PRELIMINARY ENGINEERING REPORT

Shields River Road Planning Project, MT Park 34(1)
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U.S. Department of Transportation
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Prepared for:
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ABBREVIATIONS/ACRONYMS

AASHTO	American Association of State Highway Transportation Officials
ACS	American Community Survey
ADT	Average Daily Traffic
ARRA	American Recovery and Reinvestment Act
CIP	Capital Improvements Plan
ERFO	Emergency Relief for Federally Owned Roads
ESA	Endangered Species Act
FHWA	Federal Highway Administration
FLAP	Federal Lands Access Program
FPPA	Farmland Policy Protection Act
FWP	Fish, Wildlife, and Parks
GCR	General Condition Rating
MDEQ	Montana Department of Environmental Quality
MDT	Montana Department of Transportation
MP	Mile Post
mph	Miles Per Hour
NBI	National Bridge Inventory
NRCS	National Resource Conservation Service
PASER	Pavement Surface Evaluation and Rating
PCB	Polychlorinated biphenyls
SSD	Stopping Sight Distance
USFS	United States Forest Service
vpd	Vehicles Per Day

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1.0. INTRODUCTION AND BACKGROUND

Shields River Road provides access to over 113,000 acres of the Custer-Gallatin National Forest within the Crazy Mountains. The roadway parallels the Shields River which begins in the Crazy Mountains and flows 62 miles to the confluence of the Yellowstone River east of Livingston. Shields River Road offers scenic views of mountain peaks, rivers, and streams. Over the years, several other access points to the national forest have been closed because of landowner disputes. This has made the Shields River Road corridor the most heavily utilized road by recreationists on the west side of the Crazy Mountains.

Recognizing the deteriorating conditions of the roadway, and the use as a major access to federal lands, the Federal Highway Administration (FHWA), in partnership with Park County and the United States Forest Service (USFS), developed this planning study to identify potential improvements to the Shields River Road corridor. A key outcome of the study is the development of recommendations intended to address the transportation and access needs of roadway users in the study area. The recommendations define the most critical needs of the corridor and will help the study partners prioritize and allocate resources to address the needs. This study reviews and considers environmental and social issues and aims to reduce planning time and minimize construction costs through the demonstration of feasible improvement opportunities.

The intent of this *Preliminary Engineering Report* is to analyze roadway conditions, identify areas of concern, and develop improvement options for the study corridor. The transportation conditions analysis includes a planning level examination of the corridor based on a variety of information sources and field reviews. Goals and objectives for Shields River Road are also identified based on a comprehensive review of existing and projected transportation conditions. The analysis, together with the stated goals and objectives, influenced the development of potential improvement options intended to address the identified issues and areas of concern.

1.1. STUDY AREA

Shields River Road begins at the intersection of US Highway 89 (US 89) North, on the northern end of Wilsall, Montana in Park County. Shields River Road extends for approximately 30 miles up to and through the Custer-Gallatin National Forest. The study area for the *Shields River Road Planning Project* encompasses a 19.5-mile section of Shields River Road, starting at mile post (MP) 0.0 approximately one-quarter mile north of the Town of Wilsall and ending at MP 19.5 near the National Forest Boundary. **Figure 1.1** presents the study area boundary.

The roadway provides access to the Custer-Gallatin National Forest and offers access to private ranches, homes and cabins; trailheads; designated and undesignated dispersed campgrounds; mountain lakes; and access to many creeks and drainages popular for fishing and hunting activities. Within the study area, Shields River Road is functionally classified as a minor collector. The roadway offers recreational access to hiking, biking, fishing, camping, hunting, winter sports, and wildlife viewing opportunities in the Custer-Gallatin National Forest. Multiple fishing guides, hunting guides, and outfitters operate in the area along with permitted commercial firewood and morel mushroom collectors. The use of lands accessed by Shields River Road has historically provided substantial tourism traffic and economic subsistence for the rural community of Wilsall.

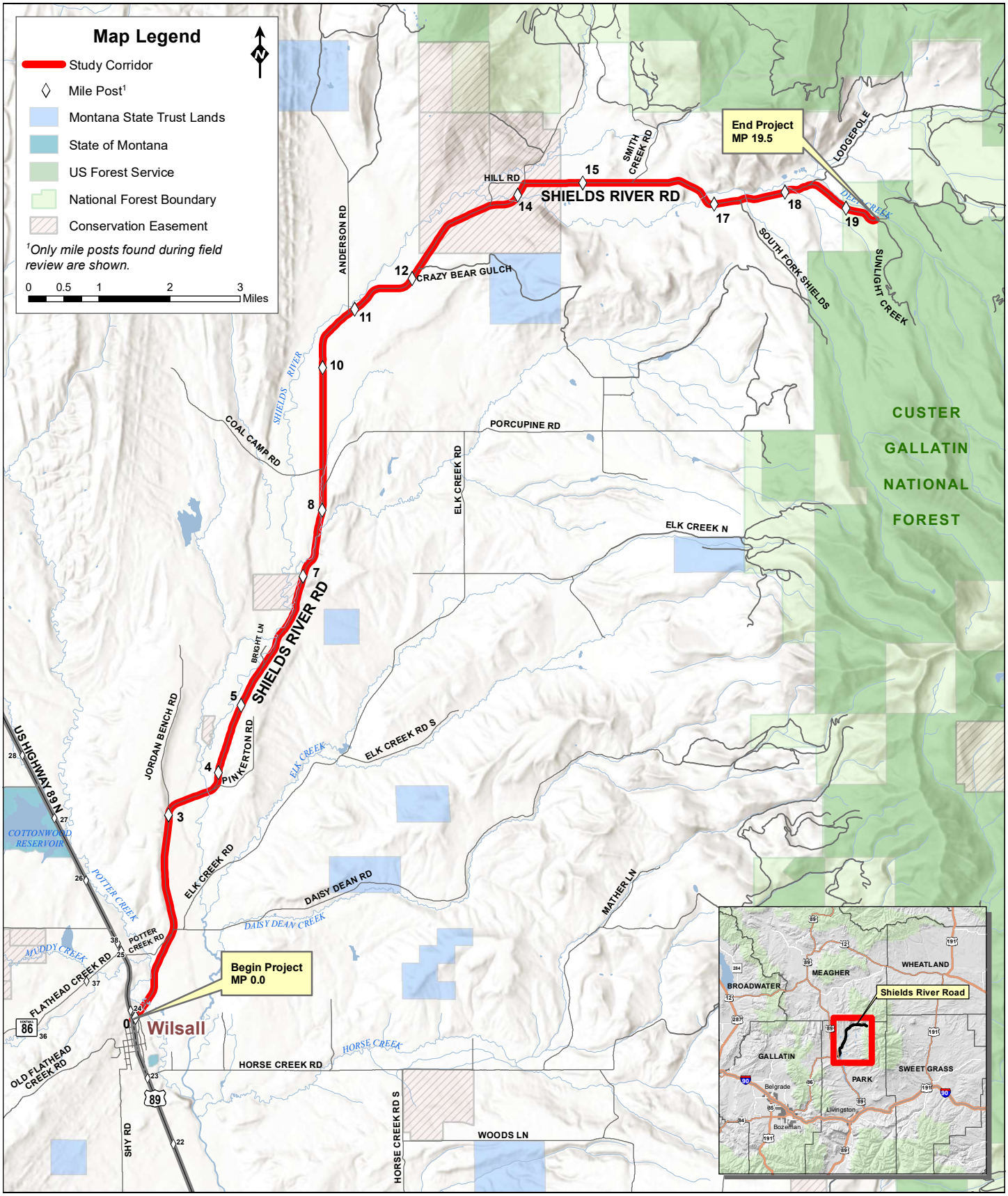

Figure 1.1: Study Area

1.2. Historic Construction and Improvements

The current alignment for Shields River Road was originally constructed in 1955 from MP 0.00 to 14.35. In 1975, a Montana Emergency Relief Project (ERFO 72(47)) was completed to construct a single-lane concrete bridge over Shields River at MP 16.8. In 2009, the Forest Service received funds from the American Recovery and Reinvestment Act (ARRA) to implement the Shields River Road and Bridge Reconstruction Project. AARA funds were used to complete the following improvements between 2009 and 2011:

- Extend the pavement from MP 14.35 to Smith Creek Junction (approximate MP 15.7) with a 26-foot paved surface;
- Improve the gravel surface from MP 15.7 to 16.8 and widen to 24 feet of surfacing;
- Replace the single lane bridge at MP 16.8 with a double lane bridge; and
- Widen the gravel surfacing from MP 16.8 to Sunlight Road (MP 19.5) to 20 feet.

1.3. Current and Planned Projects

Park County establishes priorities, long-range programming, scheduling, and funding for infrastructure needs through their *Capital Improvements Plan (CIP)*. The 2016-2020 CIP[1] includes two road and bridge rehabilitation projects on Shields River Road in the long-range 20-year assessment of needs; however, the projects are not scheduled for funding in the current 5-year CIP. These projects include: Shields River Road Bridges Rehabilitation ($60,000); and Shields River Road Rehabilitation ($8,500,000). Detailed information regarding the specifics of these projects is not currently included in the CIP. It is anticipated that the recommendations resulting from this *Shields River Road Planning Project* will be used to update the CIP and to help prioritize and obligate future funding.

1.4. Existing Plans and Regulations

Several local plans exist with goals and objectives related to the transportation system in the study area. The following provides a summary of existing planning documents and regulations relevant to the Shields River Road corridor.

- **Gallatin National Forest Land and Resource Management Plan (1987)** – The *Gallatin National Forest Land and Resource Management Plan*[2], and the accompanying *Final Environmental Impact Statement* [3] , guide all-natural resource management activities and establish management standards for the Gallatin National Forest. They describe resource management practices, levels of resource production and management, and the availability and suitability of lands for resource management within the forest, including the Shields River area. These planning efforts resulted in significant watershed restoration efforts in the Shields River area in the mid-1990s in which the Forest Service obliterated and restored old logging roads to improve water quality.

- **Shields River Road Improvement Decision Notice (2004)** – The *Shields River Road Improvement Decision Notice and Environmental Assessment*[4] called for improving Shields River Road including widening the road to between 24 and 26 feet (two traffic lanes) and laying a gravel surface on the Forest Service section; replacing the Deep Creek bridge; constructing a parking area with an accessible toilet at the junction of Shields River Road and Sunlight Road; and relocating gates closer to the parking area at Sunlight Road. Environmental effects were considered, and the decision was made to proceed with improvements based on a *Finding of No Significant Impact* report by the USFS. Major roadwork on a 5.6-mile section of Shields River Road was performed following the release of the Decision Notice.

- **Gallatin National Forest Travel Management Plan (2006)** – The *Gallatin National Forest Travel Management Plan Record of Decision*[5] developed and analyzed several alternatives for managing public access and travel within the Gallatin National Forest. The report identified a preferred alternative and detailed the anticipated changes to public road access and modifications to the roads, trails, and open spaces accessible to cars, ATVs, motorcycles, and snowmobiles.

- **Park County Active Transportation Plan (2016)** – The *Park County Active Transportation Plan*[6] is a consolidation of two existing plans – the *Park County Park Plan* (2007) and the *Livingston/Park County Trails Plan* (2006). Through the *Active Transportation Plan*, Park County and the Parks and Recreation Board aim to serve the community through four priority areas: 1) healthy and safe alternative transportation promotion; 2) parks, trails, and recreation network opportunities; 3) effective collaboration and management; and 4) positive economic competitiveness. The *Livingston/Park County Trails Plan* previously proposed a 21-mile long pathway through the Shields Valley. Through the recent planning efforts, the public identified the Shields Valley as a priority for active transportation. The Plan recommends Shields River Road as a proposed active transportation route. A large multi-use park is also recommended in the Shields Valley.

- **Park County Capital Improvements Plan (2016)** – The *Park County Capital Improvements Plan*[1] establishes long-term goals for maintaining, improving or financing new capital improvement projects and/or capital equipment over the course of the next five years. This document is utilized to assist county leaders with project planning, financing, and determining the overall needs of the population. No projects on Shields River Road were scheduled in the CIP for funding over the next five years. However, two projects – Shields River Road Rehabilitation ($8,500,000) and Shields River Road Bridges Rehabilitation ($60,000) – were included in the long-range 20-year assessment.

- **Park County Growth Policy (2017)** – The *Park County Growth Policy*[7] identifies and seeks to address key social, physical, environmental, economic, and land use issues facing Park County. Two goals relating to transportation in the county are identified under the "Key Issues: Infrastructure" section: Goal 10 is to create a system of interconnected trails; Goal 11 is to provide for a safe and efficient county road network. Land use and development goals are also defined and may influence future growth in the Shields River Road area.

Land use policies and development regulations in the study area are governed principally by Park County. Within the National Forest boundary, land use policies and regulations are dictated by the *1987 Land and Resource Management Plan*, as amended. Since the entire study area falls within County jurisdiction, it is anticipated that projects brought forward in this planning study would be subject to County regulations. However, coordination among federal, state, and local agency staff would be an essential component of any projects that may arise.

2.0. TRANSPORTATION SYSTEM

The following analysis of transportation conditions includes a planning level examination of the corridor based on existing and historic traffic data, vehicle crash history, field measurements and observations, roadway as-built plans, aerial imagery, geographic information system data, and input from local stakeholders. This analysis was used to identify areas of concern for the Shields River Road corridor.

2.1. Physical Features and Characteristics

Shields River Road connects the town of Wilsall to the Crazy Mountains. The road is paved from its beginning at Montana Highway 89 to approximately MP 15.8 at Smith Creek Road. The road is gravel from this point to its end, with the exception of a short section of asphalt at the bridge at MP 16.8. The lands along Shields River Road are predominantly agricultural in use. The road consists of generally level terrain with occasional hills and steep side slopes along the Shields River.

2.1.1. Hydraulics

Shields River Road generally parallels the Shields River within the study area. For approximately one mile, the roadway also parallels Flathead Creek. For an approximate 2.5-mile segment between Elk Creek West Road and Coal Camp Road, Shields River Road also parallels Porcupine Creek and one of its unnamed tributaries. Throughout the study area, Shields River Road crosses several streams, irrigation canals, and ditches. **Table 2.1** presents the major stream crossed by Shields River Road and their approximate location. The locations of the streams are also displayed in **Figure 2.1**.

Table 2.1: Stream and River Crossings

Name	Approximate Location (MP)	Crossing Structure
Flathead Creek	0.3	Bridge
Shields River	3.7	Bridge
Porcupine Creek	7.6	Culvert
Shields River	14.1	Bridge
Shields River	16.8	Bridge
South Fork Shields River	17.5	Culvert
Mill Creek	18.1	Culvert

2.1.2. Bridges

Bridge conditions are determined using the National Bridge Inventory (NBI) general condition ratings (GCR). The GCRs are used to describe the existing bridge as compared to its as-built condition. The material used, as well as the physical condition of the deck, superstructure, and substructure of the bridge are considered in the rating. GCRs are given a numerical rating ranging from 0 (failing condition) to 9 (excellent condition) as described in the *FHWA Coding Guide*[8].

The bridge condition is classified based on 23 CFR 490.409 [9] . When the minimum GCR of the deck, superstructure, and substructure is 7, 8, or 9, the bridge is classified as “good”. When the minimum GCR is either 5 or 6 the bridge is classified as “fair”. If the minimum GCR is 4

There are four bridges in the study area. All four bridges are in fair or good condition.

or below the bridge is classified as “poor”. One of the bridges has a condition of “good”, which indicates that it is a candidate for continued preservation and cyclic maintenance; two of the bridges have a condition of “fair”, indicating that they may be candidates for preservation and condition-based maintenance; the fourth bridge was recently replaced and has not been assessed by NBI standards but is assumed to be in “good” condition. Detailed bridge inspection reports are available in **Appendix A**.

