I. Executive Summary

Horse Creek Road Bridge, East of Wilsall (MDT #03818) is located on Horse Creek Road and crosses the Shields River. The bridge has been selected for replacement due to its poor condition, being fracture critical, and posted weight limit. Horse Creek Road is a rural route serving residences, local farms and ranches, and recreation lands. A Montana Coal Endowment Program (MCEP) Grant Application is planned to assist Park County in replacing the bridge, where currently traffic is restricted by the load limit, with a new bridge that provides adequate structural capacity. According to the MDT inspection report, traffic counts were completed in 2022, which determined an Average Daily Traffic (ADT) of 100 trips per day, with 3% truck traffic.

***Figure 1*: Horse Creek Road Bridge**

Detailed information on the condition of this bridge is shown in the Montana Department of Transportation (MDT) Structure Inspection Report (***Appendix K***). The FHWA Bridge Condition is fair (see *Section II.B.2.b* for a definition).

The sufficiency rating and summary of the primary deficiencies are summarized below:

Sufficiency Rating = 44.6

Primary Deficiencies:

- The posted weight limit on the bridge is 7 tons.
- Asphalt wearing surface exhibits approximately 10 square feet of potholes up to 2 inches deep and full width transverse cracking.
- The timber deck below asphalt wearing surface exhibits severe rot with fungal growth.
- Movement of truss structure is restricted by both the backwall as well as hard-packed gravel and debris around bearing shoes.
- Existing concrete retaining walls exist in front of the new concrete caps. These walls are from an old bridge abutment in use prior to the installation of the current truss structure. These concrete walls exhibit diagonal and vertical cracking up to 1¾" openings.
- Concrete wingwalls are separating and rotating toward the channel.
- Scour is present under one of the existing retaining walls causing settlement.

***Figure 2*: Approach road and weight limit sign**

***Figure 3*: Movable bearing flush with abutment**

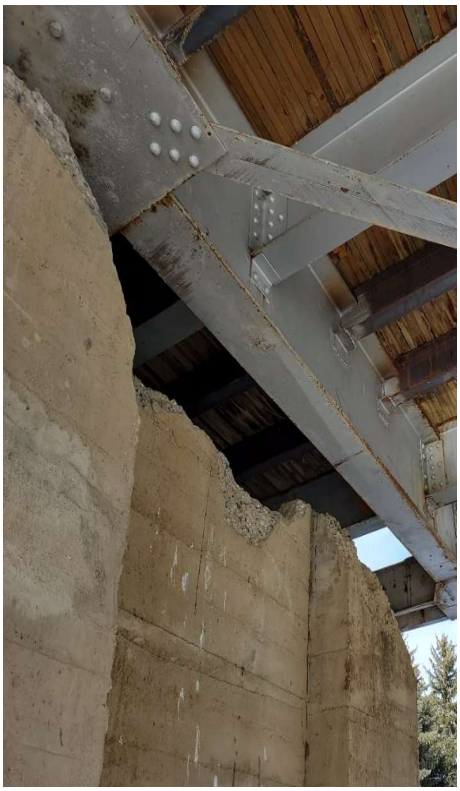

***Figure 4*: Top of retaining wall broken off**

***Figure 5*: Large Crack in retaining wall**

Three alternatives were considered to be the most viable, long-term solutions for this deteriorated bridge.

Alternative 1: Concrete bulb-tee beam superstructure
Alternative 2: Prefabricated steel superstructure with gravel deck
Alternative 3: Steel truss

Alternative 1 is the preferred alternative. The Bulb-Tee beam bridge has the lowest present worth and the lowest maintenance, as aligns with the Park County Transportation Standards.

The Opinion of Probable Cost for **Alternative 1**, Table I, shows a detailed estimate of construction costs, which are $XXX,XXX. The Project Budget Form, Table II, shows a

detailed estimate of the total project cost, including all administrative, financial activity, and contingency allowance. The total project cost is $XXX,XXX.

Table I

"Place holder for OPC table."

Table II

"Place holder for Budget Form"

II. Problem Definition

A. Identify the Area Served by the Bridge

1. Location of Bridge

Horse Creek Road Bridge, East of Wilsall on Horse Creek Road, is located in Section 30 Township 03N, Range 09E, and is located in Park County. The structure crosses Shields River on Horse Creek Road, which is a county-maintained asphalt roadway with a posted speed limit of 35 mph. The crossing provides access to landowners in Park County.

Large and small-scale vicinity maps and portions of the quadrangle United States Geologic Survey (USGS) maps are enclosed in ***Appendix A***, in addition to a general aerial map showing the project location. The bridge latitude and longitude are 45°59'18.52"N and 110°38'44.33"W respectively, and the deck elevation is approximately 5,000-ft above mean sea level.

2. Physical Characteristics of the Area

Horse Creek Road Bridge is located on Horse Creek Road and crosses the Shields River, which has a channel width of approximately 40-ft at the bridge site. The river generally flows from north to south in the project vicinity. The new bridge will be located in the same location as the existing bridge.

***Figure 6*: Road alignment of existing bridge**

The terrain at the site is generally characterized by rolling plains and gullies, with the primary vegetation being thick shrubs and cottonwoods surrounding the stream channel.

