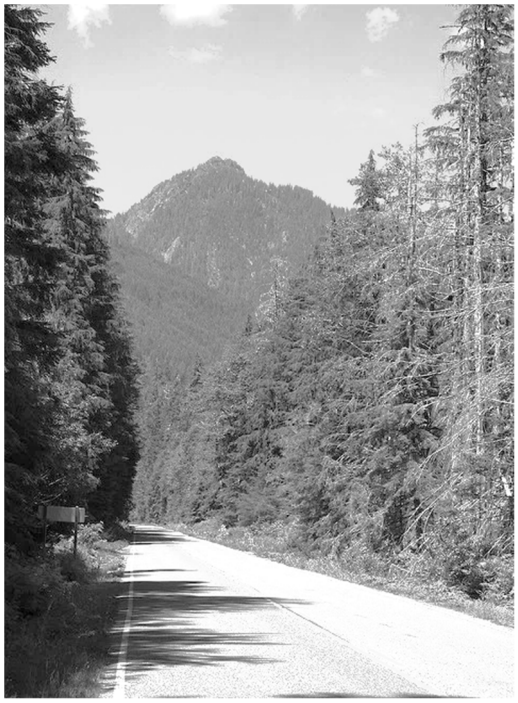

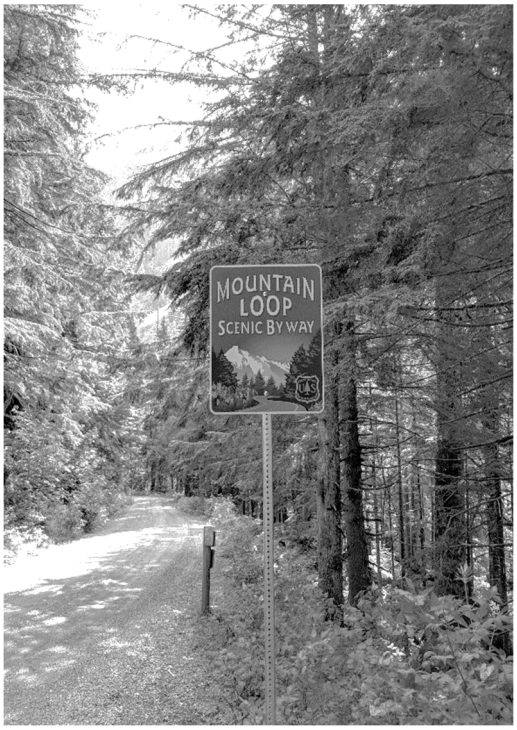

FINAL REPORT

Mountain Loop Highway Feasibility Study

WA SNOHOMISH 20(1)

IDIQ Contract No. DTFH70-15-D-00007

Task Order No. 69056718F000005

U.S. Department of Transportation
Federal Highway Administration

Prepared for:
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December 31, 2019

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ACKNOWLEDGEMENTS

The successful completion of this study was made possible through the cooperation and assistance of many individuals. The following people provided guidance and support throughout the course of this study:

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ABBREVIATIONS / ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ADT	Average Daily Traffic
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
BUILD	Better Utilizing Investments to Leverage Development
CAGR	Compound Annual Growth Rate
CAPP	County Arterial Preservation Program
Corps	U.S. Army Corps of Engineers
CRAB	Country Road Administration Board
CWA	Clean Water Act
DAHP	Washington State Department of Archaeology and Historic Preservation
Ecology	Washington State Department of Ecology
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ERFO	Emergency Relief for Federally Owned Roads
ESA	Endangered Species Act
FAST Act	Fixing America's Surface Transportation Act
FHWA	Federal Highway Administration
FLAP	Federal Lands Access Program
FLMA	Federal Lands Management Agency
FLREA	Federal Lands Recreation Enhancement Act
FLTP	Federal Lands Transportation Program
Forest Service	United States Forest Service—Mount Baker-Snoqualmie National Forest
GCR	General Condition Rating
GIS	Geographic Information System
HPA	Hydraulic Project Approval
HUC	Hydrologic Unit Code
LWCF	Land and Water Conservation Fund
MP	Mile Post
mph	miles per hour

MSATs	Mobile Source Air Toxics
MVFT	Motor Vehicle Fuel Tax
NBI	National Bridge Inventory
NEPA	National Environmental Policy Act
NFS	National Forest System
NPDES	National Pollutant Discharge Elimination System
NPS	National Parks Service
NRHP	National Register of Historic Places
PCI	Pavement Condition Index
PDO	Property Damage Only
PIP	Public Involvement Plan
RAP	Rural Arterial Program
RATA	Rural Arterial Trust Account
RCW	Revised Code of Washington
SCC	Snohomish County Code
SR	State Route
SSD	Stopping Sight Distance
STP	Surface Transportation Program
TAP	Transportation Alternatives Program
TIB	Transportation Improvement Board
TMDL	Total Maximum Daily Load
USC	United States Code
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USFWS	U.S. Fish and Wildlife Service
vpd	vehicles per day
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington State Department of Natural Resources
WNHP	Washington National Heritage Program
WRIA	Water Resource Inventory Area
WSDOT	Washington State Department of Transportation

EXECUTIVE SUMMARY

The Federal Highway Administration (FHWA), in partnership with Snohomish County and the United States Forest Service (Forest Service), has completed a feasibility study for potential improvements to the Mountain Loop Highway in the Mount Baker – Snoqualmie National Forest. The 52-mile-long highway is the only loop route of its kind on the Mount Baker-Snoqualmie National Forest. Just a 30- to 60-minute drive from the populous Seattle-Everett metropolitan area, the Mountain Loop Highway is a major recreational destination. The study, referred to as the *Mountain Loop Highway Feasibility Study*, examines the road beginning outside of Granite Falls at Mile Post (MP) 10.76 near the Verlot Public Service Center, and ending near the National Forest Service Boundary south of Darrington at MP 50.87. Throughout the planning process, it became clear that specific focus was to be given to the 14-mile gravel section of the road corridor. An overriding objective of this effort was to identify options to improve recreational access and operational safety, as well as reduce maintenance concerns, based on goals identified throughout the study.

This feasibility study is a collaborative process among FHWA, the Forest Service, Snohomish County, the communities of Darrington and Granite Falls, and the public. The study offers a planning level assessment intended to help the study partners define the most critical needs and allocate resources for the corridor. 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.

A planning level examination of the corridor was conducted based on existing and historic traffic data, collision history, field measurements and observations, roadway as-built plans, aerial imagery, Geographical Information Systems (GIS), and input from local stakeholders.

This “pre-National Environmental Policy Act (NEPA)” planning study is not a design or construction project; nor is it a decision document. The planning study identifies reasonable options for the 14-mile gravel section to address safety, geometric and environmental concerns based on goals to increase safety and efficiency for the traveling public, and provide more and better recreational access and economic opportunities to area residents. The planning effort ensured a proactive public involvement process that provided numerous opportunities for the public to be engaged in all phases of the study.

The results of the study may be used to determine the level and scope of environmental review required if a project is forwarded into a subsequent NEPA process. Information in the study can also be used by Snohomish County or USFS should they desire to move forward with any of the improvement options identified for the corridor.

ES.1 EXISTING AND PROJECTED CONDITIONS

Areas of concern and other considerations within and adjacent to the Mountain Loop Highway roadway corridor were identified through review of available reports, field observations, public databases, and other resources. They are summarized below:

TRANSPORTATION CONSIDERATIONS

Physical Features and Characteristics

- 16 of the bridges along the corridor are rated “fair” condition and one is rated “poor” condition. All bridges meet minimum design load rating standards, though there is not a consistent design load rating throughout the corridor.

- County Bridge #102 at MP 1.45 is located outside of the study corridor. It traverses the South Fork Stillaguamish River and is functionally obsolete (narrow width), identified as structurally deficient by the State of Washington since 2008, and is fracture critical where if one member were to show a crack it would need to close for inspection, repair and eventually replacement.
- Over 60 culverts of 30" or larger were identified along the study corridor. Three of the culverts were in failing condition, six were in poor condition.
- The corridor does not meet the minimum roadway surface width of 32 feet. The width is generally 28 feet for the majority of the paved section, with the exception of six miles near the beginning of the study corridor which has a width of 22 feet. The width of the gravel section varies greatly, providing only one travel lane in some locations.
- The majority of the pavement in the corridor is in good condition.

Geometric Conditions

- Approximately 96 percent of the horizontal curves on the paved sections meet or exceed a 40-mph design speed, while only 41 percent of the horizontal curves on the gravel section appear to meet the same standard (a 40-mph design speed was selected for the geometric analysis comparison for continuity with the paved sections on either end of the gravel section).
- Approximately 31 percent of the vertical curves on the gravel portion appear to meet a 40-mph design standard. 98 percent of the vertical curves on the paved portion meet a 40-mph design speed.
- There are multiple vertical profiles along the gravel portion of the study corridor that do not appear to meet a 40-mph design standard.

Traffic Conditions

- The traffic volumes on the study corridor range from 156 vehicles per day near White Chuck, to as high as 1,767 vpd near the Verlot campground.
- Average speeds vary from 37.5 mph at White Chuck to 55.3 mph at Perry Creek. More than 90 percent of vehicles travel between 45 and 55 mph. Throughout the corridor, vehicles travel at an average speed of 51 mph. This does not include speed on the gravel portion.
- The majority of vehicles traveling on the corridor are passenger cars (approximately 75 and 63 percent on the first and second paved sections, respectively) and two axle single unit vehicles (approximately 13 and 19 percent) which includes pickups, vans, and other vehicles such as campers, motorhomes, or vehicles pulling recreational trailers.
- On average, there are about half as many vehicles traveling the paved portions of the corridor in the wintertime as compared to the summertime.

Safety

- Records show 55 crashes occurring within the study area between January 1, 2008, to December 31, 2017. Two crashes resulted in fatalities, four crashes resulted in serious injuries, and 19 crashes resulted in non-serious injuries.
- The main observed crash trends are fixed object collisions (38) and roll-over collisions (10).
- A cluster of fixed object collisions (7) were observed near MP 15.5 between the Wiley Creek Campground and Schweitzer Creek. Another cluster of crashes (8) was observed between MP 11 and MP 12.

Other Vulnerabilities

- Landslides, steep side slopes, sink holes, washouts, and drainage/erosion issues are common on the Mountain Loop Highway. These events have been known to cause road damage in the past.

Environmental Considerations

Physical Environment

- Some mapped soils in the study area are classified as prime farmland, farmland of statewide importance, and "prime farmland if irrigated." The study area does not include any designated farmlands, lands zoned for agricultural uses, or lands classified as cultivated crops.
- The study area is seismically active. The highway passes through several geotechnical hazard areas. Almost the entire study area is classified as having highly erodible surficial geology.
- The study area lies within three watersheds—South Fork Stillaguamish River, Upper Sauk River, and Lower Sauk River—two of which are Tier 1 Key Watersheds. The highway also crosses 89 streams, 29 are fish-bearing. Additional unnamed streams, wetlands, and waterbodies are also present in the study area. The Sauk River and a portion of the South Fork Sauk River are part of the National Wild and Scenic Rivers System. The South Fork Stillaguamish River has been recommended for inclusion in the System.
- Some of the waters in or near the study area are listed as impaired due to elevated temperatures and sedimentation.
- Fewer than 100 wells, 1 public water supply, and two wellhead protection areas are documented in the study area.
- Several segments of the Mountain Loop Highway cross or lie within mapped 100-year floodplains. Many sections of the highway have suffered flood damage in the past, and modeling suggests flood-related damage to infrastructure is likely to become more frequent and severe.
- No air quality non-attainment areas exist in the study area, however, Darrington has been identified as an area at risk of violating standards for particulate matter.
- There are no active underground storage tanks in the study area. The Silverton Concentrator Site is currently in the state cleanup process under the Model Toxics Control Act. There are no inactive or abandoned mines in the study area.

Biological Resources

- Forested areas are the predominant land cover type in the study area, followed by developed areas, open water, and wetlands. Four species of rare vascular or non-vascular plants are documented in the study area but no plant species listed in the Endangered Species Act (ESA) are known to occur.
- The study area provides breeding, resting, foraging, and migratory habitat for many species of fish and wildlife.
- Several species of fish and wildlife that are known or expected to use habitats in the study area are listed or proposed for listing under the ESA. Designated critical habitat for several of these species is also present in the study area.
- Federal lands in the study area are managed for no net loss of core area for grizzly bears.
- Observations of 18 species of fish or wildlife on the state's list of priority species have been documented in the study area.

Social and Cultural Resources

- Minority and low-income populations exist in the study area, especially within the communities of Granite Falls and Darrington. The Sauk-Suiattle Indian Tribe homelands and reservation are located near Darrington.
- In the past, the economies of the Darrington and Granite Falls areas were heavily dependent on logging and lumber manufacturing. The communities have been trying to diversify their local economies to increase tourism and recreation.

- The majority of the lands in the study area are publicly held by the Forest Service and is used for forestry and recreation. About 5 percent of the land is owned by the State, County, or Cities while about 6 percent is privately owned.
- The highway provides access to several developed and dispersed recreational activities. The highest use occurs between May and September, when the corridor receives 17,000 to 20,000 visitors per month, on average.
- Members of several local American Indian tribes use the Mountain Loop Highway for access to traditional hunting, fishing, and gathering areas.
- Two properties in the study area—Verlot Public Service Center and the Red Bridge—are on the state and/or national registers of historic places, and a third (Blue Bridge) has been determined to be eligible for inclusion.
- The Forest Plan has identified the Mountain Loop Highway as a Primary Corridor, having "visually sensitive landscapes as viewed from major highway corridors and use areas".

ES.2 GOALS AND OBJECTIVES

Goals and objectives were derived based on a comprehensive review of existing data and input from the oversight committee, stakeholders and the public and were used to develop options. The following goals and objectives reflect the existing social, environmental, and engineering conditions described in the *Existing and Projected Conditions Report* (**Appendix B**) and recognize the local and regional use of the Mountain Loop Highway and the surrounding transportation system.

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

Areas along the gravel portion of the corridor do not accommodate simultaneous travel in two directions. Some crash trends have been identified at locations on the paved portion of the roadway. Trends relative to safety can be caused by a variety of factors, including poor roadway alignment, inadequate sight distance, and illegally parked cars.

OBJECTIVES

- Improve sub-standard elements of the roadway to meet current applicable design standards; in some locations a reduced standard should be accepted within context of the adjacent environment.
- Reduce delay for emergency responders under existing and future traffic demands.
- Manage travel speeds and provide adequate clear zones to improve operations.

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

The Mountain Loop Highway is used by local and regional travelers including vehicles, pedestrians, bicyclists, emergency response providers, and others. Depending on future growth characteristics as depicted in local adopted planning documents, the Mountain Loop Highway will realize increased passenger and vehicular traffic, and maintenance needs will continue to increase.

OBJECTIVES

- Accommodate existing and future capacity demands.
- Address non-motorized facilities consistent with local planning efforts.
- Provide connectivity to residents, and regional users accessing recreational lands along the corridor.
- Improve accessibility to better distribute recreational use.
- Reduce maintenance needs.

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

The area around the Mountain Loop Highway provides access to residential and recreational lands. It is also a secondary route to the Town of Darrington and is crucial for emergency access. Because of the location along the South Fork of the Stillaguamish River, and the Sauk River, wildlife and aquatic connectivity are areas of concern. 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 from potential options.
- Minimize adverse impacts to the wildlife and aquatic organisms from potential options.
- Provide reasonable access to recreational sites in the study.
- Avoid or otherwise minimize adverse impacts to historic, cultural, and archaeological resources that may result from implementation of options.

Other Considerations

While not a goal by itself, any option(s) developed should be sensitive to the availability of funding for recurring maintenance obligations or for the construction of new improvements. Also, over the course of the public process for this study the topics of parking, vandalism, illegal activity, and enforcement, along with identifying new access to recreational sites directly adjacent to the Mountain Loop Highway, were areas of concern generally outside the scope of this Feasibility Study. However, they are areas of concern that have been documented and commented on by members of the public.

ES.3 OPTIONS

Four options were identified as potential improvements for the 14-mile gravel section of interest. The four options appropriate for future consideration are listed below in **Table 1** and are more fully described in **Chapter 5**.

Table 1. Summary of Improvement Options and Cost Estimates

Option	Description	Range of Estimated Costs *
Option 1: Maintain Status Quo	• Continue existing conditions • Narrow roadway widths (16 feet to 22 feet) • Gravel surfacing • Inverted crown • Poor drainage off of roadway • Limited sight distance • Signage as appropriate	**$112,000 per year** *(annualized maintenance costs)*
Option 2: Minor Road and Drainage Improvements	• Utilizes existing road prism footprint • No widening of the roadway; sub-option to widen roadway at spot locations with drainage improvements • Re-work existing roadway travel surface by scarifying • Place 4" (plus/minus) of gravel surfacing • Shape roadway to obtain at least a 4% crown to promote drainage • Signage as appropriate • Improve storm water drainage facilities (ditches and culverts) A logical initital segment could be MP 40 to MP 44.65, which is the northernmost segment of gravel. This segment is in the best current condition	**$8.4M - $14.0M** *(Gravel Surfacing – low end no widening and high end with widening at spot locations, respectively)*

Option	Description	Range of Estimated Costs *
	and could be a candidate for phasing improvements along the 14-mile corridor. Estimated costs for this segment are $2.79M (low) and $4.65M (high), respectively.	
Option 3: 25 mph Design Speed	• 18 ft (minimum) or 32 ft (maximum) roadway • 9 ft lanes (no shoulders) or 12 ft lanes (4 ft shoulders) • 4" gravel or 4" asphalt surfacing (both w/8" base course) • Stabilization with calcium chloride (for gravel surfacing) • Realignment as necessary to improve geometrics (horizontal and vertical) • Generally stays within current roadway prism, limited "off-alignment" construction • Complete reconstruction of the roadway • Improves storm water drainage facilities (ditches and culverts) • Obstacles removed from clear zone • Signs A logical initital segment could be MP 40 to MP 44.65, which is the northernmost segment of gravel. This segment is in the best current condition and could be a candidate for phasing improvements along the 14-mile corridor. Estimated costs for this segment are $4.19M (gravel low) and $8.84M (gravel high), respectively, and $8.84M (asphalt low) and $13.49M (asphalt high), respectively.	**$12.6M - $26.6M** *(Gravel Surfacing – 18 ft width and 32 ft width, respectively)* **$26.6M - $40.6M** *(Asphalt Surfacing – 18 ft width and 32 ft width, respectively)*
Option 4: 40 mph Design Speed	• 32 ft (minimum) or 40 ft (maximum) roadway • 12 ft lanes (4 ft shoulders) or 12 ft lanes (8 ft shoulders) • 4" gravel or 4" asphalt surfacing (both w/8" base course) • Realignment as necessary to improve geometrics (horizontal and vertical) • Significant "off-alignment" construction, with corresponding impacts • Complete reconstruction of the roadway • Improves storm water drainage facilities (ditches and culverts) • Obstacles removed from clear zone • Signs A logical initital segment could be MP 40 to MP 44.65, which is the northernmost segment of gravel. This segment is in the best current condition and could be a candidate for phasing improvements along the 14-mile corridor. Estimated costs for this segment are $13.02M (gravel low) and $17.67M (gravel high), respectively, and $18.6M (asphalt low) and $23.25M (asphalt high), respectively.	**$39.2M- $53.2M** *(Gravel Surfacing – 32 ft width and 40 ft width, respectively)* **$56.0M-$70.0M** *(Asphalt Surfacing – 32 ft width and 40 ft width, respectively)*

** Costs are for construction only and do not include preliminary engineering or permitting. Costs are "total" costs for the entire 14-mile segment of the corridor.*

Additionally, several spot improvements were identified along the Mountain Loop Highway based on analysis of existing and projected conditions. These are summarized below in **Table 2** and are also described in **Section 5.3**.

Table 2. Spot Improvements Identified Along the Mountain Loop Highway

Location	Description
Bridge, Road and Operational Spot Improvements	
MP 1.45	County Bridge #102 over the South Fork of the Stillaguamish River is in need of replacement. It is a vital link to the Mountain Loop Highway and if ever out of service would require a 94-mile detour around or through a seasonally restricted area of the Mountain Loop Highway. The bridge is functionally obsolete (narrow width), identified as structurally deficient by the State of Washington since 2008, and is fracture critical where if one member were to show a crack it would need to close for inspection, repair and eventually replacement. *(Note this location is outside of the corridor study area but is important to the overall continuity of operations and access to the Mountain Loop Highway so is included herein).*
MP 10.76	Improve traffic circulation at the entrance to the Verlot Public Service Center. Features envisioned include a dedicated left-turn bay at the western approach to the parking lot, enhanced signing and pavement markings, and heightened pedestrian-awareness features for those walking between the Public Service Center and the pull-out directly south of the highway and adjacent to the river.
MP 14.33	The existing bridge over Black Creek is rated as poor and is a candidate for replacement. The bridge is identified as County Bridge #547. The existing bridge length is 91 feet, has three spans, and was built in 1952. Various repairs have been made to the sub-structure, and also to remove debris, over the years. It is categorized as high-risk according to the most recent bridge inspection report. The mill pond dam was constructed in 1917 and is located 250 meters upstream of bridge. The log dam is in poor condition and if failure occurs, could pose a serious threat to County Bridge #547 at Black Creek. Dam failure would result in the release of an estimated 30-foot depth of sediment that is impounded upstream of the dam. One of the logs in the middle of the structure shows signs of deterioration and splitting.
MP 14.66	The existing bridge over Wisconsin Creek is load restricted according to the 2018 Annual Bridge Report assembled by Snohomish County. The bridge is identified as County Bridge #620. Analysis to mitigate the load restriction should be made to bring the bridge up to legal highway loads.
MP 15.5	Provide safety enhancements between Wiley Creek Group Campground and Schweitzer Creek by enhancing signage. This area has sharp curves in the roadway, intermittent guardrail adjacent to the river, and sporadic pull-outs along the road. Curve ahead and speed advisory signs are in place at required locations, however there appears to be a trend of fixed object collisions in the area of the Wiley Creek Group Campground approach. Consider solar-powered or vehicle-activited amber flashers before and after approach.
MP 15.82	The existing bridge over Schweitzer Creek is load restricted according to the 2018 Annual Bridge Report assembled by Snohomish County. The bridge is identified as County Bridge #576. Analysis to mitigate the load restriction should be made to bring the bridge up to legal highway loads.
MP 18.18	The existing bridge over the South Fork Stillaguamish River is a candidate for rehabilitation, as per the 2018 Annual Bridge Report. The bridge is identified as County Bridge #537 and is called the Red Bridge. The existing bridge length is 209 feet and was built in 1954.
MP 23.33	The existing bridge over Deer Creek is a candidate for rehabilitation, as per the 2018 Annual Bridge Report. The bridge is identifed as County Bridge #670. The existing bridge length is 187 feet and was built in 1949.
MP 24.00	The existing bridge over Coal Creek is a candidate for rehabilitation, as per the 2018 Annual Bridge Report. The bridge is identified as County Bridge #556. The existing bridge length is 70 feet and was built in 1949.
MP 26.19	The existing bridge over Perry Creek is load restricted according to the 2018 Annual Bridge Report assembled by Snohomish County. The bridge is identified as County Bridge #551. Analysis to mitigate the load restriction should be made to bring the bridge up to legal highway loads.

Location	Description
MP 28.35	The existing bridge over Buck Creek Creek is load restricted according to the 2018 Annual Bridge Report assmebled by Snohomish County. The bridge is identified as County Bridge #544. Analysis to mitigate the load restriction should be made to bring the bridge up to legal highway loads.
Drainage / Culvert Spot Improvements	
MP 22.50	Replace existing 42” CMP culvert. The existing culvert is in poor condition and in need of replacement.
MP 28.80	Replace existing 36” CMP culvert. The existing culvert is in poor condition and in need of replacement.
MP 30.38	Replace existing 30” CMP culvert. The existing culvert is in poor condition and in need of replacement.
MP 32.80	Replace existing 35” x 24” CMPA culvert. The existing culvert is in poor condition and in need of replacement.
MP 38.80	Replace existing 36 CMP culvert. The existing culvert has failed and no longer is functioning.
MP 42.21	Replace existing 48 CMP culvert. The existing culvert has failed and no longer is functioning.
MP 42.47	Replace existing 49” x 33” CMPA culvert. The existing culvert is in poor condition and in need of replacement.
MP 46.23	Replace existing 30” CMP culvert. The existing culvert is in poor condition and in need of replacement.
MP 46.42	Replace existing 13 foot SSPP culvert. The existing culvert has failed and there are severe washouts at the outlet. This conveys Goodman Creek and any culvert work should be optimized to improve the water surface profile, currently a barrier to fish passage at this location. The invert of the culvert is extremely abraded and the culvert appears to be undersized. This is a high priority location along the corridor for repalcement.
MP 46.93	Replace existing 72” CMP culvert. The existing culvert is in poor condition and in need of replacement.
Bank Monitoring / Stabilization Spot Improvements	

<table>
<tr><th>Location</th><th>Description</th></tr>
<tr><td>Various Locations</td><td>There are numerous areas along the corridor where the road pinches or is against the river. These areas should be monitored because they could benefit in the future by various scaled projects using engineered rootwads or log stabilizations to channel the river away from the road and reestablish a bioengineered riparian buffer. This would benefit both fish and protect the road. The following MP ranges are areas where this constriction may be evident and should be monitored:

<table>
<tr><th>Start (MP)</th><th>End (MP)</th><th>Length</th><th>Start (MP)</th><th>End (MP)</th><th>Length</th></tr>
<tr><td>10.95</td><td>11.5</td><td>490 feet</td><td>20.8</td><td>20.92</td><td>625 feet</td></tr>
<tr><td>12.23</td><td>12.43</td><td>985 feet</td><td>21.12</td><td>21.32</td><td>940 feet</td></tr>
<tr><td>12.7</td><td>13</td><td>1,475 feet</td><td>21.6</td><td>21.95</td><td>1,755 feet</td></tr>
<tr><td>13.94</td><td>14.17</td><td>1,065 feet</td><td>22.06</td><td>22.16</td><td>525 feet</td></tr>
<tr><td>14.4</td><td>15.1</td><td>3,180 feet</td><td>22.35</td><td>22.82</td><td>2,395 feet</td></tr>
<tr><td>15.35</td><td>15.45</td><td>475 feet</td><td>22.9</td><td>23.25</td><td>1,420 feet</td></tr>
<tr><td>16.1</td><td>16.23</td><td>785 feet</td><td>23.76</td><td>23.83</td><td>475 feet</td></tr>
<tr><td>16.6</td><td>17</td><td>1,540 feet</td><td>24.25</td><td>24.35</td><td>545 feet</td></tr>
<tr><td>17.3</td><td>17.55</td><td>1,410 feet</td><td>26.9</td><td>27.1</td><td>820 feet</td></tr>
<tr><td>18.45</td><td>18.73</td><td>1,445 feet</td><td>28.8</td><td>29.3</td><td>1,150 feet</td></tr>
<tr><td>19.25</td><td>19.35</td><td>455 feet</td><td>44.9</td><td>45.15</td><td>1,085 feet</td></tr>
<tr><td>19.6</td><td>19.68</td><td>380 feet</td><td>45.81</td><td>45.97</td><td>820 feet</td></tr>
<tr><td>19.9</td><td>20.3</td><td>430 feet</td><td>46.85</td><td>47.07</td><td>1,025 feet</td></tr>
<tr><td>20.56</td><td>20.65</td><td>355 feet</td><td>50.1</td><td>50.41</td><td>1,660 feet</td></tr>
</table>
</td></tr>
<tr><td colspan="2">Parking Spot Improvements</td></tr>
<tr><td>Various Locations</td><td>Parking at recreational sites can be a hazard during high-use times of the year. Specifically, Heather Lake trailhead, Lake Twenty-two trailhead, and Barlow Pass access points realize parking congestion and conflicts. Although not a specific focus of the Feasibility Study, these areas could be candidates for further analysis in the form of a parking supply and demand analysis to accurately grasp what issues are realized, and whether parking mitigation in the form of parking expansion is necessary. Passing zones should not be allowed in these areas, and potentially other high-use recreational areas along the corridor, to reduce the potential for conflict between vehicles and pedestrians.</td></tr>
</table>

ES.4 CONCLUSIONS AND NEXT STEPS

The study evaluated the Mountain Loop Highway roadway corridor to gain a better understanding of roadway goals, objectives, constraints and opportunities, and potential funding sources. In addition to analyzing applicable data from publicly available sources, FHWA, Snohomish County, and USFS, a comprehensive public involvement process was conducted to gather relevant information from community members and stakeholder groups. This information led to a set of options for future consideration by Snohomish County and USFS for the 14-mile gravel section of the roadway.

The ability to develop a project is dependent on the availability of existing and future federal, state, local, and private funding sources. At the current time funding has not been identified to proceed with a project. Should Snohomish County or USFS elect to proceed with a project for the 14-mile gravel section of the corridor – or any other improvement outside of the gravel portion - the following steps are needed:

- Identify the option that best meets the safety, environmental, and social goals 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 any potential impacts and mitigation measures from any proposed action.

Phasing of corridor improvements could also be pursued. For example, a logical segment for the 14-mile gravel section could begin with the portion between MP 40 to MP 44.65, which is the northernmost segment of gravel. This segment is in the best current condition and could be a candidate for phasing improvements along the 14-mile corridor. Estimated costs have been presented in **Table 1** and **Table 24**, and actual milepost limits could be adjusted based on available funding or grant availability. For example if the decision is made to limit a project to approximately $5M, then a combination of asphalt (~ 3 miles) and gravel (~2 miles) may be an appropriate break-out to begin an initial project.

Any future project should be consistent with the goals and objectives contained in this study. Should this study lead to a project (or projects), compliance with NEPA will be required. Further, this Feasibility Study may be used as the basis for determining the impacts and subsequent mitigation for the improvement options in future NEPA documents. Any project developed with FHWA funding will need to be in compliance with CFR Title 23 Part 771 and ARM 18, sub-chapter 2 which sets forth the requirements for documenting environmental impacts on highway projects.

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Chapter 1
INTRODUCTION

1.1. INTRODUCTION

The Federal Highway Administration (FHWA), in partnership with Snohomish County and the United States Forest Service (Forest Service), has completed a feasibility study for potential improvements to the Mountain Loop Highway in the Mount Baker – Snoqualmie National Forest. The study, referred to as the *Mountain Loop Highway Feasibility Study*, placed specific focus on the 14-mile gravel section of the road corridor and identified options to improve recreational access and operational safety, as well as reduce maintenance concerns, based on needs identified throughout the study.

This feasibility study is a collaborative process among FHWA, the Forest Service, Snohomish County, the communities of Darrington and Granite Falls, and the public. The study offers a comprehensive planning level assessment intended to help the study partners define the most critical needs and allocate resources for the 14-mile gravel section of the corridor. 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.

A planning level examination of the corridor was conducted based on existing and historic traffic data, collision history, field measurements and observations, roadway as-built plans, aerial imagery, Geographical Information Systems (GIS), and input from local stakeholders.

1.2. BACKGROUND

The Mountain Loop Highway's beginning dates back to 1889 when gold was discovered in Snohomish County at a place that would later be known as Monte Cristo[1]. In 1891, a wagon road to move heavy mining equipment was developed by the miners between the present-day communities of Darrington and Bedal. Later that year, a surveyor discovered a good route to bring a railroad up from the smelter of Everett to the mining town of Monte Cristo (34 miles east of Granite Falls). Construction of the railway began in 1892. Severe weather events put the train out of service several times after its opening in 1893. When mining activity died out in 1899 the railroad served as transportation to the forest for wealthy tourists. After the stock market crash in 1929 and the Great Depression, the railroad was abandoned and access to the area became very difficult. When Franklin D. Roosevelt came up with the "New Deal" the old routes saw new life. A new road, that would later be known as the Mountain Loop Highway, began to take shape in 1936.

Two crews, stationed in Darrington and Verlot, began building the new road and finally connected the two ends of the road in 1941 at Barlow Pass. The road was originally meant to enable access to timber lands but was open for a short time to tourist traffic. At one time, a landowner who noticed the road went through his property began to charge travelers a toll to access the road through his property. During WWII the road was closed to civilian traffic and served as a duty station for the US Coast Guard. Military occupation in the area prompted the Federal Government to improve the road grade, straighten the road, and bypass the old railroad grade. In 1945 when the war ended, the road was reopened to civilian traffic. Over the years the road has been rerouted and replaced many times, primarily due to washout events from the scenic rivers in the area. In 1990, the Mountain Loop Highway was designated as a Forest Road Scenic Byway and now connects the towns of Granite Falls, Verlot, Silverton, Bedal, and Darrington.

The Mountain Loop Highway was designated a Forest Highway in 1961 and a National Forest Scenic Byway in 1990. The purpose of the National Forest Scenic Byways Program is to showcase driving routes on National Forest lands that provide access to outstanding scenic corridors and important natural, recreational, and historic features. The goals of the National Forest Scenic Byways Program are to:

- Support and enhance rural community economic development
- Showcase outstanding National Forest and Grassland scenery
- Increase public understanding of National Forests as a major provider of outdoor recreation
- Increase public awareness and understanding of National Forest activities and the importance of sustaining healthy, productive ecosystems
- Ensure that people remain socially connected to public lands so that they become better stewards of the nation's natural resources
- Meet the growing demand of driving for pleasure as a significant recreation use
- Increase use of National Forests by non-traditional users, including minorities and the elderly
- Contribute to the nation's overall scenic byways effort

The 52-mile-long highway is the only loop route of its kind on the Mount Baker-Snoqualmie National Forest. Just a 30- to 60-minute drive from the populous Seattle-Everett metropolitan area, the Mountain Loop Highway is a major recreational destination.

The Mountain Loop Highway offers scenic views of mountain peaks, rivers, streams, and waterfalls. A portion of the highway follows the South Fork Sauk River, part of the federally designated Skagit Wild and Scenic River system. In addition to serving many recreational visitors, the highway serves as a collector road for a few private residences and provides administrative and local access during snow-free periods.

