	PIL	PIU	ASEp
Rem sens chan width 66.7 percent AEP fld	208	ft^3/s	47.3	914	131
Rem_sens_chan_width_50_percent_AEP_flood	263	ft^3/s	63.9	1080	124
Rem sens chan width 42.9 percent AEP fld	287	ft^3/s	71.3	1160	121
Rem_sens_chan_width_20_percent_AEP_flood	408	ft^3/s	110	1520	112
Rem_sens_chan_width_10_percent_AEP_flood	531	ft^3/s	150	1890	106
Rem_sens_chan_width_4_percent_AEP_flood	678	ft^3/s	196	2340	101
Rem_sens_chan_width_2_percent_AEP_flood	795	ft^3/s	234	2700	98.8
Rem_sens_chan_width_1_percent_AEP_flood	936	ft^3/s	277	3160	97.2
Rem_sens_chan_width_0_5_pct_AEP_flood	1040	ft^3/s	310	3490	96.2
Rem_sens_chan_width_0_2_pct_AEP_flood	1240	ft^3/s	364	4220	96.3

Peak-Flow Statistics Flow Report [Area-Averaged]

PIL: Lower 90% Prediction Interval, PIU: Upper 90% Prediction Interval, ASEp: Average Standard Error of Prediction, SE: Standard Error, PC: Percent Correct, RMSE: Root Mean Squared Error, PseudoR^2: Pseudo R Squared (other -- see report)

Statistic	Value	Unit	PIL	PIU	ASEp
66.7-percent AEP flood	132	ft^3/s	53.7	325	59.4
50-percent AEP flood	160	ft^3/s	67.3	381	56.5
42.9-percent AEP flood	173	ft^3/s	73.3	408	55.7
20-percent AEP flood	233	ft^3/s	102	531	53.4
10-percent AEP flood	296	ft^3/s	131	670	52.8
4-percent AEP flood	359	ft^3/s	158	814	53.2
2-percent AEP flood	412	ft^3/s	178	953	54.2
1-percent AEP flood	465	ft^3/s	197	1100	56
0.5-percent AEP flood	519	ft^3/s	214	1260	58
0.2-percent AEP flood	579	ft^3/s	229	1460	61.4
Active chan width 66.7 percent AEP flood	0	ft^3/s			
Active Channel Width 50-percent AEP flood	0	ft^3/s			
Active chan width 42.9 percent AEP flood	0	ft^3/s			
Active Channel Width 20-percent AEP flood	0	ft^3/s			
Active Channel Width 10-percent AEP flood	0	ft^3/s			
Active Channel Width 4-percent AEP flood	0	ft^3/s			
Active Channel Width 2-percent AEP flood	0	ft^3/s			
Active Channel Width 1-percent AEP flood	0	ft^3/s			
Active Channel Width 0.5-percent AEP flood	0	ft^3/s			
Active Channel Width 0.2-percent AEP flood	0	ft^3/s			
Bankfull width 66.7 percent AEP flood	0	ft^3/s			
Bankfull Width 50-percent AEP flood	0	ft^3/s			
Bankfull width 42.9 percent AEP flood	0	ft^3/s			
Bankfull Width 20-percent AEP flood	0	ft^3/s			
Bankfull Width 10-percent AEP flood	0	ft^3/s			
Bankfull Width 4-percent AEP flood	0	ft^3/s			
Bankfull Width 2-percent AEP flood	0	ft^3/s			
Bankfull Width 1-percent AEP flood	0	ft^3/s			
Bankfull Width 0.5-percent AEP flood	0	ft^3/s			
Bankfull Width 0.2-percent AEP flood	0	ft^3/s			
Rem sens chan width 66.7 percent AEP fld	208	ft^3/s	47.3	914	131
Rem_sens_chan_width_50_percent_AEP_flood	263	ft^3/s	63.9	1080	124
Rem sens chan width 42.9 percent AEP fld	287	ft^3/s	71.3	1160	121
Rem_sens_chan_width_20_percent_AEP_flood	408	ft^3/s	110	1520	112
Rem_sens_chan_width_10_percent_AEP_flood	531	ft^3/s	150	1890	106
Rem_sens_chan_width_4_percent_AEP_flood	678	ft^3/s	196	2340	101
Rem_sens_chan_width_2_percent_AEP_flood	795	ft^3/s	234	2700	98.8
Rem_sens_chan_width_1_percent_AEP_flood	936	ft^3/s	277	3160	97.2

Statistic	Value	Unit	PIL	PIU	ASEp
Rem_sens_chan_width_0_5_pct_AEP_flood	1040	ft^3/s	310	3490	96.2
Rem_sens_chan_width_0_2_pct_AEP_flood	1240	ft^3/s	364	4220	96.3

Peak-Flow Statistics Citations

Sando, Roy, Sando, S.K., McCarthy, P.M., and Dutton, D.M.,2016, Methods for estimating peak-flow frequencies at ungaged sites in Montana based on data through water year 2011: U.S. Geological Survey Scientific Investigations Report 2015–5019–F, 30 p. (https://doi.org/10.3133/sir20155019)

Chase, K.J., Sando, R., Armstrong, D.W., and McCarthy, P., 2021, Regional regression equations based on channel-width characteristics to estimate peak-flow frequencies at ungaged sites in Montana using peak-flow frequency data through water year 2011 (ver. 1.1, September 2021): U.S. Geological Survey Scientific Investigations Report 2020–5142, 49 p. (https://doi.org/10.3133/sir20205142)

Channel-width Methods Weighting

PIL: Lower 90% Prediction Interval, PIU: Upper 90% Prediction Interval, ASEp: Average Standard Error of Prediction, PC: Percent Correct, RMSE: Root Mean Squared Error, PseudoR^2: Pseudo R Squared

W_Region

Statistic	Value	Unit	PIL	PIU	SEP
PK0_2AEP	674	ft^3/s	276	1650	0.237
PK0_5AEP	593	ft^3/s	253	1390	0.225
PK10AEP	325	ft^3/s	148	713	0.208
PK1AEP	528	ft^3/s	231	1210	0.219
PK20AEP	253	ft^3/s	114	560	0.211
PK2AEP	463	ft^3/s	207	1040	0.213
PK42_9AEP	185	ft^3/s	80.5	425	0.22
PK4AEP	398	ft^3/s	181	876	0.209
PK50AEP	170	ft^3/s	73.4	395	0.223
PK66_7AEP	139	ft^3/s	57.9	334	0.232

Channel-width Methods Weighting Citations

Chase, K.J., Sando, R., Armstrong, D.W., and McCarthy, P., 2021, Regional regression equations based on channel-width characteristics to estimate peak-flow frequencies at ungaged sites in Montana using peak-flow frequency data through water year 2011 (ver. 1.1, September 2021): U.S. Geological Survey Scientific Investigations Report 2020-5142, 49 p. (https://pubs.er.usgs.gov/publication/sir20205142)

Application Version: 4.25.0
StreamStats Services Version: 1.2.22

NSS Services Version: 2.2.1

Attachment 2 – HECRAS Outputs

Existing Conditions

HEC-RAS Plan: Existing Condtions River: Grant Creek Reach: 01

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
01	301	Q2	170.00	3952.16	3953.79	3953.79	3954.35	0.052059	5.96	28.53	26.24	1.00
01	301	Q10	325.00	3952.16	3954.42	3954.42	3955.22	0.041090	7.17	46.66	42.47	0.96
01	301	Q50	463.00	3952.16	3954.90	3954.90	3955.84	0.035800	7.86	62.93	54.12	0.93
01	301	Q100	528.00	3952.16	3955.06	3955.06	3956.10	0.036440	8.31	69.00	58.59	0.95
01	266	Q2	170.00	3950.64	3952.84	3952.19	3953.03	0.010618	3.49	49.30	33.18	0.48
01	266	Q10	325.00	3950.64	3953.69	3952.78	3953.97	0.009049	4.27	80.36	55.49	0.48
01	266	Q50	463.00	3950.64	3954.37	3953.20	3954.69	0.007778	4.65	109.09	69.93	0.46
01	266	Q100	528.00	3950.64	3954.68	3953.39	3955.01	0.007223	4.77	123.42	76.00	0.45
01	236 BR U	Q2	170.00	3950.24	3952.29	3952.01	3952.65	0.025946	4.78	35.56	25.01	0.59
01	236 BR U	Q10	325.00	3950.24	3953.01	3952.62	3953.58	0.026181	6.09	53.41	25.01	0.65
01	236 BR U	Q50	463.00	3950.24	3953.57	3953.05	3954.30	0.025482	6.85	67.62	25.01	0.66
01	236 BR U	Q100	528.00	3950.24	3953.84	3953.26	3954.62	0.024902	7.12	74.20	25.00	0.66
01	236 BR D	Q2	170.00	3949.70	3951.55	3951.46	3952.03	0.041395	5.54	30.66	25.02	0.72
01	236 BR D	Q10	325.00	3949.70	3952.16	3952.08	3952.94	0.040694	7.08	45.88	25.01	0.80
01	236 BR D	Q50	463.00	3949.70	3952.58	3952.52	3953.63	0.042247	8.20	56.45	25.01	0.85
01	236 BR D	Q100	528.00	3949.70	3952.76	3952.73	3953.93	0.043305	8.69	60.78	25.01	0.88
01	199	Q2	170.00	3949.00	3950.78	3950.46	3951.11	0.022785	4.62	36.88	27.64	0.69
01	199	Q10	325.00	3949.00	3951.38	3951.08	3951.95	0.024933	6.13	54.54	31.43	0.77
01	199	Q50	463.00	3949.00	3951.79	3951.54	3952.57	0.026170	7.13	68.29	34.30	0.81
01	199	Q100	528.00	3949.00	3951.97	3951.74	3952.83	0.026638	7.54	74.39	35.53	0.83
01	130	Q2	170.00	3947.47	3949.07	3948.84	3949.39	0.027574	4.52	37.62	32.92	0.74
01	130	Q10	325.00	3947.47	3949.62	3949.40	3950.14	0.027578	5.84	56.85	50.23	0.79
01	130	Q50	463.00	3947.47	3950.01	3949.79	3950.69	0.027579	6.70	71.99	61.32	0.82
01	130	Q100	528.00	3947.47	3950.17	3949.97	3950.93	0.027625	7.05	78.69	64.06	0.83