Soil characteristics at the project site were taken from the Natural Resources Conservation Service (NRCS) 1979 Soil Survey data. Soil data for the bridge location is primarily Meadowcreek, rarely flooded-Nesda-Clunton, which is basically a silty clay loam. The Montana Bureau of Mines Ground Water Information Center (GWIC) identifies 4 wells near the project site, which identify primarily gravel and sands with some silt at the surface, which is comparable to the soils identified on the NRCS Soil Survey. Although geotechnical investigation is generally not part of the preliminary engineering report activities, an indication of the type of foundation suitable for a new structure can be obtained from observations made at the project site, observations from bridges in the surrounding area, and the information from the NRCS and GWIC. The NRCS soil survey map for the project is located in ***Appendix B***.

Horse Creek Road Bridge is located within a Zone A special flood hazard area, which is defined as "areas subject to inundation by the 1-percent annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown."[1] Due to this FEMA designation, water surface elevations are required to be unaffected by the installation of the new bridge. Additional hydraulic analysis is included in ***Appendix C***.

According to the Montana State Library Natural Heritage Program Wetland and Riparian Mapping, no wetland records were found in the project area. See ***Appendix B*** for a map.

Information gathered from the Montana Sage Grouse Habitat Conservation Program indicates that the project site is within a General Habitat Area for sage grouse. Therefore, the appropriate consultation will be obtained prior to construction. See ***Appendix B*** for the Sage Grouse Habitat map.

3. Users of the Bridge

a. Use of the Structure

The route is currently used by a variety of vehicles, ranging from passenger vehicles to agricultural traffic; however, the posted load limit of 7 tons prevents the use of the bridge by large agricultural equipment. The use of the bridge may increase due to the new construction, as the increased weight limit will accommodate traffic that is currently utilizing alternate routes. In addition, this bridge will inherently continue to see more and more usage due to the increasing population in Park County.

[1] (Federal Emergency Management Agency)

b. Number of Users

The number of users using Horse Creek Road Bridge varies depending on the time of year. During the summer and fall season, the traffic demand is higher due to agricultural activities and recreational opportunities. The winter months generally experience lower traffic volumes, as the route is primarily limited to residential traffic.

There are multiple homes located on the east side of the bridge that require the bridge for access. In addition to the estimated 100 permanent residents, there are multiple agricultural operations and a Forest Service cabin that would benefit from this bridge replacement project. The route also provides access to National Forest lands and two trail heads.

c. Growth Areas and Population Trends

Data from the Montana Census & Economic Information Center shows that the population of Park County was 15,636 in 2010, and 17,191 in 2020, indicating a 9.9% increase in population during that time frame. In that same time frame, the Town of Wilsall, which is approximately 1 mile from the bridge site, saw a 10.7% population increase.

Because of the continuing increase in population throughout Park County, it is important to continue to improve the infrastructure of the community and continue to encourage growth for the economic health of the County.

B. Evaluate Condition of the Existing Bridge

1. History

According to the MDT Historian and the Structure Inspection Report, the existing bridge superstructure was built in 1940 and later relocated to its current location in 1986, with no reconstruction projects identified. The superstructure consists of a steel truss and timber deck, while the substructure is comprised of vertical concrete end abutments. The total bridge length is 105-ft, and the width is 24-ft.

***Figure 7*: Crack in west retaining wall**

The Montana Historical Society has provided a letter stating that there have been no previously recorded sites in the project vicinity. In general, any bridges over 50-years old are potentially eligible for listing on the National Register of Historic Places. Even though the superstructure is greater than 50 years old, because it has been relocated it is likely not eligible for listing on the National Register of Historic Places see ***Appendix G*** to read the full responses from the Montana Historical Society and MDT.

2. Condition of Bridge

a. County's Overall Bridge Needs

According to the MDT Bridge Inventory, Park County currently has 55 bridges over 20-feet in length that are inspected by MDT but are the responsibility of the County for operations and maintenance.

The Park County Bridge Inventory (***Appendix K***) shows the County's bridge deficiencies in more detail. In addition, excerpts from the 2016-2020 Park County Capital Improvements Plan are included in ***Exhibit 1 of the Grant Application***.

Stahly Engineering conducted a site visit of Horse Creek Road Bridge, performed by Nate Peressini, P.E. of Stahly Engineering & Associates. Mr. Peressini has certification from the National Highway Institute on Safety

Inspections of In-Service Bridges (see Certificate, ***Appendix K***). The site visit was performed to become better acquainted with the bridge and surrounding site and also to verify the MDT Inspection Report accurately depicted the bridge's current condition.

Park County has a track record of solving infrastructure needs with local funds when possible, and relying on grants, such as MCEP, to help fund the larger, more extensive projects that are outside the financial ability of the County alone. See ***Appendix L*** for a list of the infrastructure maintenance activities slated for 2024, as well as the 2023 completed improvements.