Most of the Mountain Loop Highway is a paved, double-lane roadway managed by Snohomish County; the 14-mile segment between Barlow Pass and the White Chuck River Road is a single-lane, gravel-surface road with turnouts and is managed by the Forest Service. The *Mount Baker-Snoqualmie National Forest Land and Resource Management Plan*[2] classified the unpaved segment as Traffic Service Level B with a desired Future Service Level of A[i]. The Plan also called for creation of a paved, double-lane roadway between Barlow Pass and the White Chuck River Road. The Mount Baker-Snoqualmie National Forest classifies the road's current and proposed operational maintenance level as Level 4—usable by all vehicle types; constant or intermittent aggregate surface; user comfort and convenience a moderate priority.

The *Forest-wide Roads Analysis*[3] identified the Mountain Loop Highway as High-Need for recreation and for access to heritage resources and Late Successional Reserves. The analysis also rated the road as High-Risk for both aquatic and wildlife resources. The tension between these management goals is reflected in public comments on recent repair and improvements proposed on the Mountain Loop Highway. While some commenters have expressed support for improving the roadway, others have expressed a preference that the unpaved segment remain unpaved or even be closed to vehicular traffic.

Land use policy and regulation in the study area is governed principally by the *1990 Land and Resource Management Plan*, as amended. Outside of the National Forest boundary, Snohomish County land use policy and development regulations would apply to projects brought forward from this feasibility study. Under some circumstances, County regulations could also apply to projects on County-maintained road segments within the National Forest boundary.

[i] Traffic flow on a Service Level B road is influenced more strongly by topography than by speed and efficiency and may encounter congestion during heavy traffic (recreation or logging activities). Service Level A roads are free-flowing with adequate passing facilities.

1.3. STUDY AREA

The study area for the *Mountain Loop Highway Feasibility Study* includes the Mountain Loop Highway (Forest Service Road 20) through Snohomish County, Washington. The Mountain Loop Highway provides access between the Town of Darrington and the City of Granite Falls as an alternative to State Route (SR) 530. The highway also offers spectacular views and access to trails, campgrounds, picnic areas, and a large amount of dispersed use recreational activities. The study corridor is 52 miles in length and connects the communities of Granite Falls and Darrington. The project study area was defined by the sponsoring agencies (Snohomish County and USFS) and is 40.11 miles in length, beginning outside of Granite Falls at Mile Post (MP) 10.76 near the Verlot Public Service Center and ending near the National Forest Service Boundary south of Darrington at MP 50.87. **Figure 1** presents the study area boundary.

Within the study area, the Mountain Loop Highway is functionally classified as a rural major collector by Snohomish County. The corridor is a Scenic Byway through the Mt. Baker – Snoqualmie Forest. The Mountain Loop Highway offers recreational access to hiking, biking, fishing, camping, kayaking, rock climbing, winter sports, sightseeing, and educational opportunities in the Mt. Baker – Snoqualmie National Forest. The corridor has historically provided substantial tourism traffic and economic subsistence for the rural communities of Granite Falls and Darrington.

Figure 1
Study Area

Mountain Loop Highway
Feasibility Study
Snohomish County, Washington

Figure 1: Study Area Boundary

1.4. PREVIOUS PLANNING EFFORTS

Many local plans exist with goals and objectives related to the transportation system. The following provides a summary of existing planning documents and regulations associated with transportation in the area.

North Stillaguamish Valley Economic Redevelopment Plan (2017)

The *North Stillaguamish Valley Economic Redevelopment Plan*[4] was commissioned after the Oso mudslide on SR 530 in 2014. The mudslide closed SR 530, disconnecting Granite Falls and Darrington making the Mountain Loop Highway an important corridor. The goal of the plan was to create a comprehensive approach to leverage local and regional assets and to coordinate efforts between the rural communities in the North Stillaguamish Valley. The plan identified the Mountain Loop Highway as an infrastructure project critical to recreational and economic development in the region.

Snohomish County Comprehensive Plan (2015)

The *Snohomish County Comprehensive Plan*[5] serves as a complete policy document that guides County decisions and services on a wide range of topics, including: land use, transportation, parks, housing, and capital facilities. The transportation element of the plan is required by the State Growth Management Act to encourage efficient multimodal transportation systems that are based on regional priorities and coordination with county and city comprehensive plans. Within the transportation element, the Mountain Loop Highway is identified as a major collector on the Arterial Circulation Map. The highway is also identified on the Countywide Bicycle Facility System as a proposed county bikeway.

Mt. Baker – Snoqualmie National Forest Forest-wide Sustainable Roads Report (2015)

In 2005, the Forest Service created a Travel Management Rule to provide national consistency and clarity on motor vehicle uses on all National Forests within the National Forest System (NFS). The *Mt. Baker – Snoqualmie National Forest Forest-wide Sustainable Roads Report*[6] is a subpart of this rule and is a strategy used to help the forest identify its future road system needs for safe and efficient travel and for administration, utilization, and protection of National Forest System lands. The report is used to inform future analyses, decisions, and specific actions. It also serves as a guide to inform future decisions on where and how to invest resources on building new roads, managing current roads, or decommissioning old roads.

South Fork Stillaguamish Vegetation Project Environmental Assessment (2009)

The *South Fork Stillaguamish Vegetation Project Environmental Assessment*[7] for the Mt. Baker – Snoqualmie National Forest identified actions performed on the Mountain Loop Highway that have a potential cumulative impact on the environment. These activities include on-going, yearly maintenance activities to clear and brush the road. In terms of past projects, the Assessment lists emergency road repair and mitigation activities on the highway in response to high water events occurring in 2015 and 2016-2018.

USDA Forest-wide Roads Analysis (2003)

The United States Department of Agriculture (USDA) *Forest-wide Roads Analysis*[3] identified the Mountain Loop Highway as High-Need for recreation and for access to heritage resources and Late Successional Reserves. The analysis also rated the road as High-Risk for both aquatic and wildlife resources. The conflict between these management goals is reflected in public comments on recent repair and improvements proposed on the Mountain Loop Highway. While some commenters have expressed support for improving the roadway, others have expressed a preference that the unpaved segment remain unpaved or even be closed to vehicular traffic.

USDA Forest Service Northwest Forest Plan (1994)

The *Forest Service Northwest Forest Plan*[8] is an overall vision for the Pacific Northwest that would allow production of timber products while still protecting and managing impacted species. The plan does not make any formal recommendations in regard to the Mountain Loop Highway. It does, however, detail how to keep roads through the Mt. Baker – Snoqualmie National Forest open for economic and recreational benefits. This information pertains to the environmental impacts of road construction for this project.

USFS Mt. Baker – Snoqualmie Forest Land and Resource Management Plan (1990)

The *Mount Baker – Snoqualmie National Forest Land and Resource Management Plan*[2] guides all-natural resource management activities and establishes management standards and guidelines for the Mt. Baker – Snoqualmie National Forest. It describes resource management practices, levels of resource production and management, and the availability and suitability of lands for resource management.

In the road management portion of the plan, the 14-mile unpaved segment of the Mountain Loop Highway between Barlow Pass and the White Chuck River Road was classified as Traffic Service Level B with a desired Future Service Level of A. The plan also called for creation of a paved, double-lane roadway between Barlow Pass and the White Chuck River Road.

Environmental Impact Statement (1975)

An Environmental Impact Statement[9] for Washington Forest Highway Route 7 (Mountain Loop Highway) from Barlow Pass to Darrington was completed in 1975 by the US Department of Transportation and FHWA. The proposed action in the report was to construct the Barlow Pass to Darrington section of the Mountain Loop Highway providing a two-lane, paved road. The improvement called for a 24-foot road width with an average running speed from 20-40 miles per hour (mph) from Barlow Pass to White Chuck River and a 30-foot road width with an average running speed of 30-45 mph to Darrington. The report recommends following the existing road with some minor deviation to avoid unstable areas and improve the alignment.

Chapter 2
PUBLIC AND STAKEHOLDER PARTICIPATION

An important aspect of the feasibility study process was to provide opportunities for ongoing and meaningful public involvement. Education and public outreach were essential parts of achieving this goal. A *Public Involvement Plan (PIP)* was developed to identify public involvement activities needed to gain insight and seek consensus about existing and future transportation needs. An important part of this study was to ensure a proactive public involvement process that provided opportunities for the public to be involved in all phases of the feasibility study process. Specific public outreach measures are noted in this chapter. Meeting content, such as press releases, advertisements, agendas, presentations, minutes, etc., for all of the described activities, are provided in the public meeting outreach summary reports contained in **Appendix B**.

2.1. PUBLIC INVOLVEMENT

2.1.1. Informational Meetings

For the *Mountain Loop Highway Feasibility Study*, three series of informational meetings were held. Each series included an evening meeting in Granite Falls and Darrington. Press releases were distributed to area media outlets, and meeting announcements were advertised in local newspapers twice prior to each meeting. Display advertisements announced the meeting location, time and date, purpose of the meeting, and the locations where documents may be reviewed.

2.1.1.1. First Informational Meeting

The first series of informational meetings provided members of the public the opportunity to review information about past projects and planning efforts for the Mountain Loop Highway, the planning process, policies that affect the study, and initial study findings. Specifically, the first set of meetings focused on providing attendees with information regarding project goals, schedule, process, and next steps, and allowed attendees the opportunity to submit comments during or following the meetings. Duplicate meetings were held in the following locations in Granite Falls and Darrington, allowing for easier attendance by interested parties at either end of the Mountain Loop Highway:

Granite Falls (August 20, 2018, 6–8:30 p.m.)
Granite Falls Middle School, Multipurpose Room
405 N Alder Ave, Granite Falls, WA 98252

Darrington (August 21, 2018, 6–8:30 p.m.)
Darrington Community Center
570 Sauk Ave, Darrington, WA 98241

Stakeholder and General Public Notification Methods

The study encouraged active participation from stakeholders and the public in identifying and commenting on study issues at every stage of the planning process. To effectively notify interested parties about the opportunity to comment during the first set of informational meetings, several notification methods were employed:

- Study partners coordinated with the Daily Herald newspaper of Everett, WA to print display advertisements of the informational meetings, printed in editions on August 12 and 15, 2018.
- Postcard meeting invitations were mailed to property owners directly adjacent to the Mountain Loop Highway corridor. A total of 195 households were mailed postcards.
- Meeting information was posted on the Daily Herald online community calendar (https://www.heraldnet.com/calendar/).
- Meeting information was posted to the *Mountain Loop Highway Feasibility Study* project website (https://flh.fhwa.dot.gov/projects/wa/mountain-loop/).
- Study stakeholders, outlined in the PIP, were emailed postcard meeting invitations and were encouraged to further distribute information through their mailing lists and interested parties.
- A meeting notification press release was distributed to the Daily Herald.

Summary of Participation and Comments

Twenty community members attended the Granite Falls informational meeting and 27 were in attendance in Darrington. Attendees represented the following groups:

- Granite Falls School District
- Granite Falls Planning Commission
- Granite Falls Historical Society
- USFS
- Pilchuck Audubon Society
- Snohomish County
- Washington State Senate
- Glacier Peak Institute
- Darrington Prevention Intervention Community Coalition
- Washington ATV Association
- Darrington Strong
- Darrington Area Resource Advocates
- Town of Darrington

In addition to the above referenced groups, residents and community members from and near both Granite Falls and Darrington attended the meetings.

Seven written comments were received during the meeting in Granite Falls and 10 were received during or shortly after the meeting in Darrington (see **Appendix B**). In general, comments centered on current roadway conditions, potential benefits and drawbacks of roadway improvements, and project concerns that should be considered.

Granite Falls

Comments received were categorized by topic area, as shown in **Figure 2**. Major topic areas included recreation, tourism, seasonal use of the Mountain Loop Highway, and speed/safety.

Over half of the commenters in Granite Falls noted that they were longtime residents and/or visitors of the Mountain Loop Highway area. Similarly, many added that they enjoy traveling the Mountain Loop Highway because of the multitude of recreational opportunities in the area, such as hiking, sightseeing, camping, biking, skiing, driving, and ATV usage. Several others travel the Mountain Loop Highway for transportation purposes, noting the corridor as an alternative to SR 530 to the north. The Mountain Loop Highway was also cited as an evacuation route for residents of the area.

Comments on the Mountain Loop Highway's current state centered on the condition of its surface and potential trade-offs associated with paving the roadway, with two commenters remarking that the gravel portion between Barlow Pass and Darrington is of particular concern. One commenter mentioned that the condition of the gravel portion has negatively affected tourism in the area, while another commenter noted that roadway maintenance has not kept pace with traffic volumes and overall use. One meeting attendee commented that the current roadway is acceptable as-is.

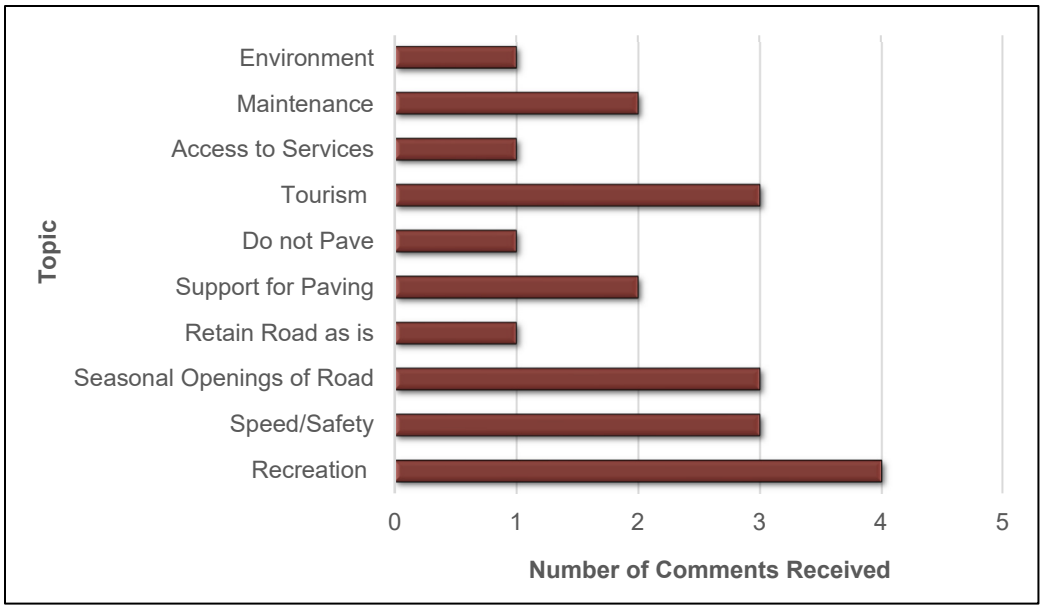

Figure 2: Comments Received at August 20, 2018 Granite Falls Informational Meeting

Over half of commenters noted positive benefits associated with paving and widening the Mountain Loop Highway, citing increased potential for economic development, historical tourism, and access to services. However, some individuals listed several potential concerns regarding roadway improvements. Three commenters noted the potential for a loss of roadside campsites and natural features if the road is widened, and raised concerns about the potential for speeding if the Mountain Loop Highway is paved in addition to being widened. One individual mentioned the possibility of lowering existing posted speed limits to allow for ATV usage of the roadway and to increase nonmotorized user safety. Two commenters stated that the Mountain Loop Highway should remain closed during winter months and potential snow-related operating costs should be considered. Individuals also raised concerns over the current lack of overnight lodging and camping opportunities in the area, and the effects that an improved roadway would have on this issue. Potential recreational improvements mentioned include a designated bicycle route, interpretive opportunities, and an additional rest area between Barlow Pass and Darrington.

Darrington

Figure 3 shows the categories of comments received at the Darrington open house. Major topic areas in Darrington included environment, tourism, speed/safety, and maintenance.

Three commenters in Darrington noted that the unpaved portion of the Mountain Loop Highway is currently in poor condition, with many potholes and high levels of dust and mud. Commenters mentioned that paving the roadway could make the area a larger tourist destination through increased comfort and accessibility to the area's hiking, camping, biking, skiing, photography, picnicking, driving, and ATV opportunities. Commenters also noted that roadway improvements would reduce maintenance costs, improve corridor safety, reduce sediment flow into the Sauk River, provide an additional evacuation route for the area, and allow greater winter recreation access.

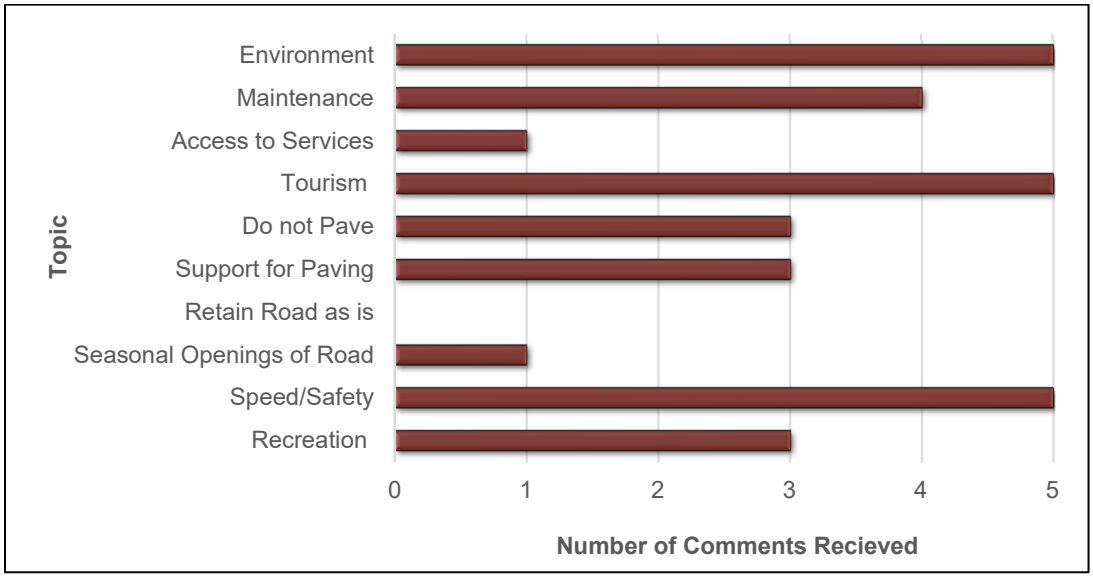

Figure 3: Comments Received at August 21, 2018 Darrington Informational Meeting

Several commenters were against, or expressed reservations about, paving and widening the roadway. Concerns were expressed over the potential for speeding and increases in traffic volumes leading to environmental harm (in the form of soil quality, impacts on trees, increased greenhouse gas emissions, increased levels of trash, and harm to wildlife) and the need for increased safety/law enforcement efforts along the corridor. Individuals also noted that while current Mountain Loop Highway travelers often stop in Darrington, paving the highway could induce visitors to simply pass through town, hindering the tourism portion of Darrington's economy. One commenter noted that considerations for pedestrians would need to be made.

2.1.1.2. Second Informational Meeting

The second set of informational meetings provided members of the public the opportunity to review information about the existing and projected conditions along the Mountain Loop Highway and provide comment on potential improvement options to be forwarded to the local partner agencies for consideration. A formal presentation was given at the beginning of each meeting, followed by a question and answer session. Duplicate meetings were held in the following locations in Granite Falls and Darrington, allowing for easier attendance by interested parties at either end of the Mountain Loop Highway:

Granite Falls (March 6, 2019, 5:30–8:30 p.m.)
Granite Falls Middle School, Multipurpose Room
405 N Alder Ave, Granite Falls, WA 98252

Darrington (March 7, 2019, 5:30–8:30 p.m.)
Darrington Community Center
570 Sauk Ave, Darrington, WA 98241

Stakeholder and General Public Notification Methods

To effectively notify interested parties about the opportunity to comment during the first set of informational meetings, the following notification methods were employed:

- Study partners coordinated with the Everett Daily Herald to print display advertisements of the informational meetings, printed in editions on February 24 and March 1, 2019.

- Postcard meeting invitations were mailed to property owners directly adjacent to the Mountain Loop Highway corridor. A total of 195 households were mailed postcards.
- Meeting information was posted on the Daily Herald of Everett, WA online community calendar at *https://www.heraldnet.com/calendar/*.
- Meeting information was posted to the *Mountain Loop Highway Feasibility Study* Project website at *https://flh.fhwa.dot.gov/projects/wa/mountain-loop/*.
- Study stakeholders, outlined in the PIP, were emailed postcard meeting invitations and were encouraged to further distribute information through their mailing lists and interested parties.
- Interested parties who had requested that their names be added to the email mailing list were emailed the postcard meeting invitation.
- A meeting notification press release was distributed to the Daily Herald.

On March 4, 2019, an article was published in the Daily Herald that summarized the efforts of the Study to date and included information on the public meetings.

Summary of Participation and Comments

There were 27 attendees who signed in at the Granite Falls informational meeting and 33 attendees who signed in at the meeting in Darrington. Attendees represented the following groups:

- Granite Falls City Council
- Granite Falls Planning Commission
- Granite Falls Historical Society
- USFS
- Pilchuck Audubon Society
- Snohomish County
- Mountain Loop Conservancy
- Washington Trails Association
- Town of Darrington
- City of Granite Falls
- Darrington Strong
- Friends for Public Use
- Darrington Town Council
- Darrington Area Resource Advocates
- North Cascades Conservation Council

In addition to the previously referenced groups, residents and community members living in and near both Granite Falls and Darrington attended the meetings.

Ten written comments were received during or shortly after (via email) the meeting in Granite Falls and 10 were received during or shortly after (via email) the meeting in Darrington (see **Appendix B**). In general, comments provided feedback on preferences for the potential improvement options as well as reactions to the findings of the existing and projected conditions analysis.

Granite Falls

Figure 4 summarizes the preferences for improvement options that were received from written comments. Option 1 received the highest number of comments in favor, followed closely by Option 2. Several commenters also remarked that they would prefer nothing to be done along the 14-mile gravel section of the Mountain Loop Highway. These commenters noted that they felt that funds could be better spent in other locations.

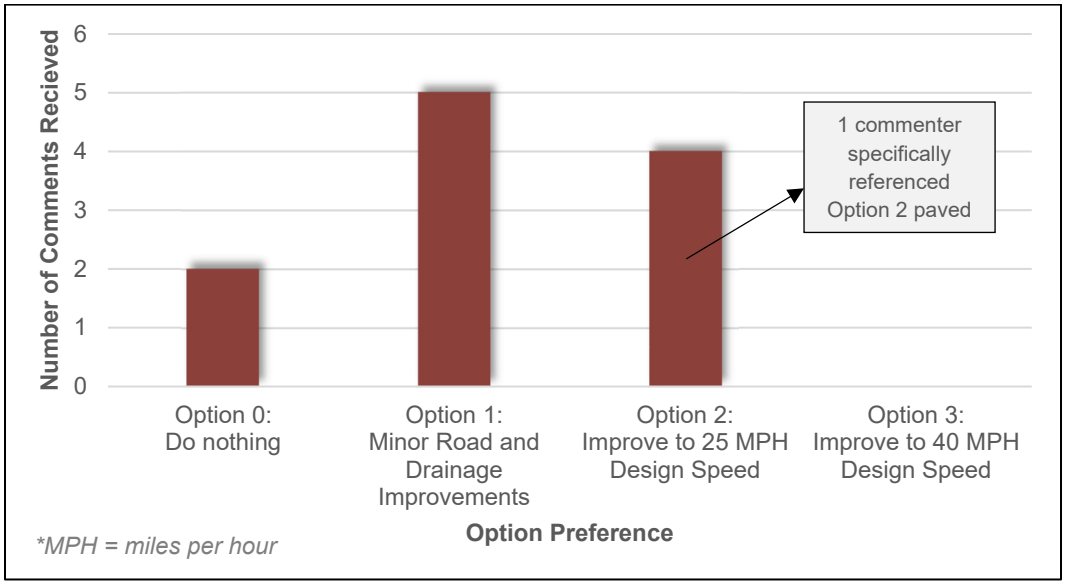

Figure 4: Comments Received at March 6, 2019 Granite Falls Informational Meeting 2

Other topics in the comments included a desire for additional trailhead parking and assurance that improvements have a minimal impact on the environment. Commenters also communicated concerns about funding availability for both project construction and regular seasonal maintenance.

Darrington

Seven of the 10 comments received in Darrington indicated a preference for Option 2; no other preferences were indicated in the other comments. Of these seven comments, six indicated that paving was preferred. One commenter was against paving the unpaved portion of the Mountain Loop Highway.

Other topics in the comments included concerns about long-term maintenance, safety in the corridor, tourism, seasonal road openings, increased traffic, and the economic benefit to Darrington.

2.1.1.3. Third Informational Meeting

The third set of informational meetings provided members of the public the opportunity to review the draft Study and learn about the next steps for the project following the completion of the Study. A formal presentation was given at the beginning of each meeting, followed by question and answer. Duplicate meetings were held in the following locations in Granite Falls and Darrington, allowing for easier attendance by interested parties at either end of the Mountain Loop Highway.

Granite Falls (November 6, 2019, 5:30–7:30 p.m.)
Granite Falls Middle School, Multipurpose Room
405 N Alder Avenue, Granite Falls, WA 98252

Darrington (November 7, 2019, 5:30–7:30 p.m.)
Darrington Community Center
570 Sauk Avenue, Darrington, WA 98241

Stakeholder and General Public Notification Methods

To effectively notify interested parties about the opportunity to comment during the informational meetings, several notification methods were employed:

- Study partners coordinated with the Everett Daily Herald to print display advertisements of the informational meetings, printed in editions on October 24 and November 3.
- Postcard meeting invitations were mailed to property owners directly adjacent to the MLH corridor. A total of 195 households were mailed postcards.
- Meeting information was posted on the Daily Herald of Everett, WA online community calendar at *https://www.heraldnet.com/calendar/*.
- Meeting information was posted to the *Mountain Loop Highway Feasibility Study* Project website at *https://flh.fhwa.dot.gov/projects/wa/mountain-loop/*.
- Study stakeholders, outlined in the PIP, were emailed postcard meeting invitations and were encouraged to further distribute information through their mailing lists and interested parties.
- Interested parties that had requested their names be added to the email mailing list were emailed the postcard meeting invitation.
- A meeting notification press release was distributed to the Daily Herald.

On November 5, an article was published in the Daily Herald that summarized the efforts of the Study so far and included information on the public meetings.

Summary of Participation and Comments

Thirty-four attendees signed the attendance sheet at the Granite Falls informational meeting and 32 attendees signed in at the meeting in Darrington. Attendees represented the following groups:

- Pilchuck Audubon Society
- Mountain Loop Conservancy
- Washington State House of Representatives
- Snohomish County
- Granite Falls Historical Society
- League of Snohomish Heritage Organization
- Snohomish County Fire District
- Washington State Republican Party
- Darrington Area Resource Advocates
- USFS
- Town of Darrington
- River Resource Trust
- North Cascades Conservation Council

In addition to the above-referenced groups, residents and community members from and near both Granite Falls and Darrington attended the meetings.

Fourteen written comments were received during the meeting in Granite Falls and thirteen were received during the meeting in Darrington. Twenty-one comments were received via email following the meetings (see **Appendix B**). In general, comments provided preferences for the potential improvement options as well as reactions to the draft Study.

Granite Falls

Figure 5 summarizes the preferences for improvement options that were received from written comments at the Granite Falls meeting. Option 2: Minor Roadway and Drainage Improvements received the highest number of comments in favor, followed by Option 1: Maintain Status Quo and Option 3: 25 MPH Design Speed Gravel. There was generally no support for Option 4: 40 MPH Design Speed. Many of the comments also indicated a desire to complete spot improvements and improve maintenance along the

corridor. Many commenters also indicated the importance of protecting the natural environment and providing adequate recreational access.

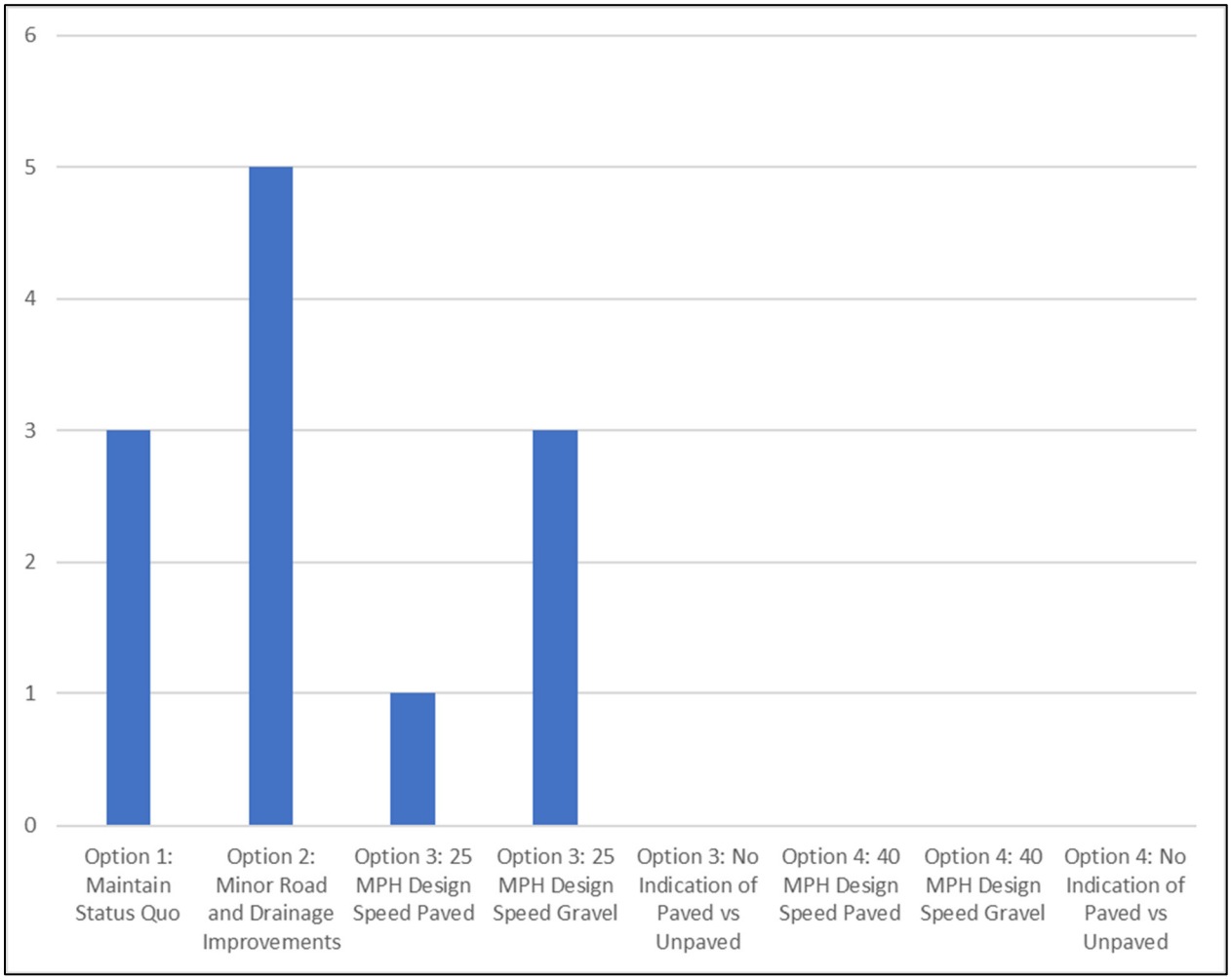

Figure 5: Comments Received by Improvement Option Preference at November 6, 2019 Granite Falls Informational Meeting 3

Darrington

Figure 6 summarizes the preferences for improvement options that were received from written comments in Darrington. Option 3: 25 MPH Design Speed Paved received the highest number of comments in favor, followed closely by Option 2: Minor Roadway and Drainage Improvements. Comments also include a desire to protect the rural feel of the roadway and prevent speeding along the corridor. Many commenters also indicated their support of spot improvements along the corridor.

Commenters also indicated concern for environmental protection, long-term maintenance, and safety in the corridor.

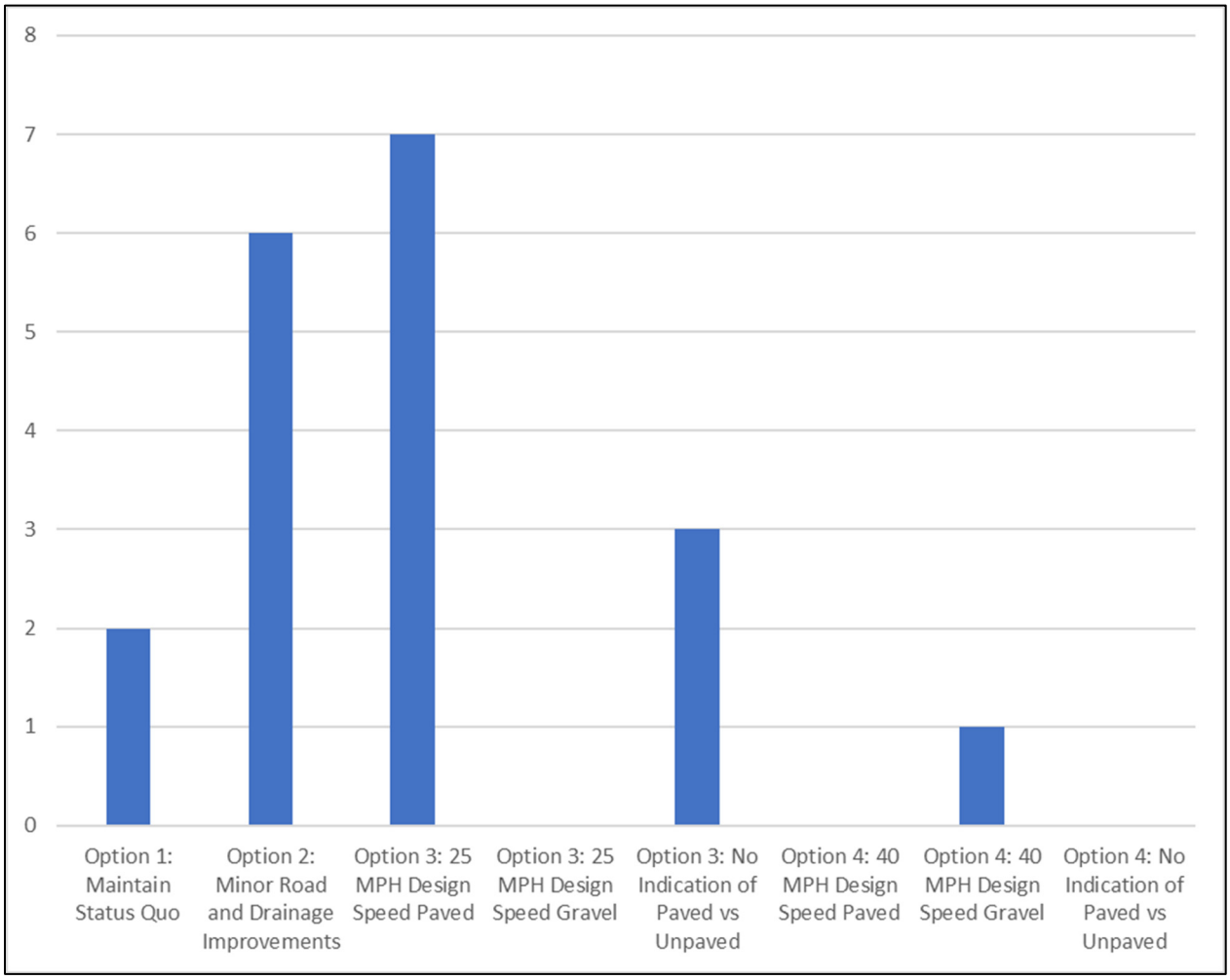

Figure 6: Comments Received by Improvement Option Preference at November 7, 2019 Darrington Informational Meeting 3

Email Comments

Figure 7 summarizes comments received via email, indicating a preference for Option 2: Minor Roadway and Drainage Improvements and Option 3: 25 MPH Design Speed (no indication of paved vs gravel). This was followed closely by a preference for Option 1: Maintain the Status Quo and Option 3: 25 MPH Design Speed Gravel.