Plan: Existing Condtions Grant Creek 01 RS: 236 Profile: Q2

E.G. US. (ft)	3953.03	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	3952.84	E.G. Elev (ft)	3952.65	3952.03
Q Total (cfs)	170.00	W.S. Elev (ft)	3952.29	3951.55
Q Bridge (cfs)	170.00	Crit W.S. (ft)	3952.01	3951.46
Q Weir (cfs)		Max Chl Dpth (ft)	2.05	1.86
Weir Sta Lft (ft)		Vel Total (ft/s)	4.78	5.54
Weir Sta Rgt (ft)		Flow Area (sq ft)	35.56	30.66
Weir Submerg		Froude # Chl	0.59	0.72
Weir Max Depth (ft)		Specif Force (cu ft)	53.48	51.03
Min El Weir Flow (ft)	3957.18	Hydr Depth (ft)	1.42	1.23
Min El Prs (ft)	3954.67	W.P. Total (ft)	27.11	26.72
Delta EG (ft)	1.91	Conv. Total (cfs)	1055.4	835.6
Delta WS (ft)	2.06	Top Width (ft)	25.01	25.02
BR Open Area (sq ft)	95.03	Frctn Loss (ft)	0.58	0.84
BR Open Vel (ft/s)	5.54	C & E Loss (ft)	0.04	0.07
BR Sluice Coef		Shear Total (lb/sq ft)	2.12	2.97
BR Sel Method	Energy only	Power Total (lb/ft s)	10.16	16.44

Plan: Existing Condtions Grant Creek 01 RS: 236 Profile: Q10

E.G. US. (ft)	3953.97	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	3953.69	E.G. Elev (ft)	3953.58	3952.94
Q Total (cfs)	325.00	W.S. Elev (ft)	3953.01	3952.16
Q Bridge (cfs)	325.00	Crit W.S. (ft)	3952.62	3952.08
Q Weir (cfs)		Max Chl Dpth (ft)	2.77	2.46
Weir Sta Lft (ft)		Vel Total (ft/s)	6.09	7.08
Weir Sta Rgt (ft)		Flow Area (sq ft)	53.41	45.88
Weir Submerg		Froude # Chl	0.65	0.80
Weir Max Depth (ft)		Specif Force (cu ft)	121.43	116.58
Min El Weir Flow (ft)	3957.18	Hydr Depth (ft)	2.14	1.83
Min El Prs (ft)	3954.67	W.P. Total (ft)	28.54	27.94
Delta EG (ft)	2.01	Conv. Total (cfs)	2008.6	1611.1
Delta WS (ft)	2.32	Top Width (ft)	25.01	25.01
BR Open Area (sq ft)	95.03	Frctn Loss (ft)	0.58	0.88
BR Open Vel (ft/s)	7.08	C & E Loss (ft)	0.06	0.10
BR Sluice Coef		Shear Total (lb/sq ft)	3.06	4.17
BR Sel Method	Energy only	Power Total (lb/ft s)	18.62	29.56

Plan: Existing Condtions Grant Creek 01 RS: 236 Profile: Q50

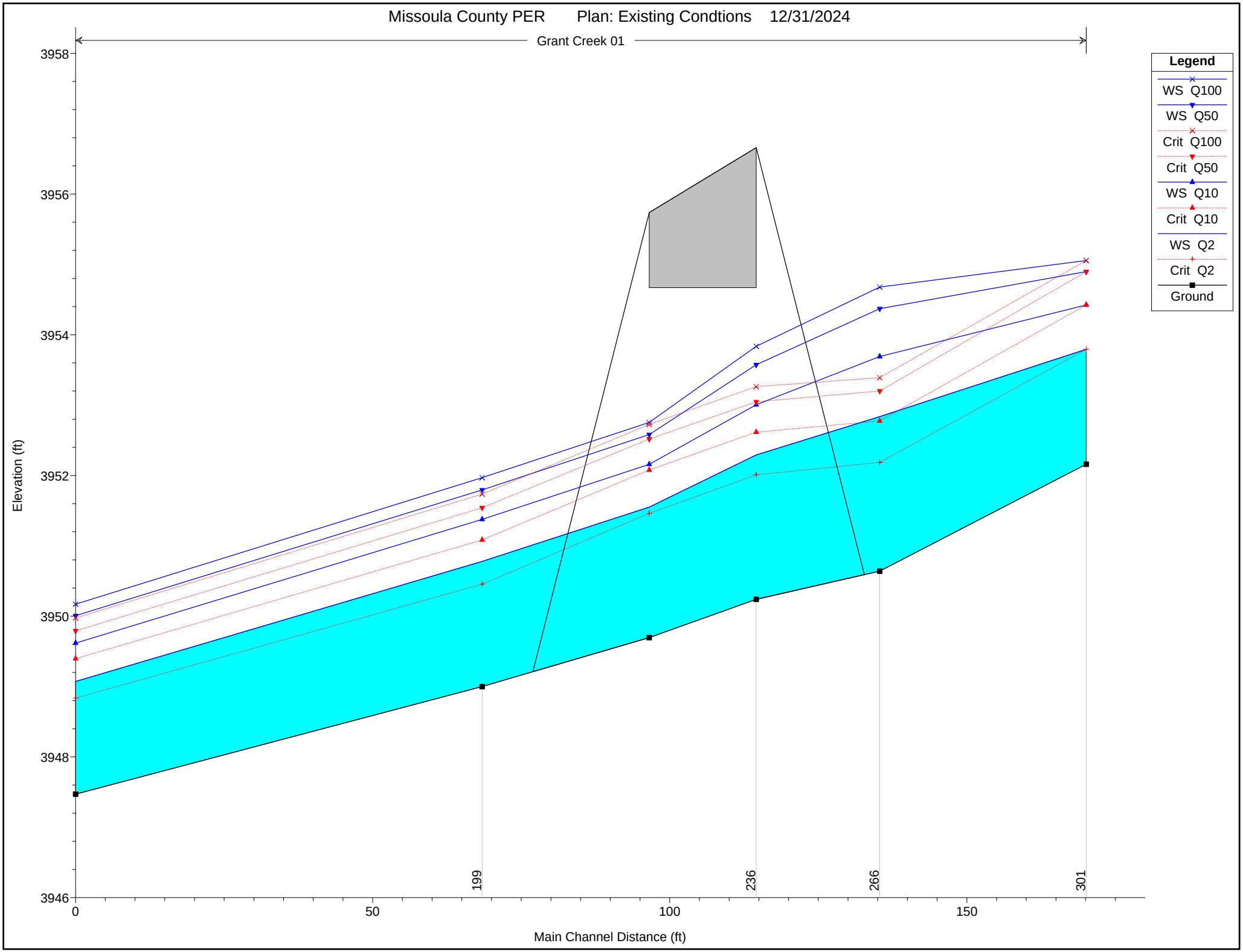
E.G. US. (ft)	3954.69	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	3954.37	E.G. Elev (ft)	3954.30	3953.63
Q Total (cfs)	463.00	W.S. Elev (ft)	3953.57	3952.58
Q Bridge (cfs)	463.00	Crit W.S. (ft)	3953.05	3952.52
Q Weir (cfs)		Max Chl Dpth (ft)	3.33	2.89
Weir Sta Lft (ft)		Vel Total (ft/s)	6.85	8.20
Weir Sta Rgt (ft)		Flow Area (sq ft)	67.62	56.45
Weir Submerg		Froude # Chl	0.66	0.85
Weir Max Depth (ft)		Specif Force (cu ft)	192.89	184.69
Min El Weir Flow (ft)	3957.18	Hydr Depth (ft)	2.70	2.26
Min El Prs (ft)	3954.67	W.P. Total (ft)	29.67	28.78
Delta EG (ft)	2.12	Conv. Total (cfs)	2900.4	2252.6
Delta WS (ft)	2.58	Top Width (ft)	25.01	25.01
BR Open Area (sq ft)	95.03	Frctn Loss (ft)	0.58	0.92
BR Open Vel (ft/s)	8.20	C & E Loss (ft)	0.10	0.14
BR Sluice Coef		Shear Total (lb/sq ft)	3.63	5.17
BR Sel Method	Energy only	Power Total (lb/ft s)	24.82	42.43

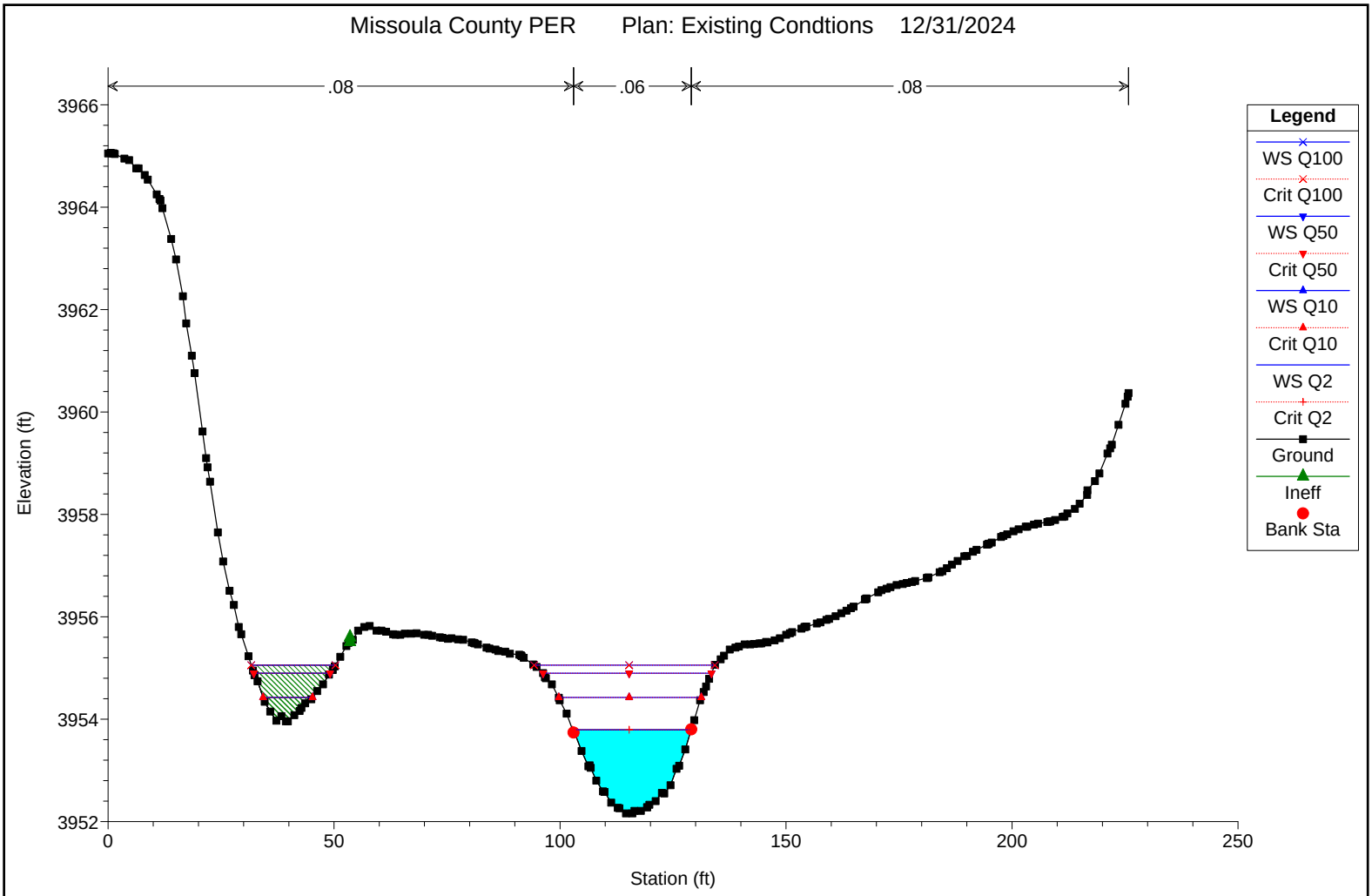
Plan: Existing Condtions Grant Creek 01 RS: 236 Profile: Q100