The Park County Bridge Inventory shows 11 bridges that have a lower sufficiency rating than the Horse Creek Road Bridge. The Horse Creek Road Bridge was chosen in lieu of these bridges due to the following reasons:

Bridge Number	Bridge Name	Reason Not Selected
03859	Tom Miner Road over Yellowstone River	New bridge under construction
03830	Potter Creek Road over Potter Creek	Pursuing alternative funding
03832	Indian Creek Road over Shields River	Pursuing alternative funding
03834	Enyart Lane over Cottonwood Creek	Repaired 2023, SR not yet updated
03820	Canyon Creek Road over Brackett Creek	New bridge deck scheduled, which will improve SR
03835	Cottonwood Bench Road over Cottonwood Creek	Limited usage
03829	Coal Camp Road over Sheilds River	Limited usage
03813	Elk Creek Road over Shields River	
03847	NF 6639 Road over Boulder River	Repaired 2023, SR not yet updated
03821	Hammond Creek Road over Rock Creek	Slated for new construction 2024
03815	Shields River Road East over Shields River	New bridge deck scheduled, which will improve SR

Of the bridges remaining in the inventory, Horse Creek Road Bridge has the lowest sufficiency rating; Therefore, Horse Creek Road Bridge was selected for inclusion in this MCEP Grant Application based on the following information:

- The bridge has a sufficiency rating of 44.6 and a posted load rating of 7-tons.
- Scour below the existing concrete wall has led to settlement.
- The condition of the concrete retaining walls is dire, with large cracks, and tops being broken off.
- Movable bearing is flush with abutment backwall at current level of expansion.

One advertised public meeting was held to allow the public an opportunity to comment on the selection of the bridge for inclusion in the MCEP Grant Application. The public meeting *will be held on April 30*, 2024, at 9:00 a.m. in Livingston at the City/County Complex. Park County Commissioners, Park County staff and a representative from Stahly Engineering were present. See ***Appendix I*** for a copy of the agenda, attendance, and minutes of that meeting. After careful consideration, the Park County Commissioners decided that submission of an MCEP Grant application to replace the Horse Creek Road Bridge, East of Wilsall, was important for the citizens of the County.

In general, replacing the Horse Creek Road Bridge does support the goals of Park County. The County has demonstrated their commitment to improving their infrastructure in their community by funding projects exclusively with County funds whenever possible. Receiving MCEP funding for this bridge is critical to the County and will allow Park County to continue to locally finance other infrastructure projects, as outlined in Park County CIP.

b. Present Condition and Capacity

The MDT Structure Inspection Report describes, in detail, the current condition and capacity of the Horse Creek Road Bridge. The date of the last MDT inspection was June 02, 2022, and the frequency of inspection is every 24 months. A summary of the primary items listed in the Inspection Report is listed below:

NBI Sufficiency Rating	= 44.6
NBI Structure Status	= Fair
Posted Load Rating	= 7 tons

NBI Appraisal Ratings

Structure Rating	= 3
Deck Geometry	= 6
Approach Roadway Alignment	= 6
Waterway Adequacy	= 8

NBI Element Condition Ratings

Deck Rating	= 6
Superstructure Rating	= 6
Substructure Rating	= 7
Approach Rail & Bridge Rail	= 0

The Federal Highway Administration has defined a system for selecting bridges for the Highway Bridge Replacement and Rehabilitation Program (HBRRP). Dependent on the condition ratings of the deck, superstructure or substructure listed on the MDT Structure Inspection Report, a bridge may be deemed as good, fair or poor based on the following criteria:

- If the lowest rating of the identified elements is greater than or equal to 7, the bridge is classified as good.
- If the lowest rating of the identified elements is below 7 but above 4, the bridge is classified as fair.
- If the lowest rating of the identified elements is less than or equal to 4, the bridge is classified as poor.

Because the lowest condition rating for this bridge is 6, the bridge has been classified as fair.

***Figure 8*: Truss resting on retaining wall.**

C. Need for the Project and Problems to be Solved

1. Current and Future Bridge Standards

In 2014, Park County adopted Transportation Standards in an effort to lend a measure of uniformity to future projects within the County (***Appendix L***). The Standards provide the minimum requirements for the design, construction and reconstruction of transportation infrastructure, which includes, but is not limited to, roads, bridges, culverts and trails. The Standards also provide guidance on bridge design specifics, materials to be used and standard dimensions.

The Park County Transportation Standards require that new county bridges be designed to meet American Association of State Highway Transportation (AASHTO) and MDT Bridge Design Standards, as modified or amended by the county bridge standard. The new bridge will be designed for HL-93 loading, which is a significant increase over the existing 7-ton load posting.

Park County designs their bridges to accommodate the 100-year flood event whenever possible. Due to this project existing in a Zone A floodplain, county

adapted floodplain regulations dictate a minimum 2 feet of freeboard and not raising the 100-year flood event backwater by more than six inches.

All Park County bridges are maintained by the County Road and Bridge Department.

2. Safety Considerations

This bridge has a Posted Load Rating of 7-tons. Although the load limit is posted on both sides of the bridge, it is common for vehicles to cross this bridge with loads that exceed the load rating. Repetitive use of the bridge by overweight vehicles shortens the remaining life expectancy of the bridge.