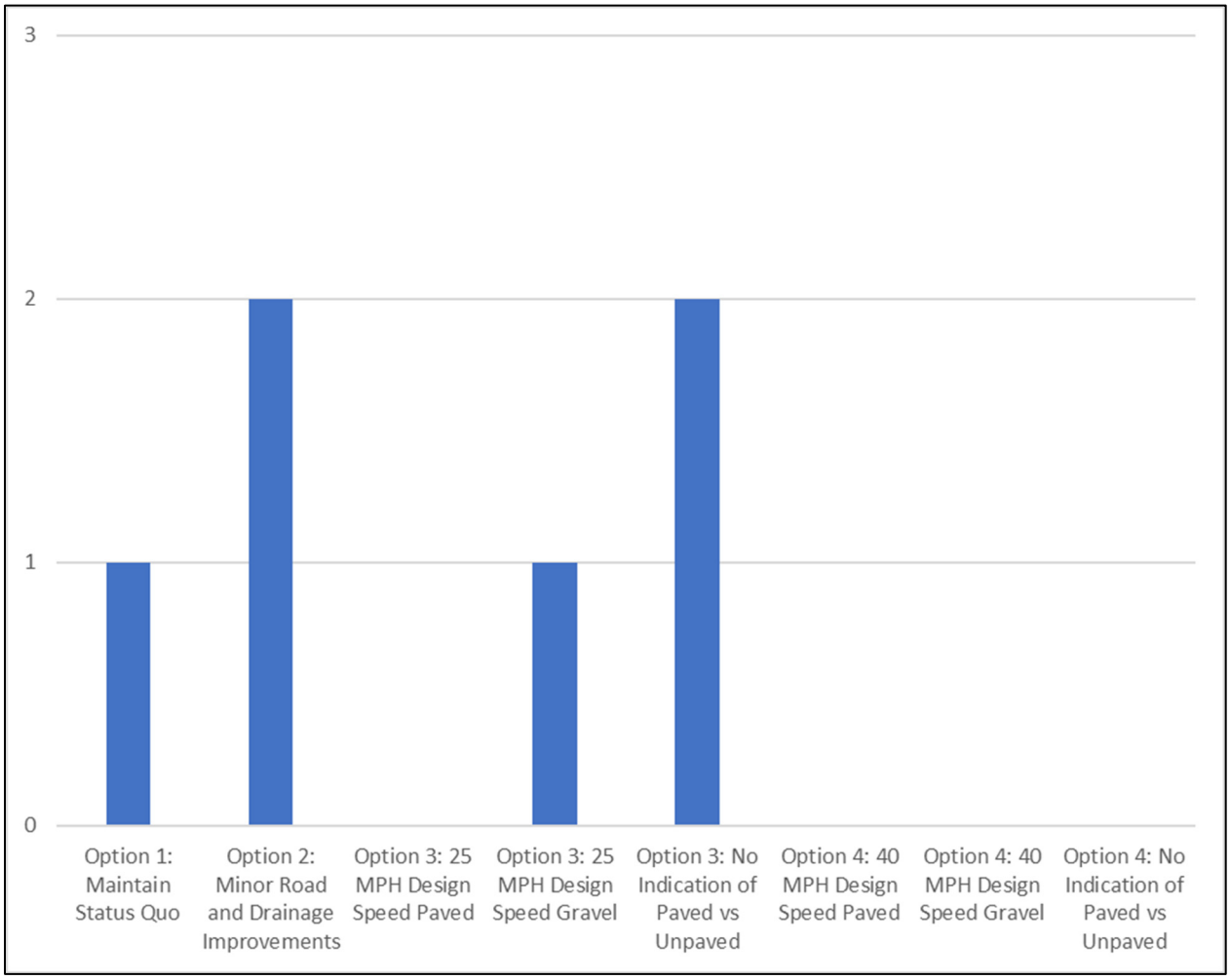

Figure 7: Comments Received by Improvement Option Preference by Email

2.1.2. Other Public Involvement Efforts

Two flyers / fact sheets were produced that described the work in progress, results achieved, screening process, and other topics. The publications were made available at the informational meetings and were posted to the study website.

A website (https://flh.fhwa.dot.gov/projects/wa/mountain-loop/) provided information regarding the study as well as an opportunity to provide comments on the study. Documents were posted for review and comment during the study process. Informational announcements were posted to the website to encourage public involvement in the study.

An email distribution list was created and maintained over the duration of the study. Advance notification of the informational meetings was made to those on the email distribution list before the meeting date. The number of individuals on the list grew to over 200 people during the course of the study.

2.2. STAKEHOLDER PARTICIPATION

A stakeholder committee was formed at the beginning of the study and included individuals, businesses, or groups identified by Snohomish County and USFS with a direct presence, involvement or investment in the study. Stakeholders were engaged at various milestones during the life of the study. Representation

on the stakeholder committee included individuals from the following organizations (see Acknowledgements section for individual names):

- Economic Alliance of Snohomish County
- Sno-King Watershed Council
- Darrington Strong
- Darrington Area Resources Advocates
- Reece's Hideout
- Forgotten Mountain River Tracts Association
- Washington Trails Association
- The Mountaineers
- Washington Wild
- The Wilderness Society
- Monte Cristo Preservation Association
- Backcountry Horsemen of Washington
- Mountain Loop Conservancy (formerly Stillaguamish Citizens Alliance)
- Pilchuck Audubon Society
- North Cascades Conservation Council
- Tribes (engaged separately by USFS)

The stakeholder committee was engaged a total of four times over the course of the planning study, as follows:

- March 7, 2018 - Introductory kick-off meeting (held in Everett, Washington)
- May 29, 2018 - Study update / reviewed environmental scan (Go-to-Meeting; joint with Oversight Committee)
- December 6, 2018 - Reviewed existing and projected conditions and options (held in Arlington, Washington; joint with Oversight Committee)
- September 24, 2019 - Reviewed Feasibility Study Draft Report (held in Arlington, Washington; joint with Oversight Committee)

The purpose of these meetings was to gather input and hear stakeholder concerns on the planning study process and associated deliverables (i.e. memorandums and reports).

2.3. OVERSIGHT COMMITTEE MEETINGS

A study oversight committee was established with representatives from Snohomish County, USFS, FHWA and the Towns of Granite Falls and Darrington. Individual representation is shown in the Acknowledgements section of this report. The oversight committee met jointly three times with the stakeholder committee as described Section 2.2. The first meeting in Everett, the kick-off meeting, was held at the same location and on the same day as the stakeholder committee (March 7, 2019) but was held two hours earlier. The oversight committee discussed study progress, analysis methodologies and results, draft technical memorandums and reports, and other issues and concerns. The oversight committee served in an advisory role and reviewed study documentation before publication.

Two additional meetings occurred with the Project Sponsors – Snohomish County and USFS – outside of the oversight committee to weigh in on the direction of the study and the draft report. These were held in Everett on November 8, 2018 and July 31, 2019.

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Chapter 3
EXISTING AND PROJECTED CONDITIONS

3.1. INTRODUCTION

This chapter presents the existing and projected road and bridge conditions, and environmental factors, for the Mountain Loop Highway planning area. These conditions and factors were utilized as part of the planning analysis to identify known issues and areas of concern. This general information may be used to support future, detailed "project level" analysis. The analysis performed includes a planning level examination of the corridor based on existing and historic traffic data, collision history, field measurements and observations, roadway as-built plans, aerial imagery, GIS, and input from local stakeholders.

3.1.1. Historic Construction and Improvements

Original Construction

Construction on the Mountain Loop Highway began in 1936 and was finished in 1941. The portion of the highway from the beginning of the study area (MP 10.76) to Barlow Pass (MP 30.68) was paved in 1961. The portion from White Chuck (MP 44.65) to the end of the study area (MP 50.87) was paved in 1983.

Pavement Preservation

Snohomish County provided the pavement preservation history for the Mountain Loop Highway from 1995 to present. Since 1995, Snohomish County has completed 16 pavement preservation projects along the corridor. **Table 3** lists the location of these projects and the type of treatment performed.

Table 3: Pavement Preservation History

Year	From	To	Begin (MP)	End (MP)	Treatment
1995	Milepost 6.2	Bridge #538	6.200	11.600	Contract Overlay
1998	Bridge #538 (Blue Bridge)	Marble Pass	12.100	21.500	Maintenance Pave
1999	MP 6.83	Bridge #538 (Blue Bridge)	6.830	12.060	Prelevel / Chip Seal
1999	Marble Pass	MP 29	21.200	29.000	Maintenance Pave
2000	MP 29	Monte Cristo Rd	29.000	30.670	Maintenance Pave
2002	Bridge #538 (Blue Bridge)	Monte Cristo Rd	12.100	30.670	Prelevel / Chip Seal
2002	MP 46.2	MP 50.49	46.200	50.490	Maintenance Pave
2003	White Chuck Bridge	Darrington C/L	44.670	52.950	Prelevel / Chip Seal
2009	Mountain View Dr	Lk 22 Trailhead	9.685	13.200	Prelevel / Chip Seal
2010	Lk 22 Trailhead	Blue Bridge	13.200	18.110	Prelevel Only
2011	Lk 22 Trailhead	Blue Bridge	13.200	18.110	Chip Seal
2012	Red Bridge (#537)	Perry Cr (Bridge #551)	18.220	26.190	Prelevel / Chip Seal
2013	.53 mi SE of Bridge #551	USFS border	26.730	30.670	Chip Seal
2016	FS Gravel @ Whitechuck (FS Rd 22)	Darrington C/L	44.670	52.544	PreLevel Only
2017	Sink Hole	Sink Hole	19.280	19.340	PreLevel/Chip Seal
2017	FS Rd 22	Darrington C/L	44.670	52.544	Prelevel

Source: Snohomish County

3.1.2. Current and Planned Projects

Federal Lands Access Program

In 2018, Snohomish County submitted three applications to the Federal Lands Access Program (FLAP) for projects along the study corridor. The FLAP program was established to improve transportation facilities that provide access to, are adjacent to, or are located within Federal lands. The program supplements State and local resources for transportation facilities with an emphasis on high-use recreation sites and economic generator. Two of the applications were infrastructure projects, while the third was for traffic circulation improvements around the Verlot Ranger Station. Although the three applications were not approved for funding in 2018, the County plans to resubmit again in the near future.

Better Utilizing Investments to Leverage Development

Snohomish County applied for a Better Utilizing Investments to Leverage Development (BUILD) grant in 2018 to replace the Granite Falls Bridge. BUILD funding supports surface transportation infrastructure investments that have a significant local or regional impact. The application argues that increased traffic demand on the Mountain Loop Highway necessitates replacement of the Granite Falls Bridge. While the bridge is not directly on the study corridor, failure of the bridge could have a substantial traffic impact on the highway if it is needed for a detour. During preparation of the application, it was revealed that the Mountain Loop Highway has been designated to be the focal project of the "Treasured Landscape Initiative" of the National Forest Foundation and that they are also planning for a 10-year forest thinning project on over 5,000 acres within the Mount Baker – Snoqualmie National Forest. The initial BUILD grant submitted in 2018 was unsuccessful, however Snohomish County will continue to submit this project for future BUILD grant consideration.

3.2. TRANSPORTATION CONDITIONS

The information contained in this section is from the *Existing and Projected Conditions Report* (**Appendix B**) which identifies roadway conditions and areas of concern for the study corridor based on a planning level examination of traffic and crash data, field measurements and observations, roadway as-built plans, aerial imagery, GIS, and input from local stakeholders.

3.2.1. Physical Features and Characteristics

Most of the Mountain Loop Highway is a paved, double-lane roadway managed by Snohomish County. The 14-mile segment between Barlow Pass and the White Chuck River Road contains gravel surfacing with varying widths and multiple turnouts, and is managed by the Forest Service. The road is steep and winding through the Mt. Baker – Snoqualmie National Forest and crosses many scenic rivers. Portions of the gravel road have only been built to minimum Forest Service standards and many segments only provide a single lane of travel.

3.2.1.1. Hydraulics

The Mountain Loop Highway generally parallels the South Fork Stillaguamish River from the beginning of the study corridor to Barlow Pass (MP 30.3), at which point it crosses into the Sauk River basin. The road then parallels the South Fork Sauk River for approximately 6.6 miles. After the North and South Forks join to form the Sauk River near MP 36.9, the road parallels the Sauk River to the end of the study area. The study corridor crosses 29 named streams and more than 60 unnamed streams. **Table 4** presents the major streams crossed by the corridor and their approximate location. The locations of the rivers are also displayed in **Figure A.1**.

Table 4. Major Streams Crossings

Name	Approximate Location (MP)
South Fork Stillaguamish River Watershed	
Benson Creek	11.4
South Fork Stillaguamish River	11.7
Twentytwo Creek	12.4
Hempel Creek	12.9
Black Creek	14.0
Wisconsin Creek	14.3
Schweitzer Creek	15.6
Boardman Creek	16.6
South Fork Stillaguamish River	17.8
Eldredge Creek	18.5
Marten Creek	20.3
Deer Creek	23.0
Coal Creek	23.6
Beaver Creek	24.5
Perry Creek	25.8
Buck Creek	28.0

Name	Approximate Location (MP)
Upper Sauk River Watershed	
South Fork Sauk River	30.9
Elliott Creek	33.5
Chocwich Creek	35.0
Bedal Creek	35.6
Merry Brook	36.2
North Fork Sauk River	36.8
Skull Creek	38.6
Sauk River	44.4
Lower Sauk River Watershed	
Dutch Creek	45.3
Dubor Creek	45.3
Goodman Creek	46.0
Murphy Creek	47.0
Clear Creek	50.1

3.2.1.2. Bridges

Bridge conditions are determined using the National Bridge Inventory (NBI) general condition ratings (GCRs). 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*[10].

The bridge condition is classified based on 23 Code of Federal Regulations (CFR) 490.409[11]. 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 or below the bridge is classified as "poor". These condition ratings are useful for planning purposes to identify potential issues and needs.

Figure A.2 shows the locations of the 21 bridges along the study corridor. **Table 5** shows the bridge specifications and condition ratings. Four of the bridges have a condition of "good", which indicates that they are candidates for continued preservation and cyclic maintenance. The majority of the bridges, 16 of 21, have a condition of "fair", indicating that they may be candidates for preservation and condition-based maintenance. One bridge received a condition rating of "poor", meaning it may be eligible for rehabilitation or replacement. Detailed bridge inspection reports are available in the *Existing and Projected Conditions Report* found in **Appendix B**.

County Bridge #102 over the South Fork of the Stillaguamish River is also shown in **Table 5**. This bridge location is outside of the study corridor but is important to the overall continuity of operations and access to the Mountain Loop Highway so is included herein. It is in need of replacement, is a vital link to the Mountain Loop Highway and if ever out of service would require a 94-mile detour around or through a seasonally restricted area of the Mountain Loop Highway. The bridge is functionally obsolete (narrow width), identified as structurally deficient by the State of Washington since 2008, and is fracture critical where if one member were to show a crack it would need to close for inspection, repair and eventually replacement.

Table 5 also lists the width of each bridge within the study area. According to the American Association of State Highway and Transportation Officials (AASHTO) *Policy on Geometric Design of Highways and Streets*[12] *(AASHTO Greenbook)*, a bridge on a rural collector road with annual daily traffic (ADT) of 400-1500 vehicles per day (vpd) is recommended to consist of the travel way plus three-foot shoulders on each side. The minimum travel way for the same street classification is 22 feet. This recommendation results in a recommended minimum bridge width of 28 feet for two travel lanes. A number of bridges within the study area have widths narrower than the recommended standards. However, the recommended standards are for new bridges. When a roadway is to be reconstructed, an existing bridge may remain in place if it is 22 feet or greater in width. If the structure has a total length greater than 100 feet, the minimum width does not apply, and the structure must be analyzed individually.

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. The rating is calculated using the FHWA Coding Guide. The rating is based 55% on the structural evaluation, 30% on the obsolescence of its design, 15% on its importance to the public, and can be reduced up to 13% based on detour length, traffic safety features, and structure type. The sufficiency rating is used to determine eligibility for federal funding with Highway Bridge Program funds. 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. Seven bridges in the study area are eligible for rehabilitation and six bridges are eligible for replacement. Note that four bridges did not have a sufficiency rating listed.

The AASHTO *Standard Specifications for Highway Bridges*[13] identifies design vehicle loads. Most bridges in the United States were designed to accommodate either an H15 or HS20 loading. An H15 loading is represented by a two-axle single unit truck weighing 15 tons. The H truck configuration includes only two theoretical axles and represents dump truck vehicles. There are two sizes of H-type vehicles: the standard 20-ton, H20 truck, or a smaller 15-ton, H15 truck. An HS20 loading is represented by a three-axle semitrailer combination weighing 36 tons. The “20” in HS20 stands for 20 tons, the “S” stands for semitrailer combination which adds in the additional 16 tons for the third axle to give a total of 36 tons. Another type of design load is the “lane load”. This uniform load scheme represents a string of closely spaced H15 single trucks (with 30 feet between the rear axle of one vehicle and the front axle of the following vehicle), with a heavier H20 truck in the middle of the string. This type of vehicular load is important for long-span structures, where slow traffic can lead to a bunching effect, with heavier loads than those generated by higher speed traffic and traveling with more space between vehicles. AASHTO also has a specification, in which an HL93 loading is used. The HL93 is an HS20 truck with the lane load added. According to AASHTO standards for collector roadways, new bridges should be built using an HL93 design loading, and bridges to remain in place must have a design loading capacity of HS15 or better. All of the bridges in the study area have a design loading capacity of HS15 or better and the newest bridge (Marten Creek) has a HL93 design load capacity. Note that six bridges did not have a design load identified.

Table 5. Bridges Inventory

County Bridge No.	Location (MP)	Feature Crossed	Year Built	Curb to Curb Width (ft)	Length (ft)	Condition	Sufficiency Rating	Design Load
102	1.45	South Fork Stillaguamish River	1934	20	340	Fair	49.11	HS15
474	11.2	Benson Creek	1995	34	67	Good	79.89	HS25
538	12.06	South Fork Stillaguamish River	1954	26	211	Fair	56.89	HS20
497	12.83	Twenty-Two Creek	1952	26.3	31	Fair	54.45	Unknown
547	14.33	Black Creek	1952	26.2	91	Poor	41.55	HS20
620	14.66	Wisconsin Creek	1960	26.4	31	Fair	48.35	LR *

County Bridge No.	Location (MP)	Feature Crossed	Year Built	Curb to Curb Width (ft)	Length (ft)	Condition	Sufficiency Rating	Design Load
576	15.82	Schweitzer Creek	1952	26.2	31	Fair	52.42	LR *
587	16.90	Boardman Creek	1952	26.1	91	Fair	53.95	HS20
537	18.18	South Fork Stillaguamish River	1954	26	209	Fair	59.19	HS20
658	20.02	Little Beaver Creek	2007	28	22	Good	47.58	Unknown
562	20.64	Marten Creek	2011	38	135	Good	84.99	HL93
670	23.33	Deer Creek	1949	26	187	Fair	48.15	H20
556	24.00	Coal Creek	1949	26	70	Fair	40.45	HS15
551	26.19	Perry Creek	1958	26	61	Fair	48.72	LR *
544	28.35	Buck Creek	1960	26.3	91	Fair	55.8	LR *
465	31.2	South Fork Sauk River	1978	28	100	Fair	Not Listed	HS20
464	33.9	Elliott Creek	1978	28	115	Good	Not Listed	LR *
463	35.9	Bedal Creek	1978	58	57	Fair	Not Listed	HS20
469	37.2	North Fork Sauk River	1961	14	200	Fair	Not Listed	Unknown
655	44.79	Sauk River	1983	28	171	Fair	90.43	HS20
656	45.69	Dutch Creek	2003	26.8	108	Fair	88.39	HS25
654	50.43	Clear Creek	1964	28	125	Fair	89.56	HS20

** "LR" indicates "Load Restricted" as per the 2018 Annual Bridge Report completed by the Snohomish County Public Works Department – Engineering Services Bridge Group (May 2019).*

3.2.1.3. Culverts

There are several culverts throughout the corridor. Sixty-one major culverts with a diameter of 30 inches or more were identified during field review. Approximately 84 percent of the culverts were in fair or good condition, and five percent (three culverts) had failed. There was water flow in approximately 82 percent of the culverts during the field review.

The appendix of the *Existing and Projected Conditions Report* (**Appendix B**) contains an inventory of each structure and lists the specifications and condition of each. **Figure A.2** shows the locations of the culverts inventoried. All data contained in the appendix were collected during field review and may differ from data in inspection reports compiled by Snohomish 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.

3.2.1.4. Maintenance and Operations

Maintenance of the Mountain Loop Highway is imperative to the safety of its users and to the economic stability of the rural communities of Granite Falls and Darrington. The Mount Baker – Snoqualmie National Forest classifies the road's current and proposed operational maintenance level as Level 4—usable by all vehicle types; constant or intermittent aggregate surface; user comfort and convenience a moderate priority.

The portion of the highway between Verlot and Barlow Pass is maintained by Snohomish County per a 1921 cooperative agreement with the Forest Service which governs this section. The 14-mile gravel portion of the Mountain Loop Highway is maintained by Snohomish County through a Forest Road Agreement (July 2009) that was amended in 2016 to specifically include the gravel portion. The portion of the highway between White Chuck and Darrington is owned by the Forest Service, and Snohomish County was granted an easement (deeded December 1999) which allows for improvement, operation, and maintenance of the road by Snohomish County with review and approval by USFS.

Parts of the Mountain Loop Highway are a primary route for county snow removal activities including the route from Granite Falls to Deer Creek and from Darrington to Backman Creek. During the winter, the 14-mile gravel section is impassable and is closed for the season, disconnecting the loop for months. In the spring, when the road reopens, snow runoff, rains, and flooding also can cause significant maintenance issues.

In March of 2014, the Oso mudslide occurred on SR 530 blocking the main route to Darrington. This road closure necessitated the clearing of snow from the gravel portion of the Mountain Loop Highway in order to open the full highway and provide an alternate route to Darrington. This event forced traffic onto the Mountain Loop Highway from March until September of 2014.

Finally, parking at recreational sites can be a hazard during high-use times of the year. Specifically, Heather Lake trailhead, Lake Twenty-two trailhead, and Barlow Pass access points realize parking congestion and conflicts. Passing zones should not be allowed in these areas, and potentially other high-use recreational areas along the corridor, to reduce the potential for conflict between vehicles and pedestrians.

3.2.1.5. Roadway Surfacing

The corridor consists of paved roadway of varying widths, from 22 feet to 31 feet, and gravel roadway of widths between 12 and 21 feet. Existing roadway surfacing characteristics were determined from Snohomish County's road logs and on-site field review. **Table 6** shows the typical width of the existing roadway and the surfacing type. The AASHTO *Greenbook* requires a minimum travel way width of 22 feet with five-foot shoulders on each side for a minimum roadway width of 32 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. The shoulder width may be reduced for design speeds greater than 30 miles per hour (mph) so long as the total roadway width is 30 feet or greater. These standards are applicable to rural collector streets with 400 to 1500 vpd. The majority of the corridor falls within these bounds, however, there are sections that have an average traffic volume of greater than 1500 vpd and others with an average traffic volume less than 400 vpd.

AASHTO provides guidance for *Very Low-Volume Roads (ADT≤400)*[14]. For roadways that qualify for this classification in the recreational and scenic subclass, an 18-foot roadway width is required for new construction. However, the cross-section widths of existing roads need not be modified except in those cases where there is evidence of site-specific safety problems. These standards are only applicable to a small portion of the corridor (ADT < 400) and with increased traffic volumes predicted in the future, following this guide specification isn't anticipated.

Snohomish County Road Design Standards for a rural arterial, major collector, with an average daily traffic volume of less than 2,000 vpd calls for a minimum pavement width of 38 feet with 11-foot travel lanes and 8-foot shoulders. The standards allow the cross-section to be altered where a stream or wetland borders the road but does not specify minimums in these cases. There are also design standards listed for rural non-arterials, subcollectors (91-2000 ADT) and collectors (2001-3000 ADT). Subcollectors have a 25-mph design speed and 24-foot surface width, collectors have a 30 mph design speed and a 30-foot surface width. The standards do not give guidance for gravel roads except private, low volume access roads with less than 90 ADT.

There are various locations along the corridor where the roadway width is constrained either by steep side slopes, retaining walls, rivers, streams, or wetlands. In these areas, the roadway can be constrained to widths as narrow as 12 feet for a stretch of several hundred feet. These constraints occur in several locations along the gravel portion of the corridor.

Roadway widths were determined during field review and were measured from edge of pavement to edge of pavement. Measurements were taken approximately every half mile or when notable changes in pavement width were observed. Every change in pavement width is not captured in **Table 6** as widths varied substantially throughout the study area. The information in the table is meant to capture the average width of roadway through sections. Pavement widths listed in the table may differ from those contained in reports by Snohomish County or the Forest Service.

Table 6. Roadway Surfacing

Begin (MP)	End (MP)	Length (mi)	Width (ft)
Pavement			
10.76	**11.8**	1.0	28.5
11.8	**18.0**	6.2	22
18.0	**19.2**	1.2	27
19.2	**20.0**	0.8	31
20.0	**23.8**	3.8	28
23.8	**26.3**	2.5	26
26.3	**30.5**	4.3	30.5
30.5	**30.67**	0.2	26
Gravel			
30.67	**31.1**	0.4	17.5
31.1	**31.7**	0.6	21
31.7	**33.5**	1.8	16
33.5	**33.7**	0.2	12.5
33.7	**34.1**	0.3	17.5
34.1	**38.4**	4.4	14.5
38.4	**39.2**	0.8	13
39.2	**40.4**	1.2	16
40.4	**42.4**	2.0	15
42.4	**43.9**	1.5	18
43.9	**44.67**	0.8	16
Pavement			
44.67	**50.87**	6.2	28

3.2.1.6. Pavement Condition

Pavement condition indices (PCI) are measured and tracked along the corridor by Snohomish County. The County collects various data to determine the relative performance of the pavement. Items of primary interest include the presence and degree of cracking and rutting, and overall ride quality. By understanding the condition of pavement, the County can identify the most appropriate treatments and resources to extend pavement life.

Table 7 shows the PCIs determined by Snohomish County in 2017 for various points throughout the corridor. A PCI with a numerical value of “100” is assigned to a new pavement with no flaws, and a value of “0” is assigned to a highly degraded pavement. For collector roadways, a PCI of greater than 85 is considered good, a PCI of 70-85 is satisfactory, 60-70 is fair, 40-60 is poor, and less than 40 means the pavement should be rehabilitated immediately. The last pavement preservation treatment and corresponding date is also listed in the table along with the pavement width and surface type.

Table 7. Pavement Condition

MP	Surface	Last Surface*	Last Treatment*	PCI	Condition
11.31	Single Chip Seal	2009	2009	86	Good
12.10	Single Chip Seal	2009	2009	90	Good
13.18	Single Chip Seal	2009	2009	86	Good

MP	Surface	Last Surface*	Last Treatment*	PCI	Condition
19.34	Single Chip Seal	2017	2017 (sink hole)	88	Good
21.20	Single Chip Seal	2012	2012	85	Good
26.73	Single Chip Seal	2013	2013	91	Good
29.00	Single Chip Seal	2013	2013	91	Good
44.67	Single Chip Seal	2003	2017	77	Satisfactory
46.20	Single Chip Seal	2003	2017	90	Good

Based on Pavement Preservation History Report from Snohomish County (Table 1**)*

The PCIs supplied by Snohomish County indicate that the first paved section, from MP 10.76 to MP 30.68, is in good condition. The last pavement preservation on this segment of the corridor was in 2013, with the exception of a sink hole repair performed in 2017. During field review, it was noted that the chip seal was separating in some areas in this section but that the overall pavement condition was good. After the gravel section ends, the PCI indicates the pavement is in satisfactory condition. Beyond that segment, beginning at MP 46.2, the rest of the pavement along the corridor is in good condition. The last chip seal on this section was performed in 2003, however, prelevel treatments were also performed in both 2016 and 2017. Prelevel is used to remove hazardous spot locations and to correct deficiencies in the roadway.

3.2.1.7. Access Points

Access points were identified through field review in June 2018. Based on this review, there are approximately 147 access points along the corridor. Private approaches, pullout areas, service roads, parking areas, trail heads, picnic areas, and campgrounds are all considered access points. The majority of accesses are concentrated at the beginning of the corridor with private access roads for Verlot residents and accesses for the various campgrounds in the area. On average, there are approximately 3.7 access points per mile along the corridor. **Table 8** provides a summary of access points grouped in incremental segments along the study area.

Table 8. Access Points and Approaches

Begin (MP)	End (MP)	Segment Length (mi)	Approaches	Density (app/mi)	Description
10.76	16	4.24	55	13.0	Begin Study Area to Esswine GC
16	21	5.00	17	3.4	Esswine GC to Dick Sperry Picnic
21	26	5.00	23	4.6	Dick Sperry Picnic to Perry Creek GC
26	31	5.00	8	1.6	Perry Creek GC to Begin Gravel Section
31	37	6.00	14	2.0	Begin Gravel Section to Bedal
37	45	8.00	18	2.3	Bedal to End Gravel Section
45	50.87	5.87	12	2.0	End Gravel Section to End Study Area
Total		**40.11**	**147**	**3.7**	

3.2.1.8. Alternative Transportation Modes

The *Snohomish County Comprehensive Plan* designates the Mountain Loop Corridor as a county bikeway. There are currently no dedicated bicycle or pedestrian facilities along the study corridor. Local stakeholders report minimal biking activities along the corridor but anticipate that biking activity may increase with road improvements. There are also no transit services on the study corridor.

3.2.1.9. Emergency Services

Due to the numerous recreational activities occurring in the Mount Baker – Snoqualmie National Forest, search and rescue missions are fairly common. The majority of rescues are air rescues but emergency services occasionally to use the corridor for access. Typically, emergency vehicles approach from Granite Falls via the Mountain Loop Highway.

3.2.2. Geometric Conditions

Existing roadway geometrics were evaluated and compared to current standards. Available as-built drawings were reviewed for the Mountain Loop Highway within the study area. Field reviews of the study corridor took place in June 2018 to confirm and supplement information contained in the as-built drawings, as well as to identify additional areas of concern within the study area.

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.

Design criteria for the study corridor are based on current AASHTO standards as described in the following sections.

3.2.2.1. Design Criteria

Table 9 lists current design standards for rural major 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. Based on the definitions provided in the Greenbook, the study corridor appears to be of rural context under rolling terrain, with projected traffic volumes between 400 and 2000 vpd. This correlates to a design speed of 40 mph. The speed limit throughout the majority of the corridor is 45 mph, however, for the purposes of this report, a design speed of 40 mph with associated design standards was assumed. A final determination of design speed will ultimately be made during project development.

Table 9. 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		30 mph	40 mph	50 mph
	Maximum Grade	Level	7%	7%	6%
		Rolling	9%	8%	7%
		Mountainous	10%	10%	9%
	Vertical Curvature (K-value)	Crest	19	44	84
		Sag	37	64	96
	Stopping Sight Distance (SSD)		200	305	425
	Radius		215	444	758

Note that the horizontal and vertical alignments for the Mountain Loop Highway are based upon as built roadway plans from as early as 1932, when the road was originally built. The existing alignment may not match the original alignment as reconstruction projects may have occurred.

There are two gaps in the as built plans for the paved sections, between approximate MP 22.5 and MP 26, and between MP 47.5 and MP 50. Additionally, as built plans and/or accurate survey information were not available for the 14-mile gravel section. The alignment for the gravel section included in the following

analysis is based upon a reviews of ground contours and aerial imagery, and as such, the curvature is approximated.

3.2.2.2. 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 design standards for horizontal curves are defined in terms of curve radius, and they vary based on design speed. For a 40-mph design speed, the minimum recommended radius is 215 feet with a minimum stopping sight distance (SSD) of 200 feet.

A summary of each horizontal curve identified along the study corridor can be found in the *Existing and Projected Conditions Report* (**Appendix B**). 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.

Table 10 summarizes the horizontal curves and the design speed that each of the curves meets. There are 280 existing horizontal curves along the Mountain Loop Highway within the study area. Approximately 40 percent of the curves (112 curves) do not meet the minimum standards for horizontal curvature based on a 40-mph design speed. Approximately 97 percent of the horizontal curves (108 curves) that do not meet 40-mph standards are on the gravel portion of the highway.

Table 10. Horizontal Curves – Design Speed Met

Design Speed Met (mph)	Pavement*		Gravel**	
	Number of Curves	Percent of Curves	Number of Curves	Percent of Curves
Total (≥40)	**92**	**96%**	**76**	**41%**
35	2	2%	14	8%
30	1	1%	35	19%
25	1	1%	53	29%
20	0	0%	6	3%
Total (<40)	**4**	**4%**	**108**	**59%**

** Does not include section between MP 22.5 and MP 26 or section between MP 47.5 and MP 50.*
*** Estimated based on existing survey contour data.*

3.2.2.3. 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.