The Montana Department of Transportation (MDT) *Bridge Design Standards*[10] require off-system bridges to have a minimum roadway width of 28 feet unless the county has different standards or if the road has very low volume and a single lane bridge (16-foot width) is adequate. MDT standards allow an existing bridge to remain in place if it is 24 feet or greater in width. *Park County Transportation Standards*[11] recommend that bridges with average daily traffic (ADT) of 100 vehicles per day (vpd) or more have a minimum width of 24 feet. Bridges with ADT of less than 100 vpd should have a minimum width of 14 feet. All bridges within the study area have acceptable widths based on these standards.

In addition to the condition ratings and bridge specifications, a bridge sufficiency rating is listed. FHWA uses the sufficiency rating to indicate the sufficiency of a bridge to remain in service. A score of 80 or less makes a bridge eligible for rehabilitation, and a score of 50 or less makes a bridge eligible for replacement. All bridges in the study area are rated sufficient and are therefore not eligible for rehabilitation or replacement.

The American Association of State Highway Transportation Officials (AASHTO) *Standard Specifications for Highway Bridges*[12] identifies design vehicle loads. Most bridges in the United States were designed to accommodate either an H15 or HS20 loading. The three assessed bridges have design loads of HS15 which represents a two-axle single unit truck weighing 15 tons. According to AASHTO standards for collector roadways, bridges to remain in place must have a design loading capacity of HS15 or better. All of the bridges in the study area have adequate design loading capacities based on this standard.

Figure 2.1 shows the locations of the four bridges along the study corridor while **Table 2.2** shows the existing conditions of the structures.

Table 2.2: Bridges in the Study Area

Structure No.	Location (MP)	Feature Crossed	Year Built	Curb to Curb Width (ft)	Length (ft)	Bridge Condition	Sufficiency Rating	Design Load
3808	0.3	Flathead Creek	1955	24.2	52	Fair	90.6	HS15
3809	3.7	Shields River	1955	24.0	70.7	Fair	87.9	HS15
3810	14.1	Shields River	1957	24.0	25	Good	88.3	HS15
N/A	16.8	Shields River	2010	28.5*	70*	Good*	N/A	N/A

** Estimated during field review.*

2.1.3. Culverts

A total of 70 culverts were identified during the field review. Of those culverts, 17 had a diameter of 30 inches or more. Fifty-five of the culverts were in fair or good condition. Three stock passes were also identified within the study area, two of which are in fair condition and one is in good condition. **Appendix B** contains an inventory of each drainage structure and lists the specification and condition of each culvert. **Figure 2.1** show the locations of the culverts inventoried. All data contained in the appendices were collected during field review and may differ from data in inspection reports compiled by Park County and/or the Forest Service. This analysis does not include a capacity assessment of the culverts nor does it examine whether the culverts pass aquatic organisms.

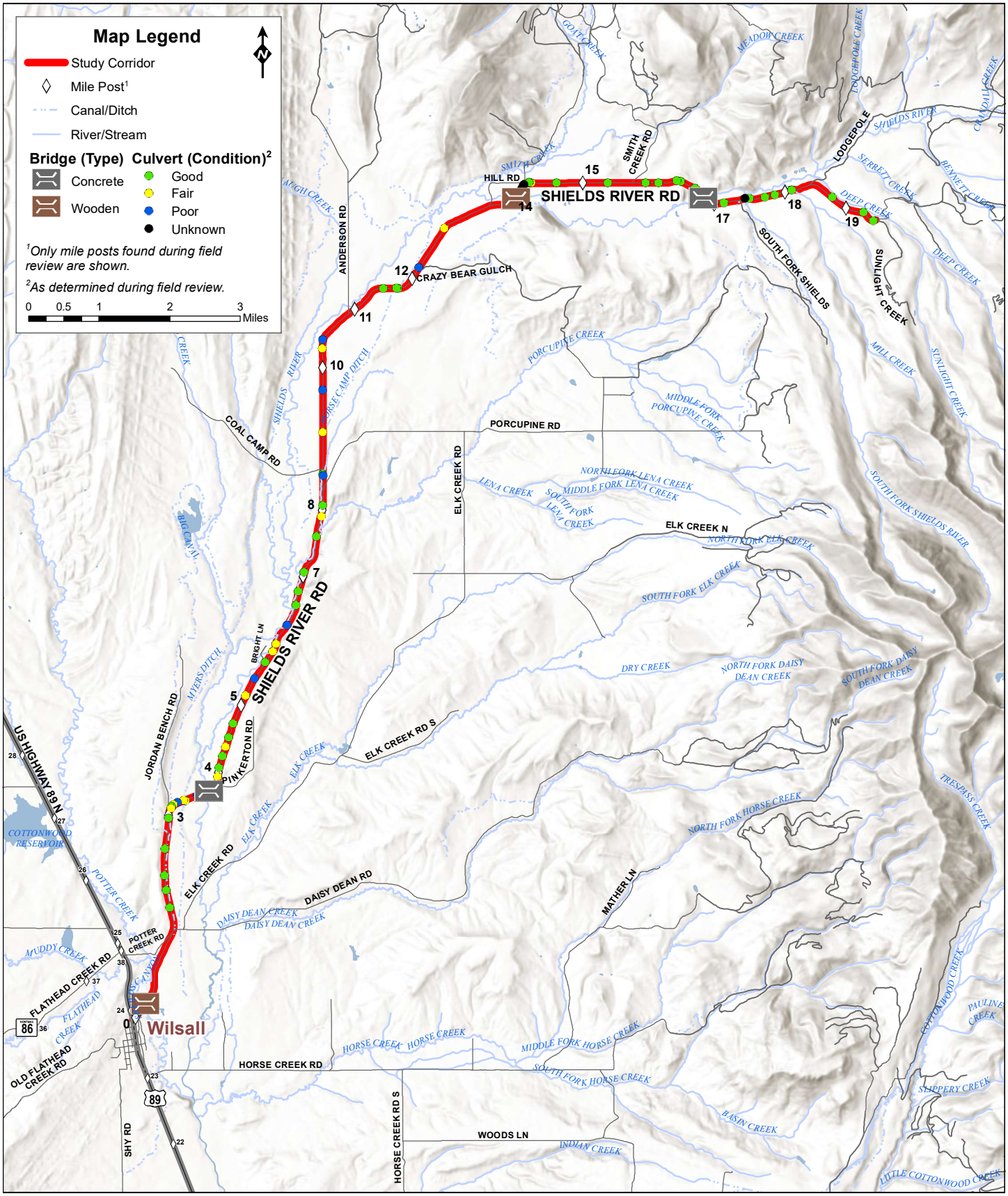

Figure 2.1: Bridges and Culverts

2.1.4. Maintenance and Operations

Park County is responsible for maintenance of Shields River Road between US 89 (MP 0.0) and the National Forest Boundary (MP 19.5). The roadway is maintained by the USFS past MP 19.5. Travel restrictions exist on the portion of road maintained by the USFS as documented in the *Motor Vehicle Use Map Custer Gallatin National Forest*[13]. From MP 0.0 to 19.5 the road is open to highway legal vehicles year-round; from MP 19.5 to 26.9 the roadway is open to highway legal vehicles between June 16th and December 1st; and beyond MP 26.9 the roadway is open to all wheeled, non-tracked vehicles during the same dates.

According to the *Park County Road Maintenance Map*[14], the roadway is designated as a "School Bus Route" between MP 0.0 and 11.8 and receives first priority for winter maintenance. From MP 11.8 to 16.9, Park County designates the roadway as Regular Maintenance and as having second priority for winter maintenance. For the remainder of the study corridor (MP 16.9 to 19.5) the roadway is designated as Seasonal Maintenance and is not scheduled for winter maintenance, however, Park County may maintain this section depending on the occupancy of the residences beyond Smith Creek Road.

2.1.5. Roadway Surfacing

Shields River Road is paved between MP 0.0 and MP 15.7 at the intersection with Smith Creek Road. The remaining portion of the roadway is gravel, with the exception of a short segment at the bridge near MP 16.8. Existing roadway widths were documented during field review and were measured from edge of pavement to edge of pavement or edge of roadway for gravel sections. Measurements were taken approximately every half mile or when notable changes in roadway width were observed. Roadway widths ranged from approximately 22 to 29 feet, with a typical width of 24 feet. **Table 2.4** shows the existing roadway width measurements.

The first 15.7 miles of Shields River Road are paved; the remaining 3.8 miles are gravel surfaced. The majority of the pavement is in deteriorating condition.

The AASHTO *Policy on Geometric Design of Highways and Streets (Greenbook)* [15] recommends a minimum travel way width of 22 feet with 4-foot shoulders on each side (for a minimum roadway width of 30 feet) to meet standards for public use based on traffic patterns and volumes. Exceptions to standards are allowed based on topographic constraints, environmental factors, etc., as approved by the road owner and maintainer. These standards are applicable to rural collectors with 400 to 2,000 vpd. However, the *Greenbook* states that alternate design criteria may be considered for minor collectors that carry 2,000 vpd or fewer in accordance with the AASHTO *Guidelines for Geometric Design of Very Low-Volume Local Roads*[16]. The *Very Low-Volume Local Roads* guidance recommends roadway widths ranging from 18 to 26 feet for new construction of roadways depending on design speed and functional subclass. The guidance also states that the cross-section widths of existing roads need not be modified except in those cases where there is evidence of site-specific safety problems.

Park County Transportation Standards also provide area specific guidance for roadway design. A typical asphalt paved road is recommended to have a minimum of two 12-foot travel lanes with 2-foot shoulders. A typical gravel surfaced road is recommended to have a minimum of 12-foot travel lanes and an overall roadway width of 24 feet. **Table 2.3** summarizes the various requirements for roadway width based on these resources.

Table 2.3: Minimum Recommended Total Roadway Width

Standard	Design Speed (mph)			
	45	50	55	60
AASHTO Greenbook*	30	30	30	30
AASHTO Very Low Volume Local Roads				
Minor Access	20	20	--	--
Recreational and Scenic	20	20	22	--
Agricultural Access	24	26	--	--
Park County Transportation Standards				
Paved	28	28	28	28
Gravel	24	24	24	24

**Based on design volume of 400 to 2,000 vpd.*

Pavement condition was also assessed as part of the field review process. A windshield survey of the roadway was performed to assess the existing surfacing condition. The evaluation was completed using methods and standards defined in the Pavement Surface Evaluation and Rating (PASER) documents. Based on this assessment, the first 14 miles of the roadway has asphalt conditions in fair or worse conditions, some areas of which are failing. Physical deficiencies observed during the PASER evaluation of the road include transverse and longitudinal cracking, alligator cracking, potholing, flushing, rutting, distortion, edge erosion, and failing patches. The recently paved portion between MP 14.0 and the gravel section (MP 15.8) is in good or very good condition. The gravel segment is also generally in good condition. **Table 2.4** includes the PASER ratings taken at half-mile increments or where there was a change in surfacing for the roadway. Existing surfacing condition is also shown in **Figure 2.2**.

Table 2.4: Roadway Surfacing and Pavement Condition

Begin (MP)	End (MP)	Width (ft)	Surface Type	PASER Rating	
0.0	0.5	30.5	Paved	3	Poor
0.5	1.0	24.5	Paved	4	Fair
1.0	1.5	24.0	Paved	3	Poor
1.5	2.0	24.0	Paved	2	Very Poor
2.0	2.5	24.0	Paved	2	Very Poor
2.5	3.0	22.5	Paved	3	Poor
3.0	3.5	24.0	Paved	3	Poor
3.5	4.0	25.0	Paved	3	Poor
4.0	4.5	24.0	Paved	2	Very Poor
4.5	5.0	25.0	Paved	3	Poor
5.0	5.5	24.5	Paved	2	Very Poor
5.5	6.0	24.0	Paved	3	Poor
6.0	6.5	23.0	Paved	2	Very Poor
6.5	7.0	23.5	Paved	3	Poor
7.0	7.5	24.0	Paved	3	Poor
7.5	8.0	24.0	Paved	3	Poor
8.0	8.5	24.5	Paved	3	Poor
8.5	9.0	24.5	Paved	2	Very Poor
9.0	9.5	24.5	Paved	3	Poor
9.5	10.0	24.0	Paved	4	Fair
10.0	10.5	24.5	Paved	4	Fair
10.5	11.0	24.0	Paved	4	Fair
11.0	11.5	24.5	Paved	3	Poor
11.5	12.0	24.0	Paved	3	Poor
12.0	12.5	26.0	Paved	2	Very Poor
12.5	13.0	25.0	Paved	1	Failing
13.0	13.5	25.5	Paved	1	Failing
13.5	14.0	25.0	Paved	4	Fair
Average MP 0.0 to 14.0				**3**	**Poor**
14.0	14.5	25.0	Paved	7	Good
14.5	15.0	25.0	Paved	8	Very Good
15.0	15.5	24.0	Paved	7	Good
15.5	15.8	24.0	Paved	8	Very Good
Average MP 14.0 to 15.8				**7**	**Good**
15.8	16.5	25.0	Gravel	4	Good
16.5	16.8	29.0	Gravel	4	Good
16.8	16.9	24.0	Paved	8	Very Good
16.9	17.5	22.0	Gravel	4	Good
17.5	18.0	24.0	Gravel	3	Fair
18.0	18.5	25.0	Gravel	4	Good
18.5	19.0	23.0	Gravel	4	Good
19.0	19.5	23.5	Gravel	4	Good
Average MP 15.8 to 19.5*				**4**	**Good**

** Excludes MP 16.8 to 16.9*

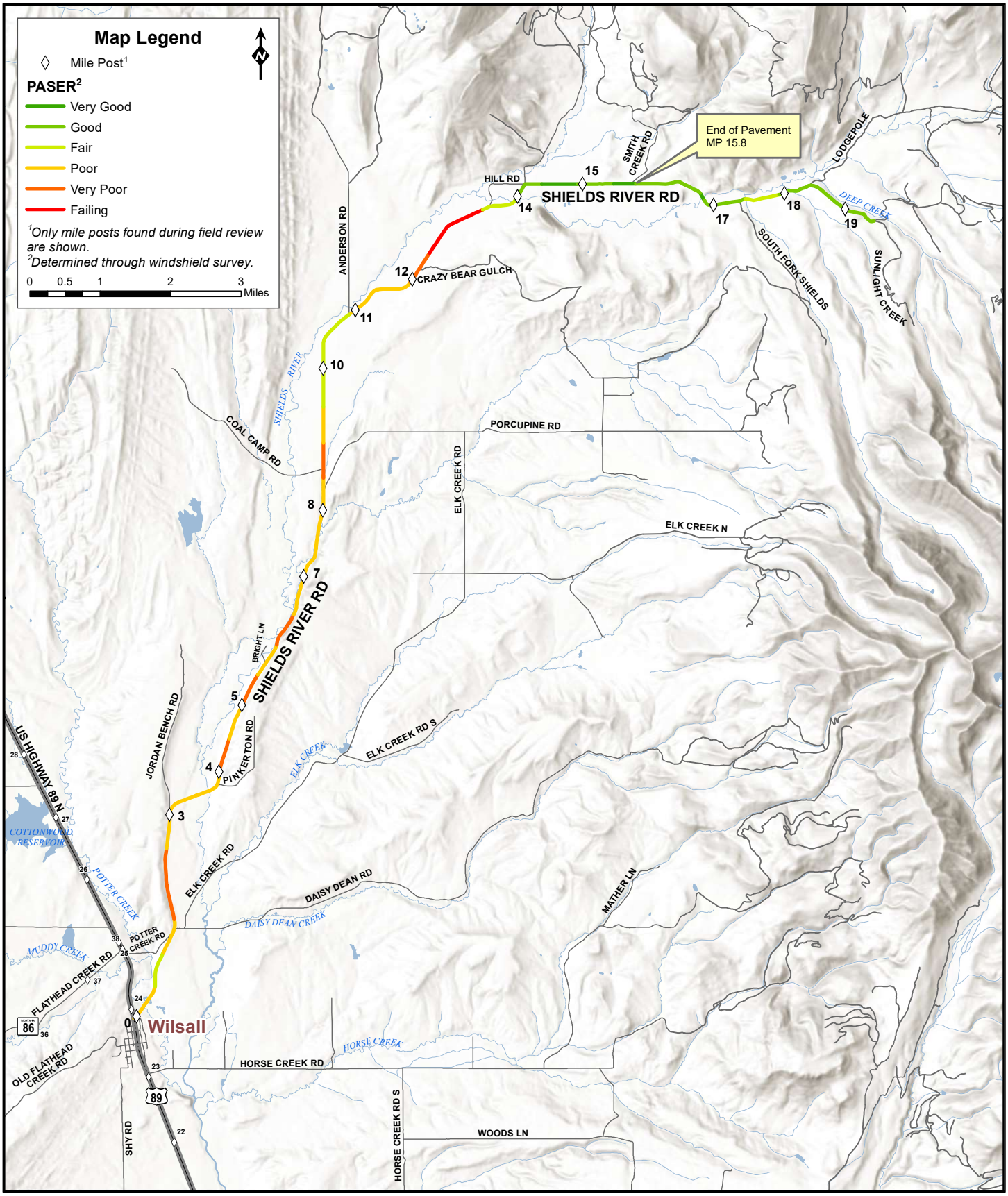

Figure 2.2: Pavement Condition

2.1.6. Access Points

Access points along Shields River Road were identified during the field review and from aerial photography. There are approximately 81 access points along the corridor. Private approaches, farm accesses, pullout areas, and public roads were all considered access points. The access points were sporadic along the corridor. On average, there were 4.2 access points per mile along the corridor. **Table 2.5** provides a summary of access points grouped into mile-long segments.