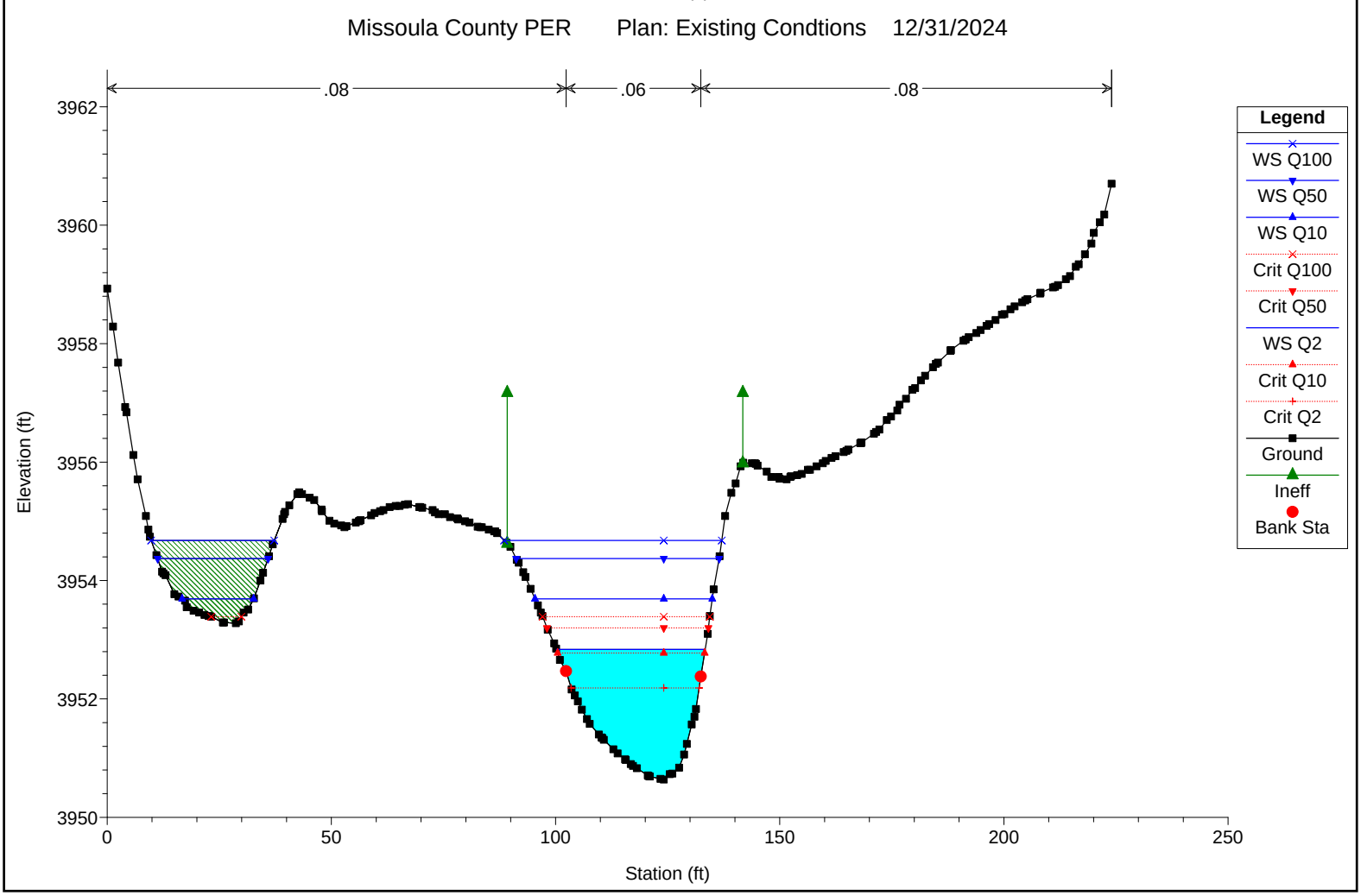
E.G. US. (ft)	3955.01	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	3954.68	E.G. Elev (ft)	3954.62	3953.93
Q Total (cfs)	528.00	W.S. Elev (ft)	3953.84	3952.76
Q Bridge (cfs)	528.00	Crit W.S. (ft)	3953.26	3952.73
Q Weir (cfs)		Max Chl Dpth (ft)	3.60	3.06
Weir Sta Lft (ft)		Vel Total (ft/s)	7.12	8.69

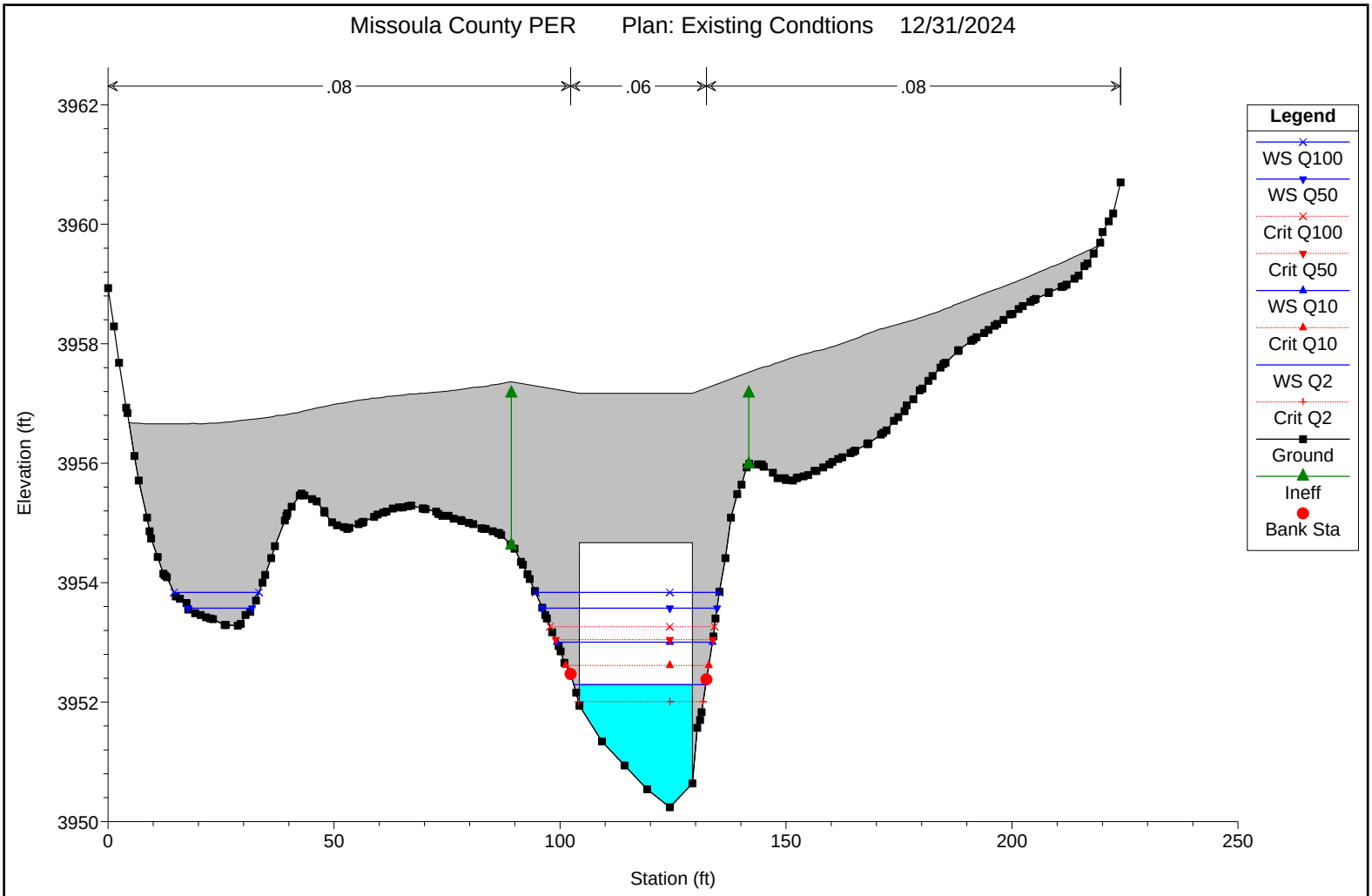
Plan: Existing Condtions Grant Creek 01 RS: 236 Profile: Q100 (Continued)