The *Existing and Projected Conditions Report* (**Appendix B**) includes a list of the location and controlling design features for the vertical curves along the study corridor. According to the AASHTO *2011 Collector Road Design Standards*, the maximum allowable grades for a 40-mph design speed are 7 percent for level terrain, 8 percent for rolling terrain, and 10 percent for mountainous terrain. The rate of vertical curvature is expressed in terms of the K-value. The K-value is defined as a function of the length of the curve compared to the algebraic change in grade, which comprises either a sag or a crest vertical curve.

For a 40-mph design speed (rolling terrain), minimum K-values of 44 and 64 are recommended for crest and sag vertical curves, respectively.

Table 11 summarizes the vertical curves on the Mountain Loop Highway and the design speed that each of the curves meets. Within the study area, there are 253 vertical curves. Nearly half of the vertical curves (114) do not meet minimum design standards for a 40-mph design speed. All but two (112) of the curves that do not meet standards are on the gravel portion of the highway.

Table 11. Vertical Curves - Design Speed Met

Design Speed Met (mph)	Pavement*		Gravel**	
	Number of Curves	Percent of Curves	Number of Curves	Percent of Curves
Total (≥40)	89	98%	50	31%
35	1	1%	16	10%
30	1	1%	28	17%
25	0	0%	23	14%
20	0	0%	21	13%
15	0	0%	10	6%
<15	0	0%	14	9%
Total (<40)	2	2%	112	69%

** Does not include section between MP 22.5 and MP 26 or section between MP 47.5 and MP 50.*
*** Estimated based on existing survey contour data.*

Table 12 shows the vertical curves which do not meet the 8 percent maximum grade for a 40-mph design speed (rolling terrain). All 48 of the substandard grades are on the gravel section of the corridor. Note that the alignment for the gravel section is based upon survey contour data, and as such, the curvature and grades are approximated. Actual grades may differ from those listed in the table.

Table 12: Substandard Vertical Curve Grades

MP	Grade Back	Grade Ahead
30.70	4.7%	15.2%
30.71	15.2%	5.3%
30.91	0.0%	-12.0%
31.01	-12.0%	-0.3%
31.12	-4.9%	-15.4%
31.14	-15.4%	-2.2%
31.18	-2.2%	-9.3%
31.19	-9.3%	-2.1%
31.27	4.6%	-12.3%
31.30	-12.3%	-5.6%
31.37	1.2%	-12.6%
31.38	-12.6%	-4.3%
31.40	-4.3%	-8.1%
31.42	-8.1%	-5.0%
31.44	-5.0%	-22.9%
31.45	-22.9%	-6.3%

MP	Grade Back	Grade Ahead
31.57	7.6%	14.8%
31.59	14.8%	6.7%
31.64	6.7%	-11.1%
31.67	-11.1%	-5.0%
32.20	-4.1%	-8.9%
32.22	-8.9%	-0.5%
32.27	-0.5%	-15.7%
32.34	-15.7%	-0.4%
33.42	3.3%	-11.6%
33.48	-11.6%	-7.3%
33.64	-7.3%	-11.8%
33.75	-11.8%	-3.1%
34.25	0.0%	-10.6%
34.39	-10.6%	0.0%
36.72	4.0%	9.6%
36.76	9.6%	-0.8%

MP	Grade Back	Grade Ahead
37.32	-6.5%	-9.3%
37.46	-9.3%	-2.9%
37.72	1.3%	8.7%
37.81	8.7%	-3.0%
39.60	-0.1%	-10.1%
39.82	-10.1%	4.3%
40.79	-0.2%	8.1%
40.92	8.1%	-4.7%
41.22	-6.8%	-12.0%
41.25	-12.0%	0.4%
41.33	0.4%	-11.8%
41.49	-11.8%	4.5%
42.17	7.2%	12.3%
42.20	12.3%	7.7%
42.46	-3.1%	9.6%
42.57	9.6%	4.6%

3.2.3. Traffic Conditions

An evaluation of traffic characteristics was completed using available data provided by Snohomish County and field-collected data. Snohomish County provided mainline traffic volume counts, vehicle speed distributions, and vehicle classifications at many locations throughout the corridor. The following sections provide details about the existing traffic characteristics of the corridor. Detailed data is included in the *Existing and Projected Conditions Report (***Appendix B**).

3.2.3.1. Existing Traffic Volumes

Snohomish County administers traffic count data at various locations along the paved roadway within the study area. Traffic counts for the gravel portion of the highway was not available for analysis. In the majority of the traffic count locations, volumes are available for an entire week during the summer. This data allows an analysis of daily variations throughout the corridor. Since the corridor is primarily used for recreational access, it is not surprising that the weekdays experience less traffic than the weekend days. It should be noted that the traffic counts provided in this section are counts for a given period and do not represent annual average daily traffic.

In addition to existing conditions, the County provided limited historic data for some of the traffic count sites within the study area. **Figure A.3** shows the most recent traffic data for each count location along the Mountain Loop Highway. Note that the Oso mudslide occurred in March of 2014, during this time traffic was diverted from SR 530 onto the Mountain Loop Highway. SR 530 was rebuilt and open to full traffic movements by September of 2014 and therefore the traffic counts provided in this section are not believed to be influenced by this event.

The traffic volumes on the Mountain Loop Highway range from 156 vehicles per day near White Chuck, to as high as 1,767 vpd near the Verlot campground. **Figures 8** through **10** show a yearly comparison of the daily variations in traffic. Since ADT values are not provided, the values in the following figures represent an average of the known volumes across the corridor. Also shown on the figures is a trendline indicating the compound average growth rates (CAGR) of traffic volumes. The trendline uses the average day for each year of data to calculate the growth rate.

Due to the limited availability of data, the data have been separated into three figures based on their location along the corridor (MP 10.76 – 19.99, MP 20.00 – 30.68, and MP 44.65 – 50.99). As noted previously, data was unavailable for the gravel portion (MP 30.68 to MP 44.65).

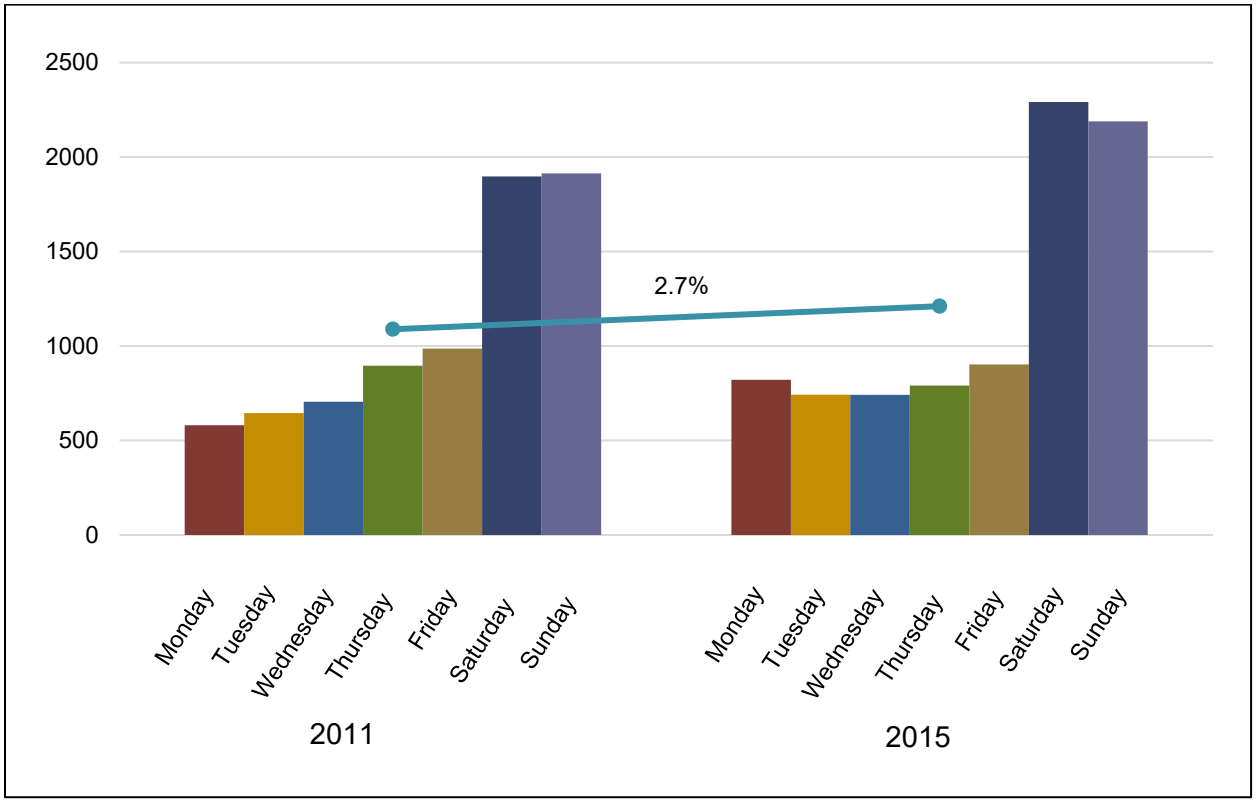

Figure 8. Traffic Volumes MP 10.76 - MP 19.99 (Verlot to Marten Creek)

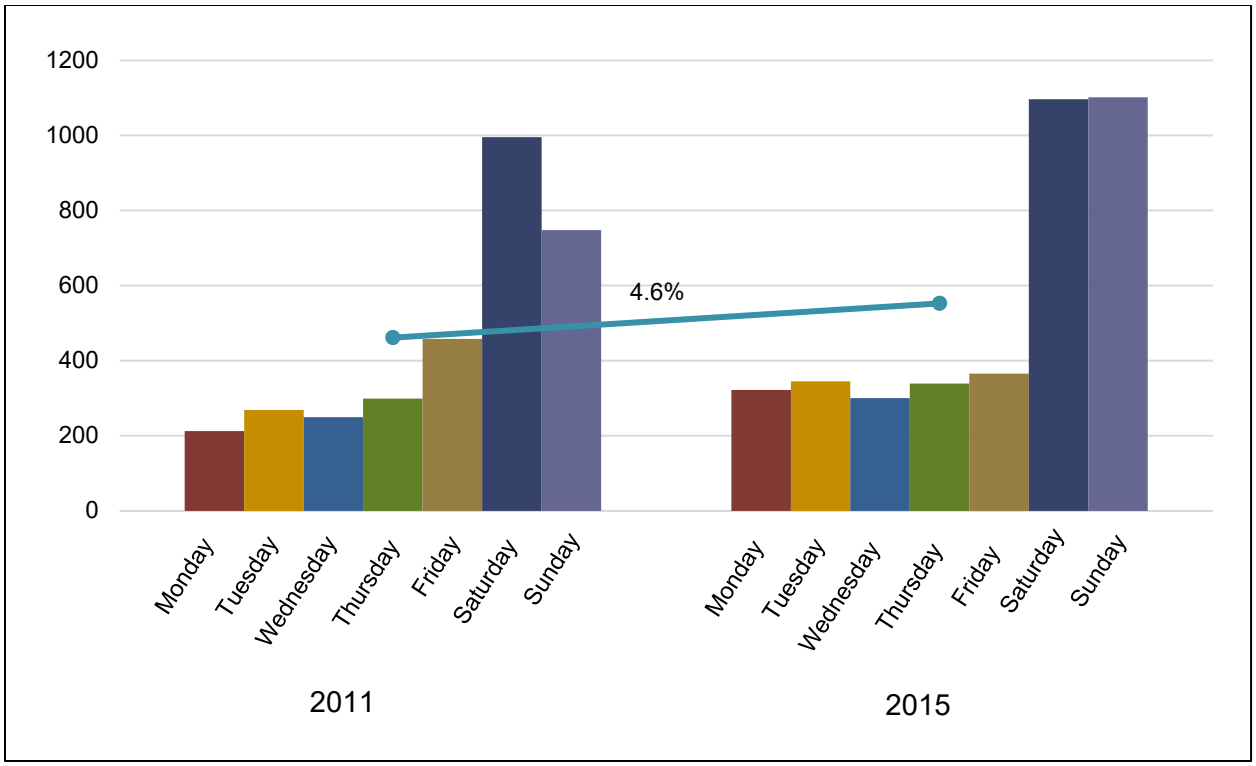

Figure 9. Traffic Volumes MP 20.00-30.68 (Marten Creek to Barlow Pass)

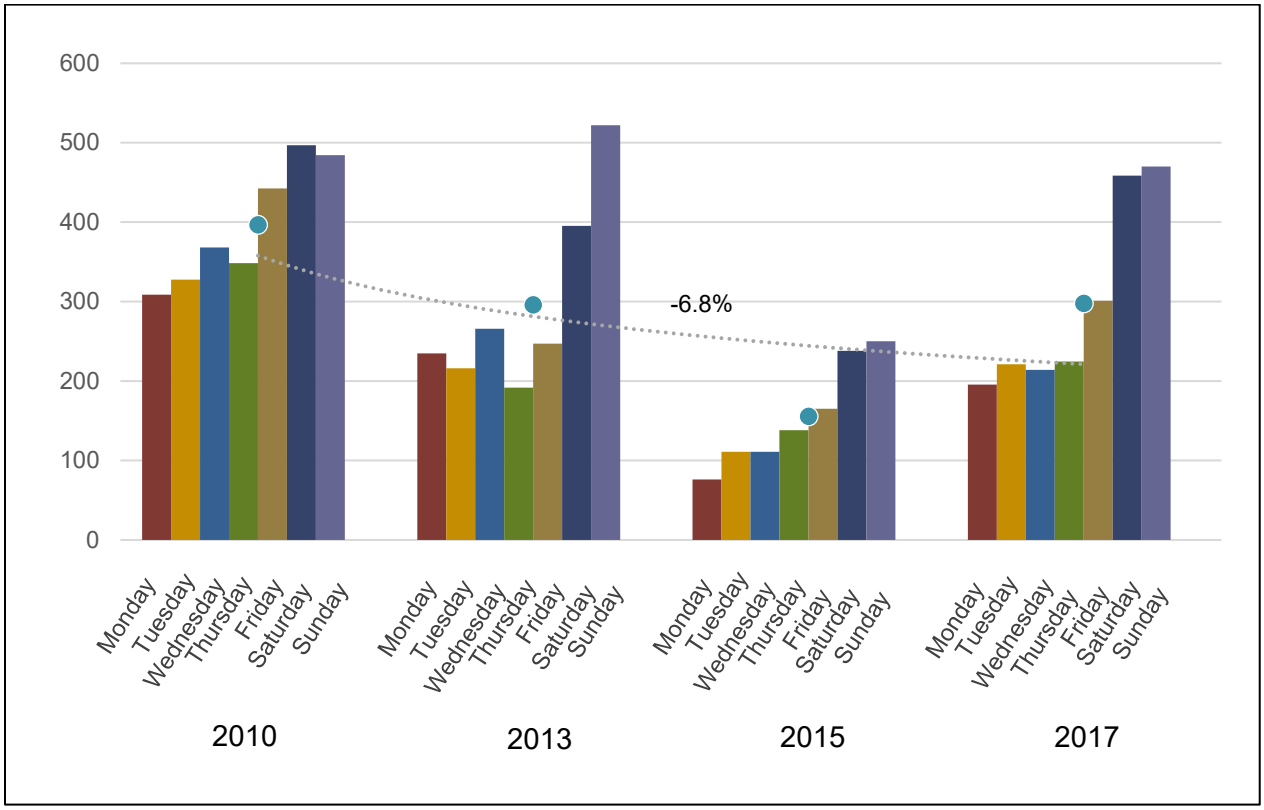

Figure 10. Traffic Volumes MP 44.65 - MP 50.99 (Dutch Creek to Clear Creek)

As the figures show, the section of the Mountain Loop Highway between White Chuck and Darrington has the lowest traffic volumes and the section between the Verlot Ranger Station and Marten Creek has the highest traffic volumes. Population centers, as well as recreational opportunities such as camping and hiking, are concentrated near the beginning of the study area so the distribution of traffic volumes reflects this demand. As mentioned previously, traffic volumes are generally lesser during the weekdays (Monday through Friday) and are significantly higher during the weekend (Saturday and Sunday).

Analysis of the historic volumes reveals somewhat surprising trends. The front sections of the Mountain Loop Highway, from the beginning of the study area (MP 10.76) to Marten Creek and from Marten Creek to Barlow Pass experienced moderate growth from 2011 to 2015, 2.7 percent and 4.6 percent, respectively. However, the section from White Chuck to the end of the study area (MP 50.87) experienced extremely variable growth. Between 2010 and 2015 the corridor experienced significant decreases in volume dropping from a weekly average of nearly 400 vpd to a weekly average of about 150 vpd. Between 2015 and 2017 traffic volumes climbed significantly but fell just short of the volumes experienced in 2010. **Table 13** shows the compound annual growth rates experienced within the study area over various time intervals. Growth rates were determined using weekly average traffic volumes.

Table 13. Historic Traffic Growth Rates

Section	Growth Rate (CAGR)	Years
MP 10.86 - 19.99	2.7%	2011-2015
MP 20.00 - 30.68	4.6%	2011-2015
MP 44.65 - 50.99	-6.8%	2010-2017

3.2.3.2. Projected Traffic Volumes

Projected transportation conditions were analyzed to estimate how traffic patterns and characteristics may change compared to existing conditions. The analysis was based on known existing conditions, historic growth trends, and anticipated future land development. Historic growth trends were provided previously in **Table 13**. The travel demand model developed for the *Snohomish County Comprehensive Plan* uses known and anticipated land development through 2035 to provide growth rates for two locations in the study area. However, these growth rates only factor in peak hour volumes, not the daily volumes. **Table 14** shows the compound annual growth rates, as defined by the traffic demand model.

Table 14. Snohomish County Travel Demand Model Growth Rates

		2015		2035		CAGR		Weighted
From	To	AM	PM	AM	PM	AM	PM	Average
Granite Falls Urban Growth Boundary	Monte Cristo Rd	314	338	320	345	0.47%	0.10%	0.28%
Beginning of Gravel	Darrington City Limits	93	134	95	135	1.88%	0.04%	0.80%
							Weighted Average (Corridor)	0.41%

Table 15 shows the weekly average daily volume for the summer traffic counts in each section of the study corridor and projected traffic volumes for the year 2040. Since growth rates ranged greatly for the corridor, from -6.8 to 4.6 percent, three potential future growth scenarios were examined. The three scenarios examined were low (0.5 percent), medium (2.5 percent), and high (4.5 percent) growth scenarios. Each of the growth rates were applied to the most recent traffic count available to calculate future 2040 traffic volumes.

Table 15. Projected Traffic Volumes (2040)

Section	Average Summer Daily Volume					Future Volume (2040)		
	2010	2011	2013	2015	2017	Low (0.5%)	Medium (2.5%)	High (4.5%)
MP 10.76-19.99	--	1,089	--	1,211	--	1,372	2,245	3,640
MP 20.00-30.68	--	461	--	553	--	626	1,025	1,662
MP 44.65-50.99	397	--	296	156	298	334	526	820

Projected traffic volumes range from 626 vpd (low growth) to 3,640 vpd (high growth) on the first paved section of the corridor with higher volumes occurring on the first half of the pavement, between Verlot and Marten Creek. On the second section of pavement, past White Chuck, traffic volumes range from 334 vpd (low growth) to 820 vpd (high growth). Under the low growth assumption, the 2040 volumes along the corridor would increase by less than 200 vpd from existing volumes. If traffic volumes grow at a high growth rate, volumes could more than triple by 2040. Similar to how different sections of the road grew at different rates in the past, it is not unlikely that the traffic volumes will grow at different rates in the future. It is also possible that, if the gravel portion of the highway is paved in the future, traffic volumes could increase at an even higher growth rate due to an increase ease of access.

3.2.3.3. Vehicle Speeds

In addition to traffic volumes, vehicle speed data was collected at the same traffic count locations along the corridor. There are many factors that can influence the speed of the vehicles traveling through the corridor including winding roads, steep grades, narrow roadways with limited passing opportunities, and several access points and parking lots. The speed data were collected over one week in the summer months at various times between 2010 and 2017. Since there is little variation in speeds between years and days of the week, all of the data for one count site was combined and averaged for the analysis. The existing speed limit throughout the majority of the corridor is 45 mph. **Figure A.4** shows the existing speed zones along the corridor.

Figure 11 shows the results of the speed data collection. The figure shows the 85th percentile speed at the various points throughout the corridor. The 85th percentile speed is the primary factor for determining the validity of the posted speed limit. The 85th percentile speed is that speed at or below which 85 percent of vehicles are traveling. For example, if the 85th percentile speed is 45 mph, it means that 85 percent of vehicles are traveling 45 mph or below.

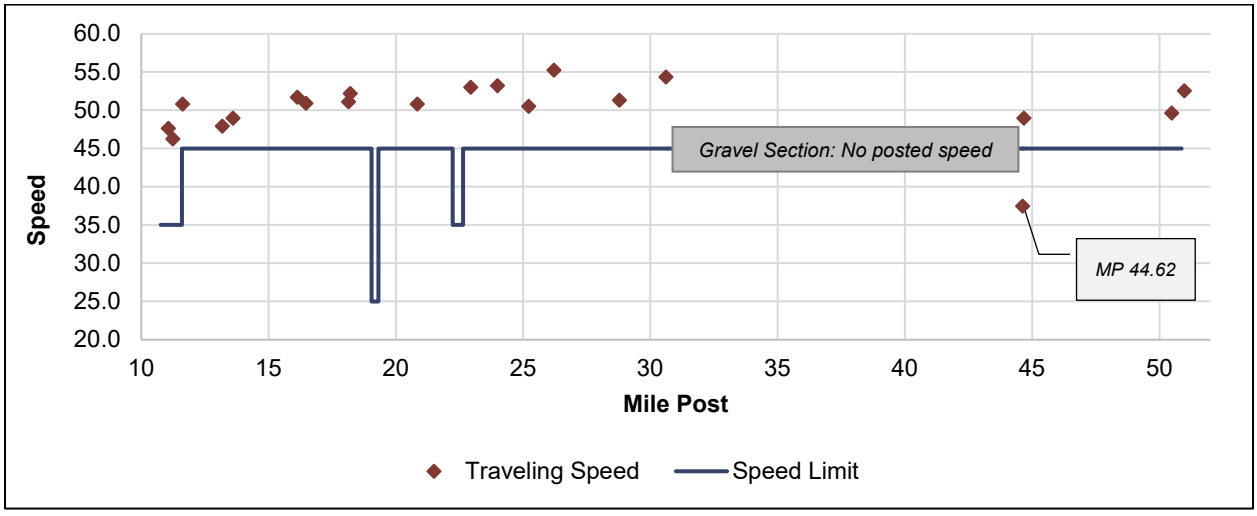

Figure 11. 85th Percentile Speed

Average speeds varied from 37.5 mph at White Chuck to 55.3 mph at Perry Creek. More than 90 percent of vehicles traveled between 45 and 55 mph. Throughout the corridor, vehicles traveled at an average speed of 51 mph. Speed data for the gravel section was not available for this analysis.

3.2.3.4. Vehicle Classifications

Vehicle classification data was provided for each count location for each day of the week that counts were performed. The two paved sections have slightly different vehicle mix characteristics. Within each paved section the vehicle classes are generally the same throughout the days of the week and over the various count years. The counts were all averaged to provide a big picture of the vehicles on each paved section of the corridor.

A variety of vehicles travel throughout the corridor including motorcycles, passenger cars, buses, and a variety of heavy trucks. Portions of the corridor are not designed nor maintained to sustain the impact of heavy vehicles use, although it does occur. From MP 10.76 to MP 30.68 approximately 9 percent of vehicles are two axle six tire trucks or larger and from MP 44.65 to MP 50.87 approximately 14 percent of vehicles meet this large truck classification. However, the majority of vehicles traveling on the corridor are passenger cars (approximately 75 and 63 percent on the first and second paved sections, respectively) and two axle single unit vehicles (approximately 13 and 19 percent) which includes pickups, vans, and other vehicles such as campers, motorhomes, or vehicles pulling recreational trailers. **Figure 12** shows the vehicle classifications experienced along the corridor in the summer.

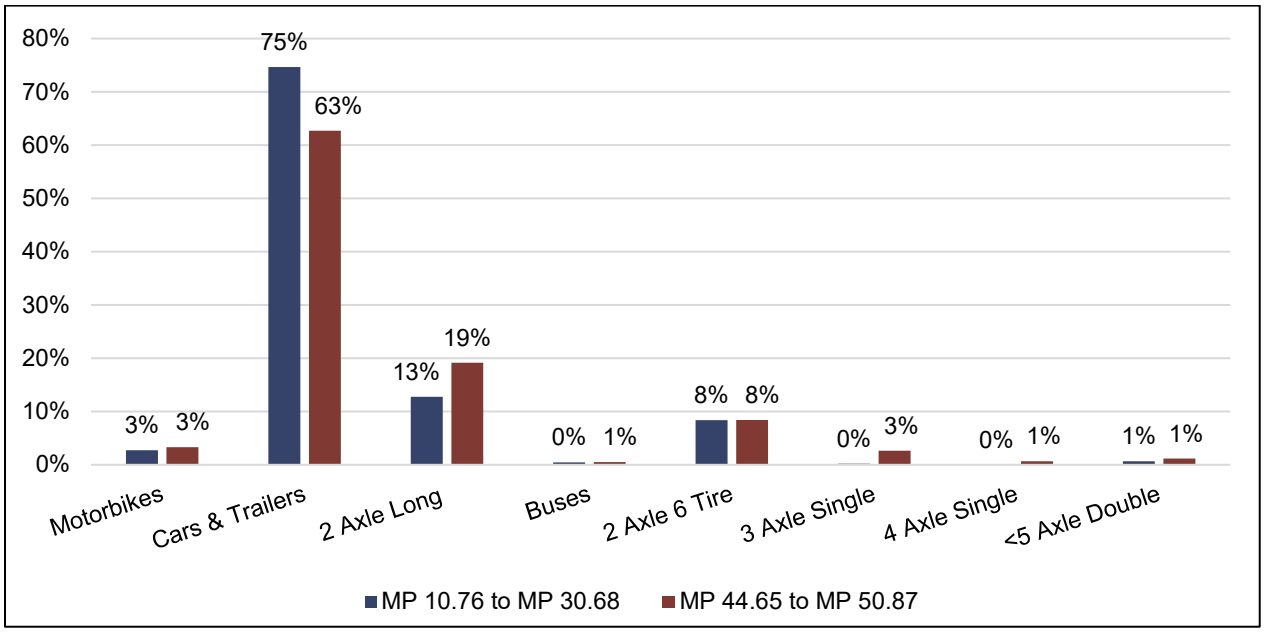

Figure 12. Summer Vehicle Classification

3.2.3.5. Seasonal Variations

The majority of the traffic data supplied by the County was for the summer months, June through August. However, winter counts were provided at three locations along the corridor in February of 2015. This limited data allows for a seasonal comparison of data. For an accurate portrayal of the seasonal variation in traffic, the winter 2015 counts were compared to the summer 2015 counts in the same locations. The count sites included Barlow Pass, White Chuck, and Sauk River Road.

On average, there about half as many vehicles traveling the paved portions of the corridor in the wintertime as compared to the summertime. Volumes are significantly less in winter than in summer on the weekdays (Tuesday through Friday). **Figure 13** shows the seasonal variation in traffic volumes.

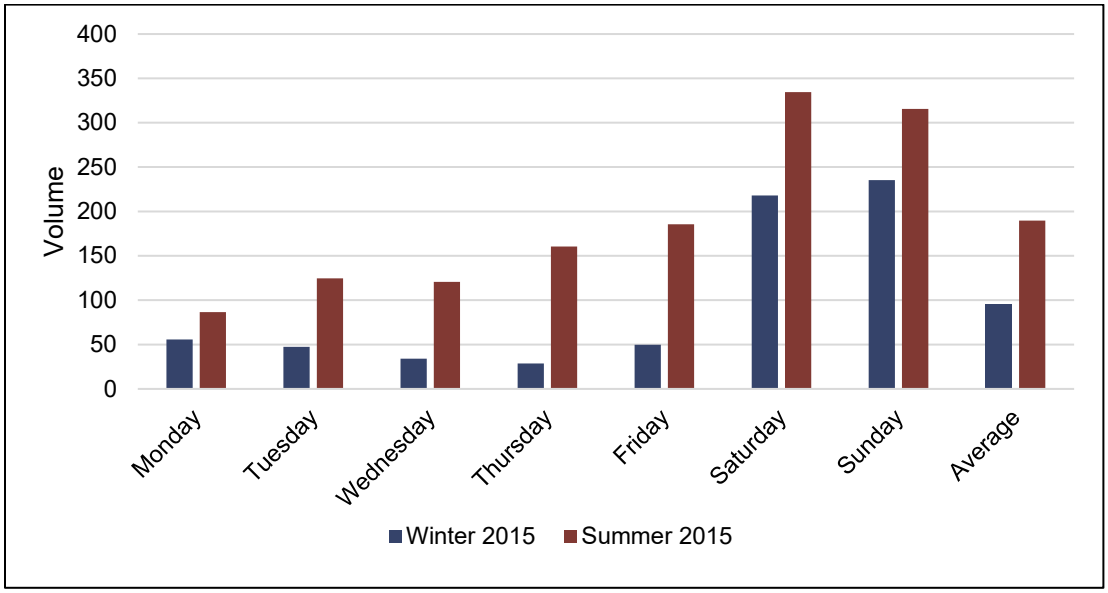

Figure 13. Seasonal Traffic Variation (2015)

The speeds at the count locations are essentially the same in both the winter and summertime. It is common to see slower speeds during the winter as compared to the summer due to adverse weather and road conditions. However, the average speed at the count locations during the winter (46.3 mph) was slightly higher than the average speed in the summer (45.9 mph). This could be due to a fewer number of slow moving vehicles such as campers and RVs and overall lower volumes of traffic allowing vehicles to travel more freely.

The vehicle classification in the summer and winter is comparable. The biggest difference is that there is a larger percentage of two axle single unit vehicles during the winter than the summer. During the winter vehicles in this classification are typically pickups potentially hauling snowmobiles or other winter recreation equipment.

3.2.3.6. Passing Zones

Passing opportunities are provided along the corridor in areas where roadway geometrics allow. Passing areas are designated by broken yellow center pavement markings. No passing zones are established in areas where there is insufficient passing sight distance or near public approaches. **Figure A.4** shows the passing zones along the corridor as documented through on-site field review.

Parking at recreational sites can be a hazard and care must be taken such that passing is not allowed on the roadway at high-use recreational areas. Lake Twenty-two trailhead and Barlow Pass access points are two specific areas that realize parking congestion and conflicts. Passing zones should not be allowed in these areas, and potentially other high-use recreational areas along the corridor.

3.2.4. Safety

Snohomish County provided crash data on the Mountain Loop Highway from January 1, 2008, to December 31, 2017. Records show 55 crashes occurring within the study area during the crash analysis period. An additional seven crashes were recorded on the Mountain Loop Highway; however, the location of these crashes was unable to be determined and these records were consequently removed for the safety analysis. Data for the gravel portion of the corridor was not available and is therefore not accounted for in this analysis.

Of the 55 recorded crashes, 2 resulted in fatalities, 4 resulted in serious injuries, and 19 resulted in non-serious injuries. The rest of the crashes resulted in property damage only (PDO). A serious injury is defined as an injury, other than a fatality, which prevents the injured person from walking, driving, or normally continuing the activities the person was capable of performing before injury.

Figure A.5 presents the spatial distribution of the crash data for the 10-year analysis period. **Table 16** provides a comparison of the crash rate, crash severity index, and crash severity rate within the study area. The crash data presented are based on crashes occurring from calendar year 2008 through 2017.

Table 16. Crash Rates

MP	Length (mi)	Crashes	PDO	Injury	Severe	Fatal	Crashes per mile
10.76 to 15.76	5.00	30	20	7	3	0	0.6
15.77 to 20.77	5.00	10	5	4	1	0	0.2
20.78 to 25.78	5.00	3	1	2	0	0	0.1
25.78 to 30.67	4.89	1	0	1	0	0	0.0
30.67 to 44.67	*Gravel Section – Data Unavailable*						
44.67 to 50.87	6.20	11	4	5	0	2	0.2
TOTAL	**26.09**	**55**	**30**	**19**	**4**	**2**	**0.2**

3.2.4.1. Safety Trends, Contributing Factors, and Crash Clusters

On average, approximately 6 crashes occurred each year during the crash analysis period and the majority (49 percent) of crashes occurred during the summer months, June through September. Single vehicle crashes accounted for nearly 90 percent of crashes, with approximately 45 percent of all crashes occurring in dry conditions. Furthermore, 65 percent of crashes occurred during daylight. Approximately 49 percent of crashes during the analysis period happened when roads were icy, snowy, or wet.

The main observed crash trends are fixed object crashes (38) followed by roll-over crashes (10). The object struck listed in the fixed object crashes included the ditch (39 percent), guardrail (11 percent), and sign posts (11 percent). Fixed object crashes (7) were observed near MP 15.5 between the Wiley Creek Campground and Schweitzer Creek. Four vehicles collided with the ditch and three with a sign post.

Eight crashes were observed between MP 11 and MP 12. All but one of the crashes occurred during daylight and half occurred under clear or partly clear weather. Five out of eight crashes were fixed object collisions in addition to one of each roll-over, rear-end, and sideswipe crash types.

There were four severe injury crashes, all of these crashes occurred in an approximate five-mile segment between MP 11 and MP 16.5. These crashes included two fixed object crashes, a roll over and rear end crash. There were also two fatalities on the study corridor over the past ten years. Both fatalities were fixed object crashes which occurred in an approximate five-mile segment between MP 45 and MP 50.

3.2.5. Other Vulnerabilities

There are many points along the corridor where natural land events including landslides, sink holes, erosion, and washouts have occurred. Some of these events have damaged the highway and its bridges and rerouted rivers. As a result, parts of the road may become impassable and are either closed for repair or, in a few cases, the road may need to be rerouted to avoid a troublesome area. The following sections discuss the areas of concern throughout the corridor and the impact that natural events may have on the corridor. This information can be useful for future road design, maintenance, and repair work on the Mountain Loop Highway. **Figure A.6** presents other vulnerabilities identified along the study corridor during the field review.

