Forest Service
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Pacific Northwest Region, Mt. Baker-Snoqualmie National Forest April 2025

North Fork Stillaguamish Landscape Analysis

Environmental Assessment

Darrington and Mt. Baker Ranger Districts, Skagit and Snohomish Counties, WA

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Introduction

This environmental assessment (EA) has been prepared to determine whether effects of the proposed activities may be significant enough to prepare an environmental impact statement. Preparing this EA fulfills agency policy and direction to comply with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations.

Location of the Proposed Project Area

This project is located northwest of the city of Darrington, Washington. The project area boundary encompasses approximately 61,849 acres, with approximately 34,978 acres on the Darrington Ranger District, and 26,871 acres on the Mt. Baker Ranger District. It is predominantly in Skagit County (97%), with a small portion in Snohomish County (3%). See Table 1 for additional location information.

Table 1. Project area location

Township	Range	Section(s)
32N	8E	1, 3, 4, 5 and 6
33N	8E	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35 and 36
33N	9E	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 28, 29, 30, 31, 32 and 33
34N	7E	7, 8, 9, 10, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 32, 33, 34
34N	8E	13, 24, 25, 26, 30, 31, 34, 35, 36
34N	9E	19, 20, 21, 22, 27, 28, 29, 30, 31, 32, 33 and 34

Management Direction

This environmental assessment has been prepared in accordance with regulations for implementing the National Environmental Policy Act of 1969 (NEPA), located at 40 CFR 1500 to 1508. It is tiered to the Final Environmental Impact Statement (FEIS) for the Mt. Baker-Snoqualmie National Forest Land and Resource Management Plan (Mt. Baker-Snoqualmie Forest Plan, USDA Forest Service 1990), as amended. Major plan amendments since 1990 include:

- Final Supplemental Environmental Impact Statement on Management of Habitat for Late Successional and Old-growth Forest Related Species Within the Range of the Northern Spotted Owl, as adopted and modified by the April 1994 Record of Decision (ROD), which provides additional standards and guidelines (USDA FS and USDI BLM 1994, commonly known as the Northwest Forest Plan (NWFP)); Record of Decision to Clarify Provisions Relating to the Aquatic Conservation Strategy Amending Resource Management Plans (USDA Forest Service and USDI Bureau of Land Management 1994).
- Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (USDA Forest Service and USDI Bureau of Land Management 2001).
- Forest-wide Environmental Assessment for Invasive Plants Record of Decision, Prevention Strategy/Best Management Practices for Noxious Weed Management (USDA Forest Service 2005);

Region 6 Record of Decision for Preventing and Managing Invasive Plants (USDA Forest Service 2005); Mt. Baker-Snoqualmie National Forest Invasive Plant Treatment Record of Decision (USDA Forest Service 2015)

The following documents are incorporated by reference.

- The North Fork Stillaguamish Watershed Analysis (USDA Forest Service 2000) characterized the watershed processes and aquatic conditions for the watershed and the associated subwatersheds.
- The Deer Creek Watershed Analysis (USDA Forest Service 1996) characterized the watershed processes and aquatic conditions for the watershed and the associated subwatersheds.
- Other sources of information cited in this EA and its project file, such as specialist reports, published studies and books.

NWFP and the Finney Adaptive Management Area

The North Fork Stillaguamish project area is located completely within the Finney Adaptive Management Area (AMA), designated in 1994 by the NWFP (1994 ROD, D-13). Eighty-seven percent of the Finney AMA falls within Late Successional Reserve (LSR) 802 (USDA, 2011). The NWFP requires each AMA to have a collaboratively developed AMA plan. While an AMA Plan is not a formal decision document, the required process for plan development and approval is part of, and clearly articulated in, the NWFP. Each AMA plan addresses, among other things, the learning themes and the kinds of experimental activities that will be implemented to achieve the objectives of each AMA while also managing according to standards and guidelines. Plan approval requires coordination with the Regional Ecosystem Office (REO) (1994 ROD, D-12).

The hierarchy of standards and guidelines within AMAs is also addressed in the NWFP. Management activities must be conducted to achieve the AMA objectives according to the associated standards and guidelines, including those for LSR where those reserves are designated. However, the Finney AMA was specifically provided the flexibility to develop a plan that changes LSR designations based on site-specific analysis and in coordination with the Regional Ecosystem Office (1994 ROD, D-11, D-12). The Finney AMA Plan was collaboratively developed and analyzed and then approved by the REO in 2011. Although no changes to LSR designations were proposed, some innovative treatment approaches were included in the plan and are proposed under this project. As an example, in this project, Variable Density Thinning (VDT) gaps, or areas of non-uniform openings, would be 0.5 to 2 acres in size as outlined in the Finney AMA Plan. Gaps, or openings, in LSR would normally be restricted to 0.25 acres in size[1].

The approved Finney AMA Plan (2011) does not differentiate between land allocations. Under the Finney AMA plan, two major learning themes have been designated: the Restoration of Late-Successional Forest and the Restoration of Riparian Habitat Conditions. These two objectives are constant across the entire AMA, including both the Adaptive Management Area – Reserved (AMA-R) and the Adaptive Management Area – Non-Reserved (AMA-NR) (Table 2).

Initial scoping for this project included some potential actions that, upon further review, would require a modification to the current Finney AMA plan. Any modifications to the AMA plan would require REO review and approval. Careful analysis of any proposed AMA plan revision would be needed to assure consistency with Endangered Species Act and National Forest Management Act requirements (ROD D-

[1] "Three to 10 percent of the resultant stand would be in heavily thinned patches (i.e., less than 50 trees per acre), or in openings up to 1/4 acre in size, to maximize individual tree development, encourage some understory vegetation development, and encourage the initiation of structural diversity." (REO 1996).

13, 14). This analysis would likely also require an updated LSR assessment for LSR 802. Collectively, the steps to modify the Finney AMA would require more time and resources than are currently available. This does not preclude the possibility of updating the Finney AMA Plan in the future.

Land Allocations

The land allocations described in the NWFP for the project area shown and defined in Table 2 with their total and treatable acres within the project area. For vegetation treatments proposed in the 61,849 acre project area, treatment would only occur within allocations that are suitable timberland and allow timber harvest. There are 19,169 acres of combined treatable commercial and non-commercial stands, approximately 30% of the project area.

Appendix A, Figure 1 displays the Nork Fork Stillaguamish Landscape Analysis project by NWFP land allocations.

Table 2. Northwest Forest Plan Land Allocations with total and treatable acres within the project area.

NWFP Land Allocation Description[2]	Project Area Acres	Treatable Acres[3]
Adaptive Management Areas – Reserved (AMA-R): Identified to develop and test innovative management to integrate and achieve ecological, economic, and other social and community objectives. Emphasis on restoration of late-successional forests and managed as an LSR (AMA-R)	51,521	12,881
Adaptive Management Areas – Non-Reserved (AMA-NR): Identified to develop and test innovative management to integrate and achieve ecological, economic, and other social and community objectives. Some commercial timber harvest was expected to occur in these areas, but with ecological objectives.	10,246	6,288
Forest Service Land Acquired after completion of Forest Plan (not designated, managed by nearest neighbor designation, AMA-R)	82	
Total	61,849	19,169

The project area is also allocated into land use allocations, or management areas (MAs) by the Mt. Baker Snoqualmie National Forest Land and Resource Management Plan ("Forest Plan", USDA 1990), as amended by the Northwest Forest Plan ("NWFP", USDA and USDI 1994). Many management areas across the Mt. Baker Snoqualmie National Forest (MBS) are specific to habitats and local objectives. The management areas are displayed for the project area in Appendix A, Figure 2. There is considerable overlap among some allocations, and more than one set of standards and guidelines may apply.

In areas where both Northwest Forest Plan Standards and Guidelines and 1990 Forest Plan management area standards and guidelines apply, the more restrictive set of standards and guidelines providing greater benefits to late-successional forest-related species would be implemented. Forest Plan management areas within the project area are displayed in Table 3, highlighting which set of standards and guidelines would prevail.

[2] Regional Ecosystem Office.
[3] Commercial and non-commercial stands. Treatment would only occur within allocations that are suitable timberland and allow timber harvest.

Table 3. Forest Plan Management Areas

MBS Land Allocations are ***more*** restrictive than NWFP Standards and Guidelines for late successional forest related species	Project Area Acres	Treatable Acres[4]
AMA-R (Late Successional Reserve, AMA)	45,542	12,535
12 - MATURE AND OLD GROWTH WILDLIFE HABITAT (AMA-NR)	297	88
19 - MOUNTAIN HEMLOCK ZONE, (AMA-R & AMA-NR)	2,154	375
1B - SEMI-PRIMITIVE NON-MOTORIZED (AMA-R)	3,853	0
25B – ELECTRONIC SITE (AMA-NR)	1	1
Total	51,847	12,999
NWFP Standards and Guidelines are *more* restrictive than MBS Land Allocations for late successional forest related species	**Project Area Acres**	**Treatable Acres**
14 - DEER AND ELK WINTER RANGE (AMA-NR)	1,086	434
17 - TIMBER EMPHASIS (AMA-NR)	7,402	4,947
2B – MIDDLEGROUND (AMA-NR)	1,432	789
99 – FOREST SERVICE LAND ACQUIRED AFTER COMPLETION OF THE FOREST PLAN (AMA-R)	82	0
Total	10,002	6,170
Grand Total	**61,849**	**19,169**

NWFP Riparian Reserves (RR): This Northwest Forest Plan allocation includes areas along all streams, wetlands, ponds, lakes and unstable or potentially unstable areas. Riparian Reserves may overlay all other management areas, and the Riparian Reserve standards and guidelines apply wherever Riparian Reserves occur (including within Late-Successional Reserves). Direction for management of Riparian Reserves is found in the Northwest Forest Plan ROD (C30 - C38). Prescriptions within Riparian Reserves are to be consistent with the Aquatic Conservation Strategy (ACS) objectives.

NWFP Late-Successional Reserves (LSR): The objective of these reserves, in combination with other allocations' standards and guidelines, is to protect and enhance conditions of late-successional and old-growth forest ecosystems. They are designed to serve as habitat for late-successional and old-growth related species. Proposed actions should be designed to contribute to attainment of the ACS objectives. A Forest-wide LSR Assessment has been completed (USDA Forest Service 2001).

NWFP Congressionally Reserved Areas include Wilderness Areas, Wild and Scenic Rivers, the Pacific Crest Trail (PCT), and other lands with congressional designations. There are no Wilderness Areas within the project area. There are no congressionally designated Wild and Scenic Rivers in the project area (see Scenery - Visuals).

Inventoried Roadless Areas (IRA) refer to those areas identified and mapped in accordance with the Roadless Area Conservation Rule (36 CFR Part 294). Approximately 14,924 acres of IRA are located within the project area. With limited exceptions, the 2001 Roadless Rule prohibits new road construction and reconstruction as well as timber harvesting within IRAs. 36 CFR 294.12-294.13. No road construction or timber harvesting are proposed within any IRA or other unroaded area as part of this project.

[4] Commercial and non-commercial stands. Treatment would only occur within allocations that are suitable timberland and allow timber harvest.

Travel Analysis and the MBS Sustainable Roads Strategy

To comply with the 2005 Travel Management Rule (36 CFR 212) and move forward with identifying the minimum road system, the MBS published the Sustainable Roads Strategy (SRS), an interdisciplinary science-based analysis (USDA Forest Service 2012). Development of the SRS included outreach to the public, local governments, and Tribes to understand what areas of the Forest received the most use, what those uses are, and what access needs are priorities.

The SRS ranked roads based on their: (1) benefit to recreation use, forest product access, agency and permittee access, and vegetation management access; and (2) risks to natural and cultural resources. However, the SRS interdisciplinary team determined that access needs, and not risks, should be the primary driver of recommendations for how roads should be managed. The rationale was that risks can be managed with· mitigation and conservation measures during road maintenance activities, and through site-specific NEPA analysis. The SRS is not a formal decision document, as such, protections for natural and cultural resources were not named or discussed in detail in the SRS. Instead, the SRS identified opportunities for changing how the forest transportation system may be managed in the future to address administrative, tribal and public access issues.

The SRS is the starting point for travel analysis, which includes the site-specific analysis necessary to identify the minimum road system (MRS) needed for safe and efficient travel and for administration, utilization, and protection of National Forest System lands. See 36 CFR 212.5(b).

Survey and Manage Direction

Federal agencies (BLM and Forest Service) are currently implementing the January 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines, the December 2003 species list with Red tree vole as Category C across its range and giving special consideration to 12 species, and the four categories of projects exempt from the Survey and Manage standards and guidelines as stipulated by Judge Pechman (October 11, 2006 “Pechman Exemptions”).

Survey and Manage Project Exemptions–Northwest Ecosystem Alliance, et al. v. Mark E. Rey, et al., No. C04-844P (District Court Order of January 2006, modified October 11, 2006): This court order re-instated the 2001 ROD and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and Other Mitigation Measure Standards and Guidelines. The October 2006 modification allowed four categories of activities to proceed without performing pre-disturbance Survey and Manage related surveys and known site management (Pechman Exemptions). These categories are: 1) thinning in forest stands younger than 80 years of age, 2) culvert replacement/removal, 3) riparian and stream improvement projects including the decommissioning of roads, and 4) hazardous fuel treatments, which apply prescribed fire.

Need for the Proposal

The North Fork Stillaguamish landscape is recognized by multiple entities, including several Tribes, as an important area. The larger Stillaguamish River basin is of high interest to the State of Washington for natural resources management, water quality, and salmon recovery goals; this basin contributes ecologically and economically to the greater Puget Sound area and beyond. The physical and biological characteristics and processes within a watershed are important to maintain or restore for soil productivity, hydrologic function, and water quality. Functioning physical and biological processes supports thriving aquatic and terrestrial ecosystems. Watersheds that function properly have terrestrial, riparian, and aquatic ecosystems that capture, store, and release water, sediment, wood, and nutrients within their range of natural variability for these processes.

Approximately 31% of the North Fork Stillaguamish Watershed is comprised of Forest Service managed lands. A legacy of past management actions has left some of North Fork Stillaguamish River watershed related ecosystem processes impaired. Some past management actions on both Forest Service and non-Forest lands within the watershed inadvertently altered hydrologic regimes, accelerated sedimentation in tributaries, provided large scale adjustment to channel form and function, disconnected floodplains and generated undesired downstream effects on native fishes. Actions that target restoration of such impaired processes can result in improved, more resilient watershed function.

Across the landscape, fragmentation of large natural patches of old growth forest have occurred. Past timber harvest has resulted in the creation of small stands of plantations which disrupt ecological function by simplifying forest structure, increasing edge contrast, and reducing connectivity. Timber harvest and land conversion have further isolated remaining patches of mature and old growth patches in this watershed. Currently less than 60% of the area on Forest Service land is old growth forest. Healthy old growth forests include a range of stand age classes with mixed species. Stand conditions would be varied across the landscape. Future management actions are intended to accelerate the development of old growth characteristics while also enhancing early seral stages and forest openings as needed to support wildlife forage and species biodiversity, where appropriate. The acceleration of mature stands would restore ecological processes and habitat characteristics for old growth dependent species, including long-range development of large snags, recruitment of large down wood and an increase in diversity of overstory tree species in a variety of sizes.

Landscape restoration actions have the potential to contribute to the local and regional economies by providing timber, firewood, and other forest products. Restoration on the landscape requires a balance of access and natural resource management while being conducted in an economical manner.

Tribal communities use and rely on lands administered by the Forest Service. The management of the landscape is intended to meet the need to protect and enhance the resources, habitat, access and places upon which Tribal reserved treaty hunting, fishing and gathering and other cultural rights depend upon.

To provide multiple uses on the landscape into the future, there is a need to improve terrestrial and aquatic conditions and processes while identifying and managing sustainable recreational opportunities:

- Terrestrial: Enhance the development of late-successional and old-growth forest habitats by improving habitat diversity in young stands, improving spotted owl and marbled murrelet nesting habitat, increase forest biological complexity and resiliency, maintain unique habitats, restore native plant communities, support tribally reserved treaty rights and resources they depend on.
- Aquatic: Enhance the health of streams and associated aquatic ecosystems by modifying the transportation system to reduce road derived impairments, increase floodplain and channel complexity, and remove barriers to aquatic species migration.
- Riparian: Enhance riparian areas for the benefit of both aquatic and terrestrial species.
- Recreation: Provide a variety of visitor experiences while managing public safety. Adjust administrative capacity by designing intentional developed and dispersed recreational opportunities, while ensuring that recreational uses and levels are sustainable.

Need for Forest Plan Amendment

The 1990 Forest Plan standards and guidelines for MA-19, Mountain Hemlock Zone, were developed to include a timber management study, and do not provide for silvicultural treatments for other resource objectives, such as huckleberry enhancement. The Forest Plan called for the development of a study plan to determine what portion of the mountain hemlock plant associations are tentatively suited for commercial timber production. The study plan was never completed, and the Mountain Hemlock Zone

therefore remains designated as unsuitable for timber production. However, these high-elevation areas can be well suited for native huckleberry species. A programmatic amendment to the 1990 Mt. Baker-Snoqualmie Land and Resource Management Plan is needed to remove the condition of consistency with the non-existent Study Plan and to allow management activities to improve habitat diversity in MA-19 across the Forest, particularly to restore habitat for huckleberries.

Changes between the Draft EA and EA

In response to public comments minor modifications, corrections, and editorial changes have been made to the text in several sections of the document, including: descriptions of the alternatives, project design criteria, climate change, and alternatives considered, not fully developed. Updated maps have been added in Appendix A.

Proposed Action and Alternatives

Forest Plan Amendment

The Forest Plan guides planning on the forest by designating Management Areas (MA) across the MBS and prescribing a common set of standards and guidelines within each MA. Standards and guidelines describe actions land managers can take to achieve the goals and objectives, while staying within constraints prescribed by law. There are two categories of standards and guidelines: Forest-wide plan components, applying to all management areas while others are specific to individual management areas. The Forest Plan includes a Mountain Hemlock Zone management area, called MA-19 (Appendix A, Figures 3-5).

Table 4. MA 19 Mountain Hemlock Zone Management Allocation Forest-wide

Ranger District	Acres	Maps in Appendix A
Mt. Baker	10,674	Figure 4
Darrington	4,646	Figure 3
Skykomish	1,780	Figure 5
Snoqualmie	81	Figure 5
TOTAL	**17,181**	

Alternatives 2 and 3 both propose a programmatic[5] Forest Plan amendment to modify certain aspects of the standards and guidelines for MA-19, Mountain Hemlock Zone. This programmatic Forest Plan amendment would apply Forest-wide. The process for executing a forest plan amendment is dictated by the Forest Service's 2012 Planning Rule (36 CFR 219.13). When a plan is amended programmatically all future projects and activities must be consistent with the amended plan.

[5] A programmatic amendment changes the Forest Plan for the duration of the Plan whereas a site-specific amendment arises from the need to take a specific action to meet a forest plan goal or a desired condition and only applies to that project or activity. See 36 CFR 219.16(b).

Table 5 – Management Area 19 Mountain Hemlock Zone Standards and Guidelines Changes

Program Element	Current forest standards and guidelines	Proposed modification to forest standards and guidelines	Rationale for change
Wildlife and Fish	Improvement of habitat may be permitted if consistent with the Study Plan.	Remove	This change would remove the requirement for Study Plan consistency.
Timber	Limit timber management activities to those needed to carry out the Study Plan. Volume harvested in this Study will not contribute to ASQ[6].	Limit timber management activities to those needed to improve habitat diversity. This may include but is not limited to huckleberry enhancement.	This change would remove the requirement for Study Plan consistency.
Timber	Other management practices NOT to be applied under this Study are: - Broadcast burning; - Genetic tree improvement; - Precommercial thinning; - Salvage harvest; - Fertilization.	Other management practices which aren't allowed in this MA are: -Genetic tree improvement; -Salvage harvest; - Fertilization.	The change would permit broadcast burning, and precommercial thinning, therefore those are dropped from this list.
Facilities	No system roads will be constructed. Temporary roads are permissible to meet Study Plan objectives or to access adjacent management areas.	No system roads will be constructed. Temporary roads are permissible to meet objectives or to access adjacent management areas.	This change would remove the requirement for Study Plan consistency.
Protection	Treatment of fuels by prescribed burning is not permitted.	Remove	This change would permit prescribed burning.

There are 2,154 acres of MA-19 within the North Fork Stillaguamish project area (1,178 acres on Mt. Baker Ranger District (MBRD), and 976 acres on Darrington Ranger District (DRD)). This includes 375 acres of proposed non-commercial stand improvement (211 acres on MBRD, 164 acres on DRD). With this amendment, up to 300 of those acres may be non-commercially thinned as described below under Huckleberry Enhancement.

Summary of Alternatives - Proposed Activities

Estimated differences between Alternatives 1, 2 and 3 are compared in Table 6.

Table 6. Summary & Comparison of Alternatives Proposed Activities

	Alternative 1	Alternative 2	Alternative 3
	Acres unless otherwise specified	Acres unless otherwise specified	Acres unless otherwise specified
Variable Density Thinning	0	Up to 10,572	Up to 8,842

[6] Allowable Sale Quantity

	Alternative 1	**Alternative 2**	**Alternative 3**
	Acres unless otherwise specified	Acres unless otherwise specified	Acres unless otherwise specified
Huckleberry Enhancement[7] - Non-commercial Thinning	0	Up to 300	Up to 300
Stand Improvement - Non-commercial Thinning	0	Up to 6,492	Up to 5,644
Riparian Reserves Variable Density Thinning	0	1,936 – 3,005[8]	Up to 1,275
Riparian Reserve Variable Density Thinning Stream Miles			
Perennial Fish Bearing (stream miles)	0	12	12
Perennial Non-fish Bearing (stream miles)	0	49	49
Intermittent (stream miles)	0	91	91
Riparian Reserves Stand Improvement -Non-commercial thinning	0	976- 1,536[9]	Up to 688
Riparian Reserve Non-commercial Thinning Stream Miles			
Perennial Fish Bearing (stream miles)	0	4	4
Perennial Non-fish Bearing (stream miles)	0	23	23
Intermittent (stream miles)	0	57	57
Temporary Road Construction			
New temporary road construction[10] (miles) (All temporary roads would be decommissioned post project)	0	19	19
Temporary road on unclassified roads with existing road prisms (miles) (All temporary roads would be decommissioned post project)	0	39.64	39.64
Temporary road on previously decommissioned roads (miles) (All temporary roads would be decommissioned post project)	0	4.30	4.30
Rock pits (less than ½ acre at any one site)	0	7	7
Danger Tree Removal	Ongoing	As Needed	As Needed
Maintenance Level - Road Miles Post Implementation			

[7] Huckleberry Enhancement – Non-commercial thinning acres overlap with Stand Improvement – Non-commercial thinning acres.
[8] This is the range of affected acres. Assuming all buffered streams require the maximum treatment level (Condition 1) to achieve the desired condition, the affected area could be 3,005 acres. If stream buffers require a lesser treatment level (Condition 2) to achieve the desired condition, the affected area could be as small as 1,936 acres. Somewhere between them is expected.
[9] This is the range of affected acres. Assuming all buffered streams require the maximum treatment level (Condition 1) to achieve the desired condition, the affected area could be 1,536 acres. If stream buffers require a lesser treatment level (Condition 2) to achieve the desired condition, the affected area could be as small as 976 acres. Somewhere between them is expected.
[10] Miles based on estimated 528ft (just under 0.10 mile) per commercial harvest unit.