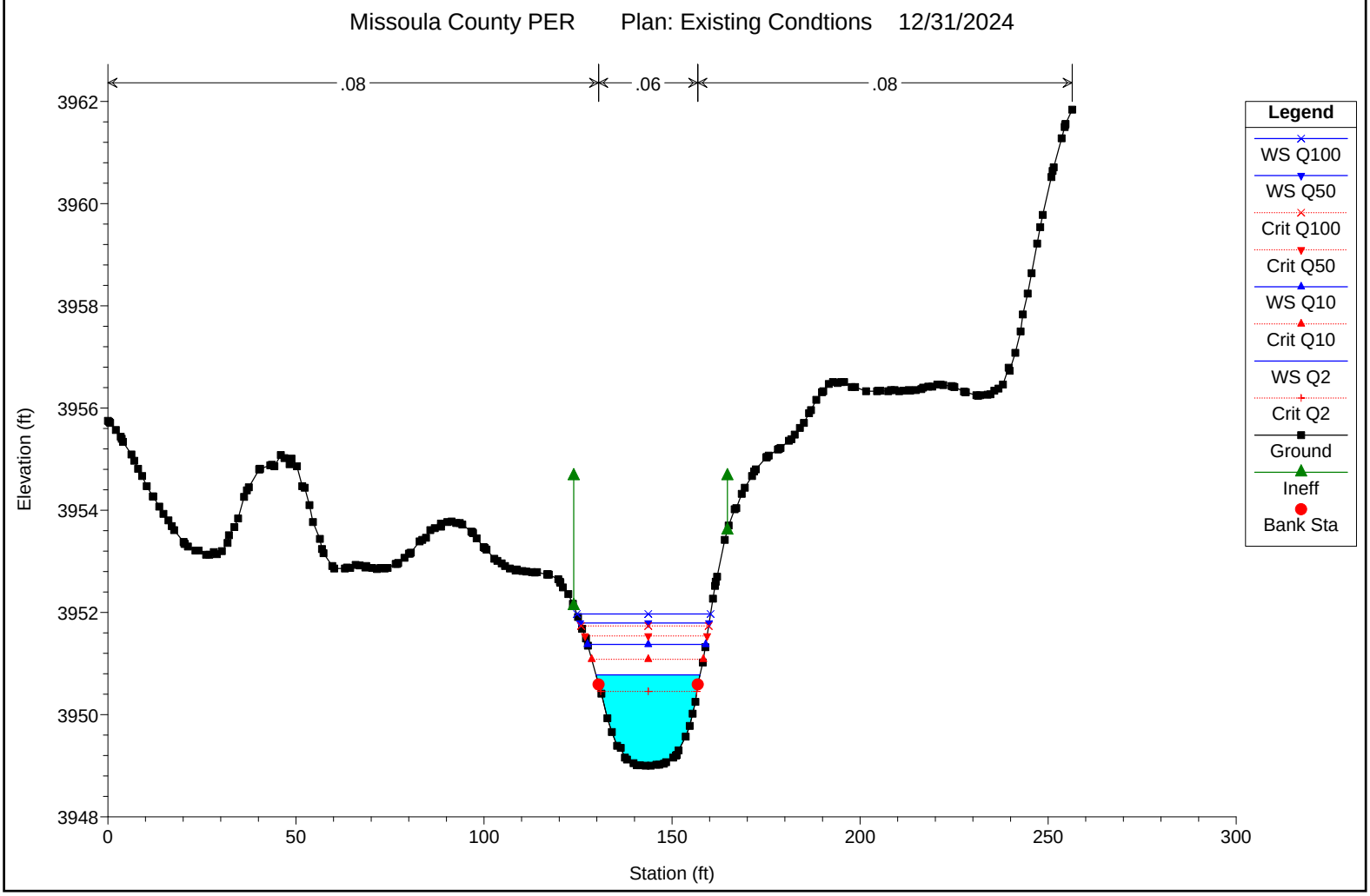
Weir Sta Rgt (ft)		Flow Area (sq ft)	74.20	60.78
Weir Submerg		Froude # Chl	0.66	0.88
Weir Max Depth (ft)		Specif Force (cu ft)	229.79	219.37
Min El Weir Flow (ft)	3957.18	Hydr Depth (ft)	2.97	2.43
Min El Prs (ft)	3954.67	W.P. Total (ft)	30.20	29.13
Delta EG (ft)	2.18	Conv. Total (cfs)	3345.9	2537.2
Delta WS (ft)	2.71	Top Width (ft)	25.00	25.01
BR Open Area (sq ft)	95.03	Frctn Loss (ft)	0.58	0.94
BR Open Vel (ft/s)	8.69	C & E Loss (ft)	0.12	0.16
BR Sluice Coef		Shear Total (lb/sq ft)	3.82	5.64
BR Sel Method	Energy only	Power Total (lb/ft s)	27.18	49.00


Missoula County PER Plan: Existing Condtions 12/31/2024
Grant Creek 01
Legend
WS Q100
WS Q50
Crit Q100
Crit Q50
WS Q10
Crit Q10
WS Q2
Crit Q2
Ground
Elevation (ft)
3958
3956
3954
3952
3950
3948
3946
0
50
100
150
199
236
266
301
Main Channel Distance (ft)

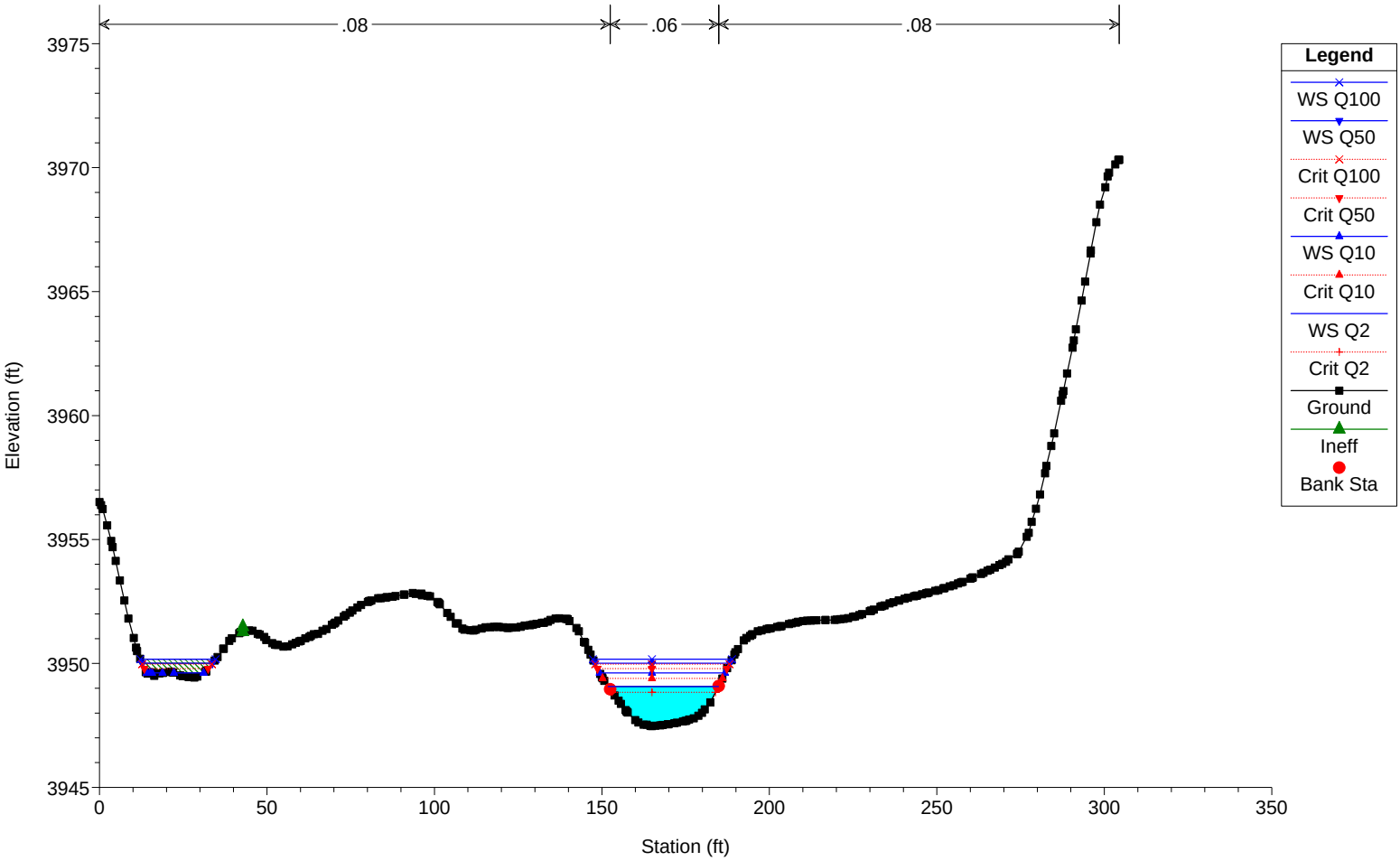

Missoula County PER Plan: Existing Condtions 12/31/2024
.08
.06
.08
3966
3964
3962
3960
3958
3956
3954
3952
Elevation (ft)
0
50
100
150
200
250
Station (ft)
Legend
WS Q100
Crit Q100
WS Q50
Crit Q50
WS Q10
Crit Q10
WS Q2
Crit Q2
Ground
Ineff
Bank Sta


Missoula County PER Plan: Existing Condtions 12/31/2024
.08
.06
.08
3962
3960
3958
3956
3954
3952
3950
Elevation (ft)
0
50
100
150
200
250
Station (ft)
Legend
WS Q100
WS Q50
WS Q10
Crit Q100
Crit Q50
WS Q2
Crit Q10
Crit Q2
Ground
Ineff
Bank Sta


Missoula County PER Plan: Existing Condtions 12/31/2024
.08
.06
.08
3962
3960
3958
3956
3954
3952
3950
Elevation (ft)
0
50
100
150
200
250
Station (ft)
Legend
WS Q100
WS Q50
Crit Q100
Crit Q50
WS Q10
Crit Q10
WS Q2
Crit Q2
Ground
Ineff
Bank Sta


Missoula County PER Plan: Existing Condtions 12/31/2024
.08
.06
.08
3962
3960
3958
3956
3954
3952
3950
3948
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)
Legend
WS Q100
WS Q50
Crit Q100
Crit Q50
WS Q10
Crit Q10
WS Q2
Crit Q2
Ground
Ineff
Bank Sta

Missoula County PER Plan: Existing Condtions 12/31/2024



Proposed Conditions

HEC-RAS Plan: Proposed Conditions River: Grant Creek Reach: 01

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
01	301	Q2	170.00	3952.16	3953.88	3953.79	3954.35	0.040929	5.54	30.71	26.87	0.90
01	301	Q10	325.00	3952.16	3954.42	3954.42	3955.22	0.041090	7.17	46.66	42.47	0.96
01	301	Q50	463.00	3952.16	3954.90	3954.90	3955.84	0.035800	7.86	62.93	54.12	0.93
01	301	Q100	528.00	3952.16	3955.06	3955.06	3956.10	0.036440	8.31	69.00	58.59	0.95
01	266	Q2	170.00	3950.64	3952.19	3952.19	3952.71	0.054083	5.81	29.25	28.55	1.01
01	266	Q10	325.00	3950.64	3952.78	3952.78	3953.52	0.044212	6.93	47.28	32.79	0.98
01	266	Q50	463.00	3950.64	3953.20	3953.20	3954.11	0.039484	7.70	61.88	36.00	0.96
01	266	Q100	528.00	3950.64	3953.39	3953.39	3954.36	0.037628	7.98	68.73	43.88	0.96
01	236 BR U	Q2	170.00	3950.12	3951.53	3951.11	3951.74	0.016138	3.69	46.08	35.63	0.57
01	236 BR U	Q10	325.00	3950.12	3952.30	3951.62	3952.60	0.012565	4.36	74.87	38.73	0.54
01	236 BR U	Q50	463.00	3950.12	3952.88	3952.00	3953.24	0.010924	4.81	97.85	41.03	0.53
01	236 BR U	Q100	528.00	3950.12	3953.13	3952.14	3953.51	0.010424	4.99	108.12	42.02	0.52
01	236 BR D	Q2	170.00	3949.64	3951.37	3950.62	3951.50	0.008081	2.95	57.58	36.88	0.42
01	236 BR D	Q10	325.00	3949.64	3952.17	3951.14	3952.39	0.007325	3.71	88.66	40.11	0.42
01	236 BR D	Q50	463.00	3949.64	3952.77	3951.51	3953.04	0.006962	4.19	113.15	42.49	0.43
01	236 BR D	Q100	528.00	3949.64	3953.02	3951.65	3953.32	0.006840	4.39	124.02	43.50	0.43
01	199	Q2	170.00	3949.00	3950.78	3950.46	3951.11	0.022785	4.62	36.88	27.64	0.69
01	199	Q10	325.00	3949.00	3951.38	3951.08	3951.96	0.024735	6.12	54.69	31.46	0.76
01	199	Q50	463.00	3949.00	3951.80	3951.53	3952.57	0.026060	7.12	68.39	34.32	0.81
01	199	Q100	528.00	3949.00	3951.97	3951.75	3952.83	0.026541	7.53	74.48	35.55	0.83
01	130	Q2	170.00	3947.47	3949.07	3948.84	3949.39	0.027574	4.52	37.62	32.92	0.74
01	130	Q10	325.00	3947.47	3949.62	3949.40	3950.14	0.027578	5.84	56.85	50.23	0.79
01	130	Q50	463.00	3947.47	3950.01	3949.79	3950.69	0.027579	6.70	71.99	61.32	0.82
01	130	Q100	528.00	3947.47	3950.17	3949.97	3950.93	0.027625	7.05	78.69	64.06	0.83

