Chapter 2 Alternatives Considered

Chapter 2 describes the alternatives considered in the Draft EIS, the process the lead agencies used to identify the Preferred Alternative, the changes that were made to the Preferred Alternative as a result of new technical studies, and updated project costs. It summarizes the impacts of the alternatives on the social, economic, and natural environment, including the effects on traffic during construction. Chapter 3 compares the expected environmental consequences of the Preferred Alternative to those of the alternatives considered in the Draft EIS.

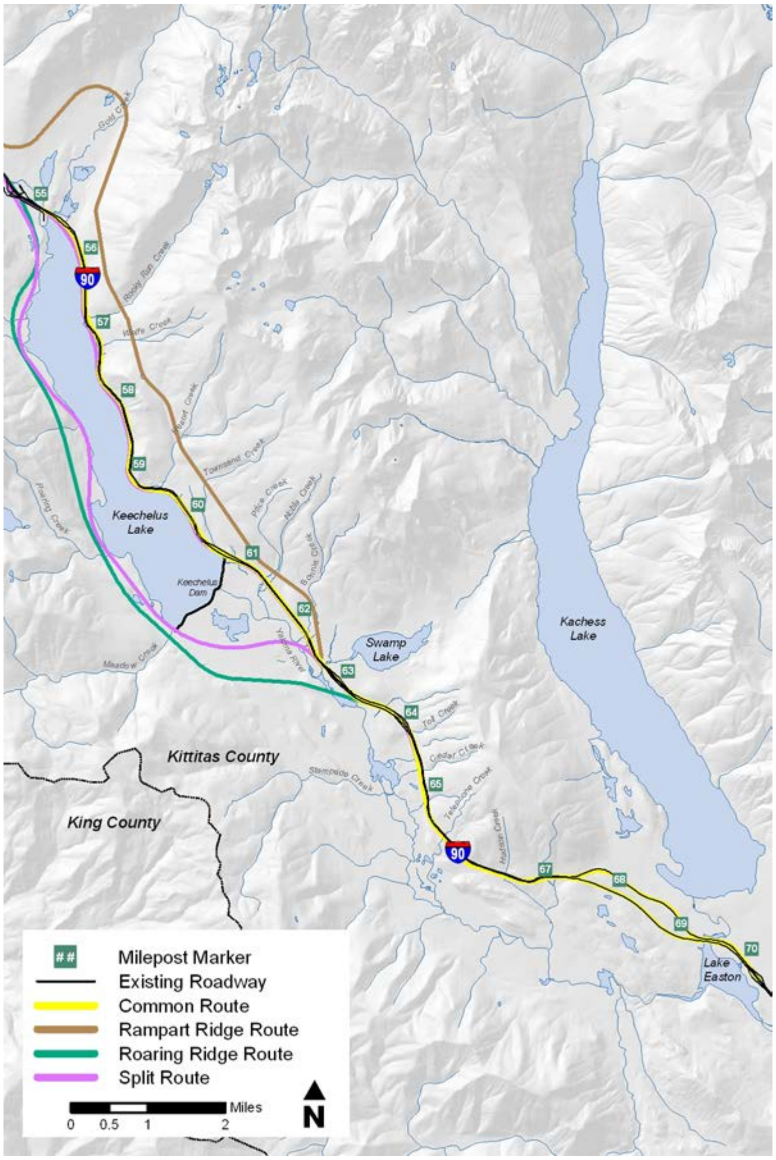
2.1 How did FHWA and WSDOT identify the range of alternatives?

Route Alternatives

FHWA and WSDOT considered a broad range of potential solutions to the I-90 project's purpose and need. These include alternatives for re-locating the highway away from its current location and managing traffic demand through measures such as signage, highway advisory radio, and electronic variable message signs. Working with the IDT, the lead agencies developed a set of initial alternatives, which are described in Chapter 2 of the Draft EIS and shown in Exhibit 2-1.

The lead agencies and the IDT analyzed these six initial alternatives and determined that the No-Build and Limited Construction Alternatives did not meet the project's purpose and need. The Rampart Ridge, Roaring Ridge, and Split Route Alternatives presented unacceptable levels of environmental impact and cost, and did not meet the project's purpose and need as well as the Common Route Alternative. The remaining alternative was the Common Route Alternative, which FHWA and WSDOT found to meet the project's purpose and need and to have acceptable levels of environmental impact. The lead agencies advanced this alternative for further study in the Draft EIS, including the development of a range of build alternatives along the Common Route, along with the No-Build Alternative, which is required under NEPA.

Exhibit 2-1
Initial Route Alternatives



The analysis of these initial alternatives is presented in detail in Chapter 2 of the Draft EIS and in the IDT's technical memoranda for the Rampart Ridge, Roaring Ridge, Split Route, and Common Route Alternatives (WSDOT 2002a through 2002d).

No-Build Alternative (not shown on map)

This alternative, which is required under NEPA, assumed that the existing highway would be maintained and repaired as needed, but that no new construction would take place.

Limited Construction Alternative (not shown on map)

This alternative considered technology-based or policy-based actions, along with mass transit and rail.

Rampart Ridge Route Alternative

This alternative would construct a new six-lane highway northeast of Keechelus Lake and would leave the existing I-90 alignment east of Hyak and rejoin it just west of the Stampede Pass Interchange.

Roaring Ridge Route Alternative

This alternative would construct a new six-lane highway southwest of Keechelus Lake, from the Hyak Interchange to the Cabin Creek Interchange.

Split Route Alternative

This alternative would construct three new eastbound lanes along the southwest shore of Keechelus Lake and convert that section of the existing highway to westbound lanes.

Common Route Alternative

This alternative would reconstruct the existing highway to six lanes, generally following the existing highway alignment.

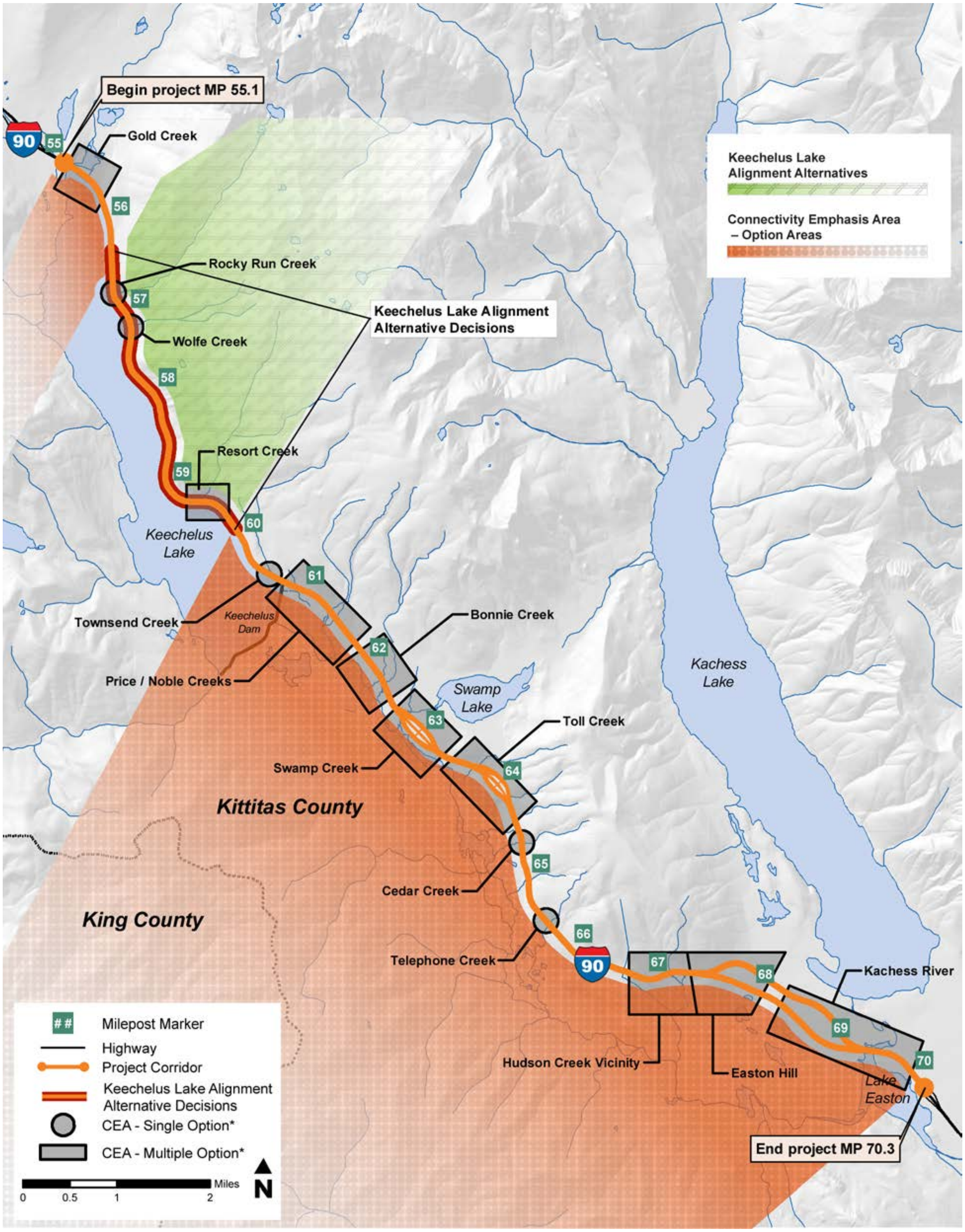
Common Route Alternatives

Following the decision to advance the No-Build and Common Route Alternatives for further study, the project team developed a range of build alternatives for the Common Route. All of the Common Route alternatives were designed to meet the project's purpose and need. All would correct problems related to traffic volumes; replace deteriorated pavement, substandard bridges, and interchanges; and add chain-up areas, and would do so in a similar manner. Addressing the remaining project needs required FHWA and WSDOT to make two distinct decisions.

The first decision was how to rebuild the highway along the east shore of Keechelus Lake. (See green area on Exhibit 2-2.) WSDOT created four separate alternatives for the 3.3-mile portion of the highway between MP 56.6 just east of Rocky Run Creek and MP 59.9 near Resort Creek, which was referred to in the Draft EIS as the Keechelus Lake Alignment. The unique project needs for this area were reducing avalanche closures, stabilizing slopes, and selecting the design speed. This portion of the highway contains few opportunities to improve ecological connectivity, because of the deeply incised nature of the three streams in this area and the steep slopes bordering the highway.

The second decision was how to improve habitat connections along the remainder of the project corridor. (See orange area on Exhibit 2-2.) This portion of the highway contains the greatest opportunities to improve ecological and hydrologic connectivity. The more gentle terrain in this part of the project corridor allowed FHWA and WSDOT to meet the remaining project needs while making maximum use of the existing highway corridor. WSDOT developed three build alternatives for most of the wildlife crossing locations.

Exhibit 2-2
EIS Decision Areas



2.2 How were the alternatives for the Keechelus Lake Alignment analyzed?

The project team developed four alternatives for the Keechelus Lake Alignment area (Exhibit 2-3). Three of these alternatives included tunnels. A detailed description of each alternative is given in Section 2.4.3 of the Draft EIS.

Evaluation of Keechelus Lake Alignment Alternatives 1, 2, and 3

The factors with the largest impact on identifying a preferred alternative for the Keechelus Lake Alignment were considerations associated with building tunnels. These factors included engineering feasibility and risk, maintenance costs, operational difficulties, environmental consequences, and cost and environmental trade-offs.

Engineering Feasibility and Risk. The lead agencies concluded that building tunnels would be a high-risk activity for both the schedule and budget. Engineering experience world-wide shows that tunnel construction generally requires making real-time adjustments to design and engineering specifications, since variations in the rock material cannot be known with certainty until tunnel boring is underway. In WSDOT’s experience, such changes in conditions and design frequently result in schedule delays and substantially increased costs.

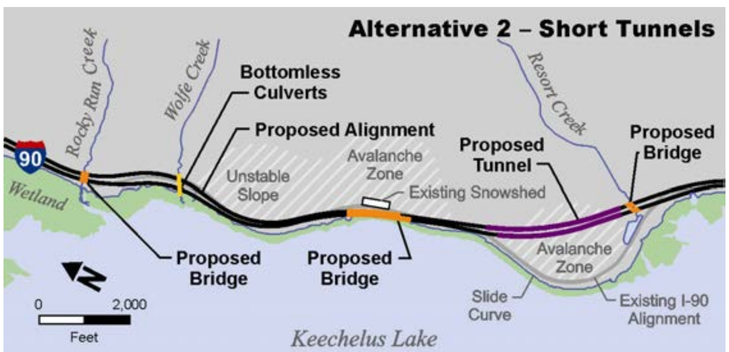
Exhibit 2-3
Keechelus Lake Alignment Alternatives

Alternative 1 – Two 1.9-mile tunnels with three lanes in each direction would be built along Keechelus Lake.

