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Memorandum

To: Damian Krings, P.E., Road Design Engineer
ATTN: R.J. Snyder, P.E., Helena Road Design – Great Falls Area Engineer

From: Chad Knuth, P.E. CMK
Great Falls District Hydraulics Engineer

Thru: Dave Hedstrom, P.E. DJH
Hydraulics Engineer

Date: October 18, 2019

Subject: STPP 9-2(15)48
North of Augusta - North
UPN 9722000
Location Hydraulic Study Report

GENERAL PROJECT INFORMATION

Introduction and General Site Description

This is the Location Hydraulics Study Report (LHSR) for the PFR that was held on September 18, 2019 for the subject project. The project has been nominated for reconstruction to enhance the safety and efficiency of the route by bringing the design up to current standards. The project location is in Teton County north of the city of Augusta. The project begins at Reference Post (RP) 47.0 and proceeds north along U.S. Highway 89 for approximately 9.0 miles, ending at RP 56.0. The functional classification of the route is a Principal Arterial.

The project will reconstruct the roadway to a 28' top width. Future widening will be considered due to the yearly increase in bicycle traffic on the route. The project will include earthwork, surfacing, drainage, pavement markings and horizontal and vertical alignment shifts.

The existing terrain within the project limits is rolling terrain used primarily as farm and ranch land. Residential growth has been minimal in the area, as observed from historical satellite images.

EXISTING HYDRAULIC INVENTORY

Project Information

Existing drainage structures were installed under the following as-built projects:

- FAP 275 A, Augusta – Choteau Highways [1935] – RP 47.8 to 53.8
- FAP 275 B, Augusta – Choteau Highways [1935] – RP 53.8 to 56.0

The project area generally drains from northwest to southeast, towards the Sun River. The Sun River is about 8 miles south of the project area, flowing west to east perpendicular to the alignment. The drainage basins that cross the PTW range from very small basins of less than an acre up to 7.7 square miles for Maloney Coulee/Basin Lake Drainage Basin.

Design Frequency

The design flood frequency is the greater of the value determined by the ADT or the ADT x the Detour Length. The ADT of 702 vehicles yielded a 25-year design flood frequency and the ADT x Detour Length yielded a 50-year design flood frequency. Therefore a 50-year flood frequency will be used for all hydraulic designs.

Drainage Crossings

Minor Drainage—Drainage Culverts 42" and Smaller

According, to the as-built plans, there are 23 minor mainline drainage culverts within the project section.

Minor Culverts

Size	No. of Culverts
18"	15
24"	7
30"	1

Major Drainage—Bridges and Drainage Culverts 48" and Larger

Within the project limits there are two major drainage crossings. These crossings are existing stockpasses associated with tributaries to Roundup Coulee. Two additional 36" drainage culverts are included in this section due to their significant drainage basin size. The two pipes are located at either end of Basin Lake which drains approximately 7.7 square miles

The following table lists the major drainage crossings as well as the two 36" drainage culverts within the project limits.

Major Crossings 48" and Larger

RP	As-Built Station	Drainage Name	Existing Structure	Year Constr.	Basin Area (mi^2)	*Q_{Design} (cfs)	*Q_{100} (cfs)
48.7	539+00	Maloney Coulee/Basin Lake	36" RCP	1935	7.7	913	1,230
48.9	552+00		36" RCP	1935			
51.5	685+80	N/A	7' X6' Stockpass/Dr.	1935	0.8	312	405
53.4	784+83	N/A	7' X6' Stockpass/Dr.	1935	0.1	111	140

*USGS Regression Equations for the NW Foothills Region were used for the preliminary analysis.

Irrigation Facilities

There are no existing irrigation facilities within the project limits.

Storm Drains

There are no storm drain facilities within the project limits.

Floodplains
There are no floodplains within the project limits.

FIELD REVIEW & DESIGN CONSIDERATIONS

Drainage Crossings
Minor Drainage—Drainage Culverts 42" and Smaller

There are 23 mainline drainage culverts within the project limits. All the pipes are concrete with square ends. The culverts are at the end of their service life being installed in 1935. However, during the PFR field review, the few pipes I observed appear to be in fair condition. It was noted during the PFR by MDT Maintenance the existing culverts are undersized and poor outlet drainage exists. Additional and appropriately sized drainage structures as well as outlet drainage will be analyzed as the design progresses.

Figure 1: Outlet ditch does not drain

Figure 2: Inlet of pipe.

One spring exists west of the project alignment near RP 52.0. The spring was developed by Mr. Hodgskiss, the current landowner. The water generated from the spring flows southeasterly to the roadway cross drain located near station 702+00 (RP 51.8). The water flows underneath the PTW via a 30" RCP culvert and flows into a tributary of Roundup Coulee, before eventually out falling into Freezeout Lake.

Major Drainage—Bridges and Drainage Culverts 48" and Larger

There are two stockpasses shown on the as-builts at stations 685+80 (RP 51.5) and 784+83 (RP 53.4). Each stockpass is a combination drainage/stockpass that drains a relatively small basin. The runoff generated from the basins flows into a tributary of Roundup Coulee, before eventually out falling into Freezeout Lake. As the design progresses right-of-way will verify if the stockpasses are deeded and if the owner will relinquish its rights. If so, hydraulically sized drainage structures will be designed.