Plan: Proposed Conditions Grant Creek 01 RS: 236 Profile: Q2

E.G. US. (ft)	3952.71	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	3952.19	E.G. Elev (ft)	3951.74	3951.50
Q Total (cfs)	170.00	W.S. Elev (ft)	3951.53	3951.37
Q Bridge (cfs)	170.00	Crit W.S. (ft)	3951.11	3950.62
Q Weir (cfs)		Max Chl Dpth (ft)	1.40	1.72
Weir Sta Lft (ft)		Vel Total (ft/s)	3.69	2.95
Weir Sta Rgt (ft)		Flow Area (sq ft)	46.08	57.58
Weir Submerg		Froude # Chl	0.57	0.42
Weir Max Depth (ft)		Specif Force (cu ft)	50.92	63.46
Min El Weir Flow (ft)	3957.29	Hydr Depth (ft)	1.29	1.56
Min El Prs (ft)	3955.39	W.P. Total (ft)	36.29	37.70
Delta EG (ft)	1.60	Conv. Total (cfs)	1338.2	1891.1
Delta WS (ft)	1.41	Top Width (ft)	35.63	36.88
BR Open Area (sq ft)	213.52	Frctn Loss (ft)	0.20	0.33
BR Open Vel (ft/s)	3.69	C & E Loss (ft)	0.04	0.06
BR Sluice Coef		Shear Total (lb/sq ft)	1.28	0.77
BR Sel Method	Energy only	Power Total (lb/ft s)	4.72	2.28

Plan: Proposed Conditions Grant Creek 01 RS: 236 Profile: Q10

E.G. US. (ft)	3953.52	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	3952.78	E.G. Elev (ft)	3952.60	3952.39
Q Total (cfs)	325.00	W.S. Elev (ft)	3952.30	3952.17
Q Bridge (cfs)	325.00	Crit W.S. (ft)	3951.62	3951.14
Q Weir (cfs)		Max Chl Dpth (ft)	2.18	2.53
Weir Sta Lft (ft)		Vel Total (ft/s)	4.34	3.67
Weir Sta Rgt (ft)		Flow Area (sq ft)	74.87	88.66
Weir Submerg		Froude # Chl	0.54	0.42
Weir Max Depth (ft)		Specif Force (cu ft)	122.12	144.07
Min El Weir Flow (ft)	3957.29	Hydr Depth (ft)	1.93	2.21
Min El Prs (ft)	3955.39	W.P. Total (ft)	39.75	41.31
Delta EG (ft)	1.57	Conv. Total (cfs)	2899.3	3797.5
Delta WS (ft)	1.40	Top Width (ft)	38.73	40.11
BR Open Area (sq ft)	213.52	Frctn Loss (ft)	0.17	0.32
BR Open Vel (ft/s)	4.34	C & E Loss (ft)	0.04	0.11
BR Sluice Coef		Shear Total (lb/sq ft)	1.48	0.98
BR Sel Method	Energy only	Power Total (lb/ft s)	6.41	3.60

Plan: Proposed Conditions Grant Creek 01 RS: 236 Profile: Q50

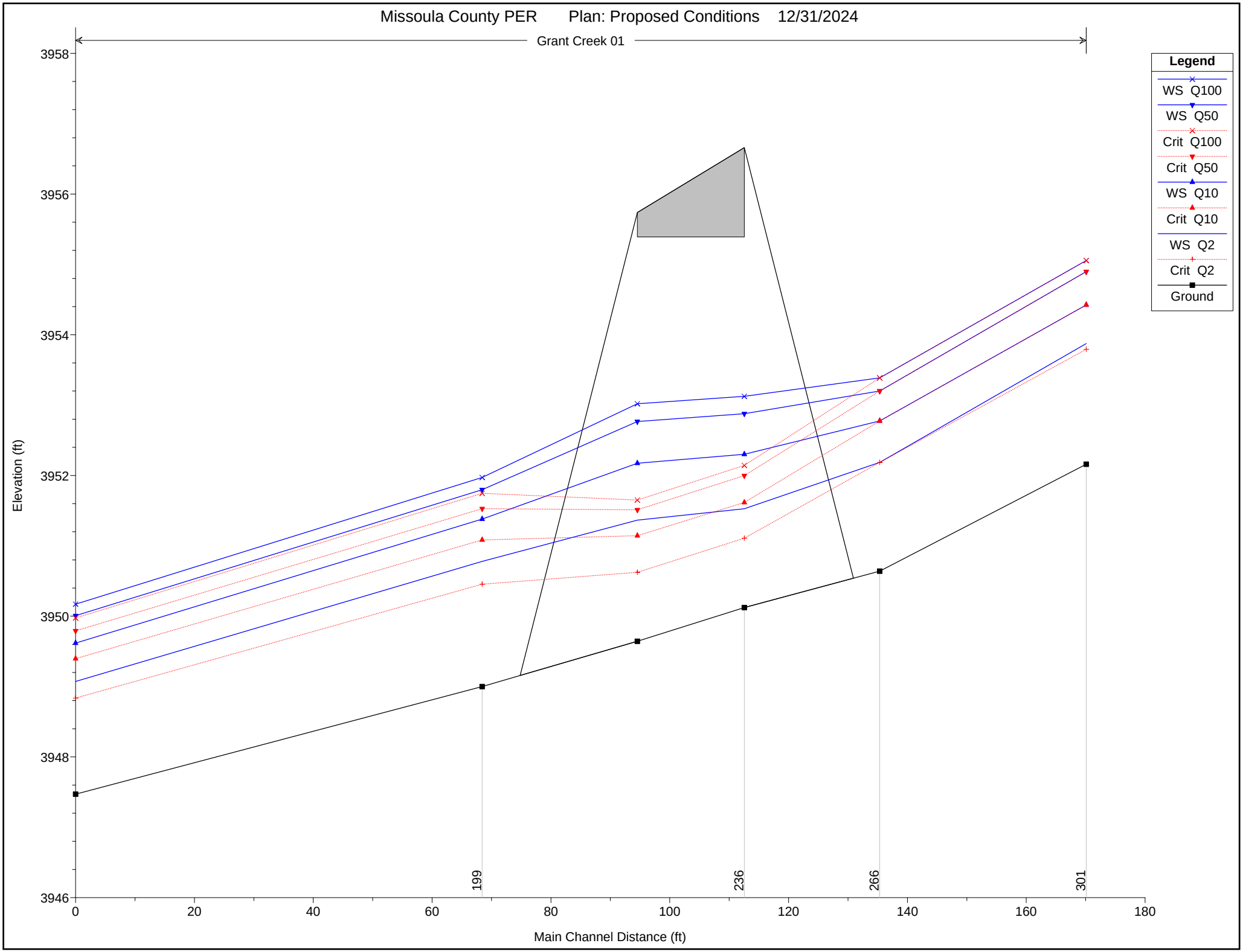
E.G. US. (ft)	3954.11	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	3953.20	E.G. Elev (ft)	3953.24	3953.04
Q Total (cfs)	463.00	W.S. Elev (ft)	3952.88	3952.77
Q Bridge (cfs)	463.00	Crit W.S. (ft)	3952.00	3951.51
Q Weir (cfs)		Max Chl Dpth (ft)	2.75	3.12
Weir Sta Lft (ft)		Vel Total (ft/s)	4.73	4.09
Weir Sta Rgt (ft)		Flow Area (sq ft)	97.85	113.15
Weir Submerg		Froude # Chl	0.53	0.43
Weir Max Depth (ft)		Specif Force (cu ft)	196.73	226.44
Min El Weir Flow (ft)	3957.29	Hydr Depth (ft)	2.38	2.66
Min El Prs (ft)	3955.39	W.P. Total (ft)	42.33	43.96
Delta EG (ft)	1.54	Conv. Total (cfs)	4429.8	5549.2
Delta WS (ft)	1.40	Top Width (ft)	41.03	42.49
BR Open Area (sq ft)	213.52	Frctn Loss (ft)	0.15	0.32
BR Open Vel (ft/s)	4.73	C & E Loss (ft)	0.04	0.15
BR Sluice Coef		Shear Total (lb/sq ft)	1.58	1.12
BR Sel Method	Energy only	Power Total (lb/ft s)	7.46	4.58

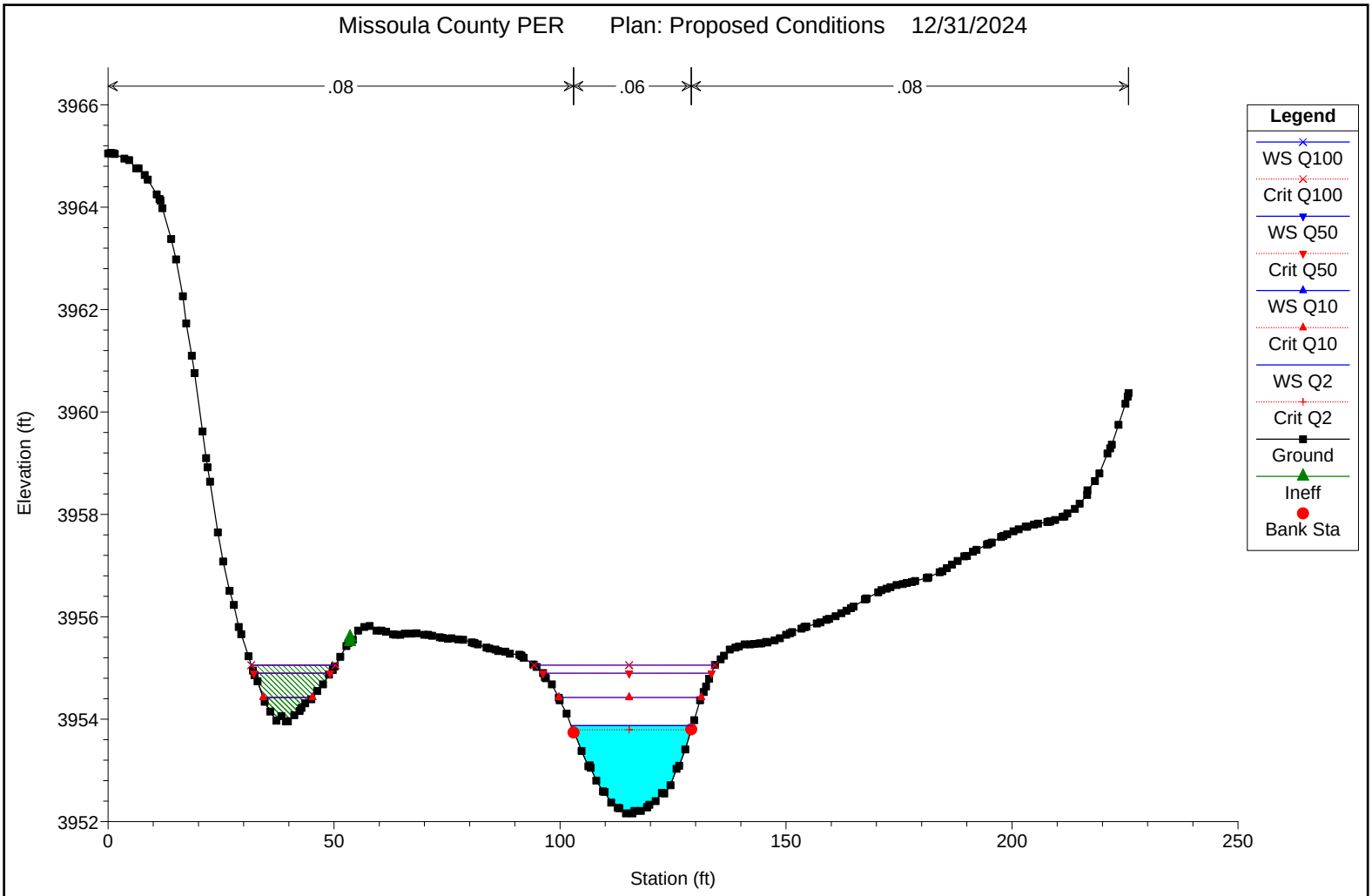
Plan: Proposed Conditions Grant Creek 01 RS: 236 Profile: Q100