Rocky Run Creek – Replace two existing 6-foot culverts and a single-span bridge with two 120-foot single-span bridges.

Wolfe Creek – Replace two existing 6-foot culverts with bottomless culverts.

Resort Creek – Replace two existing culverts with two 120-foot single-span bridges.

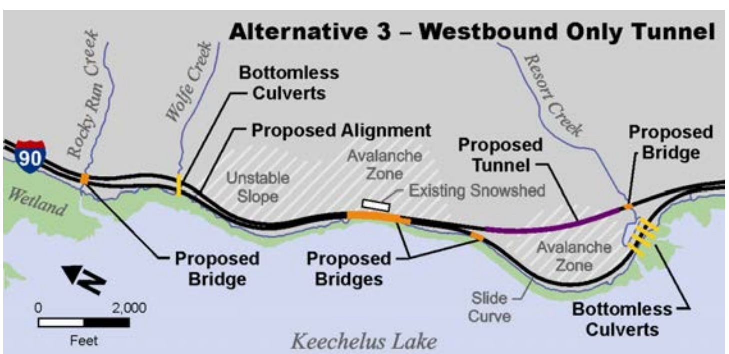


Alternative 2 – Two 0.6-mile tunnels with three lanes in each direction would be built along Keechelus Lake.

Rocky Run Creek – Same as Alternative 1.

Wolfe Creek – Same as Alternative 1.

Resort Creek – Same as Alternative 1.



Alternative 3 – One 0.6-mile tunnel with three lanes would be built in the westbound direction along Keechelus Lake. Three eastbound lanes would be constructed along Keechelus Lake.

Rocky Run Creek – Same as Alternative 1.

Wolfe Creek – Same as Alternative 1.

Resort Creek – Replace the existing 6-foot culvert under the westbound lanes with a 120-foot single-span bridge. Replace the existing 6-foot culvert under the eastbound lanes with bottomless culverts.

Alternative 4 – Three lanes would be constructed in each direction around Slide Curve.

Rocky Run Creek – Same as Alternative 1.

Wolfe Creek – Same as Alternative 1.

Resort Creek – Replace existing 6-foot culvert with bottomless culverts.

Maintenance Costs. Any of the tunnel alternatives would substantially increase the cost of maintenance. Maintenance costs for tunnels are far higher than for normal highways, because of required systems for ventilation, lighting, fire detection, and 24-hour monitoring. WSDOT estimated the annual maintenance cost of the existing project area at approximately $184,000 and Alternative 4 (the Preferred Alternative) at approximately $290,000. All of the tunnel alternatives had annual maintenance costs of over $1 million with Alternative 1 the most expensive at over $2.8 million. For more information see Section 2.6, *What would the project cost?*

Operational Difficulties. Tunnels also present severe operational problems. Tunnels would require specialized emergency response equipment and would place limits on the width and types of cargo that could pass through the tunnel. Stalled vehicles in the tunnel would represent an added hazard. Trucks hauling hazardous and flammable materials could present additional problems, and would need to be accommodated in the design and operational plan for the tunnels.

Environmental Consequences. In all three tunnel alternatives, the proposed eastern end point is at Resort Creek, which contains the largest concentration of high-value wetlands in the project area. Constructing a tunnel entrance at this location, with associated maintenance and chain-up/chain-off areas, would require extensive fill and cause severe impacts to these wetlands.

Cost and Environmental Trade-Offs. The costs of tunnel construction would be very high, and in some cases higher than the total amount of funding available for the project. Based on its cost estimates, the lead agencies and the IDT concluded that any of the tunnel alternatives would likely force the project to forego most or all of the improvements to ecological connectivity. A full discussion of costs is presented in Section 2.6, *What would the project cost?*

Foregoing these connectivity improvements in favor of building a tunnel would not meet the purpose and need for the project. Failure to meet the project’s stated purpose and need would make the project subject to challenge by agencies or interest groups. Additionally, any substantial reduction in ecological connectivity improvements would likely cause the USFS to determine that the project was not consistent with its land management plans. (See Section 1.13, *What other actions are necessary to complete the project?*) A determination of inconsistency would prevent the USFS from granting FHWA and WSDOT the additional easement needed for the project. Eliminating ecological connectivity improvements also would conflict with ongoing conservation efforts within the project area by state and federal agencies and non-profit groups. Consequently, selection of one of the tunnel alternatives would require WSDOT and the Washington State Legislature to increase project funding considerably to allow the project to fully meet the project needs. As described in Section 2.6, *What would the project cost?*, this funding shortfall could be up to $1.1 billion for Phase 1 alone.

Evaluation of Keechelus Lake Alignment Alternative 4

Alternative 4, the only non-tunnel alternative, would use the existing easement wherever possible. Because Alternative 4 would not include tunnels, this alternative would present much lower construction risk, and would eliminate important operation and maintenance problems.

Alternative 4 would result in fewer impacts to wetlands than the tunnel alternatives, particularly at Resort Creek. Using the existing alignment to the greatest extent possible would minimize the loss of terrestrial habitat from new highway fill. Preliminary studies developed for the Draft EIS indicated that compensatory mitigation could be accomplished for the unavoidable impacts.

The IDT concluded that Alternative 4 would meet the project’s purpose and need as effectively as the three tunnel alternatives. Alternative 4 would avoid the problems associated with tunnels, and would have a substantially lower cost.

Recommendation

The IDT recommended Alternative 4 as the Preferred Alternative for the Keechelus Lake Alignment, and the lead agencies accepted the IDT's recommendation in June 2006. More information on the four alternatives for the Keechelus Lake Alignment is available in Chapter 2 of the Draft EIS. More information on the IDT's recommendation is available in Appendix B.

2.3 How were the alternatives for the remainder of the project area analyzed?

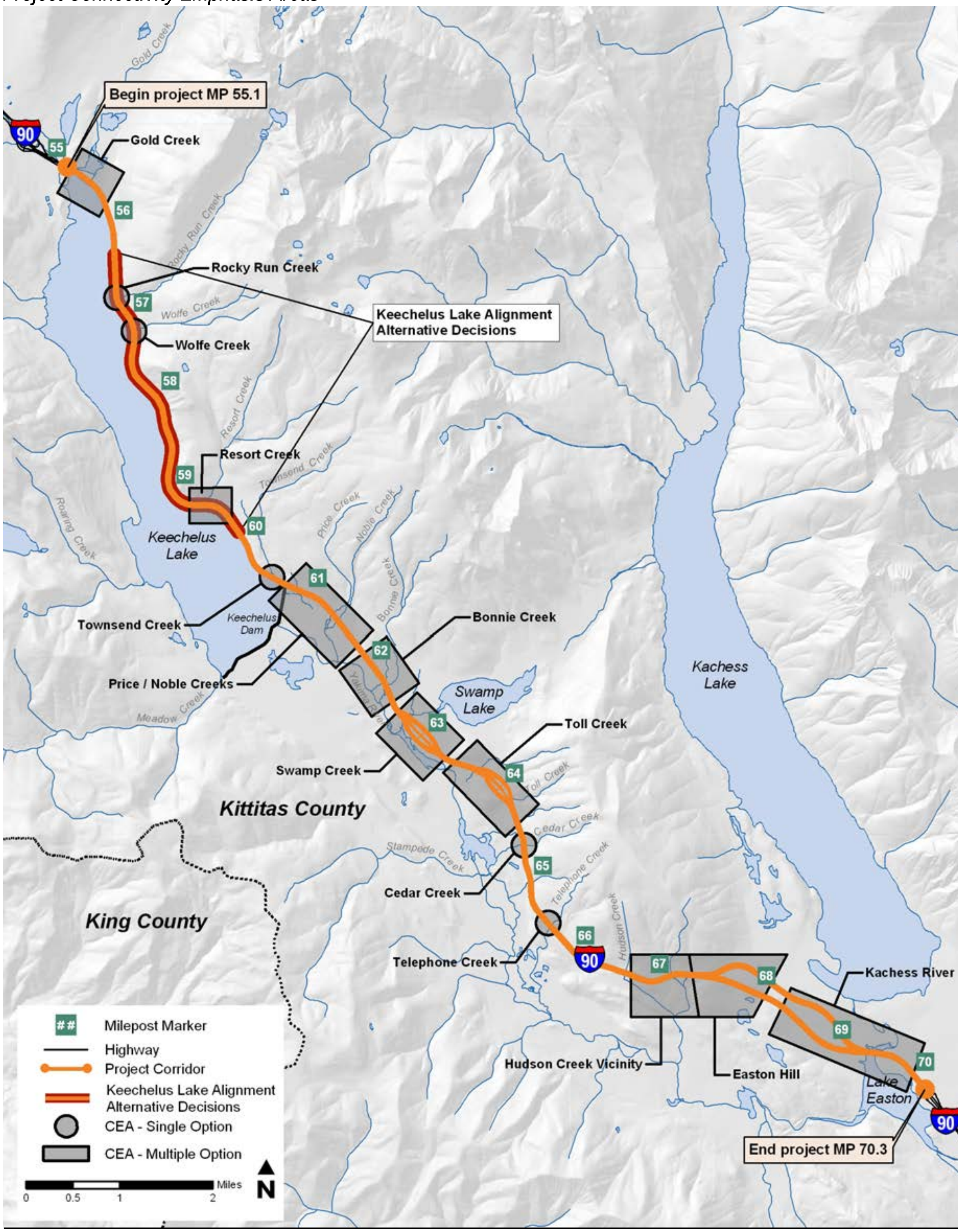
All of the build alternatives for the remaining project area have been designed to meet the project's transportation needs. All would expand the highway to three lanes in each direction, stabilize unstable slopes, and add new chain-on areas. The primary decision for this part of the project was how the lead agencies would meet the project's ecological connectivity needs, primarily at stream crossings. The lead agencies recognized early in the project that many of the stream crossings offered opportunities to improve both hydrologic and ecological connectivity, and agreed that evaluating these opportunities required the expertise of specialists from both inside and outside of WSDOT.

Many streams in the project area cross I-90 through narrow culverts. (Shown: Townsend Creek)

In response, FHWA and WSDOT convened the MDT, a technical advisory group of hydrologists and biologists. Their purpose was to provide a mitigation strategy that would meet the ecological connectivity needs in the project area. In response, the MDT identified 14 locations within the project area that could benefit from connectivity improvements. Most of these areas are at stream crossings, but some are located within larger wildlife corridors away from streams. These areas are referred to as CEAs and are shown in Exhibit 2-4.

The MDT evaluated bottomless culverts as an option to improve stream function and provide wildlife passage.

Exhibit 2-4
Project Connectivity Emphasis Areas



CEA borders illustrate the general locations where the project will invest more resources to meet ecological connectivity objectives. Public and private lands near these CEAs are not part of the I-90 project. The project may acquire private land near CEAs via purchase, easement, and/or federal land transfer.

WSDOT worked with the MDT to develop design options for improvements at each CEA. These design options were based on the MDT's connectivity objectives, and included replacing existing narrow culverts with wider, bottomless culverts or bridges; replacing existing short bridges with longer bridges; and building wildlife overpasses at two locations. In order to consider a full range of alternatives for both cost and effectiveness, WSDOT identified three potential designs for the connectivity improvements wherever site conditions allowed (Options A, B and C). At some CEAs, however, conditions were sufficiently constrained that only a single design option was appropriate.

The MDT considered mid-sized stream crossings to allow a wider area for natural stream function and wildlife movement. (Design Visualization)

The MDT then evaluated these design options for each CEA using their connectivity objectives, and made recommendations to the IDT. The MDT's findings are described in more detail in the *Interstate 90 Snoqualmie Pass East Mitigation Development Team Recommendation Package* (Appendix D).