Table 2.5: Access Points

Begin (MP)	End (MP)	Segment Length (mi)	Approaches	Density (app/mi)	Description
0.0	3.8	3.8	16	4.2	Beginning of Study area (US 89) to Pinkerton Road
3.8	8.4	4.6	15	3.3	Pinkerton Road to Porcupine Road
8.4	15.7	7.3	35	4.7	Porcupine Road to Smith Creek Road
15.7	19.5	3.8	15	3.9	Smith Creek Road to end of Study Area – Gravel section
Total		**19.5**	**81**	**4.2**	**Entire Corridor**

2.1.7. Right-of-Way

Park County Transportation Standards recommend a minimum of 60 feet of right-of-way for both asphalt and gravel roads within County jurisdiction. Most of the land surrounding Shields River Road is privately owned. A section of the roadway, between approximate MP 12.5 and 14.5, is privately owned but a conservation easement held by Gallatin Valley Land Trust exists on the land. Based on right-of-way plans from the original road construction, Park County holds at least 40 feet of right-of-way on each side of the Shields River Road centerline through the first 14.35 miles of the roadway. Right-of-way plans for the last 4.65 miles of Shield River Road are unavailable. **Figure 2.3** shows the public and private land ownership within the study area.

Park County holds at least 40 feet of right of way on each side of the Shields River Road centerline from MP 0.0 to 14.35. Park County design standards recommend a minimum of 60 total feet of right-of-way.

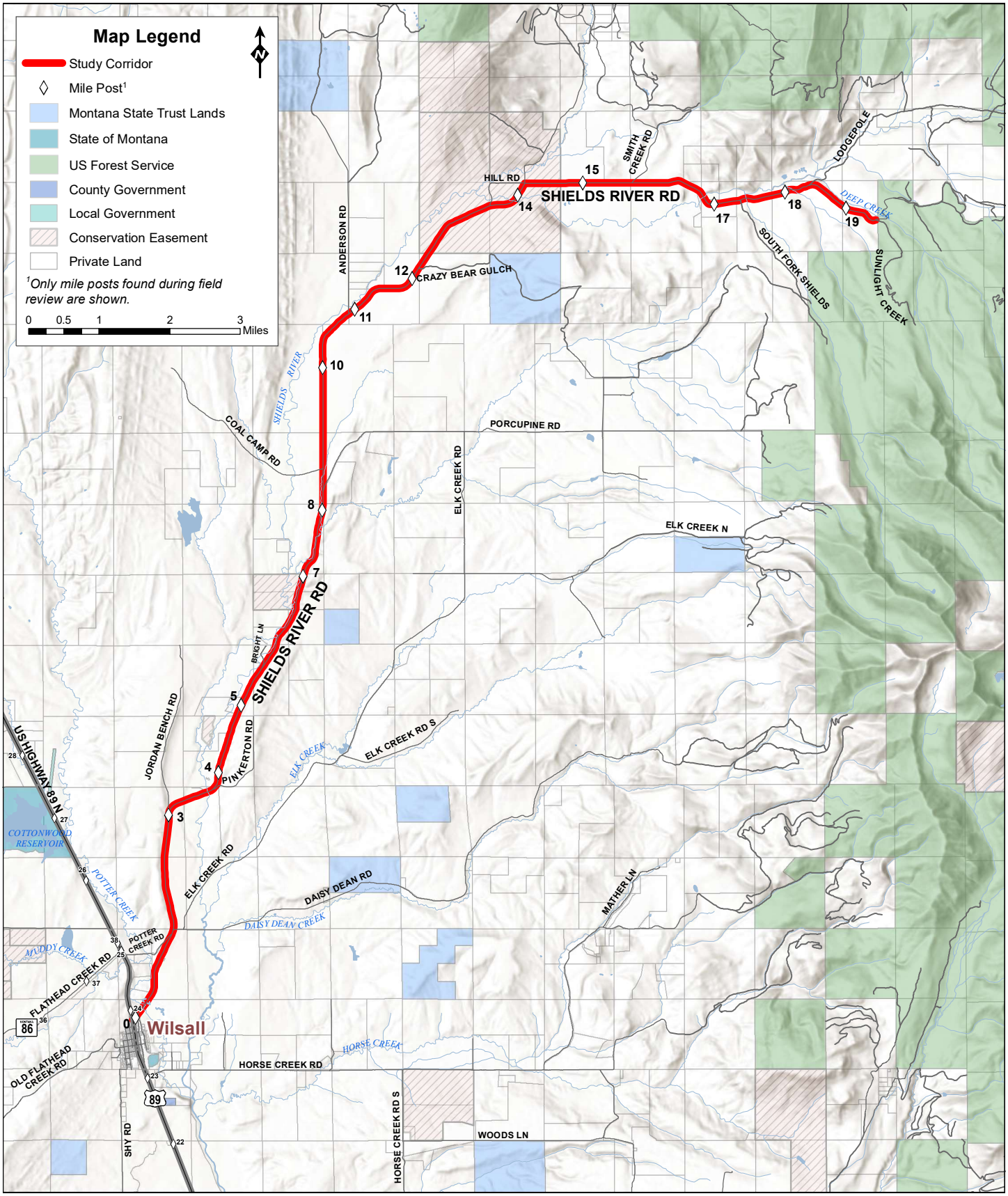

Figure 2.3: Property Ownership

2.1.8. Utilities

Several utilities are located within the study area including underground and overhead power along with underground fiber optics. The utilities exist along both sides of the roadway and cross the road both underground and above ground in several locations. All utilities are generally located within the roadway right-of-way.

2.1.9. Alternative Transportation Modes

The *Park County Active Transportation Plan* designates Shields River Road as a proposed active transportation route. There are currently no dedicated bicycle or pedestrian facilities along the study corridor. Biking, walking, and running activities along the corridor are reported and could increase with additional use in the future. There are also no transit services on the study corridor.

2.1.10. Recreational Opportunities

Shields River Road provides access to the Custer-Gallatin National Forest, public-use cabins, trailheads, campgrounds, and other popular recreation areas. The roadway, along with lands accessed by the roadway, are used for a variety of recreational activities including bicycling, running, hiking, wildlife viewing, ATV and motorcycle activities, horseback riding, fishing, hunting, camping, snowmobiling, cross-country skiing, and snowshoeing. Primary destinations accessed by Shields River Road include: 2 USFS cabins (Crandall Creek and Porcupine Creek); 12 vacation-rental-by-owner facilities; 8 designated dispersed campsites; over 30 undesignated dispersed campsites; 12 day-use sites; 6 developed trailheads; 24 trail systems; 9 designated ATV routes; numerous mountain lakes; and several streams. From some of the camping sites, historic interpretation and trailheads can be accessed. **Figure 2.4** shows the locations of the various recreational opportunities near the study area.

A desire has been expressed to construct a parking lot at the intersection of Shields River Road and Smith Creek Road to facilitate winter recreation in the Custer-Gallatin National Forest.

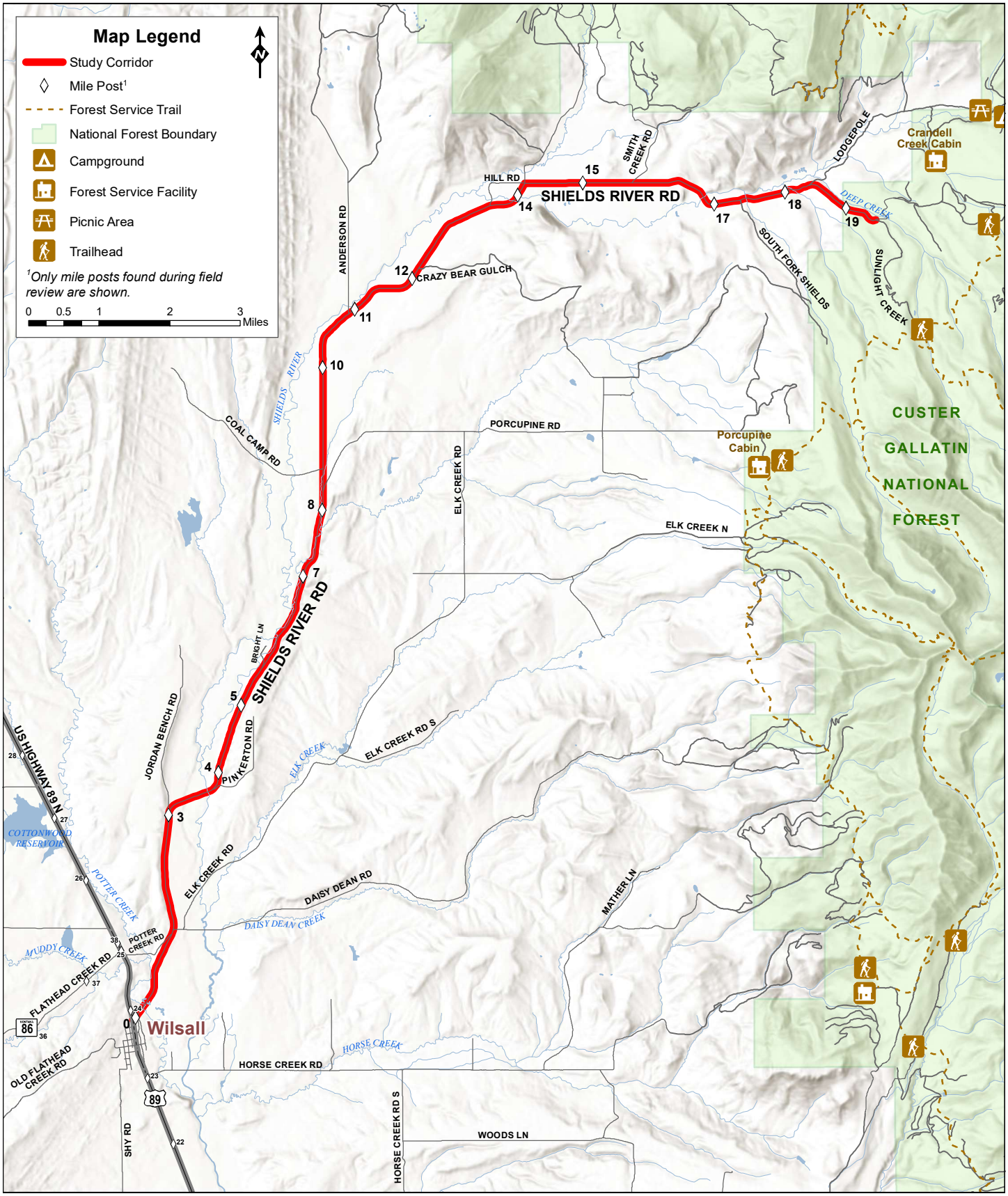

Figure 2.4: Recreational Facilities

2.2. Geometric Conditions

Existing roadway geometrics were evaluated and compared to current standards. As-built drawings were available for the first 14.35 miles from when the road was originally constructed. Existing geometric conditions were determined based on these as-builts from 1954. Note that the existing alignment may differ from the original alignment as reconstruction and spot improvements may have occurred over the past 65 years. For the remaining 5 miles of the study corridor, as-built drawings are unavailable, so field review and aerial photography were used to document existing roadway geometrics.

2.2.1. Design Criteria

The *AASHTO Greenbook* specifies general design principles and controls that determine the overall operational characteristics of the roadway. Of critical importance to determining design standards is the design speed. AASHTO's manuals provide guidance for design speed based on facility and operating characteristics; however, some judgment is necessary. A facility's design speed and its operating speed may differ. The design speed is a selected speed used to determine the various geometric design features of the roadway. The operating speed is the highest overall speed at which a driver may travel on a given section of roadway under favorable weather conditions and prevailing traffic conditions without at any time exceeding the safe speed as determined by the design speed.

Table 2.6 lists current design standards for rural collector routes according to AASHTO design criteria. The highway design criteria depend on terrain, area context (i.e., urban or rural), and daily traffic volumes. The projected traffic volumes for the corridor are between 300 and 400 vpd. Based on the terrain and area context definitions provided by AASHTO, the study corridor appears to be of rural context under level terrain with some areas of rolling terrain. This correlates to a design speed ranging from 40 miles per hour (mph) to 50 mph. However, the speed limit throughout the corridor is 55 mph. AASHTO recommends, where practical, design speeds greater than those given in the *Greenbook* be considered. Given the higher speed limit, a design speed of 60 mph with associated design standards was assumed for the purposes of this report. A final determination of design speed will ultimately be made during project development.

Table 2.6: Geometric Design Criteria

Design Element			Design Criteria		
			0 to 400 vpd	400 to 2000 vpd	Over 2000 vpd
Design Control	Design Speed	Level	40 mph	50 mph	60 mph
		Rolling	30 mph	40 mph	50 mph
		Mountainous	20 mph	30 mph	40 mph
Alignment Elements	Design Speed		40 mph	50 mph	60 mph
	Maximum Grade	Level	7%	6%	5%
		Rolling	8%	7%	6%
		Mountainous	10%	9%	8%
	Vertical Curvature (K-value)	Crest	44	84	151
		Sag	64	96	136
	Stopping Sight Distance (SSD)		305	425	570
	Radius		444	758	1,200

2.2.2. Horizontal Alignment

Elements comprising horizontal alignment include curvature, superelevation (i.e., the bank on the road), and sight distance. These horizontal alignment elements influence traffic operation and safety and relate directly to the design speed of the corridor. AASHTO's design standards for horizontal curves are defined in terms of curve radius, and they vary based on design speed. For a 60-mph design speed, the minimum recommended radius is 1,200 feet with a minimum stopping sight distance (SSD) of 570 feet.