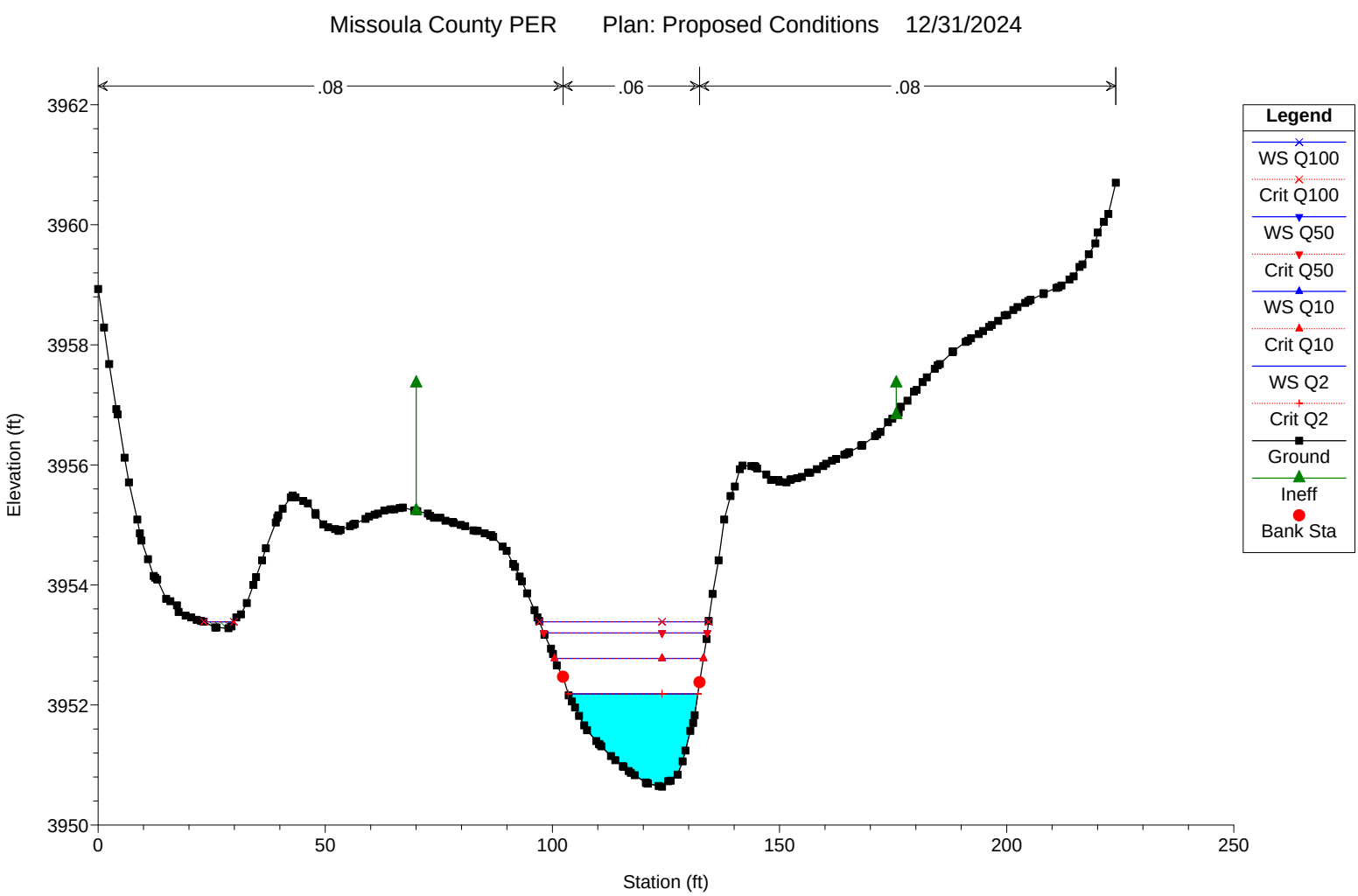
E.G. US. (ft)	3954.36	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	3953.39	E.G. Elev (ft)	3953.51	3953.32
Q Total (cfs)	528.00	W.S. Elev (ft)	3953.13	3953.02
Q Bridge (cfs)	528.00	Crit W.S. (ft)	3952.14	3951.65
Q Weir (cfs)		Max Chl Dpth (ft)	3.00	3.38
Weir Sta Lft (ft)		Vel Total (ft/s)	4.88	4.26

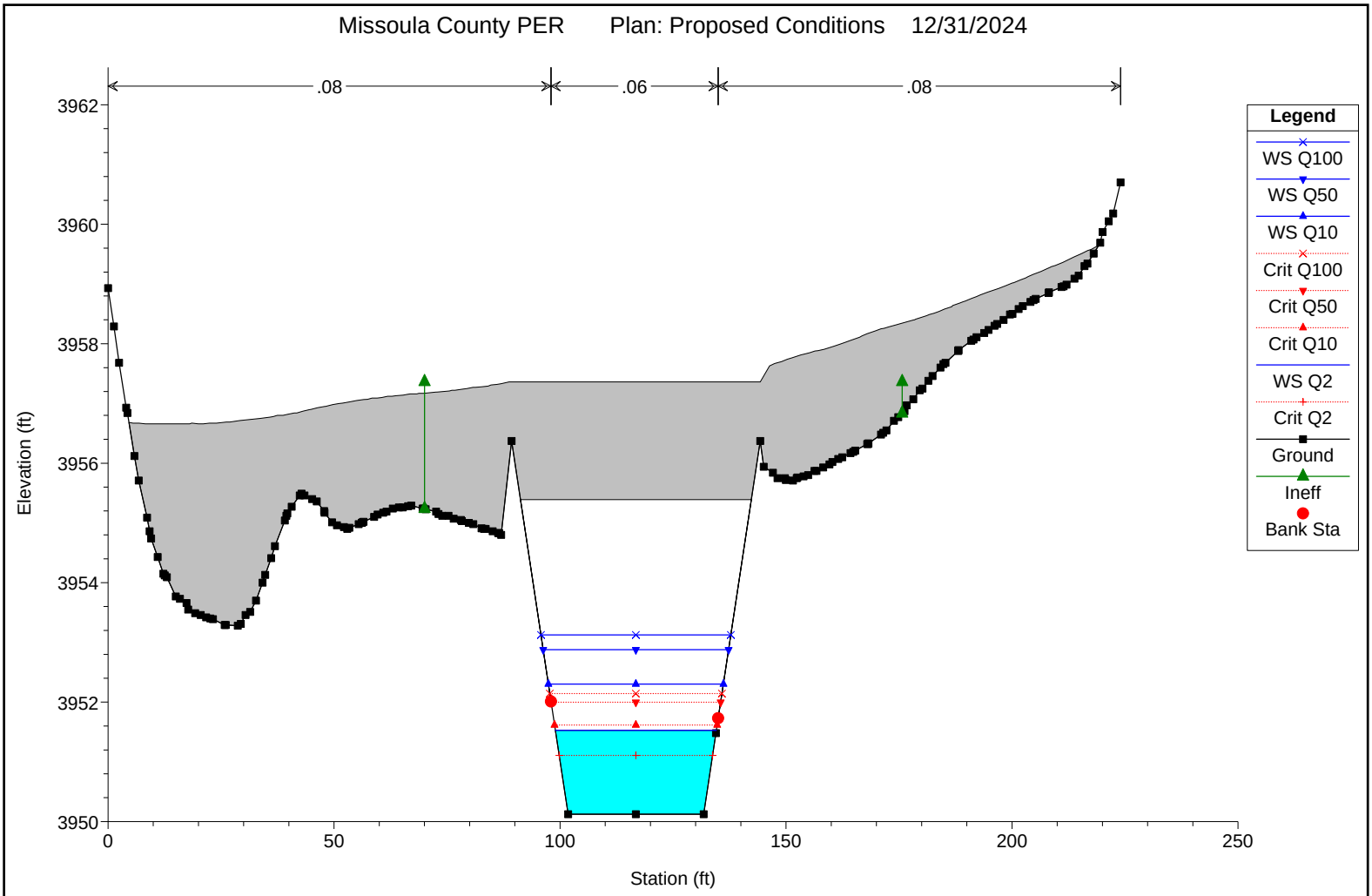
Plan: Proposed Conditions Grant Creek 01 RS: 236 Profile: Q100 (Continued)