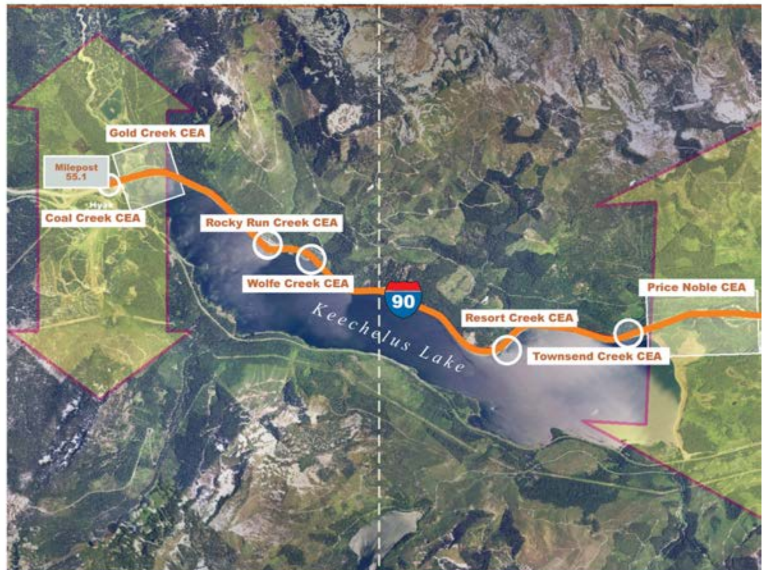
WSDOT engaged three recognized experts in the fields of wetland science, wildlife crossing structures, and hydrology to assure the scientific integrity of the MDT's work (see Appendix D). The MDT integrated the results of this review into their final recommendations.

For the purposes of analysis, the Draft EIS grouped the CEA options into three Improvement Packages: A, B, and C. Package A would be the most expensive, and would provide the greatest level of environmental benefit, and Package C would be the least expensive, with the lowest level of environmental benefit. In general, Package A would include a larger number of longer bridges, while Package C would rely on shorter bridges or bottomless culverts. This accounts for the differences in both effectiveness and cost.

The MDT recommended building large bridges at many streams and known wildlife crossing areas. (Shown: Design visualization for two bridges at the wildlife corridor near Hudson Creek)

Following publication of the Draft EIS in June 2005, the MDT recommended modifications to design options at four CEAs where the original designs did not fully meet their connectivity objectives. WSDOT designated these modifications as Option D. Exhibit 2-5 shows the entire range of options considered by the MDT at each CEA.

Exhibit 2-5
The MDT's Evaluation of the CEA Options



	Mountain Hemlock/Subalpine Fir				Western Hemlock		
OBJECTIVE	Coal Creek	Gold Creek	Rocky Run Cr	Wolfe Creek	Resort Creek*	Townsend Creek	Price/Noble Creeks
High-Mobility Species	●	●●●	●	●	●	●	●●●
Low-Mobility Species	●●	●●	●●	●	●	●●	●●●
Stream Channel and Floodplain Processes	●●	●●●	●●	●●	●●	●●	●●●
Wetland and Subsurface Flow		●●			●●		●●●
EXISTING STRUCTURES	Box culverts	140' bridge	40' bridge 2-6' culverts	6' culvert	6' culvert	6' culvert	10' culvert 4' culvert
Option A		☆☆☆ 120' bridge 1,100' EB/ 900' WB bridge	☆☆☆ 120' bridge	☆☆☆ 25' x 8' culvert WB 20' x 10' culvert EB	☆☆☆ Alternative 1 Twin bore tunnels 120' bridge 1 HCZ	☆☆☆ 25' x 12' culvert	☆☆ 120' bridge 2-800' bridges 1 HCZ
Option B		☆☆ 1,200' EB/ 1,000' WB bridge 100' wildlife bench			Alternative 2 Same as Alternative 1		☆ 120' bridge 800' bridge 2 HCZs
Option C		120' bridge 300' bridge			Alternative 3 Single bore tunnel WB 120' bridge WB Multiple culverts EB** 1 HCZ		3-120' bridges 2 HCZs
Option D		☆ 120' bridge 700' bridge			Alternative Alt. 4 Multiple culverts**		☆☆☆ Wildlife Overcrossing 3-120' bridges 2 HCZs

Design recommendations at Townsend, Cedar, and Telephone Creeks were modified by the IDT to better meet MDT objectives. Design recommendations at Rocky Run and Resort Creeks were modified by the WSDOT design team due to engineering constraints, and bridges were added and/or increased in size to better meet MDT objectives.

Pacific Silver Fir					Western Hemlock/Grand Fir		
Bonnie Creek	Swamp Creek	Toll Creek	Cedar Creek	Telephone Creek	Hudson Creek	Easton Hill	Kachess River
●●●	●●●	●●●	●●	●●	●●●	●●●	●●●
●●●	●●●	●●●	●●	●●	●●●	●●	●●
●●●	●●●	●●	●●	●●	●●		●●
●●●	●●●	●●●			●●●	●●	●
6' culvert	2-8' culverts	4' culvert 3' culvert	4' culvert	5' x 4' culvert	2' culvert	No Structure	99' bridge EB 150' bridge WB
★★★ 600' bridge 1 HCZ	★★ 240' bridge 120' bridge 4 HCZs	★★★ 120' bridge 6'x5' culvert	★ ≥4' culvert 1 HCZ	★ ≥4' culvert	★★★ 240' bridges 2 HCZs	★★★ 120' bridge (EB and WB)	120' bridge Replace existing county bridges
240' bridge 2 HCZs	★★★ 3-120' bridges 5 HCZs	Same as Option A			120' bridge 3 HCZs	★★ Wildlife Overcrossing EB and WB 1 HCZ	Widen existing county bridges
16' x 10' culvert 2 HCZs	120' bridge 6 HCZs	6'x5' culvert			≥4' culvert 3 HCZs	★ Wildlife Overcrossing WB 120' bridge 1 HCZ	Widen existing county bridges
							★★★ Wildlife Overcrossing (EB and WB) Widen existing county bridges

LEGEND

★ MDT Recommendation Ranking; three stars = highest

Option meets connectivity objectives

Option does not meet connectivity objectives

Level of Emphasis

●●● Strong emphasis

●● Moderate emphasis

● Low emphasis

Little or no emphasis

North-South Linkage Zones

HCZ = hydrologic connectivity zone

ASSUMPTIONS BEHIND HYDROLOGY RATINGS:
Stream channel process, is for CEAs with unconfined floodplains and dynamic migrating streams. for CEAs where focus is on fish and debris passage. where only minor streams occur. Blank means no streams.
Wetland flow paths, indicates high value wetland resources and/or subsurface flow paths at the CEA. or indicates some wetlands, relatively low value or less extensive. Blank indicates wetland and subsurface flow are relatively minor.

* At the Resort Creek CEA, different highway alternatives are linked to different design options (three separate options).

** Resort Creek Alignments 3 and 4: multiple culverts with combined width of 100 feet. At least one culvert to provide 12-foot clearance.

Recommendation

Based on the work of the MDT, the IDT re-examined the options at each CEA and recommended the most appropriate option for the Preferred Alternative. In general, the IDT recommended the options included in Improvement Package A. In the cases where Option A did not represent the best connectivity option, an alternate or modified option was identified. The IDT's recommendations were adopted by FHWA and WSDOT in June 2006 (Appendix B).

During the identification of the Preferred Alternative for the CEAs, the IDT and WSDOT made minor design modifications at Resort Creek, Townsend Creek, Cedar Creek, and Telephone Creek. At each location, culvert sizes were increased beyond the minimums suggested by the MDT in order to improve the effectiveness of the connectivity design. These modifications fall within the range of the alternatives analyzed in the Draft EIS. Exhibit 2-6 shows the IDT's recommendations for the Preferred Alternative.

Exhibit 2-6
The IDT's Recommendations at Individual CEAs

CEA	Recommended Preferred Alternative
Gold Creek	Option A
Rocky Run Creek	Option A
Wolfe Creek	Option A
Resort Creek	Option D
Townsend Creek	Option A Modified
Price/Noble Creeks	Option D
Bonnie Creek	Option A
Swamp Creek	Option B Modified
Toll Creek	Options A/B Modified
Cedar Creek	Option A Modified
Telephone Creek	Option A Modified
Hudson Creek	Option A
Easton Hill	Option A
Kachess River	Option D

The MDT's recommendations and each option's details are shown on Exhibit 2-5

WSDOT also prepared design visualizations for the proposed ecological connectivity improvements at Gold Creek (Exhibit 2-7), the wildlife overcrossing at MP 60.8 (Exhibit 2-8) and Hudson Creek (Exhibit 2-9).

2.4 How was the project subsequently modified?

After the lead agencies identified the Preferred Alternative, WSDOT conducted additional technical studies to support more detailed design work. These included studies of geotechnical (soil and rock) conditions, avalanches, and construction methods.

In November 2006, WSDOT convened a team of experts to conduct a value engineering study on the project. Based on the new studies, the value engineering team recommended two major changes to the Preferred Alternative. Both would reduce project costs and environmental impacts.

Value Engineering is a systematic application of recognized techniques by a multidisciplinary team to identify the function of a product or service and the lowest life cycle cost without sacrificing safety, necessary quality, or environmental attributes.

The first change would reduce the design speed of the new highway. The original design speed for all of the build alternatives was 75 miles per hour (mph) for the entire 15-mile corridor. The value engineering team recommended that the design speed be reduced to 65 mph for the western six miles of the corridor along Keechelus Lake, and 70–75 mph for the remainder of the corridor. This recommendation to reduce the design speed to 65 mph is based on physical constraints of the site, including the sharp curves along Keechelus Lake and the narrow highway alignment between the rock slopes and the lake. Keeping the design speed at 65 mph also would avoid changing the design speed and the posted speed limit several times within this part of the project corridor. The 70–75 mph design speed east of Keechelus Lake would provide a smooth transition to the higher speed limits east of the project area and would match the alignment at Easton and beyond.

Design Speed is the speed used to determine the various design features of the roadway.

Exhibit 2-7
Design Visualization of Preferred Alternative for Gold Creek

Existing Condition

Design Visualization of Option A

At Gold Creek, the two existing 140-foot bridges would be replaced with two new bridges approximately 900 and 1,100 feet long, and would add a 120-foot bridge at the far west end of the Gold Creek floodplain to allow wildlife passage when Keechelus Lake is at high pool.

Exhibit 2-8
Design Visualization of Wildlife Overcrossing at MP 60.8

Existing Condition

Design Visualization

The area near MP 60.8 at the end of Keechelus Lake is a documented wildlife corridor. The rock knob at this location presents a good location to design and build a wildlife overcrossing bridge.

Exhibit 2-9
Design Visualization of Hudson Creek Bridges to allow Wildlife Crossings under I-90

Existing Condition

Design Visualization

The area near Hudson Creek is a documented wildlife corridor. The existing 2-foot culvert would be replaced with twin 230-foot bridges to allow wildlife to cross under the highway.

The second change recommended by the value engineering team was to eliminate the large viaduct bridges planned in Keechelus Lake. As originally planned under Alternatives 2, 3 and 4, the new highway would be shifted away from its existing location in order to avoid the avalanche slopes near MP 58.1 and allow for a 75 mph design speed. Two long bridges (over 1,100 feet) would be built over Keechelus Lake. Also, a 600-foot bridge would be constructed on the eastbound lanes near MP 58.6. The existing roadway at the avalanche chutes would be removed to create a large chute allowing avalanches to pass beneath the bridges. The existing snowshed would be left in place. The value engineering team recommended that these viaduct bridges be eliminated, based on the following findings from new technical studies conducted in 2006:

In the Draft EIS, Alternatives 2, 3, and 4 included viaduct bridges parallel to the shore of Keechelus Lake in front of the snowshed. (Design Visualization)

- Rock in the vicinity of the snowshed is stronger than was previously assumed, which would allow taller rock cuts (WSDOT 2007b)

- Avalanche modeling indicated that avalanche powder blast may cause white-out conditions on the proposed viaduct, which would create safety problems (Mears 2007)

- Constructing the viaduct bridges and the required retaining walls would present engineering problems that approach the level of fatal flaws, which could make the alternative impossible to build. The lake in this location is very deep with a steeply sloping bottom. Support structures for the bridge would be more than 170 feet tall in some locations. Bedrock on the lake bottom is of poor quality and is overlain by up to 80 feet of soil (WSDOT 2007b)

- Access to the work area during construction would be limited by the narrow eastbound road shoulders and steep embankment slopes

- The construction period is limited by the long winters and by rapidly fluctuating water levels in Keechelus Lake

The existing snowshed does not adequately protect the roadway from avalanche danger.

The value engineering team recommendation to remove the viaduct bridges would require WSDOT to replace the existing snowshed at MP 58.1, which covers the two westbound lanes. Because of the construction techniques used when it was built, the snowshed cannot be expanded without being completely removed and replaced. The snowshed is listed on the NRHP, and removing it requires evaluation under Section 4(f) of the Transportation Act. This evaluation can be found in Chapter 5, *Programmatic Section 4(f) Evaluation*.