	Alternative 1	Alternative 2	Alternative 3
	Acres unless otherwise specified	Acres unless otherwise specified	Acres unless otherwise specified
Decommission	No Change	12.12 miles	47.55 miles
Maintenance Level 1 Closed/Storage	No Change	112.63 miles	57.79 miles
Maintenance Level 2 – High Clearance	No Change	62.13 miles	81.53 miles
Maintenance Level 3 – Suitable for Passenger Cars	No Change	79.59 miles	79.59 miles
Storm proofing	No Change	193.93 miles	193.93 miles
Aquatic Organism Passage	0	Up to 30 sites	Up to 30 sites
Instream Wood (2-4 Trees >20" dbh per site)	0	Up to 12 sites	Up to 12 sites
Beaver Habitat Enhancement*	0	Up to 7 sites	Up to 7 sites
Dispersed Camping	0	Up to 10 areas	Up to 10 areas
Texas Pond Dam and Recreation Area	0	1 area	1 area

Alternative 1 – No Action

The No-Action Alternative forms the basis for a comparison between meeting and not meeting the project needs. This alternative provides baseline information for understanding changes associated with the action alternative(s) and expected environmental responses because of past management actions.

Under this alternative, none of the proposed treatments or activities described in the Proposed Action and Alternatives section would occur. The densely stocked second growth stands would not be thinned and actions that would improve late seral or old growth attributes, enhance huckleberry, and improve watershed function would not be authorized at this time.

Alternatives 2 and 3 – Action Alternatives

Actions described in this section are the same for both alternatives 2 and 3. Most of the activities proposed by the action alternatives are identical. Differences are described in Alternative 2 and Alternative 3 sections below.

Variable Density Thinning: This treatment is designed to expedite development of desired structural characteristics to improve Late Successional and Old Growth habitat capacity for northern spotted owls and marbled murrelets. Past timber harvesting created stands in younger age classes which are densely stocked, structurally simple, and lack the complex old forest structure needed as quality habitat for old forest associated species. Although the full suite of conditions that develop in old growth forests over long periods of time cannot be expected to accelerate through a single thinning treatment, some select characteristics (such as tree diameter, density, canopy structure, species composition, and vegetative cover) can be improved in the near term while others continue to gradually develop. Through the proposed treatments, thinning would move stands out of the closed-canopy stage and accelerate the development of conditions found in late seral forests. A multilayered canopy is a desired characteristic of late seral forests and through a well-developed understory, hiding cover and forage opportunities can provide habitat for many different species. (Hayes, et al. 1997). While heavy thinning reduces the total volume of wood, it promotes rapid growth of individual trees by reducing competition for light and water resulting in large live trees over time (Hayes, et al. 1997). Other desired habitat components such as large

crowns, branch growth, and broken and diseased trees for snag recruitment and nesting can be identified and enhanced as densities are reduced and growing space is provided to these such components.

Table 7. Variable Density Thinning

Variable Density Thinning - Commercial Silvicultural Prescription
Apply variable density thinning (VDT), an ecological based treatment, to implement a thin from below with skips (un-thinned areas), gaps (non-uniform openings), and sections of heavy thinning to accelerate the development of young stands into multilayered stands with large trees and diverse plant species and structures. The stands identified for thinning are those that are less than 80 years of age, and likely to meet the conditions necessary for commercial thinning in the next 15-20 years. Additionally, stands selected for treatment were regenerated following a harvest or other disturbance, then developed as a single layered stand. • Gaps would be 0.5 to 2 acres in size as outlined in the Finney AMA Plan Experimental Design, and applied to 3-10% of the harvest unit. • Heavy Thins would consist of approximately 50 residual trees per acre and combined with gaps, would not exceed 3-10% of the harvest unit. • Skips would occur over 10% of the harvest unit. • Post treatment target density would be 35% of SDI (Stand Density Index) maximum. Consideration would be made to leave as many stand components directly related to late-successional development as possible. Some of these components include large, broken and diseased trees important for snag recruitment, nesting habitat, and large snags or logs.

Huckleberry Habitat Enhancement: Harvesting of huckleberry (*Vaccinium* spp.) fruit is an important activity among multiple user groups and is an action largely restricted in this area to National Forest System (NFS) lands due to habitat and elevation constraints. Although huckleberry species are widespread across the MBS (observed in approximately 1/3 of Forest ecology plots) (Nelson 2015), opportunities for reasonable access to higher quality harvest sites are not abundant nor sustainable enough to meet the needs of tribal and recreational gatherers while also providing adequate sustenance to wildlife and pollinators. These treatments would improve habitat diversity, forest biological complexity and resiliency, restore native plant communities, support tribally reserved treaty rights and resources they depend on. Forest understory species contribute to biological diversity and long-term ecosystem productivity in late-successional and old-growth forest habitats.

To encourage huckleberry growth, this treatment could occur in non-commercial stands that have a huckleberry plant association type (*Vaccinium* spp.), and would be comprised of non-commercial silvicultural activities to provide moderate to full sun exposure for flowering and berry production. Trees removed for huckleberry enhancement would not remove old growth characteristics as they average 8 inches or less DBH. Big huckleberry (Vaccinium membranaceum) is known to be most abundant in open conditions following disturbance to its forest site, including logging and fire, though outcomes from fire are mixed (Minore et al. 1979, Nelson ed. 2015). Berry production is enhanced in partial shade to full sun rather than dense shade (Minore et al. 1979, Nelson ed. 2015).

Table 8. Huckleberry Habitat Enhancement

Huckleberry Habitat Enhancement Non-Commercial Thinning Silvicultural Prescription
Apply a thin from below to a desired spacing and create small openings. Enhancement treatments would occur in stands that have a huckleberry plant association type, and target the removal of trees to reduce competition from maturing conifer trees that are shading out huckleberry growth. Stands identified for this treatment are dense, overstocked young stands with an average tree size below merchantability (7-8 inches in DBH) that regenerated either by planting or natural regeneration following past timber harvest. • Enhance stand conditions by removing trees in direct competition of huckleberry plants and reducing overall competition to improve growth and vigor of desired leave trees. • Create small openings from .5 to 1 acre in size to allow additional light to encourage the growth of native huckleberry species.

- Highest priority areas would be selected from areas that include vehicle access for management and tribal elders, with slopes less than 20 percent.
- Prescribed fire may be used.

Stand Improvement: This treatment applies a pre-commercial or non-commercial thinning designed to enhance stand conditions with treatments varying in intensity to meet site objectives. Primary objectives for stand improvement within this project area are to increase growth and vigor of desired trees, but also to improve species composition, reduce potential fire severity risk, reduce susceptibility to insects and disease, and to enhance species specific habitat.

Table 9. Stand Improvement

Stand Improvement Non-Commercial Thinning Silvicultural Prescription
Apply a thin from below for improvement of diameter growth rates and stand health. Stands identified for this treatment are dense, overstocked young stands with an average tree size below merchantability (7-8 inches in DBH) that regenerated either by planting or natural regeneration following past timber harvest. • Reduce tree competition to a desired density and spacing that would promote growth to desired leave trees.

The following are connected actions that may be associated with the terrestrial actions described above:

Fuels: Following all thinning activities, a variety of fuels treatments would be applied to reduce ground fuels, lower the risk of high severity wildfires, and to provide a defensible area along roads for potential future wildfire management. These fuels treatments may include: piling and burning of slash material, prescribed underburning or broadcast burning, chipping of fuels, or removal of fuels for processing off site. The chosen slash disposal method is dependent on a combination of the following factors: projected fuel loading, the projected fire intensity level of a potential wildfire burning in the activity fuels, and proximity to frequently traveled roadways.

Logging systems could include a combination of ground-based, cable, and may include tethered logging. Current NFS roads, unclassified or abandoned road grades, and new temporary roads would be used to access the stands. NFS roads within and adjacent to the project area could be used as haul routes.

Temporary roads are proposed to facilitate project implementation. Most would be on existing road[11] prisms or templates. These roads would be closed and rehabilitated after management activities have been completed. Some new temporary roads would be needed. The estimated miles are based on an average of 528 feet (0.10 mile) per commercial harvest unit in the project area. All temporary roads would be designed to minimize soil disturbance, closed, and rehabilitated following project activities. Rehabilitation typically consists of reducing compaction, planting with native seed, adding surface cross drains or drainage dips, removal of temporary culverts, camouflaging road junctions and scattering with slash as needed.

For portions of this project area, up to 7 miles of temporary road would be constructed to a "specified" standard. These roads would be placed on abandoned roads with limited adjustments to accommodate modern logging systems. Due to road engineering complexities, length, number of sales that may utilize potential specified roads, and duration the road may be in service, this modification would allow for the road to be designed to a higher standard than a typical temporary road. All roads added in this manner would be temporary and would be decommissioned after implementation.

[11] Throughout this EA "unclassified roads" may be used interchangeably to refer to existing road prisms or templates where temporary roads may be located.

System road maintenance and reconstruction is proposed. Road maintenance consists of a variety of activity components that can include, but are not limited to: spot surfacing, roadside brushing, erosion control, logging out, road surface blading, ditch cleanout, debris removal, dust abatement, culvert cleaning or replacement, danger tree removal, removal and installation of road closure devices, and other items such as installation of road cross-drains that contribute to the preservation of the existing road and its safe use.

Road reconstruction activities could include widening select corners/switchbacks to improve access safety, realignment of road segments in areas such as road junctions, restore roads to a serviceable standard by clearing heavily overgrown roads; removing slides and debris, and repairing slumps greater than 10 cubic yards; installing, repairing and improving drainage structures; adding drainage and subgrade reinforcement for seeps and springs; installation of culverts; and placement of rock surfacing. Rock sources for crushed rock aggregate sites may be expanded up to ½ acre per site, not to exceed 7 acres total in the project area. Existing use of rock sources located within IRAs may continue but they would not be considered for expansion.

Table 10. Potential Haul Route Miles, and Existing Transportation System

Proposed Haul Route Roads by Maintenance Level (ML[12]) Alternative 2 & 3	**Miles**
1 - Basic custodial care (Closed)	45.61
2 - High clearance vehicles	52.69
3 – Suitable for passenger cars	75.94
4 – Moderate degree of user comfort	0.00
5 – High degree of user comfort	0.00
Estimated Existing Unclassified Roads- for temporary use (All temporary roads would be rehabilitated post project)	39.64
Estimated Temporary Roads on previously decommissioned roads (All temporary roads would be rehabilitated post project)	4.30
Estimated New Temporary Roads-Logging System (All temporary roads would be rehabilitated post project)	19[13]
Total Haul Route Miles[14]	237.18
Total estimated miles of road within the project area[15]	
1 - Basic custodial care (Closed)	76.53
2 - High clearance vehicles	64.28
3 - Suitable for passenger cars	52.86
4 - Moderate degree of user comfort	0.26

[12] ML 1: closed roads that have been placed in storage between intermittent uses; ML 2: roads open for use by high clearance vehicles; ML 3: roads open and maintained for travel by a prudent driver in a standard passenger car; ML 4: roads open and maintained for travel with a moderate degree of user comfort; ML 5: roads open and maintained for travel with a high degree of user comfort.
[13] Miles based on estimated about 528 ft (just under 0.10 mile) per commercial harvest unit.
[14] Operational miles of all roads used for project, estimated from Geographic Information Systems (GIS).
[15] Operational level, miles estimated from Geographic Information Systems (GIS) database.

5 – High degree of user comfort	0.00
Total Road Miles	193.93

In the case of in-holdings of private land where National Forest system roads (FSR) occur without permanent easements, the Forest would proceed with permanent easement acquisition. In the event a permanent easement cannot be acquired before project implementation, the Forest would seek a temporary road-use permit. If an easement or permit cannot be acquired, alternative routes would be used.

Stormproofing: Forest roads can alter water flow, sedimentation, and habitat for aquatic organisms. The legacy road network and associated infrastructure, constructed in locations that resulted in altered riparian and aquatic processes, are the primary sources of impeding water quality and fisheries habitat function in the project area. A range of treatments designed to decrease road-water interactions would be applied on roads that continue to be open for administrative and public use (ML 2 – 5 roads). These treatments would include ditch line cleaning, installing cross drainage, surface rocking at stream crossings, enlarging culvert sizes at intermittent and perennial fishless streams, etc. Roads were prioritized and targeted based on modeled impacts to streams where most of the indicators were rated at high or very high.

In all road activities, drainage structures would be added where needed to protect water resources and maintain the integrity of the road surface.

Aquatic and Riparian actions proposed include:

Aquatic Organism Passage (AOP): Coupled with storm proofing treatments are targeted methods to restore aquatic organism passage at road crossings with perennial fish bearing streams. Existing undersized culverts (which cause barriers to fish migration) would be removed and replaced with larger appropriately sized AOP structures, designed to both effectively pass 100-year flood return interval flows and simulate natural stream and habitat function, restoring passage for fish.

Proposed road treatments, including the installation of AOPs, would decrease various watershed impairments on roads with a large number of stream crossings per mile. Also targeted are roads that have a high drainage area (road drainage length compared to stream length), roads within Riparian Reserves (typically within 300 feet of streams) and roads in areas where the density of roads per square mile is higher in the smaller HUC14 watersheds. Proposed road treatments were identified by first analyzing road related impairment to watershed conditions. In areas where a road prism has already begun to close naturally, and reopening the road with heavy equipment is undesired, alternative methods may be used to remove any culverts at risk of creating resource damage. These alternatives may include blasting, in which case mitigations and design criteria would minimize potential negative effects.

Improve Instream Habitat Quality: Enhance aquatic habitat complexity in streams by increasing large woody debris (LWD) that mimics historic wood recruitment to channels and floodplains. Such wood recruitment would help rebuild an important ecological element that historically supported aquatic habitat quality prior to legacy actions of yarding wood out of streams and rivers. In addition, LWD would aid geomorphic development and interaction between channels and floodplains helping these systems become more resilient to climate change (i.e. moving away from incised stream channel conditions). Actions to increase LWD would focus on channels with low to moderate gradients; where wood is shown to be deficient; and where increasing LWD would improve desired aquatic habitat and geomorphic forming processes. Large wood supplementation may involve tree tipping, which could include felling or pushing (with heavy equipment) live trees (generally 18 – 24 inches in diameter) into channels and floodplains. LWD actions would be technically informed by a collaborative approach between Forest Service, Tribes and Washington Department of Fish and Wildlife (WDFW).

Beaver Habitat Enhancement: In co-management with local Tribes riparian areas with low gradient, perennial water sources would be considered for potential construction of beaver dam analogs as a

conservation and restoration agent in the watershed and on the landscape. Areas would be confirmed using current modeling available, including the Beaver Restoration Assessment Tool (BRAT). These areas would be consistent with WDFW Memorandums of Understanding (MOU), located to minimize any risk to other resources, and with consideration for areas with historic beaver use. Managing for beaver populations that create functional habitats that replicate natural processes historically observed in the Stillaguamish basin has been suggested as a climate change adaptation tactic (Lawlor et al 2014).

Condition-based Management

Action alternatives include both pre-identified site-specific treatments and some treatments that use a condition-based management (CBM) approach that supports responsiveness and flexibility between planning and implementation. Under CBM, best currently available site-specific data is paired with subsequent field validation surveys conducted before implementation to verify that conditions on site match those predicted during the project planning phase. Treatments are assigned at each location by evaluating the information collected during the field validation surveys against the specific decision criteria described below. These steps assure that we move the landscape towards the desired condition by applying the right treatment at each location based on the most up-to-date information.

Project components analyzed with CBM include dispersed camping and Alternative 2 riparian reserve stream buffers. Appropriate treatments for each condition found in these areas have been determined. Using existing data, the IDT used these conditions and criteria to estimate the maximum treatments that could be implemented using condition-based management. While the IDT expects that some of these areas would not be treated because they may not meet the decision criteria, the maximum estimates of condition-based treatments were used to determine effects in the analysis for this project.

Dispersed Camping

Dispersed camping in the project area occurs primarily in isolated sites, with occasional interconnected grouping of sites (see Appendix A, Figure 9). Many of the sites are located adjacent to fish-bearing streams and throughout riparian areas. Some streams where these dispersed sites occur support ESA-listed and other native fishes and can overlap with designated critical habitat. Dispersed sites are often compacted and denuded of ground vegetation. Runoff from these sites add sedimentation to the adjacent stream and degrades spawning and rearing habitats. In some instances, the dispersed site directly overlaps with active streambanks, accelerating undesired bank erosion. To decrease impacts to water quality, riparian, floodplain, and other aquatic resources from dispersed recreation within riparian reserves, this alternative would attempt to balance visitor access and resource protection.

Recreation and Aquatic Specialists would identify and evaluate the dispersed camping sites. Some dispersed camping sites are currently accessed via unauthorized and illegal motorized vehicle routes. These unauthorized motor vehicle routes to dispersed camping sites would be rehabilitated to allow non-motorized access only or would be eliminated. Along with these routes, the dispersed camping sites associated with unauthorized routes would either be eliminated, eliminated and replaced, or reduced in size, based on conditions evaluated on the ground (Table 11).

Table 11. Proposed condition-based management actions for dispersed camping sites in Riparian Reserves

Objective: Restore riparian areas impacted from dispersed camping to a functioning riparian area and stream channel. These actions are needed to meet standards and guidelines for recreation management in Riparian Reserves, consistency with Aquatic Conservation Strategy objectives, and to improve riparian and aquatic habitat function for ESA-listed fishes and designated critical habitats.		
Site Condition	**Action**	**Description of action**
Dispersed camp sites overlap with the active streambank, undesired accelerated bank erosion is occurring, the footprint of the camp site is denuded of vegetation that normally would be	Eliminate and Replace	Eliminate existing dispersed camp site and relocate it outside of the riparian area, to a more sustainable site. Replacement sites would be

composed of riparian species, and potential alternative dispersed sites exist in the area.		chosen to maximize use of previously disturbed sites and would be reviewed by wildlife specialists to avoid future hazard tree removal of potential habitat trees.
Dispersed camp sites overlap with the active streambank and undesired accelerated bank erosion is occurring, or sites are outside the active streambank and do not meaningfully contribute erosion into the stream, and the footprint of the camp sites are denuded of vegetation that normally would be composed of riparian species and are adjacent to other sites farther from the stream where use is acceptable, but is denuded of vegetation that would normally be composed of riparian species.	Reduce	Reduce the footprint of the existing dispersed camp site, while restoring streambanks and vegetation.
Dispersed camp sites overlap with the active streambank, undesired accelerated bank erosion is occurring, and other alternative dispersed sites exist in the area.	Eliminate	Eliminate the dispersed site. For this treatment, the dispersed site would not be replaced elsewhere.

Each of the proposed actions in Table 11 could be achieved through a variety of techniques. Ground adjacent to the stream could be recontoured to restore a more natural slope and floodplain. Soil that is hardened by frequent use could be decompacted with heavy equipment, then seeded or planted with riparian vegetation wherever feasible. Barriers, such as large rocks or logs, may be placed to establish parking boundaries and prevent cross-country travel by motorized vehicles. Recreation staff would monitor and reevaluate the sites over time to determine if additional actions are needed.

Texas Pond

For complete details, photos, and map see Appendix A, Figures 9-15.

Dam Repair and Maintenance: Texas Pond Dam is an earth embankment dam needing repair and maintenance to bring it back to a serviceable condition and keep the dam at a Low Hazard Classification Rating. Repairs are needed to the dam, concrete spillway, pipes, valves and control box. This repair would require the reservoir to be dewatered completely, or by the installation of a sheet piling coffer dam around the existing pipe and pumping the work area free of water.

In the past, Texas Pond was stocked by WDFW with non-native fish for recreational purposes. In coordination with Washington State Fisheries Co-Managers (Tribes and WDFW), the pond and associated facilities would be evaluated and treated to prohibit or minimize downstream movement of non-native fish.

Texas Pond Recreation Area: The dam has been used historically by the public for dispersed camping, including parking. Camping and parking on the dam would be prohibited to improve public safety. Replacement sites would be in previously disturbed areas on FSR 29, and the first 200 feet of FSR 2947. To restore riparian areas impacted from dispersed camping, denuded areas, including unauthorized access routes, would be rehabilitated. Barriers would be placed to restrict access from unauthorized motor vehicles. The existing vault toilet would be replaced with an accessible vault toilet facility. An information board would be added.

Forest Service Road 2810000 (North Mountain Road)

Removing Forest Service Jurisdiction from Forest Service Road 2810000 (North Mountain Road) from MP 0.47 to MP 6.65 is proposed. This road no longer is needed for the administration of National Forest

System lands. Forest Service access to the North Mountain Lookout will be by way of the 2811 and 2800 roads along with the upper portion of the 2810 road which the Forest Service will continue to manage.

Monitoring

Post-harvest monitoring and assessment would follow the guidelines outlined in the Finney AMA plan to assess stand characteristics such as species composition, the distribution of tree sizes, the diversity of plant species and sizes in and outside of gaps, and to observe the change in tree sizes over time. Monitoring within the Finney AMA, presents opportunities to partner with those outside the agency and develop collaborative monitoring strategies. Implementation and effectiveness monitoring would occur under USDA Forest Service National Best Management Practices.

Alternative 2

Actions described in this section are specific to Alternative 2, and are in addition to those described above in "Alternatives 2 and 3 – Action Alternatives".

Cutting and removal of trees between 20"-26" DBH: Alternative 2 includes Regional Ecosystem Office (REO) review to allow for the cutting and removal of trees between 20" – 26" dbh. This would occur in stands identified for variable density thinning.

The silviculture treatments (variable density thinning) in this project are designed to expedite development of desired structural characteristics to improve habitat capacity for northern spotted owls and marbled murrelets. Due to the high productivity of this area and results from collected data on a past neighboring project, the proposed treatment stands are likely to have a large proportion of trees greater than 20" DBH while remaining dense, single-storied, and homogeneous with limited understory development. Current thinning practices in LSRs (under 20 inches and thin from below) would not be sufficient in lowering tree density to meet desired stand and landscape objectives. Variable density thinning and harvesting trees up to 26" DBH in these stands would decrease the amount of time needed to attain late-successional characteristics and is consistent with NWFP Standards and Guidelines for Late-Successional Reserves.

Riparian Reserves Variable Density Thinning - Riparian reserves include those portions of a watershed directly coupled to streams and rivers, that is, the portions of a watershed required for maintaining hydrologic, geomorphic, and ecologic processes that directly affect standing and flowing waterbodies such as lakes and ponds, wetlands, streams, stream processes, and fish habitats (ROD, B-12). The riparian reserves within proposed stands are in the same dense, structurally simple conditions as the stands they run through. Treatments would help attain Aquatic Conservation Strategy objectives, especially by maintaining and restoring species composition and structural diversity of plant communities in riparian areas. Current ecological conditions within Riparian Reserves (RR) generally fall within two functional categories:

- RR condition 1) streams where second growth has recruited few or no trees to the stream channel, floodplain or valley bottom; and
- RR condition 2) streams where second growth has recruited moderate to high amounts of trees to the stream channel, floodplain and valley bottom.

The proposed Riparian Reserve treatments are along streams with buffer areas where no trees would be cut, surrounded by variable density thinning consistent with the variable density thinning conducted in adjacent stands. Under Alternative 2, the width of the buffered areas would depend on the stream classification and the condition of the riparian reserve (Table 12).

Table 12. Residual Stream Buffers for RR Condition 1 and RR Condition 2

Stream Classification	RR Condition 1 – Retained No-Thin Buffers	RR Condition 2 – Retained No-Thin Buffers
Fish Bearing (Perennial and Intermittent)	100 ft	100 ft
Perennial Non-fish Bearing	50 ft	100 ft
Intermittent Non-fish Bearing	25 ft	50 ft

Where RR condition 1 occurs, the silviculture prescription would create tree spacing through thinning that accelerates the growth of the remaining larges trees over time, while retaining higher basal areas post-harvest. Small patches ¼ to ½ acre in size would be thinned to promote tree growth, while other patches would be left unthinned or lightly thinned with a higher tree density retained. In unthinned or lightly thinned patches, a few individual trees, 18" to 24" in diameter, would be evaluated for potential manual felling into the channel to improve channel function in the short-term. The occasional tree that falls due to windthrow as a side effect of thinning (Roberts et al. 2007) would represent additional, natural recruitment of wood into the channel.

Where RR condition 2 occurs, large wood (from fallen second growth trees) has begun performing desired riparian reserve functions (adding roughness to streams and floodplains, trapping sediment, rebuilding stream channel base levels, naturally creating tree spacing, etc.). In these instances, larger no-cut buffers would be applied to allow the ongoing process of natural recruitment to streams and valley bottoms to occur, especially in perennial and intermittent streams. The remaining portion of Riparian Reserve that is thinned would be consistent with the overall non-Riparian Reserve stand area.