Landslides

The highway passes through or alongside landslide hazard areas mapped by Snohomish County or the Washington State Department of Natural Resources at several locations, including near Schweitzer Creek and Boardman Creek (MP 16.5 to 16.9), at the base of Gordon Ridge (MP 19.3 to 19.6), near Palmer Creek west of Barlow Pass (MP 28.5 to 28.9), and between Barlow Pass and Monte Cristo Lake (MP 30.5 to 31.8). Signs of unstable soils, such as sunken or broken road beds, are evident at many locations along the corridor.

There are three major landslides in the area: the Gold Basin Campground slides, the Waldheim Slide, and the Marten Creek Slide. Slides at the Gold Basin Hill (approximate MP 13.25) have been documented going back to the 1940s. The slides have temporarily closed the campground and have necessitated moving or closing campground sites. These slides have not directly impacted the Mountain Loop Highway. The Waldheim Slide (approximate MP 20.6) occurred in December 2010 and closed the Mountain Loop Highway for five months to perform emergency repairs to the road and stabilized the slope. The slide caused one lane and part of a second lane to collapse into the river below. The Marten Creek Slide (approximate MP 21) occurred in 2008. There is evidence of a number of other small, less impactful landslides that have occurred in the area. The northernmost 8 miles of the corridor, from MP 42.5 to the Darrington city limits, are within a lahar hazard area mapped by Snohomish County.

Steep Slopes

There are many locations along the corridor that have steep side slopes on one or both sides of the roadway. On steep slopes there is 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 minimize the risk of slope failure, avoiding the potential for expensive road repairs or road closures. Steep slopes can be stabilized by flattening the slope, adding drainage, or using retaining structures. A number of steep slope areas were documented during the field review.

Sink Hole

A sinkhole is a depression or hole in the ground causes by some form of collapse of the surface layer. The formation of sinkholes involves the natural processes of erosion or gradual removal of bedrock by groundwater or the lowering of a water table. Sinkholes can also be caused by a collapse of a cave below the surface, due to the area's extensive mining history this is a probable cause of sinkholes in the area. There is a sinkhole along the corridor near MP 19 which requires ongoing maintenance efforts.

Washouts

A washout is a breach in a road caused by flooding. Washouts are fairly common along the corridor due to the many river crossings. The washout of the Bedal Creek Bridge (approximate MP 35.5) was caused by a debris torrent where floating logs jam the water source. Water builds up behind these jams, and when enough pressure builds up, the jam releases in a torrent washing out bridges or roadways.

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's stability and undermine the capacity of the pavement to carry traffic. There were multiple locations along the corridor that were observed to have poor drainage during field review. In some locations with poor drainage there were existing culverts built to divert water from the roadway. Some culverts have been blocked with debris allowing water to pool along the roadside.

3.3. ENVIRONMENTAL CONDITIONS

The information contained in this section is from the *Environmental Scan* (**Appendix B**) which provides a planning-level overview of resources and identifies potential constraints and opportunities for the *Mountain Loop Highway Feasibility Study*. The scan is not a detailed environmental investigation. If improvement options are forwarded from the feasibility study into project development, an analysis for compliance with the National Environmental Policy Act (NEPA) and other applicable federal and state regulations will be completed as part of the project development process. Information provided in this report may be forwarded into the NEPA process at that time.

3.3.1. Physical Environment

3.3.1.1. Soil Resources and Prime Farmland

Most of the study area was not included in the Snohomish County soil survey area mapped by the Natural Resources Conservation Service.[15] Soil survey data are available for only the small areas outside of the National Forest boundary at the beginning and end of the project corridor. Some mapped soils near the Verlot end of the study area are classified as prime farmland or farmland of statewide importance. A mapping unit near the Darrington end of the study area is classified as "prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season." Notably, however, the study area does not include any farmlands designated in the Snohomish County comprehensive plan or zoned by the County for agricultural uses. Moreover, no lands classified in the National Land Cover Database as cultivated crops are present in the study area.

To ensure compliance with the *Farmland Protection Policy Act* (7 United States Code [USC] 4201 et. seq.), any improvement options that are forwarded from this feasibility study should undergo additional review for the presence of farmlands in the anticipated project impact area.

3.3.1.2. Geologic Hazards

The study area is seismically active. The Mountain Loop Highway is less than two miles from two major fault systems—the Straight Creek Fault and the Darrington-Devils Mountain Fault—and numerous earthquakes have been recorded in the area.[16]

Segments of the highway near Verlot (MP 10.8 to 15.5), between Barlow Pass and Monte Cristo Lake (MP 30.4 to 32.7), and southeast of Darrington (MP 42.3 to 50.5) are mapped by Snohomish County as having a moderate to high risk of soil liquefaction during seismic events (**Figure A.7**). Liquefaction occurs when water-saturated sandy soil loses strength during severe shaking and behaves like quicksand. Movement of liquefied soils can rupture pipelines and waterlines, move bridge abutments and road and railway alignments, and pull apart the foundations and walls of buildings.[17] The presence of such soils necessitates the implementation of special measures to ensure stability during earthquakes and other seismic events.

The northernmost 8 miles of the highway in the study area, from MP 42.5 to the Darrington city limits, are within a lahar hazard area mapped by Snohomish County (**Figure A.7**). Lahars (rapidly flowing slurries of rock and mud formed during volcanic eruptions) can reroute rivers and damage roadways and bridges. Lahars associated with eruptions of Glacier Peak have inundated the Sauk River valley several times during the last 13,000 years.[18]

The highway passes through or alongside landslide hazard areas mapped by Snohomish County or the Washington State Department of Natural Resources (WDNR) at several locations, including near Schweitzer Creek and Boardman Creek (MP 16.5 to 16.9), at the base of Gordon Ridge (MP 19.3 to 19.6), near Palmer Creek west of Barlow Pass (MP 28.5 to 28.9), and between Barlow Pass and Monte

Cristo Lake (MP 30.5 to 31.8) (**Figure A.8**). Almost the entire highway corridor in the study area is classified by Snohomish County as having highly erodible surficial geology (i.e., any of the following geological mapping units: Alluvium, Mass Wasting, Vashon Recessional Outwash, Vashon Recessional Lacustrine). Signs of unstable soils, such as sunken or broken road beds, are evident at many locations along the Mountain Loop Highway.

Snohomish County requires development activities, actions requiring a project permit, or clearing of ground within erosion or landslide hazard areas minimize the risk of hazards by preventing the collection, concentration, or discharge of stormwater or groundwater within the hazard area by minimizing the creation of impervious surfaces, and by retaining vegetation (Snohomish County Code [SCC] 30.62B.320). Such activities are also not allowed to increase surface water discharge, sedimentation, slope instability, erosion, or landslide potential to adjacent or downstream and down-drift properties.

In addition, the County classifies the South Fork Stillaguamish River as far upstream as Silverton (approximately MP 22) and the Sauk River upstream to the junction of the North and South Forks (approximately MP 37) as having active channel migration zones. The County may require a channel migration zone study for development activities or actions requiring project permits in such areas.

Snohomish County critical areas regulations specify special requirements for actions proposed within 200 feet of mine hazard areas, which include areas underlain by or affected by underground mine workings such as tunnels but excluding any areas where the mine workings have been properly stabilized and closed and made safe consistent with all applicable federal, state, and local laws. Recommendations incorporated into permits for such actions may include buffers, setbacks, or reclamation plans for properly closing the mining facilities. Several active mine sites are mapped in the study area along the South Fork Stillaguamish River between Red Bridge Campground (MP 18.0) and Barlow Pass (MP 30.3) (**Figure A.9**).

Improvements brought forward from this feasibility study would be subject to more detailed geotechnical analysis. Part of this detailed analysis may involve taking advance borings to evaluate soil characteristics at exact project locations. Compliance with Snohomish County critical areas regulations may also be necessary.

3.3.1.3. Surface Waters

The study area lies within three different watersheds as delineated by the U.S. Geological Survey—South Fork Stillaguamish River (Hydrologic Unit Code [HUC] 1711000802), Upper Sauk River (HUC 1711000601), and Lower Sauk River (HUC 1711000604)—and within two Water Resource Inventory Areas (WRIAs) as defined by the Washington State Department of Ecology (Ecology)—WRIA 5 (Stillaguamish) and WRIA 4 (Upper Skagit). WRIAs define watershed areas monitored by Ecology for water quality impairments, contamination, and degradation.

The Mountain Loop Highway parallels the South Fork Stillaguamish River from this feasibility study start point to Barlow Pass (MP 30.3), at which point it crosses into the Sauk River basin. The road parallels the South Fork Sauk River for approximately 6.6 miles. After the North and South Forks join to form the Sauk River near MP 36.9, the road parallels the Sauk River all the way to the end of the study area.

Both the Sauk River watershed and the South Fork Stillaguamish watershed are designated Tier 1 Key Watersheds under the *1994 Northwest Forest Plan*, meaning the entire study area falls within areas so designated. Tier 1 Key Watersheds were selected for their direct contributions to the conservation of anadromous salmonids, particularly by providing refugia for at-risk fish species.[19] Key Watersheds are a component of the *Aquatic Conservation Strategy*, which was developed "to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands".[19] The

Northwest Forest Plan standards and guidelines for Key Watersheds specify that the mileage of existing system and non-system roads should be reduced.

In addition, the *Northwest Forest Plan* established Riparian Reserves along streams, wetlands, ponds, lakes, and unstable or potentially unstable areas on NFS lands; within these areas, the conservation of aquatic and riparian-dependent terrestrial resources receives primary emphasis.[19] Potentially pertinent standards and guidelines for road projects within Riparian Reserves include the following:

- Federal, state, and county agencies should cooperate to achieve consistency in road design, operation, and maintenance necessary to attain *Aquatic Conservation Strategy* objectives.
- For each existing or planned road, meet *Aquatic Conservation Strategy* objectives by a) minimizing road and landing locations in Riparian Reserves, b) minimizing disruption of natural hydrologic flow paths, including diversion of stream flow and interception of surface and subsurface flow, and c) restricting side-casting as necessary to prevent introduction of sediment to streams.
- Meet *Aquatic Conservation Strategy* objectives by a) reconstructing roads and associated drainage features that pose substantial risk, and b) prioritizing reconstruction based on current and potential impact to riparian resources and the ecological value of the affected resources.
- Culverts, bridges, and other stream crossings…shall accommodate at least the 100-year flood, including associated bedload and debris…Crossings will be constructed and maintained to prevent diversion of stream flow out of the channel and down the road in the event of crossing failure.[19]

The Mountain Loop Highway crosses more than 89 streams that are mapped in the WDNR hydrography data layer for Washington (see **Figure A.1**). Twenty-nine of these are named perennial, fish-bearing streams (see **Table 4**). Unnamed streams in the study area include a mix of perennial and seasonal streams, both fish-bearing and non-fish-bearing, as well as streams that have not been classified. Note that these are just the streams that have been incorporated into the WDNR hydrography data layer. Additional streams, wetlands, and other waterbodies are likely present throughout the study area.

Road construction and reconstruction activities such as culvert installation or replacement, placement of fill, or armoring of banks have the potential for impacts to surface waters. The U.S. Army Corps of Engineers (Corps) and Ecology regulate activities within or over surface waters. Coordination with federal, state, and local agencies would be necessary to determine the appropriate permits based on the choice of 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.

The South Fork Stillaguamish River, the South Fork Sauk River, and the Sauk River are all designated shorelines of the state under the *Shoreline Management Act* (90.58 Revised Code of Washington [RCW]). Shoreline areas in Snohomish County that are subject to the provisions of the Act include rivers or streams with a mean annual flow greater than 20 cubic feet per second, areas within 200 feet of these waters and their floodplains, and associated wetlands. Proposed land uses, modifications, and development activities are subject to permitting requirements and must be designed and conducted to achieve no net loss of shoreline ecological functions.

3.3.1.3.1. Water Quality

The *Clean Water Act* (CWA), administered by the Corps and U.S. Environmental Protection Agency (EPA), is the principal federal legislation directed at protecting water quality. The Corps is responsible for ensuring compliance with Section 404 of the CWA, regarding issuance of permits to place dredge or fill

materials into waters of the United States. Examples of projects that require such permits include road widening projects that entail the extension of existing culverts, or the placement of armoring on stream banks. Under Section 401 of the CWA, Ecology has the authority (as delegated by EPA) to approve, deny, or condition any project requiring a Section 404 permit and to ensure that the work will meet state water quality standards. Ecology establishes the standards and regulations, subject to approval by EPA, under which waters of the state must be managed to meet federal requirements. The State of Washington recognizes the Forest Service as the designated management agency for meeting CWA requirements on NFS lands.

CWA Section 303(d) requires the State of Washington to periodically prepare a list of all surface waters where pollutants have impaired the beneficial uses of water (for drinking, recreation, aquatic habitats, etc.). Types of pollutants included high temperatures, fecal coliform bacteria, excess nutrients, low levels of dissolved oxygen, and toxic substances. Ecology and Region 6 of the Forest Service meet this management mandate through a Memorandum of Agreement that emphasizes reducing the effects of roads on water quality.

The CWA requires the development and implementation of cleanup plans for waterbodies that fail to meet state water quality standards. This typically involves the development of a Total Maximum Daily Load (TMDL) in which Ecology determines the sources of pollutants and sets the maximum amount of pollutants that each source can discharge to a waterbody. Ecology has developed a *Water Quality Implementation Plan*[20] to address water quality violations for fecal coliform, dissolved oxygen, pH, mercury, and temperature in the North and South Forks of the Stillaguamish River. One segment of the South Fork Stillaguamish River in the study area, between Heather Creek and Twentytwo Creek near Verlot, is included in the TMDL based on elevated temperatures.[21] The TMDL calls for improvements to riparian areas, stabilization and decommissioning of roads to reduce sediment, and reduction of timber harvest activities that alter peak flow and stream temperature. Primary concerns identified in the TMDL study include the maintenance of shade over streams and the reduction of sediment loads in streams to create deeper, cooler streams that provide quality aquatic habitat.[20] All other segments addressed by the TMDL study are outside the study area.

While a TMDL has not been established for sediment, sedimentation in the South Fork Stillaguamish River has played a role in the degradation of habitat, geomorphic structure, and hydraulic function needed to maintain a diverse aquatic ecosystem. Sedimentation and temperature are directly tied in the ecosystem, and the need to reduce sedimentation from roads and reduce numbers of road crossings has been addressed in watershed analyses prepared by the Forest Service. Increased fine sediment input has been identified as one of the biggest drivers limiting the survival of Chinook salmon in the Stillaguamish watershed.[22] A landslide on the opposite side of the river from the Gold Basin Campground has been identified as one of the largest contributors of fine sediment in the South Fork Basin.[23,24]

A segment of the Sauk River near Darrington, immediately downstream of the study area, is on the current CWA 303(d) list of impaired waters, based on elevated temperatures.[21] A TMDL has not yet been developed for this waterbody.

In 2016, the EPA determined that National Pollutant Discharge Elimination System (NPDES) permits are not required for stormwater discharges from forest roads. The decision means that stormwater runoff from forestry roads on NFS lands does not require a federal discharge permit under the CWA. The applicability of this determination to the Mountain Loop Highway would need to be reviewed for any projects that may be brought forward from this feasibility study.

All federally funded transportation projects must meet applicable standards for stormwater management. Federal-aid projects managed by FHWA in Washington must comply with Washington State Department

of Transportation (WSDOT's) *Highway Runoff Manual,*[25] which has been determined by Ecology to be equivalent to Ecology's *Stormwater Manual.*[26]

3.3.1.3.2. Wild and Scenic Rivers

The Sauk River and a portion of the South Fork Sauk River (downstream of the Elliott Creek confluence) in the study area are part of the National Wild and Scenic Rivers System, designated by Congress to safeguard fisheries, wildlife, and scenic qualities for generations to come. The National Wild and Scenic Rivers designation is intended to balance demands among uses and protect some of the nation's most outstanding rivers in a natural and free-flowing state. Designated rivers are classified as wild, scenic, and recreational depending on the type and intensity of development. The designated river segments in the study area are classified as scenic, which is defined as "free of impoundments, with shorelines or watersheds still largely primitive and largely undeveloped, but accessible by road in places."

Section 7 of the *Wild and Scenic Rivers Act* provides authority to the Secretary of Agriculture to evaluate and make a determination on water resource projects that affect wild and scenic rivers. Section 7(a) prohibits departments and agencies of the United States from assisting in the construction of any water resources project that "...would have a direct and adverse effect on the values for which such a river was established." Water resources projects are those proposed activities that are federally assisted and within the bed and bank of a wild and scenic river.

The South Fork Stillaguamish River within the study area has been recommended for inclusion in the National Wild and Scenic Rivers System, with a classification of scenic.[2] The river was so designated in part because it retains outstandingly remarkable values associated with scenic, recreation, fisheries, wildlife, historic/cultural, and ecological resources. Recommended Wild and Scenic Rivers are to be managed to protect those characteristics that contribute to their eligibility until formally designated by Congress. No substantial evidence of human activity should be present, although the river may be accessible by roads that may occasionally bridge the river. Lands should appear natural when viewed from the river banks.

A Section 7(a) review would be needed if any improvement options forwarded from this feasibility study have the potential to adversely affect the scenic qualities of the Sauk River or the South Fork Sauk River. Similarly, any improvement options with the potential to affect the scenic qualities of the South Fork Stillaguamish River would be subject to review to ensure they do not adversely affect the river's eligibility for inclusion in the National Wild and Scenic Rivers System.

3.3.1.4. Groundwater

Groundwater is water that is found in interconnected pores or fractures in a saturated zone or stratum located beneath the surface of the earth or below a surface waterbody. In addition to providing drinking water, groundwater is an important source of water for rivers, streams, lakes, and wetlands, as well as for plants that grow near those waterbodies.[27] Protection of groundwater quality and quantity in Snohomish County is accomplished primarily through the management of critical aquifer recharge areas, which are identified as critical areas (SCC 30.62C).

Snohomish County has established the following three categories of critical aquifer recharge areas:

- Sole source aquifers designated by EPA in accordance with the *Safe Drinking Water Act* of 1974
- Areas within the 10-year travel zones of wellhead protection areas for public water systems with 15 or more service connections
- Areas of high, medium, and low sensitivity to groundwater contamination within the Snohomish County Ground Water Management Area designated by Ecology

No EPA-designated sole source aquifers are present in the study area, and only the western edge of the study area (MP 10.5 to 12.5, west of Twentytwo Creek) falls within the Snohomish County Ground Water Management Area. For these reasons, the primary concern for this discussion is areas within the 10-year travel zones of wellhead protection areas.

Ecology has documented more than 17,000 domestic water wells in Snohomish County; fewer than 100 of these are within the study area.[28] For wells that serve 15 or more connections, Washington requires the delineation of wellhead protection areas within which source water is assessed for sensitivity and vulnerability to contamination. The Washington State Department of Health has identified one such public water system in the study area, serving the Verlot Public Service Center.[29] Snohomish County also indicates the presence of a wellhead protection area at that location, along with another serving the Gold Basin Campground approximately two miles east of the public service center. The Mountain Loop Highway bisects the 10-year travel zones of both of those wellhead protection areas. Neither the Washington State Department of Health nor Snohomish County has identified any other wellhead protection areas in the study area.

Wells can be a costly item to mitigate if they are not avoided. Mitigation of a well usually involves drilling a new well for the owner in a new location that is not affected by the potential project. Well costs are based on per foot price; a deeper and higher volume needed would result in a higher cost.

In any future roadway improvements on the corridor, FHWA and the cooperating agencies would take measures to avoid adverse impacts on public water supply wells. Impacts on existing domestic wells would also be considered if improvement options are forwarded from this feasibility study. Compliance with Snohomish County critical areas regulations may also be necessary.

3.3.1.5. Wetlands

Wetlands receive substantial protection through federal, state, and local policies and statutes. Among these are the CWA and the Forest Service *Aquatic Conservation Strategy*, both of which are discussed in **Section 3.3.1.3.1**. At the state level, projects that require federal licenses or permits and that may involve the discharge of dredge or fill material into wetlands are subject to a water quality certification by Ecology. In addition to federal (U.S. Army Corps of Engineers) and state regulatory reviews, development projects (including road projects) may be subject to regulatory review and permitting at the local level. Proposed developments and land use activities may be subject to review by local governments to ensure consistency with regulations established for the protection of critical areas pursuant to the *Growth Management Act* (36.70A RCW) and, where applicable, the *Shoreline Management Act*. All of these review and permitting processes typically result in the implementation of measures designed to avoid, minimize, and mitigate adverse effects on wetlands.

National Wetlands Inventory mapping data from the U.S. Fish and Wildlife Service (USFWS) indicates that wetlands are present throughout the study area, particularly in the river valley bottoms where the Mountain Loop Highway is located (**Figure A.10**). National Wetlands Inventory maps are prepared from the analysis of high-altitude imagery and are not sufficiently accurate or detailed for project-level wetland determination and/or delineation. Detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis, as well as the identification of previously unmapped wetlands.

Wetland delineations would be required if improvement options are forwarded from this feasibility 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. Unavoidable impacts to wetlands must be compensated through mitigation in accordance with applicable federal, state, and local regulatory requirements.

3.3.1.6. Floodplains and Floodways

Many sections of the Mountain Loop Highway have suffered flood damage in the past. Prominent among these are four sites between Bedal Creek and Monte Cristo Lake (MP 33.1, 33.6, 34.8, and 35.6). Because of the natural topography—a valley with steep sideslopes and a narrow floodplain—and the alignment of the road on a narrow terrace of alluvium adjacent to the valley wall, the site at MP 33.6 in particular is a persistent high-risk location. During flood events in 1990 and 1995-96, the South Fork Sauk River encroached on the road at this site. Record-setting rainfall in October 2003 led to extremely high flows, severely damaging numerous bridges, trails, and roads, including the Mountain Loop Highway at that location. The Bedal Creek bridge was damaged during another major flood event in November 2007. The bridges at Chocwich Creek and Skull Creek were damaged during flood events in November and December 2015.

Modeling of future regional climate patterns indicates that flood-related damage to bridges and other infrastructure is likely to become more frequent and severe. The flood risk in the northern Cascades of Washington is projected to increase in the coming decades.[30,31] Many components of the transportation system are sensitive to increased peak runoff, which can affect the stability of road and trail prisms and embankments, the condition of road surfaces, the structural integrity of bridges, and the functionality of culverts.[32] The increasing risk of flood-related damage may amplify the need for drainage improvements and storm-proofing along the Mountain Loop Highway in the future.

Presidential Executive Order (EO) 11988, dated May 24, 1977, directs federal agencies to avoid to the extent possible adverse impacts associated with floodplains and to avoid direct or indirect support of development in the floodplain.

In addition, projects within the 100-year floodplain are subject to Snohomish County flood hazard permit requirements. Among other requirements, development authorized by a flood hazard permit must not:

a) Significantly increase the level of flooding on any lands;
b) Threaten the preservation of those natural conditions which are conducive to the maintenance of constant rates of water flow throughout the year by:
    i. creating or exacerbating rapid water runoff conditions which contribute to increased downstream flooding; and
    ii. eliminating natural groundwater absorption areas essential for reducing surface flood flows downstream. In-kind on-site mitigation may be used to achieve this requirement; or
c) Materially pollute or contribute to the turbidity of flood waters (SCC 30.43C.100).

Several segments of the Mountain Loop Highway cross or lie within the mapped 100-year floodplains of the South Fork Stillaguamish River, South Fork Sauk River, or Sauk River (**Figure A.11**). Any improvement options forwarded from this feasibility study involving the placement of fill within the regulatory floodplain will require permits from agencies with permitting authority; the specific agencies and permits would depend on the location and nature of the specific project.

3.3.1.7. Air Quality

Agencies responsible for transportation projects funded or approved by FHWA must consider potential project-related impacts on air quality. This requirement applies, however, only within areas that currently do not meet air quality standards for certain pollutants (ozone, carbon monoxide, particulate matter, or nitrogen dioxide), or where those standards have not been met in the past. No such areas are present in or near the study area; therefore, any projects that may be forwarded from this feasibility study would not be required to undergo quantitative project-level analysis of potential air quality impacts. Ecology has identified Darrington as an area at risk of violating standards for particulate matter. This designation does not generate any specific analysis requirements or restrictions on project-related activities, however.

Depending on the scope of any improvements that may be forwarded from this feasibility study, an evaluation of mobile source air toxics (MSATs) may be required. MSATs are compounds emitted from highway vehicles and off-road equipment, and which are known or suspected to cause cancer or other serious health and environmental effects.

The *Clean Air Act Amendments of 1977* give federal land managers an affirmative responsibility to protect the values related to air quality (including visibility) within Class I areas. Wilderness areas are designated as Class I areas for air quality protection. Visibility is a value that is protected primarily within the boundaries of a Class I area, although the *Clean Air Act* includes provisions for defining vistas integral to a visitor's experience, even if these vistas extend beyond the boundaries of the Class I area. The Glacier Peak Wilderness, east of the study area, is a Class I area for air quality protection. Visibility is a value that is protected primarily within the boundaries of the Glacier Peak Wilderness Class I area.

Environmental analyses of any projects forwarded from this feasibility study may also be required to address anticipated greenhouse gas emissions that may result from project construction, operation, and maintenance. Emission modeling tools available from EPA and FHWA can be used for a quantitative analysis.

3.3.1.8. Hazardous Substances

Ecology works to clean up contaminated properties throughout the state. Cleanup projects vary greatly in size and complexity, from routine cleanup of contamination from leaking underground storage tanks, to large, complex projects that require engineered solutions. Ecology also regulates underground storage tanks on properties owned by private businesses and public entities, ensuring that the tanks are installed, managed, and monitored in a manner that prevents releases into the environment.

Ecology reports no active underground storage tanks or leaking underground storage tank sites in the study area.[33] The nearest underground storage tanks are in Granite Falls, approximately 14 miles west of the study area. Two underground storage tanks at the Verlot Public Service Center were removed in the 1990s and would thus be unlikely to affect any improvement options that may be forwarded from this feasibility study. The nearest leaking underground storage tank site is at the Green Gables Gas Stop (Ecology cleanup site number 11047), approximately 0.8 mile west of the southwestern starting point (MP 10.76) for this feasibility study. Based on this information, it is not anticipated that leaking underground storage tank sites would adversely affect any improvement options proposed in this feasibility study.

According to Ecology, the study area includes one site currently in the state cleanup process under the *Model Toxics Control Act*.[33] This is the Silverton Concentrator Site near the former mining area of Silverton (MP 22, see **Figure A.9**), where arsenic and metallic pollutants have been found to exceed levels that trigger cleanup actions. Cleanup has not been implemented at this site. The site is across the South Fork Stillaguamish River from the Mountain Loop Highway, and thus would be unlikely to affect any improvement options from this feasibility study. If a project were to overlap this site, a soil investigation should occur. If contaminated soils are present, a special provision regarding handling of contaminated soils is recommended for inclusion in project documentation.

WDNR has not identified any inactive or abandoned mines in the study area. Notably, WDNR's inventory of inactive and abandoned mines has thus far been limited to mines with more than 2,000 feet of underground development, more than 10,000 tons of production, or a known mill site or smelter. Inactive or abandoned mines too small to meet those criteria could be present in the study area, but unmapped.

The site of the Monte Cristo mining area is approximately four miles southeast of the study area, at the headwaters of the South Fork Sauk River. The river carries contaminants downstream from the site and into the study area. Sampling studies have found concentrations of arsenic in Monte Cristo Lake (near MP 32.6) as high as 190 micrograms per liter, more than 10,000 times the level established by Ecology

for the protection of human health.[34] If any projects forwarded from this feasibility study involve work within Monte Cristo Lake or the South Fork Sauk River, additional coordination with the Forest Service and Ecology will be necessary, and special measures may need to be implemented for the protection of human health in work areas.

3.3.2. Biological Resources

3.3.2.1. Vegetation

Native vegetation in the study area is typical for the western slopes of the North Cascades. Coniferous forest is the dominant vegetation type, with stand conditions ranging from recently clearcut areas to old-growth stands. Historically, infrequent, large, stand-replacing fires were the primary agent of vegetation disturbance. More recently, timber management has been the primary agent of change. Clearcut logging was the primary method for managing timber in the study area until the 1990s; since then, other methods, such as commercial thinning, have become more widespread. Other distinctive vegetation types are found in riparian and wetland areas (where deciduous trees, shrubs, and forbs are more common), as well as residential areas near Verlot (where maintained lawns and ornamental plantings are found).

GIS data from the 2011 National Land Cover Database indicate that forested areas are the predominant land cover type in the study area (**Figure A.12**). More than 80 percent of the study area consists of evergreen forest, deciduous forest, or a mix of the two (**Table 17**). Deciduous and mixed evergreen/deciduous forest types are more common in the lower-elevation valley bottoms, while evergreen forest is more common on mountain slopes. Developed areas, including the surface of the Mountain Loop Highway and other roadways, comprise another 8.6 percent of the study area. Most of the rest of the study area consists of open water (such as lakes and rivers) or shrub/scrub cover. At the lower elevations, the shrub/scrub land cover type commonly indicates residential areas and sites of relatively recent intensive forest management activity. At higher elevations and away from roaded areas, the shrub/scrub cover type is more indicative of avalanche chutes and subalpine shrublands. Such areas are largely absent from the study area, which lies along river valley bottoms. Any projects forwarded from this feasibility study would need to comply with Forest Service management policies, as well as applicable state and county requirements.

Table 17. Land Cover

Land Cover Type	Percent of Study Area
Evergreen Forest	61.0
Mixed Forest	18.8
Deciduous Forest	2.7
Shrub/Scrub	2.5
Grassland/Herbaceous	0.2
Woody Wetlands	1.0
Emergent Herbaceous Wetlands	0.1
Developed, Open Space	6.8
Developed, Low Intensity	1.7
Developed, Medium Intensity	0.1
Open Water	4.6
Barren Land (Rock/Sand/Clay)	0.6

Source: National Land Cover Database[35]

Department of Agriculture Regulation 9500-4 directs the Forest Service to manage habitats for all existing native and desired non-native species of plants to maintain viable populations of these species.

Forest Service policy (Forest Service Manual 2670.3) requires the protection of habitat for Forest Service sensitive species from adverse modification or destruction, as well as the protection of individual organisms from harm or harassment as appropriate.

Projects on NFS lands in the study area are subject to additional standards and guidelines for the management of certain rare or uncommon species, called survey and manage species, that are associated with late-successional forests. These standards and guidelines specify the protection of sites known to support such species, as well as requiring pre-disturbance surveys for some species.

Data from the Washington Natural Heritage Program (WNHP) include records of populations of four species of rare vascular or non-vascular plants in the study area (**Table 18**). WNHP data do not reflect exhaustive surveys of the study area, and not all species that may be of concern for project planning are included in the database. For example, populations of Forest Service sensitive species and survey and manage species have been documented during site-specific surveys conducted for Forest Service projects in the study area but are not listed in **Table 18**. If any projects are forwarded from this feasibility study, botanical surveys would need to be completed for each project.

Field surveys for noxious weeds should also take place before any ground disturbance occurs. Proposed projects should incorporate applicable practices outlined by the Forest Service and the Snohomish County Noxious Weed Control Board.

Table 18. Documented Rare Plants

Name	State Ranking / Listing Status[1]
Spleenwort-leaved goldthread (*Coptis aspleniifolia*)	S2 / S
Black lily (*Fritillaria camschatcensis*)	S2 / T
Rainier pseudocyphellaria lichen (*Pseudocyphellaria rainierensis*)	S4 / S
Beard lichen (*Usnea longissima*)	S4 / S

Source: WNHP 2018

[1] ***State rankings:*** *S2 = Imperiled; S4 = Widespread but of long-term concern;* ***State listing status:*** *S = Sensitive; T = Threatened.*

No plant species that have been listed as endangered or threatened under the *Endangered Species Act* (ESA) are known to occur in the Mount Baker-Snoqualmie National Forest. The WNHP does not report any observations any ESA-listed species in the study area as of 2018.

EO 13112 of February 3, 1999 (Invasive Species) directs federal agencies to prevent the introduction and spread of invasive species, and to support efforts to eradicate and control invasive species that are established. The Mount Baker-Snoqualmie National Forest adopted *1990 Land and Resource Management Plan* amendments in 2005 and 2015 that provide specific direction for the management of invasive species in the study area. Any projects on NFS lands would be required to implement measures to prevent the establishment and control the spread of invasive species. Areas with a history of disturbance, such as highway rights-of-way, are at particular risk of weed encroachment.

3.3.2.2. Fish and Wildlife

The study area provides breeding, resting, foraging, and migratory habitat for many species of fish and wildlife. This section provides general descriptions of fish and wildlife species and habitat in the study area, along with regulatory provisions that are not directed at individual species. Species listed as threatened or endangered under the ESA are addressed in **Section 3.3.2.3**; other species of concern are addressed in **Section 3.3.2.4**.

The mosaic of vegetation cover types in the study area provides habitat for a diverse array of wildlife species associated with forested communities in western Washington. The diversity of wildlife habitat is enhanced by the presence of riparian and wetland habitats and special habitat features such as snags, logs, and rocky outcrops. The relatively low level of human development in the study area also enhances the quality of habitat for many wildlife species. Streams and other waterbodies in the study area provide habitat for many species of fish, both resident and migratory.

The *National Forest Management Act of 1976* specifies that projects, activities, permits, contracts, and uses of NFS lands must provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area. *Department of Agriculture Regulation 9500-4* directs the Forest Service to manage habitats for all existing native and desired non-native species of fish and wildlife to maintain viable populations of these species.

The *Magnuson-Stevens Fishery Conservation and Management Act*, as amended, requires federal action agencies to consult with the National Marine Fisheries Service regarding certain actions. Consultation is required for any action or proposed action authorized, funded, or undertaken by the agency that may adversely affect essential fish habitat for species included for management in federal Fishery Management Plans. Streams and other watercourses in the study area provide essential fish habitat for Pacific salmon species. As such, essential fish habitat consultation would be required if any improvement projects brought forward from this feasibility study entail ground-disturbing work in or near fish-bearing streams.