Horse Creek Road Bridge is a fracture critical bridge and has been determined to be unsuitable for calculated fractured conditions. Although MDT inspects this bridge every 24 months, the stability of the bridge can change rapidly; therefore, the condition of the bridge may be negatively impacted if the bridge experiences damage due to impact or overloaded vehicles. When the condition of a bridge changes, it is not always immediately obvious to users of the bridge, which contributes to an unsafe, and potentially disastrous, situation.

The roadway alignment at the bridge is relatively perpendicular with regard to the channel, and the approach road on both sides of the bridge is in alignment with the bridge. There are no documented issues due to the road alignment; therefore, the new bridge will be placed in the same location as the existing bridge.

The installation of approach railing at the new bridge will improve safety conditions, and the bridge will be designed to accommodate truck traffic carrying legal loads.

3. Alternative Routing Options

The shortest detour for vehicles unable to safely utilize the Horse Creek Road Bridge is approximately 10 miles via other county roads.

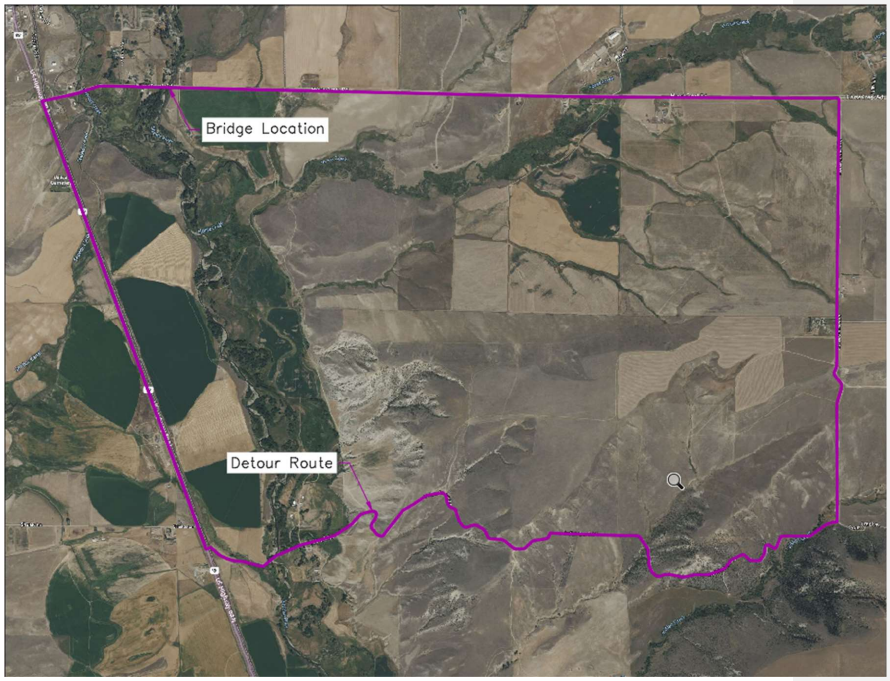

***Figure 9*: 10-mile detour route.**

4. Impact on Public and Emergency Services

The inconvenience to the public and delay of emergency services is already significant as the posted load limit prohibits use by most emergency service vehicles. The alternate route is approximately 10 miles and adds 20-30 minutes to the response time of emergency vehicles. Delays in ambulance, sheriff, and fire crews affect the safety of the public and the current bridge weight restrictions eliminate this route for use by heavy fire trucks.

5. Utility Location or Relocation

There are currently overhead lines on the north and south sides of the bridge. Coordination for the temporary shut off or relocation of the utilities will begin prior to the construction phase of the project to avoid any construction delays. The contractor will be responsible for having all utilities located prior to construction.

Commented [NH1]: Will overhead lines even need to be relocated?

Commented [NP2R1]: Yes, they likely will have to be shut off/relocated for construction.

6. Floodway

The bridge crosses the Shields River and is located within a FEMA Zone A special flood hazard area. The new bridge is not expected to correct any

issues associated with the floodway, and as required, will be designed not to impact the existing base flood elevation. As part of the final bridge design, a hydraulic analysis will be performed to ensure the design is adequate to pass the required flood event. See ***Appendix C*** for the Hydraulic Investigation Report.

D. Environmental Considerations

The bridge crosses the Shields River, a permanent flowing channel, approximately 40-ft wide at the bridge site. The proposed project will be within the existing road right of way, and only temporary disturbances will be required to complete construction.

The existing bridge was constructed in 1986 and is comprised of a steel truss with a timber deck overlayed in asphalt with vertical concrete abutments. Montana SHPO considers anything over 50-years of age to have the potential for eligibility for inclusion on the National Register of Historic Places. Because this bridge is less than 50-years of age, and the steel truss has been relocated from its original location, this bridge is likely not eligible. (see ***Appendix G***).

The bridge project will have a minor, temporary positive economic impact on the local economy in terms of employment. The new bridge will benefit public safety by replacing an antiquated bridge with a new structure that meets current safety standards and increased load limits. Vehicles currently unable to use the bridge due to weight restrictions will no longer be required to detour around the bridge.