Appendix C summarizes each horizontal curve identified in the as-built plans for the study corridor. As-built plans are only available for the first 14.35 miles of the corridor. A determination of whether the curve met standards was decided based on the design criteria discussed previously. The controlling design criteria for the horizontal curves are radius and SSD. SSD for a horizontal curve is evaluated based on the ability to see through the inside of the corner. Minimum sight obstruction distances were calculated based on the criteria contained in the *AASHTO Greenbook*. The minimum sight obstruction distance is measured from the center of the inside travel lane and defines the area that should be clear of obstructions to allow for the recommended SSD.

Based on review of as-built plans, there are 29 horizontal curves along the first 14.35 miles of the study area corridor. Of these curves, 14 do not meet 60-mph design standards for horizontal curvature. For the remaining portion of the corridor, horizontal curve radii were measured based off aerial photography. Only those curves with design speeds less than 60 mph were identified. A total of 13 horizontal curves were identified along this segment with design speeds less than 60 mph. Several of these curves, although substandard in radius, are very short in length and are not necessarily a concern for sight distance. **Table 2.7** summarizes the horizontal curves and the design speed that each curve meets.

Table 2.7: Horizontal Curves Design Speed Met

Design Speed Met (mph)	MP 0.0 – 14.35		Design Speed Met (mph)*	MP 14.35 – 19.5
	Number of Curves	Percent of Curves		Number of Curves*
Total ≥ 60	**15**	**52%**	**Total ≥ 60**	**
55	3	10%	50	2
50	9	31%	45	1
45	1	3%	40	5
40	0	0%	35	3
35	1	3%	≤ 30	2
Total ≤ 60	**14**	**48%**	**Total ≤ 60**	**13**

** Estimated based on aerial photography*
*** Not determined*

2.2.3. Vertical Alignment

Vertical alignment is a measure of the elevation change of a roadway. The length and steepness of grades directly affect the operational characteristics of the roadway. The controlling design limits for vertical curves are SSD, vertical curvature (K-value), and maximum grade. Vertical curves can be placed into two categories: crest and sag. A crest curve is created at the top of a hill or when the grade decreases. Conversely, a sag curve occurs at the bottom of a hill or when the grade increases.

Park County Transportation Standards state that the maximum allowable grade of new roads is 10 percent. Improvements to existing facilities should be in accordance with AASHTO standards which state that the maximum allowable grades range between 5 and 10 percent depending on design speed and terrain. No vertical profile data was available for the study corridor. The existing as-builts did not include roadway

profiles or vertical curve information. During the field review three vertical curves were visually observed to have poor sight distances. These locations are at approximately MP 8.0, 17.5, and 18.1.

2.2.4. Sight Distance

Sight distance is the length of roadway visible to a driver and is influenced by the geometry of the road (horizontal or vertical curves) and obstacles alongside the road. Sight distance is commonly defined in three ways: passing sight distance, stopping sight distance, and intersection sight distance. In general, the driver of a vehicle should have an unobstructed view and enough distance to perceive, react, and safely stop for or avoid approaching vehicles and other hazards.

Although roadway geometrics are not available, it was observed during the field review that there are two locations along Shields River Road where trees and other vegetation may inhibit the driver's sight distance. These are located at approximately MP 11.3 and 13.8. There were also five locations where the roadway geometrics limited the sight distance of the observers. Of these five locations, two were horizontal curves (MP 19.3 and 19.4), two were vertical curves (MP 17.5 and 18.1), and one was a compound horizontal/vertical curve (MP 8.0).

2.2.5. Clear Zone

The FHWA defines a clear zone as the unobstructed, traversable roadside area that allows a driver to stop safely or regain control of a vehicle that has left the roadway. The width of the clear zone is based on traffic volumes, speeds, and slopes. Clear roadsides consider both fixed objects and terrain that may cause vehicles to rollover. Due to the low ADT and rural context of Shield River Road, a clear zone of 7 to 10 feet with recoverable slopes is recommended. No cross-sectional data were available to evaluate clear zone distances.

In some locations, vegetation within the clear zone limits sight distance for drivers. This can hinder the ability of a driver to see oncoming traffic.

2.3. Traffic Conditions

Park County staff estimate traffic volumes on Shields River Road based on the number of year-round residences in the area which are only accessible by Shields River Road, Forest Service cabin occupancy rates, and permitting information for grazing and lodging in the area. Based on these factors, the current ADT on Shields River Road is estimated to be 245 vpd. During the peak season, Park County Staff estimates there are 340 vpd traveling on Shields River Road. It is also estimated that approximately eight percent of the traffic volumes are heavy trucks, including agriculture and logging vehicles.

To supplement the Park County traffic estimates, traffic data were collected between July 2 and July 9, 2019. This week was selected to gather data during a typically busy recreational week. Road tubes were set up at four sites along the corridor at approximately MP 0.5, 5.2, 14.3, and 19.3. **Table 2.8** presents the ADT data collected at these sites. Due to the holiday nature of the time period studied, the data were separated between weekday and weekend traffic. As can be seen in the data, there is more traffic on the weekend likely due to recreational use.

Table 2.8: Existing Traffic Volumes

Location (MP)	Weekday ADT (vpd)	Weekend ADT (vpd)	Combined Total ADT (vpd)
0.5	285	311	295
5.2	195	213	201
14.3	151	197	162
19.3	39	72	49

From these data it can be seen that traffic decreases with distance along the Shields River Road corridor. The site at MP 14.3 was selected to determine how much traffic is using Smith Creek Road, likely for recreational access. Based on the difference between the volumes measured at MPs 14.3 and 19.3, approximately 110 vpd are using Smith Creek Road.

Park County staff also estimated projected traffic volumes on Shields River Road based on projected land uses and operations in the study area. Staff estimate that traffic volumes on Shields River Road will increase by approximately 20 percent over the next 20 years. With this growth rate, the ADT is projected to be 294 vpd and the peak season ADT is projected to be 408 vpd.

2.4. Safety

MDT provided crash data on Shields River Road from January 1, 2009, to December 31, 2018. Records show seven crashes occurring within the study area during the crash analysis period. Of the recorded crashes, two resulted in serious injuries, one resulted in minor injuries, three resulted in property damage only, and in one crash the injuries were unknown. In addition to these seven crashes, three fatality markers were documented along the roadway during the field review. Further investigation showed that all three crashes occurred outside of the 10-year analysis period. A detailed crash report was available for the fatality near MP 6.0, which was a roll over crash that occurred in 2005. Information on the other two fatal crashes was not available. **Figure 2.5** presents the location and severity of the crashes occurring during the 10-year analysis period and the three additional fatal crashes noted during the field review. Note that this evaluation only includes those crashes that have been reported by a patrolling officer. Given the location and rural context of the roadway, there are likely additional crashes that have occurred but went unreported.

2.4.1. Safety Trends, Contributing Factors, and Crash Clusters

In general, crashes on Shields River Road are rare. During the 10-year crash analysis period, less than 1 crash occurred per year, on average, with 2 occurring in 2017. All of the crashes occurred in the spring and summer months (March through August) and three occurred in July. The majority of the crashes (five) occurred at nighttime under unlit conditions.

The main crash types were fixed object collisions (three) and rollover collisions (two). An additional fatal rollover crash occurred outside the 10-year analysis period. The other crash types were domestic animal and not fixed object or debris. An animal in the roadway was listed as a contributing circumstance in two of the crashes. Three of the crashes (two rollover and one fixed object) involved an impaired driver.

All crashes involved a single vehicle and six of the seven involved only one occupant. Three of the crashes occurred under dry road conditions, three under wet, icy, or frost covered roads, and in one crash the road condition was unknown. Four of the crashes occurred when it was cloudy, two when it was clear, and one when it was raining. All of the crashes occurred within the first 7.5 miles of the study area. There is a cluster of rollover crashes near MP 6.0. This area has been discussed as a safety concern due to the steep side slopes, deteriorating roadway edges, and limited sight distance on the horizontal and vertical curves.

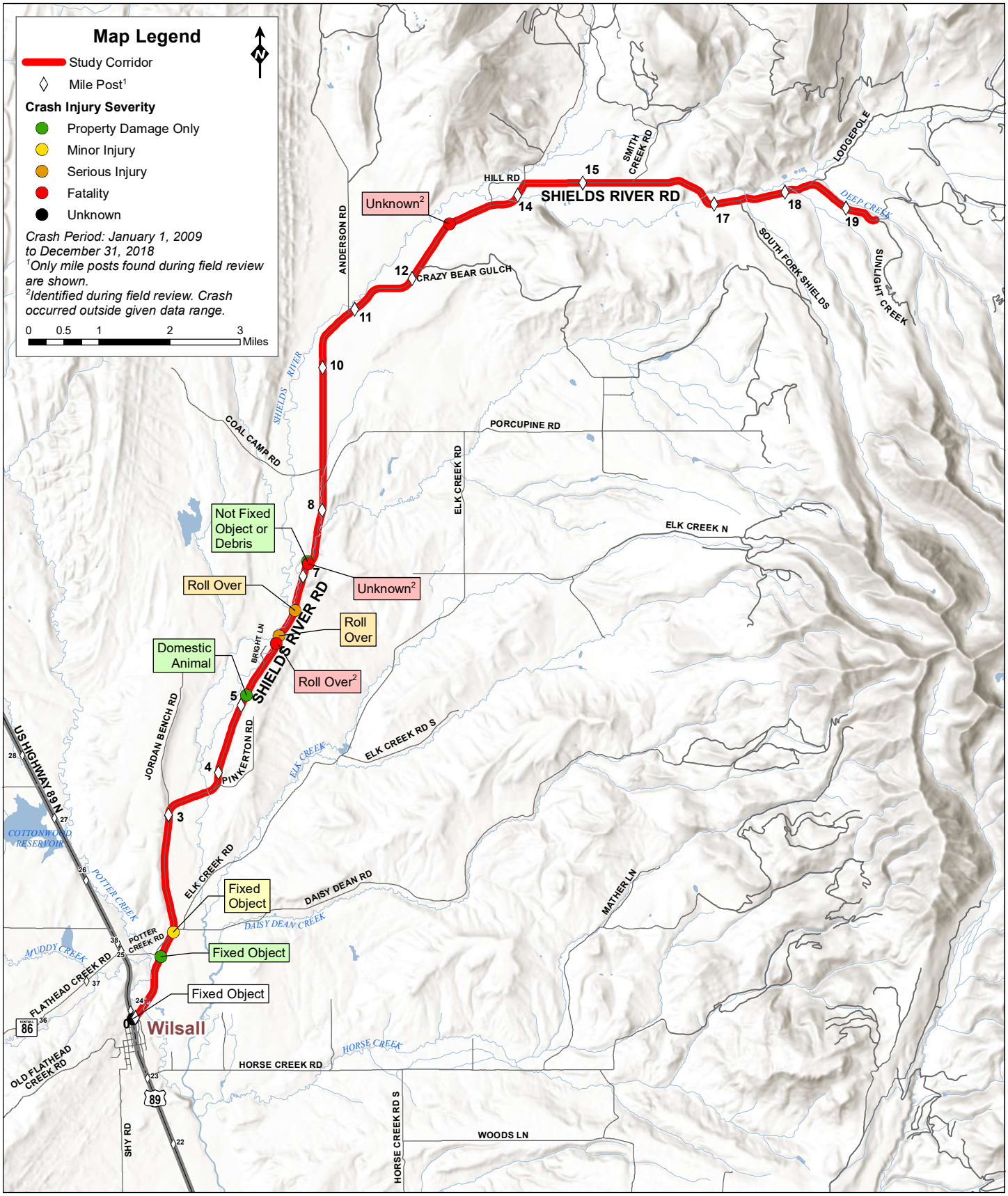

Figure 2.5: Crash Locations

2.5. Other Vulnerabilities

There are locations along the corridor where natural land events, including landslides and erosion, have occurred. The following sections discuss these areas and how they may impact future road design, maintenance, and repair work on Shields River Road. **Figure 2.6** presents these additional vulnerabilities along the study corridor as identified during the field review.

Steep Slopes

There are many locations along the corridor that have steep side slopes on one or both sides of the roadway. Areas with steep slopes may have an elevated risk of erosion. Slope failures, or landslides, typically occur where a slope is over-steep, where material is not compacted, or where cuts in natural soils encounter groundwater or zones of weak material. These areas of steep slopes are especially important to consider to help minimize the risk of slope failure and avoid the potential for expensive road repairs or road closures. Steep slopes can be stabilized by flattening the slope, adding drainage, or using retaining structures. There were 23 locations identified during the field review as having steep side slopes. Almost half of these steep slope locations (11) are between MP 3.6 and 8.1.

Areas with steep slopes may have an elevated risk of erosion, slope failures, or landslides. Steep slopes also pose a safety risk to drivers as they are difficult to recover from.

Landslides

Two landslide areas were documented in the study area during field review. The first is approximately located between MP 6.1 and 6.5. This landslide area was informally rated as medium severity during the field review. The second landslide location is at approximately MP 7.5. This landslide was rated as low severity. Both landslides occurred on the right side of the roadway.

A report prepared for MDT in 2002[17] indicates that there are other slide areas located along the Shields River approximately between MP 14.0 through the end of the study area. These slides are primarily associated with intrusive bodies and are located along stream cuts which indicates that undercutting played a role in the movement. The report also indicates that there is some faulting and folds located in these areas.

Two landslide areas are documented along the corridor during field review. Slides caused by stream undercutting are also reportedly present in the study area.

Drainage/Erosion

Improper drainage on a roadway can lead to serious erosion issues. When water falls on roads and is not removed promptly, the water seeps into lower layers of the pavement, weakens the soil which can compromise the soil stability and undermine the capacity of the pavement to carry traffic. There were seven locations along the corridor observed to have poor drainage or erosion issues during the field review. In some of these locations there were existing culverts built to divert water from the roadway while others had sections of culverts which had been detached allowing water to pool along the roadside.

Improper drainage on the roadway can lead to serious erosion issues including deteriorated roadway edges.

Subgrade

There are locations along the roadway where the subgrade was noted as being deficient during the field review. A weak or deteriorating subgrade is typically characterized by rutting, depressions, or upheaval in the pavement. This distress on the pavement can be caused by a variety of factors including frost heave, lack of compaction, or weak materials. The locations where deficient subgrade was noted occurred between MP 6.2 and 13.5.

A weak subgrade is characterized by rutting, depressions, or upheaval in pavement. There are several locations along the roadway where the subgrade was noted as being deficient.