Prior to project implementation, validation surveys would be conducted throughout all riparian reserves to determine the current condition (RRC1 or RRC2) and assign the appropriate buffer width to each section (Table 12).

For maps of proposed potential extent of treatments as related to RR1, RR2 and the below changes to system roads for each alternative, see Figures 16-18.

Changes Proposed to System Roads: Roads that are creating resource damage, and no longer needed for future management activities of National Forest System lands within the project area were identified. These roads would be evaluated for treatments to mitigate resource damage while balancing tribal and user access needs. Treatments may include altering or relocation of access routes, improvement of erosion control mechanisms, storage or decommissioning. A summary of proposed road changes is in Table 13 with specific roads displayed in Table 16, including any proposed changes for both Alternative 2, and Alternative 3. For close-up maps see Appendix A, and for additional road details see Appendix C.

During the Forest Transportation Analysis Process (TAP, 36 CFR Part 261, Subpart A) commonly known as SRS (Sustainable Roads Strategy) or Minimum Roads Analysis, system roads were evaluated, and management recommendations were provided for each road. There are certain instances, however, where the proposed action deviates from past management decisions or the SRS recommendations based on current analysis of site-specific conditions.

Table 13. Summary of Proposed Road Changes on Forest Service system roads

Maintenance Level	Current Road Miles	Alternative 2 Proposed Miles	Alternative 3 Proposed Miles
1 - Basic custodial care (Closed)	93.13	112.63	57.79
2 - High clearance vehicles	74.79	62.13	81.53
3 - Suitable for passenger cars	84.60	79.59	79.59

4 - Moderate degree of user comfort	14.00	0	0
5 – High degree of user comfort	0	0	0
Proposed Decommission	0.0	12.12	47.55
Total Miles *	266.52	266.47	266.46
*Road segment mileage rounding accounts for minor difference in totals.			

Road storage: NFS system road would be managed to ML-1 standards, which includes disconnecting the road from the hydrologic system (termed hydrologic closure). ML-1 roads are "stored" until administrative access is needed, for which the road is re-opened (i.e. reconstructed), then stored again post-use or decommissioned if no future use is needed. During the period of storage motorized access is not allowed. Hydrologic closure focuses on a range of methods to move surface water off the road and decrease road impacts at stream crossings, such as removal of culverts. Stabilizing road surfaces now saves on costs later if the roads are needed again.

Road decommissioning: Roads that are decommissioned are removed from the National Forest Road System and receive no further maintenance. The road surface of system roads are treated to restore hydrologic connectivity and function by applying various treatments, including one or more of the following: reestablishing former drainage patterns, stabilizing slopes, and restoring vegetation; blocking the entrance to a road or installing water bars; removing culverts, reestablishing drainages, removing unstable fills, pulling back road shoulders, and scattering slash on the roadbed; eliminating the roadbed by restoring natural contours and slopes; and other methods designed to meet the specific conditions associated with the unneeded road.

In all road activities, drainage structures would be added where needed to protect water resources and maintain the integrity of the road surface.

Table 14. Proposed Road Treatments by Subwatersheds[16]

HUC 12 Subwatershed(s)	Decommissioning (miles)		Storage (miles)	
	Alt 2	Alt 3	Alt 2	Alt 3
Aldon Creek-Skagit River	-	-	-	-
Day Creek	0.77	0.77	8.50	8.50
French Creek-North Fork Stillaguamish River	1.42	8.67	9.16	1.92
Headwaters North Fork Stillaguamish River	6.59	22.07	41.12	14.36
Loretta Creek-Skagit River	-	-	0.31	0.31
Lower Deer Creek	-	2.68	15.07	12.39
Lower Finney Creek	-	-	-	-
Prairie Creek-Sauk River	-	0.08	0.63	0.55
Sauk River	-	4.15	7.58	3.43
Segelsen Creek-North Fork Stillaguamish River	1.19	5.16	7.58	3.61
Upper Deer Creek	2.14	3.98	10.41	8.45
Upper Finney Creek	-	-	12.26	4.28
TOTAL	12.11	47.56	112.62	57.80

[16] Includes some road miles of haul routes outside the project boundary that would be treated post use.

Alternative 3

Actions described in this section are specific to Alternative 3 and are in addition to those described above in "Alternatives 2 and 3 – Action Alternatives".

Variable Density Thinning: Alternative 3 variable density thinning would not cut or remove trees over 20" dbh.

Riparian Reserves Variable Density Thinning: The proposed Riparian Reserve treatments are along streams with buffer areas where no trees would be cut, surrounded by variable density thinning consistent with the variable density thinning conducted in adjacent stands. Like Alternative 2, Riparian Reserve prescriptions would be similar to prescriptions described for variable density thinning and stand improvement. Instead of condition based riparian reserve buffers, Alternative 3 proposes riparian buffers based solely on stream classification (Table 10), regardless of the riparian reserve condition.

Table 15. Riparian Reserve Stream Buffers

Stream Classification	Alternative 3– Retained No-Thin Buffers
Fish Bearing (Perennial and Intermittent)	150 ft
Perennial Non-fish Bearing	150 ft
Intermittent Non-fish Bearing	50 ft

Changes Proposed to System Roads: Roads that are creating resource damage, and no longer needed for future management activities of National Forest System lands within the project area were identified. These roads would be evaluated for treatments to mitigate resource damage while balancing tribal and user access needs. Treatments may include altering or relocation of access routes, improvement of erosion control mechanisms, storage or decommissioning. A summary of proposed road changes is in Table 13 with specific road displayed in Table 16, including any proposed changes for both Alternative 2, and Alternative 3. For maps see Appendix A, Figures 6-8 and for additional road details see Appendix C. Road storage and decommissioning is described above under alternative 2.

In all road activities, drainage structures would be added where needed to protect water resources and maintain the integrity of the road surface.

Table 16. Road Management Proposed Changes.[17]

Road No.	Road Seg. Length	Current ML Level	Alt 2 Proposed ML Level	Alt 3 Proposed ML. Level	SRS Aquatic Risk	SRS Road Level	Rationale for Proposed Changes[18]	Finney Roads EA Decision (if applicable)	North Fork Stillaguamish Roads Decision (if applicable)
1700000	6.00	4	3	3	H	3	CT		
1700000	8.00	4	3	3	H	3	CT		
1730000	3.20	2	1	2	H	1	PPC		
1730000	0.21	1	1	2	H	1	PPC	Closed - 0	
1731000	6.65	1	1	2	L	1	PPC	Closed - 1	
1732000	4.18	1	1	2	H	1	PPC	Closed - 1	
1732014	0.18	1	1	2	L	1	PPC	Closed - 0	
1740000	0.25	2	1	1	L	1	RSA		
1740111	0.14	2	1	2	L	1	CT & PA	Closed - 0	
1740111	1.47	2	1	1	L	1	PA	Closed - 0	
1750000	0.79	2	1	1	H	1	CT	Closed - 1	
1750011	1.42	1	1	D	H	1	CT	Closed - 0	
1750025	0.21	1	D	D	L	1	No CT or PPC	Closed - 0	
1750100	0.22	1	D	D	L	1	No CT or PPC	Closed - 0	
1751000	0.48	1	1	D	L	1	CT	Closed - 0	
1755013	0.91	1	1	D	H	1	CT		
1765000	2.31	1	2	2	L	1	PPC	Closed - 1	
1765550	0.23	2	1	1	M	1	PPC	Closed - 0	
1766000	1.00	2	1	1	L	1	EOF No CT or PPC		
1766000	0.41	1	D	D	M	1	EOF No CT or PPC		
1766020	0.36	1	D	D	L	1	EOF No CT or PPC	Closed - 0	

[17] ML 1: closed roads that have been placed in storage between intermittent uses; ML 2: roads open for use by high clearance vehicles; ML 3: roads open and maintained for travel by a prudent driver in a standard passenger car; ML 4: roads open and maintained for travel with a moderate degree of user comfort; ML 5: roads open and maintained for travel with a high degree of user comfort. Colors in table match maps in Appendix A.

[18] Haul Route / CT = Commercial Timber, PPC = Planned Pre-Commercial; PA = Private Access; REC = Recreation; RSA = Rock Source Access; EOF = Easement Outside of Forest Boundary; MA = Mining Access or Special Use

Road No.	Road Seg. Length	Current ML Level	Alt 2 Proposed ML Level	Alt 3 Proposed ML. Level	SRS Aquatic Risk	SRS Road Level	Rationale for Proposed Changes[18]	Finney Roads EA Decision (if applicable)	North Fork Stillaguamish Roads Decision (if applicable)
1800014	1.10	1	1	D	M	1	CT		
1800014	0.55	1	1	D	M		CT		
1800017	0.40	1	1	D	H	1	CT		
1800022	0.65	1	1	D	H	1	CT		
1800025	0.23	1	1	D	H	1	CT	Closed - 0	
1800025	0.07	1	1	D	H	1	PPC & RSA	Closed - 0	
1810000	1.50	1	2	2	H	1	CT	High Clear.	
1810000	0.77	1	2	2	H	1	CT	Closed - 0	
1820000	3.49	2	2	2	H	1	CT & MA	High Clear.	
1820000	0.33	2	D	D	H	1	No CT or PPC	Closed - 1	
1820011	0.46	1	D	D	L	1	No CT or PPC	Closed - 0	
1820013	0.29	1	D	D	H	1	No CT or PPC	Closed - 0	
1820050	0.30	1	1	D	L	1	CT	Closed - 0	
1822000	0.46	1	1	D	H	1	CT	Closed - 0	
1822000	0.48	1	D	D	H	1	No CT or PPC	Closed - 0	
1822014	0.16	1	D	D	L	1	No CT or PPC	Closed - 0	
1855000	1.14	2	1	1	H	1	PPC		
1855013	1.08	1	2	2	H	2	Admin Access only & PPC		
1870000	1.93	1	1	D	H	1	CT		
1870000	0.12	1	D	D	H	1	No CT or PPC		
1880000	0.78	2	D	D	M	1	No CT or PPC		
1880011	0.09	1	2	2	M	D	CT & Pit Accees		
1880011	0.32	1	D	D	M	D	No CT or PPC		
1880011	0.09	1	D	D	M	D	No CT or PPC		
1880012	0.18	1	2	2	L	D	CT & Pit Access		
1880013	0.48	1	1	D	M	1	CT		
1890000	0.46	2	1	D	H	2	CT		

Road No.	Road Seg. Length	Current ML Level	Alt 2 Proposed ML Level	Alt 3 Proposed ML. Level	SRS Aquatic Risk	SRS Road Level	Rationale for Proposed Changes[18]	Finney Roads EA Decision (if applicable)	North Fork Stillaguamish Roads Decision (if applicable)
1890011	1.03	1	D	D	M	1	No CT or PPC		
1890013	0.30	1	2	2	H	1	CT		
1890013	1.53	1	1	D	H	1	CT		
1890013	0.05	1	D	D	H	1	No CT or PPC		
1890017	0.21	1	D	D	H	1	No CT or PPC		
1890130	0.60	1	1	D	M	1	CT		
1891000	0.41	2	1	D	H	1	CT		
1891000	1.29	2	1	D	H	1	No CT or PPC leads to roadless area		
1891000	1.90	2	1	D	H	1	No CT or PPC leads to roadless area		
1891000	0.59	2	1	D	H	1	No CT or PPC leads to roadless area		
1891011	0.40	1	1	D	H	1	CT		
2800000	10.10	3	2	2	H	3	CT		
2800000	0.27	3	1	D	H	3	CT		
2800000	1.50	3	1	D	H	2	CT		
2800017	0.95	1	1	D	H	1	CT		L1
2800018	1.11	1	1	D	H	1	CT		L1
2800019	0.98	1	1	D	H	1	CT		L1
2800020	0.54	1	1	D	H	1	CT		L1
2815000	1.00	2	1	1	H	1	PPC		
2820000	0.31	2	1	D	H		CT		
2830000	0.68	2	1	1	L	1	CT		L1
2830000	0.32	2	1	1	L	1	PPC		L1
2832000	0.37	1	1	D	L	1	CT		
2840000	4.69	3	2	2	H	1	CT		
2840000	0.18	3	1	1	H	1	PPC		

Road No.	Road Seg. Length	Current ML Level	Alt 2 Proposed ML Level	Alt 3 Proposed ML. Level	SRS Aquatic Risk	SRS Road Level	Rationale for Proposed Changes[18]	Finney Roads EA Decision (if applicable)	North Fork Stillaguamish Roads Decision (if applicable)
2840000	2.28	3	1	1	H	1	PPC		
2840011	0.63	1	1	D	H	1	CT		L1
2840016	0.85	1	D	D	H	1	No CT or PPC		
2840016	0.30	1	D	D	H	1	No CT or PPC		
2840018	0.15	2	1	1	L	1	CT		
2840018	0.12	2	1	1	L	1	PPC		
2841000	1.98	2	1	D	H	1	CT		L1
2841013	0.46	1	1	D	H	1	CT		
2841013	0.10	1	D	D	H	1	No CT or PPC		
2849000	0.38	1	1	D	H	1	CT		L1
2850000	1.63	1	1	D	H	1	CT		L1
2850000	0.37	1	D	D	H	1	No CT or PPC		L1
2851000	0.78	1	1	D	H	1	CT		L1
2860000	0.50	1	1	D	H	1	CT		L1
2870000	0.78	2	D	D	H	1	No CT or PPC		
2872000	0.27	2	1	1	H	1	PPC		
2880000	0.06	2	2	2	L	1	CT		
2880000	2.85	2	1	2	L	1	PPC		
2881000	1.98	2	1	2	H	1	PPC		
2882000	1.15	2	2	2	H	1	CT		
2882000	0.42	2	1	1	H	1	PPC		
2885000	1.76	2	D	D	H	D	No CT or PPC		
2886000	0.38	2	D	D	H	D	No CT or PPC		
2890000	0.03	2	D	D	H	1	CT		
2890000	1.89	2	D	D	H	1	No CT or PPC		
2900000	0.08	2	1	1	M	1	PA		
2940000	1.33	1	1	D	L	1	CT		

Road No.	Road Seg. Length	Current ML Level	Alt 2 Proposed ML Level	Alt 3 Proposed ML. Level	SRS Aquatic Risk	SRS Road Level	Rationale for Proposed Changes[18]	Finney Roads EA Decision (if applicable)	North Fork Stillaguamish Roads Decision (if applicable)
2942000	3.26	2	1	D	L	1	CT		
2947000	0.04	1	2	2	L	D	REC - Dispersed Camping		
2950000	1.49	2	1	D	L	1	CT		
2950011	0.03	1	1	D	L	1	CT		
2950011	0.13	1	D	D	L	1	No CT or PPC		
2950014	0.34	1	1	D	H	1	CT		
2956000	0.50	1	1	D	H	1	CT		

Evaluation of the Forest Plan Amendment

The need for this programmatic Forest Plan Amendment ties to the purpose and need for the project, which includes supporting tribally reserved treaty rights and resources they depend on. Based on the direction provided in 36 CFR 219, the Responsible Official must determine the appropriate scope and scale of forest plan amendments and which substantive provisions of the 2012 Planning Rule (36 CFR 219.8-.11) are directly related to the proposed amendment. Based on the need for change and relevant forest-specific information and data, the following substantive requirements of 36 CFR 219.8 through 219.11 are directly related.

36 CFR 219.8(b)(5) – Cultural and historic resources and uses

A cultural resource may be many things, including valuable plant resources such as huckleberry patches, or areas of rare plants. According to a study performed by the Tulalip Tribe, maintaining an adequate supply and access to plants, like mountain huckleberry, on the Mt. Baker-Snoqualmie National Forest is critical to Tulalip and other area tribes. Huckleberries tend to decline as the tree canopy becomes denser and to increase after canopy reduction. A history of fire suppression along with the creation of Late Successional Reserves under the Northwest Forest Plan amendment have limited the creation of openings, causing the spatial distribution of mountain huckleberry habitat to decline (Bill et al., 2015).

The high elevation areas of MA-19 can be well suited for native huckleberry species, which need moderate to full sun exposure for flowering and berry production. The proposed forest plan amendment would eliminate existing direction requiring consistency with a non-existent study plan to undertake activities designed to enhance huckleberry habitat. This would make it easier for the forest and tribal co-managers to implement huckleberry enhancement and restoration activities.

36 CFR 219.9(a)(2) – Ecosystem diversity

Contributing to ecosystem diversity, timber management activities in MA-19 would be limited to those needed to improve habitat diversity, including huckleberry enhancement. Treatments would primarily consist of non-commercial silvicultural activities to promote huckleberry habitat, enhance habitat for a variety of wildlife species, promote a more diverse mosaic of forest conditions on the landscape, and provide increased connectivity of limited habitat.

36 CFR 219.10(a)(5) – Habitat conditions, subject to the requirements of §219. 9 for wildlife, fish, and plants commonly enjoyed and used by the public; for hunting, fishing, trapping, gathering, observing, subsistence, and other activities (in collaboration with federally recognized Tribes, Alaska Native Corporations, other Federal agencies, and State and local governments);

Wildlife benefits are expected to result from the proposed plan amendment. Areas treated pursuant to this amendment direction would provide localized increases in forage for a variety of wildlife from bears to birds, as well as providing nectaring plants with a variety of pollinator species from butterflies to bumble bees. See also 36 CFR 219.8(b)(5) – Cultural and historic resources and uses addressed above.

36 CFR 219.11(c) – Timber harvest for purposes other than timber production.

These lands are normally characterized by heavy snowfall accumulations and a very short growing season. MA-19 was classified as “not suitable” for timber production in the Forest Plan because existing knowledge, research, and experience did not provide reasonable assurance of reforestation success within 5 years after final harvest (36 CFR 219.(c)(3)). (Forest Plan 4-257). This forest plan amendment would not change that determination. MA-19 would remain classified as “not suited” for timber production.

Effects of Proposed Forest Plan Amendment

Alternative 1 – No Change from Current Management

Under Alternative 1, MA-19, Mountain Hemlock Zone (MHZ) management direction would not change. Existing standards and guidelines would remain. The Mountain Hemlock Zone is classified forest wide, totaling approximately 17,181 acres. The study plan may be implemented to determine the suitability of timber production to test theories of various timber harvest methodologies to establish the best practice for regeneration within 5 years (Desired Future Condition; MBS 4-457). The study plan was to be limited to 250 acres across the entire MHZ. Since no such Study Plan was developed, habitat improvement, and many other activities proposed in MA-19 areas would not be permitted.

Alternatives 2 and 3

Both action alternatives include a proposed programmatic forest plan amendment to remove the plan component requirement of a study plan within MA-19, Mountain Hemlock Zone. Modifying the standards and guidelines for MA-19 would allow management activities to improve habitat diversity in MA-19 across the Forest, particularly when the primary objective is to restore habitat for huckleberries.

The proposed forest plan amendment would apply to all areas of MA-19 across the forest, however there are no ground disturbing actions proposed on any MA-19 areas outside of the North Fork Stillaguamish Landscape Analysis project boundary, therefore there would be no direct or indirect effects on these areas. Up to 300 acres within the project boundary could be non-commercially thinned for huckleberry enhancement in MA-19. Trees up to 8” dbh, that are in direct competition of huckleberry plants would be selected for thinning. This would improve the growth rate of residual trees by reducing competition. Huckleberry habitat would be improved by providing moderate to full sun exposure for flowering and berry production. Prescribed fire may occur to reduce plant competition and encourage huckleberry growth.

The proposed project would be consistent with the substantive provisions described above.

Cumulative Effects of Amendment

The analysis area for cumulative effects is the Mt. Baker-Snoqualmie National Forest boundary. The proposed forest plan amendment would apply to all areas of MA-19 across the forest. However, there are no ground disturbing actions proposed on any MA-19 areas outside of the North Fork Stillaguamish Landscape Analysis project boundary. There would be no anticipated effects that would overlap in time and space with the proposed huckleberry enhancement in the project boundary. Therefore, there would be no cumulative effects. Additional site-specific analysis of effects would be required to implement actions in MA-19 areas located outside of the North Fork Stillaguamish Landscape Analysis project area boundary.

Environmental Impacts of the Proposed Action and Alternatives

This section summarizes the potential impacts of the proposed action and alternatives for each potentially affected resource. There are no expected significant impacts to any resource. The following resource sections are excerpts and summaries from corresponding reports. Analysis methodologies, more detailed existing condition discussions and additional rationale for determinations of effects for each resource will be disclosed in specialist reports, which are incorporated by reference and available in the project record for this EA and on the project website. See each report for a complete list of references.

Because most proposed activities are the same between Alternative 2 and Alternative 3, the term "action alternatives" refers to both Alternatives 2 and 3 when the analysis or discussion results in a similar conclusion.

Climate Change

Climate change trends for the North Fork Stillaguamish Landscape Project indicate increasing temperatures, increasing winter peak stream flows, decreasing summer low flows, and increasing summer drought through the 21st century (Raymond et al, 2014). The project area is almost completely within the North Fork Stillaguamish watershed (HUC-10) with a rain dominated precipitation regime. Across the project watershed, hydrology is especially vulnerable to climate change. Climate analysis recently completed in support of the 2014 climate change vulnerability assessment show a 1.5°C temperature increase by mid-century. Warmer winters will lead to increased flood events and the earlier onset of snowmelt. As the frequency and severity of winter flood events grows, the threat of landslides and subsequent damage to roads and trails will make maintenance more difficult. In addition, warmer and wetter winters will allow for survival of overwintering bark beetles while hotter and drier summers will lead to increased tree stress and reduced vigor. To counter this pattern of climatic stressors, active management can be used to increase forest resiliency and address the climate vulnerabilities of hydrologic interactions with road and trail networks. The warming trend will expose climate sensitivities and be more pronounced for the aquatic resources in the project area and across the associated watersheds.

Climate Sensitivity

Resources within the project watershed are sensitive to increased exposure to climate change. The degree of climate sensitivity varies by resource type and is tied to the adaptive capacity within the terrestrial and aquatic systems. Past land management has changed the landscape altering the effects of climate change at the project scale. Climate change sensitivities in the North Fork Stillaguamish project area include:

Old growth forest – The loss of old growth forest habitat, increased fragmentation and reduced connectivity make the forested landscape more vulnerable to insect outbreaks and fire. The conversion of multi-storied forests into timber plantation stands makes old growth habitat dependent species more vulnerable to drought stress and changing disturbance events.

Forest health – Past management practices will result in greater climate change sensitivities to dense, mid-seral forest stands as drought stress and fire events increase. Tree mortality from increased bark beetle outbreaks is expected because of warmer winters, hotter summers, and increased drought (USFS, 2021). Sensitivities of forested vegetation to changes in disturbances are reduced tree vigor with increased vulnerability to insects and pathogens.

Riparian habitat – Climate sensitivities of riparian habitat to changes in hydrologic regimes will be in response to more frequent floods and higher peak flows in the fall/winter. These hydrologic changes reduce riparian habitat within forests as extreme flood events and summer droughts increase. Extreme rain events are expected to become more frequent, causing localized impacts to soils, streams, and riparian vegetation.

In-stream habitat - Sensitivities of fish and aquatic habitats to increased flooding frequency and intensity in the fall/winter. Higher peak flows and more flood events may reduce fall egg-fry and winter yearling survival. Additional sensitivities of aquatic habitats to lower stream flows and warmer stream temperatures are reduced fish habitat quality as thermal stress increases on summer runs.

Transportation – Increased erosion and landslides are sensitivities of the road and trail networks as extreme flood events become more frequent. In stream sensitivity to increased sedimentation because of

flooding roads and culverts will impact water quality. Higher peak flows, increasing flood frequency, and increased soil moisture will result in damage to roads, trails, and bridges.

Adaptation Tactics

Active management can be used to implement strategies and adaptation tactics to address climate change sensitivities. Climate change vulnerability is most pronounced in previously managed areas, primarily associated with timber harvest and road building. Adaptation tactics in the North Fork Stillaguamish project area include:

Old growth forest – Use of variable density thinning in timber plantation stands to accelerate development of late-successional characteristics can increase resilience to disturbances for the benefit of old growth dependent species.