Water resources in the Shields River will not be adversely impacted due to the project and impacts to wildlife and aquatic resources will be minimal to nonexistent. According to the U.S. Fish & Wildlife Service Information for Planning and Consultation (IPaC), there are three species of concern in the project vicinity (see ***Appendix B***); however, there are no critical habitats.

The Montana Sage Grouse Habitat Conservation Program (MSGHCP) website was consulted to determine if the project is located within an area of concern. Based on the map, the project vicinity is located within a Sage Grouse Executive Order Habitat Classification (see map, ***Appendix B***).

The proposed project will be within the existing county road right of way and road prism, and only minor temporary disturbances will be required to replace the bridge. Permits will be obtained from the U.S. Army Corps of Engineers (404), Montana Fish, Wildlife and Parks (SPA 124), Park County (floodplain), DNRC (Sage Grouse Consultation) and, if necessary, the Montana Department of Environmental Quality (Authorization 318). The level of impact to wetland areas

is expected to be less than 0.10 acres; therefore, no wetland mitigation will be required. Wetland mitigation is not required unless more than 0.10 acres are disturbed.

An Environmental Checklist (***Appendix H***) was completed during this application process, following the outline provided in the *Uniform Application for Montana Public Facility Projects*.

The following agencies were contacted for comments concerning the Environmental Assessment: Montana Fish, Wildlife & Parks; US Fish and Wildlife; State Historic Preservation Office; Department of Environmental Quality; Department of Natural Resources Conservation; National Heritage Program; US Army Corps of Engineers; Park County Floodplain Administrator; and Montana Department of Transportation. Comments can be found in ***Appendix G***.

Best Management Practices (BMP's) will be implemented to prevent dust and sedimentation during construction, and water will be used for dust abatement as directed by the inspector. A Montana DEQ-Pollutant Discharge Elimination System (MPDES) Permit will be obtained prior to construction. Furthermore, erosion and sediment control plans will be included as part of the contract specifications. Sediment control barrier will be placed on the downhill edge of all disturbances.

Traffic will require a temporary detour during the construction window (90 days maximum). Because the detour route via other county roads is only 10 miles, the route will be closed during construction of the new bridge. Safety and warning signs and features will be used at the project to alert traffic.

E. General Design Requirements for Improvement

The new bridge will meet the appropriate Park County bridge design standards and Floodplain Hazard Management Regulations:

Design Load	= AASHTO LRFD HL-93 truck loading
Bridge Width	= 24-ft (clear, useable width)
Hydraulic Requirements	= 100-year design flood
Freeboard	= 24" @ 100-year design event

A site investigation of this bridge gathered information regarding the existing structure, an existing stream channel cross section, rough topography, and historic flooding evidence. A preliminary hydraulic evaluation was performed for this site on the basis of an existing channel cross section, taken at the upstream edge of the bridge, and computed peak stream discharges. Based on this

information, the following information was used to determine the new bridge length:

Design Event	Peak Flow (cubic feet/second)
25-year	2,230
50-year	2,720
100-year	3,210

The peak flow, stream channel cross section, roadway profile and stream characteristics were entered into Hydra-Flow to evaluate the hydraulic model for a new structure design.

Using the width of the existing channel upstream of the bridge, a structure length of 104-feet was analyzed and found to provide the required freeboard, maintain the existing road grade, and pass the 50-year and 100-year flood events.

A geotechnical investigation will be performed prior to the design and construction of the new structure to ensure appropriate practices are in place for existing soils.

The new structure will provide crashworthy guardrail and end treatments to ensure the safety of the traveling public. T101 or W740 guardrail will be installed as part of the project, which are often used by MDT on lower-level state highways and bridges off the State Highway System. End treatments for the guardrail will be utilized to transition from the roadway, where there is no guardrail, to the ridged guardrail on the bridge.

III. Alternative Screening Process

The Alternative Screening Process considers all reasonable and economical bridge rehabilitation or replacement alternatives. The bridge alternatives that were considered are discussed below.

Rehabilitation / Replacement Options

1. No Action Alternative
   The “no action” alternative is not an option for this bridge, as the existing bridge has serious deficiencies due to fracture critical issues. The condition of the bridge does not allow use by a number of emergency vehicles, and the alternate route adds significant time to emergency response. The condition of the bridge will only continue to deteriorate, which will eventually cause an even lower load rating and possibly closure. The limited load rating creates a significant risk to

public safety. In addition, the fracture critical condition of the bridge makes this structure susceptible to sudden failure.

2. Eliminating the Bridge / Closing the Road
   Eliminating the bridge is not feasible as the alternate route is 10-miles and significantly affects emergency services. This road serves as an important route for local ranching and farming activities and closing this route will impose a hardship on the citizens of Park County.

3. Rehabilitation of the Existing Structure
   Because the issues with the existing bridge are both on the superstructure and on the abutments, the repairs would be significant. While the rehabilitation of a bridge can increase the load capacity of the bridge, repairs to this bridge would be significant as both the superstructure and substructure require improvements. Improvements to the substructure would require working in an active channel underneath a bridge, resulting in high costs due to extensive amounts of manual labor and limited ability to use machinery. This option will not be investigated further due to the limited improvement it would provide for the19xtensivee amount of work.