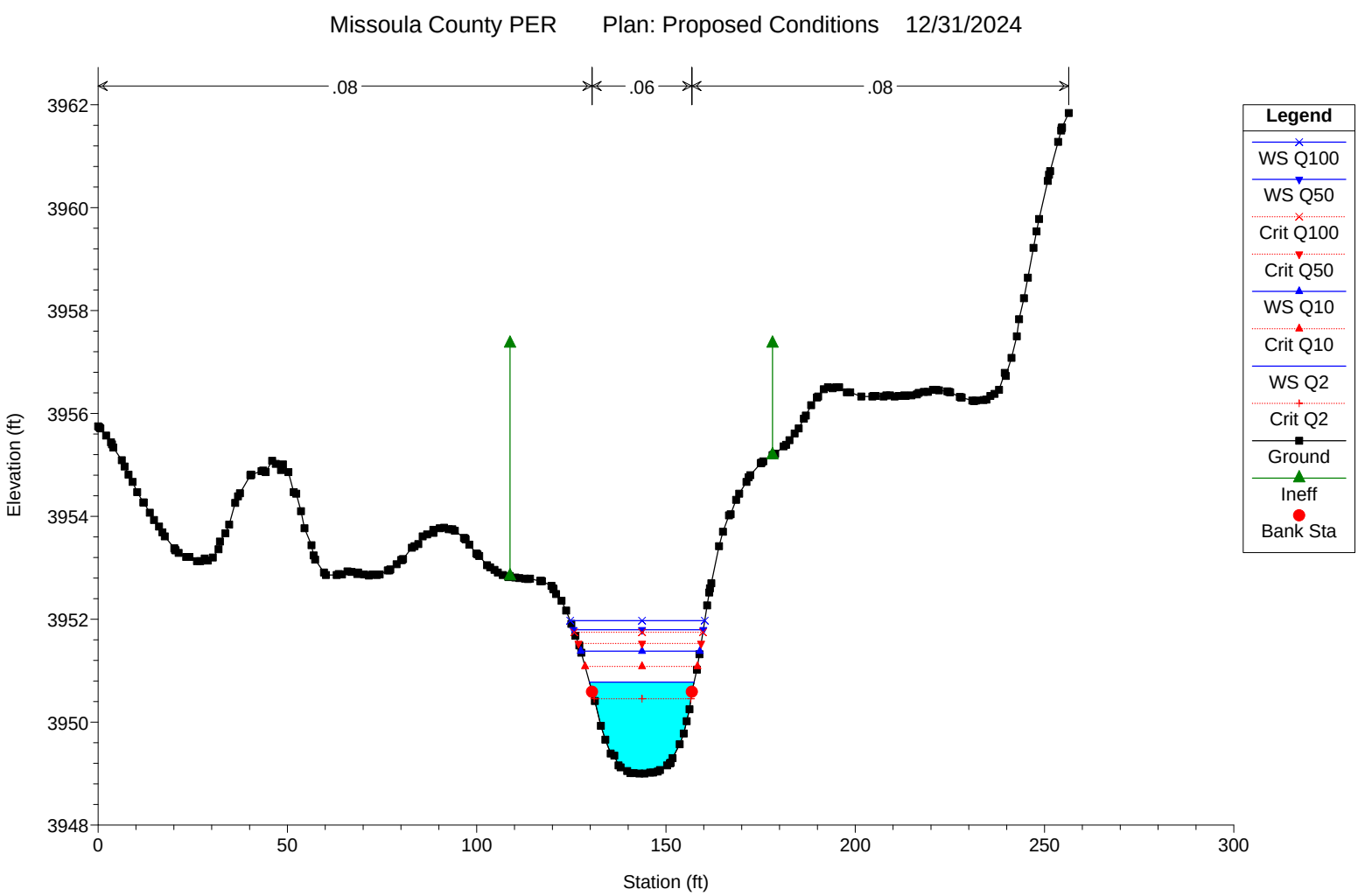
Weir Sta Rgt (ft)		Flow Area (sq ft)	108.12	124.02
Weir Submerg		Froude # Chl	0.52	0.43
Weir Max Depth (ft)		Specif Force (cu ft)	234.72	267.90
Min El Weir Flow (ft)	3957.29	Hydr Depth (ft)	2.57	2.85
Min El Prs (ft)	3955.39	W.P. Total (ft)	43.43	45.09
Delta EG (ft)	1.53	Conv. Total (cfs)	5171.4	6384.1
Delta WS (ft)	1.42	Top Width (ft)	42.02	43.50
BR Open Area (sq ft)	213.52	Frctn Loss (ft)	0.15	0.31
BR Open Vel (ft/s)	4.88	C & E Loss (ft)	0.04	0.17
BR Sluice Coef		Shear Total (lb/sq ft)	1.62	1.17
BR Sel Method	Energy only	Power Total (lb/ft s)	7.91	5.00


Missoula County PER Plan: Proposed Conditions 12/31/2024
Grant Creek 01
Legend
WS Q100
WS Q50
Crit Q100
Crit Q50
WS Q10
Crit Q10
WS Q2
Crit Q2
Ground
Elevation (ft)
3958
3956
3954
3952
3950
3948
3946
0
20
40
60
80
100
120
140
160
180
Main Channel Distance (ft)
199
236
266
301

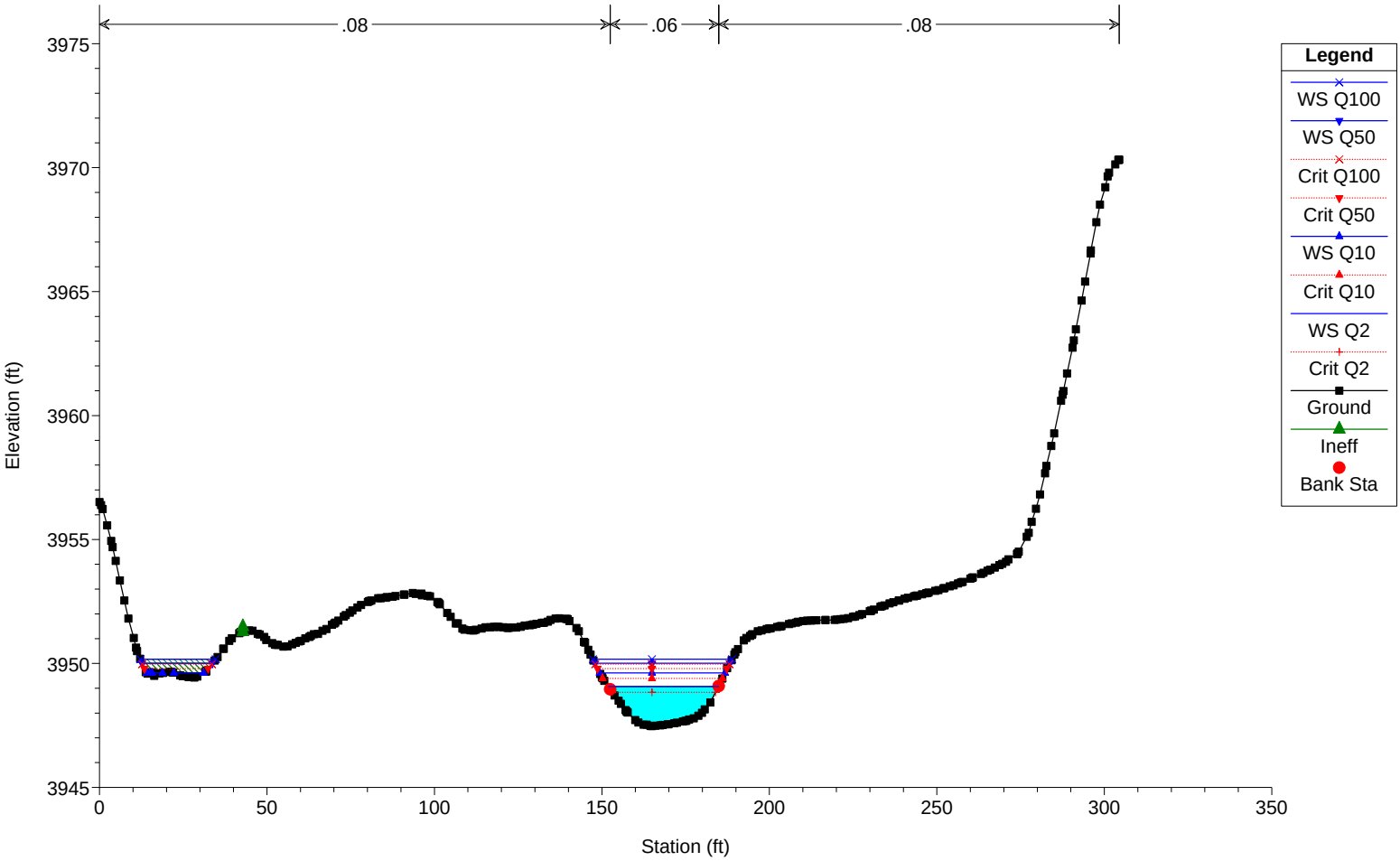

Missoula County PER Plan: Proposed Conditions 12/31/2024
.08
.06
.08
Elevation (ft)
Station (ft)
Legend
WS Q100
Crit Q100
WS Q50
Crit Q50
WS Q10
Crit Q10
WS Q2
Crit Q2
Ground
Ineff
Bank Sta


Missoula County PER Plan: Proposed Conditions 12/31/2024
.08
.06
.08
Elevation (ft)
Station (ft)
Legend
WS Q100
Crit Q100
WS Q50
Crit Q50
WS Q10
Crit Q10
WS Q2
Crit Q2
Ground
Ineff
Bank Sta


Missoula County PER Plan: Proposed Conditions 12/31/2024
.08
.06
.08
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
WS Q10
Crit Q100
Crit Q50
Crit Q10
WS Q2
Crit Q2
Ground
Ineff
Bank Sta


Missoula County PER Plan: Proposed Conditions 12/31/2024
.08
.06
.08
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
Crit Q100
Crit Q50
WS Q10
Crit Q10
WS Q2
Crit Q2
Ground
Ineff
Bank Sta

Missoula County PER Plan: Proposed Conditions 12/31/2024



APPENDIX E:

ENVIRONMENTAL CORRESPONDENCE

From: Knotek, Ladd
To: Casey Bereszniewicz
Subject: RE: Bench Road Bridge Replacement Over Grant Creek
Date: Monday, January 6, 2025 2:28:48 PM
Attachments: image006.png
image007.png
image008.png
image009.png
image010.png
image011.png

Hi Casey-
Thanks for reaching out.
That location is definitely inhabited by bull trout (and genetically pure W Cutthroat Trout), with active spawning in spring and fall

Time window for any instream construction and disturbance: OK July 1 to Aug 25. or during April.
Let me know if there are issues with this timing.

W. Ladd Knotek
Fisheries Management Biologist
Montana Fish, Wildlife & Parks

3201 Spurgin Road
Missoula, MT 59804
Ph: (406) 542-5506 | C: (406) 552-9415
Montana FWP [gcc02.safelinks.protection.outlook.com] | Montana Outdoors Magazine [gcc02.safelinks.protection.outlook.com]

From: Casey Bereszniewicz <cbereszniewicz@greatwesteng.com>
Sent: Monday, January 6, 2025 2:17 PM
To: Knotek, Ladd <lknotek@mt.gov>
Subject: [EXTERNAL] Bench Road Bridge Replacement Over Grant Creek

Good afternoon Ladd,

Missoula County intends to upgrade and replace the existing Bench Road Bridge with a new bridge meeting current design parameters. We are currently in the process of assessing environmental/biological impacts, and was hoping to get your feedback regarding construction windows to prevent potential impacts to Bull Trout.