Forest health – Reducing monocultures, increasing stand-level biodiversity, and thinning to decrease stand density to minimize impacts of insect outbreaks and reduced tree vigor.

Riparian habitat – Restoring native vegetation structure and composition for shading and reducing stream temperatures. Increasing water storage capacity with use of beavers where appropriate.

In-stream habitat – Increasing floodplain connectivity will minimize the impacts of flood events on fish habitat. Increasing culvert sizes and disconnecting roads from streams will reduce the threats from roads.

Transportation – Decreasing road density, repairing and reconstructing roads to accommodate extreme flood events will help reduce sedimentation in streams and climate driven road closures. For trails and bridges at risk from increased peak flows and landslides consider rerouting trails and increasing the height of bridges.

The climate sensitivities and adaptation tactics identified for resources within the North Fork Stillaguamish Landscape Project area are from Climate Change Vulnerability and Adaptation in the North Cascades Region, Washington (Raymond et al. 2014).

Rationale for Project-Scale Effects Conclusions on Climate Change

The proposed actions would affect no more than 11972 acres of forest by commercially thinning smaller trees from the stand, retaining a residual stand of about 63 percent of the original stand by basal area. This scope and degree of change would be minor relative to the amount of forested land being 182,261 acres in the watershed. In addition, the effect of the proposed project focuses on aboveground carbon stocks, which typically comprise a fraction of the total ecosystem carbon stocks in the proposed managed area; 50 percent or more of the ecosystem carbon is in the soils, a very stable and long-lived carbon pool (McKinley et al. 2011, Domke et al. 2017).

An analysis of baseline carbon stocks and fluxes for the Mt. Baker-Snoqualmie National Forest indicates that baseline carbon stocks on the national forest are stable. Forest carbon stocks decreased by about 11 percent between 1990 and 2013. Negative impacts on carbon stocks were likely a result of stand dynamics and aging. According to satellite imagery, timber harvesting has been the most prevalent disturbance detected on the Forest since 1990. However, harvests during this period have been relatively small and low intensity. Forest carbon losses associated with harvests have been small compared to the total amount of carbon stored in the Forest, resulting in a loss of about 0.2 percent of non-soil carbon from 1990 to 2011.

Climate change is a global phenomenon, because major greenhouse gasses (GHGs)[19] mix well throughout the planet's lower atmosphere (IPCC 2013). Global emissions of GHGs in 2019 were estimated at 36.8 ± 1.8 gigatonnes[20] carbon dioxide (CO_2) equivalent[21] (Friedlingstein et al. 2019), while national emissions in 2019 were estimated at 6.56 gigatonnes CO_2 equivalent (US EPA 2021. Regionally, Oregon's 2015 GHG emissions were 63 megatonnes CO2 equivalent OR (OR DEQ, N.d.), and Washington's 2018 emissions were 99.6 megatonnes CO2 equivalent (WA Dept. of Ecology N.d.).[22] Given these emission numbers, a project of this size makes an extremely small contribution to overall emissions. Because local GHGs emissions mix readily into the global pool of GHGs, it is difficult and highly uncertain to ascertain the indirect effects of emissions from single or multiple projects of this size on global climate. Therefore, at the global and national scales, this proposed project's direct and indirect contribution to GHGs and climate change would be negligible. In addition, because the direct and indirect effects would be negligible, the proposed project's contribution to cumulative effects on global GHGs and climate change would also be negligible. Lastly, carbon emissions during the implementation of the proposed project would have only a momentary influence on atmospheric carbon concentrations, because carbon will be removed from the atmosphere with time as the forest regrows, further minimizing or mitigating any potential cumulative effects.

The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) summarized the contributions of global human activity sectors to climate change (IPCC 2014). From 2007 to 2016, forestry and other land uses contributed a net of 13 percent of the human-caused global CO_2 emissions[23] (Shukla et al. 2019). The largest source of GHG emissions in the forestry sector globally is deforestation (Pan et al. 2011, Houghton et al. 2012, IPCC 2014), which is defined as the removal of all trees to convert forested land to other land uses that do not support trees or allow trees to regrow for an indefinite period of time (IPCC 2000) (e.g., conversion of forest land to agricultural or developed landscapes). However, forest land in the United States has had a net increase since the year 2000, and this trend is expected to continue for at least another decade (Wear et al. 2013, USDA Forest Service 2016). In addition, estimates of forested area on the Mt. Baker-Snoqualmie National Forest have remained stable from 1990-2013.

This landscape project is not considered a major source of GHG emissions. Forested land will not be converted into a developed or agricultural condition or otherwise result in the loss of forested area. In fact, forest stands are being retained and thinned to maintain a vigorous condition that supports enhanced tree growth and productivity, thus contributing to long-term carbon uptake and storage. In 2019, forests in the United States removed about 789 megatonnes[24] of CO_2 from the atmosphere after accounting for natural emissions (e.g., wildfire and decomposition) (US EPA 2021).

Forests have a "boom and bust" cycle with respect to carbon, as forests establish and grow, experience mortality with age or disturbances, and regrow over time. Forest management activities such as harvests

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[19] Major greenhouse gases released as a result of human activity include carbon dioxide (CO_2), methane, nitrous oxide, **hydrofluorocarbons, and perfluorocarbons.**

[20] Gigatonne is one billion metric tons; equal to about 2.2 trillion pounds.

[21] Equivalent CO_2 (CO_2e) is the concentration of CO_2 that would cause the same level of radiative forcing as a given type and concentration of greenhouse gas. Examples of such greenhouse gases are methane, perfluorocarbons, and nitrous oxide.

[22] Megatonne is one million metric tons; equal to about 2.2 billion pounds.

[23] Fluxes from forestry and other land use (FOLU) activities are dominated by CO_2 emissions. Non-CO_2 greenhouse gas emissions from FOLU are small and mostly due to peat degradation releasing methane and were not included in this estimate.

[24] A megatonne is one million metric tons; equal to about 2.2 billion pounds.

and hazardous fuels reduction have characteristics similar to disturbances that reduce stand density and promote regrowth through thinning and removal, making stands and carbon stores more resilient to environmental change (McKinley et al. 2011). The relatively small quantity of carbon released to the atmosphere and the short-term nature of the effect of the proposed project on the forest ecosystem are justified, given the overall change in condition increases the resistance to wildfire, drought, insects and disease, or a combination of disturbance types that can reduce carbon storage and alter ecosystem functions (Millar et al. 2007, Amato et al. 2011). Furthermore, any initial carbon emissions from this proposed project will be balanced and possibly eliminated as the stand recovers and regenerates, because the remaining trees and newly established trees typically have higher rates of growth and carbon storage (Hurteau and North 2009, McKinley et al. 2011).

In the absence of commercial thinning, the forest where this proposed project would take place will thin naturally from mortality-inducing natural disturbances and other processes resulting in dead trees that will decay over time, emitting carbon to the atmosphere. Conversely, the wood and fiber removed from the forest in this proposed project will be transferred to the wood products sector for a variety of uses, each of which has different effects on carbon (Skog et al. 2014). Carbon can be stored in wood products for a variable length of time, depending on the commodity produced. It can also be burned to produce heat or electrical energy, or converted to liquid transportation fuels and chemicals that would otherwise come from fossil fuels. In addition, a substitution effect occurs when wood products are used in place of other products that emit more GHGs in manufacturing, such as concrete and steel (Gustavasson et al. 2006, Lippke et al. 2011, McKinley et al. 2011). In fact, removing carbon from forests for human use can result in a lower net contribution of GHGs to the atmosphere than if the forest were not managed (McKinley et al. 2011, Bergman et al. 2014, Skog et al. 2014). The IPCC recognizes wood and fiber as a renewable resource that can provide lasting climate-related mitigation benefits that can increase over time with active management (IPCC 2000). Furthermore, by reducing stand density, the proposed project may also reduce the risk of more severe disturbances, such as insect and disease outbreak and severe wildfires, which may result in lower forest carbon stocks and greater GHG emissions.

In summary, this proposed project affects a relatively small amount of forest land and carbon on the Mt. Baker-Snoqualmie National Forest and, in the near term, might contribute an extremely small quantity of GHG emissions relative to national and global emissions. This proposed project will not convert forest land to other non-forest uses, thus allowing any carbon initially emitted from the proposed project to have a temporary influence on atmospheric GHG concentrations, because carbon will be removed from the atmosphere over time as the forest regrows.

Botanical Resources

Affected Environment

The project is located within the Northern Cascades Physiographic Province (Franklin & Dyrness, 1973). The dominant species in the project area are Western hemlock (*Tsuga heterophylla*), Pacific silver fir (*Abies amabilis*), Douglas-fir (*Pseudotsuga menziesii*), and western redcedar (*Thuja plicata*). Red alder (*Alnus rubra*) is present in moist flats, areas with frequent soil movement and/or landslides, and in riparian zones. Legacy or remnant old-growth trees are present and sporadically distributed throughout the treatment stands; however, the vast majority of trees are under 80 years in age. Hardwoods are represented by vine maple (*Acer circinatum*) and bigleaf maple (*Acer macrophyllum*). Other unique habitats include small, incidental rock outcrops and emergent wetlands.

Roadside habitat within the project area is highly disturbed. The right-of-way is frequently maintained through general activities such as mowing, brushing, ditch cleaning, grading and slide removal, culvert

cleaning, slope repair, etc. The edge of the road is a habitat that typically receives more light than the surrounding forest, and additional water from road run-off. Plant species that tend to inhabit the road edge are typically early colonizers or invasive.

Numerous special status plants and high priority invasive plants are documented in the Project area, both within and outside of proposed treatment stands and roads. Attachment A of the botany report lists special status species known or suspected to occur in the Project area. Invasive plants known to occur in the Project area can be found in NRIS.

Environmental Consequences

Alternative 1: No Action

No actions would occur under the No Action Alternative. No impacts are expected to documented or suspected special status plants beyond those that are presently occurring. High priority invasive plant occurrences in the project area would continue to be treated as needs arise per standard operating procedure of the Forest's Invasive Plant Program, consistent with the Early Detection Rapid Response direction in the Forest Plan, as amended (2015).

Alternatives 2 and 3

For this analysis, a direct effect is the result of an action that has an immediate impact in time and space. It is any action that has an immediate impact on a special status plant or contributes to the introduction or spread of an invasive plant within the project area. Indirect effects of the proposed actions are those effects that occur at a different place or later point in time after project implementation. For this analysis, an indirect effect is any action that may later affect a special status plant or invasive plant within the project area. Direction, intensity, and duration of the effects in comparison to untreated landscapes are considered in analysis.

Special Status Plants

Special status plants can be negatively affected by stand and road treatments. Effects can be caused by, but not limited to, direct injury, solar exposure alteration, hydrologic pattern alteration, soil alteration, microclimate alteration, and/or invasive species introduction. The degree of effects is relative to where a population occurs in relation to disturbing activities. In addition, the extent and duration of the effects may influence the magnitude of direct and indirect effects.

Project Design Criteria are in place to minimize impacts to known occurrences. Site-specific mitigations would be applied to known special status sites based on the occurrence extent prior to implementation. Mitigations may include buffering occurrences, avoidance of occurrences, and/or other measures to provide for the persistence and maintain viability of the species at the site. Suitable habitat, for this analysis, is the environmental gradient and species assemblage in which a species of concern is typically found.

All stands proposed for vegetation management and road treatments are all under 5000-feet in elevation. The highest commercial stand and associated access road treatment is 3,720-feet. The highest non-commercial stands and associated access road treatment is 4,688-feet. *Pinus albicaulis* typically grows near timberline, within and above the subalpine zone (USFWS 2021). There are no proposed actions within the subalpine zone. In addition, the project area is outside the indicated US Fish and Wildlife Service's range for the species (USFWS 2023) and no occurrences have been documented in the project

area. In addition, vegetation management is not a threat to the species (USFWS 2021). There would be no effect to the threatened species *Pinus albicaulis* from proposed actions.

Impacts, either direct or indirect, to documented Survey and Manage botanical species from proposed actions is likely. The likelihood of impacts as a result of project actions is moderate because known sites would be managed. Although individuals may be impacted, sites would be managed through mitigations to ensure viability and persistence of the species at the known site.

Invasive Plants

Invasive plants can be affected by stand and road treatments. Potential effects can include introduction, establishment, and spread of invasive plants within the project area.

Invasive plants are widely distributed and abundant in the project area. Project Design Criteria would limit the introduction, establishment, and spread of these plants. Prevention measures to limit the introduction of invasive plants include the requirement to clean all equipment before coming on the Forest, the use of weed-free gravel and fill, etc. Measures in place to reduce the spread of existing occurrences include the requirement to work from a weed-free area first before moving into infested areas. Roads and rock pits/sources in which ground-disturbing activities would occur require pre-implementation treatments. These measures are unlikely to contain all existing infestations or prevent all introductions.

All areas that are disturbed have the potential to be colonized by invasive plants. Road (re)construction and maintenance activities include the movement of soil and rock material that may be contaminated with plant propagules, including a dormant seed bank. Stand treatments would reduce canopy cover and ground cover, in addition to increased ground disturbance. Most of the documented invasive species are shade intolerant. Opening the canopy may increase the amount of habitat suitable for establishment. Many treatment stands are adjacent to infested roadsides. With increased ground disturbance and movement of potentially contaminated material, there is the potential for existing infestations to expand into newly disturbed sites, such as reconstructed and temporary roads, treatment stands, and to expand farther along existing roadsides.

Potential effects from road treatments may result in the introduction, establishment, and/or spread of invasive species. The effects of these species on road edge habitat may include: 1) alteration in vegetation composition, 2) decreased wildlife habitat, and 3) decreased habitat for native pollinators. Invasive species that occur within the ROW are most likely to be impacted by road treatments. Continued disturbance of the road edge creates habitat for invasion. Invasive species that occur outside of the ROW are unlikely to be impacted by road treatments because there are no ground-disturbing activities outside the general ROW.

Decommissioning of temporary roads and closing of system roads would have the greatest effect of limiting the continued disturbance under which invasive plants thrive as well as stop the route of entry into new areas previously un-infested. Road decommissioning, or in some cases closure, would reduce the spread of invasives if current forest policy continues so that plants are treated prior to decommissioning or closure is implemented. Conversely, if invasives cannot be treated or restoration has not taken place prior to closure, lack of access could prevent future treatment or restoration of infested sites.

Cumulative Effects of the Action Alternatives

Cumulative effects are the accumulation of direct and indirect effects, due to the repetition and interaction over time, by other actions in the past, present, and reasonably foreseeable future, in addition to the proposed action. For this analysis, a cumulative effect is the result of the accumulation of impacts that

may affect a special status plant or cause the introduction or spread of an invasive plant within the project area. The entire extent of the project area serves as the cumulative effects analysis area.

Activities causing disturbance to vegetation in the past, present and future are largely a result of timber stand harvest and management and road (re)construction and maintenance, and to a lesser extent, special uses, recreation, and fish and wildlife habitat enhancement projects. The accumulation of direct and indirect impacts from these activities has resulted in vegetation alteration or modification. The actions proposed in this project would further alter vegetation in the project area.

Cultural Resources

Affected Environment

The project analysis area encompasses the traditional territories of the Stillaguamish, Tulalip, Upper Skagit, Samish, Swinomish, and Sauk-Suiattle Tribes. This is, of course, a generalization confounded by legal tribal identities originating from treaty times, whereas the reality is more complex. The formal identities of affected tribes were established as an oversimplification of groups of politically autonomous villages with intricate interfamilial ties and territorial permissions. Contemporary delineations of tribal interests do little to reflect the historical and pre-contact use of traditional territories. In general, the project area includes numerous pre-contact travel routes and sites that were used for countless generations by the ancestors of many contemporary tribal people. In addition to the somewhat formalized concept of tribal areas of interest, individual tribal members may have far-reaching familial connections to traditional resources within the project area regardless of tribal membership or residence. Furthermore, outlying areas used for generations may no longer be productive or accessible, leaving tribal members to seek resources far from their original ancestral lands. Therefore, many locations in the analysis area may hold special significance to tribal members, including those outside of the closest tribes, as a matter of complex familial tradition or modern necessity.

Environmental Consequences

Alternative 1 – No Action

This alternative would have no direct effects on significant archaeological or historical resources but could continue to affect the deficiencies in other cultural values. The lack of direct effects to archaeological resources or historic sites does not equate to a lack of indirect effects to resources of cultural importance. A century of Forest Service management and historic logging practices have displaced, disrupted, and countered countless generations of indigenous forest management. Whereas "indigenous peoples have been active participants in sustained plant resource production systems, influencing, through diverse and intentional methods, the quality and quantities of the foods and materials on which they have traditionally relied," much of the project analysis area has been adversely impacted by fire suppression, mid-century clear cuts, and a degraded road system (Turner, Deur and Lepofsky 2013). Failure to address the deficiencies will perpetuate the problems described in the purpose and need and hinder the return to a functioning forest ecosystem.

Alternatives 2 and 3

The effects can be categorized under three general types of actions, mechanical tree removal, non-mechanical tree removal, and prescribed fire.

Mechanical Timber Harvesting

Commercial thinning of trees would use a variety of mechanical logging systems, which can vary in their degree of impact. With tree felling, the affect is direct, such as a tree falling on a standing structure. The degree of impacts from yarding can vary from method to method, and are further dependent on slope, soil conditions, erosion potential, equipment used, and other factors. The simplest assumption is that artifacts can be dislodged, broken, and displaced. Lithic materials generally fare better in preservation but can suffer more impact breakage from hard strikes and pressure from skidding, vehicle tracks, and tires. Organic materials such as bark netting, baskets, mats, etc. are less effected by compaction from vehicle weight, but are less resistant to weather once exposed on the surface. Displacement affects the context in which artifacts are located and can reduce or destroy the scientific value of a site. A broken artifact in context is worth more than a whole artifact in another location. The degree of displacement depends on conditions and treatment methods, as well as the site's extant integrity. Direct effects to archaeological sites from mechanical logging activities can range from non-existent to total loss.

Indirect effects can range in scope from site-specific to broadly regional. Should artifacts be exposed by vegetation removal or soil displacement, they are more likely to be picked up by the public, or the loggers themselves (Bryant, Gehr and Flenniken 1982). Exposure also subjects the site to erosion, which further displaces and destroys the archaeological matrix. Increased exposure to weathering also poses a risk as organic materials such as woven fibers, wood, bark, and bone implements often deteriorate quickly once exposed to the surface. A less obvious indirect effect is that of destruction to site integrity by altering the viewshed or other nearby conditions. Sites are evaluated under specific criteria for their eligibility to the National Register of Historic Places (NRHP); however, they also must retain integrity to convey that significance. Indirect effects of integrity are generally ascertained through consultation and not through the direct identification of sites within the project area.

Mechanical logging also affects the understory diversity, including culturally important plants or fungi. In many cases, the current conditions are not desirable. Forest Service suppression of fire for more than a century has allowed former huckleberry patches to become non-productive through tree encroachment. Studies regarding logging effects on huckleberry propagation have shown "any type of logging disturbance on south and west aspects, followed by scarification or burning, significantly reduced berry production and huckleberry shrub cover (Martin 1979)." This is the result of the destruction of existing plant communities, which are usually maintained through lateral expansion of vegetative clones (Hudec 2018). Consequently, "forbs and graminoids are often the dominant species in clearcuts after scarification (Martin 1979)." It should be noted that huckleberries are not the only plant species of cultural importance. Although modern harvesting practices are far less damaging to the soil surface, they are not specifically prescribed to support the propagation of particular understory species.

Non-commercial Thinning

Non-commercial thinning stands would be accessed by foot or a standard truck, treated by chainsaws, and would not require skidding. Direct effects are negligible among low-profile sites such as lithic scatters or other non-architectural sites. Standing architecture would be at risk from tree felling but also easily avoided. Indirect effects resulting from erosion and artifact exposure are also less due to the retention of woody material on the surface. Conversely, the debris would protect unobtrusive sites from visibility, access, and erosion. Canopy openings without heavy ground disturbance are also more conducive to the propagation of valuable plant resources such as huckleberry clones.

Prescribed Fire

Prescribed burning of slash piles, ground fuels, and understory may be employed. The direct effects include risk to flammable and organic materials on or near the surface. The risk is highest for historical

features constructed of wood, such as railroad trestles or cabins. Lithic materials fare better in burned areas but can suffer changes in material integrity. Effects are dependent on fire severity and duration. A low severity short-duration burn may produce little to no damage to glass, metal, or stone artifacts. However, high intensity fire for a long duration, resulting from dense fuel loading such as large slash piles, can alter, melt, or break glass, oxidize metals, and collapse the crystalline structures of silicate stones. Intense fire can also alter soil characteristics, contaminating hearth features or soil inclusions that could have yielded diagnostic soil dates. Indirect effects result from increased erosion because of vegetation removal and formation of hydrophobic surface soils.

Road Construction and Road Closures

Direct effects for the construction of new roads or realignments varies depending on the existing condition and terrain. New construction of a formal road prism suitable for a large vehicle would employ heavy equipment and displace a substantial amount of soil. Where heavy equipment is employed, the consequence is the displacement of artifacts, destruction of buried features, and the total disturbance of archaeological matrix. If rock faces are to be cut, there is the potential for damaging or destroying rock art sites or rock shelter features. However, in most cases, what is considered "new" construction of temporary roads is the reconstruction of a former logging road or spur that was decommissioned or abandoned and is no longer classified within the road system. The impact is generally not more than the existing disturbance. Thus, reconstruction within these parameters generally does not pose a threat to significant sites. The exceptions would likely be found in realignments of corners where new soil disturbance is required to widen or straighten a curve.

Road decommissioning is proposed for some roads after access is no longer needed. If the road is an engineered feature with a defined prism, it is likely sites suffered a total disturbance during the initial construction. Thus, decommissioning after a road has been constructed/reconstructed for project access would not pose a threat greater than the roads initial construction.

Alterations of maintenance levels are generally low impact as they occur within existing road prisms. The closure of a road requires the removal of aquatic barriers and construction of additional drainage features. The potential effects are similar to road decommissioning. However, potential impacts are typically reduced due to the ground disturbance occurring within non-native fill material.

Road construction and decommissioning has the potential to provide or remove access to cultural resources. This can be both to the benefit and detriment of a site or traditional use area. If a cultural resource such as an archaeological site is at risk from looting or vandalism, the lack of access provides added protection. If a site is part of a shared cultural heritage and requires access by either tribal members or the public for its use and/or enjoyment, then providing access is a benefit. In the case of affected tribes, this right to access is affirmed by the trust relationship between the federal government and the tribes, the American Indian Religious Freedom Act, EO 13007, and the Treaty of Point Elliot.

Hazard Tree Removal

Individual hazard tree removal by non-mechanical methods and does not involve skidding typically does not pose a threat to archaeological sites. Mechanical removal of individual trees or small groups of trees has limited potential to affect cultural resources in a similar capacity as tree harvesting methods described above. However, old-growth trees may exhibit cultural modification or hold cultural significance or other utilitarian value to tribal members.

Rock Sources/Quarry Sites

The use of existing quarry sites has the potential to damage or destroy archaeological sites or otherwise affect cultural resources via the employment of heavy equipment. Most quarry locations are heavily

impacted and involve steep slopes; however, none have been reviewed for this analysis or previous projects. In addition, the project area includes one of four known *in situ* deposits of nephrite in Washington (Ozbun and Adams 2015), though most known traditional quarries in this area have become scarce or depleted through industrial quarrying. Nephrite is a traditional tool material historically used for ground stone tools and is occasionally sought by tribal cultural resource staff and artists. Expansion of quarries for road surfacing may inadvertently expose new nephrite sources, which may ultimately create a benefit so long as the mineral is not depleted.

Stormproofing and Aquatic Organism Passage

Aquatic organism passages and stormproofing are projects implemented within existing roads. The effects are the mostly the same as any road construction, maintenance, or decommissioning actions described above, except that they may be isolated to specific loci as opposed to running the length of a road.