4. Replace with Culvert
   The Sheilds River drainage basin and resulting peak stream flows are sizable, as indicated by the existing structure length of 105ft and the 100-year flows of 3,210 cfs. Based on the existing channel width and river flows, the use of a culvert at this location would not be a favorable option for this site.

5. Single Span Bridge
   Using a 2:1 abutment spill slope, the required bridge length is approximately 104-ft, which would provide the necessary waterway opening based on the alignment. A single span bridge only requires two substructure units (the abutments), leaving the channel unrestricted by an intermediate pier. Based on this initial consideration, this crossing will be evaluated for a single span structure.

6. Multiple Span Bridge
   As previously mentioned, the approximate length of bridge for this crossing is 104-ft. In general, multiple span bridges are avoided whenever possible in order to minimize substructure construction costs, impacts to the channel and long-term substructure and channel opening maintenance costs. Due to the number of available materials that will provide a single span bridge, as well as the cost of additional substructure units, a multiple span bridge will not be considered for this location.

Based on the bridge replacement options and layouts that were explored, a single span bridge is considered the best choice for this site. The bridge options that were evaluated for this bridge replacement are as follows:

Single Span Superstructure Options

1. Pre-cast, Prestressed Concrete Beam Superstructure
   A precast / prestressed concrete beam superstructure option for this bridge replacement will consist of bulb-tee beams, which are commonly used for spans of 50-feet to 120-feet.

   Prestressed concrete I-beams with a cast in place concrete deck were not considered for this option. The concrete I-beam option requires a cast in place deck, which can result in a smoother, more uniform bridge deck, but is much more expensive and labor intensive.

   The integral riding surface of the bulb-tee beam section will meet the desired finished surface for this route and is a recommended option.

2. Prefabricated Steel Girder Superstructure
   A prefabricated steel girder superstructure generally consists of wide flange steel beams and corrugated metal decking, which can be finished with a riding surface of cast in place concrete, asphalt or gravel. Because the approach roadways at this location are currently asphalt, only asphalt surfacing over the steel decking will be evaluated.

3. Steel Truss Superstructure
   New steel truss superstructures are not commonly used but are available from a handful of bridge manufacturers as a prefabricated, field erected superstructure. This option, similar to a steel girder superstructure, is available with a number of deck options, such as concrete, asphalt, or metal grating. While the installation of a steel truss may be aesthetically pleasing, the cost of the structure is, on average, 50% more than the cost of a concrete beam or steel girder superstructure.

Based on the superstructure options considered, the following options will be explored further in the alternative analysis section:

- Single span prestressed concrete bulb-tee beam
- Single span prefabricated steel girder
- Single span truss

End Abutment Substructure Options

1. Wood Piles
   Wood piles have not been commonly used for several decades. Wood piles have three main disadvantages: First, it is not practical or recommended to splice wood piles; second, the cost of purchasing and installing wood piles has proven to be more expensive in recent years; third, wood piles have a shorter life expectancy than steel piles or concrete footings. As a result, wood piles are not a recommended substructure option.

2. Steel Piles with Concrete Pile Cap
   Steel piles, which typically consist of H-piles or pipe piles, are commonly used for bridge foundations in this general area, and throughout the state. H-piles can be used in most soil conditions and are the recommended option when larger gravel or cobbles are anticipated. A driving tip may be required to minimize damage to the pile. Pipe piles can also be used in most soil conditions but are better suited for soil types without large gravel or cobbles. Pipe piles, especially when driven with a closed end, can achieve bearing at a shallower depth. A cast-in-place concrete cap will be placed on top of, and integral with, the steel piles.

3. Concrete Spread Footing
   A concrete spread footing can be used at most bridge locations and are highly recommended where the soil conditions consist of rock or hard gravel-based soils. When using a spread footing on softer soil, a larger footing is required, which will increase the cost of the foundation. In addition, the presence of ground water can significantly increase the cost of construction, as dewatering and cofferdams may be necessary. Construction methods may require shoring to prevent surface water from entering the excavation site. Groundwater is anticipated at this location due to the proximity to the Shields River.

   To reduce the risk of the concrete heaving, it is common practice to place spread footings below frost depth, which requires significant excavation and forming when compared to a steel pile foundation.

   Due to the risk involved with spread footings, and the scour that is currently present, concrete spread footings are not a recommended substructure option.

4. Precast Concrete Grade Beam Abutment
   A precast grade beam can be set directly on the soil with minimal excavation, and significantly reduces the on-site concrete work required. Grade beam dimensions are typically 3-ft x 3-ft x the length of the abutment needed. This type of footing is not commonly used in Montana, although the U.S. Forest Service and some county agencies have used this type of foundation on low

volume roads. The bottom of this type of abutment is generally not below frost depth and is susceptible to frost heave. In addition, excessive settlement can be a factor if this type of an abutment is set on existing roadway fill embankment that was not properly compacted. Finally, if scour at the abutment is probable, undermining of this shallow abutment can cause the bridge to become unstable. Again, due to the soils and the presence of scour currently at this location, precast concrete grade beams set directly on the soil are not a recommended substructure option.