WSDOT modified the project design to eliminate the viaduct bridges and replace the existing snowshed with a new, larger structure. (Design Visualization)

Reducing the design speed and removing the viaduct bridges would reduce environmental impacts and would allow the highway to remain closer to its existing alignment, eliminating the need for new fill in Keechelus Lake. Removing the viaduct bridges would eliminate the need for substantial amounts of in-water construction.

FHWA and WSDOT adopted these recommended changes in March 2007. Additional information can be found in Appendix B. The revised alternative for the Keechelus Lake Alignment are shown in Exhibit 2-10.

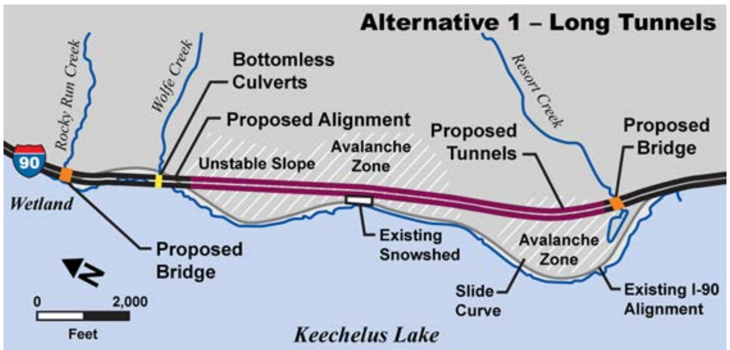
In May 2008, WSDOT proposed a further minor change to the project design at Resort Creek. WSDOT replaced the original Preferred Alternative design, a series of culverts, with a pair of 180-foot single-span bridges. This change would avoid design and construction problems with culverts, and allow for creation of additional habitat connections under the bridges.

All project modifications adopted by FHWA and WSDOT fall within the range of alternatives analyzed in the Draft EIS.

Final Project Description

The Preferred Alternative includes the improvements shown in Exhibit 2-11. A detailed description of the Preferred Alternative can be found in Appendix C.

Exhibit 2-10
Revised Keechelus Lake Alignment Alternatives

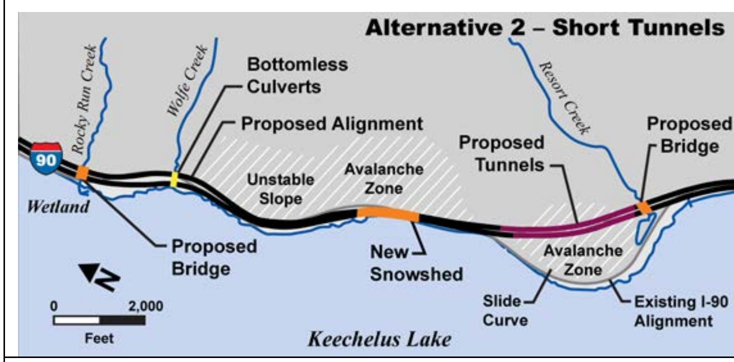


Alternative 1 – Two 1.9-mile tunnels with three lanes in each direction would be built along Keechelus Lake.

Rocky Run Creek – Replace two existing 6-foot culverts and a single-span bridge with one 120-foot and one 160-foot single-span bridge.

Wolfe Creek – Replace two existing 6-foot culverts with bottomless culverts.

Resort Creek – Replace existing 6-foot culvert with two 120-foot single-span bridges.

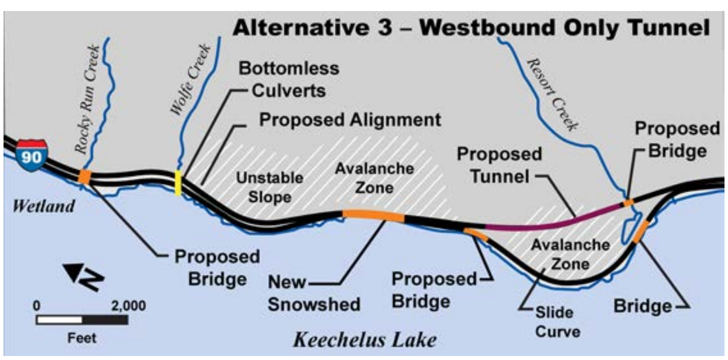


Alternative 2 – Two 0.6-mile tunnels with three lanes in each direction would be built along Keechelus Lake. Replace existing snowshed with new six-lane expanded snowshed.

Rocky Run Creek – Same as Alternative 1.

Wolfe Creek – Same as Alternative 1.

Resort Creek – Same as Alternative 1.

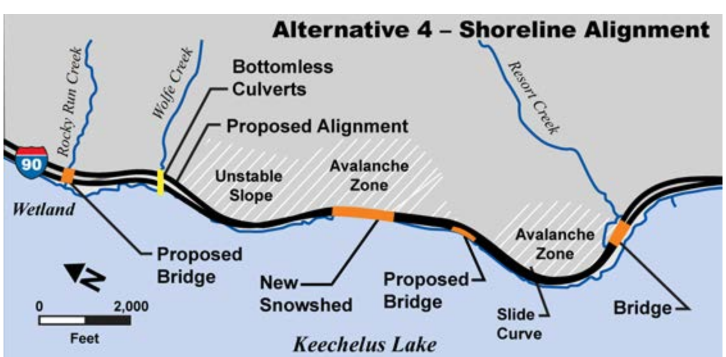


Alternative 3 – One 0.6-mile tunnel with three lanes would be built in the westbound direction along Keechelus Lake. The eastbound lanes would be constructed along Keechelus Lake. Replace existing snowshed with new six-lane expanded snowshed.

Rocky Run Creek – Same as Alternative 1.

Wolfe Creek – Same as Alternative 1.

Resort Creek – Replace the existing 6-foot culvert under the westbound lanes with a 120-foot single-span bridge. Replace the existing 6-foot culvert under the eastbound lanes with a 180-foot single-span bridge.



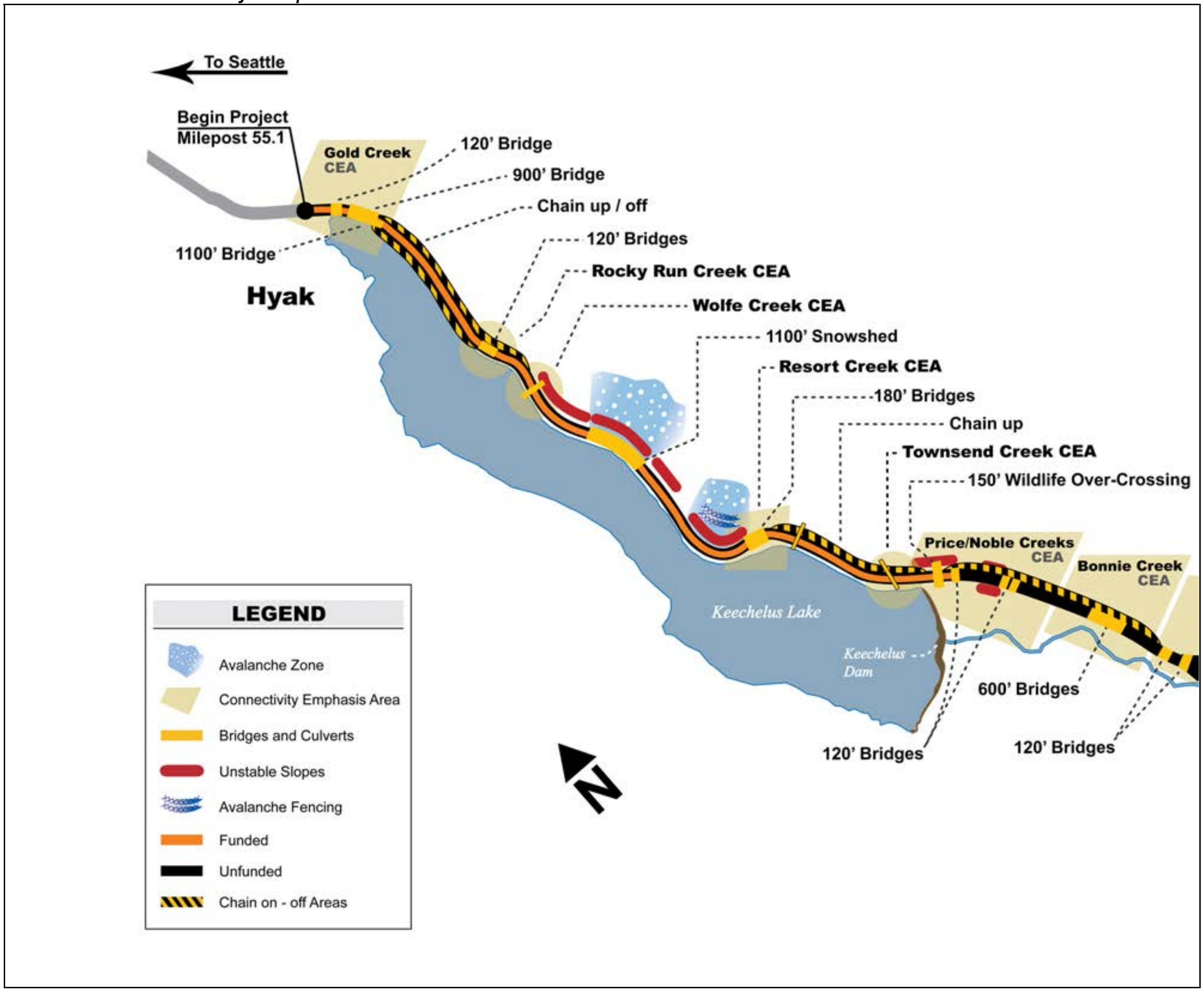
Alternative 4 – Three lanes would be constructed in each direction around Slide Curve. Replace existing snowshed with new six-lane expanded snowshed.

Rocky Run Creek – Same as Alternative 1.

Wolfe Creek – Same as Alternative 1.

Resort Creek – Replace existing 6-foot culvert with two 180-foot single-span bridges.

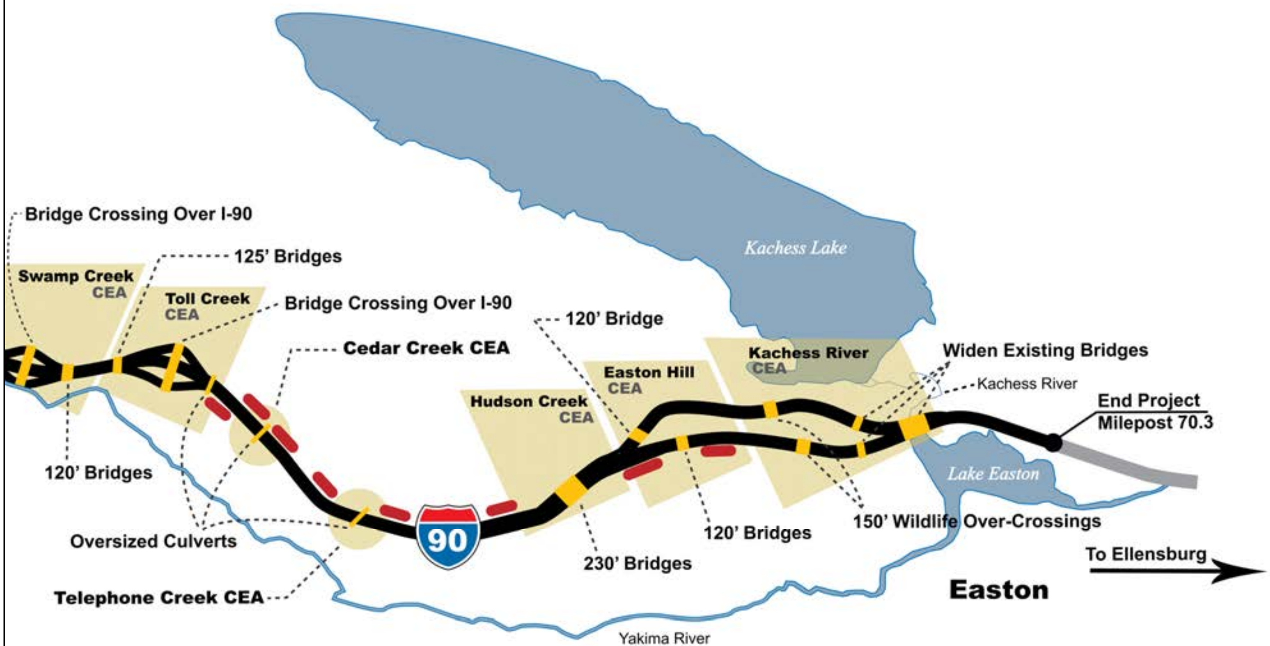
Exhibit 2-11
Preferred Alternative Major Improvements



2.5 How has the project avoided and minimized environmental impacts?

This section discusses the project's approach to avoiding and minimizing environmental impacts. Environmental analysis under NEPA requires the lead agency to analyze social, economic and environmental goals. FHWA and WSDOT have worked to understand and balance the impacts to the social, economic, and natural environment at every stage of the I-90 project, including identifying the alternatives and the design of the project itself.