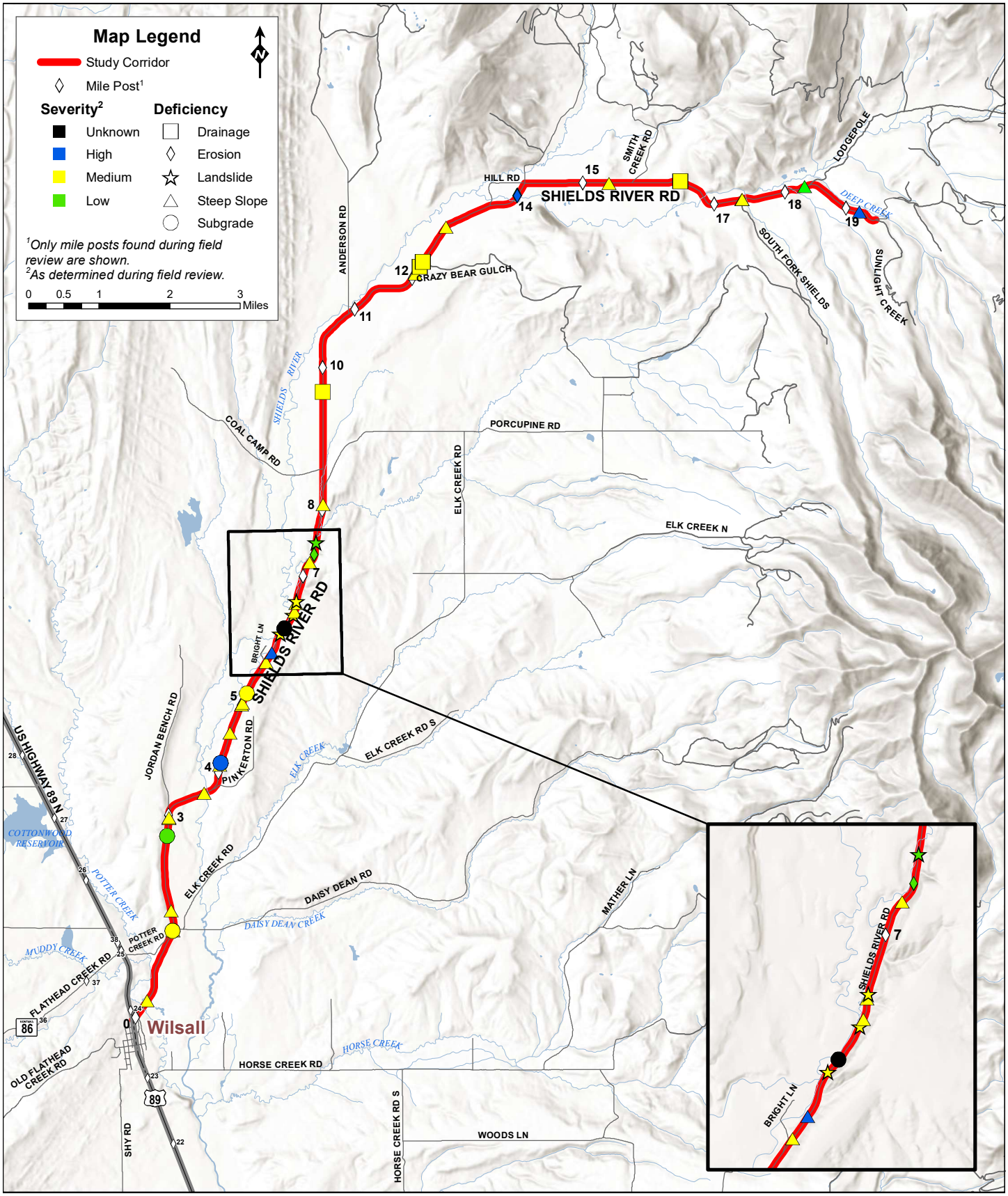

Figure 2.6: Other Vulnerabilities

3.0. ENVIRONMENTAL SETTING

As with any roadway improvement project, the current and potential environmental conditions need to be considered. Most environmental concerns within the study area that may impact project development relate to the Shields River and the habitat it provides. Shields River and several other streams cross Shields River Road several times throughout the study area. Culverts and bridges have been placed to control these crossings however there are locations where erosion from the water has damaged the roadway causing the need for repairs. The river and surrounding wetlands provide a substantial habitat that supports diverse populations of fish and wildlife. Some of the species present in the study area are listed, or proposed for listing, under the Endangered Species Act (ESA).

An *Environmental Scan (Scan)* (see **Appendix D**) has been prepared documenting the current environmental conditions. This section provides a summary of *Scan* which provides a planning-level overview of resources and identifies potential constraints and opportunities based on readily available environmental information. Multiple environmental studies have been conducted in the study area over the course of several decades. Some of these have addressed proposed improvements to Shields River Road, while others have been concerned with larger-scale issues of land and resource management. Information from these past studies was reviewed and supplemented with publicly available data from federal, state, and local agencies. Improvement projects forwarded from this planning project which may impact the Shields River, the species supported by the watershed, the land surrounding the roadway, and the nearby populations will need to be considered. Project-level environmental analysis would be required for any improvements forwarded from this study. Information contained in the *Scan* may be used to support future environmental

3.1. PHYSICAL ENVIRONMENT

The following subsections present an overview of items related to the physical environment of the study area.

3.1.1. Land Ownership and Land Use

Almost all the land in the study area is privately held and are primarily used for agriculture (grazing and crop production) and forestry. There are also several residences accessed by Shields River Road along with two state-owned tracts within close proximity which are designated as State Trust Lands for agriculture and grazing. These lands are managed by the Montana Department of Natural Resources and Conservation. There are also conservation easements held by Montana Land Reliance, Montana Department of Transportation, and Gallatin Valley Land Trust in the study area. If any improvement options are forwarded from the planning study, additional research and coordination would be needed to ascertain the specific encumbrances that may be attached to each parcel of land.

3.1.2. Soil Resources and Prime Farmland

The *Farmland Policy Protection Act* (FPPA) (7 U.S.C. 4201 et. seq.) requires special consideration be given to soils considered as prime farmland, unique farmland, or farmland of statewide or local importance by the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS). The FPPA is intended to minimize the impact Federal programs have on the unnecessary and irreversible conversion of farmland to nonagricultural uses. Based on the NRCS classifications, there are no soils classified as prime farmland, unique farmland, or farmland of local importance in the study area. Some mapped soils on the eastern side of the roadway between Pinkerton Road and Porcupine Road are classified as farmland of statewide importance.

Projects are subject to requirements in the FPPA if they may irreversibly convert farmland (directly or indirectly) to nonagricultural use. If any improvement options are forwarded from the planning study, coordination with the NRCS will be required to determine if the FPPA applies and necessary NRCS processing requirements. Projects planned and completed without the assistance of a Federal agency are not subject to the FPPA.

3.1.3. Geologic Hazards

The study area within the Shields River drainage basin which lies within the western part of the Crazy Mountains structural basin. The Crazy Mountains were formed by a massive domal uplift resulting in varied and complex bedrock outcrops. The Wilsall/Crazy Mountain area is in a moderate seismic risk zone. Earthquakes ranging from magnitude 1.5 up to 4.0 are not uncommon in the area. Geotechnical investigations will likely be required for reconstruction or significant improvements to Shields River Road to determine potential stability, erosion, and settlement concerns posed by surface geology and soil conditions.

3.1.4. Surface Waters

The study area lies entirely within the Shields River Watershed. The roadway also lies partially within the Lower Flathead Creek, Cottonwood Creek, Shields River-Antelope Creek, Shields River-Kavanaugh Creek, Porcupine Creek, Meadow Creek, and Shields River-Bennett Creek sub watersheds.

Shields River Road generally parallels the Shields River throughout the entire study area. For approximately one mile, the roadway also parallels Flathead Creek. For an approximate 2.5-mile segment between Elk Creek W Road and Coal Camp Road, Shields River Road also parallels Porcupine Creek and one of its unnamed tributaries. The corridor crosses several streams and other named perennial, fish-bearing streams within the study area. Additional unnamed streams, wetlands, irrigation canals, ditches, and other waterbodies are also present.

Shields River Road generally parallels the Shields River throughout the entire study area. The Shields River main stem is currently listed as "impaired" by MDEQ.

Road construction and reconstruction activities such as culvert installation or replacement, placement of fill, or bank stabilization have the potential for impacts to surface waters. Coordination with federal, state, and local agencies would be necessary to determine the appropriate permits based on the improvement options forwarded from this study. Impacts should be avoided and minimized to the maximum extent practicable. Impacts to streams and wetlands may trigger compensatory mitigation requirements.

Water Quality

The Shields River main stem is currently listed as "impaired" by the Montana Department of Environmental Quality (MDEQ) due to physical and ecology impacts derived mainly from sediment. The source of impairment is crop production, grazing in riparian zones, silviculture activities, and streambank modifications. The waterbody is classified as Category 4A by MDEQ, meaning all required total maximum daily loads are in place to correct identified impairments or threats. Shields River is also classified by MDEQ as Use Class B-1. The waterbody's existing and anticipated beneficial use is primarily aquatic life (salmonid). Class B-1 waterbodies may also benefit drinking water, recreation, agriculture, or industry, although these uses have not yet been assessed.

The Park Conservation District sponsors the *Shields River Watershed Restoration Plan* which was accepted by the MDEQ in June 2012 as a means of charting a path to improved water quality. The plan was developed by the Shields Valley Watershed Group which consists of landowners coordinating efforts to maintain productive and sustainable ranching lifestyles. Several restoration projects led by USFS and Montana Fish, Wildlife, and Parks (FWP) have also been completed to improve water quality and stream habitats within the Shields River watershed.

In Montana, stormwater management is regulated by MDEQ. A Montana Pollutant Discharge Elimination System general permit is required for stormwater discharges from construction activities that result in the disturbance of equal to or greater than one acre of total land area. The applicability of this permit for Shields River Road would need to be reviewed for any project that may be brought forward from the planning study.

Irrigation Features

About 5,100 acres of lands surrounding the study area are irrigated with water originating in the upper Shields River basin. An additional 600 acres of land in the Porcupine Creek drainage is irrigated with water diverted from the South Fork of the Shields River. The two general types of irrigation in the Shields River Watershed are flood and sprinkler irrigation. The Big Canal is the largest irrigation canal in the study area at about 12 miles long and supplying about 2,200 acres of irrigated land. The Big Canal feeds several smaller ditches with the largest being the Myer's Ditch. The Big Canal crosses Shields River Road at near MP 2.8 and Myer's Ditch crosses at MP 3.2. Another, the Horse Camp Ditch, supplies water to about 760 acres of irrigated lands and crosses Shields River Road at MP 12.0. Several other smaller ditches and canals exist throughout the study area and throughout the Shields River Watershed. Irrigation facilities that may be affected by improvement options advanced from this planning project should be coordinated with appropriate overseeing authorities and affected landowners to avoid or minimize impacts to agricultural operations and downstream water users.

3.1.5. Groundwater

Groundwater resources in northern Park County are under increasing pressure from land use change from irrigated cropland to residential. Much of the new development is dependent on individual household wells for potable water, and on septic systems for wastewater disposal. With increased use, there is a potential for groundwater resources to become overutilized in some locations. Based on available data, there are approximately 30 wells located within the study area. Well depths vary by individual location, but the majority of wells drilled in the study area have been drilled to depths of less than 100 feet. Static water levels vary considerably but range from 5 to 30 feet below the ground surface in most locations. Impacts to the groundwater supply should be considered in any improvement option that may be brought forward from the planning study.

3.1.6. Floodplains and Floodways

Several segments of Shields River Road cross or lie within Zone A (100-year floodplain) of the Shields River although the majority of the roadway lies outside the floodplain boundary (Zone X). Numerous major flood events have occurred within the Shields River Watershed in the past. High precipitation events and snowmelt from the Crazy Mountains are primary causes of flooding of the Shields River, however, the most significant flood events have occurred south of the study area. The *Park County Flood Hazard Management Regulations* regulate development activities in flood hazard areas. If any improvement options advanced from this study cross encroach on a regulated flood hazard area, it will be necessary to coordinate with and obtain a floodplain permit from the county floodplain administrator.

3.1.7. Wetlands and Waters of the U.S.

Available data show primarily freshwater emergent wetlands and freshwater forested/shrub wetlands along the Shields River and other intermittent rivers, streams, and drainages. Wetland delineations would be required if improvement options are forwarded from the planning study that could potentially affect wetlands. Future projects in the study area would need to incorporate project design features to avoid and minimize adverse impacts on wetlands to the maximum extent practicable. Various state and federal water quality permits may be required to implement construction projects on the Shields River Road.

3.1.8. Hazardous Substances

The following summarizes potential hazardous sites within the study area:

- **Hazardous Waste Release Sites:** Wilsall PCB Site, one mile north of Wilsall, is a smaller than one-acre area where a former resident dismantled electrical transformers and burned transformer oil, contaminating soils with polychlorinated biphenyls (PCBs), dioxins, and heavy metals. This site was identified as a hazardous waste release site in 1991 and was delisted in 1996 following cleanup activities.
- **Underground Storage Tanks:** There are four active underground storage tanks at the Park Farmers Co-Op approximately one-half mile from Shields River Road. The tanks are located at the intersection of Elliot Street South (US Highway 89) and Shields Street West. All of the tanks are actively in use.
- **Petroleum Tank Releases:** Mantz Texaco (Site 3403476) was identified as the site of a petroleum release in Wilsall, the incident was resolved in 2007. A second site, Park Farmers Coop (Site 3406686), also located in Wilsall was identified as the site of a petroleum release in August 1993 but it has not yet been resolved. A third site, Wilsall Consolidated School (Site 3405391), was resolved in 2000. Spear Lazy U Ranch L P (Site 3401300), is the fourth petroleum release site in the study area. It is located on Hill Road just north of Shields River Road and a release was identified in 2000 and resolved in 2003.

At this time, none of the hazardous substance sites are expected to be “must avoid” locations or likely to affect project design. However, if a project were to overlap a hazardous substance site, a soil investigation would likely be needed to determine the extent of contamination and whether remediation may be necessary. If contaminated soils are present, a special provision regarding handling contaminated soils may be needed.

3.1.9. Air Quality

Park County is considered an attainment area for all pollutants and there are no nearby nonattainment areas. Since Park County is considered in attainment, for all pollutants, federally-funded transportation projects on Shields River Road by the FHWA would not be subject to conformity requirements.

3.1.10. Noise

Residences in the study area comprise the only sensitive noise receptors that could be affected by roadway improvements on Shields River Road. Detailed noise analyses are often conducted when the potential for noise impacts exists due to substantial changes in roadway design or configuration. However, given the rural environment, low volumes of traffic, and dispersed nature of residences in the study area, noise impacts resulting from potential roadway improvements are unlikely. Construction activities associated with improvements to Shields River Road may result in localized and temporary noise impacts in the vicinity of residences. These impacts can be minimized by incorporating measures to control of noise sources during construction.

3.2. Biological Resources

The following information applies to the biological environment within the study area and reflects a baseline natural resource condition. Depending on the level of detail available through the high-level baseline scan, some of the information is presented at the county level, some at the study area level, and some at the corridor level.

3.2.1. Vegetation

Native vegetation in the Shields River Valley is consistent with elevation-based gradients in mountain valleys of the northern Rocky Mountains. Some of the riparian vegetation at lower elevations in the Shields River watershed is woody species such as cottonwood, willow, and alder, but much of the woody vegetation in agricultural areas was historically removed and has been replaced by a mix of herbaceous vegetation and shrubs. As elevation increases, the vegetation turns to mesic and xeric shrub lands dominated by sagebrush, transitions to grasslands and, eventually, culminates in coniferous forests. The vegetation in the study area consists of agriculture/crops, grasslands, riparian, shrubs, and coniferous and deciduous forest. The forestland includes lodgepole pines, Douglas firs, and mixed mesic and subalpine forest species.

Invasive weeds are a growing concern in the Shields River watershed. Priority species include Russian and spotted knapweed, leafy spurge, Dalmation toadflax, and whitetop. Russian and spotted knapweeds, Dalmatian toadflax, and leafy spurge have been identified by the Montana Noxious Weed Trust Fund as weeds that the Montana noxious weed survey and mapping system must monitor on a section basis. The Park County Weed Control District has been active in public education for noxious weeds. New developments are required to develop a weed management plan and landowners are encouraged to use biocontrol or large animal grazing. If improvement options are forwarded from this study, field surveys for noxious weeds should take place before any ground disturbance occurs. Proposed projects should incorporate applicable practices outlined by the Park County Weed Control District. Any projects forwarded from the feasibility study within the National Forest would need to comply with USFS management policies.

Whitebark pines (*Pinus albicaulis*) are designated as a candidate species for listing under the ESA. Whitebark pines are typically found in cold, windy, high elevation or high latitude sites in western North America and as a result, many stands are geographically isolated. Whitebark pines are unlikely to occur along Shields River Road but may potential occur on high elevation forest lands in the area.

3.2.2. Fish and Wildlife

The Shields River Watershed provides breeding, resting, foraging, and migratory habitat for many species of fish and wildlife. The watershed has approximately 453 miles of habitat with 277 miles being inhabited by both native and non-native species and 176 miles having native fish species only. The study area supports eleven species among four families of fish.