Based on the substructure options that were considered, steel pile foundations are the only option to be included in the alternative analysis. This is due to anticipated high ground water and scour issues that have previously occurred at Horse Creek Bridge.

Summary

A single span bridge will be used for this bridge replacement. The superstructure and substructure that will be considered in the alternative analysis are listed below:

Superstructure Options

Option 1: Precast / prestressed concrete beam
Option 2: Prefabricated steel with steel deck and gravel surface
Option 3: Steel truss

Substructure Options:

Option A: Steel piles with concrete cap

This will result in three options as described in the alternative analysis section.

IV. Alternative Analysis

A. Description

The bridge layouts were designed using the existing channel width, channel elevation, and roadway elevation. Using channel slopes of 2:1 to determine the span length of the new bridge, 104-ft is required to clear span the existing channel in its entirety. Because the new bridge has 2:1 side-slopes rather than vertical abutment walls, the new bridge will match the naturally defined channel banks and will not constrict the existing channel.

B. Schematic Layout

Schematic layouts of the proposed bridge options are enclosed in ***Appendix D***. Cost estimates for each of the alternatives are enclosed in ***Appendix E***. The two combinations are listed below:

Alternative 1: Concrete bulb-tee beam with a steel pile foundation.
Alternative 2: Prefabricated steel superstructure with a steel pile foundation.
Alternative 3: Steel truss with steel pile foundation.

C. Regulatory Compliance and Permits

The new bridge will meet all the current regulatory, compliance and permit requirements. The permits that will be required for this new structure are listed below.

SPA 124 Permit: Montana Stream Protection Act

Any agency of federal, state, county or city government proposing a project that may affect the bed or banks of any stream in Montana must apply for this permit. The purpose of the permit is to protect and preserve fish and wildlife resources and to maintain streams and rivers in their natural and existing state.

This permit requires the review and approval of the structure layout by the Montana Department of Fish, Wildlife and Parks.

Comments from Montana FWP indicate coordination will need to take place for land acquisition and relocation of the fishing access on the south side of the project.

404 Permit: Federal Clean Water Act

Any person, agency, or entity, either public or private, proposing a project that will result in the discharge or placement of dredge or fill material into waters of the United States must apply for this permit. Waters of the U.S. includes the area below the ordinary high-water mark of stream channels, and wetlands adjacent to these waters. The purpose of this permit is to restore and maintain the integrity of the nation's waters.

The permit requires the review and approval of the structure layout by the U.S. Army Corps of Engineers

318 Authorization: Short-Term Water Quality Standard for Turbidity

Any person, agency, or entity, either public or private, initiating construction activity that will cause short term or temporary violations of state surface water quality standards for turbidity must apply for this permit. The purpose of this permit is to protect water quality and minimize sedimentation.

Although this permit is administered by the Department of Environmental Quality, the authorization may be waived by the Montana FWP during its review process of the SPA 124 permit. Most often, for a bridge project, the permit is not applied for directly, and is obtained through the SPA 124 permit process.

Park County Floodplain Permit

Detailed hydraulic calculations in combination with the structure layout and design are typically submitted to the County Floodplain Coordinator for review and approval. The purpose of this permit is to promote the health, safety, and general welfare of the residents, and to minimize public and private losses due to flood conditions in Regulated Flood Hazard Areas.

Sage Grouse Consultation

Any person, agency, or entity, either public or private, initiating new land uses or activities that will adversely impact sage grouse habitats must apply for this permit. The purpose of this permit is to minimize adverse impacts and protect sage grouse habitats.

This permit requires the review and approval of the project layout by the Montana Department of Natural Resources.

D. Land Requirements

The existing county road right of way is 60-ft wide. Since the roadway alignment at this site is not changing, the construction of the new bridge will remain within the existing county road right of way and road prism. A detour bridge will not be installed during construction, so no temporary easement is required.

E. Environmental Considerations

Section II.D - Environmental Considerations includes a detailed discussion of the various environmental considerations for this project. Regarding the alternative analysis for each of the options explored, all have very similar environmental considerations and will promote efficient construction methods, minimize duration of construction, and consequently, will tend to minimize impacts at the project site.

The prestressed concrete beam superstructure will be constructed with a concrete curb, which prevents direct drainage of storm water off the deck into the stream. This is a request from the Montana Department of Environmental Quality.

Each alternative will have minimal impacts to wetlands due to the elevation and footprint of the structure crossing. None of the options are expected to require

wetland mitigation, which is triggered when wetland impacts are greater than 0.10 acres.

F. Construction Problems

No unusual or significant construction problems are anticipated for this project. The estimated construction time for this project is 90 days or less. There are currently underground communication utilities adjacent to and attached to the upstream side of the bridge. As a part of the bridge replacement design, a utility locate will be performed and the topographic survey of existing bridge will capture the location of the marked utilities. Furthermore, the contractor will make assurances prior to construction by having all utilities located.

G. Cost Estimates

1. Project Costs

Detailed project cost estimates have been prepared for all alternatives and are included in ***Appendix E***. The cost estimates have taken into account the administrative, financial, engineering and construction costs involved with the project.