NEPA requires the lead agency to analyze social, economic and environmental goals.



How did the lead agencies minimize impacts through identification of alternatives?

Over the course of the project, alternatives were screened at several key points (Exhibit 2-12).

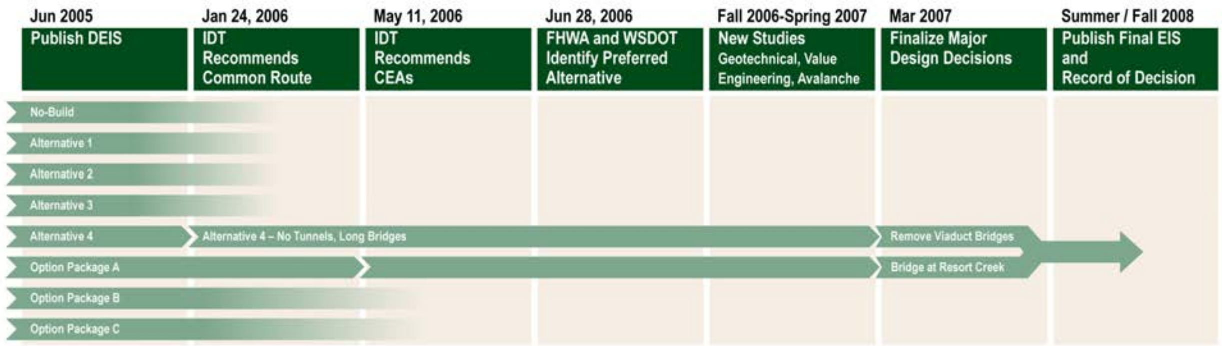
Exhibit 2-12
Development of the Preferred Alternative

At each point where an alternative was identified, FHWA and WSDOT made decisions in a way that would minimize impacts to the social, economic and natural environment. The key decision points were: advancing the Common Route from the initial route alternatives, identifying the Preferred Alternative for the Keechelus Lake Alignment and the CEA Improvement Packages area, and making subsequent design modifications to the Preferred Alternative.

Advancing the Common Route Alternative

By advancing the Common Route from the initial route alternatives for inclusion in the Draft EIS, the project minimized impacts to the social environment by avoiding impacts to recreation resources. These potential impacts included the Iron Horse State Park and the John Wayne Trail for the Roaring Ridge and Split Route alternatives, and the USFS trail systems for the Rampart Ridge alternative.

The Common Route also avoided the high costs of constructing an entirely new highway corridor which, when combined with removing and restoring the existing corridor would have been much more expensive than using the existing Common Route.



Identifying the Preferred Alternative

Identifying Keechelus Lake Alignment Alternative 4 as the Preferred Alternative avoided serious impacts to high-quality wetlands at Resort Creek, and preserved enough funding to fully meet the project's ecological connectivity goals at the CEAs.

Subsequent Design Decisions

As discussed earlier, FHWA and WSDOT modified the Preferred Alternative by lowering the design speed along Keechelus Lake, placing bridges rather than culverts at Resort Creek, eliminating the proposed viaduct bridges, and removing the existing snowshed. These changes avoided impacts to the natural environment by allowing greater use of the existing right-of-way and reducing the amount of new highway fill. These modifications also reduced the cost of the project, preserving more of the available funding to meet the project's purpose and need.

How have FHWA and WSDOT designed the project to avoid impacts to the social, economic, and natural environment?

As design of the Preferred Alternative has continued, WSDOT has made incremental adjustments to the location of the new highway and the design of the new structures to avoid impacts, primarily to the social and natural environments.

The project has avoided social impacts by avoiding all known historic, cultural or archeological resources except the existing snowshed, and by designing the new highway to avoid impacts to private property.

The project also avoided impacts to all recreational resources except one, the Price Creek Sno-Park (Westbound). The recreation parking at this sno-park would be replaced at a new location as a NEPA commitment.

FHWA and WSDOT have adopted architectural guidelines and a roadside restoration and vegetation plan for the project that would enhance the visual appeal of the new highway structures.

The project has avoided impacts to the natural environment by adjusting the location of the new highway to avoid sensitive areas including wetlands, streams, and terrestrial habitat. Where impacts cannot be avoided, the project has often been able to shift them from higher-value to lower-value resources. This has been particularly true with wetlands and aquatic resources, as described in Section 3.4, *Wetlands and Other Jurisdictional Waters*.

What other project-specific commitments have been made?

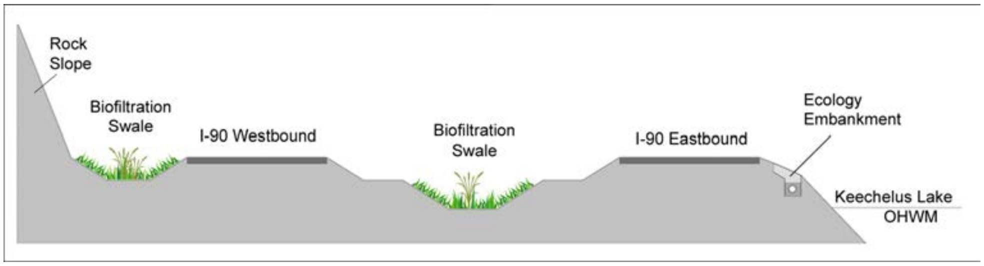
FHWA and WSDOT have made specific project commitments in several areas to improve existing environmental conditions and improve the highway's functionality.

Stormwater Treatment

The existing highway does not have any means to manage or treat stormwater runoff. All of the build alternatives would include stormwater treatment as an element of both construction and operation. WSDOT has identified preliminary locations for stormwater management and completed preliminary designs.

Stormwater treatment would consist largely of biofiltration swales and ecology embankments (Exhibit 2-13), as described in Section 3.3, *Water Resources*. Ecology embankments are the primary treatment type for areas with rock slopes because they save room and reduce the amount of rock cuts. As a result of these improvements, WSDOT expects overall pollutant loading in project area streams and Keechelus Lake to decrease.

Exhibit 2-13
Examples of Stormwater Treatment



The project will provide stormwater treatment for both new and existing impervious surfaces in the project area. In much of the western part of the project area, stormwater treatment is physically impossible because the highway is located between a steep rock bank and Keechelus Lake, with no additional area for stormwater treatment facilities. WSDOT will compensate for the lack of stormwater treatment in these areas by providing additional treatment in other areas, possibly outside of the original project limits. Stormwater management is discussed in more detail in Section 3.3, *Water Resources.*

In some areas, terrain prevents WSDOT from treating stormwater.

Baseline and Long-Term Wildlife Monitoring

Monitoring wildlife movement to establish current conditions and to determine whether the new crossing structures are effective is an essential part of the I-90 project. WSDOT developed a *Wildlife Monitoring Plan* (Appendix O) in cooperation with its Wildlife Monitoring Technical Committee.

WSDOT began pre-construction monitoring in 2008, and will continue monitoring through, and possibly beyond, project completion. Because the project would be built over many years, the lead agencies expect to be able to apply the lessons learned from previous construction phases to subsequent phases. Monitoring wildlife use of the crossing structures will be essential to this adaptive management approach.

Monitoring would consist of two tiers:

Image of a bear from a mounted wildlife monitoring camera near Snoqualmie Pass.

- Baseline monitoring in and near the project's right-of-way, which would consist of collecting data on current wildlife movement (including accidents involving wildlife), and data on the use and effectiveness of the crossing structure designs after they are built. Pre-construction monitoring began in 2008.

- Additional monitoring farther away from the right-of-way, which would complement the baseline monitoring and may help to advance the state of knowledge of wildlife crossing design and performance, along with landscape level topics such as population viability. WSDOT would most likely partner with other agencies and groups to accomplish this additional monitoring.

2.6 What would the project cost?

How did WSDOT estimate project costs?

In the Draft EIS, WSDOT estimated the costs of each project alternative, based on the limited design information available at that time. The costs presented in the Draft EIS were base costs, which did not include the risks of building tunnels, the costs of inflation to the proposed year of expenditure, or potential mitigation costs. These estimates were intended to provide a relative comparison of the costs of the alternatives.

The cost estimates from the Draft EIS are shown in Exhibit 2-14. As in the Draft EIS, this table compares base costs only.

After publishing the Draft EIS, WSDOT updated its cost estimate to account for design changes to the project, and to bring the cost estimates to 2007 dollars (Exhibit 2-15). The costs shown are base costs only.

Exhibit 2-14
Draft EIS Base Cost Comparisons in 2003 dollars (millions)

Costs/Funds	Keechelus Lake Alignment Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4/ Preferred Alternative
Keechelus Lake Alignment	467	311	241	140
CEA Improvement Packages area[1]	171 to 261	171 to 261	171 to 261	171 to 261
Total Estimated Base Cost by Alternative	638 to 728	482 to 572	412 to 502	311 to 401

Costs not adjusted to year of expenditure.
[1] CEA Improvement Packages area includes the improvements at the individual CEAs, additional lanes and chain-up/chain-off areas.

Exhibit 2-15
Updated Base Cost Comparisons in 2007 dollars (millions)

Costs/Funds	Keechelus Lake Alignment Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4/ Preferred Alternative
Keechelus Lake Alignment	832	498	396	241
CEA Improvement Packages area[1]	431 to 584	431 to 584	431 to 584	431 to 584
Total Estimated Base Cost by Alternative	1,263 to 1,416	929 to 1,082	827 to 980	672 to 825

Costs not adjusted to year of expenditure.
[1] CEA Improvement Packages area includes the improvements at the individual CEAs, additional lanes and chain-up/chain-off areas.
Estimates are based on level of design information available at the time of the update (May 2007) and include modifications discussed in Section 2.4, How was the project subsequently modified?

As WSDOT completed more of the project design, it was possible to include costs of risk and inflation to the year of construction. WSDOT uses the Cost Estimation Validation Process (CEVP) to estimate these cost factors. In August 2006, WSDOT performed a CEVP exercise covering the Preferred Alternative for Phase 1 of the project. WSDOT estimated the cost of Phase 1 at $474 million to $587 million, adjusted to the year of expenditure. Expressing project estimates as a range is an accepted practice because of the size and complexity of the project, which makes it difficult to accurately express costs in a single number.

The **Cost Estimate Validation Process™** is a comprehensive, risk-based method for estimating construction costs. The process is iterative in nature, with each set of results representing a "snapshot in time" under the conditions at that time. The process incorporates identifiable and quantifiable project risk factors such as planning, design, bidding, construction and changed conditions.

After estimating the costs for the Preferred Alternative, WSDOT applied the CEVP results to the full range of alternatives in Phase 1 by applying the same percentage increase to each of these alternatives to account for risk and inflation (Exhibit 2-16).

Exhibit 2-16
Cost Comparisons Including Risk and Inflation (millions)

Costs/Funds	Keechelus Lake Alignment Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4/ Preferred Alternative
Phase 1 including CEA area improvements[1]	1,358 to 1,681	858 to 1,063	706 to 874	474 to 587
Remaining project area[2]	516 to 752	516 to 752	516 to 752	516 to 752
Total Project Cost	1,874 to 2,433	1,374 to 1,815	1,222 to 1,626	990 to 1,339

Costs are adjusted to year of expenditure/mid-point of construction.
[1] Costs based on August 2006 CEVP results and the level of design information available at the time of the estimate.
[2] Currently unfunded. Estimates are based on January 2007 CEVP results and the level of design information available at the time of the estimate, and assume that initial funding occurs in 2009 with design following.

In January 2007, WSDOT used the CEVP process to estimate the costs for the remaining ten miles of the corridor, which is currently unfunded. Again, this analysis focused on the Preferred Alternative, and WSDOT estimated the costs of the Preferred Alternative for this portion of the project area at $516 million to $752 million. The alternatives in this part of the project area do not differ substantially, and WSDOT determined that this cost range can be applied to the range of alternatives (Exhibit 2-16).