Yellowstone cutthroat trout is considered a sensitive species by the USFS and a Species of Concern by Montana. The Shields River watershed provides substantial habitat for Yellowstone cutthroat trout – the watershed contains 66 percent of the core and conservation populations. In the past twenty years, over 4 million dollars has been spent on diversion dams and fish passage infrastructure within parts of the Shields River to maximize the watershed as a basin-level stronghold for Yellowstone cutthroat trout.

The Shields River Valley supports diverse wildlife populations. The elk population is large with the majority occurring on the west side of the valley near the study area. The Shields River and its tributaries provide an attractive habitat for moose, and they can often be seen from Shields River Road during the winter. The Shields River Valley also supports an unusually high concentration of golden eagles; the largest antelope

population in Park County; and one of the largest mountain goat populations in the lower 48 states. The wetlands provide important staging, resting, and viewing areas for migratory waterfowl and shorebirds. A small population of remnant sage grouse, a species of concern throughout the western US, can also be found in the Shields River Valley.

If any improvement projects are brought forward from this study, coordination should occur with fish and wildlife biologists from Montana FWP and the USFS to gain further insight into issues related to the management of these species, as well as measures for avoiding, minimizing, or mitigating adverse effects on species and habitat.

3.2.3. Threatened and Endangered Species

As noted earlier, whitebark pines, a candidate plant species for listing under the ESA, occurs within the Custer-Gallatin National Forest and is typically found in high elevation, upper montane habitat near the treeline. There are also three species of wildlife known or expected to use habitats in Park County which are listed or proposed for listing under the ESA. The grizzly bear and Canada lynx are threatened species present in the county while the wolverine is a proposed for listing species that may occur within mountainous and forested areas of Park County. All three of these species have been observed within the study area based on available information, although there are no designated critical habitats for these species within the study area. The wolverine is the only species that has been documented as having a sustained presence within the study area. Any improvements forwarded from the planning study would need to undergo review for compliance with the provisions of the ESA. The listing status of species and critical habitat can change over time; therefore, an up-to-date list of potentially affected species and critical habitats should be reviewed for each project.

3.2.4. Other Species of Concern

Species of Concern are native animals or plants that are at-risk due to declining population trends, threats to their habitats, restricted distribution, among other factors. The *Environmental Scan* lists three mammals, eight birds, one fish, and three plants considered to be Species of Concern with occurrences in this area of Montana and presents their federal and state statuses. A species occurrence is an area of land or water in which a species is, or was, present. If any projects are brought forward from this study, a thorough review of wildlife sightings databases should be conducted, and habitats near any proposed project sites should be evaluated to determine their suitability for any Species of Concern. Measures to avoid or minimize disturbance of these species or their habitat should be incorporated into project design and implementation.

3.3. Social and Cultural Resources

The following subsections present an overview of the social and cultural environment within the study area.

3.3.1. Demographic and Economic Conditions

Implementing regulations for the National Environmental Policy Act require federal agencies to assess potential social and economic impacts resulting from proposed actions. FHWA guidelines recommend consideration of impacts to neighborhoods and community cohesion, social groups including minority populations, and local and/or regional economies, as well as growth and development that may be induced by transportation improvements. Demographic and economic information presented in this section is intended to assist in identifying populations that might be affected by improvements in the study area.

According to the *American Community Survey* (ACS), Wilsall and Park County are much less diverse, racially and ethnically, than the state. Persons identifying as White make up 100 percent of the population in Wilsall and approximately 95 percent of the population in Park County. The percentage of the population

identifying as American Indian or Alaska Native is less in Park County (0.7 percent) as compared to Montana (4.4 percent). For all other races, Park County and Montana have comparable population distributions.

Median household income in Wilsall is higher than both county and state median values. The median income in Wilsall is approximately 20 percent more than all households in Montana and 38 percent more than all households in Park County. The wealth of the Wilsall community is reflected in the two percent poverty rate cited in the ACS. The county and state have comparable poverty rates (13 and 14 percent, respectively) but the unemployment rate in Park County is approximately half of that of Montana (2.8 versus 4.8 percent, respectively) over the 50-year period considered in the ACS.

Park County's economy is strong and growing. This is primarily attributed to the proximity of Yellowstone National Park which continues to attract high volumes of tourists. Park visitors from all over the world allow lodging, restaurant, retail, and entertainment industries in the county to thrive. However, in the northern part of the county, in the Shields River Valley, the economy has historically been driven by agriculture, forestry, fishing, and hunting. About 30 years ago, the Town of Wilsall was a small trade town on a Northern Pacific Railroad spur line. But the as the popularity of the Shields River Valley for anglers, hunters, and other recreationists has grown, Wilsall and surrounding communities have experienced notable increases in construction, retail, educational, and healthcare industries. Recreational facilities and opportunities available via Shields River Road, and its access to Custer-Gallatin National Forest, support the local businesses that sell fuel, sporting and camping equipment, groceries, meals, clothing, souvenirs, and other tourist associated commodities. Recreationists also contribute to the local economy by hiring one of the nearly two dozen local commercial outfitters or guides for fishing, hunting, horseback riding and/or pack trip activities permitted in this area.

Title VI of the *United States Civil Rights Act of 1964* and *Executive Order 12898* require that projects receiving federal funds must not result in disproportionately high and adverse effects on minority or low-income populations. For transportation projects, this means that minority or low-income populations must not be disproportionately isolated, displaced, or otherwise subjected to adverse effects. If improvement options are forwarded from the planning study into project development, environmental justice would need to be further evaluated during the project development process. However, demographic data obtained for this study indicates minority and/or low-income populations are not present in the area.

3.3.2. Recreational Resources

In addition to providing access for an estimated 460 residences, Shields River Road also provides access to a multitude of developed and dispersed recreation opportunities in the Custer-Gallatin National Forest. Park County Public Works Department staff estimates that approximately 30,000 people visit and recreate in this area of Custer-Gallatin National Forest each year, although no formal counts have been conducted.

Primary visitor destinations accessed by Shields River Road include Forest Service cabins, vacation rentals, designated and undesignated dispersed campsites, day-use sites, developed trailheads, trail systems, ATV routes, mountain lakes, and streams. Shields River Road, and land accessible by the roadway, is used for a variety of outdoor recreation experiences including bicycling, running, hiking, wildlife viewing, motorized activities, horseback riding, fishing, hunting, camping, and winter sports.

Park County staff estimate that 30,000 people visit and recreate in this area of Custer-Gallatin National Forest each year.

Access to the Crazy Mountains and historic mountain trails has long been the subject of contentious debate among private landowners, the Forest Service, and recreationists. Many of the public lands are accessed via trails that cross private land at the base of the mountains. Over the years, many of the access points have been closed through landowner disputes. This leaves Shields River Road as the most heavily utilized road by recreationalists on the west side of the Crazy Mountains.

Recreation areas may be protected under Section 4(f) of the *US Department of Transportation Act of 1966* if they are publicly owned, open to the public during normal hours of operation, and serve recreation activities as a major purpose as stated in adopted planning documents. There are no known designated day use sites, fishing accesses, trailheads, or camp sites within the study area that may be impacted by improvement options forwarded from the planning study. If improvement options are forwarded from the planning study, potential effects on recreational use should be investigated and appropriately considered in accordance with Section 4(f).

Projects may also be subject to Section 6(f) of the *Land and Water Conservation Fund Act* which was enacted to preserve, develop, and ensure the quality and quantity of outdoor recreation resources. Section 6(f) protection applies to all projects that affect recreational lands purchased or improved with Land and Water Conservation funds. Based on a project funding review, no areas qualify for protection under Section 6(f) within the study area.

3.3.3. Cultural and Historic Resources

Federal agencies are required to consider the effects of their undertakings (including funding, licensing, or permitting the undertakings of other entities) on historic properties and must consult affected American Indian tribes. Available data identified the following tribes with potential interests in Park County, Montana:

- Apache Tribe of Oklahoma
- Crow Tribe of Montana
- Fort Belknap Indian Community of the Fort Belknap Reservation of Montana
- Shoshone-Bannock Tribes of the Fort Hall Reservation

Implementing regulations also require agencies to seek ways of avoiding, minimizing, or mitigating any adverse effects on historic properties. There are no historic properties listed on the National Register of Historic Places within the study area. If any projects are brought forward from the planning study, a cultural resource survey for unrecorded historic and archaeological properties would need to be completed within the area of potential effect defined for each project. Direct and indirect impacts (such as visual, noise, and access impacts) to eligible or listed properties would need to be considered if improvements options are carried forward.

3.3.4. Visual Resources

The study area encompasses a wide variety of settings including the Shields River Road roadway corridor and county roads, rural development, national forestland, other public lands, and wetlands. Actions that may have visual impacts include projects on new location or that involve expansion, realignment or other changes that could alter the character of an existing landscape or move the roadway closer to residential areas, parks and recreation areas, historic or other culturally important resources.

4.0. AREAS OF CONCERN AND CONSIDERATION

The following is a summary of observed trends and areas for further consideration. These areas were identified through review of as-built drawings, field review, past studies, public databases, and other resources. More discussion has been provided in the previous sections and is reiterated here as appropriate.

4.1. TRANSPORTATION CONDITIONS

Section 2 identifies physical features, geometric conditions, traffic conditions, safety trends, and other vulnerabilities within the study area that may be affected by potential future improvements arising from this study. Project-level traffic, geometric, or safety analysis may be required for any improvements forwarded from this project. The following transportation system conditions were noted:

Physical Features and Characteristics

- All of the bridges along the corridor are rated “fair” condition or “good” condition. All bridges meet minimum design load rating standards.
- Nearly 70 culverts were identified along the study corridor, 17 of those culverts were 30” or larger. Approximately 20 percent of the culverts were in poor condition.
- The corridor does not meet the AASHTO minimum roadway surface width of 32 feet or the Park County minimum roadway width of 28 feet. The roadway width ranges from 22 to 29 feet, is paved from MP 0.0 to 15.8, and is gravel surfaced from MP 15.8 to 19.5.
- The majority of the pavement in the corridor is in poor condition while the gravel is in good condition.

Geometric Conditions

- Based on as-built plans, about half of the horizontal curves on the first 14.35 miles of the study area meet or exceed a 60-mph design speed. Based on aerial photography, 13 curves on the last 4.65 miles of Shields River Road meet minimum design standards for a 60-mph design speed.
- No vertical curvature data are available; however, three vertical curves identified during the field review appear to have poor sight distances.
- There are seven locations where sight distance is limited. Two locations are affected by roadside vegetation and the roadway geometrics limit the sight distance in five locations.

Traffic Conditions

- Existing traffic volumes range from approximately 300 vpd near US 89 to 50 vpd at the end of the study corridor.
- Traffic volumes are projected to increase by approximately 20 percent of over the next 20 years.
- Heavy trucks make up approximately 8 percent of the current vehicle mix.

Safety

- Records show seven crashes occurring within the study area between January 1, 2009, to December 31, 2018. Two crashes resulted in serious injuries and two resulted in non-serious injuries. Three fatalities occurred outside the 10-year analysis period.
- Five crashes occurred at nighttime under unlit conditions.
- The main observed crash types were fixed object collisions (three) and rollover collisions (two). An additional fatal rollover crash occurred outside the 10-year analysis period.
- An animal in the roadway was listed as a contributing circumstance in two of the crashes while three of the crashes involved an impaired driver.

Other Vulnerabilities

- Steep side slopes, landslides, drainage/erosion issues, and locations with subgrade issues are common concerns on Shields River Road. These events have caused road damage in the past.

4.2. Environmental Setting

The *Environmental Scan* identifies physical, biological, social, and cultural resources within the study area that may be affected by potential future improvements arising from the *Shields River Road Planning Project*. Project-level environmental analysis would be required for any improvements forwarded from this study. Information contained in the *Environmental Scan* may be used to support future environmental documentation for compliance with the National Environmental Protection Act. The following environmental concerns were noted:

Physical Environment

- Land surrounding the study area is primarily used for agriculture (grazing and crop production) and forestry, although there are also several residences accessed by Shields River Road. Conservation easements exist on a few parcels of land adjacent to Shields River Road.
- The study area contains some soils classified as farmland of statewide importance by the NRCS.
- The Wilsall/Crazy Mountains area is in a moderate seismic risk zone. Several earthquakes ranging from magnitude 1.5 up to 4.0 have occurred in the Crazy Mountains.
- Shields River Road crosses several perennial, fish-bearing streams, additional unnamed streams, wetlands, irrigation canals and ditches throughout the study area.
- The Shields River main stem is listed as “impaired” due to impacts derived from sediments.
- Parts of Shields River Road lie within the 100-year floodplain of the Shields River.
- There is one delisted hazardous waste release site, four active underground storage tanks, and four petroleum tank release sites (three are resolved) in the study area.
- Residences in the study area comprise the only sensitive noise receptors that could be affected by roadway improvements on Shields River Road.

Biological Resources

- Invasive weeds are a growing concern in the Shields River watershed.
- The Shields River Watershed provides breeding, resting, foraging, and migratory habitat for many species of fish and wildlife. The watershed provides substantial habitat for Yellowstone cutthroat trout - the watershed contains 66% of the core and conservation populations.
- The Shields River Valley supports diverse wildlife populations including elk, moose, golden eagles, antelope, mountain goats, migratory waterfowl and shore birds, and sage grouse.
- The grizzly bear, Canada lynx, wolverine, and whitebark pine tree are listed, or candidates to be listed, under the ESA. All three wildlife species have been observed in the study area and the whitebark pine may potentially occur on high elevation forest lands in the area. Several other mammal, bird, fish, and plant Species of Concern have also been observed in the study area.

Social and Cultural Resources

- Demographic data obtained for this study indicate minority and/or low-income populations are not present in the area. The economy has historically been driven by agriculture, forestry, fishing, and hunting and is supported currently by anglers, hunters, and other recreationists.
- In addition to providing access for 460 residences, Shields River Road also provides access to over 113,000 acres of Custer-Gallatin National Forest which offers a multitude of developed and dispersed recreation opportunities.
- No resources qualifying for protection under Section 4(f) or Section 6(f) have been identified in the study area.

5.0. GOALS AND OBJECTIVES

Goals and objectives were identified based on a comprehensive review of existing information and input from the project team, stakeholders, and the public. Goals and objectives are important in explaining why a potential improvement option may be necessary. The following goals and objectives reflect the existing social, environmental, and engineering conditions and recognize the local and regional use of Shields River Road and the adjoining transportation system. In addition to identified goals and objectives, all improvement options should be sensitive to the availability of funding for recurring maintenance obligations or for the construction of new improvements.

Goal 1: Improve the safety and operation of the roadway facility.

Available crash data and anecdotal information from partnering agencies and residents indicate a need to improve the safety of Shields River Road. During field review, several locations along the corridor with limited sight distance and substandard geometry were noted. There are also locations where fatal or serious injury crashes have been reported. This goal is intended to improve the safety of the roadway in order to meet the traveling needs of the public, including both visitors to Custer-Gallatin National Forest and local residents. Roadway upgrades and/or management strategies are necessary to achieve a higher level of safety and improved operations for Shields River Road. This can be achieved by improving the roadway to meet current geometric standards (to the extent practicable), providing adequate clear zones, improving drainage conditions, providing consistent road widths, and properly maintaining the roadway.

Objectives:

- Improve roadway elements to meet current design criteria to address identified safety concerns (to the extent practicable).
- Manage travel speeds and provide adequate clear zones to improve operations and safety.
- Provide consistent roadway widths and appropriate surfacing.

Goal 2: Provide a roadway facility that accommodates future traffic growth, recreational activity, and reduces maintenance needs.