Water features such as culverts generally exist within a disturbed context and involve non-native fill soil. It is possible that cultural resources will be affected by ground disturbance if components are buried below the existing feature, or outside of the lateral footprint of disturbance. It is also possible that existing passages are themselves historical features.

Instream enhancements

Various instream enhancements are proposed such as tipping trees into streams, and existing instream structure maintenance/enhancement. Most work instream does not have the potential to affect significant archaeological sites as the stream channels are periodically scoured by floods. River terraces, however, can retain important sites and features. Depending on the approach to instream work, heavy equipment may affect the stability of terrace sites directly by tipping (uprooting) trees for instream wood, or by constructing temporary access routes. The installation of wooden structures or the creation of "beaver dam analogs" may damage sites by creating side streams that erode older terraces or flooding adjacent terraces. In addition, trees may be valuable as cultural resources.

Designated Dispersed Camping/Restoration

Dispersed camping is not in itself an undertaking thus not subject to Section 106 review or clearance. However, the designation of dispersed campsites is an undertaking and presents a possible adverse effect to significant cultural resources. Effects of designating an existing dispersed camp could occur from the increased intensity of use, thus continuing loss from erosion or looting. Establishment of fire rings and hardening of eroding surfaces can further displace or damage artifacts and features. Designating new locations could subject otherwise intact cultural sites to new impacts. The proposal to close specific sites could include recontouring, decompacting, and replanting. This could damage or destroy shallow or surface cultural sites. The closure and rehabilitation of associated user-created access routes (roads that were not authorized so have no cultural resource analysis) would be considered an undertaking as defined in 36CFR800 and would result in ground disturbance.

Designation of sites often comes with a suite of stabilization or protective actions. When done to improve stability of soils, or protect the surrounding environment, it can provide a positive effect for nearby archaeological or historic resources by preventing erosion or escaped campfires. Designation can also be used to direct activity away from known sensitive sites.

Texas Pond

Texas Pond has a collection of recorded sites from pre-contact through the historic period. The recreational improvements and rehabilitation efforts have the potential to damage the sites directly through artifact displacement during groundwork or indirectly through increased concentration of public

activity. The site records require updating and the recreation plan requires refinement and would be further reviewed before implementation.

Conclusion

For some proposed undertakings, the details remain incomplete as part of the condition-based management. For others, the particulars were developed late in the review process. While a generalized analysis of the types of effects is possible, specific risks to cultural resources remain unknown or assumed. This was not an unexpected outcome for the NEPA timeline, nor does it prohibit a decision per 36CFR800.1c. Section 106 review would be completed prior to implementation.

Hydrology

Affected Environment

Watershed Information

The project area overlaps three HUC 10 watersheds, North Fork Stillaguamish River, Lower Sauk River, and the Finney Creek-Skagit River and includes eight HUC 12 subwatersheds (Table 17). For maps of the watersheds and subwatersheds, see Appendix A, Figures 19-20

Table 17. Watershed and subwatersheds in the Project Area.

Watershed (HUC10)	Subwatershed (HUC12)	HUC12 Code	Subwatershed Area (acres)	USFS Ownership (acres)	USFS Project (acres)	USFS Percent of Subwatershed in Project (percent)
North Fork Stillaguamish R.	Brooks Cr-NF Stillaguamish R.	171100080106	18,736	278	258	1%
Finney Creek-Skagit River	Day Creek	171100070106	22,250	1,951	1,950	9%
North Fork Stillaguamish R.	French Creek-North Fork Stillaguamish R.	171100080105	17,330	11,499	6,788	39%
North Fork Stillaguamish R.	Headwaters North Fork Stillaguamish R.	171100080101	25,794	23,764	23,764	92%
North Fork Stillaguamish R.	Lower Deer Creek	171100080108	26,181	7,412	7,412	28%
Lower Sauk River	Prairie Creek-Sauk R.	171100060404	24,087	6,717	179	1%
Lower Sauk River	Sauk River	171100060405	28,987	8,654	2,173	7%
North Fork Stillaguamish R.	Segelsen Creek-North Fork Stillaguamish R.	171100080103	14,883	5,600	4,810	38%
North Fork Stillaguamish R.	Upper Deer Creek	171100080107	16,550	14,515	14,515	88%

The Stillaguamish River and the Sauk River are both Tier 1 Key Watersheds on Federal land, providing, or expected to provide, high-quality refugia habitat for maintenance and recovery of at-risk stocks of

anadromous salmonids and resident fish species (Aquatic Conservation Strategy, USDA FS and USDI BLI 1994). All subwatersheds in the analysis area have an overall Watershed Condition Classification rating of good, indicating functioning properly under the USDA Forest Service Watershed condition Framework (Potyondy, J. P., & Geier, T. W. 2011). The two most limiting watershed conditions in the analyses area include aquatic habitat, and road and trail conditions, with several watersheds having a current rating of poor or fair (Table 18).

Table 18. Watershed Condition Classification indicator ratings by subwatershed in the Project Area.

Subwatershed	Aquatic Biota	Riparian wetland veg	Water quality	Water quantity	Aquatic habitat	Roads and trails	Soil	Fire effects regime	Forest cover	Forest health	Invasive species
Day Creek	Good	Fair	Good	Good	Poor	Poor	Good	Good	Good	Good	Good
French Creek-NF Stillaguamish R.	Fair	Good	Good	Good	Fair	Good	Fair	Good	Good	Good	Good
Headwaters NF Stillaguamish R.	Fair	Good	Good	Good	Poor	Fair	Fair	Good	Good	Good	Good
Lower Deer Creek	Fair	Good	Good	Good	Poor	Poor	Good	Good	Good	Good	Good
Prairie Creek-Sauk River	Good	Good	Fair	Good	Fair	Fair	Good	Good	Good	Good	Good
Sauk River	Good	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Good
Segelsen Creek-NF Stillaguamish R.	Fair	Good	Good	Good	Fair	Fair	Good	Good	Good	Good	Good
Upper Deer Creek	Fair	Good	Good	Good	Fair	Good	Fair	Good	Good	Good	Good

In the Stillaguamish River watershed Deer Creek, Little Deer Creek, and the North Fork Stillaguamish River on Forest Service lands have been included on the Washington State Department of Ecology's Section 303(d) list as impaired for stream temperature, and currently have a Total Max Daily Load (TMDL) plan in place to reduce thermal pollution. The North Fork Stillaguamish River has several additional water quality impairments off Forest Service Lands centered in the middle of the project area that could potentially be influenced by vegetation management of upstream Forest Service land.

Environmental Consequences

Alternative 1: No Action

Under this alternative, future trends in the riparian reserve would include higher than natural trees per acre and would likely contribute to less stand resilience as atmospheric conditions progress with warming trends of climate changes (i.e. prolonged periods of hot and dry weather putting non-typical stress on individual and groups of trees). If no actions are taken water quality benefits from road maintenance related interconnected actions of commercial harvest operations would not occur. Depending on the use and location of roads, some roads within the project area may still have routine maintenance that is not associated with any commercial harvest actions.

Alternatives 2 and 3

Using a condition-based approach for riparian reserve buffers in alternative 2, RR condition 2 would utilize larger buffers along Deer Creek and the Upper North Fork Stillaguamish River, given they are fish bearing. If alternative 2 is implemented with condition 2 applied along the Deer Creek and Upper North

Fork Stillaguamish River, there is likely to be no effects on stream temperature. Alternative 3 also meets the stream temperature recommendations for intermittent, perennial and fish bearing streams.

Regarding roads and possible sedimentation, during the implementation of this project sedimentation at road stream interactions would likely be similar as the current condition. Some temporary roads would be constructed and at these locations there could be some increase in sediment processes. Temporary roads would be restored to a full contour recovery post-use. Best Management Practices (BMP's) and project design criteria (PDCs) would be implemented to help maintain or improve current road and stream interactions.

Both alternatives 2 and 3 would create more hydrologically stable roads through either road storage and hydrologic closure, or road decommissioning. The effects of this on sedimentation would be similar for both action alternatives. Under Alternative 2, 12.1 miles would be decommissioned, and 90 miles of ML-1 roads would be placed in a condition that would require little to no maintenance until needed for future management (Table 19). Alternative 3 would decommission 47.5 miles, with 43.5 miles of ML-1 roads stored and hydrologically stable (Table 20). A system road managed to ML-1 standards would include disconnecting the road from the hydrologic system (termed hydrologically stable or hydrologic closure). While roads are stored motorized access is not allowed. Hydrologic closure focuses on a range of methods to move surface water off the road and decrease road impacts at stream crossings. This could be as little as a berm, to the removal of problem culverts and installation of water bars. Treatments would occur within 15 to 20 years.

Table 19. Alternative 2 Proposed Road Implementation Use & Post Implementation Conditions

Subwatershed Name	Alt 2 Implementation ML					Alt 2 Post-implementation ML (Long Term)					
	1	2	3	ML 1-3 Tot	Density ML 1-3 Rds	1 (Goal of Hydro Stability)	2	3	Decom.	ML 1-3 Tot (Not Decom)	Density* ML 1-3 Rds (Not Decom)
Aldon Cr – Skagit River	-	-	3.17	3.17	-	-	-	3.17	-	3.17	-
Day Creek	9.27	1.27	-	10.54	2.15	8.50	1.27	-	0.77	9.77	1.90
French Cr-NF Stillaguamish	9.75	4.73	-	14.48	1.20	9.16	3.90	-	1.42	13.06	1.06
Headwaters NF Stillaguamish	29.33	42.87	15.08	87.28	2.21	41.12	24.49	15.08	6.59	80.69	2.04
Loretta Cr – Skagit River	0.31	-	8.97	9.28	-	0.31	-	8.97	-	9.28	-
Lower Deer Cr	15.07	6.99	6.18	28.24	2.02	15.07	6.99	6.18	-	28.24	2.02
Lower Finney Cr	-	-	3.26	3.26	-	-	-	3.26	-	3.26	-
Prairie Cr-Sauk	0.63	-	2.15	2.78	2.24	0.63	-	2.15	-	2.78	2.24
Sauk River	7.42	1.72	4.19	13.33	3.25	7.58	1.55	4.19	-	13.32	3.25
Segelsen Cr-NF Stillaguamish	8.21	9.63	18.52	36.36	3.14	7.58	9.07	18.52	1.19	35.17	2.98
Upper Deer Cr	13.28	12.71	9.88	35.87	1.49	10.41	13.43	9.88	2.14	33.72	1.40
Upper Finney Cr	12.26	1.43	8.01	21.70	-	12.26	1.43	8.01	-	21.70	-
GRAND TOTAL	105.53	81.35	79.41	266.29	2.02	112.62	62.13	79.41	12.11	254.16	1.89

*Road density values are for the Project Area only due to lack of data for open roads in subwatersheds outside National Forest land.

Table 20. Alternative 3 Proposed Road Implementation Use & Post Implementation Conditions

Subwatershed Name	Alt 2 Implementation ML					Alt 2 Post-implementation ML (Long Term)					
	1	2	3	ML 1-3 Tot	Density ML 1-3 Rds	1 (Goal of Hydro Stability)	2	3	Decom.	ML 1-3 Tot (Not Decom)	Density* ML 1-3 Rds (Not Decom)
Aldon Cr – Skagit River	-	-	3.17	3.17	-	-	-	3.17	-	3.17	
Day Creek	9.27	1.27	-	10.54	2.15	8.50	1.27	-	0.77	9.77	1.90
French Cr-NF Stillaguamish	9.75	4.73	-	14.48	1.20	1.92	3.90	-	8.67	5.82	0.38
Headwaters NF Stillaguamish	29.33	42.87	15.08	87.28	2.21	14.36	35.77	15.08	22.07	65.21	1.62
Loretta Cr – Skagit River	0.31	-	8.97	9.28	-	0.31	-	8.97	-	9.28	-
Lower Deer Cr	15.07	6.99	6.18	28.24	2.02	12.39	6.99	6.18	2.68	25.56	1.79
Lower Finney Cr	-	-	3.26	3.26	-	-	-	3.26	-	3.26	-
Prairie Cr-Sauk	0.63	-	2.15	2.78	2.24	0.55	-	2.15	0.08	2.70	1.95
Sauk River	7.42	1.72	4.19	13.33	3.25	3.43	1.55	4.19	4.15	9.17	2.03
Segelsen Cr-NF Stillaguamish	8.21	9.63	18.52	36.36	3.14	3.61	9.07	18.52	5.16	31.20	2.46
Upper Deer Cr	13.28	12.71	9.88	35.87	1.49	8.45	13.57	9.88	3.98	31.90	1.32
Upper Finney Cr	12.26	1.43	8.01	21.70	-	4.28	9.41	8.01	-	21.70	-
GRAND TOTAL	105.53	81.35	79.41	266.29	2.02	57.80	81.53	79.41	47.56	218.74	1.52

*Road density values are for the Project Area only due to lack of data for open roads in subwatersheds outside National Forest land.

Table 21 displays the reduction of roads within 300 feet of streams in flood prone areas and total stream crossings for all alternatives. This is based on the miles of level one roads that could be hydrologically stable and miles of decommissioned roads. For both action alternative 2 and alternative 3, these reductions would be approximately 40%, including all ML-1 roads and all roads proposed for decommissioning.

Table 21. All Alternatives Comparison for Roads Near Streams

Alternative	Total Road Miles within 300 feet of Streams (miles)		Total Road Miles within Flood Prone Areas (miles)		Total Road Stream Crossings (number of crossings)	
	Implementation	Post Implementation	Implementation	Post Implementation	Implementation	Post Implementation
Alt 1 (No Action)	99.7	No Change	6.3	No Change	835	No Change
Alt 2	98.4[a]	57.6	10.6[b]	5.0	820[a]	482
Alt 3	98.4[a]	61.0	10.6[b]	5.0	820[a]	482

[a] Slightly lower numbers are showing in the roads within 300 feet of streams and in the stream crossings due to possible decommissioning of roads during implementation

[b] More roads are reflected in the Flood Prone Area column (6.3 miles – Alt 1 vs 10.6 – Alt 2, due to temporary roads during implementation, which would be fully decommissioned by the end of the project.

Water Quality- 303d Listed Waters

The Stillaguamish River Watershed Temperature study (DOE 2004, Adams and Sullivan 1989) found that the daily maximum temperatures in a stream are strongly influenced by removal of riparian vegetation because of diurnal patterns of solar shortwave heat flux. The net heat flux into a stream can be managed by increasing the shade from vegetation, which reduces the shortwave solar flux. Other processes, such as longwave radiation, convection, evaporation, bed conduction, or hyporheic exchange also influence the net heat flux into or out of a stream. USFS NorWeST Regional Database and Modeled Stream Temperatures data, shows that most streams in the project area, have a mean August temperature of less than 14 degrees C and would not exceed state water quality standards.

Water Quality - Sediment Delivery

Road networks are the most important source of accelerated delivery of sediment to anadromous fish habitats in forested watersheds of the Pacific Northwest (Swanson et al. 1987). Sediment from the road system can be delivered to streams by direct erosion of cut and fill slopes associated with stream crossings, or by surface runoff from roads and ditches that carries sediment-laden water directly or indirectly to streams. Not all sediment production from roadways reaches the aquatic system, because surface runoff from road surfaces and ditches is often directed to unchanneled slopes below the road where runoff has the potential to infiltrate the ground surface, or the sediment settles out onto the forest floor before entering the stream network.

Past timber harvesting and road building activities detrimentally altered the sediment regimes in many of the subwatersheds. Subwatersheds with the greatest impacts are those with the highest density of open roads, roads with deferred maintenance, and roads in the riparian areas.

Deferred Maintenance: Approximately 175 miles of roads in the project area could be used as part of the proposed actions. This means that up to 90 percent of the road system in the project area would receive maintenance or reconstruction. Headwaters of the NF Stillaguamish, Upper Deer Creek and Lower Deer Creek subwatersheds have the largest proportion of ML1 and ML2 roads with deferred maintenance needs in the project area. Reconstruction and maintenance activities would have immediate short-term soil disturbances but in the long term would improve drainage and have less sediment delivery than existing conditions.

Additionally, there is a long-term benefit with the reduction of 40% in roads within floodplains and with stream crossings. This is accomplished by treating ML-1 roads for hydrological stability, and through proposed road decommissioning. This could also lower instream sediment loading from roads.

Open Road Density at the watershed scale is often used to assess watershed conditions. Open road densities less than 1 road mile per mile squared of area are considered “good” and contribute to proper functioning conditions, densities between 1 and 2.4 miles per mile squared are considered “fair” and are functioning at risk, and greater than 2.4 miles per miles squared are considered “poor” and can impair watershed function (Potyondy and Geier 2011). Currently all subwatersheds in the analysis area are within the range of “fair”. With road decommissioning and treating ML-1 roads for hydrological stability, these watersheds could fall close to 1 mile per square mile and be considered good or close to good and contribute to a proper functional condition in the long term. Some of these subwatersheds may have short-term increases in open road densities during implementation as closed roads and unclassified roads would be re-opened and new temporary roads would be constructed. The increase in densities would persist for up to 5 years depending on the length of the timber sale contract, but this short-term increase would not exceed the threshold that would move any subwatershed to degraded condition. Open road densities would be similar for all watersheds following completion of cumulative road treatments.

Vegetation Treatments would contribute very minimal sediment, if any, to streams within the project area. Soil disturbing activities would be largely mitigated through avoidance and riparian buffers. These areas

would be buffered out of the proposed treatments and no equipment operations, cutting, or pile-burning would occur as appropriate for each buffer type. These buffers are consistent with Rashin et al. 2006 study, which found stream buffers were most effective where timber falling and yarding activities were kept at least 10 meters from streams and outside of steep inner gorge areas. This study found 10-meter setbacks for ground disturbance prevented sediment delivery to streams for approximately 95 percent of harvest-related erosion features in Washington. Similar outcomes would be expected for the North Fork Stillaguamish Landscape Analysis project and are consistent with state water quality standards.

Both alternatives have the potential to temporarily affect aquatic resources in the short-term, primarily due to building of temporary roads, and maintenance of existing system roads. Each activity has the potential to disturb soil. During implementation, there would be small spikes of sediment delivery to streams and waterbodies from activities such as grading and culvert replacement. Existing roads within the watershed would continue to provide sediment inputs to streams and waterbodies as long as they are on the landscape. However, the long-term sediment inputs would likely be lower than existing condition because of improved drainage and erosion control from reconstruction and maintenance activities.

Mitigation measures incorporated into the project would be implemented to minimize erosion and sedimentation. The implementation of best management practices would avoid or minimize potential increases in sediment loads to streams during project implementation. Long-term effects on hydrologic resources are expected to be minor and recovery could occur quicker than expected under the no action alternative.

Water Quality - Stream Temperature

A stream channel's ability to maintain stream temperatures is directly coupled with stream channel geomorphology and solar inputs. Elevated sediment regimes can overwhelm a stream channel's capacity to carry sediment resulting in loss of pool volume, instigation of channel widening along with shortening of the water column and subsequent increased stream temperatures. As discussed above, sediment production from the project is anticipated to be minimal therefore is not anticipated to impact temperature through geomorphic influences.

Riparian vegetation shading stream and river channels in the project area is highly variable. Along many of the project area streams, near channel riparian vegetation including hardwoods and shrubs that provide shading and other functions to the ecohydrology of these stream corridors are lacking or non-existent. Past harvesting has left stands so dense that insolation has been insufficient to support riparian vegetation. Thinning adjacent to these areas would hopefully release the hardwoods and other shade producing riparian species. While this project would not be treating trees in the no cut buffer areas, any increase in insolation and growth response along project area tributaries would be beneficial to ecohydrologic function of the Riparian Reserves as a whole. Along the North Fork Stillaguamish River, riparian vegetation is slowly recovering from past activities and is helping to increase bank stability and reverse historic channel widening.

As discussed above, the North Fork Stillaguamish Landscape Analysis project would have riparian no-cut buffers depending on stream type to protect riparian vegetation and stream temperature. The intent of no-cut buffers is to protect all vegetation on hillslopes immediately adjacent to streams to retain sufficient shade to prevent direct overhead solar heating of the stream. The literature consensus that a 100 foot no cut buffer, would result in no detectable changes to stream temperature following vegetation reduction harvests (Wilkerson et al. 2006). While the canopy density directly overhead would not be affected, the angular canopy density would be reduced by the thinning treatments in riparian reserves adjacent to the buffers thus allowing for increased solar inputs to intermittent streams. The solar inputs and response times would be greater on the smaller intermittent streams with smaller buffers than on larger non-fish bearing perennial streams with larger-foot buffers.

There is little to no literature comparing the effects of variable buffer widths on intermittent streams in the Pacific Northwest. However, the Groom et al. (2011) study found perennial streams with a 20-foot (6 meter) no cut buffer, coupled with a 50-foot limited entry buffer, exhibited a 40 percent probability of exceeding 0.3ºC temperature increase. This study however evaluated effects from clear-cutting which will not be used in this project. Using the information gained by this study it could be inferred that intermittent streams may have some seasonal increases to stream temperatures in areas that crown cover is reduced. It would be expected that the magnitude of the temperature increases would be heavily diluted because most intermittent streams would not be flowing when solar inputs are greatest, therefore effects to downstream temperatures should be minimal. Additionally, in the thinning entry of the remaining portions of the RRs has a desired canopy cover target of 40 to 50% (USDA Forest Service 2022b). This is far superior shade cover, then that in the Groom's study.

Depending on which alternative is implemented it is possible that there may be small localized short-term increase to stream temperatures of intermittent stream branches, however; such solar fluxes are necessary to encourage diverse riparian understory and to promote variable nutrient cycling (Warren et al. 2017). The variable density thinning treatments proposed in this project are intended to mimic a more natural riparian forest accelerating the development of late-successional structure and composition. Long-term changes to temperature are not anticipated as hardwoods and other shade producing riparian species would be released reducing angular solar inputs over time. Overall, these treatments would lead to improved riparian function and ecohydrology.

Water Quantity - Stream Flows

Removal of live vegetative cover can increase runoff and alter streamflows in forested watersheds. The threshold at which flow increases become measurable ranges between 15 to 25 percent vegetation reduction within a subwatershed and is dependent upon antecedent soil moisture; with vegetation reduction having more significant changes to water yields when conditions are wet and soil moisture is high (Stednick 1996, Bosch and Hewlett 1982). The removal of overstory vegetation decreases interception and transpiration allowing water tables and stream flows to increase. If vegetation removal exceeded 25 percent of the subwatershed then the expected result would be faster response times and higher peak flows of streams, and elevated water tables in wetlands, ponds, and lakes during flooding events. Such changes could cause accelerated rates of erosion, could contribute to slope instability or mass wasting events, and could lead to failure of road stream crossings and other infrastructure. Changes in water quantity could persist for up to 15-years (Verry 1986) and are more pronounced during wet cycles (Carrera-Hernandez et. al. 2011).

The Headwaters North Fork Stillaguamish HUC 12 watershed would receive the majority of treatments proposed. Thinning operations are anticipated to reduce relative vegetation cover by approximately 2,497 acres. The watershed has a total of 25,794 acres so the maximum reduction of vegetation cover would be approximately 10%, therefore, neither action alternative is expected to have a measurable increase in stream flow. A portion of the water that would be contributed to streams may be used by the remaining vegetation and help establish larger tree diameter and enhance forest health. Commercial thinning operations contribute far less sediment than road and stream interactions. Pre-commercial thinning treatments would not produce measurable sediment increases in streams within the project area. The reduction of road density proposed in either alternative would reduce sediment transfer to streams and may help reduce high peak flows.

Cumulative Effects

Past actions are considered if they are still contributing to cumulative effects, which are primarily roads, otherwise, past actions were considered as part of the baseline condition.

Regular scheduled road maintenance and corridor trimming would be on-going. Recovery of vegetation and riparian habitat along road corridors that pass through riparian reserves would be occurring concurrently. These on-going roads maintenance actions may or may not be in the area of this project's activities. The effects of other on-going projects such as invasive species removal or rehabilitation would be site specific and due to separation in space, would have no cumulative effects within the riparian reserves in this project.