Under the *Washington State Hydraulic Code* (77.55 RCW), a Hydraulic Project Approval (HPA) from the Washington Department of Fish and Wildlife (WDFW) may be required for construction activities occurring in or near state waters that will affect fish life. An HPA may also be required for performance of other work that would use, divert, obstruct, or change the natural flow or bed of any waters of the state, including some wetlands. Activities commonly requiring HPAs include construction or repair of bridges, culvert installation, and culvert removal. Through issuance of an HPA, WDFW may place conditions on activities to protect fish and aquatic habitats. If improvement options are forwarded from this feasibility study, the lead agency would need to coordinate with WDFW concerning permitting requirements and the implementation of appropriate measures to avoid or minimize adverse effects on aquatic resources.

Collisions with wildlife do not appear to be a significant hazard in the study area. WSDOT maintains a database of vehicle collisions involving wildlife on federal, state, and local roads throughout Washington. Of nearly 500 incidents involving wildlife in Snohomish County between 2010 (the first year for which geographic data were available) and 2017, none were documented in the study area.[36]

If any improvement projects are brought forward from this feasibility study, project planners should coordinate with fish and wildlife biologists from WDFW and the Forest Service to gain further insight into issues related to the management of these species, as well as measures for avoiding, minimizing, and mitigating adverse effects on species and habitat.

3.3.2.3. Threatened and Endangered Species

Section 7(a)(2) of the ESA of 1973, as amended, requires federal agencies to review actions they authorize, fund, or carry out, and to ensure such actions do not jeopardize the continued existence of federally listed species, or result in the destruction or adverse modification of designated critical habitat. Several species of fish and wildlife that are known or expected to use habitats in the study area are listed or proposed for listing under the ESA (**Table 19**). Designated critical habitat for several of these species is also present in the study area. Any improvements forwarded from this feasibility 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.

Table 19. Threatened and Endangered Species Status

Species	Listing Status	Critical Habitat Status
Chinook salmon (*Oncorhynchus tshawytscha*), Puget Sound evolutionarily significant unit	Threatened	Designated; present in study area
Steelhead trout (*O. mykiss*), Puget Sound distinct population segment	Threatened	Designated; present in study area
Bull trout (*Salvelinus confluentus*)	Threatened	Designated; present in study area
Northern spotted owl (*Strix occidentalis caurina*)	Threatened	Designated; present in study area
Marbled murrelet (*Brachyramphus marmoratus*)	Threatened	Designated; present in study area
Yellow-billed cuckoo (*Coccyzus americanus*)	Threatened	Proposed; none in study area
Gray wolf (*Canis lupus*)	Endangered	Designated; none in study area
Grizzly bear (*Ursus arctos horribilis*)	Threatened	Proposed in 1973 but rendered stale by 1978 amendments to the Endangered Species Act
North American wolverine (*Gulo gulo luscus*)	Proposed Threatened	None designated or proposed

Sources: USFWS, National Marine Fisheries Service

3.3.2.4. Other Species of Concern

In addition to meeting requirements relating to ESA-listed species and designated critical habitat, any projects brought forward from this feasibility study would need to comply with Forest Service management policies and, where applicable, with Snohomish County critical areas regulations.

Projects on NFS lands in the study area must also comply with the standards and guidelines for the management of certain rare or uncommon species, called survey and manage species, that are associated with late-successional forests. These standards and guidelines specify the protection of sites known to support these species, as well as requiring pre-disturbance surveys for some species.

Forest Service policy (Forest Service Manual 2670.3) requires the protection of habitat for USFWS species of concern, Forest Service sensitive species, and management indicator species[ii] from adverse modification or destruction, as well as the protection of individual animals from harm or harassment as appropriate.

Federal lands in the study area are managed for no net loss of core area for grizzly bears; core areas are defined as areas larger than 24 acres and more than 0.31 mile from open roads, motorized trails, or high-use trails. Projects that reduce core habitat are required to offset these reductions through the creation of new core area nearby—that is, by closing roads, motorized trails, or high-use trails. The new core area must be of equal or greater size and must contain seasonal foraging components of equal or greater value compared to the area where core habitat was lost.

EO 13186, dated January 17, 2001, directs federal agencies to avoid or minimize negative impacts of their actions on migratory birds, and to take active steps to protect birds and their habitat. In response to this order, the Forest Service has implemented management guidelines specifying that migratory birds must be addressed in NEPA reviews of actions with the potential to affect migratory birds. The Forest Service must evaluate the effects of agency actions on migratory birds, focusing first on species of management concern along with their priority habitats and key risk factors.

[ii] *National Forest planning regulations require each National Forest to identify and monitor management indicator species whose population changes may indicate the effects of management activity. Management indicator species include threatened, endangered, or sensitive species; species commonly hunted, fished, or trapped; non-game species of special interest; and species that represent certain habitats or habitat elements. Management indicator species for the Mount Baker-Snoqualmie National Forest include spotted owl, pine marten, pileated woodpecker, bald eagle, peregrine falcon, grizzly bear, gray wolf, primary excavators, mountain goat, black-tailed deer, and Rocky Mountain elk.*

Snohomish County *Critical Area Regulations* (SCC 30.62A) place restrictions on project activities within or near fish and wildlife habitat conservation areas, as well as requiring projects to be designed and conducted to achieve no net loss of critical area functions and values. These restrictions apply to streams, wetlands, other waterbodies, and primary association areas for species listed by the state or federal government as endangered or threatened.

Data from the WDFW Priority Habitats and Species Program indicate that observations of 18 species of fish or wildlife on the state's list of priority species have been documented in the study area (**Table 20**). Several of these are also Forest Service sensitive species or Mount Baker-Snoqualmie National Forest management indicator species. Priority Habitats and Species data do not reflect exhaustive surveys of the study area, and not all species that may be of concern for project planning are included in the database. For example, populations of Forest Service sensitive species and survey and manage species have been documented during surveys conducted for Forest Service projects in the study area but are not listed in **Table 20**. The need for site-specific surveys would need to be evaluated for any projects forwarded from this feasibility study.

If any projects are brought forward from this feasibility study, a thorough review of the Forest Service wildlife sightings database 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.

Table 20. WDFW Priority Species

Species	Federal Status	State Status	Forest Service Status
Fish			
Bull trout *(Salvelinus confluentus)*	Threatened	Candidate	Management Indicator Species
Chinook salmon *(Oncorhynchus tshawytscha)*	Threatened	Candidate	Management Indicator Species
Chum salmon *(Oncorhynchus keta)*	none	Candidate	Management Indicator Species
Coastal resident cutthroat trout *(Oncorhynchus clarki clarki)*	none	none	Management Indicator Species
Coho salmon *(Oncorhynchus kisutch)*	none	none	Management Indicator Species
Pink salmon *(Oncorhynchus gorbuscha)*	none	none	Management Indicator Species
Rainbow trout *(Oncorhynchus mykiss)*	none	none	Management Indicator Species
Fish (continued)			
Sockeye salmon *(Oncorhynchus nerka)*	none	none	none
Steelhead *(Oncorhynchus mykiss)*	Threatened	Candidate	Management Indicator Species
Mammals			
Townsend's big-eared bat *(Corynorhinus townsendii)*	Species of Concern	Candidate	Sensitive
Big brown bat *(Eptesicus fuscus)*	none	none	none
Yuma myotis *(Myotis yumanensis)*	none	none	none
Grizzly bear *(Ursus arctos horribilis)*	Threatened	none	Management Indicator Species
Birds			
Harlequin duck *(Histrionicus histrionicus)*	none	none	Sensitive
Marbled murrelet *(Brachyramphus marmoratus)*	Threatened	Threatened	none
Northern goshawk *(Accipiter gentilis)*	Species of Concern	Candidate	Sensitive
Vaux's swift *(Chaetura vauxi)*	none	Candidate	none
Amphibians and Reptiles			
Western toad *(Anaxyrus boreas)*	Species of Concern	Candidate	none

Source: WDFW 2018[37]

3.3.3. Social and Cultural Resources

3.3.3.1. Demographic and Economic Conditions

Implementing regulations for NEPA 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 a summary of information contained in the *Environmental Scan* and the *Economic Opportunities Memorandum* which are contained in **Appendix B**. The information is intended to assist in identifying populations that might be affected by improvements in the study area.

Title VI of the *United States Civil Rights Act of 1964* and *EO 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations)* both 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 this feasibility study into project development, environmental justice would need to be further evaluated during the project development process.

Table 21 summarizes recent population and demographic data for the two communities near the study area and includes data for Snohomish County and Washington for comparison.

Table 21. U.S. Census Demographic Data

		Granite Falls	Darrington	Snohomish County	Washington
Population (2016)		**3,458**	**1,301**	**787,620**	**7,288,000**
Racial/Ethnic Characteristics	**White (not Hispanic or Latino)**	90.5%	89.9%	70.9%	69.5%
	Hispanic or Latino	5.3%	0.7%	9.9%	12.4%
	Black or African American	1.2%	3.7%	3.3%	4.1%
	American Indian or Alaska Native	0.6%	6.7%	1.6%	1.9%
	Asian	1.6%	1.3%	10.7%	8.6%
	Two or more races	2.0%	7.8%	4.6%	4.6%
Economic Characteristics	**Median household income, 2012-2016**	$58,698	$45,313	$73,528	$62,848
	Persons below poverty level, 2016	3.3%	15.9%	8.0%	11.3%
	Unemployment rate, 2016	2.9%	9.1%	6.2%	6.8%

Sources: U.S. Census Bureau[38, 39]

In general, racial and ethnic diversity in the communities near the study area are lower than countywide and statewide levels. Persons identifying as White make up approximately 90 percent of the population in Granite Falls and Darrington, compared to approximately 70 percent in Snohomish County and Washington. In most cases, racial and ethnic minorities make up a smaller percentage of the population in the communities near the study area than at broader geographic scales. The notable exception is persons identifying as American Indian/Alaska Native, who make up almost seven percent of the population in Darrington, compared to levels below two percent in other geographies. This difference may be attributable to the people of the Sauk-Suiattle Indian Tribe, whose homelands and reservation are located near Darrington.

Median household incomes in Granite Falls and Darrington are both below County and state median values. Darrington's economic condition stands in stark contrast to that of Granite Falls, however. The median income in Granite Falls is approximately 93 percent of the statewide median, while that in Darrington is 72 percent of the statewide median. More notably, the poverty rate in Darrington is nearly double the countywide rate, while the poverty rate in Granite Falls is less than half the countywide rate. In addition, the unemployment rates in Darrington and Granite Falls are substantially lower and higher, respectively, than the countywide and statewide rates.

In the past, the economies of the Darrington and Granite Falls areas were heavily dependent on logging and lumber manufacturing. The communities have been trying to diversify their local economies to increase tourism and recreation. Access to recreational sites is an important part of the desired

recreational experience for both local residents and visitors. Recreationists spend money to acquire equipment related to their recreation activities; they also purchase food, transportation, lodging, and other services for travel to and from recreation sites. Although much of this money is spent in the recreationists' areas of origin, some spending takes place closer to the destination site. These expenditures contribute to personal income and to the creation and maintenance of jobs in the affected economic sectors (e.g., dining, lodging, gas, groceries, restaurants, auto repair, etc.).

The following paragraphs provide an overview of economic conditions in Snohomish County, as summarized by Vance-Sherman.[40]

Because of its proximity to and shared labor market with King County, Snohomish County is incorporated into the Seattle-Bellevue-Everett Metropolitan Division and the Seattle-Tacoma-Bellevue Metropolitan Statistical Area, as designated by the Bureau of Labor Statistics.

The geographic distribution of population, economic activity, and land use in Snohomish County is diverse, with a mix of rural and urban zones. For the most part, population centers in the County are oriented south in proximity to the border with King County and west along Interstate 5. By contrast, northern and eastern Snohomish County (including the study area) are characterized by smaller cities, farms, and reservations.

Snohomish County's early industrial economy was based on the availability of abundant natural resources, primarily timber and farming. In the late 1960s, the Boeing aircraft manufacturing company established a major manufacturing plant at Paine Field near Everett. Subsequent development of other high-technology industries in Snohomish County brought population increases and a shift from an economy based on logging and agriculture to one rooted in manufacturing and an expanding service sector.

Manufacturing continues to be a major economic driver in Snohomish County. Just over 63,000 jobs (23.1 percent of total Snohomish County non-farm employment) in 2014 were in manufacturing industries. This is proportionally higher than any other county in Washington and above the national average. The manufacturing base, coupled with proximity to a major urban center, provides the foundation for a diverse local economy.

Other major industry sectors in 2014 included government (38,200 jobs), retail trade (33,300 jobs), educational and health services (32,900 jobs), leisure and hospitality (24,100 jobs), professional and business services (23,700 jobs), and construction (17,500 jobs).

During the recent period of recession and recovery, unemployment rates in Snohomish County peaked at 11.2 percent in early 2010. The average unemployment rate for 2010 was 10.7 percent. Since 2010, the unemployment rate has been on a consistent downward trend. In July 2015, the unemployment rate was 4.3 percent.

In general, employment patterns in Darrington and Granite Falls are not substantially different from countywide patterns. Similar to Snohomish County, major industry sectors in both communities include manufacturing, government, retail trade, educational and health services, and leisure and hospitality.[39] One noticeable difference is that less than one percent of the workforce in Darrington is employed in professional and business service industries, compared to nine percent countywide and seven percent in Granite Falls. In total, Darrington supported approximately 500 jobs in 2011, which is approximately 12 percent of capacity, as indicated in the *Town of Darrington Comprehensive Plan*.[41] Darrington has a 2025 employment growth target of 535 jobs. In 2013, there were approximately 970 jobs in Granite Falls. By 2035, the City anticipates that there will be a total of 2,275 jobs within Granite Falls, as indicated in its Comprehensive Plan.[42]

3.3.3.1.1. Mount Baker-Snoqualmie National Forest Economics

The Verlot Public Service Center received $195,093 in revenue and over 37,600 visitors in 2017[43]. **Figure 14** summarizes visitors and revenues by month at the Verlot Public Service Center. The busiest months were July and August with 40 percent of all visitors and 43 percent of all revenue occurring during those months. The two busiest weeks were the weeks of Memorial Day and July Fourth. The Verlot Public Service Center was open a total of 160 days in 2017. Most of the revenue collected at the Verlot Public Service Center is from Forest Pass sales ($145,015 in 2017), followed by merchandise sales ($27,698 in 2017). Other revenue streams included iron ranger sales, pass machine sales, snowshoe donations, and Christmas tree permits.

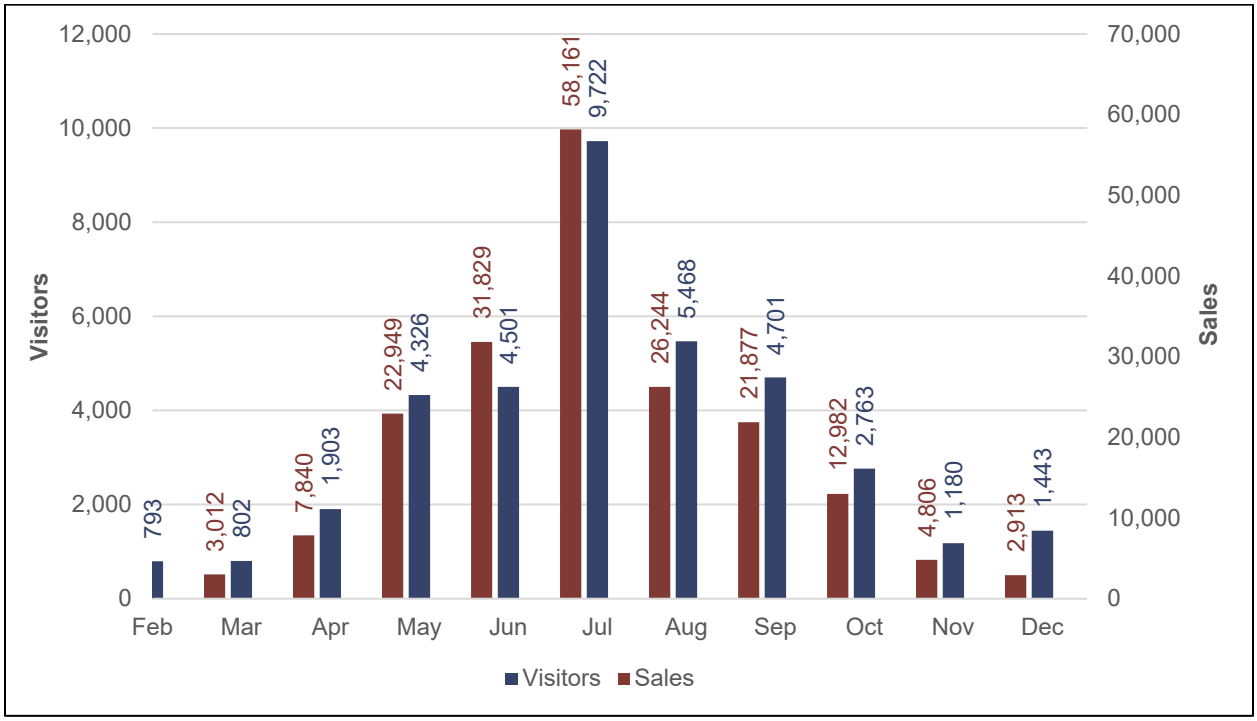

Figure 14: Visitors and Sales at Verlot Public Service Center

The *Gem of the Emerald Corridor: Nature's Value in the Mt. Baker-Snoqualmie National Forest*[44] report also provides estimates of visitors and expenditures by ranger district to the national forest. In the Darrington Ranger District in 2015, there were a total of 228,817 visitors with expenditures of approximately $7.3 million contributing to the regional economy. The report also summarizes the importance of visitors to the Mount Baker-Snoqualmie National Forest to gateway communities, such as Darrington and Granite Falls. Trip-related expenditures associated with national forest recreation support economic development, jobs, income, and taxes. **Table 22** summarizes the regional jobs supported by visitors to the Darrington Ranger District.

Table 22: Darrington Ranger District Expenditures and Employment

Expenditures	Annual Jobs Supported by Outdoor Recreation Spending				Visits per Job
	Direct	Indirect	Induced	Total	
$7,277,672	26	3	4	34	6,815

The 1990 *Land and Resource Management Plan, Mount Baker-Snoqualmie National Forest*[2] explains the timber management strategy as a balance between jobs, demand for wood and wood products, income to the treasury, and protecting the various "non-market values" of other forest users. Snohomish County, Granite Falls, and Darrington generally express a need for a similar balance as described in their Comprehensive Plans. Timber sales provide employment opportunities and income, particularly to nearby

rural communities. The *Gem of the Emerald Corridor: Nature's Value in the Mt. Baker-Snoqualmie National Forest* report summarizes that across the Mount Baker-Snoqualmie National Forest, 2016 timber sales contributed $454,396. Timber extraction jobs are both labor and resource intensive; therefore, the rural jobs it supports tend to offer higher wages than other rural jobs.

A review of GIS data provided by the Forest Service found thousands of instances of timber-harvesting activity near the study area dating back to 1886. Since 2001, there have been a total of approximately 1,057 planned acres and approximately 875 accomplished acres of timber harvest near the study area.[45] For all these acres, the type of timber harvest was commercial thinning[iii].

3.3.3.2. Land Ownership and Land Use

Almost all land in the study area is publicly held. Nearly 90 percent of the study area consists of NFS lands managed by the Mount Baker-Snoqualmie National Forest (**Figure A.13**, **Table 23**). The predominant land uses are forestry and recreation. Near the western end of the study area, the Mountain Loop Highway crosses several parcels of private land outside of the National Forest boundary. These parcels are zoned for residential uses or commercial forestry. The road also crosses several private inholdings within the National Forest boundary, zoned for commercial forestry, residential, or recreational uses. Two parcels crossed by the road between Silverton and Barlow Pass are owned by the Granite Falls School District. Land ownership data from Snohomish County indicate that a quarter-section parcel near Bedal is owned by Washington State Parks.

Table 23. Land Ownership

Landowner Type	Percent of Study Area
Federal (National Forest)	88.6
State	1.8
County	> 0.1
City	3.4
Private	6.1

Source: Snohomish County GIS data

If any improvement options are forwarded from this feasibility study, additional research and coordination would be needed to ascertain the specific encumbrances that may be attached to each parcel of land.

The *1990 Land and Resource Management Plan*, as amended, provides management direction for NFS lands within the study area. Direction is provided in the form of goals and objectives, standards and guidelines, and Management Area prescriptions. Any improvement projects brought forward from this feasibility study would need to demonstrate consistency with applicable direction.

The portions of the study area from MP 12.5 to MP 37 (approximately) lie within the bounds of Late-Successional Reserves designated under the *1994 Northwest Forest Plan* to provide habitat for species associated with old-growth forests. Management activities, including road improvements, are allowed within Late-Successional Reserves, provided the activities are neutral or beneficial to the creation and maintenance of late-successional habitat.

[iii] *An intermediate harvest with the objective of reducing stand density primarily to improve growth, enhance forest health, and other resource objectives. Treatment can recover potential mortality while producing merchantable material. Thinning includes the following: chemical (killing of unwanted trees by herbicide application); crown (removal of trees from dominant and co-dominant strata); free (no consideration to crown position); low (removal of trees from lower crown classes); mechanical or row (removal of trees either in row, strips by using a fixed spacing interval); and selection (removal of the crown class to favor those in the lower crown classes.) This activity code is in the Timber and Silviculture grouping*.

The federal *Coastal Zone Management Act* provides additional management direction for lands in the study area. Snohomish County is one of 15 counties that are designated as the coastal zone in Washington. The Washington State Coastal Zone Management Program requires federal activities that affect any land use, water use, or natural resource of the coastal zone to comply with the enforceable policies of the following four statutes:

- *Shoreline Management Act*
- *State Water Pollution Control Act*
- *State Clean Air Act*
- *State Environmental Policy Act* (if applicable)

To ensure compliance with the *Coastal Zone Management Act*, any improvement options forwarded from this feasibility study would need to be reviewed for consistency with the requirements of these statutes.

3.3.3.3. Recreational Resources

This section is a summary of the information contained in the *Environmental Scan* and the *Recreational Opportunities Memorandum* regarding the recreational opportunities and resources in the Mountain Loop Highway corridor. More information can be found in the respective reports contained in **Appendix B**. A map of the recreation sites within the corridor can be found in **Figure A.14**.

The Mountain Loop Highway is readily accessible to more than three million residents of the central Puget Sound area. The highway provides access to more than a dozen campgrounds, 30 trailheads, 2 public boat launches, numerous interpretive sites, 3 wilderness areas, 3 Research Natural Areas, 5 picnic areas, 2 National Historic Register sites, the historic mining town of Monte Cristo, and over 200 miles of trail, including the Pacific Crest National Scenic Trail. Detailed information, including an inventory of these recreation sites can be found in the *Recreational Opportunities Memorandum.* Most recreational use occurs on the South Fork Stillaguamish side of the loop. The highest use occurs between May and September, when the corridor receives 17,000 to 20,000 visitors per month, on average. Recreational visitation decreases during the winter months, when Snohomish County typically plows the road from Verlot to Deer Creek (approximately MP 23) and from Darrington to the White Chuck River (approximately MP 44).

Dispersed recreational activities comprise a large portion of the recreation in the study area. Seasonal and traditional dispersed uses include camping (dispersed, non-fee), picnicking, driving for pleasure, hiking, birding, mushroom gathering, berry picking, hunting, target shooting, fishing, and trapping. Kayaking and canoeing are popular water-based activities; several firms have special use permits from the Forest Service for outfitting and guiding rafting trips on the Sauk River. Snowmobiling, cross-country skiing, and snowshoeing are popular winter activities. During summer and especially on holidays, every wide spot in the road and every turn-out may be used for camping and/or picnicking. Most users of the area are residents of local communities such as Darrington, Granite Falls, Marysville, Everett, and Lake Stevens, as well as the greater Puget Sound metropolitan area and southern British Columbia.

While dispersed recreation has not been an active management focus within the corridor, issues and user conflicts are not uncommon. Site closures or user conflicts between private landowners and the visiting public can limit recreational access. Visitors excluded from areas closed to the public may travel farther up the highway corridor and along Forest Service spur roads in search of legally accessible sites. Evidence of pressure from these displaced users includes recreational use conflicts, human waste, increased trash dumping, and other illegal activities in many areas.

Use of all types of recreation sites in the study area has shifted or expanded over the last few decades. Regional population growth, combined with a sharp increase in the proportion of the population

participating in outdoor activities such as hiking, has contributed to increased demand for recreation on NFS lands. Despite this increase, the development or reconstruction of recreation opportunities and facilities (e.g., campgrounds, trails, picnic areas, trailheads) within the study area has remained somewhat static. Many trailheads, such as those for Heather Lake, Sunrise Mine, and Lake 22, currently do not provide sufficient parking spaces to accommodate the visitation they receive. As a result, visitors park along nearby roadways, constricting traffic, and causing unsafe highway crossing conditions.

The Forest Service recently completed an environmental assessment for the proposed commercial thinning of approximately 2,100 to 3,600 acres of forest stands in the South Fork Stillaguamish River drainage that had been clearcut between the 1940s and the 1990s. The proposed project, if approved, would result in a substantial increase in the volume of truck traffic on the Mountain Loop Highway for several years. Additional project actions would include toilet facility upgrades at two trailheads, relocation and/or expansion of three trailheads, and the removal of replacement of culverts that present barriers to the passage of fish and other aquatic organisms. The Forest Service is also currently exploring options for the management of the Monte Cristo mining area near Barlow Pass, including issues related to trail maintenance, parking, toilet facilities, and road access.

Representatives of local communities have expressed interest in expanding the capacity to accommodate overnight visitors in the area. The Forest Service recently conducted a study to identify potential locations for a new campground on NFS lands in the South Fork Stillaguamish River drainage. The study concluded that no such locations are available. The Forest Service is exploring options for converting a site previously owned by the Everett School District (Camp Silverton, near MP 20.5) into a public campground. The potential for new campground development on NFS lands in the Sauk River drainage is under consideration.

Recreational areas may be protected under Section 4(f) of the *U.S. Department of Transportation Act of 1966*. Recreation facilities qualify as Section 4(f) properties 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. Historic properties listed or eligible for listing on the National Register of Historic Places (NRHP) also qualify as Section 4(f) properties. Before funding or approving a project that occupies or adversely affects a Section 4(f) property, FHWA must determine that there is no prudent or feasible alternative that completely avoids the resource. As discussed above, numerous recreational facilities are present in the study area. Historical properties are discussed in **Section 3.3.3.4**. If improvement options are forwarded from this feasibility study, potential effects on recreational use would need to be considered in accordance with Section 4(f).

Section 6(f) of the *Land and Water Conservation Fund (LWCF) Act* 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 LWCF funds. The Secretary of the Interior must approve any conversion of LWCF property, in whole or in part, to a use other than public outdoor recreation. Based on a review of a list of all projects funded by LWCF grants within Snohomish County, no projects qualifying for protection under Section 6(f) are present in the study area. [46]

3.3.3.4. Cultural Resources

The *National Historic Preservation Act* (16 USC 470) is the primary federal law governing the preservation of cultural and historic resources in the United States. This Act established a national preservation program and the basic structure for encouraging the identification and protection of cultural and historic resources of national, state, tribal, and local significance. A key element of the preservation program is the NRHP, which is the federal list of historic, archaeological, and other cultural resources deemed worthy of preservation. In Washington, the National Register is administered by the Washington State Department of Archaeology and Historic Preservation (DAHP). Resources listed, or determined eligible

for listing, are considered historic properties. Such properties are also generally afforded protection under Section 4(f). Section 106 of the *National Historic Preservation Act* requires federal agencies to consider the effects of their undertakings (including funding, licensing, or permitting the undertakings of other entities) on historic properties and stipulates that affected American Indian tribes must be consulted. The implementing regulations of Section 106 also require agencies to seek ways of avoiding, minimizing, or mitigating any adverse effects on historic properties.

To comply with these regulations and with NEPA, agencies must consider the effects of proposed projects on previously identified resources as well as resources not yet identified. In addition, in accordance with the *Archaeological Sites and Resources Act* (RCW 27.53) and the *Indian Graves and Records Act* (RCW 27.44), a permit must be obtained from DAHP before any excavation that will alter, dig into, deface, or remove archaeological resources; including American Indian graves, cairns, or glyptic records. The State Historic Preservation Officer reviews and comments on archaeological surveys performed on site and makes determinations regarding eligibility and effect.

In addition, U.S. Government agencies have a permanent legal obligation to exercise statutory and other legal authorities to protect tribal land, assets, resources, and treaty rights, as well as a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes. The study area is within the usual and accustomed lands of several American Indian tribes, including the Lummi Nation, Samish Tribe, Sauk-Suiattle Indian Tribe, Stillaguamish Tribe, Swinomish Tribal Community, Tulalip Tribes, and Upper Skagit Tribe. Members of local tribes use the Mountain Loop Highway for access to traditional hunting, fishing, and gathering areas.

Additional statutes, regulations, and policies aimed at protecting cultural resources include the following:

- The *American Indian Religious Freedom Act* protects the inherent rights of American Indian tribes to the free exercise of their traditional religions. Agencies are required to consult with tribes if an anticipated action is expected to affect their practice of traditional religions or their access to religious sites. In addition, under *EO 13007*, federal agencies are required to avoid physical damage as much as possible to American Indian sacred sites located on federal and American Indian lands. The agencies are further directed to ensure that reasonable notice is provided of proposed land actions or policies that may restrict future access to, or ceremonial use of, or adversely affect the physical integrity of sacred sites. A site need not be a historic property to merit protection under this EO.
- The *Antiquities Act of 1906* prohibits the unauthorized excavation, removal, and defacement of objects of antiquity on public lands. The *Archaeological Resources Protection Act of 1979* strengthens the *Antiquities Act* by prohibiting the unauthorized excavation, removal, and damage of archaeological resources on federal and tribal lands.
- The *Native American Graves Protection and Repatriation Act of 1990* establishes the rights of lineal descendants and members of Indian tribes to certain human remains and precisely defined cultural items recovered from federal or Indian lands. The Act also establishes procedures and consultation requirements for intentional excavation or accidental discovery of American Indian remains or cultural items on federal or tribal lands.
- *EO 13175 (Consultation and Coordination with Indian Tribal Governments)* requires federal agencies to develop an accountable process to ensure the meaningful and timely input by tribal officials in the development of regulatory policies that have substantial direct effects on one or more Indian tribes, on the relationship between the federal government and the Indian tribes, or on the distribution of power and responsibilities between the federal government and Indian tribes.

- *EO 11593 (Protection and Enhancement of the Cultural Environment)* directs federal agencies to inventory cultural resources under their jurisdiction, nominate all federally owned properties that meet the criteria of the NRHP, use due caution until the inventory and nomination processes are completed, and ensure that federal plans and programs contribute to preservation and enhancement of non-federally owned properties.

DAHP maintains a GIS database of buildings, structures, and sites that have been evaluated for inclusion in the NRHP or its State of Washington equivalent, the Washington Heritage Register, as well as all above-ground resources that have been surveyed. Access to archaeological data is redacted from public viewing in accordance with state law. According to Washington DAHP, two properties in the study area are on the state and/or national registers, and a third has been determined to be eligible for inclusion.[47]

The Verlot Public Service Center, built in 1936, is on the NRHP and the Washington Heritage Register. The site is managed under a programmatic agreement between the Forest Service, the Oregon and Washington State Historic Preservation Offices, and the Advisory Council on Historic Preservation.

Also on the Washington Heritage Register is South Fork Stillaguamish Bridge #537 (MP 17.8), known as the Red Bridge. The bridge has been characterized as eligible for listing in the NRHP for its association with bridge building in Washington in the 1950s and for its association with the history of the site. The Red Bridge is one of the few unaltered examples of riveted steel Pratt/Parker through-truss bridges in Washington.

South Fork Stillaguamish River Bridge #538 (MP 11.7), known as the Blue Bridge, is also eligible for listing in the NRHP as an excellent example of a riveted steel Pratt/Parker through-truss bridge. The Red Bridge and Blue Bridge were some of the last Pratt/Parker through trusses constructed in the state.

If any projects are brought forward from this feasibility 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.

3.3.3.5. Noise

Traffic noise may need to be evaluated for any future improvements in the study area. A noise analysis is required for projects that include a substantial shift in the horizontal or vertical alignments, increasing the number of through lanes, providing passing lanes, or increasing traffic speed and volume. Such an analysis includes measuring ambient noise levels at selected receivers and modeling design year noise levels using projected traffic volumes. If noise levels approach or substantially exceed noise abatement criteria for the project, noise abatement measures may be necessary. Possible abatement measures available for consideration include, but are not limited to, the following:

- Alternating the horizontal or vertical alignment;
- Constructing noise barriers such as sound walls or earthen berms; and/or
- Decreasing traffic speed limits.

Noise abatement measures must be considered reasonable and feasible and be supported by the affected public.

Construction activities associated with any improvements forwarded from this feasibility study may cause localized, short-duration noise impacts. These impacts can be minimized by using standard WSDOT specifications for the control of noise sources during construction.

3.3.3.6. Visual Resources

Scenic quality is a fundamental element of recreation experiences. Driving to enjoy the scenery continues to be a top national recreational activity. The appreciation of scenic views has long been a highly valued activity for visitors to the Mount Baker-Snoqualmie National Forest.

As discussed in **Section 3.3.1.3.2**, the Sauk River and a portion of the South Fork Sauk River in the study area are part of the National Wild and Scenic Rivers System, with a classification of Scenic. In addition, the South Fork Stillaguamish River has been recommended for similar designation. Also, as noted in **Section 1.2**, the Mountain Loop Highway is a National Forest Scenic Byway.

The *1990 Land and Resource Management Plan*, as amended, has identified the Mountain Loop Highway as a Primary Corridor, having "visually sensitive landscapes as viewed from major highway corridors and use areas. Lands within this corridor are to be managed for scenic quality level on both foreground (visible areas from 300 feet to 0.25 mile) and middleground (visible areas from 0.25 mile to 2.0 miles)".[2] Objectives for visual quality within the study area include "retention" and "partial retention." Retention means that management activities should not be visible to the casual forest visitor. Partial retention means that management activities are to remain subordinate to the natural environment. [2]

Evaluation of the potential effects on visual resources would need to be conducted if improvement options are forwarded from this feasibility study.