How do the estimated costs compare to the available funding?

In 2005, the Washington State Legislature passed a 16-year spending plan to address some of Washington's most critical transportation needs. Over 270 projects will be funded by a 9.5 cent per gallon gas tax increase and other fees that were approved by Washington voters in 2005.

The statewide spending plan included $388 million for the first phase of the I-90 project. In 2007, the Legislature increased the allocation to approximately $545 million. This funding increase was a result of updated project design, changes in seismic codes, inflation cost, and market conditions.

The revised project costs can be compared to the available funding of approximately $545 million (Exhibit 2-17).

Exhibit 2-17
Total Project Cost Compared to Currently Allocated Funding (millions)

Costs/Funds	Alternative1	Alternative2	Alternative3	Alternative4/ Preferred Alternative
Estimated costs for Phase 1[1]	1,358 to 1,681	858 to 1,063	706 to 874	474 to 587
Allocated funding for Phase 1	545	545	545	545
Estimated shortfall for Phase 1	813 to 1,136	313 to 518	161 to 329	(71) to 42
Additional project cost for the remaining project area, including CEVP risks[2]	516 to 752	516 to 752	516 to 752	516 to 752
Total estimated project cost	1,874 to 2,433	1,374 to 1,815	1,222 to 1,626	990 to 1,339
Funding needed beyond current allocation to complete the project	1,329 to 1,888	829 to 1,270	677 to 1,081	445 to 794

Costs are adjusted to year of expenditure/mid-point of construction.
[1] Costs based on August 2006 CEVP results and the level of design information available at the time of the estimate.
[2] Currently unfunded. Estimates are based on January 2007 CEVP results and the level of design information available at the time of the estimate, and assuming that initial funding occurs in 2009 with design following.

Exhibit 2-17 shows that for Phase 1 (the only funded phase), the cost of Keechelus Lake Alignment Alternatives 1, 2, and 3 would exceed the funding available by between $161 million and $1.136 billion. Alternative 4, the Preferred Alternative, also could exceed the project allocation. However, if WSDOT aggressively manages construction risk, then the $545 million appropriated for Phase 1 could be sufficient to complete this part of the project.

How would the project affect the cost of maintenance and operations?

Maintenance and operations are activities that WSDOT must perform to keep the highway open to traffic and in good condition. Because of its location in the Cascade Mountain Range, WSDOT employs more maintenance staff in winter months for snow and ice removal and avalanche control. Maintenance and operation of the existing roadway requires WSDOT to employ 25 full time employees and 45 seasonal (winter) employees on Snoqualmie Pass. Six of these employees conduct avalanche control work. Snow and ice removal account for approximately 77 percent of WSDOT's annual maintenance budget for the Snoqualmie Pass area.

The build alternatives would vary in their effect on maintenance costs, but all of the build alternatives would require an increase in maintenance staff and equipment. This is because all of these alternatives would add new lanes, bridges, culverts, stormwater runoff facilities, and chain-up areas. These increases in maintenance costs are not part of the I-90 project budget.

WSDOT's maintenance staff works on areas both inside and outside of the project. In order to compare the impacts of the alternatives to maintenance costs, WSDOT estimated the cost of maintenance by lane mile.

Lane mile:

One mile of a single lane. A four-lane highway, for example, will have four lane miles for each mile of highway.

Tunnels have a much higher maintenance cost per lane mile than ordinary paved highways, based on the required systems for ventilation, lighting, fire detection, and maintenance of these systems. Tunnels also require additional staff for safety and emergency response. WSDOT used the annual maintenance costs for the Mt. Baker and Mercer Island I-90 tunnels as the basis for these lane mile costs. This does not include the cost of 24-hour monitoring, which requires 6.5 employees and costs $430,000 each year for the Mt Baker tunnels. WSDOT believes that these costs would be similar for the tunnels proposed in Alternatives 1, 2 and 3.

The estimated costs of maintenance are shown in Exhibit 2-18 and Exhibit 2-19.

Cost Conclusions

WSDOT's cost estimates show that the main cost driver for the project is the choice of alternatives along Keechelus Lake. The construction costs of the Keechelus Lake Alignment Alternatives vary widely, with Alternative 1, the most expensive, estimated at three to four times the cost of Alternative 4, the least expensive. These cost differences are the result of the high cost and risk of building tunnels.

Exhibit 2-18
Estimated Annual Maintenance Costs, Keechelus Lake Alignment Alternatives

	No Build	Alternative 1[1]	Alternative 2[2]	Alternative 3[3]	Alternative 4/ Preferred Alternative
Tunnel lane miles	0	11.4	3.6	2.4	0
Non-tunnel lane miles	13.2	9.4	17.2	19.0	20.8
Estimated annual maintenance costs	184,000	2,374,400	950,000	738,800	291,200
Estimated annual monitoring costs	0	430,000	430,000	430,000	0
Total costs	184,000	2,804,400	1,380,000	1,168,800	291,200

Based on 3.3 miles total length.
Approximate maintenance costs: tunnel lane miles: 197,000/lane mile/year, non-tunnel 14,000/lane mile/year.
[1] Two1.9 mile tunnels, each with three lanes
[2] Two 0.6 mile tunnels, each with three lanes
[3] One 0.6 mile tunnel with three lanes and one 0.6 mile tunnel with one lane (maintenance and emergency access)

Exhibit 2-19
Estimated Annual Maintenance Costs, CEA Improvement Packages

	No Build	Option Package A	Option Package B	Option Package C	Preferred Alternative
Total lane miles	50.6	78.0	78.0	78.0	78.0
Total estimated maintenance costs	708,000	1,092,000	1,092,000	1,092,000	1,092,000

Based on 11.9 miles of total length plus existing truck climbing lanes and existing chain-up areas for the No-Build Alternative, and expanded truck climbing lanes and chain-up areas for all of the build alternatives. Maintenance cost per lane mile is the same as for the Keechelus Lake Alignment non-tunnel lane miles.

Choosing any of the tunnel alternatives would very likely raise the cost of Phase 1 of the project well beyond the amount funded by the Legislature. The cost of the Preferred Alternative is reasonably equivalent to the amount funded.

While the maintenance and operations costs are not part of the project budget, these costs also would be substantially higher for any of the tunnel alternatives.

2.7 What are the expected environmental consequences?

As with any large construction project, the I-90 project will produce both beneficial and adverse environmental impacts. Overall, all of the project partners expect that the project's beneficial effects would be much larger than adverse impacts.

Summary of Beneficial Effects

Benefits to Traffic Safety and Capacity

All of the build alternatives would provide increased capacity for traffic by widening the highway to three lanes in each direction. Slope stabilization and the new snowshed would reduce the danger of avalanches and rock fall hazards. Straightening the highway where possible and building wider shoulders would lower the danger of accidents. Building wildlife crossing structures would reduce the potential for collisions between wildlife and vehicles. These beneficial effects would be similar for all of the build alternatives, except in the area of collisions between wildlife and vehicles, where the Preferred Alternative would provide the greatest benefit, since the wildlife crossing structures in this alternative most closely meet the project's ecological connectivity objectives.

Benefits to Social Values

Benefits to the social environment would include improved scenic quality by implementing the Cascadian Architectural design theme. Additional social benefits would include the reduction of driver frustration due to traffic backups, and increased access to recreation areas. Increasing wildlife habitat connections in the project area also has been identified as an important social value.

Benefits to Economic Values

All of the build alternatives would result in greater predictability and fewer delays to freight transport, as the avalanche, rock fall and sharp curve problems are corrected. All of the build alternatives would reduce the economic costs of traffic delays. All would result in reduced costs of pavement repair, as the project would replace the current deteriorated pavement. All would result in temporary increases to employment during construction.

Benefits to the Natural Environment

All of the build alternatives would result in benefits to wildlife and wildlife habits. Crossing structures would result in a greater ability for wildlife to safely cross the highway, which would include both larger, more mobile species such as deer and bear, and smaller, less mobile species such as amphibians. All would result in more natural stream channel movement and fish passage by replacing narrow bridges and culverts with longer bridges and bottomless culverts. All would result in increased habitat connections at the CEAs, which may lead to an improved species viability rate.

These beneficial effects would be greatest for the Preferred Alternative, which has been designed to most fully meet the project's ecological connectivity objectives. Benefits would be smaller for the other build alternatives, and for CEA Improvement Package C, these benefits would not always meet the project's purpose and need.

All of the build alternatives would improve groundwater flow under the highway by placing small culverts at identified hydrologic connectivity zones (HCZs). This benefit would be similar for all of the build alternatives.

Under all of the build alternatives, water quality would improve, as WSDOT would install structures for stormwater runoff treatment for both existing and new impervious surfaces. This would include compensatory treatment for areas where terrain makes stormwater treatment difficult or impossible.

Beneficial effects are discussed in more detail in Chapter 3, *Affected Environment and Consequences*.

Summary of Adverse Impacts

Adverse Impacts to Social Values

Construction of any of the build alternatives would result in some temporary social impacts, including traffic delays due to construction and noise impacts to residents and recreation users. The only permanent adverse social impacts would be replacing the existing snowshed, which is an historic structure. WSDOT does not expect the project to result in relocation of residences or businesses. The adverse impacts of the build alternatives would be very similar.

Adverse Impacts to Economic Values

Construction of any of the build alternatives would cause some temporary economic impacts, primarily due to traffic delays. There would be no permanent adverse economic impacts. For the Keechelus Lake Alignment Alternatives, the Preferred Alternative would most likely have the lowest impact since the period of construction would be the shortest. For the CEA Improvement Packages, the adverse impacts of the build alternatives would be very similar.

Adverse Impacts to the Natural Environment

Construction of any of the build alternatives would cause some temporary impacts to the natural environment, primarily from disturbed vegetation. Temporary impacts would be limited to the period of construction and would be successfully mitigated through construction best management practices (BMPs).

Any of the build alternatives would cause some permanent impact, primarily from the placement of new highway fill. Adverse impacts would include loss of terrestrial, riparian and aquatic habitat, including some project area wetlands, streams, and deep water areas of Keechelus Lake. The overall area of impact would be very similar for any of the build alternatives; however, the Preferred Alternative would shift impacts from higher to lower-quality wetlands.

Due to removal of mature forest, the project would potentially impact one species listed under the ESA: the northern spotted owl.

Adverse impacts are discussed in more detail in Chapter 3, *Affected Environment and Consequences*, and summarized in Exhibit 2-20 and Exhibit 2-21.

Exhibit 2-20
Permanent Adverse Impacts, Keechelus Lake Alignment Alternatives

Element of the Environment	No Build	Alternative 1	Alternative 2	Alternative 3	Alternative 4/ Preferred Alternative
Geology and Soils					
Avalanche hazards	Increase	Decrease	Decrease	Decrease	Decrease
Total disturbed area (acres)	None	36.9	52.7	55.8	58.7
Air Quality					
	None	None	None	None	None
Water Resources[1]					
Water quality	No change	Meets Highway Runoff Manual			
Wetlands and Other Jurisdictional Waters[1]					
Category I wetlands (acres)	None	2.00	1.93	1.41	0.00
Category II wetlands (acres)	None	0.87	0.87	0.87	0.87
Category III wetlands (acres)	None	0.36	0.36	1.02	0.80
Wetlands without hydric soil indicators (acres)	None	3.89	4.02	4.48	4.48
Category IV wetlands (acres)	None	0.26	0.46	0.46	0.46
Total Wetlands (acres)	None	*7.39*	*7.64*	*8.24*	*6.61*
Wetland Buffers (acres)	None	8.15	10.17	9.11	7.64
Reservoirs (acres)	None	0.94	1.22	4.06	3.80
Streams (acres)	None	0.19	0.19	0.08	0.07
Potentially jurisdictional ditches (linear feet)	None	454	1,522	1,560	2,538
Terrestrial Species					
Total Terrestrial Habitat Filled (acres)	None	31.3	46.7	45.8	49.2
Mature Forest Filled (acres)	None	1.7	3.4	2.8	5.1
Transportation					
LOS D	2013	2041	2041	2041	2041
LOS E	2025	2058	2058	2058	2058
Noise					
	Noise will increase with traffic volume, but will not meet federal abatement criteria.				
Historic, Cultural, and Archaeological Resources					
	None	None	Removal of the snowshed	Removal of the snowshed	Removal of the snowshed
Recreation Resources					
	None	None	None	None	None

Exhibit 2-20
Permanent Adverse Impacts, Keechelus Lake Alignment Alternatives

Element of the Environment	No Build	Alternative 1	Alternative 2	Alternative 3	Alternative 4/ Preferred Alternative
Land Use					
Private Land (approximate acres acquired)	0	6.8	7.4	4.5	0.7
Public Land (approximate acres acquired)	0	89.3	48.6	43.5	39.3
Total	*0*	*96.1*	*56.0*	*48.0*	*40.0*
Visual Quality					
	None	Minimal	Minimal	Minimal	None
Social and Economic Resources					
	Continued road closures	None	None	None	None
Hazardous Materials and Waste					
	None	None	None	None	None
Energy					
	Lowest Consumption	Highest Consumption	2nd Highest Consumption	3rd Lowest Consumption	2nd Lowest Consumption

The area of permanent impact is between MP 56.6 and MP 59.9.