Conclusion

Both action alternatives strive to enhance the health of streams and associated aquatic ecosystems by modifying the transportation system. Alternative 2 would have less roads decommissioned than Alternative 3. However, both alternatives would place maintenance level 1 roads into a hydrologically stable storage condition. This long-term goal of placing enough roads into this condition would decrease the effects of roads on instream environments.

In the short term, over the period of either action alternative, operations could contribute to instream sedimentation input at small scales. In the long run with the reduction of as much as 40% of the roads within floodplains and 40% reduction in road stream crossings, this could lead to much lower instream sediment loading due to roads.

Both action alternatives have wide enough buffers to maintain in-stream temperatures for anadromous species. Treatments in the outer portion of the riparian reserves with a variable density thin, in the long run would allow large diameter trees to be ultimately present in riparian reserves and to contribute to future large wood recruitment into instream environments.

Activity-specific design criteria and BMPs are designed to minimize detrimental soil disturbance, protect water quality, and maintain physical stability and hydrologic connectivity of riparian and aquatic habitats (see appendix B of EA for a list of applicable BMPs). There is little potential for the proposed action alternatives to have long-term adverse effects to the geomorphic, hydrologic, or riparian characteristics and aquatic habitats in affected watersheds.

Both action alternatives are consistent with the Clean Water Act. Federal water quality standards for designated beneficial uses would be met or exceeded. This project would not negatively affect 303(d) listed waterbodies. Each alternative for this project is consistent with the Mt. Baker-Snoqualmie National Forest Land and Resource Management Plan and Final Environmental Impact Statement, as amended since all watershed standards and guidelines are met. State and Federal water quality standards would be met using best management practices (mitigation measures) and any applicable permitting from State and Federal agencies. Riparian areas would also move toward the desired future condition of improved habitat diversity through mature tree management while maintaining trees needed for slope stability and future large woody debris recruitment into stream systems. Both alternatives are consistent with the Aquatic Conservation Strategy Objectives. In conclusion, Alternatives 2 and 3 propose treatments that would benefit the watershed.

Fisheries

Affected Environment

For watershed information see hydrology section and fisheries report in the project record.

Fish Habitat in the Analysis Area

This analysis focuses on the Upper North Fork Stillaguamish River watershed where most of the actions are proposed. Fish populations and habitat in other subwatershed have similar baseline conditions so are noted when differences are deemed important to address.

Critical Habitat -Designated critical habitats for Puget Sound Chinook, Puget Sound steelhead, and bull trout in relation to the project area are listed in Table 22 with the pertinent fish species.

The primary constituent elements (PCEs) of critical habitat identified by USFWS for bull trout are: (1) space for individual and population growth and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, or rearing (or development) of offspring; and (5) habitats that are protected from disturbance or are representative of the historical, geographical, and ecological distributions of a species.

For Puget Sound Chinook and steelhead, the freshwater PCEs for Chinook and steelhead are nearly identical: (1) freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development; (2) freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks; (3) freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

Essential Fish Habitat -The National Marine Fisheries Service released the final rule for essential fish habitat (EFH) for Pacific salmon in 2008 (73 FR 60989). In relation to the project area, they include all streams and other water bodies occupied or historically accessible to Puget Sound Chinook salmon, coho and pink salmon, which are the species managed by the Pacific Coast Salmon Plan. EFH are those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. The North Fork Stillaguamish River provides EFH for Pacific Coast salmon.

Sensitive Fish Species Habitat -In preliminary findings from a Puget Sound-wide eDNA sampling effort completed between 2020 and 2021, there were positive results confirming Pacific Lamprey in the North Fork Stillaguamish River basin (K. Carim, personal communication, 04/13/2022). All confirmations of eDNA were below the project area. The sampling was limited both in time and space, and eDNA results alone cannot confirm absence of Pacific Lamprey. No samples were taken within the project; therefore the results do not preclude the possibility of Pacific Lamprey being within the project area. The historical population in the Stillaguamish is estimated to have been between 1,000 – 5,000 but is assumed to be around 500 – 1,000 (Plumb and Blanchard 2021).

Habitat conditions below the project area are likely more suitable for Pacific Lamprey spawning and incubation, particularly in the mainstem North Fork Stillaguamish River, Deer Creek, Little Deer Creek, and Segelson Creek, however habitat conditions for emerging ammocoetes seem to be limited in quantity in the project area.

Fish Species

Table 22 displays the fish species of interest, any special designations, and their utilization of the project area.

Table 22. Fish species and habitats of interest and special designations.

Species (Stock)	Status[25]	Utilization Associated with Project Area[26]
Chinook (NF Stillaguamish River (Summer and Fall); *Oncorhynchus tshawytscha*	NMFS—Listed threatened (3/99); Designated critical habitat (9/05); Essential fish habitat FS—MIS SaSI 2002— Depressed	Mainstem North Fork Stillaguamish River to RM 37.3 at natural barrier. Deer Creek documented up to RM 12.1 (pers. comm. WDFW) and gradient accessible to RM 19.8 as well as Higgins Creek up to RM 3.32. Gradient accessible large tributaries to the NF Stillaguamish River above Deer Creek include Dicks Creek (RM 1.5), Segelson Creek (RM 1.07), Critical habitat in Deer Creek to RM 1.37 and in the mainstem North Fork Stillaguamish to the natural barrier at RM 37.3) and EFH in all occupied or historically accessible habitat in the project area.
Bull trout (Stillaguamish River); *Salvelinus confluentus*	USFWS—Listed threatened (11/99); Revised designated critical habitat (10/10) FS—MIS SaSI 2004—Unknown	Documented in mainstem North Fork Stillaguamish to mouth of Squires Creek (RM 31.2) presumed to RM 34.26. Presumed in Segelson Creek (RM 1.69), Dicks Creek (RM 1.53), documented in Deer Creek through RM 19.8 and Higgins Creek to RM 2.2. Presumed to be in Higgins an additional 1.91 miles. Documented in Little Deer Creek to RM 0.96 and presumed further upstream to RM 5.83. Critical habitat in the mainstem North Fork Stillaguamish River up to the natural anadromous barrier at RM 37.3, in Deer Creek to RM 19.8, Little Deer Creek and Higgins Creek to approximately the headwaters.
Steelhead (Stillaguamish River Winter; Deer Creek Summer); *Oncorhynchus mykiss*	NMFS—Listed Threatened (6/07; only anadromous); Designated critical habitat (2/16) FS—MIS (anadromous and resident rainbow) SaSI 2002—Depressed	Mainstem North Fork Stillaguamish River to the natural barrier at RM 37.3. Deer Creek documented up to RM 18.4 as well as Higgins Creek up to RM 3.32, Little Deer Creek (RM 5.92), and DeForest Creek (RM 0.37). Documented in large tributaries to the NF Stillaguamish River above Deer Creek include Dicks Creek (RM 1.81), Segelson Creek (RM 1.85). Critical habitat is the same as described above for the distribution of winter and summer steelhead.
Coho (Stillaguamish River); *Oncorhynchus kisutch*	NMFS—Candidate; Not Warranted (7/10); Essential fish habitat FS—-MIS SaSI 1992—Depressed	Mainstem North Fork Stillaguamish River to the natural barrier at RM 37.3. Deer Creek documented up to RM 19.8 as well as Higgins Creek up to RM 1.80 and gradient accessible to RM 3.32, Little Deer Creek (RM 4.78), and DeForest Creek (RM 0.30). Documented in large tributaries to the NF Stillaguamish River above Deer Creek include Dicks Creek (RM 1.81), Segelson Creek (RM 0.60).

[25] *NMFS—National Marine Fisheries Service; FS—Forest Service; USFWS—United States Fish and Wildlife Service; SaSI—Washington Salmonid Stock Inventory (WDFW 2000, 2002, 2004); MIS—Management Indicator Species (from USDA FS 1990)*

[26] *Sources: SaSI reports at http://wdfw.wa.gov/conservation/fisheries/sasi/; Salmon Conservation Reporting Engine (SCoRE) at https://fortress.wa.gov/dfw/score/score/species/species.jsp; SalmonScape at http://apps.wdfw.wa.gov/salmonscape/; the activity map layer in WDNR's Forest Practices Application Mapping Tool at https://fortress.wa.gov/dnr/protectiongis/fpamt/index.html; and Williams et al., 1975.*

Species (Stock)	Status[25]	Utilization Associated with Project Area[26]
		EFH in all occupied or historically accessible habitat in the project area.
Pink (North Fork Stillaguamish River); *Oncorhynchus gorbuscha*	NMFS—Not Warranted (10/95); Essential fish habitat FS—MIS SaSI 2002—Healthy	Mainstem North Fork Stillaguamish River to the RM 36.19 and gradient accessible to the natural barrier at RM 37.3. Documented in Segelson Creek up to RM 0.74 and gradient accessible to RM RM 1.04. Dicks Creek is gradient accessible to RM 1.50. Documented in Deer Creek to RM 1.31 and gradient accessible beyond to confluence with Higgins Creek. Higgins to (RM 3.32) and Little Deer Creek (RM 4.98) are gradient accessible. EFH in all occupied or historically accessible habitat in the project area.
Chum (North Fork Stillaguamish River); *Oncorhynchus keta*	NMFS—Not Warranted (3/99) FS—MIS SaSI 2002—Healthy	Mainstem North Fork Stillaguamish River to confluence with Squires Creek (RM 31.2) presumed beyond to the natural barrier at RM 37.3. Documented in Dicks Creek to RM 0.96 and gradient accessible to RM 1.50. Documented in Segelson Creek to RM 1.38. Documented in lower Deer Creek to RM 1.38 and gradient accessible beyond to confluence with Higgins Creek. Higgins to (RM 3.32) and Little Deer Creek (RM 4.98) are gradient accessible. Gradient accessible beyond to confluence with Higgins Creek.
Coastal cutthroat (Stillaguamish River); *Oncorhynchus clarki*	NMFS–-Not Warranted (4/99) FS–-MIS (anadromous and resident) SaSI 2000—Healthy	Mainstem North Fork Stillaguamish through the area described above including above the natural barrier at RM 37.3. Documented in Cascade Creek at crossing with FSR 18. Presumed throughout upper North Fork Stillaguamish River to natural or manmade barriers. Documented in Deer Creek and presumed in accessible tributaries throughout the project up to natural or manmade barriers.
Pacific Lamprey	FS Sensitive Species	Unknown

As effects to the management indicator fish species are only made at the Forest scale, Table 23 shows forest-wide presence of these species.

Table 23. Documented and presumed presence by fish species of interest.

Fish species	Miles of documented presence on the MBS[27]
Chinook salmon	202
Bull trout	513
Steelhead	356
Coho salmon	366
Pink salmon	154
Chum salmon	54

[27] From WDFW 2018; does not include miles on other land ownerships

Sockeye salmon	141
Cutthroat trout	587
Rainbow trout	491

Environmental Consequences

Alternative 1: No Action

With this alternative, fish habitat and the riparian area surrounding aquatic resources in the project would maintain existing availability of wood that could be recruited to streams. The smaller diameter trees in the riparian area that currently exist would continue to provide stream functions in smaller tributaries (Jackson 2001; Beechie and Sibley 1997), however the lack of mobilization and transport to fish-bearing waters (Jackson 2001), inability to provide channel forming functions in larger fish-bearing streams (Martin and Benda 2001), or be retained in larger channels (Bilby and Ward 1989; Montgomery et al. 1995; Beechie and Sibley 1997) contributes less function to downstream fish habitat.

Roads would continue to obstruct tree recruitment to headwater catchments from being exported via naturally occurring debris flow, mass wasting, or snow avalanching mechanisms to downstream fish habitat (Hassan et al. 2005, May and Gresswell 2004). Lack of road reconstruction and maintenance would continue to put most of the roads and infrastructure at risk of failure due to lack of general maintenance to low-level roads and infrequent maintenance to low-clearance public use roads (ML 3-5). Increased risk of failure from infrastructure reaching end of service life could lead to downstream degradation of fish habitat and short to long-term alteration of behavior or physiology of fishes depending on the magnitude and duration of the failure.

The replacement of up to 30 estimated fish movement barriers (AOPs) would not occur. There are several fish barriers in the project area identified using a range of tools from GIS modeling to field verification. All confirmed or presumed fish barriers would continue to disconnect fish from available fish habitat.

Alternatives 2 and 3

The impacts to the fisheries resource of each alternative do not differ enough in scope or scale to warrant independent analysis for all project elements so they are analyzed collectively. Timing of project activities would be spread over 15-20 years. Project activities and their effects would not occur all at once, nor all in the same watershed, and are likely not to be fully implemented for up to 20 years.

Direct and Indirect Effects on fish and fish habitat

The effects on the fisheries resource from both action alternatives include the number of potential trees recruited to nearby streams that contribute to the creation of fish habitat, sediment delivery from road related activities, and the replacement or removal of fish barrier structures.

Wood recruitment to streams

Less than 8% of the stream network within proposed commercial treatment areas are considered fish-bearing streams. Less than 26% are considered perennial non-fish stream. Both Alternative 2 and 3 propose to apply no-cut buffers (Table 24) all streams. These buffer widths would protect a large proportion of trees that could naturally be recruited to streams and provide immediate benefits to fish by developing and/or supplementing fish habitat. A determination of buffer width for alternative 2 non-fish streams would be a function of stream specific wood loading and would be determined at the time of implementation.

Table 24. Action Alternative Stream Buffers

Stream Classification	Alt 2 RR Condition 1 – Retained No-Thin Buffers	Alt 2 RR Condition 2 – Retained No-Thin Buffers	Alternative 3– Retained No-Thin Buffers
Fish Bearing (Perennial and Intermittent)	100 ft	100 ft	150 ft
Perennial Non-fish Bearing	50 ft	100 ft	150 ft
Intermittent Non-fish Bearing	25 ft	50 ft	50 ft

The 25 or 50 foot no-cut buffer on non-fish intermittent streams would reduce the total number and volume of trees that could be recruited to nearby streams, however conclusions from previous research largely suggests that most recruited wood to streams originates from distances within 50 feet. In addition, windthrown mortality of riparian trees has been observed to increase with proximity to treatment areas (Liquori 2006, Martin and Grotenfendt 2006, Schuett-Hames and Stewart 2019) and soon after treatment which could provide a short-term pulse of wood to streams.

Less than 32% of the entire stream network in the treated areas of the project area are considered perennial non-fish streams. This equates to less than 50 miles of a stream network within treated vegetation areas of over 150 miles of stream. The difference in total acres along less than fifty miles of stream with an applied buffer of 150 feet (Alternative 3) or 100-50 feet (Alternative 2) is of such few acres and the consequences of that difference on physical habitat would be undetectable.

Over 60% of the stream network within the treatment area are considered non-fish intermittent streams. The no-cut buffers range from 50 to 25 feet across the alternatives and would reduce the greatest number and volume of wood from riparian areas that have the potential to recruit to adjacent streams. However, the loss of recruitable trees in these areas does not have an immediate impact to fish or fish habitat. The benefits of recruited wood in upslope non-fish streams to fish and fish habitat are the ecological functions that they protect through establishing a more natural geomorphic setting in the near term and the possible exportation of wood to downstream fish and fish habitat in the long-term. Given that nearly 70% of the treatment area reside above roads that preclude downstream movement of large wood, the consequences of reducing the number and volume of wood along non-fish intermittent streams to downstream fish and fish habitat is likely negligible.

Dispersed camping and Texas Pond recreation actions would restore heavily impacted riparian areas and relocate activities to areas that minimize the need for tree removal surrounding aquatic resources. Areas restored would allow for riparian vegetation to return and eventually provide future wood for potential recruitment to nearby aquatic resources. Repair of the Texas Pond dam and spillway would include coordination with Washington State Fisheries Co-Managers (Tribes and WDFW). The pond and associated facilities would be evaluated and treated to prohibit or minimize downstream movement of non-native Eastern Brook Trout and small-mouth Bass into the Sauk River. Non-native fish are a limiting factor to ESA-listed salmon recovery therefore treatment by any means would improve conditions for those fish species and all other native fish.

Stand improvement, including huckleberry enhancement, occurs in areas that are typically not occupied by fish nor connected to fish-bearing streams, however, in the case they are appropriate buffers would be implemented to maintain tree recruitment potential.

Beaver habitat enhancement and instream wood proposed actions would not remove riparian trees as part of the proposed activity. Inundation of the surrounding area after project implementation may cause limited mortality to adjacent riparian trees. Any beaver enhancement project would be required to follow

conditions provided by WDFW in the USFW and WDFW Memorandum of Understanding (2022) and Project Design Criteria (PDC) required through the USFS Aquatic Restoration Biological Opinions issued by NMFS and USFWS (Appendix B).

Underburning, broadcasting burning, and pile burning are activities implemented post treatment, are limited to the treatment area, limited to downed wood, ladder fuels, and understory vegetation. These actions would not remove standing live riparian trees and are limited by site-specific PDCs (Appendix B).

Sediment

Under both action alternatives system roads and non-system roads (temporary roads) would be used to access stands for vegetation treatment (Table 6, Table 10). A portion of nearly 870 stream crossings would receive needed maintenance and replacement.

Heavy road use associated with timber harvest can cause sediments to be mobilized from gravel road surfaces (Reid and Dunne 1984). Where roads are within 150 feet of streams, local inputs of sediment could be deposited in fish habitat (Dube et al. 2004), filling pools used for rearing or hiding. Sedimentation during spawning periods could smother eggs. Seasonal restrictions on log haul and required installation of erosion control features would greatly minimize sedimentation from increased road use. There would also be minor, short-term impacts to streams due to small amounts of sediment inputs that would be generated during road maintenance activities such as culvert removal and road drainage work (Foltz et al. 2008). The short-term increase in sediment would have minimal negative impact on fish and fish habitat with the potential for long term benefits from maintaining the service life of existing infrastructure and replacing some infrastructure to meet current regulatory standards. The implementation of BMPs would mitigate, to the extent possible, downstream translation of sediment to fish habitat.

Dispersed camping and Texas Pond recreation actions – PDCs would limit sediment discharge to adjacent aquatic resources (Appendix B). Repair and maintenance of the Texas pond dam would likely produce short term pulses of suspended sediment that would translate to downstream fish and fish habitat. Appropriate erosion control measures would be implemented prior to disturbance to minimize sediment transport.

Stand improvement, including huckleberry enhancement -sediment production from this activity is anticipated to be minimal and unlikely to be translated downstream to fish-bearing streams.

Beaver habitat enhancement - Short-term sediment production can be anticipated during project implementation but will be limited to foot traffic in streams as part of Beaver Dam Analogue (BDA) construction. If successful, these structures could reduce the volume of fine sediment transported downstream through reduced streamflow velocities and sediment aggradation.

Underburning, broadcasting burning, and pile burning are activities implemented post treatment, and impacts are limited by site-specific PDCs that minimize the potential for sediment to enter aquatic resources, specifically the retention of riparian buffers that filter out sediment. (Appendix B).

Fish Passage - Within the project area, there are an estimated thirty fish bearing streams that cross USFS roads. Many have been verified as fish barriers. Short-term sedimentation would occur during replacement or removal of barriers, lasting during construction and within a year of completion after the first couple flushing flows of the season. BMPs and timing windows would minimize inputs of sediments and contaminants, and habitat would be available immediately upon completion and over the long-term.

Fish - Direct effects to fish could occur during implementation of fish passage and other road projects in fish-bearing streams. De-watering of the work areas may entail fish to be handled during capture-removal from the sites, including where federally listed fish may be present. Indirect effects of improving riparian, instream habitat quality and quantity would benefit fish health, growth, and survival. Quantifying such benefits in relation to proposed project activities is not feasible, however.

Mitigations for drafting water would prevent entrainment of fish. Other proposed activities are away from streams and would be neutral to fish with implementation of mitigation measures and pertinent BMPs to address indirect effects such as sedimentation.

Effects to Federally Listed Fish and Critical and Essential Habitats

Action alternatives would treat, store, or decommission roads near federally listed fish habitats. Preliminary effects determinations indicate the implementation of either proposed action alternative to ESA listed fish species, designated critical habitat, and essential fish habitat for Pacific Coast salmon could result in an effects determination of Likely to Adversely Affect.

Overall, project activities are expected to have a long-term benefit from reduced potential for road failures and road-related sedimentation of spawning and rearing habitats, increased habitat complexity, and stability, improved riparian area function, and increased accessibility of habitats past barriers. As required, consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service would be complete before implementation of the project begins.

MBS Sensitive Species

Analysis of sensitive species looks at the significance of effects on the populations, its habitat, and on the viability of the species. The primary limiting factors affecting Pacific Lamprey in the North Fork Stillaguamish basin are unlikely to be negatively impacted by any project elements. There are no direct effects from proposed project activities. Indirect effects that influence Pacific Lamprey life history strategies could originate from changes in fine sediment transport (road maintenance, reconstruction, haul) and stream temperature (vegetation treatment). While sediment and temperature are not specific limiting factors, they are important abiotic factors that can impacts different parts of the Pacific Lamprey life cycle. Changes in stream temperature from implementation of any of the alternatives proposed are described in the hydrology report. Based on those findings it is unlikely that changes in stream temperature would increase outside of the normal range for incubating eggs. The implementation of best management practices would avoid or minimize potential increases in sediment loads to streams during project implementation. Transport and deposition of fine sediment within the range occurs naturally and is a beneficial characteristic of ammoecete rearing habitat, therefore the fine sediment contribution from project activities is unlikely to have a negative impact on lamprey or their rearing habitat if it stays within that range. Proposed project activities may impact individual Pacific Lamprey or Pacific Lamprey habitat, but will not likely contribute to a trend towards Federal listing or cause a loss of viability to the Pacific Lamprey population or species.

Effects to Management Indicator Species

Effects to the management indicator fish species are made at the Forest scale. The MBS management indicator species are Chinook salmon, steelhead, bull trout, coho, pink, chum, sea-run cutthroat, rainbow, and resident cutthroat. While there are no specific “effect calls” for management indicator species, proposed activities would not affect the Forestwide viability of these populations, nor would they have a measurable negative effect to the quality or quantity of their habitats in the mainstems of the upper North Fork Stillaguamish River or upper Deer Creek, their tributaries or in the (generally) low-gradient fish-bearing reaches of the small tributaries in the project area. While the risk of potential future negative

effects to fish and habitats would be reduced, quantifying such benefits to fish or to their habitats would be difficult.

Cumulative Effects of Action Alternatives

All Action Alternatives may result in short-term impacts from sediment at sites where road reconstruction, maintenance, or haul use occurs near streams. Reduction in riparian trees that could potentially recruit to streams would be long-term impact. All impacts are expected to be minimal and localized with the implementation of Best Management Practices and no-treatment riparian buffers. This is negligible when added to the more frequent and wide-spread riparian management impacts occurring on state and private land currently and in the future. These impacts combined continue to slow the recovery of suitable habitat for ESA, Sensitive, and MIS fish species. There would be a long-term benefit from maintenance of the road system. Road work would maintain the service life of existing structures and replace some infrastructure with new structures up to current regulatory standard. Long term positive effects to fish habitat would be realized in the future from reduced mass wasting and infrastructure failure. The action alternatives would take place over 10-20 years in sub-watersheds. The effect of riparian tree removal would be isolated to very small areas across the entire project area.

Fire, Fuels and Air Quality

Affected Environment

Fuels would be assessed following thinning to determine whether an unacceptable load of fuels remains. Fuel loads would be classified as acceptable or unacceptable. Unacceptable fuel loads would be those that are converted from an existing fuel model to a moderate or high load activity fuel model and are modeled to have a fire intensity level that would not comply with Forest Plan direction.

Fuel Conditions

Fire behavior and severity depend on the various properties of fuels, and the continuity and arrangement of those fuels. The fire hazard for a forest stand or landscape can be characterized by the potential for fuels to cause specific types of fire behavior and effects. Fuels are classified in six strata (Sandberg, et al., 2001): tree canopy; shrubs/ small trees; low vegetation; woody fuels; moss, lichens, and litter; and ground fuels (duff). The influences of fine fuels such as litter, duff, grasses, and small woody fuels (less than three inches diameter) have the greatest effects on spread rate and intensity of fires. These fuels are used in fire behavior models developed for predicting fire behavior and rate of spread of the initiating fire. (Rothermel 1983).