Shields River Road provides access to over 113,000 acres of the Custer-Gallatin National Forest, multiple residences, agricultural lands, and several recreation areas. The corridor is used by local and regional traffic including passenger vehicles, commercial vehicles, agricultural equipment, pedestrians, bicyclists, ATVs, and others. The number of visitors to the National Forest is expected to continue to grow over time due to increased recreational interest and opportunities in the area. As a result, Shields River Road is expected to realize an increase in traffic, by both motorized and non-motorized transportation modes. As activity on the roadway increases, maintenance needs will also continue to increase. Proper and regular maintenance of Shields River Road will help ensure the corridor continues to adequately serve residents and visitors in the future.

Objectives:

- Accommodate existing and future travel demands.
- Address non-motorized facilities consistent with local planning efforts.
- Enhance connectivity for residents and regional users accessing recreational lands.
- Reduce maintenance needs.

Goal 3: Minimize adverse impacts to the environmental, cultural, scenic, and recreational characteristics of the study area.

The Shields River Road serves residential, agricultural, and recreational lands. Over the past several years, this portion of Park County has become one of the most popular recreational destinations on the west side

of the Crazy Mountains. Because of its location along the Shields River and the unique scenic and recreational characteristics of the area, preservation of wildlife and aquatic connectivity and habitat are issues of high importance. All improvements should be reviewed for their potential impact to the environmental, scenic, cultural, and recreational aspects of the corridor.

Objectives:

- Minimize adverse impacts to riparian environments.
- Minimize adverse impacts to the wildlife and aquatic organisms.
- Provide reasonable access to recreational sites near the study area.
- Avoid/minimize adverse impacts to historic, cultural, and archaeological resources.

6.0. IMPROVEMENT OPTIONS

This section contains a list of potential improvements intended to address previously identified issues and areas of concern and satisfy corridor goals and objectives outlined in **Section 5.0**. The improvement options reflect input from stakeholders and the public, as well as information gathered from a thorough evaluation of the existing and projected conditions of the study corridor. The following steps were applied to develop improvement options:

1. Identify roadway issues and areas of concern based on field review, engineering analysis of as-built drawings, crash data analysis, and consultation with stakeholders.
2. Identify overall corridor goals and objectives.
3. Analyze the information gathered to develop improvement options to address the roadway issues and areas of concern while ensuring consistency with the goals and objectives.

Implementation of improvement options ultimately depends on the availability of funding, personnel resources, right-of-way needs, and other project delivery elements. Planning level cost estimates are listed in 2019 dollars for each improvement option. The costs include estimates for surfacing, striping, signing, culvert cleaning/replacement, guardrail installation, preliminary engineering, construction engineering, construction, and indirect costs. **Appendix E** contains planning level cost estimates for the options.

Considerations related to project development and potential impacts are provided for each option. Potential barriers such as right-of-way, physical features, and environmental conditions may influence the project development process and could add additional time and cost. More detailed project-level analysis would be required for any improvements forwarded from this study. Information contained in this report may be used to support future project development and environmental documentation.

6.1. Design Typical Sections

The current roadway width varies throughout the corridor. In general, the roadway is currently 24 feet wide between MP 0.0 and 14.2; 26 feet wide between MP 14.2 and 15.7; 24 feet wide between MP 15.7 and 16.8; and 20 feet wide between MP 16.8 and 19.5. Based on standards developed by AASHTO and Park County, roadway characteristics, and corridor function, the recommended roadway width ranges from 20 to 30 feet (see **Table 2.3**). While it might be appropriate to maintain the current cross sections, it may also be beneficial to widen the roadway to a common typical section and to provide for widened shoulders. The roadway also currently lacks shoulder and centerline striping. There is a desire to include striping with future project(s) along the paved portion corridor to delineate travel lanes, shoulders, and passing zones. The width and surfacing of the gravel section (MP 15.7 to 19.5) is appropriate for existing and anticipated use.

Three potential typical sections of varying widths were identified for the paved section of Shields River Road. These typical sections are based on existing standards and are aimed at addressing existing and projected demands, safety concerns, and project development constraints. The first option is to reconstruct Shields River Road with a consistent 24-foot roadway width. In most locations throughout the corridor, the roadway subgrade is already wide enough and would not need to be expanded to accommodate new surfacing. This typical section would include 12-foot travel lanes with no shoulders (**Figure 6.1**) and most closely matches what is in place today. The second option is to reconstruct the roadway to be 28-feet wide, consistent with *Park County Transportation Standards.* This would allow for 12-foot travel lanes and 2-foot shoulders (**Figure 6.2**). The third option is to reconstruct the roadway according to the AASHTO *Greenbook* standards for rural collector roadways. This standard calls for 11-foot travel lanes and 4-foot shoulders for a total surface width of 30 feet (**Figure 6.3**).

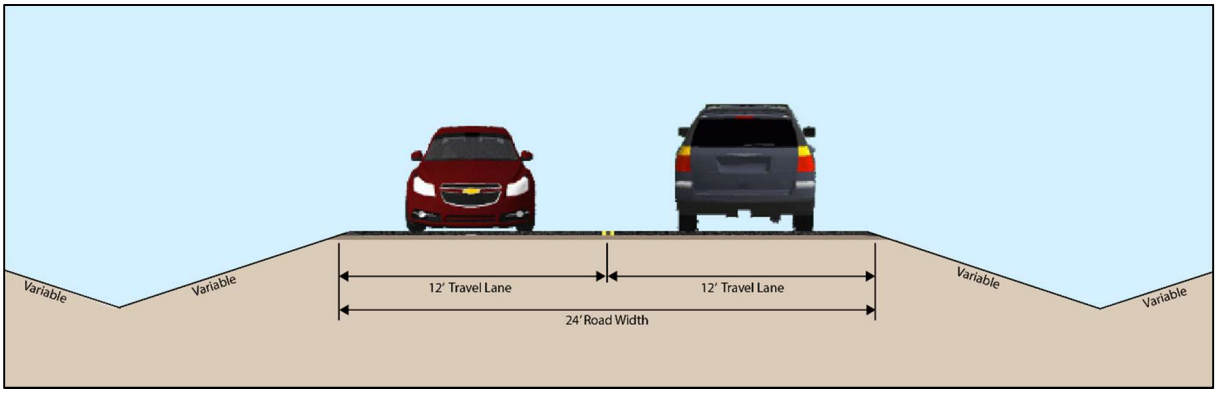

Figure 6.1: 24-foot Typical Section (Existing)

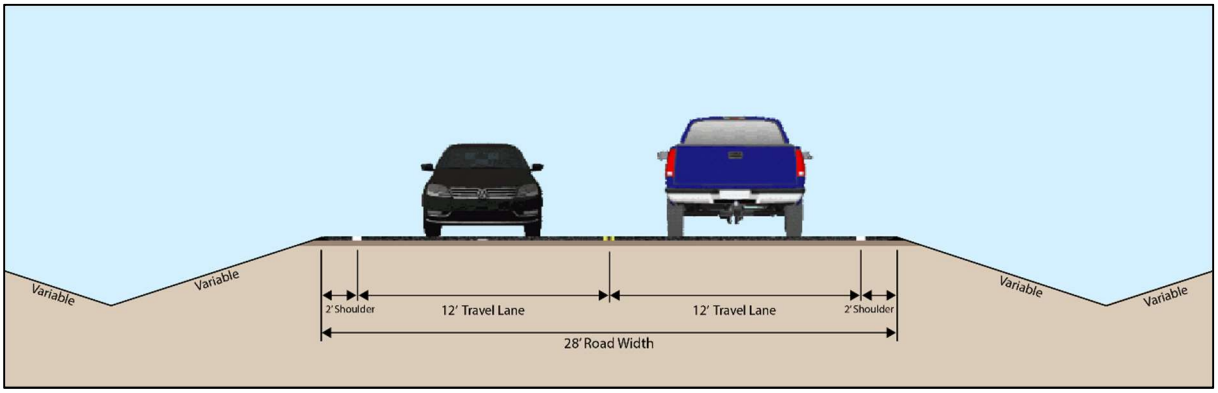

Figure 6.2: 28-foot Typical Section (Park County Standards)

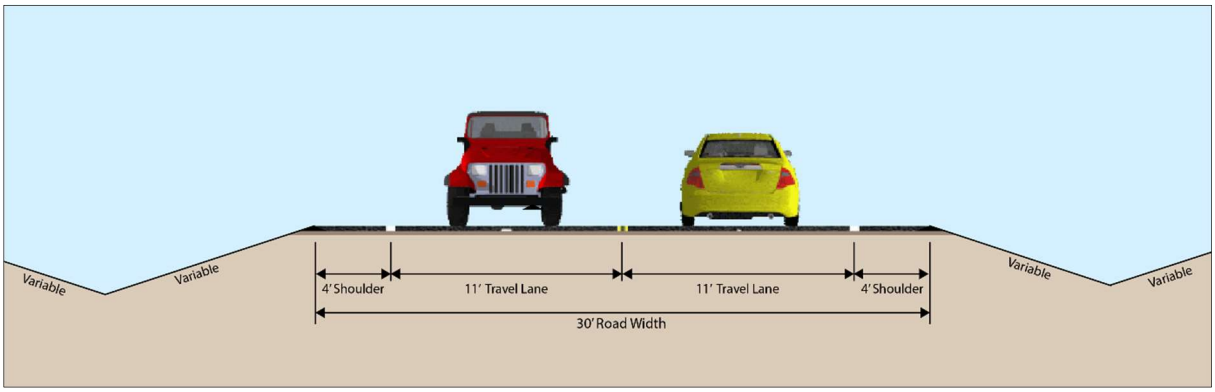

Figure 6.3: 30-foot Typical Section (AASHTO Standards)

Since Shields River Road provides access to recreational opportunities, residences, and agricultural lands, it is used by a variety of vehicles each with differing design needs. For example, wider travel lanes are recommended to accommodate the heavy vehicles and tractors in the area used for agricultural and commercial purposes. Widened shoulders are also desirable for non-motorized and recreational use along the corridor. A wider roadway may also improve sight distance, allowing more space for vehicles to maneuver curves, and provide for more recoverable area for traveling motorists. Conversely, increasing the roadway width may result in a more comfortable facility for drivers which can indirectly increase vehicle speeds. Widening the roadway more than the existing 24-foot width will also require additional subgrade and drainage work, resulting in increased construction impacts and higher costs.

There appears to be adequate right-of-way to widen Shields River Road to accommodate any of the three recommended typical sections. Since the traffic volumes on Shields River Road are relatively low, all three typical sections would also adequately accommodate existing and projected traffic volumes. The determination of which typical section is appropriate for the roadway will need to be evaluated in more detail during the project development process. With that in mind, the following sections provide a range of cost estimates depending on which typical section is used.

6.2. Roadway Reconstruction/Rehabilitation

Reconstruction and rehabilitation of the roadway is needed due to deteriorated surfacing conditions and to accommodate existing and future needs. The following sections discuss design considerations for each segment, recommended improvement options based on identified typical sections, and estimated planning-level costs. To evaluate potential project development options, the corridor was broken into multiple segments based on logical breaks and changes in roadway condition/context. Various considerations for each segment were identified including potential barriers and constraints such as physical features and environmental conditions which may influence the project development process and could add additional time and cost.

Segment 1: US 89 to Pinkerton Road (MP 0.0 to 3.8)

This segment starts on the northern edge of Wilsall and extends northeasterly through rural residential and agricultural lands. In this section, Shields River Road crosses two major streams, Flathead Creek and Shields River, via bridges which are both in fair condition. The pavement condition is generally poor or very poor based on a PASER evaluation. There are two locations where the pavement subgrade is visibly deteriorated, at MP 1.4 and MP 2.7, as evidenced by alligator cracking, potholes, and failing patch repairs. Steep side slopes are also present throughout this section which have the potential to cause erosion. There is one substandard horizontal curve at MP 3.2 where Jordan Beach Road joins Shields River Road. There have been three crashes along this segment over the past ten years, all of which were fixed object crashes of low severity between MP 0.0 and 1.3.

Recommendations:

- Reconstruct to typical section standard.

Considerations:

- Adjacent wetlands may be impacted by roadway improvements.
- Shields River Road crosses or lies adjacent to delineated floodplains.
- There are two bridges, both in fair condition and of adequate width.
- The Big Canal crosses Shields River Road near MP 2.8 and the Myer's Ditch crosses at MP 3.2.
- There are five culverts in need of additional evaluation.
- There is one concrete stock pass in this section at MP 3.2.

Estimated Cost:

- Typical Section 1 (24-feet): $2,300,000
- Typical Section 2 (28-feet): $3,500,000
- Typical Section 3 (30 feet): $3,900,000

Segment 2: Pinkerton Road to Porcupine Road (MP 3.8 to 8.4)

Shields River Road parallels the Shields River and Porcupine Creek through the majority of this segment. The roadway also crosses Porcupine Creek and one of its tributaries at MP 7.6 and 7.9, respectively. The pavement condition of this segment was evaluated as very poor to poor. The surfacing between MP 5.5

and 8.0 is especially poor with evidence of sloughing, cracking, and erosion. The proximity of the river throughout this section, combined with steep side slopes and landslide areas, presents special geotechnical concerns. Several active landslides were documented during the field review on the east side of Shields River Road between MP 6.1 and 7.5. The geometric review showed seven substandard horizontal curves and one substandard vertical curve. At one location, MP 8.0, a combination horizontal/vertical curve was also noted as having sight distance issues. There have been five crashes along this segment over the past ten years. There is a cluster of three rollover crashes at a tight s-curve near MP 6.0. Two of the three fatality markers noted in the study area are present in this section.

Recommendations:

- Reconstruct to typical section standard.
- Flatten side slopes and install guardrail on s-curve near MP 6.0.

Considerations:

- The roadway surfacing is failing with evidence of geotechnical and slope stability issues.
- Shields River Road crosses or lies adjacent to delineated floodplains.
- There are four culverts noted as needing additional environmental evaluation.
- There are concrete stock passes at MP 4.2 and 6.0.

There are safety concerns at MP 6.0 due to steep side slopes, deteriorating roadway edges, and limited sight distance.

Estimated Cost:

- Typical Section 1 (24-feet): $3,300,000
- Typical Section 2 (28-feet): $5,100,000
- Typical Section 3 (30 feet): $5,600,000

Segment 3: Porcupine Road to Hill Road (MP 8.4 to 14.2)

Shields River Road generally parallels the Shields River throughout this section. The roadway crosses the river at MP 14.1 via a bridge that is in good condition. There are seven major culverts in this section, including several associated with the Horse Camp Ditch. Several of the culverts in this section are in poor condition with detached culvert sections at MP 14.0 and poor roadside drainage. There is evidence of water pooling at MP 9.7, 12.2, and 12.3. The pavement ranges from failing to fair based on the PASER evaluation. Between MP 12.0 and 13.5 the surfacing is especially poor and shows evidence of severe degradation including alligator cracking and failing patch repairs. The roadway is relatively flat through this section with steep side slopes in a few areas. There are six substandard horizontal curves at two locations, MP 11.3 and 13.8. These areas are noted as having sight distance issues due to trees and other vegetation in the clear zone. There is a fatality marker in this this section at MP 12.9 which appears to be at one of the substandard horizontal curves.

Recommendations:

- Reconstruct to typical section standard.

Considerations:

- Adjacent wetlands may be impacted by development.
- Shields River Road crosses or lies adjacent to delineated floodplains.
- There are 12 culverts noted as needing additional environmental evaluation.

Estimated Cost:

- Typical Section 1 (24-feet): $3,500,000
- Typical Section 2 (28-feet): $5,300,000
- Typical Section 3 (30 feet): $5,900,000

Segment 4: Hill Road to Smith Creek Road (MP 14.2 to 15.7)

This segment of Shields River Road was paved in 2010 as part of an ARRA project. There are no major bridges or culverts in this section. The intersection where Hill Road, Hamilton Road, and Shields River Road meet (MP 14.2) is a sharp 90-degree curve. The intersection has stop control along Hill Road but is missing signage along Hamilton Road. Additional signing warning of the sharp curve is also missing or has fallen over.