3.4. EXISTING AND PROJECTED CONDITIONS SUMMARY

3.4.1. TRANSPORTATION CONDITIONS SUMMARY

The *Existing and Projected Conditions Report* (**Appendix B**) identified geometric conditions, traffic conditions, safety trends, and other vulnerabilities within the study area. This following is a summary of the observed trends and areas for further consideration identified through review of as-built drawings, field review, public databases, and other resources. Project-level traffic, geometric, or safety analysis may be required for any improvements forwarded from this study. The following transportation system conditions were noted:

Physical Features and Characteristics

- 16 of the bridges along the corridor are rated "fair" condition and one is rated "poor" condition. All bridges meet minimum design load rating standards, though there is not a consistent design load rating throughout the corridor.
- County Bridge #102 at MP 1.45 is located outside of the study corridor. It traverses the South Fork Stillaguamish River and is functionally obsolete (narrow width), identified as structurally deficient by the State of Washington since 2008, and is fracture critical where if one member were to show a crack it would need to close for inspection, repair and eventually replacement.
- Over 60 culverts of 30" or larger were identified along the study corridor. Three of the culverts were in failing condition, six were in poor condition.
- The corridor does not meet the minimum roadway surface width of 32 feet. The width is generally 28 feet for the majority of the paved section, with the exception of six miles near the beginning of the study corridor which has a width of 22 feet. The width of the gravel section varies greatly, providing only one travel lane in some locations.
- The majority of the pavement in the corridor is in good condition.

Geometric Conditions

- Approximately 96 percent of the horizontal curves on the paved sections meet or exceed a 40-mph design speed, while only 41 percent of the horizontal curves on the gravel section appear to meet the same standard (a 40-mph design speed was selected for the geometric analysis comparison for continuity with the paved sections on either end of the gravel section).
- Approximately 31 percent of the vertical curves on the gravel portion appear to meet a 40-mph design standard. 98 percent of the vertical curves on the paved portion meet a 40-mph design speed.
- There are multiple vertical profiles along the gravel portion of the study corridor that do not appear to meet a 40-mph design standard.

Traffic Conditions

- The traffic volumes on the study corridor range from 156 vehicles per day near White Chuck, to as high as 1,767 vpd near the Verlot campground.
- Average speeds vary from 37.5 mph at White Chuck to 55.3 mph at Perry Creek. More than 90 percent of vehicles travel between 45 and 55 mph. Throughout the corridor, vehicles travel at an average speed of 51 mph. This does not include speed on the gravel portion.
- The majority of vehicles traveling on the corridor are passenger cars (approximately 75 and 63 percent on the first and second paved sections, respectively) and two axle single unit vehicles (approximately 13 and 19 percent) which includes pickups, vans, and other vehicles such as campers, motorhomes, or vehicles pulling recreational trailers.
- On average, there are about half as many vehicles traveling the paved portions of the corridor in the wintertime as compared to the summertime.

Safety

- Records show 55 crashes occurring within the study area between January 1, 2008, to December 31, 2017. Two crashes resulted in fatalities, four crashes resulted in serious injuries, and 19 crashes resulted in non-serious injuries.
- The main observed crash trends are fixed object collisions (38) and roll-over collisions (10).
- A cluster of fixed object collisions (7) were observed near MP 15.5 between the Wiley Creek Campground and Schweitzer Creek. Another cluster of crashes (8) was observed between MP 11 and MP 12.

Other Vulnerabilities

- Landslides, steep side slopes, sink holes, washouts, and drainage/erosion issues are common on the Mountain Loop Highway. These events have been known to cause road damage in the past.

3.4.2. Environmental Setting Summary

The *Environmental Scan* (**Appendix B**) identified physical, biological, social, and cultural resources within the study area that may be affected by potential future improvements arising from the *Mountain Loop Highway Feasibility Study*. 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 NEPA.

Physical Environment

- Some mapped soils in the study area are classified as prime farmland, farmland of statewide importance, and “prime farmland if irrigated.” The study area does not include any designated farmlands, lands zoned for agricultural uses, or lands classified as cultivated crops.

- The study area is seismically active. The highway passes through several geotechnical hazard areas. Almost the entire study area is classified as having highly erodible surficial geology.
- The study area lies within three watersheds—South Fork Stillaguamish River, Upper Sauk River, and Lower Sauk River—two of which are Tier 1 Key Watersheds. The highway also crosses 89 streams, 29 are fish-bearing. Additional unnamed streams, wetlands, and waterbodies are also present in the study area. The Sauk River and a portion of the South Fork Sauk River are part of the National Wild and Scenic Rivers System. The South Fork Stillaguamish River has been recommended for inclusion in the System.
- Some of the waters in or near the study area are listed as impaired due to elevated temperatures and sedimentation.
- Fewer than 100 wells, 1 public water supply, and two wellhead protection areas are documented in the study area.
- Several segments of the Mountain Loop Highway cross or lie within mapped 100-year floodplains. Many sections of the highway have suffered flood damage in the past, and modeling suggests flood-related damage to infrastructure is likely to become more frequent and severe.
- No air quality non-attainment areas exist in the study area, however, Darrington has been identified as an area at risk of violating standards for particulate matter.
- There are no active underground storage tanks in the study area. The Silverton Concentrator Site is currently in the state cleanup process under the Model Toxics Control Act. There are no inactive or abandoned mines in the study area.

Biological Resources

- Forested areas are the predominant land cover type in the study area, followed by developed areas, open water, and wetlands. Four species of rare vascular or non-vascular plants are documented in the study area but no plant species listed in the ESA are known to occur.
- The study area provides breeding, resting, foraging, and migratory habitat for many species of fish and wildlife.
- Several species of fish and wildlife that are known or expected to use habitats in the study area are listed or proposed for listing under the ESA. Designated critical habitat for several of these species is also present in the study area.
- Federal lands in the study area are managed for no net loss of core area for grizzly bears.
- Observations of 18 species of fish or wildlife on the state's list of priority species have been documented in the study area.

Social and Cultural Resources

- Minority and low-income populations exist in the study area, especially within the communities of Granite Falls and Darrington. The Sauk-Suiattle Indian Tribe homelands and reservation are located near Darrington.
- In the past, the economies of the Darrington and Granite Falls areas were heavily dependent on logging and lumber manufacturing. The communities have been trying to diversify their local economies to increase tourism and recreation.
- The majority of the lands in the study area are publicly held by the Forest Service and is used for forestry and recreation. About 5 percent of the land is owned by the State, County, or Cities while about 6 percent is privately owned.
- The highway provides access to several developed and dispersed recreational activities. The highest use occurs between May and September, when the corridor receives 17,000 to 20,000 visitors per month, on average.
- Members of several local American Indian tribes use the Mountain Loop Highway for access to traditional hunting, fishing, and gathering areas.

- Two properties in the study area—Verlot Public Service Center and the Red Bridge—are on the state and/or national registers of historic places, and a third (Blue Bridge) has been determined to be eligible for inclusion.
- The Forest Plan has identified the Mountain Loop Highway as a Primary Corridor, having “visually sensitive landscapes as viewed from major highway corridors and use areas”

Chapter 4
GOALS AND OBJECTIVES

Goals and objectives were derived based on a comprehensive review of existing and projected data and input from the oversight committee, stakeholders and the public and were used to develop options. The following goals and objectives reflect the existing social, environmental, and engineering conditions described in the *Existing and Projected Conditions Report* (**Appendix B**) and recognize the local and regional use of the Mountain Loop Highway and the surrounding transportation system.

4.1. GOAL #1

Improve the safety and operation of the roadway facility.

Areas along the gravel portion of the corridor do not accommodate simultaneous travel in two directions. Some crash trends have been identified at locations on the paved portion of the roadway. Trends relative to safety can be caused by a variety of factors, including poor roadway alignment, inadequate sight distance, and illegally parked cars.

OBJECTIVES

- Improve sub-standard elements of the roadway to meet current applicable design standards; in some locations a reduced standard should be accepted within context of the adjacent environment.
- Reduce delay for emergency responders under existing and future traffic demands.
- Manage travel speeds and provide adequate clear zones to improve operations.

4.2. GOAL #2

Provide a roadway facility that accommodates future traffic growth and reduces maintenance needs.

The Mountain Loop Highway is used by local and regional travelers including vehicles, pedestrians, bicyclists, emergency response providers, and others. Depending on future growth characteristics as depicted in local adopted planning documents, the Mountain Loop Highway will realize increased passenger and vehicular traffic, and maintenance needs will continue to increase.

OBJECTIVES

- Accommodate existing and future capacity demands.
- Address non-motorized facilities consistent with local planning efforts.
- Provide connectivity to residents, and regional users accessing recreational lands along the corridor.
- Improve accessibility to better distribute recreational use.
- Reduce maintenance needs.

4.3. GOAL #3

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

The area around the Mountain Loop Highway provides access to residential and recreational lands. It is also a secondary route to the Town of Darrington and is crucial for emergency access. Because of the location along the South Fork of the Stillaguamish River, and the Sauk River, wildlife and aquatic connectivity are areas of concern. 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 from potential options.
- Minimize adverse impacts to the wildlife and aquatic organisms from potential options.
- Provide reasonable access to recreational sites in the study.
- Avoid or otherwise minimize adverse impacts to historic, cultural, and archaeological resources that may result from implementation of options.

4.4. OTHER CONSIDERATIONS

While not a goal by itself, any option(s) developed should be sensitive to the availability of funding for recurring maintenance obligations or for the construction of new improvements. Also, over the course of the public process for this study the topics of parking, vandalism, illegal activity, and enforcement, along with identifying new access to recreational sites directly adjacent to the Mountain Loop Highway, were areas of concern generally outside the scope of this Feasibility Study. However, they are areas of concern that have been documented and commented on by members of the public.

Chapter 5
IMPROVEMENT OPTIONS AND SCREENING

5.1. IMPROVEMENT OPTION IDENTIFICATION

A full range of options were developed for analysis based on the identified transportation system goals and objectives. The goals and objectives were developed through an evaluation of the information contained in the *Existing and Projected Conditions Report* (**Appendix B**). Improvement options considered in this report reflect input from stakeholders and the public, as well as an evaluation of the existing conditions and future goals of the Mountain Loop Highway within the study area. Three steps are applied to develop improvement options:

- Identify roadway issues and areas of concern based on field review, engineering analysis of as-built drawings, crash data analysis, consultation with project sponsors, stakeholders, and information provided by the public.
- Identify overall corridor goals and objectives.
- Analyze the information gathered to develop possible improvement options that address the roadway issues and areas of concern, as well as satisfying corridor goals and objectives.

Implementation of an improvement option(s) depends on funding availability and other project delivery elements. **Table 24** at the end of this section summarize the identified improvement options for the 14-mile gravel segment. The following discuss the possible improvement options and associated planning level cost estimates for the 14-mile gravel segment. A summary of potential spot improvements for the paved sections of the road are presented in **Section 5.3**.

5.1.1. Estimate Of Improvement Costs

Planning level cost estimates are listed in 2019 dollars for each improvement option. The planning level costs do not include estimates for right-of-way or preliminary engineering, but do include construction, construction engineering, and indirect and incidental costs. In addition to actual construction unit costs, allotments are made for temporary traffic control, erosion control, scheduling, contractor QA/QC, sampling and testing, and survey. On top of these items, a contingency factor of 50 percent was applied to the estimated cost ranges due to unknown factors at this particular planning level stage. **Appendix B** contains planning level cost estimates, including all assumptions.

5.1.2. Improvement Options Developed

This section contains descriptions of the improvement options developed for the 14-mile gravel section of the Mountain Loop Highway corridor, including how the improvement options address previously defined issues or areas of concern. The improvement options are intended to satisfy the corridor goals and objectives. Quantities for common construction items were developed to arrive at estimated construction costs. A mixture of previously obtained survey made available by WFLHD, and incorporation of a high-level digital elevation model (DEM), were used to derive mapping and 3D terrain. By application of different roadway typical sections and modifications to alignment and grade, quantities were derived such that estimated construction costs could be calculated.

5.1.2.1. Option 1: Maintain Status Quo

Areas of concern with the existing 14-mile gravel section have been well articulated throughout the entire planning process and is documented more fully in **Chapter 3** of this report. One option that should remain under consideration would be the "Do Nothing" option. Under this scenario, there would be no improvement(s) made to the 14-mile gravel section, and the status quo would remain related to ongoing maintenance activities. Existing concerns expressed about the existing gravel portion include inadequate width, poor driving surface, poor drainage off the roadway due to loss of roadway crown, poor sight distance, and excessive dust. Some have argued that the current condition of the road inherently limits traffic, controls excessive speed, and is more appropriate in context to the scenic and recreational nature of the corridor.

Figure 15: Narrow Width of Existing Gravel Section

Estimated Cost: $112,500 per year (*Maintenance - $4,000 per mile * 14 miles * twice per year*)

5.1.2.2. Option 2: Minor Road and Drainage Improvements

Option 2 is intended to utilize the existing road prism footprint and work with the present condition. No widening of the roadway would occur, so there would not be any "across the board" improvement to the width of the existing road. Some spot locations could be widened if it was easy to do so and improved on very narrow locations. This option consists of re-working the existing roadway travel surface by scarification, placing 4" (plus/minus) of gravel surfacing, shaping the roadway to obtain at least a 4% crown to promote drainage, and signage as appropriate to notify travelers of narrow widths, limited sight distance, and possibly one-lane road areas with turnouts before and after the relevant sections. This option would improve conditions considerably over those in place now, but fall short of correcting horizontal and vertical geometric deficiencies. Where possible, new culverts and ditches would be incorporated to improve drainage characteristics.

Estimated Cost: $8.4M - $14.0M (Gravel Surfacing – low end no widening and high end with widening at spot locations, respectively)

5.1.2.3. Option 3: 25 mph Design Speed

Option 3 is to reconstruct the 14-mile gravel section to a 25 mph design speed. Generally, the 25 mph design speed will allow the roadway to primarily follow the existing roadway horizontal alignment, with few exceptions where needed to improve curvature around sharp corners. Significant "off alignment" construction would not be required, and the existing footprint could generally be utilized. This option would result in improvements to the vertical profile to increase visibility, and the roadway would be shaped to obtain a good roadway crown to promote drainage off of the roadway. The new driving surface could consist of either gravel surfacing or asphalt surfacing. Both surfacing options would be 4" and

include 8” of base course. Regulatory and/or advisory signage, as appropriate, would be utilized to warn of curves, identify turnouts (if placed) and post speeds. If asphalt surfacing is used, paint striping may be utilized to match the currently paved portions of the corridor. New culverts and ditches would be incorporated to improve drainage characteristics.

Option 3 could realize a roadway width of anywhere between 18 feet (minimum) to 32 feet (maximum). The minimum roadway width of 18 feet would allow for two 9-foot lanes with no shoulders and would strive to meet standards contained in AASHTO Geometric Design of Very Low-Volume Local Roads guidelines. This type of roadway section was recently constructed on the Middle Fork Snoqualmie Road project. This option would widen the roadway in the narrow areas and better accommodate 2-way traffic within the corridor limits. Substandard horizontal and vertical curves in the road will require localized realignment.

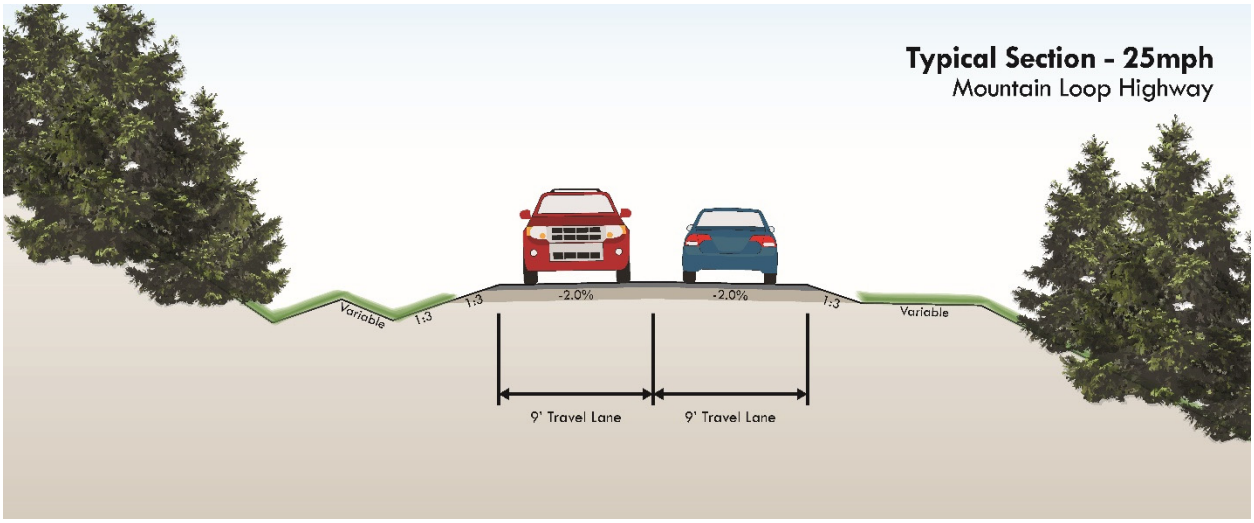

Figure 16: 18-Foot Roadway Width (w/Asphalt Surfacing) for 25 mph

Estimated Cost: $12.6M - $26.6M (Gravel Surfacing – 18 ft width and 32 ft width, respectively)
$26.6M - $40.6M (Asphalt Surfacing – 18 ft width and 32 ft width, respectively)

5.1.2.4. Option 4: 40 mph Design Speed

Option 4 is similar to Option 3 in terms of reconstructing the 14-mile gravel section. However this option would bring the roadway up to a 40 mph design speed. The 40 mph design speed would require very significant work to attain horizontal and vertical improvements to satisfy higher speeds. Accordingly, a large portion of the reconstructed roadway would be “off alignment” in virgin areas adjacent to the existing roadway.

This option would provide a good roadway crown to promote drainage off of the roadway, and more closely mimic driver expectations similar to the currently paved portions of the roadway on either side of the 14-mile gravel section. The new driving surface could consist of either gravel surfacing or asphalt surfacing. Both surfacing options would be 4” and include 8” of base course. Regulatory and/or advisory signage, as appropriate, would be utilized to warn of curves, identify turnouts (if placed) and post speeds. If asphalt surfacing is used, paint striping may be utilized to match the currently paved portions of the corridor. New culverts and ditches would be incorporated to improve drainage characteristics.

Option 4 would necessitate a roadway width of 32 feet (minimum) to 40 feet (maximum). The minimum roadway width of 32 feet would provide two 12-foot lanes with 4-foot shoulders and would meet AASHTO standards for expected traffic volume and design speed.

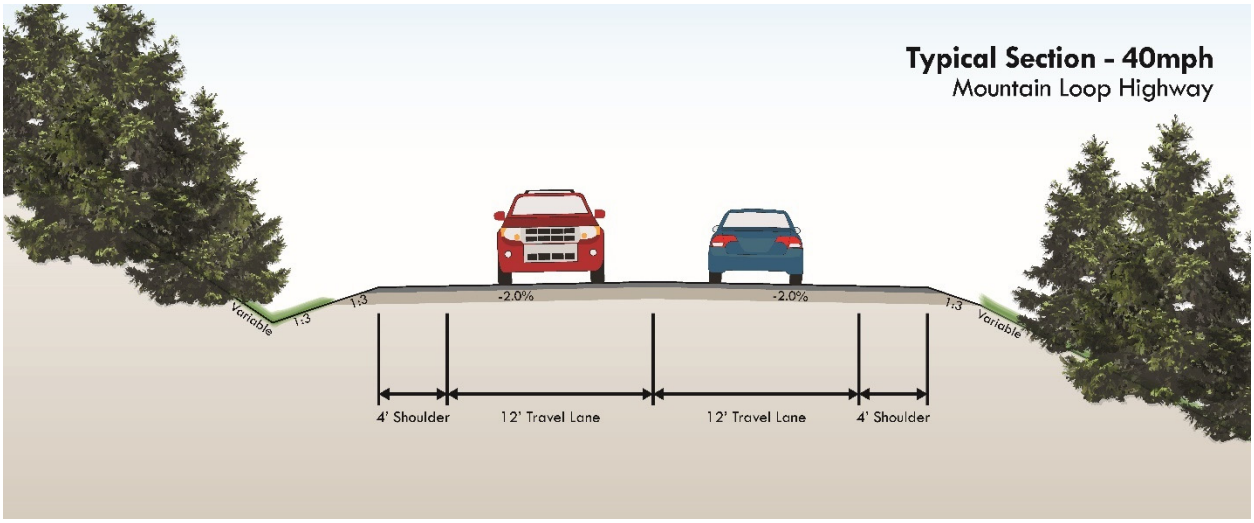

Figure 17: 32-Foot Roadway Width (w/Asphalt Surfacing) for 40 mph

Estimated Cost: $39.2M- $53.2M (Gravel Surfacing – 32 ft width and 40 ft width, respectively)
$56.0M-$70.0M (Asphalt Surfacing – 32 ft width and 40 ft width, respectively)

5.1.2.5. Summary of Improvement Options and Cost Estimates

Table 24. Summary of Improvement Options and Cost Estimates

Option	Description	Range of Estimated Costs *
Option 1: Maintain Status Quo	• Continue existing conditions • Narrow roadway widths (16 feet to 22 feet) • Gravel surfacing • Inverted crown • Poor drainage off of roadway • Limited sight distance • Signage as appropriate	**$112,000 per year** *(annualized maintenance costs)*
Option 2: Minor Road and Drainage Improvements	• Utilizes existing road prism footprint • No widening of the roadway; sub-option to widen roadway at spot locations with drainage improvements • Re-work existing roadway travel surface by scarifying • Place 4" (plus/minus) of gravel surfacing • Shape roadway to obtain at least a 4% crown to promote drainage • Signage as appropriate • Improve storm water drainage facilities (ditches and culverts) A logical initital segment could be MP 40 to MP 44.65, which is the northernmost segment of gravel. This segment is in the best current condition and could be a candidate for phasing improvements along the 14-mile corridor. Estimated costs for this segment are $2.79M (low) and $4.65M (high), respectively.	**$8.4M - $14.0M** *(Gravel Surfacing – low end no widening and high end with widening at spot locations, respectively)*
Option 3: 25 mph Design Speed	• 18 ft (minimum) or 32 ft (maximum) roadway • 9 ft lanes (no shoulders) or 12 ft lanes (4 ft shoulders) • 4" gravel or 4" asphalt surfacing (both w/8" base course) • Stabilization with calcium chloride (for gravel surfacing) • Realignment as necessary to improve geometrics (horizontal and vertical) • Generally stays within current roadway prism, limited "off-alignment" construction	**$12.6M - $26.6M** *(Gravel Surfacing – 18 ft width and 32 ft width, respectively)* **$26.6M - $40.6M** *(Asphalt Surfacing*

Option	Description	Range of Estimated Costs *
	• Complete reconstruction of the roadway • Improves storm water drainage facilities (ditches and culverts) • Obstacles removed from clear zone • Signs A logical initital segment could be MP 40 to MP 44.65, which is the northernmost segment of gravel. This segment is in the best current condition and could be a candidate for phasing improvements along the 14-mile corridor. Estimated costs for this segment are $4.19M (gravel low) and $8.84M (gravel high), respectively, and $8.84M (asphalt low) and $13.49M (asphalt high), respectively.	*– 18 ft width and 32 ft width, respectively)*
Option 4: 40 mph Design Speed	• 32 ft (minimum) or 40 ft (maximum) roadway • 12 ft lanes (4 ft shoulders) or 12 ft lanes (8 ft shoulders) • 4" gravel or 4" asphalt surfacing (both w/8" base course) • Realignment as necessary to improve geometrics (horizontal and vertical) • Significant "off-alignment" construction, with corresponding impacts • Complete reconstruction of the roadway • Improves storm water drainage facilities (ditches and culverts) • Obstacles removed from clear zone • Signs A logical initital segment could be MP 40 to MP 44.65, which is the northernmost segment of gravel. This segment is in the best current condition and could be a candidate for phasing improvements along the 14-mile corridor. Estimated costs for this segment are $13.02M (gravel low) and $17.67M (gravel high), respectively, and $18.6M (asphalt low) and $23.25M (asphalt high), respectively.	**$39.2M- $53.2M** *(Gravel Surfacing – 32 ft width and 40 ft width, respectively)* **$56.0M-$70.0M** *(Asphalt Surfacing – 32 ft width and 40 ft width, respectively)*

** Costs are for construction only and do not include preliminary engineering or permitting. Costs are "total" costs for the entire 14-mile segment of the corridor.*

5.2. IMPROVEMENT OPTION SCREENING PROCESS

Screening criteria were developed to assist in the evaluation of the four improvement options identified for the 14-mile gravel segment of the Mountain Loop Highway. Screening criteria provide a means of comparing the improvement options qualitatively with a set of specific measures. The screening process consisted of a high-level screen. Additional evaluation will be needed of the identified improvement options should a project move forward for the 14-mile segment.

The criteria outlined below was utilized to determine how well an improvement option followed the goals and objectives laid forth earlier in **Chapter 4**. The screening system described in this section illustrates how each improvement options' ability to meet the screening criteria was scored.

Spot improvements identified in **Section 5.3** are not screened as they are stand-alone, generally minor improvements that are specific to a discrete scope of work.

5.2.1. Screening Criteria

The following screening criteria were developed based on input by the Oversight Committee and general public. The screening evaluates four improvement options against the three goals and objectives developed for the Mountain Loop Highway, specifically the 14-mile gravel portion. As discussed in **Chapter 4**, the primary concerns for the 14-mile gravel portion of the Mountain Loop Highway are as follows:

- Goal #1: Improve the safety and operation of the roadway facility
- Goal #2: Accommodate future traffic growth and reduce maintenance needs
- Goal #3: Minimize adverse impacts to the environmental, cultural, scenic and recreational characteristics of the corridor

Table 25. Screening Criteria Rating Factors

Low Impact		Medium Impact		High Impact	
○	*Best Able to Meet Goal & Objectives*	◐	*Moderately Able to Meet Goal & Objectives*	●	*Least Able to Meet Goal & Objectives*

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

As discussed in **Chapter 4**, safety and operation of the roadway facility is an identified goal. Operationally, some areas along the gravel portion of the corridor do not accommodate simultaneous travel in two directions. Potential safety concerns related to improvements for the 14-mile gravel portion include poor roadway alignment, sub-standard roadway width (in spot areas), inadequate sight distance, and high (~future) speeds dependent on the type of improvement option considered. If possible, conditions could be bettered by improving sub-standard elements of the roadway to meet current applicable design standards. In some locations a reduced standard should also be considered within context of the adjacent environment. Screening criteria developed to measure safety and operations include the following:

- Speeds
- Roadway Horizontal Curvature
- Roadway Vertical Profile
- Roadway Width
- Emergency Response Time

Speeds

Speeds are identified frequently as an item of concern. For the paved portion of the Mountain Loop Highway, designated speed signs are present throughout the corridor. On the gravel portion, no speed limit signs are evident. Public comments have expressed concern over improvements leading to higher speeds, while some have commented that the existing narrow width and gravel surfacing in effect controls speeds at a lower level. For this criteria, the lower the speed indicates best meeting the needs and objective, and a higher speed is viewed as undesirable. The following rating factors are assigned for this criteria relative to speeds.

Range for Speeds	Rating Factor
Will Not Result in a Speed Increase	○
May Result in a Speed Increase	◐
Will Result in a Speed Increase	●

Table 26. Rating for Speeds

	14-Mile Gravel Section					
	Option 1: Maintain Status Quo	Option 2: Minor Road and Drainage Improvements	Option 3: 25 mph Design Speed		Option 4: 40 mph Design Speed	
			Gravel	Asphalt	Gravel	Asphalt
Rating Factor	○	○	◐	●	●	●

Roadway Horizontal Curvature

Each improvement option was reviewed to see if it would meet horizontal curve design criteria for a design speed of 25 mph. Design speed has been a topic of interest throughout the *Mountain Loop Highway Feasibility Study*. Very few members of the Oversight Committee, Stakeholder Group, or general public envisioned a design speed and context similar to the currently paved portions of the roadway. As design speeds increase, overall impacts to the adjacent roadside environment also increase. This criteria is based on whether improvements can meet or not meet a 25 mph design speed for the 14-mile segment as it pertains to horizontal curvature of the roadway. Note that this implies that the 25-mph design speed is desirable going forward if a project develops.

Range for Horizontal Curves Design Criteria	Rating Factor
Meet Design Criteria at 25mph	○
May Be Able to Meet Design Criteria at 25 mph	◐
Not Able to Meet, or Exceeds, Design Criteria at 25mph	●

Table 27. Rating for Roadway Horizontal Curvature

	14-Mile Gravel Section					
	Option 1: Maintain Status Quo	Option 2: Minor Road and Drainage Improvements	Option 3: 25 mph Design Speed		Option 4: 40 mph Design Speed	
			Gravel	Asphalt	Gravel	Asphalt
Rating Factor	●	◐	○	○	●	●

Roadway Vertical Profile

Similar to horizontal curvature, vertical profile (i.e. grades) are important to roadway standards and design. Steeper grades on a roadway are less desirable, and the higher the design speed on a facility, the flatter the grades are required. This criteria is based on whether improvements can meet or not meet a 25 mph design speed for the 14-mile segment as it pertains to vertical profile (i.e. grades) for the roadway.

Range for Vertical Profile Design Criteria	Rating Factor
Meet Design Criteria at 25mph	○
May Be Able to Meet Design Criteria at 25 mph	◐
Not Able to Meet, or Exceeds, Design Criteria at 25mph	●

Table 28. Rating for Roadway Vertical Profile

	14-Mile Gravel Section					
	Option 1: Maintain Status Quo	Option 2: Minor Road and Drainage Improvements	Option 3: 25 mph Design Speed		Option 4: 40 mph Design Speed	
			Gravel	Asphalt	Gravel	Asphalt
Rating Factor	●	◐	◐	◐	●	●

Roadway Width

There are numerous areas within the 14-mile gravel segment that do not meet width standards nor provide for two-way traffic. Some may argue that this is desirable, but for a safe and functioning roadway environment at least a two-way traffic flow should be maintained. This criteria is intended to measure whether an option can or cannot meet the width requirement. Much like the design speed discussion earlier, the width requirement for the 14-mile gravel segment is debatable. For purposes of this screening and recognizing the value in seeking a roadway width to limit impacts to the surrounding roadside environment, a width threshold of 18 feet was established as a measurement for screening. If the improvement can meet the 18 feet width for the 14-mile segment – but not exceed it - then that is viewed as desirable going forward if a project develops.

Range for Width Design Criteria	Rating Factor
Meets Road Width of 18 Feet	○
May Be Able to Meet Width of 18 Feet	◐
Not Able to Meet, or Exceeds, Width of 18 Feet	●

Table 29. Rating for Roadway Width

	14-Mile Gravel Section					
	Option 1: Maintain Status Quo	Option 2: Minor Road and Drainage Improvements	Option 3: 25 mph Design Speed		Option 4: 40 mph Design Speed	
			Gravel	Asphalt	Gravel	Asphalt
Rating Factor	●	◐	○	○	●	●

Emergency Response Time

The ability of emergency responders to react to calls within and adjacent to the corridor came up during the feasibility study. Due to the high recreational uses and proximity to a major urban area, emergency calls are slightly higher than would be expected in other areas of the state. Predictably, improving faster response times in an emergency are desirable, and oddly enough are directly opposite a desire to maintain a reasonable speed through the 14-mile gravel segment. A faster speed generally equates to a faster response time; a slower speed equates to a slower response time. Rating factors for emergency response time are as follows:

Range for Width Design Criteria	Rating Factor
Results in a Faster Response Time	○
May Result in a Faster Response Time	◐
Maintains the Current Response Time	●

Table 30. Rating for Emergency Response Time

	14-Mile Gravel Section					
	Option 1: Maintain Status Quo	Option 2: Minor Road and Drainage Improvements	Option 3: 25 mph Design Speed*		Option 4: 40 mph Design Speed*	
			Gravel	Asphalt	Gravel	Asphalt
Rating Factor	●	◐	○	○	○	○

**Both Option 3 and Option 4 will result in a faster response time; however, by definition Option 4 will be faster than Option 3.*

5.2.1.1.2. Goal #2: Accommodate future traffic growth and reduce maintenance needs

As stated previously, the Mountain Loop Highway is used by local and regional travelers including vehicles, emergency response providers, and others. This also includes pedestrians, and to some extent bicyclists. Depending on future growth characteristics as depicted in local adopted planning documents, the Mountain Loop Highway will realize increased passenger and vehicular traffic, and maintenance needs will continue to increase. It is an objective to accommodate future capacity demands, be cognizant of non-motorized needs consistent with local planning efforts, provide connectivity to residents and regional users accessing recreational lands along the corridor, and reduce maintenance needs. Screening criteria developed to measure accommodating future traffic growth and reducing maintenance needs include the following:

- Accommodate Future Traffic Growth
- Improve Non-Motorized Transportation
- Maintenance Cost

Accommodate Future Traffic Growth

Traffic volumes are expected to grow along the corridor as detailed in **Chapter 3** using a variety of growth scenarios. The public and also some on the stakeholder committee observed that what may not get captured in the potential traffic growth estimates are the concept of induced demand. Induced demand essentially suggests if you build or improve a roadway facility, the improvement itself may lead to more traffic that likely wouldn't have been on the facility to begin with. Capturing the quantitative effects of induced demand are well outside the scope of this Feasibility Study. Traffic will grow, though, and this criteria is intended to measure the ability of each improvement option to accommodate additional traffic volumes. A wider roadway, that meets a faster design speed, will generally carry more traffic through-put than a slower speed, narrow roadway. Rating factors intended to capture the ability of an option to accommodate future traffic growth are as follows:

Range for Width Design Criteria	Rating Factor
Accomodates Future Traffic at a High Level	○
Accomodates Future Traffic at a Medium Level	◐
Accomodates Future Traffic at a Low Level	●

Table 31. Accommodate Future Traffic Growth

	14-Mile Gravel Section					
	Option 1: Maintain Status Quo	Option 2: Minor Road and Drainage Improvements	Option 3: 25 mph Design Speed		Option 4: 40 mph Design Speed	
			Gravel	Asphalt	Gravel	Asphalt
Rating Factor	●	●	◐	◐	○	○

Improve Non-Motorized Transportation

Presently, there isn't a large amount of non-motorized use within the corridor outside of developed recreation areas along the paved portion, and dispersed camping locations within the 14-mile segment. Several comments were received at the public informational meetings that expressed the desire to increase bicycling activities within the corridor. For the 14-mile segment, improvements to facilitate increased bicycle activities could vary. A wider roadway width, better road surfacing, and improvements to deficient curves to improve sight distance could all be viewed as desirable to satisfy this objective. However increased speeds likely to follow a wider roadway section could be a detriment to non-motorized users. Rating factors for improving non-motorized transportation are as follows:

Range for Improving Non-Motorized Transportation	Rating Factor
Improves Non-Motorized Function	○
May Improve Non-Motorized Function	◐
Does Not Improve Non-Motorized Function	●

Table 32. Improve Non-Motorized Transportation

	14-Mile Gravel Section					
	Option 1: Maintain Status Quo	Option 2: Minor Road and Drainage Improvements	Option 3: 25 mph Design Speed		Option 4: 40 mph Design Speed	
			Gravel	Asphalt	Gravel	Asphalt
Rating Factor	●	◐	◐	○	◐	○

Maintenance Cost

Each improvement option not only needs to be built, but also needs to be maintained. For the existing 14-mile gravel section, all improvement options would result in two-lane facilities with the exception of maintaining the status quo. Gravel roadways are more expensive to maintain than asphalt roadways, and wider roadways are more expensive to maintain than narrower roadways. To that end, rating factors for this criteria assume a narrow, asphalt surfaced roadway would be easier and less costly to maintain than a wide, gravel surfaced roadway. Maintaining the status quo is rated as most undesirable since almost all have agreed that the roadway maintenance needs fall short of the available budget and resources to satisfy them.