In the project area, the fuels conditions have the variance typical of a productive, west-side forest. In the areas of stem exclusion the ground fuel loads are often lighter in the larger size classes, but heavier in the small size classes such as needle cast, litter, and small branches and feature a thick duff layer. In stands with more vertical structure, more surface fuels and ladder fuels are present, which creates a conduit for ground fire to travel to the crowns of trees.

Fuel Models (FM) are used to help describe and quantify surface fuel characteristics and estimate fire behavior. Criteria used to identify a fuel model involves assessing the fuel strata that supports the fire as it spreads and generates heat intensity. Fuel conditions defined by quantity and arrangement have been categorized into 40 standard descriptive fuel models (Scott and Burgan, 2005). Most of the project area (77%) is represented by TL5 fuel model, which is a Timber Litter fuel type. The primary carrier of fire in the TL fuel models is dead and down woody fuel. TL5 is High Load Conifer Litter, and the primary carrier of fire is high load conifer litter, light slash, or mortality fuel. TU5 is the next most prevalent fuel

type (9%) in the project area. The primary carrier of fire in TU5 is heavy forest litter with a shrub or small tree understory.

Air Quality

Air quality in the project area is generally considered good to excellent. However, locally adverse conditions can result from wildfire smoke from British Columbia or central Washington during the summer and fall.

Environmental Consequences

This analysis focuses on the effects to fuels, fire behavior, and air quality on the project area's wildfire risk and hazard, and how effective the proposed treatments would be at both lessening the risk of a wildfire that results in a large-scale loss of forest, and at moving forests towards their natural disturbance regime.

Alternative 1 - No action

A no action alternative would continue with fire exclusion as the dominant anthropogenic disturbance on the landscape. Alternative 1 would not substantially alter current initial attack and extended attack response. Most fires in the area are likely to still be human caused. Large fire growth is likely to be an infrequent, but high-severity event caused by dry, east winds which bring low humidity and high winds.

Fuels in the area would continue the natural trajectory that occurs with forest succession. As stem exclusion continues in the younger closed canopy stands, ground fuels would continue to increase, as trees compete and self-prune. In older, more mature forests with more vertical structure, ladder fuels would continue to increase, which would also contribute to more ground fuels as branches, leaves, and needles fall and accumulate on the forest floor. The surface fuels and understory cohorts would increase ladder and crown fuel connectivity. This gradual increase in fuel loading over time, combined with fire suppression and exclusion would result in an increased fire intensity level, and increased resistance to control in the long term.

There would be no change from current management activities that would affect air quality. Prescribed burning opportunities in the Upper-Finney Chute timber sale, part of which is within the project area would continue. Other existing contributors to air pollution, such as urban growth, vehicles, agriculture, recreational campfires, and wildfire smoke would remain.

Alternatives 2 and 3

These effects are common to both action alternatives. Project activities would reduce the number of trees per acre, resulting in wider crown spacing. This would also reduce canopy bulk density and increase the height to live crown, or canopy base height. These treatments may reduce crown fire potential by increasing the distance between crowns, which may reduce the likelihood of fire moving from the canopy of one tree to another.

The thinning in the action alternatives would increase the amount of dead and down woody fuels (slash) on the ground in the short term. The fuel loads remaining on site after thinning operations are a function of pre-existing site conditions and the number of trees harvested in each unit. These two values combine to determine post-harvest fuel loadings and guide where and what type of fuels treatments would be applied. If post thinning treatments are not applied, fire risk may be increased due to higher surface fuel loading.

Coarse woody debris may be increased following thinning treatments. Fuels larger than three inches diameter have little influence on spread and intensity of the initiating fire; however, this size class of fuels can contribute to the development of large fires and high fire severity. Resistance to control, soil heating, tree mortality, and affects to firefighter and public safety are influenced by loading, size, and decay state of large woody fuel.

Ladder fuels, fuels that create vertical continuity from ground fuels to tree canopies, would be reduced in most thinning operations.

In the long term, 20 to 50 years, the slash would break down and decay, and understory would develop. The effect of increased resistance to control and potential for intense, large fires would slowly decline.

The project may slightly increase the possibility of human-caused fires. Creating open timber stands and landings along roadways may lead to more public use of the areas by hunters, firewood cutters, and dispersed camping. Most wildfires on the forest are human-caused and increased public use in an area may lead to an increase of human-caused fires. Maintaining access to recreation areas for emergency firefighting personnel to suppress any human-caused fires is important for public and firefighter safety.

Closing or decommissioning roads might have a different negative effect. Although reducing access to areas by decommissioning or closing roads would result in less human-caused fires in those inaccessible areas, the lack of vehicle access could still pose a challenge to suppression resources and may delay responses to fires.

Both alternatives would impact air quality via increased logging traffic and prescribed burning. Air quality effects resulting from prescribed burning are generally short duration events as smoke dispersal usually occurs within a few days. Scheduled ignitions also are planned when weather conditions are prime for adequate smoke dispersal. Prescribed burning would be implemented in accordance with all applicable policy, guidance, and direction.

With both alternatives 2 and 3, implementing fuels treatments, the effects of elevated fire risk would be reduced. However, there may be a period between thinning treatments and follow-up fuels actions (or decomposition and breakdown of fuels) where the fuel loading may pose a higher fire risk. Thinned areas have higher fine fuel loading and if a wildfire were to occur, greater consumption of fine fuels contributes to higher tree mortality (Raymond and Peterson, 2005). The probability of ignition is strongly related to fine fuel moisture content, air temperature, the amount of shading of surface fuels, and the occurrence of an ignition source (Rothermel, 1983). Stand structure strongly influences these factors. A change from the dense, dank stands that exist in the project area to an open stand may result in preheating of fuels. As stands are opened and crown spacing is increased, both solar radiation and winds can penetrate the canopy and dry the surface fuels. There tends to be a warmer, drier microclimate in more open stands compared to denser stands (Countryman 1955, Weatherspoon 1996). Therefore, in the short term, direct effects of thinning would be an elevated risk of higher intensity wildfire should an ignition source be present. If it is determined that follow up fuels treatments are not needed, long term effects would diminish over time, and the mesic climate in the project area favors decomposition of surface fuels.

Effects of Alternative 2.

The actions within alternative 2 that have specific effects to fire, fuels, and air quality are those concerning roads. Alternative 2 has more roads moved to Level 1 or storage. This effect is described above and may lead to delayed response of initial attack resources to a wildfire if one were to occur past the closure.

Effects of Alternative 3.

The actions within Alternative 3 that have specific effects include those involving roads and size limit on tree removal. Alternative 3 proposes more roads to be decommissioned, which has the same effect previously mentioned of making initial attack on a wildfire potentially more difficult or delayed.

With timber harvest being limited to trees less than 20" DBH, there is the potential for trees larger than 20" DBH to be felled for safety reasons during logging operations. Since those trees cannot be removed, they would remain on the ground within the unit. This would be additive to the activity slash that is created from thinning operations. Whole trees left in the unit contribute to fuels of all size classes. If a wildfire were to occur in these areas, the heavier fuel loading would increase resistance to control and suppression difficulty.

Cumulative Effects

The cumulative effects analysis considers past and future planned treatments in the project area.

The Segelson 2 project that is within the project area would have no effect on smoke produced from hazardous fuels or activity fuels projects, as there were no post-harvest treatments planned.

The Upper-Finney Chute timber sale units that are within the project area may have impacts to air quality due to post-harvest prescribed burning of activity fuels. The Washington Department of Natural Resources (DNR) Smoke Management Plan provides operating procedures and advisory information regarding the management of smoke and fuels on the forestlands of Washington State. The Forest Service follows DNR smoke management procedures and guidelines to meet compliance with the Clean Air Act.

Recreation

Affected Environment

Recreation in the project area consists primarily of dispersed recreation, recreation that generally occurs in primitive environments without facilities. Existing recreation opportunities consist of approximately 6.4 miles of system trail managed for hiker/pedestrian use, 29.1 miles of groomed snowmobile trails, and the Texas Pond recreation area. Additionally, with the density of National Forest system roads (FSR) in the Project area, road-based, dispersed recreational use is prevalent (e.g., driving for pleasure, hunting, camping, etc.).

Environmental Consequences

Proposed project actions with direct and indirect effects on recreation resources include commercial and non-commercial thinning, temporary-use road construction, maintenance, and reconstruction of existing system roads, altering or relocation or decommissioning of roads, and recreation site improvements.

Alternative 1- No Action

Under this alternative, no management activities within the project area would occur. Current conditions at recreation sites are not expected to change and affects to recreational opportunities in the area would likely be limited to an anticipated gradual increase in recreation use over time and deteriorating road conditions. Roads would either continue to deteriorate or remain unchanged as maintenance of the existing road system would occur based on competition for Forest priorities and funding. The public would continue to experience conditions commonly encountered with road access issues due to damage, repairs or other unforeseeable circumstances that require temporary closures.

Alternatives 2 and 3

These effects are common to both action alternatives. Alternatives 2 and 3 would have no long-term effect on the types and forms of various recreation within the project area and would provide an opportunity to potentially improve the recreation experience through road maintenance and recreation management activities.

Under the action alternatives, recreation management activities would occur at Texas Pond. The proposed activities would alter the Texas Pond camping experience and ultimately improve visitor safety through the relocation of campsites and parking areas, and the potential addition of facilities. Impacts to recreation during designated site implementation are expected but would be minimized to the extent possible through application of project design criteria.

The condition-based management actions proposed for dispersed camping sites may alter the dispersed camping experience in the project area. Impacts to recreation would be minimized to the extent possible through application of design criteria and mitigation measures.

Road activities included for purposes of commercial thinning, would help maintain public access at current safety standards and improve recreation access and road-based opportunities. Due to the density of National Forest system roads in the Project area, road-based, dispersed recreational use is the dominant recreational activity. Under the action alternatives, most recreation activities would continue with no long-term shifts, disruptions, or changes in use. In the short term, access to some locations may be impacted through temporary closures, disruptions during active thinning and hauling of vegetation along the roads. However, with adequate mitigations and coordination, these effects would be temporary.

In each action alternative, roads that would be stored or decommissioned would occur primarily on roads that are marginally drivable due to being brushed closed or already closed as a level 1 (stored) road. All roads that lead to existing recreation sites would continue to be maintained for passenger vehicles (approximately 80 miles of roads suitable for passenger cars). Alternative 2 would have a marginally greater effect on recreation by reducing the miles of open road suitable for high clearance vehicles by approximately 18 miles. Some of the proposed maintenance level changes may occur on roads that are used for dispersed recreation, however, nonmotorized access (hiking, biking, horseback riding, etc.) may still be a viable option on stored roads. Depending on the treatment, dispersed recreation access on decommissioned roads may not be available as restoration could range from blocking the entrance to full obliteration recontouring.

Cumulative Effects

Past, ongoing, and foreseeable actions that have affected, and may continue to affect, recreation resources in the project area include commercial and non-commercial thinning, temporary-use road construction, maintenance, and reconstruction of existing system roads, altering or relocation or decommissioning of roads, and recreation site improvements. Past actions are considered if they are still contributing to cumulative effects, otherwise, past actions were considered as part of the baseline condition. Present and reasonably foreseeable future activities include continued maintenance on forest system roads. When combined with the anticipated long-term benefits of the action alternatives, present and future activities would have a positive effect on recreation by maintaining access routes and improving the forest setting. Additionally, with the implementation of the project design criteria to ensure public safety, there is minimal risk of additional incremental degradation of recreation associated with the action alternatives.

Scenery (Visual Resources)

Affected Environment

The management direction for scenic resources as defined by the Visual Management System utilizes Visual Quality Objectives (VQOs). The updated management direction for scenic resources as defined by the Scenery Management System utilizes Scenic Integrity Objectives (SIOs). While the terminology has changed, the concepts are the same. A crosswalk between the two system's terminologies can be found in the Visual Resources report. The project area has a range of scenic integrity objectives, from low to high. Objectives for scenic management are VQOs. Table 25 depicts the acres and percentage per scenic integrity level/VQO within the project area.

Table 25. SMS/VQOs Mapped in Project Area

Project Area Scenic Management / Visual Quality Objectives	Acres	Percent	Scenic Integrity
Low / Modification	30,419	49%	Moderately Altered
Moderate / Partial Retention	22,718	37%	Slightly Altered
High / Retention	8,712	14%	Appears Unaltered
Total	61,849	100%	

Past development, timber harvesting, fire, and road construction have contributed to the existing condition of the visual landscape, creating an area where human activity is evident. A portion of the project area is located within the viewshed of the Highway 530 / Sauk River FR 22 assigned viewshed corridor (sensitivity 2) as well as the viewshed of several segments of the Skagit Wild and Scenic River System on the Sauk, Suiattle, and Skagit Rivers (sensitivity 1).

Views of the project area from the primary travel corridors (SR 530 and select areas of the Sauk, Suiattle, and Skagit Rivers) are of densely vegetated slopes, broken by occasional avalanche chutes, which give way to more sparse forest, meadow, and exposed rock along the ridgelines. At lower elevations, some variation in forest pattern is visible where stands have regenerated from past harvest.

The proposed project is not in or immediately adjacent to a designated or recommended wild and scenic river corridor. However, stands within the project area are visible in the middleground (up to 4 miles from the foreground) and/or background (4 miles from the viewer to the horizon) views from some locations on the Skagit, Sauk, and Suiattle Rivers, part of the Skagit Wild and Scenic River System. The river classification for the pertinent sections of both the Sauk and Suiattle is scenic and recreation for the sections of the Skagit. Sensitivity level 1 is assumed for viewsheds in all three of these rivers given that scenery is noted as an "outstandingly remarkable value" of the Skagit Wild and Scenic River System. The viewshed beyond the classified foreground is the same for each of the rivers in the middleground and background, moderate / partial retention. According to the SMS handbook, moderate scenic integrity refers to landscapes where the valued landscape character "appears slightly altered" and noticeable deviations remain visually subordinate to the landscape character being viewed. In a natural appearing landscape, created openings (e.g., gaps) can be added by repeating size, shape, edge effect, surface color and pattern, by mimicking natural openings common to the landscape character.

Environmental Consequences

Alternative 1- No Action

Under this alternative no management activities within the project area would occur and the existing visual condition of the landscape would continue. Past Forest management practices in this area produced a relatively homogeneous landscape consisting of dense, even aged stands around 40-70 years old. In the short term, there would be no direct, or indirect effects to visual resources if no action were taken, but in the long-term, conditions in some areas may appear cluttered, similar in texture, and not diverse in age. There would be no effect on viewsheds, or scenic integrity associated with the Skagit Wild and Scenic River System or the SR 530 / Sauk River FR 22 viewshed corridor.

Alternatives 2 and 3

These effects are common to both action alternatives. Thinning within the project area would introduce a variety of textures and diversity of color and form to the landscape within treated stands. Through the proposed treatments, thinning would move stands out of the closed-canopy stage and accelerate the development of conditions found in late seral forests, such as tree diameter, density, canopy structure, species composition, and vegetative cover.

Proposed treatments are consistent with the visual quality objectives for the management areas within the project. The standards and guidelines for each management area prescription are in the Forest Plan (pages 4-153 - 4-277) and three scenic integrity levels within the project area (low, moderate, high), Handbooks 462 and 701 provide direction on approaches to meet integrity levels. Silvicultural treatment would occur only in those management areas where timber harvest is allowed. Project design criteria will mitigate impacts by ensuring that treatments are consistent with the scenery objectives within management area prescriptions and viewsheds. Project actions are not expected to have a noticeable effect on the continuity of the landscape, as any openings would be small and edges around openings would have feathered, natural appearance.

Skagit Wild and Scenic River System Viewshed

A viewshed analysis was completed to predict what a potential viewer could or could not see in the landscape along the river system and factored in distance, topography, and canopy cover. For the full analysis see Visuals report. Management activities associated with the action alternatives would result in short- and long-term effects to scenic quality along portions of SR 530 and the Skagit Wild and Scenic River System. Over the short-term, the proposed thinning treatments would move stands out of the closed-canopy stage and accelerate the development of conditions found in late seral forests. Over the long-term, the primary change to scenic quality would be a mosaic of differing age classes displayed.

Cumulative Effects

Past, ongoing, and foreseeable actions that have affected, and may continue to affect, visual resources in the project area. Past actions are considered if they are still contributing to cumulative effects, otherwise, past actions were considered as part of the baseline condition. Present and reasonably foreseeable future activities could include vegetation management projects on National Forest System lands or other ownerships (private, State, etc.). When combined with the anticipated long-term benefits of the action alternatives, present and future activities could have a positive effect on visuals by creating a mosaic of differing age classes and improving viewsheds. Additionally, with the implementation of the project design criteria to ensure scenic integrity, there is minimal risk of additional incremental degradation of visuals associated with the action alternatives.

Soils

Affected Environment

Soil Disturbance

Timber harvest activities began in the area around 1901. Harvest stands had been clearcut and routinely burned for slash reduction and site preparation for many years prior to the 1980s. However, most of the stands have regenerated resulting in a relatively homogeneous landscape. Between 1940-1990, about 18,988 acres were harvested within the North Fork Stillaguamish project area. Although there likely was loss of soil strength and topsoil during that time, the soils are highly productive with high resilience and low sensitivity (Meurisse, R. et al. 1990.).

Although large portions of the North Fork Stillaguamish watershed have been harvested, roaded, and developed for residential and agricultural use, the North Fork Stillaguamish Watershed Analysis, completed in 2000, supports a finding of relatively intact terrestrial and aquatic ecosystems. Land management practices assume greater importance as development in the Stillaguamish River basin and Puget Sound region continues (North Fork Stillaguamish, 2000).

There are 160 miles of roads within the Deer Creek watershed, with only 15 miles paved. Surface erosion within the Deer Creek watershed from roads and clearcuts was not a significant source of fine sediment to stream channels in comparison to sediment from mass wasting events. The sediment produced from timber harvesting activities and road activities is less than one percent of the sediment produced by the DeForest Creek slide in 1983. (Deer Creek, 1996). There are approximately 337 miles of existing roads within the North Fork Stillaguamish watershed, 145.4 miles are within the MBS (North Fork Stillaguamish, 2000).

Soil Erosion

Past ground disturbance from tree harvesting activities potentially exposed soil during activities such as skidding and yarding of logs, temporary roads and landing development, fuels treatments, and actions associated with road decommissioning. Such activities can directly affect soil productivity by reducing soil depth and volume, which may result in a loss of nutrients and water holding capacity. Indirect effects from these activities include storm water runoff, carrying soil particles to water bodies, surface compaction or rutting from heavy equipment concentrating water on the soil surface, and slope stability changes. Logging practices of clear cutting are not a part of this project.

Landslides

Several landslide inventories have been completed within the NF Stillaguamish River watershed. Two comprehensive reports were completed in the later part of 1997 (Perkins & Collins, 1977) and (Collins, 1997). The inventories and documentation from these two reports provided the following information:

• 1,080 landslides were inventoried within the entire Stillaguamish basin.

• 58% of this total (approximately 626) occurred within the NF Stillaguamish watershed.

• Approximately 519 of these slides were considered to have delivered sediment to an adjacent stream channel.

• Within the entire basin (North and South forks), the inventories estimated that approximately 75% of the total number of failures were associated with human disturbance (52% from roads and 22% from clearcuts).

• Deer Creek, Upper NF and Higgins Ridge were considered to be the most significant contributors of sediment to the NF Stillaguamish River.

• Landslide sediment delivery from Deer Creek and the Upper NF apparently peaked in the 1980s. Sediment delivery from Higgins Ridge peaked in the 1960s. The sediment delivery peak in Boulder Ridge and Squire Creek was in the 1940s.

• Within the entire Stillaguamish basin, shallow-rapid landslides were the most common (59%). Approximately 35% of the total number of landslides occurred within glacial deposits and, while fewer in number, account for a disproportionately high contribution of the total sediment delivery.

• The DeForest Creek Slide (in Deer Creek) and the Hazel slide are deep seated landslides that have had a significant influence on the total sediment production within the NF Stillaguamish River. While Deer Creek is outside the model analysis area, it deserves mention due to the significant influence that the DeForest Creek slide has had on the NF Stillaguamish River. Collins (et. al. 1994) estimated that this one slide would have tripled the suspended sediment load of the NF Stillaguamish River (WY 1984-1992) and doubled the Stillaguamish River's load downstream of the forks in Arlington.

In 2000 the MBS NF Stillaguamish Watershed Analysis produced a Slope Stability Model which provided estimates of potential accelerated mass wasting activity resulting from previous management activity. This estimate is based on an evaluation that considered road density in conjunction with the current stand age of timber. Unstable and potentially unstable soils were also analyzed using GIS desktop analysis. There would be no treatment stands in areas of unstable or potentially unstable soils.

The model indicated that the highest proportion of high and moderate management related mass wasting potential is concentrated in the Upper North Fork. The Middle also contains relatively high concentrations of high-risk potential. The reliability of road and stand age data for the Lower NF Stillaguamish 5th field watershed (Lower NF) is questionable due to the predominance of non-Federal lands. The Boulder River watershed, which contains the highest concentration of naturally occurring high risk topography, has experienced very little reading and timber harvest activity. When considering both the natural hazard potential in conjunction with management activities, the Upper North Fork represents the highest combined hazard potential (North Fork Stillaguamish, 2000).

Environmental Consequences

Alternative 1: No Action

The effects of the no action alternative on soils would mean a continued accumulation of organic material, and further development of root to soil interactions within the dense homogenous aged stands. The unstable road-stream interactions would remain unstable and continue to introduce some sediment to nearby streams. General road maintenance and uses of the area would be the only other contributing source of sediment to streams or compaction.

Alternatives 2 and 3

The proposed vegetation management and associated actions may cause some sediment generation from road use, maintenance, disturbance and/or compaction of soil strata where machinery is used, and vegetation management actions occur over soils or poorly constructed road infrastructure. In the near term, the proposed vegetation management, and associated actions in both Alternatives 2 and 3 would decrease vegetation density and cover over soils, which would lead to increased surface runoff flow, decreased plant transpiration of soil moisture, and increased groundwater infiltration and pore water pressures. Maintenance of the road infrastructure may prevent sediment generation by road failure events.

Erosion

Both action alternatives would temporarily remove or reduce vegetation in the proposed project area, which would likely result in a temporary increase in surface erosion until the vegetation cover recovers. The rate of surface erosion is closely correlated with vegetative cover (Rice 1972).

Both action alternatives would be implemented with an objective to place Maintenance Level 1 roads into a hydrologically stable storage condition within the project area. This is a long-term goal of placing enough roads into this condition, which would decrease the effects of roads on instream environments. The objective is to achieve this in 15 to 20 years. In the short term, over the period of either action alternative, operations could contribute to instream sedimentation input at small scales. In the long run with the reduction as much as 40% of the roads within floodplains and 40% reduction in road stream crossings this could lead to much lower instream sediment loading due to roads.

Riparian areas would also move toward the desired future condition of improved habitat diversity through mature tree management while maintaining trees needed for slope stability and future large woody debris recruitment into stream systems. Both alternatives are consistent with the Aquatic Conservation Strategy Objectives.

Slope Stability

The stability of steep slopes depends greatly on plant roots to maintain shear strength of soil mantels. Roots are crucial to vertically anchor the topsoil to the soil mass and into the fractures in bedrock which laterally ties unstable slopes together. Two years after thinning operations there is a loss of strength and the large roots will degrade and lose their strength by the ten-year mark. (Ziemer R.R., Swanston D.N. 1977). Project design criteria would be implemented to minimize impacts to soils (Appendix B). Areas that have been identified as unstable would not have treatments, however temporary roads may cross over areas of concern. A geologist or soil scientist would survey areas that are known to have a high hazard rating or unstable soils prior to implementation of any activities in the area.