The community has expressed interest in building a parking lot for winter use at the intersection of Shields River Road and Smith Creek Road (MP 15.7). The parking lot is desired to be large enough for about 45 cars and 15-20 trucks plus trailers and plowed, upon request, during the mid-December to mid-April season. The primary purpose of this parking area would be to facilitate snowmobile and other winter recreational access.

The existing surfacing is currently in good to very good condition. A chip seal is needed to help preserve the condition of the surfacing, and to extend the overall pavement life. At some point in the future, resurfacing will also likely be needed.

Recommendations:

- Pavement preservation and general maintenance.
- Enhance signage at MP 14.2 (intersection of Shields River Road/Hill Road/Hamilton Road) to warn drivers of the sharp curve.
- Coordinate with USFS and private residences to construct parking lot at the Shields River Road/Smith Creek Road intersection. The parking lot is estimated to cost approximately $25,000 not including right-of-way. (Note: this cost is not included in cost estimate)

Most of the existing signage at the intersection of Hill Road/Hamilton Road/Shields River Road has fallen over or is missing.

Considerations:

- Adjacent wetlands may be impacted by development.
- There is a conservation easement held by Gallatin Valley Land Trust on both sides of the roadway between MP 14.2 and 14.5.
- Additional right-of-way from private land owners would be required to construct the desired parking area at the intersection with Smith Creek Road.

Estimated Cost:

- $70,000 (chip seal)
- $640,000 (resurfacing)

Segment 5: Smith Creek Road to End Project (MP 15.7 to 19.5)

This portion of Shields River Road has gravel surfacing. In 2010, the surfacing was improved, and the roadway widened to 24 feet from MP 15.7 to 16.8 and to 20 feet from MP 16.8 to 19.5 as part of an ARRA project. Included in the project was the replacement of an existing single-lane bridge over the Shields River (MP 16.8) with a new two-lane bridge along with asphalt paving for a short section on the bridge approaches. Other drainage crossings were also improved with the project.

Shields River Road crosses the Shields River, South Fork Shields River, and Mill Creek through this section. There are 3 major culverts and 15 total culverts, all of which are in good condition. There are 13 substandard horizontal curves and 2 substandard vertical curves in this section. Two vertical curves (MP 17.5 and 18.1) and two horizontal curves (MP 19.3 and 19.4) were documented as having sight distance/clear zone issues during the field review. At MP 17.4, 18.3, and 19.2, areas of steep side slopes exist on the north side of the road.

The gravel surfacing is generally rated as good based on the PASER assessment. Annual maintenance is needed to maintain the surfacing and to reduce the presence of rutting and washboards. Ensuring proper roadway drainage will also help extend the life of the surface. At some point in the future, resurfacing will likely be needed.

Recommendations:

- Roadway preservation and general maintenance.

Considerations:

- Shields River Road crosses or lies adjacent to delineated floodplains.
- There are five culverts noted as needing additional environmental evaluation should improvements occur.

Estimated Cost:

- Annual maintenance
- $790,000 (resurface)

The gravel surfacing is in good condition. General preservation and maintenance should be completed annually to extend the life of the surface.

6.3. Combined Reconstruction

The previous section provided options for improving the roadway in segments. A segmented approach was evaluated due to the anticipated difficulty in securing funding for improving the length of the corridor. A combined reconstruction approach is discussed in this section should it be desirable to improve the corridor with a single project. This combined approach includes all of the improvements identified for Segments 1, 2, and 3 of the Shields River Road. Although more expensive, this approach addresses the most critical areas of concern in a single project. Included in this option is reconstruction of the pavement surfacing from MP 0.0 to 14.2. Additional enhancements to improve the safety of roadway users, including guardrail and signage, are also recommended.

Recommendations:

- Reconstruct to typical section standard from MP 0.0 to 14.2.
- Install guardrail on s-curve at approximate MP 6.0.
- Enhance signage at MP 14.2 (intersection of Shields River Road/Hill Road/Hamilton Road) to warn drivers of sharp curve.

Considerations:

- The roadway surfacing is failing with evidence of geotechnical and slope stability issues at spot locations, particularly between MP 6.1 and 7.5.
- Adjacent wetlands may be impacted by roadway reconstruction.
- Shields River Road crosses or lies adjacent to delineated floodplains.
- There are 27 culverts noted as needing additional environmental evaluation.

Estimated Cost:

- Typical Section 1 (24-feet): $9,100,000
- Typical Section 2 (28-feet): $13,900,000
- Typical Section 3 (30 feet): $15,400,000

6.4. Summary of Options and Estimated Costs

The improvement options described in the previous sections are intended to offer a range of potential mitigation strategies for corridor issues and areas of concern. Five improvement options were proposed for logical segments of the roadway. An option is also presented which includes full reconstruction of the section of the corridor with poor asphalt pavement conditions. A summary of the improvement options is provided in **Table 6.1** and shown graphically in **Figure 6.4**.

Table 6.1: Improvement Options Summary

Segment	Recommendation	Estimated Cost
Segment 1: US 89 to Pinkerton Road (MP 0.0 to 3.8)	• Reconstruct to typical section standard.	• 24-feet: $2.3M • 28-feet: $3.5M • 30-feet: $3.9M
Segment 2: Pinkerton Road to Porcupine Road (MP 3.8 to 8.4)	• Reconstruct to typical section standard. • Install guardrail on s-curve at approximate MP 6.0.	• 24-feet: $3.3M • 28-feet: $5.1M • 30-feet: $5.6M
Segment 3: Porcupine Road to Hill Road (MP 8.4 to 14.2)	• Reconstruct to typical section standard.	• 24-feet: $3.5M • 28-feet: $5.3M • 30-feet: $5.9M
Segment 4: Hill Road to Smith Creek Road (MP 14.2 to 15.7)	• Pavement preservation and general maintenance. • Enhance signage at MP 14.2 (intersection of Shields River Road/Hill Road/Hamilton Road) to warn drivers of sharp curve.	• $70k (chip seal) • $640k (resurfacing)
Segment 5: Smith Creek Road to End Project (MP 15.7 to 19.5)	• Preservation and general maintenance.	• Annual maintenance • $790k (resurfacing)
Combined Reconstruction (MP 0.0 to 14.2)	• Reconstruct to typical section standard. • Install guardrail on s-curve at approximate MP 6.0. • Enhance signage at MP 14.2 (intersection of Shields River Road/Hill Road/Hamilton Road) to warn drivers of sharp curve.	• 24-feet: $9.1M • 28-feet: $13.9M • 30-feet: $15.4M

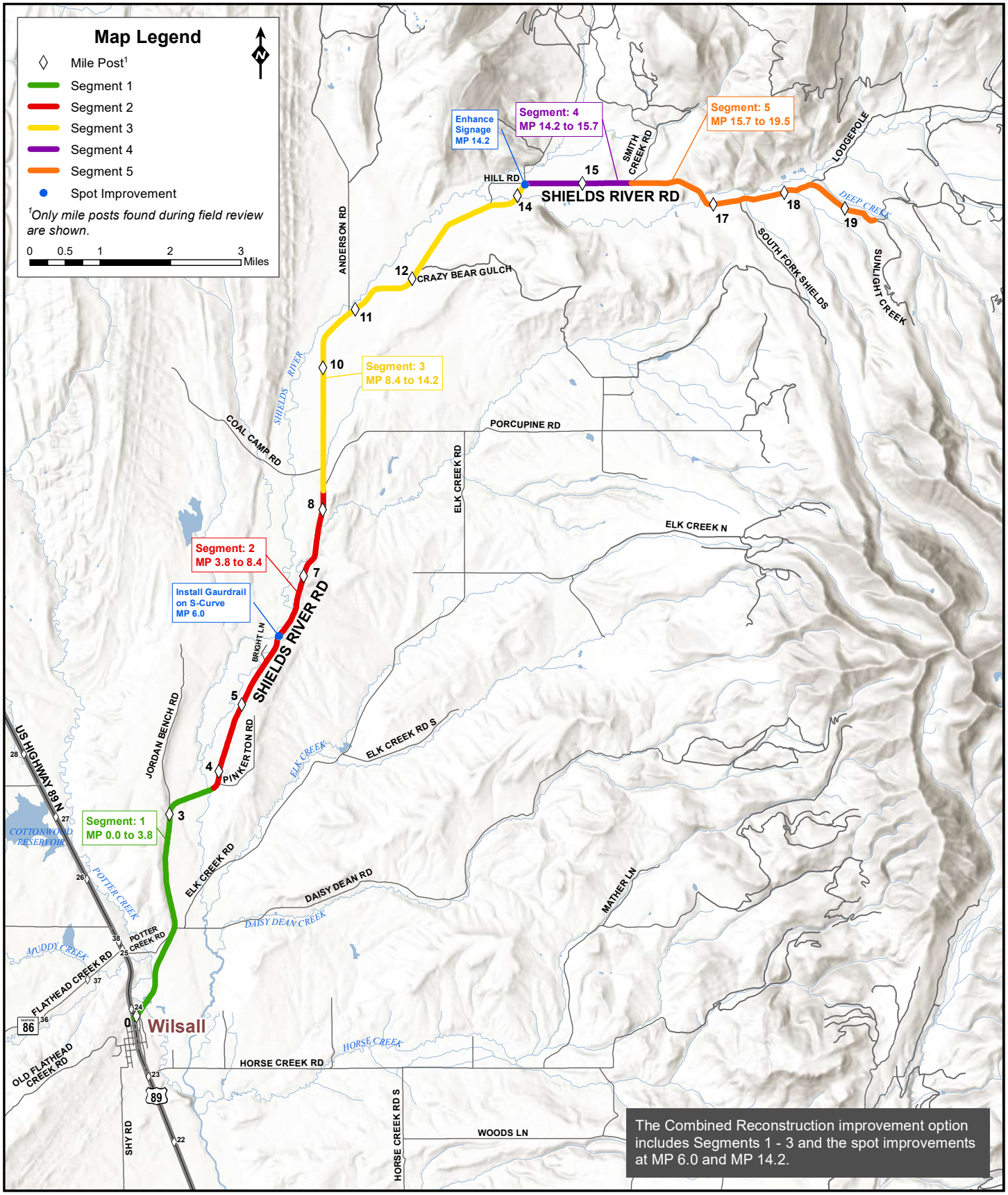

Figure 6.4: Improvement Options

7.0. PUBLIC MEETING SUMMARY

Education and outreach are essential elements in successfully informing individuals about the planning process and soliciting feedback on the study outcomes. A public meeting was held at the Shields Valley Senior Citizens Center in Wilsall, Montana on Tuesday August 13, 2019 from 4:30 to 6:30 PM to give members of the public an opportunity to speak with project staff and have their questions answered about the planning study. The *Public Meeting Summary* (**Appendix G**) reviews the meeting details and summarizes the public comments received. To effectively notify interested parties about the opportunity to attend the public meeting and offer comments to the planning team, several notification methods were employed including postcard meeting invitations, email invitations, distribution of flyers, social media posts, and advertisements on the project website.

The public meeting was formatted as an open house with no formal presentation. This format allowed each attendee to speak directly with project staff and/or representatives from FHWA and Park County. Display boards were used to summarize key points from this *Preliminary Engineering Report* and facilitate discussion. The public also had the opportunity to review and comment on the recommended improvement options.

A total of 36 community members signed in at the public meeting and two written comments were received at the meeting. Additional comments were received after the meeting during the public review period of this *Preliminary Engineering Report* (**Appendix H**). In general, questions and comments centered on current roadway conditions, potential benefits and drawbacks of improvement options, and other project concerns that should be considered. The following highlights the verbal comments received:

- **Timeline:** Some attendees were concerned about the deterioration of the roadway over the next several years before construction can be completed and the costs of maintenance within that same time. Project staff explained that future improvements would be implemented by Park County and the availability of funding is the primary factor on when a project may be constructed.
- **Heavy Vehicle Traffic:** Some of the participants were concerned with the impact that heavy vehicles (logging and agricultural equipment) have on Shields River Road. These vehicles were cited as a cause of some of the poor pavement conditions including pot holing and rutting.
- **Maintenance:** Many of the participants expressed frustration regarding the current condition of Shields River Road. Although maintenance work occurs annually, the repairs often fail after the following winter and freeze/thaw period and are not a solution to the main problems.
- **Safety:** Safety was noted as a concern by many meeting attendees. High speeds combined with tight curves, steep side slopes, and poor pavement were cited as common causes of crashes or near misses on Shields River Road. In particular, the area between MP 6.0 and 7.2 is of concern from a safety standpoint due to the narrow roadway, poor geometrics, and steep slopes.

In general, most participants agreed that repaving Shields River Road from MP 0.0 to 14.2 is needed. Most participants also felt that the newly paved portion past MP 14.2 and the gravel section were fine as is and only need general annual maintenance. Regarding the options for repaving the corridor, there were mixed opinions. Some felt that the 24-foot typical section was fine and should be kept to expedite project development due to the lower costs. Participants favoring this option noted the low traffic volumes and immediate need for resurfacing as reasons for support. Others felt a wider section with shoulders, such as Option 2 with a 28-foot typical section, would be better. A wider roadway was said to be needed to accommodate the large agriculture vehicles, improve safety, and provide room for snow storage. Some participants felt it would be short sighted to not expand the roadway to meet future demands. Most participants agreed that the 30-foot typical section is not necessary (Option 3). Regardless of which option is selected, most participants expressed a desire for centerline and shoulder striping.

8.0. CONCLUSION AND NEXT STEPS

This study evaluated the Shields River Road corridor to gain a better understanding of corridor goals, objectives, constraints, and opportunities. A thorough analysis of applicable data from Park County, FHWA, USFS, MDT and other resources was conducted to identify an initial set of improvements that would address the operational characteristics, safety, and physical condition concerns of the existing facility. This evaluation led to a set of improvement options to be considered by appropriate project sponsors moving forward.

The pavement on the first 14.2 miles of Shields River Road is old and in poor condition. In order to preserve access to the residential, agricultural, and recreational lands, improve safety, and accommodate future travel demands, reconstruction of the roadway is necessary. From an implementation standpoint, it may be desirable to improve the roadway incrementally. With this in mind, three reconstruction project segments were identified: Segment 1: MP 0.0 to 3.8; Segment 2: MP 3.8 to 8.4; Segment 3: MP 8.4 to 14.2. If desired, and if funding can be secured, these segments can also be combined into a single project to improve the 14.2-mile section.

The remaining 5.3 miles of the study corridor were recently improved by the Forest Service through an ARRA project. This section of the corridor is still in good condition and does not need full reconstruction. It is recommended that a chip seal be completed along the pavement section (MP 14.2 to 15.7) to preserve and extend the surfacing life. The gravel section (MP 15.7 to 19.5) should receive annual maintenance to ensure proper roadway drainage to reduce rutting, potholes, and washboards. Cost estimates are also provided for future resurfacing of these segments.

The ability to develop a project is dependent on the availability of existing and future funding. At the current time, funding has not been identified to proceed with a project. Should Park County elect to proceed with a project, the following steps are needed:

- Identify the option(s) that best meets the safety, environmental, and social needs in the area identified in the study;
- Identify and secure a funding source or sources; and
- Follow appropriate guidelines for project nomination and development, including a public involvement process and environmental documentation that describes potential impacts and mitigation measures from the proposed action.

Any future project should be consistent with the needs and objectives contained in this study. Should this study lead to a project (or projects), compliance with appropriate funding and environmental regulations will be required. The information presented in this report can serve as a baseline for future project development and to apply for funding support.

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