[1] *Impacts to wetlands and water resources have been delineated and surveyed and are shown to the nearest hundredth of an acre; other areas are based on field measurements, surveyed footprint, and GIS analysis, and are shown to the nearest tenth of an acre.*

Exhibit 2-21
Permanent Adverse Impacts, CEA Improvement Packages Area

Element of the Environment	No Build	Option Package A	Option Package B	Option Package C	Preferred Alternative
Geology and Soils					
Total disturbed area (acres)	None	203.2	208.2	211.5	205.5
Air Quality					
	None	None	None	None	None
Water Resources					
Water quality	No change	Meets Highway Runoff Manual			
Wetlands and Other Jurisdictional Waters[1]					
Category I wetlands (acres)	None	0.23	0.32	0.42	0.3
Category II wetlands (acres)	None	3.28	3.54	3.51	4.39
Category III wetlands (acres)	None	2.61	3.24	3.31	2.59
Wetlands without hydric soil indicators (acres)	None	1.23	1.23	1.23	1.30
Category IV wetlands (acres)	None	1.00	1.05	1.05	1.01
Total Wetlands (acres)	None	*8.35*	*9.38*	*9.52*	*9.59*
Wetland Buffers (acres)	None	13.30	14.52	14.90	13.45
Reservoirs (acres)	None	2.30	2.34	2.34	2.33
Streams (acres)	None	0.83	0.85	0.91	0.83
Potentially jurisdictional ditches (linear feet)	None	1,229	1,285	1,205	1,272
Terrestrial Species					
Wildlife mortality	Increase	Decrease	Decrease	Decrease	Decrease
Total Terrestrial Habitat Filled (acres)	None	197.2	202.2	205.5	199.5
Mature Forest Filled (acres)	None	70.2	71.3	79.1	70.3
Transportation					
LOS D	2013	2041	2041	2041	2041
LOS E	2025	2058	2058	2058	2058
Noise					
	Noise will increase with traffic volume, and may meet abatement criteria at Lake Easton State Park.				
Historic, Cultural, and Archaeological Resources					
	None	None	None	None	None
Recreation Resources					
	None	Closure of Price Creek Sno-Park (Westbound) and Price Creek Interim Rest Area (Eastbound)			

Exhibit 2-21
Permanent Adverse Impacts, CEA Improvement Packages Area

Element of the Environment	No Build	Option Package A	Option Package B	Option Package C	Preferred Alternative
Land Use					
Private Land (approximate acres acquired)	0	6.6	6.6	6.6	6.6
Public Land (approximate acres acquired)	0	87.9	87.9	87.9	87.9
Total	*0*	*94.5*	*94.5*	*94.5*	*94.5*
Visual Quality					
	None	None	None	None	None
Social and Economic Resources					
	Continued road closures	None	None	None	None
Hazardous Materials and Waste					
	None	None	None	None	None
Energy					
	Lowest Consumption	2nd Highest Consumption	3rd Lowest Consumption	2nd Lowest Consumption	Highest Consumption

The area of permanent impact includes the entire project area except the area between MP 56.6 and MP 59.9.
[1] Impacts to wetlands and water resources have been delineated and surveyed and are shown to the nearest hundredth of an acre; other areas are based on field measurements, surveyed footprint, and GIS analysis, and are shown to the nearest tenth of an acre.

2.8 How would FHWA and WSDOT mitigate for the adverse impacts?

The project's approach to mitigation began with designing the project to avoid and minimize impacts. These efforts included:

- Identifying project alternatives that would have the lowest level of impact
- Making small adjustments to the location of the new highway to avoid areas of sensitive habitat wherever possible
- Designing the new highway to treat stormwater for the equivalent of all new and impervious surfaces in the project area
- Designing bridges and culverts to state design standards and the performance standards recommended by the MDT and IDT

The lead agencies have committed to using appropriate BMPs to mitigate for the impacts of construction. Construction BMPs are designed to assure compliance with all applicable regulations, permit conditions, and the conditions of the transfer of federal land to FHWA and WSDOT for the expanded highway.

Where environmental impacts remain, the lead agencies have committed to performing compensatory mitigation. BMPs and compensatory mitigation are discussed in more detail in Chapter 3, *Affected Environment and Consequences* and summarized in Chapter 4, *Mitigation Summary*. Mitigation methods would be different for each element of the environment. Exhibit 2-22 summarizes the project's approach to compensatory mitigation where needed.

2.9 Would there be unavoidable impacts following mitigation?

FHWA and WSDOT believe that following mitigation there would be no substantial adverse impacts to any element of the environment.

2.10 How would construction affect travel in the project area?

Construction of any of the build alternatives would affect travel in the project area. These impacts would include detours, construction work zones, and reduced speed limits.

WSDOT has made several commitments to minimize impacts to traffic while the project is under construction. WSDOT will keep two lanes open in each direction during construction during peak driving times except for rare exceptions. Construction would sometimes require WSDOT to reduce traffic to a single lane; however, WSDOT will keep lane closures as short as possible and would typically limit them to Monday through Thursday during low traffic periods. During blasting operations, traffic traveling both directions would be required to stop as a safety measure.

Exhibit 2-22
Compensatory Mitigation Approach and Project Commitments for Permanent Impacts

Element of the Environment	Compensatory Mitigation Approach
Geology and Soils	Since there will be no permanent adverse impacts to geology and soils, no compensatory mitigation will be required.
Air Quality	Since there will be no permanent adverse impacts air quality, no compensatory mitigation will be required.
Water Resources	WSDOT will provide stormwater treatment for the equivalent of all impervious surfaces. To compensate for areas where the terrain makes treatment impracticable, WSDOT will provide additional treatment in other off-site locations in or near the project corridor. WSDOT will use the *Highway Runoff Manual* Appendix 2A procedure or the “equivalent area” approach to mitigate for constrained areas in which stormwater treatment is physically impossible. This approach allows WSDOT to retrofit stormwater treatment onto existing off-site impervious surface with pollution loading characteristics similar to the constrained areas.
Wetlands and Other Jurisdictional Waters	**Restoration** WSDOT will restore wetland areas, stream channels and riparian areas at each CEA where new bridges and culverts are installed. Wetlands and riparian areas probably existed prior to the original highway construction at these locations, and WSDOT’s actions will reestablish connections between wetlands and other high quality habitats, as well as restore channel migration and floodplain functions. Mitigation measures proposed at locations within and adjacent to CEAs include: • Restoring and creating wetland, stream, and riparian zone area and function • Restoring connections between wetlands and other important wildlife habitats • Restoring channel migration and surface and subsurface flow paths • Restoring connections between streams, floodplains, and riparian zones • Restoring passage for fish and aquatic organisms at stream crossings Impacts from these restoration activities would be limited to soil disturbance during construction. Mitigation sites temporarily affected by construction will be restored once construction is complete. Restoration activities may include: • Restoring pre-construction contours • Replacing or amending surface soils • Planting or seeding with native herbaceous and/or woody vegetation WSDOT will maintain and monitor all planted areas, based on the commitments made in the final Wetland & Aquatic Resource Mitigation Plan, which will be completed by WSDOT as part of project permitting. **Habitat Preservation** WSDOT is acquiring a 265-acre property for habitat preservation in the Gold Creek Valley. This property contains wetlands, riparian areas, and mature forest, including potential habitat for northern spotted owls, marbled murrelets, and bull trout. This property has potential for high-density development, which would be avoided through this acquisition. WSDOT has committed to preserve this property in perpetuity.

Exhibit 2-22
Compensatory Mitigation Approach and Project Commitments for Permanent Impacts

Element of the Environment	Compensatory Mitigation Approach
	Proposed Wetland Mitigation Ratio WSDOT will compensate for unavoidable impacts to wetland area and function at a minimum 1:1 mitigation ratio, in accordance with Federal Executive Order 11990, Governor's Executive Order 89-10 (Protection of Wetlands: "No Net Loss") and WSDOT Directive 31-12 (Protection of Wetlands Action Plan). A Clean Water Act Section 404 permit will be obtained. **Highway Reclamation** As phases of the project are completed, WSDOT will perform extensive restoration activities that include areas of additional forested habitat, highway reclamation, buffer improvements, and highway slope vegetation with native species.
Fish, Aquatic Species, and Habitats	The lead agencies believe that by combining avoidance, mitigation, and BMPs, the impacts of the project to fish and other aquatic species and their habitats will be minimized. Potential impacts to Columbia River bull trout will be avoided and/or minimized through compliance with the applicable measures specified in the USFWS Biological Opinion. The project also will implement the conservation measures in the *Biological Assessment* and the *Biological Evaluation*. The remaining impacts will be mitigated through beneficial effects including fish passage restoration, increase in overall habitat, improved in-stream physical processes, and improved water quality. Consequently, no additional compensatory mitigation will be required.
Terrestrial Species	FHWA and WSDOT believe that by combining avoidance, mitigation, and BMPs, the impacts of the project to terrestrial species will be minimized. Potential impacts to the marbeled murrelet and northern spotted owl will be avoided and/or minimized through compliance with the applicable measures specified in the USFWS Biological Opinion. The project also will implement the conservation measures in *the Biological Assessment* and *the Biological Evaluation*. The project will mitigate for the remaining impacts through the beneficial effects of the build alternatives, which includes improved ecological connectivity, an increase in riparian habitat, and a decrease in wildlife mortality. Consequently, no additional compensatory mitigation will be required. However, WSDOT has acquired areas of mature forest now in private ownership as part of the preservation component for wetlands.
Transportation	Since there will be no permanent adverse impacts to transportation, no compensatory mitigation will be required.
Noise	WSDOT found that a noise wall at Lake Easton State Park Campground would be both feasible and reasonable. Lake Easton State Park is not within the currently funded portion of the project. When funding becomes available for this portion of the I-90 project, WSDOT will conduct a supplemental noise analysis that addresses potential noise impacts and the feasibility of a noise barrier wall. WSDOT will continue to consult with State Parks to determine whether a noise wall or other suitable noise mitigation measure is required at Lake Easton State Park.