Two 36" culverts are shown on the as-builts at stations 539+00 (RP 48.7) and 552+00 (RP 48.9). They act as equalizer culverts that balance Basin Lakes water surface elevation along either side of U.S. 89. According to Jason Allen, MDT Section Head for the August area, the water surface elevation reaches within 1' of the roadway surface at maximum lake capacity. At this point, the water overtops a coulee high point and drains in a southeasterly direction. The drainage coulee continues southeast and the water flows underneath the Sun River Slope Canal via an unknown

size culvert. The water exits the culvert and flows into School Section Coulee, before eventually out falling into the Sun River. A grade raise and larger culverts will be analyzed in this area as the design progresses.

Figure 3: 7'x6' Comb. Stockpass/Dr.

Figure 4: 36" RCP @ Basin Lake

Bridges

There are no bridges within the project limits. The 370 Activity will not be necessary.

Irrigation Facilities

There are no irrigation facilities within the project limits. The 368 Activity will not be necessary.

Storm Drains

No storm drain facilities will be included in the project since the road is a rural area. The 362 Activity will not be necessary.

Site History and Maintenance Observations

Mr. Allen indicated that the highway drainage culverts are undersized and there is poor culvert outlet drainage. Ponding occurs up gradient of the highway culverts, but the water has not flowed overtop the roadway to his knowledge. However, at three different sections along the project the water has reached as high as the fog line on the PTW. The first section is located between stations 435+00 (RP 47.0), just north of the Sun River Slope Canal to Station 510+00 (RP 48.3). The second section is in the vicinity of Basin Lake between stations 539+00 (RP 48.7) and 552+00 (48.9). The last section is at 618+00 (RP 50.2), just west of Jackson Corner. Mr. Allen noted the ponding generally occurs when the area receives a rain on snow or rain on frozen ground event, otherwise there are no drainage issues. These observations and recollections of MDT Maintenance will be used to evaluate the hydraulics as the design progresses.

Floodplain Impacts & Other Longitudinal Encroachments

There are no mapped floodplains in the project area. The 382 Activity will not be necessary.

Channel Modifications

Channel modifications are not anticipated with the project.

Resource Coordination
Wetlands may be present with the project limits. A Clean Water Act Section 404 Permit may be required for impacts to wetlands or streams considered Waters of the United States. A Biological Resources Report (BRR) will be prepared.

There are no fisheries within the project limits.

Utility and/or Railroad Coordination
All potential utility conflicts will be identified during the utility location phase of the project. It was noted during the PFR that overhead power (transmission and distribution), underground telephone and fiber are within the project limits. There are no railroads within the project limits.

Constructability & Water Quality
In stream work may take place within the project limits. This could result in temporary increased erosion potential, reduced slope stability, and could temporary increase turbidity downstream of the project area. Any in stream construction may require a Federal 404 and SPA 124 permit. This will be analyzed as the design progresses.

RIGHT OF WAY INFORMATION REQUEST

Irrigation Study Report
No irrigation facilities were found within the project limits. A Stockpass Report is being requested for the project.

MATERIALS INFORMATION REQUEST

Culvert Inspection Report, Corrosive Soils & Water
Corrosive soil tests and water samples are requested for the project. Provide a representative number of corrosive soil samples at existing culvert locations within the project limits. Take corrosive water samples at all crossings that are carrying water at the time of sampling.

Streambed Sample
A streambed sample is not needed for the project.

Video Inspection
No Video inspection will be necessary.

UTILITIES INFORMATION REQUEST

SUE Survey
Utility location data collected by District survey should be sufficient for preliminary design. If it appears that there may a utility conflict with a proposed structure, additional utility survey may be requested as needed.

HYDRAULIC SURVEY REQUEST

Hydraulic Survey Requirements

1. Minor Drainage Survey. At a minimum collect the following at all minor cross drains/approach culverts on the project. Refer to Chapter 11 of the MDT Survey Manual for additional information.
    a. Pipe size and type
    b. Inlet and outlet: pipe inverts, top of pipe, stream thalweg 1' beyond pipe ends.
    c. Note any scour holes. If present provide photos and DTM survey at each location.
    d. Thalweg upstream and downstream of the pipe for a distance of 50' or to the existing right-of-way line, whichever is greater. At locations where the thalweg parallels the PTW (i.e. 30" RCP at Station 702+00) survey an additional 50' beyond the right-of-way line.
    e. At locations where road design anticipates alignment shifts. Survey additional thalweg shots upstream/downstream for design of the proposed drainage structures. Refer to road design for alignment shift locations.

2. Major Drainage Survey. Two stockpasses exist at as-built stations 685+80 (RP 51.5) and 784+83 (RP 53.4). DTM survey an area that encompasses the stockpass structure as well as 75' away from either opening, and 75' either side of the structures centerline. Refer to Chapter 11 of the MDT Survey Manual for additional information.

If you have any questions regarding this memo or the hydraulic survey, please contact (Chad Knuth at 444-7656 or cknuth@mt.gov.

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