Range of Maintenance Costs	Rating Factor
Asphalt Surfacing	○
Gravel Surfacing	◐
Maintains Status quo (no improvements)	●

Table 33. Maintenance Cost Rating

	14-Mile Gravel Section					
	Option 1: Maintain Status Quo	Option 2: Minor Road and Drainage Improvements	Option 3: 25 mph Design Speed		Option 4: 40 mph Design Speed	
			Gravel	Asphalt	Gravel	Asphalt
Rating Factor	●	◐	◐	○	◐	○

5.2.1.1.3. Goal #3: Minimize adverse impacts to the environmental, cultural, scenic and recreational characteristics of the corridor

Chapter 4 discusses the need to provide access to residential and recreational lands, as well as regional connectivity between Granite Falls and Darrington. Transportation improvements to accommodate these objectives could be in conflict with the environmental, cultural, scenic and recreational characteristics of corridor. If and when any improvement option may be developed, an in-depth analysis will be required that examines potential impacts to environmental, sensitive, and recreational resources. Improvement options would be examined per the litany of resources contained in **Chapter 3** through the development of the *Environmental Scan*. Because of the location along the South Fork of the Stillaguamish River, and the Sauk River, wildlife and aquatic connectivity are primary areas of concern. All improvements should be reviewed for their potential impact to the environmental, scenic, cultural, and recreational aspects of

the corridor with the objectives of minimize adverse impacts to riparian environments, wildlife and aquatic organisms connectivity, and historic, cultural, and archaeological resources that may result from implementation of options.

For a high-level screen of environmental, cultural, scenic and recreational characteristics, a criteria was identified that is based solely on the width of the roadway, with no assessment of the type of surfacing and potential impacts between gravel and asphalt.

Environmental, Cultural, Scenic and Recreational Impacts

The wider the roadway prism the more negative impacts would be expected, and the narrower the roadway prism the least impacts would be observed. Maintaining the status quo would result in the least impacts related to environmental, cultural, scenic and recreational characteristics. Respective rating factors for each improvement option are described below.

Range for Overall Resource Impacts	Rating Factor
Low Impact Level (Status Quo)	○
Medium Impact Level (Narrow Road Prism)	◐
High Impact Level (Wide Road Prism)	●

Table 34. Overall Resource Impacts Rating

	14-Mile Gravel Section					
	Option 1: Maintain Status Quo	Option 2: Minor Road and Drainage Improvements	Option 3: 25 mph Design Speed		Option 4: 40 mph Design Speed	
			Gravel	Asphalt	Gravel	Asphalt
Rating Factor	○	○	◐	◐	●	●

5.2.1.1.4. Other Considerations

The Oversight Committee identified that both the overall planning level cost and public preference are something that should be mentioned as the planning process was carried out. Both of these final screening criteria are described in the following section.

Planning Level Cost

High level planning cost estimates were prepared for each of the four improvement options for the 14-mile segment. The planning level cost estimates included primary construction items typical of a Federal road project in a rural, resource intensive area. A substantial contingency was added, 50%, to account for the numerous unknowns at this stage of a project's development. Costs do not include right-of-way costs, project development costs, inflation, etc. The results of the planning level cost estimates are shown in **Table 35**.

Cost ranges are as follows:

- Option 2: Minor Road and Drainage Improvements $0.6M-$1.0M (per mile)
- Option 3: Improve to a 25-mph Design Speed; Gravel Surfacing $0.9M-$1.9M (per mile)
- Option 3: Improve to a 25-mph Design Speed; Asphalt Surfacing $1.9M-$2.9M (per mile)
- Option 4: Improve to a 40-mph Design Speed; Gravel Surfacing $2.8M-$3.8M (per mile)
- Option 4: Improve to a 40-mph Design Speed; Asphalt Surfacing $4.0M-$5.0M (per mile)

The rating factors were measured against the highest range of costs for each option for the 14-mile gravel section, with ranges calculated for the following three possible ratings:

Range of Planning Level Costs	Rating Factor
Cost midpoint less than $15,000,000	○
Cost midpoint between $15,000,000 and $45,000,000	◐
Cost midpoint greater than $45,000,000	●

Table 35. Planning Level Cost Rating

	14-Mile Gravel Section					
	Option 1: Maintain Status Quo	Option 2: Minor Road and Drainage Improvements	Option 3: 25 mph Design Speed		Option 4: 40 mph Design Speed	
			Gravel	Asphalt	Gravel	Asphalt
Planning Level Cost (Range)	$112,000*	$8.4M - $14.0M	$12.6M - $26.6M	$26.6M - $40.6M	$39.2M- $53.2M	$56.0M- $70.0M
Rating Factor	○	○	◐	◐	●	●

An estimate of **annual maintenance needs are $4,000 per mile * 14 miles * twice per year = $112,000.*

Public Preference

The last criteria considered in this high-level screening process was whether an improvement option had the support of the community. Public preference is an important screening criteria because if the public does not support an improvement option early in the planning process there is a likelihood that the option will not be supported as a project moves forward. Unfortunately, absent a broad-based survey querying all users of the corridor, it is not statistically possible to gather enough data to confirm whether an option is supported or not. At various public open houses, and through the examination of public comments received, there is no clear-cut support evident for one option over the other. For those that express support to pave the 14-mile gravel section, there are just as many that have stated to leave the roadway alone. Thus, screening based on public preference cannot be made with any reasonable confidence, and therefore is discounted in this high-level screening analysis.

Range of Public Preference	Rating Factor
High Public Preference	○
Medium Public Preference	◐
Low Public Preference	●

Table 36. Rating for Public Preference

	14-Mile Gravel Section					
	Option 1: Maintain Status Quo	Option 2: Minor Road and Drainage Improvements	Option 3: 25 mph Design Speed		Option 4: 40 mph Design Speed	
			Gravel	Asphalt	Gravel	Asphalt
Rating Factor*	N/A	N/A	N/A	N/A	N/A	N/A

** Cannot be assessed based on information received to date; therefore, rating is "Not Applicable" (N/A).*

5.2.2. Summary of Screening Process

Table 37 presents a graphical summary of the aforementioned screening rating factors and how those factors align with the previously defined goals and objectives. The intent of the screening process is not to arrive at a "preferred" improvement option or recommendation for the 14-mile section, but rather weigh in on how well an improvement may satisfy the relevant goals and objectives established through this feasibility study analysis.

Table 37. Summary of Screening Process

	14-Mile Gravel Section					
	Option 1: Maintain Status Quo	Option 2: Minor Road and Drainage Improvements	Option 3: 25 mph Design Speed		Option 4: 40 mph Design Speed	
			Gravel	Asphalt	Gravel	Asphalt
Goal #1: Safety and Operation of the Roadway Facility						
Limit Speeds	○	○	◐	●	●	●
Improve Horizontal Curvature	●	◐	○	○	●	●
Improve Vertical Profile	●	◐	◐	◐	●	●
Improve Roadway Width	●	◐	○	○	●	●
Improve Emergency Response Time	●	◐	○	○	○	○
Goal #2: Accommodate future traffic growth and reduce maintenance needs						
Accommodate Future Traffic Growth	●	●	◐	◐	○	○
Improve Non-Motorized Transportation	●	◐	◐	○	◐	○
Maintenance Cost	●	◐	◐	○	◐	○
Goal #3: Minimize adverse impacts to the environmental, cultural, scenic and recreational characteristics of the corridor						
Overall Resource Impacts	○	○	◐	◐	●	●
Other Considerations						
Planning Level Costs	○	○	◐	◐	●	●
Public Preference	N/A	N/A	N/A	N/A	N/A	N/A

5.3. SPOT IMPROVEMENTS

Several spot improvements were identified along the Mountain Loop Highway based on analysis of existing and projected conditions. The spot improvements are based visual inspection of all culverts over 30" in diameter, review of the bridge inspection reports prepared by others, and a high-level review of crash statistics. Previously submitted FLAP grant applications that were un-successful were also reviewed and carried forward if appropriate. The identified spot improvements are presented in **Table 38** and also **Figure 18**.

Table 38. Spot Improvements Identified Along the Mountain Loop Highway

Location	Description
Bridge, Road and Operational Spot Improvements	
MP 1.45	County Bridge #102 over the South Fork of the Stillaguamish River is in need of replacement. It is a vital link to the Mountain Loop Highway and if ever out of service would require a 94-mile detour around or through a seasonally restricted area of the Mountain Loop Highway. The bridge is functionally obsolete (narrow width), identified as structurally deficient by the State of Washington since 2008, and is fracture critical where if one member were to show a crack it would need to close for inspection, repair and eventually replacement. *(Note this location is outside of the corridor study area but is important to the overall continuity of operations and access to the Mountain Loop Highway so is included herein).*
MP 10.76	Improve traffic circulation at the entrance to the Verlot Public Service Center. Features envisioned include a dedicated left-turn bay at the western approach to the parking lot, enhanced signing and pavement markings, and heightened pedestrian-awareness features for those walking between the Public Service Center and the pull-out directly south of the highway and adjacent to the river.
MP 14.33	The existing bridge over Black Creek is rated as poor and is a candidate for replacement. The bridge is identified as County Bridge #547. The existing bridge length is 91 feet, has three spans, and was built in 1952. Various repairs have been made to the sub-structure, and also to remove debris, over the years. It is categorized as high-risk according to the most recent bridge inspection report. The mill pond dam was constructed in 1917 and is located 250 meters upstream of bridge. The log dam is in poor condition and if failure occurs, could pose a serious threat to County Bridge #547 at Black Creek. Dam failure would result in the release of an estimated 30-foot depth of sediment that is impounded upstream of the dam. One of the logs in the middle of the structure shows signs of deterioration and splitting.
MP 14.66	The existing bridge over Wisconsin Creek is load restricted according to the 2018 Annual Bridge Report assembled by Snohomish County. The bridge is identified as County Bridge #620. Analysis to mitigate the load restriction should be made to bring the bridge up to legal highway loads.
MP 15.5	Provide safety enhancements between Wiley Creek Group Campground and Schweitzer Creek by enhancing signage. This area has sharp curves in the roadway, intermittent guardrail adjacent to the river, and sporadic pull-outs along the road. Curve ahead and speed advisory signs are in place at required locations, however there appears to be a trend of fixed object collisions in the area of the Wiley Creek Group Campground approach. Consider solar-powered or vehicle-activited amber flashers before and after approach.
MP 15.82	The existing bridge over Schweitzer Creek is load restricted according to the 2018 Annual Bridge Report assembled by Snohomish County. The bridge is identified as County Bridge #576. Analysis to mitigate the load restriction should be made to bring the bridge up to legal highway loads.
MP 18.18	The existing bridge over the South Fork Stillaguamish River is a candidate for rehabilitation, as per the 2018 Annual Bridge Report. The bridge is identified as County Bridge #537 and is called the Red Bridge. The existing bridge length is 209 feet and was built in 1954.

Location	Description
MP 23.33	The existing bridge over Deer Creek is a candidate for rehabilitation, as per the 2018 Annual Bridge Report. The bridge is identified as County Bridge #670. The existing bridge length is 187 feet and was built in 1949.
MP 24.00	The existing bridge over Coal Creek is a candidate for rehabilitation, as per the 2018 Annual Bridge Report. The bridge is identified as County Bridge #556. The existing bridge length is 70 feet and was built in 1949.
MP 26.19	The existing bridge over Perry Creek is load restricted according to the 2018 Annual Bridge Report assembled by Snohomish County. The bridge is identified as County Bridge #551. Analysis to mitigate the load restriction should be made to bring the bridge up to legal highway loads.
MP 28.35	The existing bridge over Buck Creek Creek is load restricted according to the 2018 Annual Bridge Report assmebled by Snohomish County. The bridge is identified as County Bridge #544. Analysis to mitigate the load restriction should be made to bring the bridge up to legal highway loads.
Drainage / Culvert Spot Improvements	
MP 22.50	Replace existing 42” CMP culvert. The existing culvert is in poor condition and in need of replacement.
MP 28.80	Replace existing 36” CMP culvert. The existing culvert is in poor condition and in need of replacement.
MP 30.38	Replace existing 30” CMP culvert. The existing culvert is in poor condition and in need of replacement.
MP 32.80	Replace existing 35” x 24” CMPA culvert. The existing culvert is in poor condition and in need of replacement.
MP 38.80	Replace existing 36 CMP culvert. The existing culvert has failed and no longer is functioning.
MP 42.21	Replace existing 48 CMP culvert. The existing culvert has failed and no longer is functioning.
MP 42.47	Replace existing 49” x 33” CMPA culvert. The existing culvert is in poor condition and in need of replacement.
MP 46.23	Replace existing 30” CMP culvert. The existing culvert is in poor condition and in need of replacement.
MP 46.42	Replace existing 13 foot SSPP culvert. The existing culvert has failed and there are severe washouts at the outlet. This conveys Goodman Creek and any culvert work should be optimized to improve the water surface profile, currently a barrier to fish passage at this location. The invert of the culvert is extremely abraded and the culvert appears to be undersized. This is a high priority location along the corridor for repalcement.
MP 46.93	Replace existing 72” CMP culvert. The existing culvert is in poor condition and in need of replacement.

Location	Description
Bank Monitoring / Stabilization Spot Improvements	
Various Locations	There are numerous areas along the corridor where the road pinches or is against the river. These areas should be monitored because they could benefit in the future by various scaled projects using engineered rootwads or log stabilizations to channel the river away from the road and reestablish a bioengineered riparian buffer. This would benefit both fish and protect the road. The following MP ranges are areas where this constriction may be evident and should be monitored: Start (MP) / End (MP) / Length 10.95 / 11.5 / 490 feet 12.23 / 12.43 / 985 feet 12.7 / 13 / 1,475 feet 13.94 / 14.17 / 1,065 feet 14.4 / 15.1 / 3,180 feet 15.35 / 15.45 / 475 feet 16.1 / 16.23 / 785 feet 16.6 / 17 / 1,540 feet 17.3 / 17.55 / 1,410 feet 18.45 / 18.73 / 1,445 feet 19.25 / 19.35 / 455 feet 19.6 / 19.68 / 380 feet 19.9 / 20.3 / 430 feet 20.56 / 20.65 / 355 feet 20.8 / 20.92 / 625 feet 21.12 / 21.32 / 940 feet 21.6 / 21.95 / 1,755 feet 22.06 / 22.16 / 525 feet 22.35 / 22.82 / 2,395 feet 22.9 / 23.25 / 1,420 feet 23.76 / 23.83 / 475 feet 24.25 / 24.35 / 545 feet 26.9 / 27.1 / 820 feet 28.8 / 29.3 / 1,150 feet 44.9 / 45.15 / 1,085 feet 45.81 / 45.97 / 820 feet 46.85 / 47.07 / 1,025 feet 50.1 / 50.41 / 1,660 feet
Parking Spot Improvements	
Various Locations	Parking at recreational sites can be a hazard during high-use times of the year. Specifically, Heather Lake trailhead, Lake Twenty-two trailhead, and Barlow Pass access points realize parking congestion and conflicts. Although not a specific focus of the Feasibility Study, these areas could be candidates for further analysis in the form of a parking supply and demand analysis to accurately grasp what issues are realized, and whether parking mitigation in the form of parking expansion is necessary. Passing zones should not be allowed in these areas, and potentially other high-use recreational areas along the corridor, to reduce the potential for conflict between vehicles and pedestrians.

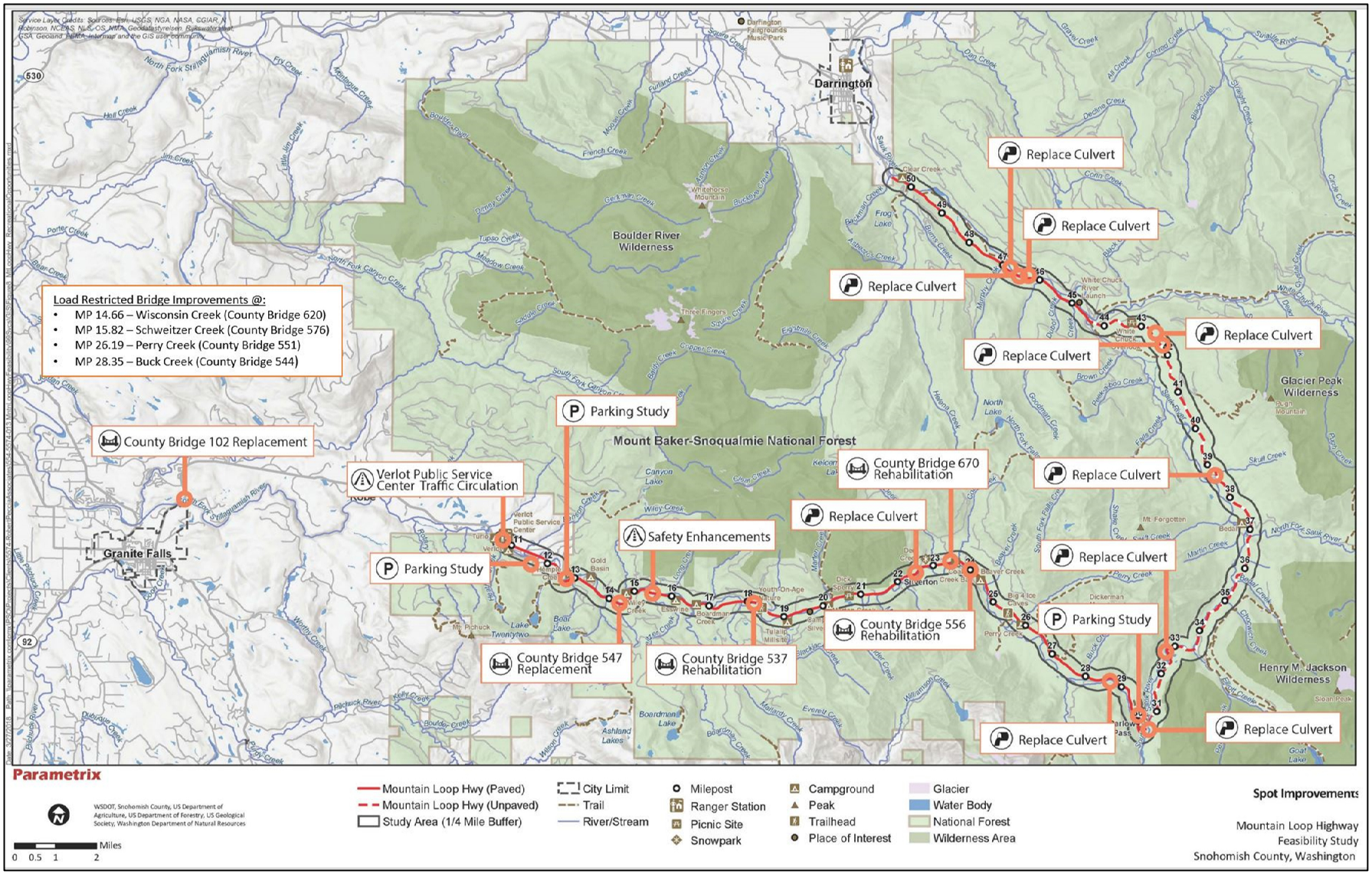

Figure 18: Spot Improvement Locations

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Chapter 6

FUNDING MECHANISMS

WSDOT administers a number of programs that are funded from State and Federal sources. Local and/or private funding sources may also be available to implement projects forwarded from this feasibility study. The following is a summary of funding sources that may be potential sources for funding projects proposed in this study.

6.1. FEDERAL FUNDING SOURCES

The following is a summary of major Federal transportation funding categories received by WSDOT through the Fixing America's Surface Transportation (FAST) Act enacted on December 3, 2015. WSDOT administers all federal highway transportation funds, subject to federal and state criteria, including funds that go to local agencies. WSDOT acts as a fiscal agent for the federal government, ensuring that local agencies comply with the multitude of federal transportation and environmental laws and regulations.

6.1.1. Federal Lands Access Program

FLAP was established in 23 U.S.C. 204 to improve transportation facilities that provide access to, are adjacent to, or are located within Federal lands. The program supplements State and local resources for public roads, transit systems, and other transportation facilities, with an emphasis on high-use recreation sites and economic generators. The program is designed to provide flexibility for a wide range of transportation projects.

The program is funded by contract authority from the Highway Trust Fund and subject to obligation limitation. Funds will be allocated among the States using a statutory formula based on road mileage, number of bridges, land area, and visitation.

Western Federal Lands issues Request for Proposals every two years, and agencies may request $100,000 or more in funding. A minimum local match of 13.50 percent is required; although a higher local match amount typically results in a higher-ranked application. The Federal Land Management Agency (FLMA) must support and sign the application.

6.1.2. Federal Lands Transportation Program

The Federal Lands Transportation Program (FLTP) was established in 23 USC 203 to improve the transportation infrastructure owned and maintained by the following FLMAs: National Park Service (NPS), Bureau of Land Management (BLM), Bureau of Reclamation (BOR), USFWS, USFS, Corps, and independent Federal agencies with land and natural resource management responsibilities.

The FLMAs have considerable responsibility and latitude for managing their program within the FLTP. The FHWA, however, is ultimately responsible for ensuring the program is administered according to the statutory and implementing regulations for title 23 USC. This includes conformity to highway planning, design, construction, maintenance, and safety standards. The use of FLTP funds does not affect the overall responsibility for construction, maintenance, and operations of the facilities. That responsibility continues to lie with the owner of the facility.

6.1.3. Federal Lands Recreation Enhancement Act

The *Federal Lands Recreation Enhancement Act* (FLREA; 16 USC §§6801-6814) authorizes five agencies to charge and collect recreation fees on federal recreational lands and waters. The five agencies are the BOR, BLM, USFWS, NPS, and the USFS. The agencies retain the collected fees primarily for on-site improvements.

The FLREA authorizes agencies to charge different kinds of fees at recreation sites, outlines criteria for establishing fees, and prohibits fees for certain activities or services. The USFS can charge "standard amenity fees" in areas or circumstances where a certain level of services or facilities are available. FLREA also authorizes all five agencies to charge an "expanded amenity fee" for specialized facilities and services, and special recreation permit fees for specialized uses, such as group activities.

6.1.4. Nationally Significant Federal Lands and Tribal Projects

The *Nationally Significant Federal Lands and Tribal Projects* (NSFLTP) program provides federal funding for the construction, reconstruction or rehabilitation of transportation projects providing access to or located on Federal or Tribal lands. Under the NSFLTP, the Federal share of a project can be up to 90 percent and can be used to improve the condition of a critical transportation facility. Large-scale projects with estimated construction costs of $50 million or more are given priority consideration for selection, but the program accepts projects with estimated construction costs of at least $25 million.

6.1.5. Emergency Relief for Federally Owned Roads

The ERFO Program was established to assist federal agencies with the repair or reconstruction of tribal transportation facilities, federal lands transportation facilities, and other federally owned roads that are open to public travel, which are found to have suffered serious damage by a natural disaster over a wide area or by a catastrophic failure. The intent of the ERFO program is to pay the unusually heavy expenses for the repair and reconstruction of eligible facilities. The ERFO program is not intended to cover all repair costs but rather supplement FLMA repair programs.

6.1.6. Better Utilizing Investments to Leverage Development

The BUILD Transportation Discretionary Grant program provides a unique opportunity for the US Department of Transportation (USDOT) to invest in road, rail, transit and port projects that promise to achieve national objectives. The BUILD program enables USDOT to examine projects on their merits to help ensure that taxpayers are getting the highest value for every dollar invested. The eligibility requirements of BUILD allow project sponsors at the State and local levels to obtain funding for multi-modal, multi-jurisdictional projects that are more difficult to support through traditional USDOT programs.

6.1.7. Surface Transportation Program

The Surface Transportation Program (STP) continues to be the most flexible of all the highway programs and provides the most financial support to local agencies. Projects eligible for STP funding include highway and bridge construction and repair; transit capital projects; bicycle, pedestrian and recreational trails; and construction of ferry boats and terminals. WSDOT allocates STP funds to Metropolitan Planning Organizations and County Lead Agencies for prioritizing and selecting projects that align with their regional priorities involving all entities eligible to participate in a public process.

6.1.7.1. Local Bridge Program

The Local Bridge Program provides assistance for eligible bridges on public roads. The state prioritizes and programs state and local bridges for funding. Due to the federal bridge program discontinuation, local bridge projects are funded by the National Highway Performance Program and STP.

6.1.7.2. Transportation Alternatives Program

The Transportation Alternatives Program (TAP) is a set-aside of STP funds. The program provides funding for programs and projects defined as transportation alternatives, including on- and off-road pedestrian and bicycle facilities, infrastructure projects for improving non-driver access to public transportation and enhanced mobility, community improvement activities, environmental mitigation and safe routes to school projects. A set-aside for the Recreational Trails Program is also provided under TAP.

6.2. STATE FUNDING SOURCES

State revenue comes from numerous taxes, fees, permits, tolls, and other revenues. Washington's fuel taxes (gasoline, diesel, biodiesel, etc.) comprise the largest share of all transportation revenue. Licenses, permits and fee revenues comprise the second largest share of all transportation revenues. This revenue is related to motor vehicle registrations, weight fees, license plate replacement fees, title fees, and dealer permits. The remaining consists of ferry fares, toll revenue, driver related, and other transportation related revenue.

6.2.1. State Fuel Tax

The Washington state fuel tax is the single biggest source of transportation revenue for state and local governments. Currently the state fuel tax is set by the legislature at 49.4 cents per gallon and generates approximately $3 billion per biennium.

Washington State Legislature requires portions of this tax be spent for the particular purposes such as the 2003 Nickle Package, 2005 Transportation Partnership Act, 2015 Connecting Washington funding package, operations and maintenance, and local road projects.

6.2.2. Highway Construction Bonds

Highway Construction Bonds are an important source of funding for transportation capital projects in Washington authorized in chapter 47.10 RCW16. Debt service is the periodic payment of principal, interest, insurance, and covenants on a bond. Transportation bonds are typically issued as 25 or 30-year debt. Bonds are backed by future fuel tax, license, permits and fee revenue and/or tolls and the revenue must be collected for the entire 25 or 30 years debt period. The Washington State Treasurer is also authorized to refinance original issues of bonds if conditions warrant this type of transaction. Refunding prior bond issues can reduce total debt service requirements and achieve budgetary savings over the remaining term of the bond.

6.3. LOCAL FUNDING SOURCES

In addition to the state revenues, local entities receive transportation funding. Typically, several local programs related to transportation exist for budgeting purposes and to disperse revenues. These programs are tailored to fulfill specific transportation functions or provide particular services.

6.3.1. Snohomish County Road Fund

Snohomish County receives revenue from private timber-harvest tax, federal forest-yield, leasehold excise tax, inter-departmental service fees, interest income, and miscellaneous review fees. The County Road Fund is for roads owned and managed in the Snohomish County Road Atlas. The County Road Fund can only be used as a local match to Federal dollars through a project agreement approved by the legislative authority for capital projects.

6.3.2. County Road Administration Board

The Washington State County Road Administration Board (CRAB) was created by the Legislature in 1965 to provide statutory oversight of Washington's 39 county road departments. The agency receives funding from a portion of the counties' Motor Vehicle Fuel Tax (MVFT) withheld for state supervision, and from a small portion of the grant programs under CRAB's administration.

The responsibility to distribute the counties' portion of the MVFT was transferred to CRAB in 1985. At that time the agency also became the custodian of the county road log, a database of almost 40,000 miles of roads and 3,300 bridges. The formula for the distribution of fuel tax revenues is updated biennially to reflect statewide changes in population, costs, and mileage.

6.3.2.1. Rural Arterial Program

The Rural Arterial Program (RAP) is a biennial road and bridge reconstruction funding program administered by CRAB in which counties compete for Rural Arterial Trust Account (RATA) funds within their respective regions. Taken from fuel tax revenues, the RATA account generates approximately $40 million per biennium. The RAP competitive grant program requires consideration of the following:

- Structural ability to support loaded trucks
- Ability to move traffic at reasonable speeds
- Adequacy of alignment and related geometry
- Accident and fatal accident experience
- Local significance

6.3.2.2. County Arterial Preservation Program

The County Arterial Preservation Program (CAPP) is similar to the Department of Transportation's Highway Preservation Program. The CAPP program is designed to help counties preserve their existing paved arterial road networks. The program generates approximately $30 million per biennium.

CAPP funds are allocated directly to the counties to help them avoid costly roadway failures had the surface repairs been delayed. The CRAB monitors each county's overall arterial preservation program and accomplishments year by year. This encourages effective planning and ensures the funds are used where they are most needed. In order to retain their eligibility for CAPP funds year to year, counties are required to use a pavement management system to assist their project selection and decision process.

6.3.3. Transportation Improvement Board

The Washington State Transportation Improvement Board (TIB) funds high priority transportation projects in communities throughout the state to enhance the movement of people, goods and services. TIB is an independent state agency, created by the Legislature, that distributes and manages street construction and maintenance grants to 320 cities and urban counties throughout Washington State. Funding for TIB's grant programs comes from revenue generated by three cents of the statewide gas tax.

The TIB provides funding for cities and towns with a population less than 5,000 through four grant programs: the Small City Arterial Program, the Small City Sidewalk Program, the Small City Preservation Program, and the Relight Washington Program. These programs fund projects with the intent of reconstructing or maintaining the transportation infrastructure. Funding is distributed regionally, with projects competing only in their own region. Match requirements are determined by population. TIB's small city funding is awarded annually through a competitive process. Applications are reviewed by TIB staff and projects are rated based on criteria developed by the Board.

6.4. PRIVATE FUNDING SOURCES AND ALTERNATIVES

Private financing of highway improvements, in the form of right-of-way donations and cash contributions, has been successful for many years. In recent years, the private sector has recognized that better access and improved facilities can be profitable due to increases in land values and commercial development possibilities. Several forms of private financing for transportation improvements exist, have been used in other parts of the United States, and could be successful in funding improvement on the Mountain Loop Highway.

6.4.1.1. Cost Sharing

The private sector pays some of the operating and capital costs for constructing transportation facilities required by development actions.

6.4.1.2. Transportation Corporations

These private entities are non-profit, tax exempt organizations under the control of state or local government. They are created to stimulate private financing of highway improvements.

6.4.1.3. Road Districts

These are areas created by a petition of affected landowners, which allow for the issuance of bonds for financing local transportation projects.

6.4.1.4. Private Donations

The private donation of money, property, or services to mitigate identified development impacts is the most common type of private transportation funding. Private donations are very effective in areas where financial conditions do not permit a local government to implement a transportation improvement itself.

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Chapter 7
FEASIBILITY STUDY CONCLUSION

The study evaluated the Mountain Loop Highway to gain a better understanding of system goals, objectives, constraints and opportunities, and potential funding sources. In addition to analyzing applicable data from FHWA, Snohomish County, and USFS; a comprehensive public involvement process was conducted to gather relevant information from community members and stakeholder groups. This information led to a set of options to be considered by appropriate project sponsors moving forward.

The study identified several options that would address the operational characteristics, safety and physical conditions of the existing facility. A high-level screening process was attempted to document how well an option did (or didn't) satisfy the goals and objective defined in **Chapter 4**. The purpose of this exercise was not to "select" a preferred option, but primarily to develop a planning level cost of what funding expenditures may be required given the range of options developed. Snohomish County and/or USFS may elect to proceed with any of the options developed for the 14-mile gravel roadway section.

7.1. NEXT STEPS

The ability to develop a project is dependent on the availability of existing and future federal, state, local, and private funding sources. At the current time funding has not been identified to proceed with a project. Should Snohomish County or USFS elect to proceed with a project for the 14-mile gravel section of the corridor – or any other improvement outside of the gravel portion - the following steps are needed:

- Identify the option 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 any potential impacts and mitigation measures from any proposed action.

Phasing of corridor improvements could also be pursued. For example, a logical segment for the 14-mile gravel section could begin with the portion between MP 40 to MP 44.65, which is the northernmost segment of gravel. This segment is in the best current condition and could be a candidate for phasing improvements along the 14-mile corridor. Estimated costs have been presented in **Table 1** and **Table 24**, and actual milepost limits could be adjusted based on available funding or grant availability. For example if the decision is made to limit a project to approximately $5M, then a combination of asphalt (~ 3 miles) and gravel (~2 miles) may be an appropriate break-out to begin an initial project.

Any future project should be consistent with the goals and objectives contained in this study. Should this study lead to a project (or projects), compliance with NEPA will be required. Further, this Feasibility Study may be used as the basis for determining the impacts and subsequent mitigation for the improvement options in future NEPA documents. Any project developed with FHWA funding will need to be in compliance with CFR Title 23 Part 771 and ARM 18, sub-chapter 2 which sets forth the requirements for documenting environmental impacts on highway projects.

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Chapter 8
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