2. Present Worth Analysis

The cost estimates provided include detailed unit costs of the capital improvements for this project. Listed below is a brief narrative of the Operations and Maintenance (O&M) costs included with each alternative using a present worth analysis. O&M costs for the foundation are similar for every substructure option; therefore, only the cost for superstructure O&M have been differentiated. The O&M costs have been calculated based on a 100-year service life of this bridge. The cost indicated in the O&M narratives are in today's dollars.

Alternative 1: Concrete Bulb-Tee Beam Superstructure

- Assumes deck repairs for the concrete surface every 25 years after initial construction at a cost of $25,000 each for a total of $75,000
- Assume bridge rail and object marker repair / replacement every 15 years at a cost of $3,000 each for a total of $18,000
- Assumes additional riprap needed twice during the life of the structure at a cost of $10,000

Total O&M Costs = $103,000

Alternative 2: Prefabricated Steel Superstructure with Asphalt Deck

- Assumes deck repairs for the asphalt surface every 10 years after initial construction at a cost of $7,500 each for a total of $67,500

- Assume bridge rail and object marker repair / replacement every 15 years at a cost of $3,000 each for a total of $18,000
- Assumes additional riprap needed twice during the life of the structure at a cost of $10,000

Total O&M Costs = $95,500

Alternative 3: Steel Truss Superstructure with Asphalt Deck

- Assumes deck repairs for the asphalt surface every 10 years after initial construction at a cost of $7,500 each for a total of $67,500
- Assume bridge rail and object marker repair / replacement every 15 years at a cost of $3,000 each for a total of $18,000
- Assumes additional riprap needed twice during the life of the structure at a cost of $10,000

Total O&M Costs = $103,000

The total present worth analysis for each alternative is summarized in the following table.

Table III

Present Worth Analysis				
Alternatives	**Capital Costs**	**O&M Costs**	**Service Life**	**Total Cost**
Alternative 1 Concrete Tri-Deck Beam Superstructure	$XXXXXX	$XXX,XXX	100 years	$XXXXXX
Alternative 2 Prefabricated Steel Superstructure with Asphalt Deck	$XXXXXX	$XXX,XXX	100 years	$XXXXXX
Alternative 3 Steel Truss Superstructure with Asphalt Deck	$XXXXXX	$XXX,XXX	100 years	$XXXXXX

The substructure units should not require any additional operational or maintenance expenses for the life of the structure.

H. Basis of Selection of a Preferred Alternative

Selection of the preferred alternative has taken into account technical feasibility, environmental impacts and cost considerations. Because there are only three alternatives to choose from, as defined in the Alternative Analysis, and the design of the alternatives are very similar in nature, the Basis of Selection will be

based purely on cost considerations. Therefore, **Alternative 1** is the preferred alternative.

V. Description of the Preferred Alternative

A. Site

The project site is located on a moderate volume county road, and the selected alternative minimizes the duration of installation time. Although multiple cranes are required to set the concrete beams, they can be installed quickly, minimizing construction activity and road closure.

B. Design

The design criteria used for the preliminary engineering and layout of the preferred alternative is listed below:

Design Guidelines:	AASHTO LRFD Bridge Design Specifications 2020
Design Load:	AASHTO HL-93 truck loading
Design Flood:	100-year flood event
Roadway Width:	24-foot clear width on bridge (minimum)
Channel Width:	Match existing / natural channel base width

C. Environmental

Best management practices will be implemented to prevent dust and sedimentation during construction and erosion and sediment control plans will be included as part of the contract specifications. Sediment control barrier will be placed on the downhill edge of all disturbances.

State and federal agencies were provided information about this proposed project, as well as a request for comments concerning the project. All letters and responses are provided in ***Appendix G***.

D. Cost Summary for the Selected Alternative

A cost summary for the selected alternative, **Alternative 1**, is shown on Page 4, and in ***Appendix E***. A project budget form is shown on Page 5 and enclosed in the ***Uniform Application***.

VI. Recommendations and Implementation

A. Funding Strategy

The proposed source of funding for construction of the Horse Creek Road Bridge over the Shields River –East of Wilsall is a match between Park County and MCEP funds.

B. Implementation

VII. The design and construction of this project is proposed for summer/fall 2026. The implementation schedule for this project is enclosed in ***Appendix F***.

A. Public Participation

Park County has received strong public support for the replacement of the Horse Creek Road Bridge over the Shields River, as demonstrated by the letters of support included in ***Appendix J***.

One public meeting was held in Park County for the purpose of obtaining public comments regarding the bridge selection for replacement through the Montana Coal Endowment Program (MCEP). The meeting was held April 30, 2024, at 9:00 a.m. at the City/County Complex in Livingston, where the Park County Commissioners, Park County grant personnel, and representatives of Stahly Engineering were present.

The public meeting was also held for the purpose of obtaining public comments regarding the Draft Preliminary Engineering Report for the Horse Creek Road Bridge over the Shields River. No written comments were received prior to the meeting, and no public comments were received at the meeting.

The public meeting notifications, presentations, newspaper articles, sign in sheets, and meeting minutes are located in ***Appendix I.***