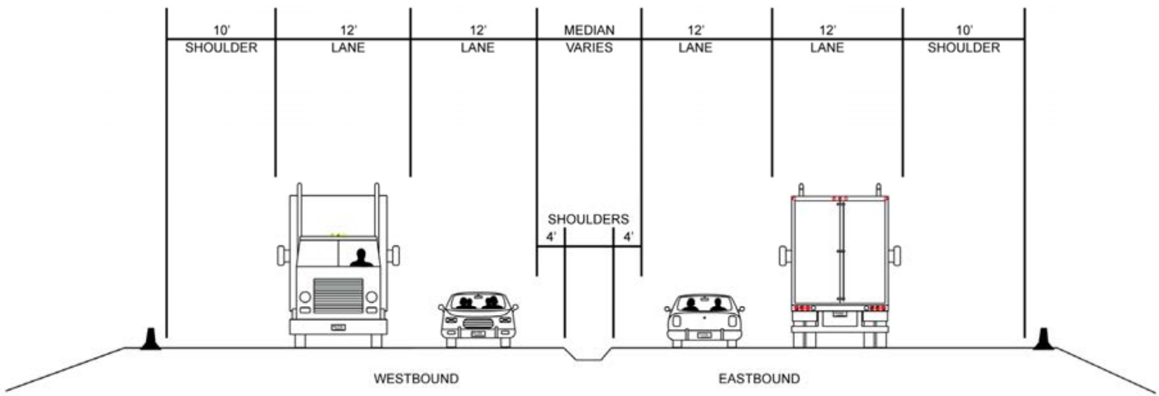
Exhibit 2-22
Compensatory Mitigation Approach and Project Commitments for Permanent Impacts

Element of the Environment	Compensatory Mitigation Approach
Historic, Cultural, and Archaeological Resources	WSDOT has agreed on the following measures, all located at Travelers' Rest, a potentially historic WSDOT-owned building located at the Snoqualmie Pass summit: • Historic structures report for the Travelers' Rest building • Site assessment of current and potential uses of Travelers' Rest, including mitigation options and needs • Phase 1 environmental site assessment for hazardous materials Interpretive signs at Travelers' Rest depicting historic travel, including Native Americans, over Snoqualmie Pass, history of the Travelers' Rest building and site, and history and engineering facts of the snowshed
Recreation Resources	WSDOT has committed to improving the Crystal Springs Sno-Park and Cabin Creek Sno-Park based on the long-term plans for those locations. WSDOT will develop an agreement with State Parks for the Crystal Springs Sno-Park to identify other temporary and long-term commitments for the site. WSDOT will work with the USFS to develop a Special Use Permit that will specify details for WSDOT's temporary occupancy of the Cabin Creek Sno-Park and long-term reclamation for the site. WSDOT will replace the parking afforded by the Price Creek Sno-Park (Westbound) at a location to be determined in consultation with the USFS, and the current parking will be restored. The new location will not conflict with resources managed by State Parks or the USFS. WSDOT will not close the Price Creek Sno-Park (Westbound) until funding has been received for the remainder of the project, and a replacement site has been identified, designed, and constructed.
Land Use	In the event that residents or businesses are relocated, WSDOT will comply with the terms of the federal Uniform Relocation Act of 1970, as amended.
Visual Quality	FHWA and WSDOT will comply with the requirements of the Project Architectural Design Guidelines and project roadside master plan.
Social and Economic Resources	Since there will be no permanent adverse impacts to social and economic resources, no compensatory mitigation will be required.
Hazardous Materials and Waste	Since there will be no permanent adverse impacts to hazardous materials and waste, no compensatory mitigation will be required.
Energy	Since there will be no permanent adverse impacts to energy, no compensatory mitigation will be required.

BMP – best management practice
CEA – connectivity enhancement area
FHWA – Federal Highway Administration
USFS – US Forest Service
USFWS – US Fish and Wildlife Service
WSDOT – Washington State Department of Transportation

Currently, the existing typical highway cross section consists of four 12-foot lanes (two in each direction of travel), 10-foot outside shoulders, and four-foot inside shoulders (Exhibit 2-23).

Exhibit 2-23
Existing Highway Cross Section



During construction, WSDOT would use a similar highway cross section. Traffic would be routed away from the work zone on four 12-foot lanes, two in each direction of travel. Both the inside and outside shoulders would be four feet wide. The traffic capacity of the construction detour lanes would be reduced from 2,000 to 1,300 vehicles per hour per lane, as a result of the unfamiliar alignment and reducing the speed limit to 55 mph in the work zone. Detour lanes would be located within the project's disturbed area and would not create additional environmental impact.

Typically, construction would stop for the winter, and traffic would be separated from construction zones using a four-lane configuration similar to existing conditions where possible.

Conceptual Construction Phasing

Each of the build alternatives would result in different construction phases, and WSDOT will determine the exact sequence of construction steps during final design and permitting.

For the Preferred Alternative, WSDOT would use the following general approach to Phase 1 of the project, the funded phase between Hyak and Keechelus Dam:

- ***Phase 1A.*** Build a detour bridge at Gold Creek, develop the materials site at Rocky Run Creek, and stockpile and process material from the Rocky Run Creek site at Crystal Springs Sno-Park. This sub-phase would begin in 2009 and last for one construction season.

- ***Phase 1B.*** Widen the highway between MP 55.1 (the project end point at Hyak) and MP 57.5, including the bridges at Gold Creek and the culverts at Rocky Run Creek, Wolfe Creek and Unnamed Creek (MP 57.3). This sub-phase would begin in 2010 and last for four construction seasons.

- ***Phase 1C.*** Widen the highway from MP 57.5 to the end of Phase 1 at MP 59.9, including the culverts and bridges at Resort Creek, Unnamed Creek (MP 59.7), and Townsend Creek, and construct the new snowshed. WSDOT will extend Phase 1C past MP 59.9 if the budget allows. This sub-phase would begin in 2011 and last for five construction seasons.

More detailed information on potential construction phasing for the Preferred Alternative can be found in the *Transportation Discipline Report* (Appendix P).

Bicycle Traffic

Bicycle traffic will be affected during construction, since the existing shoulder may become hazardous or temporarily unusable. Along the narrow area of the highway along Keechelus Lake, it will be particularly difficult for bicycles and vehicles to coexist.

WSDOT has considered several options to manage bicycle traffic, and currently plans to use a combination of four options:

- Informing local bike clubs of planned closures so that they can alert their members

- Temporary bicycle detours through the construction zone

- Temporary closures with event shuttles and posted detour routes

- Equipping incident response team vehicles with bicycle racks that could accommodate three to four bicycles so that the incident response team vehicles could give bicyclists rides through the construction zone

After construction, WSDOT would continue allowing bicyclists to use the outside paved shoulders of I-90. None of the build alternatives include specific improvements for pedestrians or bicycles.

2.11 Where would construction materials be stored and processed?

WSDOT identified five potential aggregate sources. WSDOT's preferred site is Pit Site PS-S-255, a gravel pit located at the mouth of Rocky Run Creek and submerged when Keechelus Lake is at high water.

Pit site PS-S-255 contains approximately 500,000 cubic yards of material, of which only 50 percent is suitable for aggregate. WSDOT would use approximately 200,000 to 300,000 cubic yards of material. These materials are exposed only during low lake levels. WSDOT could extract these aggregate materials only when Keechelus Lake water levels are low enough to gain access to the site.

Additional area would be needed to store and process construction material and stage equipment during project construction. WSDOT evaluated 19 potential sites within the project corridor, all of which were previously disturbed (Exhibit 2-24). WSDOT evaluated each site using three sets of criteria: fatal flaws, benefits vs. constraints, and logistical information such as distance from the site to highway interchanges. WSDOT's analysis is presented in the *Materials and Staging Report* (Appendix E).

Auxiliary Site Types

Material Source: provide various materials (mainly aggregates) for the project.

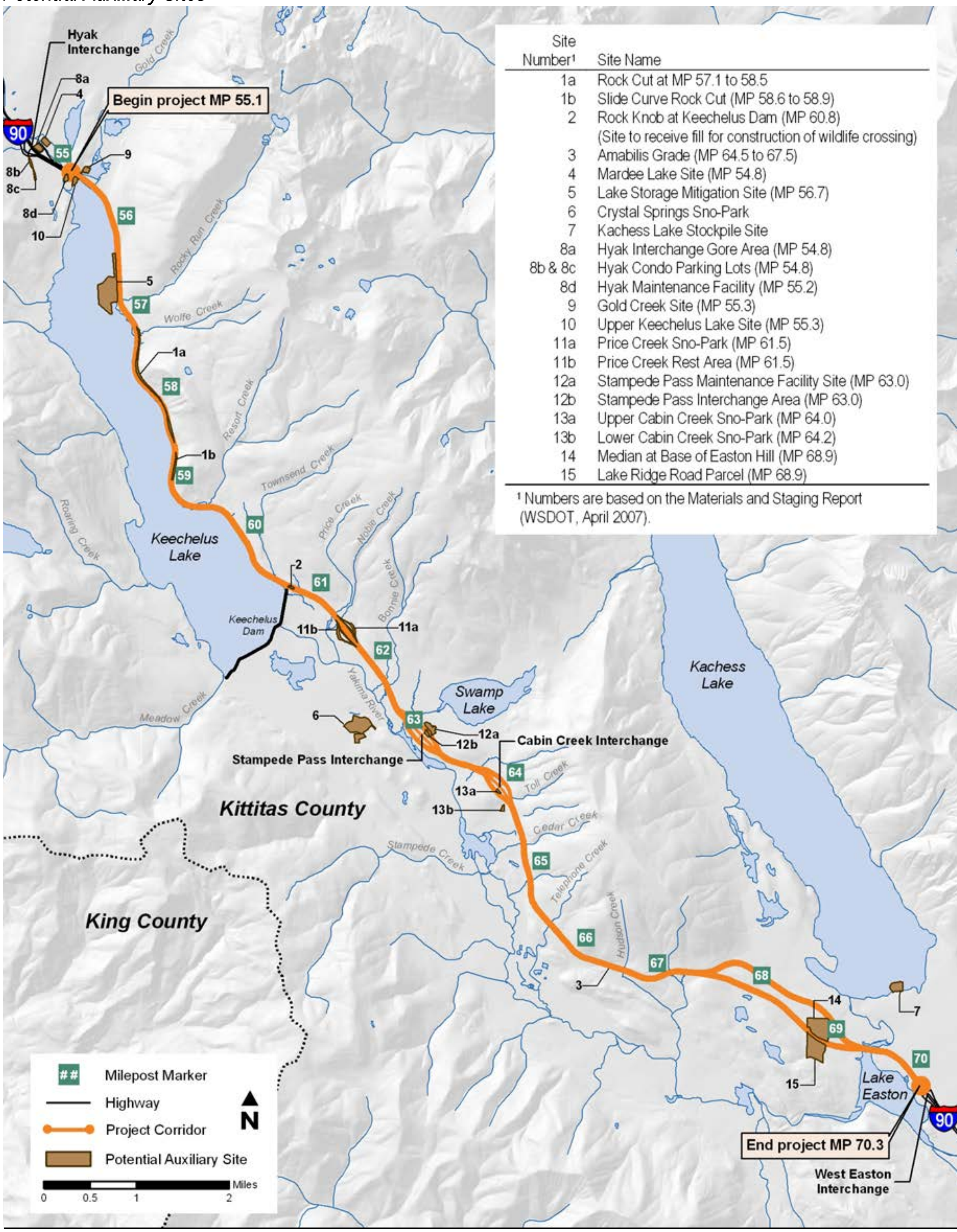
Staging: support maintenance and storage of equipment, field offices, refueling, parking areas for work crews, and/or material delivery and stockpile for project materials other than roadway materials.

Processing: refine raw materials into usable materials using asphalt plants, concrete batch plants, and/or aggregate crushers.

Stockpiling: accumulate roadway materials (such as crushed aggregate or recycled roadway materials) for distribution to construction locations.

Wasting: dispose of excess materials, some of which may not be considered suitable for use in the project.

Exhibit 2-24
Potential Auxiliary Sites



CEA borders illustrate the general locations where the project will invest more resources to meet ecological connectivity objectives. Public and private lands near these CEAs are not part of the I-90 project. The project may acquire private land near CEAs via purchase, easement, and/or federal land transfer.

Based on this rating, WSDOT identified four preferred sites and 13 acceptable sites. The most likely site would be the Crystal Springs Sno-Park, which would be used during Phase 1 for processing aggregate and for storing materials and equipment. The site is 78 acres in size, is partly disturbed, and is conveniently located in the approximate center of the project area. Using the disturbed portion of this site during construction would not affect its primary use for winter recreation, since WSDOT would not use it during the winter. After construction, WSDOT, in consultation with State Parks, would leave the Crystal Springs Sno-Park in a configuration that would allow winter use.

Additional information on materials, staging, and stockpiling sites can be found in the *Materials and Staging Report* (Appendix E).

WSDOT does not plan to use the Kachess Lake Stockpile Site (Site Number 7) during construction of Phase 1. However, this site may be used during subsequent phases. This site is outside the project area, and if WSDOT decides to use this site, environmental documentation will be supplemented as needed to include the site.

WSDOT may not require contractors to use its preferred auxiliary sites in every case. However, FHWA and WSDOT would require any other proposed sites to meet all requirements for environmental review and permitting prior to use, and such sites would be reviewed for compliance with the project's ecological connectivity objectives.

Either the contractor or WSDOT would obtain proper permitting for each auxiliary site prior to use. Permit conditions will determine how each site will be treated after construction is completed. Sites may remain in operation, be reclaimed to a more natural condition, or recovered for another use such as recreation.

Based on WSDOT's assessment of potential sites, the only potential environmental impact of using these sites would be disturbance to wetlands. WSDOT has inventoried potential sites for wetlands and will continue to examine these sites during project permitting to make sure that there are no changes that would increase impacts beyond those described within the Final EIS. The lead agencies believe that these potential impacts can be avoided through avoidance, minimization, timing, and the use of construction BMPs. Restoring the sites following completion of the project would create a substantial environmental benefit.