Thank you!
Casey

[greatwesteng.com]

[greatwesteng.com]

[facebook.com]

[instagram.com]

[linkedin.com]

Casey Bereszniewicz
Environmental Scientist

d: (978) 460-3785
o: (406) 449-8627

2501 Belt View Drive
Helena, MT 59601

ATTACHMENT A

USFWS IPaC Species List

2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Canada Lynx Lynx canadensis There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/3652	Threatened
Grizzly Bear Ursus arctos horribilis There is **proposed** critical habitat for this species. https://ecos.fws.gov/ecp/species/7642	Threatened
North American Wolverine Gulo gulo luscus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5123	Threatened

Fishes

NAME	STATUS
Bull Trout Salvelinus confluentus There is **final** critical habitat for this species. Your location overlaps the critical habitat. https://ecos.fws.gov/ecp/species/8212	Threatened

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

This location overlaps the critical habitat for the following species:

NAME	TYPE
Bull Trout Salvelinus confluentus https://ecos.fws.gov/ecp/species/8212#crithab	Final

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are likely bald eagles present in your project area. For additional information on bald eagles, refer to Bald Eagle Nesting and Sensitivity to Human Activity

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON

Bald Eagle Haliaeetus leucocephalus — Breeds Jan 1 to Aug 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1626

Golden Eagle Aquila chrysaetos — Breeds Jan 1 to Aug 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1680

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

ATTACHMENT B

USFWS NWI Wetland Mapping

U.S. Fish and Wildlife Service
National Wetlands Inventory

Bench Rd. Over Grant Creek

November 21, 2024

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

ATTACHMENT C

Flood Insurance Rate Maps

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 11N. The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from NAIP Orthophotography produced with a one meter ground resolution from photography dated 2011.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map,** how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

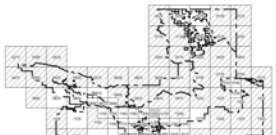
This map may reflect more detailed or up to date **stream channel configurations** than those shown on the previous FIRM. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations and improved topographic data. The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles, and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside the floodplain.

Missoula County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)	Flooding Source	Vertical Datum Offset (ft)
Bitterroot River	3.5	Lower Grant Creek	3.5
Blackfoot River	3.5	Miller Creek	3.5
Clark Fork	3.6	Pattee Creek	3.5
Clearwater River	3.7	Rattlesnake Creek	3.6
Grant Creek	3.6	Rock Creek	3.6
Lolo Creek	3.6		

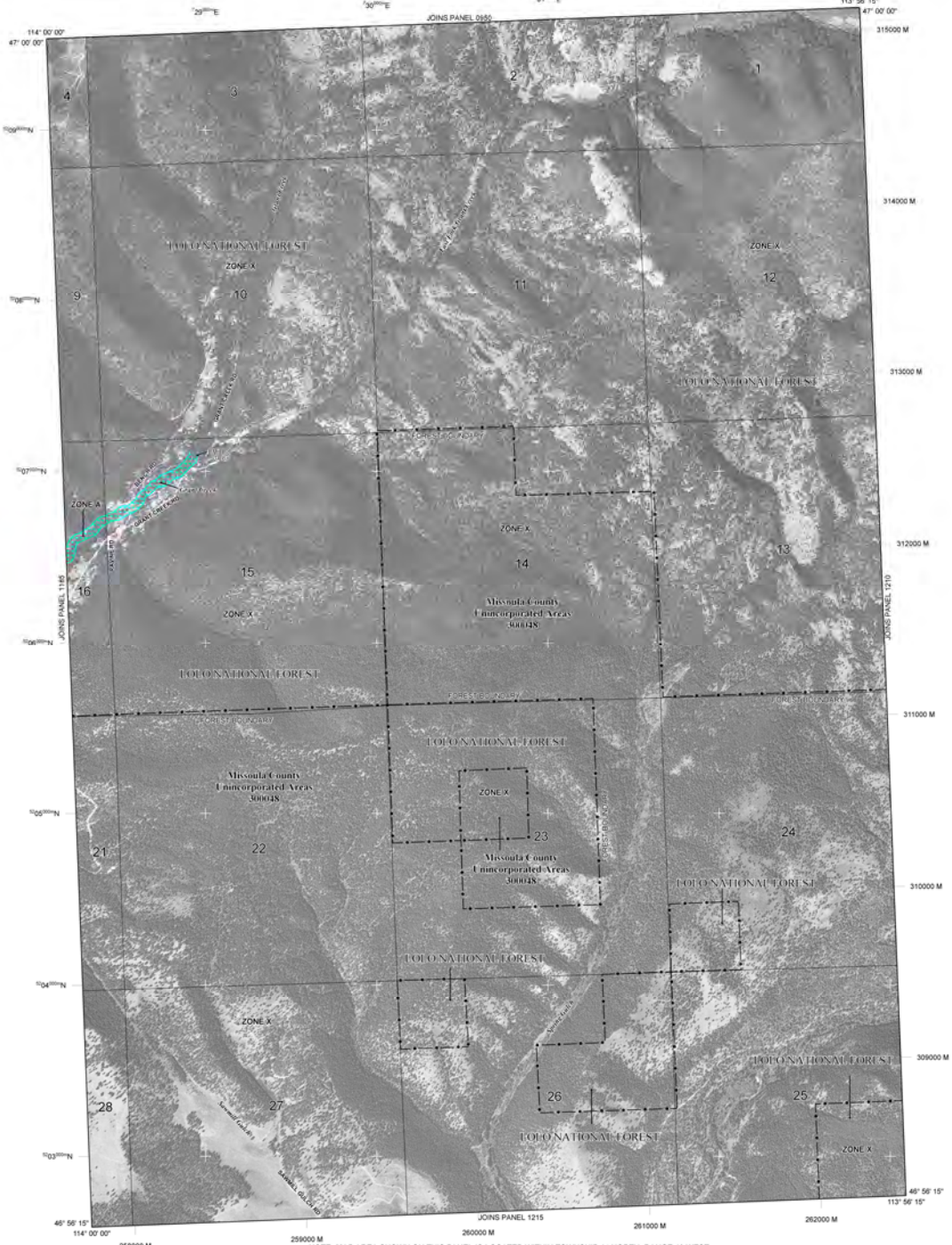
Example: To convert Clark Fork elevations to NAVD 88, 3.6 feet were added to the NGVD 29 elevations.

PANEL INDEX



As per the Administrative Rules of Montana (ARM) 36.15.701(5), "The designated floodplain boundary is based on base flood elevations. The mapped floodplain boundary may be used as a guide for determining whether property is within the designated floodplain, but the exact boundary shall be determined according to the base flood elevation. If the local administrator determines it is unclear whether property is in or out of the floodplain, the local administrator shall require the applicant to provide additional information which may include elevations obtained through a level survey performed by a professional engineer or registered land surveyor."

Panel Not Printed



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 14 NORTH, RANGE 19 WEST.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% Annual Chance Floodplain Boundary
- 0.2% Annual Chance Floodplain Boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

- A — A — Cross section line
- 23 — 23 — Transect line
- 45° 02' 08", 93° 02' 12" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
- 4989000 M — 1000-meter ticks: Montana State Plane Zone (FIPS Zone 2500), Lambert Conformal Conic projection
- 5041000 M N — 1000-meter Universal Transverse Mercator grid values, zone 11N
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
August 16, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
July 6, 2015 - to change Base Flood Elevations, to update corporate limits, to update roads and road names, to change Special Flood Hazard Areas, to incorporate previously issued Letters of Map Revision and to reflect updated topographic information.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1205E

FIRM

FLOOD INSURANCE RATE MAP

MISSOULA COUNTY, MONTANA AND INCORPORATED AREAS

PANEL 1205 OF 1900

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MISSOULA COUNTY, Unincorporated Areas	300048	1205	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER 30063C1205E

MAP REVISED JULY 6, 2015

Federal Emergency Management Agency

ATTACHMENT D

SHPO File Search

From:	Casey Bereszniewicz
To:	Karl Yakawich
Subject:	FW: BENCH ROAD BRIDGE OVER GRANT CREEK REPLACEMENT, MISSOULA
Date:	Tuesday, December 3, 2024 8:20:57 AM
Attachments:	image001.png 20241122004.pdf image003.png image004.png image005.png image006.png image007.png

Hi Karl, this is all that we received from SHPO for the File Search.

Casey Bereszniewicz
Environmental Scientist

d: (978) 460-3785
o: (406) 449-8627

2501 Belt View Drive
Helena, MT 59601

From: Murdo, Damon <dmurdo@mt.gov>
Sent: Monday, November 25, 2024 10:30 AM
To: Casey Bereszniewicz <cbereszniewicz@greatwesteng.com>
Subject: BENCH ROAD BRIDGE OVER GRANT CREEK REPLACEMENT, MISSOULA

November 25, 2024

Casey Bereszniewicz
Great West Engineering, Inc.
2501 Belt View Drive
Helena MT 59601

RE: BENCH ROAD BRIDGE OVER GRANT CREEK REPLACEMENT, MISSOULA. SHPO Project #: 20241122004

Dear Casey:

I have conducted a file search for the above-cited project located in Section 15, T14N R19W.

According to our records there have been no previously recorded sites within the designated search locales. The absence of cultural properties in the area does not mean that they do not exist but rather may reflect the absence of any previous cultural resource inventory in the area, as our records indicated none.

It is SHPO's position that any structure over fifty years of age is considered historic and is potentially eligible for listing on the National Register of Historic Places. If the existing bridge to be replaced is over fifty years old, we would recommend that it be recorded, and a determination of their eligibility be made prior to any disturbance taking place. If this is a MDT project, we would ask that you contact Jon Axline, for any concerns that he may have regarding this proposed project.

If you have any further questions or comments, you may contact me at (406) 444-7767 or by e-mail at dmurdo@mt.gov. I have attached an invoice for the file search. Thank you for consulting with us.

Sincerely,

Damon Murdo
Cultural Records Manager
State Historic Preservation Office

MONTANA
HISTORICAL SOCIETY
State Historic
Preservation Office

FILE SEARCH REQUEST INVOICE

DATE: 25-Nov-24

SHPO Invoice #: 20241122004

Bill To:

Contact Name: Casey Bereszniewicz
Organization: Great West Engineering, Inc.
Address: 2501 Belt View Drive
City/State/Zip: Helena MT 59601
Email: cbereszniewicz@greatwesteng.com

File Search Fee Structure
$35 / Section Searched

For questions contact:
Damon Murdo
dmurdo@mt.gov
406-444-7767

Project Name:	BENCH ROAD BRIDGE OVER GRANT CREEK REPLACEMENT, MISSOULA

Total Cost:	**$35.00**

Total sections searched for SHPO Project #: 20241122004	**1**

Please make all checks payable to:
Montana Historical Society
PO Box 201201
Helena, MT 59620

** PAY ONLINE HERE **
https://svc.mt.gov/doa/opp/HISSHPO/cart

Due upon receipt. Please pay within 30 days.

MTHS Accounting Use Only	604	604.1
	29.75	5.25