Snyder and Wade performed a simple large-scale assessment of natural soil stability in the 1970 Mt. Baker National Forest Soil Resource Inventory, including an assessment of expected mass movement resulting from human activity (vegetation management). Areas assessed as naturally unstable and/or greatly increased expected mass wasting due to human activity were avoided during project planning and development. The project is generally limited to areas evaluated as moderate to good natural stability and low to moderately increased expected mass wasting due to human activity.

Many studies in the Pacific Northwest have linked shallow mass wasting of soil to clear-cut logging activities on steep slopes, but the relationship between less impactful vegetation management and mass wasting is less understood. The driving factors behind logging related mass wasting are common and understood to be: 1) increased groundwater infiltration and pore water pressures, and 2) loss of root cohesive strength. It is likely that vegetation management, which is less impactful than clear-cut logging, would likely result in a lesser increase of instability compared with clear-cut logging.

The timescale of the root strength loss and recovery in the soil depends on the species and size of vegetation in the soil. Ziemer and Swanston found that larger roots decay and lose strength over a longer time period (1977). Previous study by Hale and Nichols in the Canyon Creek drainage within the project area, indicated that the greatest frequency of mass wasting in clear-cut logged areas occurred approximately 8 years after clear-cutting and on average 12 years after clear-cutting (1994). Hale and Nichols found that the frequency of mass wasting begins decreasing back to baseline after the peak occurrence at 8 years, likely due to the recovery of vegetation and root systems.

It would be likely that vegetation management affecting smaller and fewer trees than the areas studied by Hale and Nichols in 1994 would result in less, and a shorter time frame, of increased mass wasting and

vice versa. Vegetation management which results in eventual improved density of large trees with strong root systems may eventually improve slope stability after the period of initial decreased stability.

Forest fires often have similar negative impacts to soil slope stability as clear-cut logging due to burning vegetation cover and increased surface runoff. Improved resilience against forest fire would also likely decrease incidence of forest fire related slope instability.

Soil Disturbance, Organic Matter and Soil Organisms

Alternative 2 has more acres proposed for vegetation management, therefore Alternative 2 has more potential for effects to soils and waterbodies than Alternative 3. See Table 6 for potential acres and miles of disturbance by alternative. Most new areas in a detrimental soil condition (DSC) (compaction and displacement) would be associated with new temporary roads, skid trails and landings within ground-based harvest units.

Road decommissioning includes removing the road footprint from the landscape and may involve different methods to do so. The rates at which de-compaction would occur is dependent on the method and design utilized to remove the road and disconnect it from the hydrologic system. Regardless, road decommissioning is expected to result in establishment of vegetation in the previous roadway with development of soil function and fertility characteristics occurring over the long-term (> 20 years).

Connected to road treatments include storm proofing, restoring aquatic organism passage at road crossings and dispersed recreation site restoration. Storm proofing implements road surface and ditch line treatments that function to frequently and effectively move water off and away from roads. Doing so is an effective way to not only decrease sedimentation, but limits hydrologic impairment associated with gully formation on hill slopes or other erosion processes. These actions can limit soil loss.

Thinning actions are expected to have neutral effects on existing soil conditions at the project site scale. Thinning would maintain vigorous live conifers that would positively respond post-treatment in both growth and crown size over the long-term (> 20 years). Therefore, elements that cause new DSCs are not present, while forest-soil ecological interaction would continue without interruption of ground disturbing impacts.

Burning to treat post-harvest activity fuels (slash) throughout a unit could result in soil exposure and some surface erosion. Effects to soils from treating thinning slash with prescribed fire can have both positive and negative impacts. Prescribed burning that does not result in high severity conditions can achieve positive effects related to soil nutrient cycling and increased availability (Feller 1989). However, the reverse can also occur when nutrients such as nitrogen become lost to the atmosphere when burn intensities are higher (Feller 1989). The latter is not expected as the NF Stillaguamish Project area exists in a western Cascade Mountain ecosystem with very high precipitation bands making high fire resonance time on soil surfaces unlikely.

Landslide Risk

Increasing landslide risk is related to proposed actions that de-stabilize soil surfaces. Commercial thinning, and associated logging systems are actions under both action alternatives that have the highest potential to increase landslide risk. However, by utilizing the project design criteria the likelihood of de-stabilizing such features greatly decreases. A full suite of activity specific design criteria and best management practices were incorporated into the project design criteria (Appendix B) to limit the extent of soil disturbances, minimize losses to soil productivity, and to ensure treatments only occur on slopes and soils field verified as stable. No vegetation treatments would occur on unstable or potentially unstable areas under Alternative 2 or Alternative 3.

Commercial thinning, road development, and associated activities are not expected to contribute to any new landslides within or adjacent to the activity areas. Harvest activities would thin areas that are considered stable. Thinning would not significantly affect hillslope stability in the short term because the roots of remaining trees already intermingle with those trees that would be cut, and new root growth would result before the roots of cut trees decay and lose their strength. Over the long term, the thinning would enhance tree growth and tree root development, restoring hillslope stability to original levels. Existing shallow landslide and small rotational failures within the activity area would be protected and would continue to slowly stabilize and revegetate. Existing system roads that would be used for haul would be maintained and repaired as needed. These actions would reduce risk associated with the proposed action, as well as some of the risk of future resource damage from road-related landslides.

Cumulative Effects

A significant proportion of logging related mass wasting events originate from roads. Alternatives 2 and 3 would construct a total of approximately 44 miles of additional road mileage using the pre-existing road templates but predominately utilize temporary, stored, or existing roads. However existing roads disrupt the natural slope topography and drainage patterns of the project area and are frequently an existing point of decreased slope stability. Landscape scale human impacts which are proximate to existing roads, such as vegetation management proposed in Alternatives 2 and 3, may cause a cumulative increase in incidence of road originated mass wasted events. Maintenance of road infrastructure may reduce likelihood of road originated mass wasting events.

Conclusion

The actions proposed in both Alternatives 2 and 3 would likely cause disturbance and compaction of soils in the vegetation management areas. Both action alternatives would likely result in a short-term increase in surface erosion and mass wasting of soil, until vegetation cover and root strength recovers. Alternative 2 disturbs a greater area and would cause more short-term impacts than alternative 3. Stands that have portions of unstable soils would be surveyed prior to implementation of all activities. In the long-term, proposed vegetation management in both action alternatives, and resulting increased density of large trees with stronger root systems, and a greater resilience against forest fires, would lead to improved soil slope stability.

Silviculture

Affected Environment

Past forest management practices were primarily even-age silviculture for timber production objectives. Stands were clearcut and routinely burned for slash reduction and site preparation for planting. Most of these stands were regenerated in the mid-1940s to early 1980s, with precommercial thinning in a small portion of stands around the late 1970s to early 1990s. These stands are in the stem exclusion stage of stand development (Oliver and Larson, 1996). Competition for growing space and resources (light, moisture, and soil nutrients) is high enough that some overstory trees are dying, and seedlings in the understory are unable to develop into mature trees.

There are three Potential Vegetation Types (PVT) that make up the proposed treatment stands: Pacific Silver Fir Type, Western Hemlock Type, and the Mountain Hemlock Type. A potential vegetation type is the projected climax plant community which would occupy a site, given current climate and site conditions (Henderson et al., 1992). Within each PVT, are more specific classifications known as plant associations (Henderson et. Al., 1992). These plant associations are all classified as suitable timberlands with moderate to high timber productivity.

An overall forest health assessment found that the common forest pathogens that contribute to tree mortality and damage to conifer trees in the project area include Armillaria root disease, Laminated root rot, Heterobasidion root disease, Hemlock dwarf mistletoe, Douglas-fir beetle (typically in association with armillaria and laminated root rot), and silver fir beetle (also associated with the presence of armillaria). This assessment is available on the project website.

Recent hot, dry conditions across Washington, including several days of a historic heat wave in late June 2021 have led to reports of crown damage and early needle senescence of several conifer species across western Washington. Symptoms suggestive of heat and drought damage have been observed around and within the project area. During periods of dryness or drought, limited soil moisture increases the stresses on individual trees, making them less able to resist attack by insects or diseases.

Environmental Consequences

Stands suitable for silvicultural treatment throughout the project area are proposed for a range of treatment intensities that include variable density thinning, stand improvement in non-commercial treatment areas, and stand improvement for huckleberry habitat enhancement. The total treatment area makes up 31% of the project area.

Alternative 1 – No Action

No direct effects would occur with this alternative. Without treatment stands would continue to grow in dense conditions, causing additional suppression mortality (Oliver and Larson, 1996). This mortality would lead to more snags than if stands were thinned, but snags created in this stage of development are limited to lower diameter classes, relatively short-lived, and not big enough to accommodate larger cavity-nesting species. Opportunities for small canopy opening disturbances are limited and would likely take several decades for existing seedlings to develop and contribute to more complex canopy structure. Stands with no treatment would have high canopy cover and high mortality rates. Trees grown at high densities lead to higher height/diameter ratio, resulting in stands more susceptible to breakage, windthrow, and attack by insects or disease (Smith et, al., 1997). Additionally, there would continue to be a lack of complex early-seral habitat and the landscape would be less resilient to large scale disturbances such as fire, windthrow, and insects and diseases.

Alternative 2

Under alternative 2 the proposed action aims to manage forest density, species composition and structure by conducting commercial and non-commercial vegetation thinning using mechanized equipment and/or hand crews. Through this alternative, planned activities aim to create habitat enhancement within AMA-NR and AMR-R within the range of the Northern Spotted Owl and in accordance with the Finney AMA plan and experimental design. Table 26 outlines the approximate acres of each treatment proposed within the project area including total approximate acres for the two conditions of riparian no cut buffers.

Variable density thinning

For this project, commercial thinning would implement treatment in varied intensities in the form of skips, gaps, and heavily thinned sections within operable areas. Skipped areas would consist of unthinned patches while heavy thinning sections would remove trees down to approximately 50 trees per acre. As outlined by the Finney AMA experimental design, gaps would be from .5-2 acres in size and around 5 trees per acre would be retained in gaps as green tree or snag retention. Gaps, combined with heavy thinning, would only be implemented across 3-10% of the treatment area.

Gaps are an essential part of mimicking disturbance. Forest disturbances occur in an infinite variety of types, sizes, intensities, and effects. Small chronic disturbances are those that cause the death of

individual trees or small groups of trees and are the most relevant to the developmental processes within established forest stands. These small disturbances commonly caused by insects, diseases, and snow and wind events, create openings in the overstory of closed forests and free up resources. The conditions created by these small chronic disturbances, cause an increase in legacies such as snags, logs, and other course woody debris which structurally enrich the existing stand. These legacies are important in forest ecosystem development and are a major factor in creating and sustaining structural complexity in old forest ecosystems. (Franklin et al., 2018)

When implementing treatment for the benefit of late successional and old growth habitat, careful consideration would be made to leave as many stand components directly related to late-successional development as possible. Some of these components include large, broken and diseased trees important for snag recruitment, nesting habitat, and large snags or logs. Furthermore, within Alternative 2 where trees over 20 inches in diameter at breast height (DBH) are abundant and inhibiting the prescription from reaching density objectives, removal of these trees up to 26” in DBH would occur to better meet the treatment objective of 35% of SDI max.

Through ecological based treatment, managing for more diverse goals becomes easier to implement. Variable density thinning provides an opportunity to combine other prescriptive elements at implementation such as intense thinning around selected trees to enhance rapid development of larger trees and to develop larger branch systems favored as a wildlife objective (Franklin et al., 2018). Preference for retaining Douglas-fir as leave trees would create opportunities for epicormic branch development (new branch growth from dormant buds on the trunk) when additional light is available to the sides of the trees. Epicormic branches are an important habitat characteristic of old-growth forests and provide platforms that are important for wildlife and epiphytic plants.

Stand Improvement Thinning

Although no stand exam data was collected for stands selected for these treatments, they exhibit similar stand conditions as the other PVTs given the past forest management practices of the area. Stand improvement thinning would occur to improve stand conditions and, in specifically targeted areas, for the enhancement for huckleberry habitat. Trees up to 8” DBH would be thinned, generally by hand. This would improve the growth rate of residual trees by reducing competition. Huckleberry habitat would be improved by providing moderate to full sun exposure for flowering and berry production.

Table 26. Comparison of Alternatives 2 & 3 treatable acres by treatment type

Treatment	Stand Acres Excluding RR No Cut Buffers	Riparian Reserve Conditions Alternative 2		Alternative 3
		Condition 1 Acres Including RR No Cut Buffers	Condition 2 Acres Including RR No Cut Buffers	
Variable Density Thinning	11,972	10,571	9,504	8,842
Stand Improvement Including Huckleberry Enhancement	7,197	6,492	5,931	5,644
Total	19,169	17,063	15,435	14,486

Variable Density Thinning in Riparian Reserves

Variable Density Thinning would take place to help attain Aquatic Conservation Strategy objectives, especially by maintaining and restoring species composition and structural diversity of plant communities in riparian areas. No-cut buffers adjacent to streams, which is identified in Table 12 would be retained to

maintain shade and undisturbed soil conditions. The decision points for Riparian Reserves determine the no cut buffer width. Variable density thinning in Riparian Reserves would implement treatment in varied intensities in the form of skips, gaps, and heavily thinned sections within treatment areas. Skipped areas would consist of unthinned patches, heavy thinning down to approximately 50 trees per acre gaps combined with openings up to .25 acres in size would not exceed 3-10% of the Riparian Reserve treatment area and would target a relative density of 35% of max SDI.

Economics

Using on a weighted stumpage rate of $75.48 per thousand board feet (MBF) for the last three major timber sales sold on the Mt. Baker-Snoqualmie National Forest. This value accounts for typical timber quality, logging costs, road costs, and environmental protection measures that are typically found on the Mt. Baker-Snoqualmie National Forest. Based on modeling from FVS, 17 MBF per acre is estimated to be removed with the Variable Density Thinning of the commercial units. Based on this information, the commercial harvest would generate an estimated $1,283 per acre. This number is highly subject to change depending on percent of stand area harvested and log prices, which typically fluctuate seasonally and from year to year depending on market conditions.

Summary of Effects from Alternative 2

Thinning can move stands out of the closed-canopy stage and accelerate the development of conditions found in late seral forests. A multilayered canopy is a desired characteristic of late seral forests and through a well-developed understory, hiding cover and forage opportunities can provide habitat for many different species. (Hayes, et al, 1997). While heavy thinning reduces the total volume of wood, it promotes rapid growth of individual trees by reducing competition for light and water resulting in large live trees (Hayes, et al, 1997). Implementing intermediate treatments would not only promote growth of vigorous dominant and codominant trees, but also vary the heterogeneity of tree sizes that hastens development of old-growth structure in mature stands (Acker, et al, 1998). Additionally, by providing ample growing space for desired residual trees, large crown and branch growth would result as a common component of widely spaced trees or trees next to gaps or openings. (Hayes, et al, 1997). Large branch diameters are desired habitat for marbled murrelets as they provide nesting when of sufficient girth, covered with lichens, or contorted into “witch’s brooms” by dwarf mistletoe infection. Although the full suite of conditions that develop in old-growth forests over long periods of time cannot be expected to accelerate through a single thinning treatment, some select characteristics (such as tree diameter, density, canopy structure, species composition, and vegetative cover) can be improved in the near term while others continue to gradually develop.

Alternative 3

Under alternative 3, the proposed action aims to manage forest density, species composition and structure by conducting variable density thinning and stand improvement vegetation thinning using mechanized equipment and/or hand crews exactly as intended within alternative 2. However, this alternative would limit the harvest of trees within LSR stands to 20” in DBH. Stand improvement stands and stand improvement for huckleberry habitat enhancement within this alternative would be implemented identically as proposed in alternative 2. The proposed action for Riparian Reserves in this alternative would not fall under condition-based management and would instead identify fixed no cut buffers for the project area and would not change based on site observations. Table 26 displays approximate acres by treatment type for alternative 3 with the no cut buffers applied. Through this alternative, proposed stands and objectives remain the same as alternative 2.

By implementing a 20” diameter limit it would become difficult for treatments within the project area to achieve desired objectives. This means that in some stands, the 20”+ DBH size classes are what is limiting the effectiveness of the treatment to reduce the stand density to the desired post-treatment

condition of ~35% of SDI max. While large trees are an important part of late-successional habitat, the current level of competition, lack of a multistoried structure and understory species composition are not.

Economics

As with alternative 2, the estimated acres presented for the project area are subject to change as well as the presented volumes since they are based on modeling from FVS and depend on percent of stand area harvested and log prices, which typically fluctuate seasonally and from year to year depending on market conditions. Timber values are estimated based on a weighted stumpage rate of $75.48 per thousand board feet (MBF) as identified in alternative 2.

However, under alternative 3, timber value is greatly reduced when a 20” diameter limit was implemented in the model. Alternative 3 results in an average volume removal of 9MBF/acre and based on this information, the commercial harvest would generate an estimated $679 per acre, which depending on site specific situations, could cause some stands to be deemed not commercially viable and may not support the cost of the treatment

Summary of Effects from Alternative 3

Without the flexibility to remove trees in the 20” to 26” diameter classes in alternative 3, opportunities to specifically manage for desired trees and late successional characteristics are greatly limited. Similarly, creating canopy gaps to encourage structural complexity becomes difficult as implementation would be spatially dictated by the presence and distribution of 20”+ DBH trees as per standards and guidelines in the NWFP, 20” trees that are cut for the creation of gaps would be cut and left on site and too many large downed trees has become a safety concern in past sales on the MBS. In these situations, when many trees over 20” in DBH were dropped and left to facilitate skid trails and skyline corridors, this increased amount of large, downed wood presented operability and safety concerns. Skyline corridors specifically pose threats to loggers as there is a high potential for large trees to be dislodged and sent downslope on cutters. Proposed treatment stands under alternative 3 would also likely not aid as much in reducing the risk of high severity fire or insects and disease related disturbances since overall stand density and competition related mortality would continue at an elevated rate compared to alternative 2. Additionally, the reduction in harvest volume due to the 20” diameter limit would impact the merchantability of stands and prevent necessary treatments.

Considerations Common to Alternatives 2 and 3

Forest Health

Within the North Fork Stillaguamish project area, consideration needs to be made for implementing treatments in areas infected with root diseases. Natural occurrences of root rot can cause small openings and canopy gaps that can lead to increases in plant community diversity, structural diversity, snag abundance, and provide useful wildlife habitat (Hadfield et al. 1986, Thies and Sturrock 1995). However, since root rot is considered a disease of the site, thinning can potentially exacerbate the presence of root rot diseases in a stand since more stumps means more places for the pathogen to infect. Once a tree is killed for any reason (i.e., directly by the root pathogen, by an associated bark beetle, or by cutting) root diseases are capable of surviving and feeding on the dead host as a saprophyte for decades (Hadfield et al. 1986, Morrison et al. 1991). If infections are less severe, the most successful management strategies for root diseases include shifting species composition away from susceptible species to more diverse, root disease tolerant species (Hadfield et al. 1986, Hagle 2010).

For more information on specific forest health concerns see the Silviculture Specialist Report.

Reforestation

Retained trees would provide a seed source to supply additional natural regeneration. Planting of like species composition would be implemented to ensure the desired conditions of the PVT's are being met, but species or elevational adjustment for climate change may also need to be considered.

All regeneration is planned to be natural within variable density thinning treatments. Any large gaps up to 2 acres would be monitored and if monitoring shows that natural regeneration has not occurred, appropriate follow-up actions in these created openings may occur (like site preparation planting/filling planting, and/or animal damage control) depending on the results of the monitoring. Any resulting regeneration would create a complex structure that is desired to create a complex multi-storied structure desired for the development of late successional habitat.

Conclusion

All Alternatives would meet Forest Plan Standards and Guidelines. However, Alternative 3 would forego opportunities for silvicultural treatments to better meet wildlife habitat and other project objectives. By not removing trees in the size classes of 20"-26" in DBH, objectives would not be fully met. By limiting the removal of trees within these size classes, stand density is less likely to be reduced to the desired 35% of SDI Max and would not provide as much adequate growing space to selected residual trees. This would result in stands needing even more time to develop desired characteristics that could have otherwise been initiated sooner with treatment.

Implementing Alternative 2 would have greater benefits for late-successional forest. Alternatives 2 and 3 would implement variable density thinning which would apply an ecological forestry approach at different intensities to set stands on a trajectory to assume characteristics of late successional and old growth habitat more quickly than if left to grow in current conditions. However, the flexibility to harvest and remove trees over 20" in DBH allows the proposed treatments to best meet objectives and overall habitat goals.

Furthermore, Alternative 2 allows for the greater number of acres treated due to condition-based riparian no cut buffers allowing for more flexibility as different conditions allow. Total treatable acres for both alternatives can be found in Table 26.

Transportation

Affected Environment

The existing road system provides access for fire protection, administration, recreation, timber harvest, firewood gathering and other forest product removal, vegetation management, private land access and other forest management activities. National Forest system roads are broken down by operational maintenance level, which describes the standard to which the road is currently managed (see Table 10 for miles of road by maintenance level). Some specific road condition information is detailed in the Transportation report, but overall, most road conditions in the project area vary from very poor to marginally good. Multiple roads have deferred maintenance needs.

Environmental Consequences

Alternative 1

This alternative would result in no changes in road status or road maintenance levels. Roads would continue to be maintained under the annual road maintenance budget, with many roads being maintained on an infrequent basis. Any additional road repair or reconstruction of the current roads would be

dependent upon funds becoming available. Deferred road maintenance needs would continue. Since use would continue to occur on existing poor condition roads, there would be a longer-term detrimental impact to the transportation resource because current maintenance and reconstruction needs would not be addressed. Lack of road maintenance and reconstruction would result in a negative effect with respect to both safety and the environment. Current road failures, drainage failures, and erosion control problems that have been identified within this road system would continue.

Alternatives 2 and 3

Action alternatives would benefit the open road system thru maintenance and reconstruction of open roads used for public access and haul routes, as well as contribute to a resilient road system by addressing deferred maintenance needs. The proposed changes in road maintenance would save the Forest on deferred road maintenance costs, and with reduced road maintenance needs, allow the Forest to apply limited road maintenance funding to higher priority roads within the districts associated. The action alternatives would allow the Forest Service to meet public access and administrative needs (FSM 7710.2(3)) as well as protection of the environment (FSM 7730.2(3)).

Under both action alternatives, short-term traffic from harvest operations and forest product removal would require adequate traffic control, some temporary public road closures, and proper communications to maintain safe and efficient traffic flow. A short-term reduction in public access may occur in some areas to minimize user conflicts during project implementation.

Activities proposed in both action alternatives would contribute to a well maintained, safer, and more efficient road system which would provide long-term public and administrative access in the project area.

Travel Analysis and the MBS Sustainable Roads Strategy

During the Forest Transportation Analysis Process (TAP, 36 CFR Part 261, Subpart A) commonly known as SRS (Sustainable Roads Strategy) or Minimum Roads Analysis, system roads were evaluated, and management recommendations were provided for each road. There are certain instances, however, where the proposed action deviates from past management decisions or the SRS recommendations based on analysis of site-specific conditions. A summary of proposed road changes is below (Table 27); details can be found in Table 16 and Appendix A, Figures 6-8 of this EA.

Table 27. Summary of **Proposed Maintenance Level Changes**

Maintenance Level	Alt 2	Alt 3
Change from current status to decommission	12.12 miles	47.55 miles
Maintenance Level 1 Closed/Storage	112.63 miles	57.79 miles
Maintenance Level 2 – High Clearance	62.13 miles	81.53 miles
Maintenance Level 3 – Suitable for Passenger Cars	79.59 miles	79.59 miles

Both alternatives would contribute to Travel Management (36 CFR Part 212, Subparts A) objective directions for a minimum road system by reducing the amount of Level 3 and 4 road miles, and changing the amounts of Level 1, 2 and decommissioned miles. This moves the Forest transportation system toward its desired future condition, and specialized aquatic treatments (storm proofing) would lower the amount of work and funding needed for management of the transportation system in the future.

Cumulative Effects

The effects of timber haul on the roads may have a short-term adverse effect due to wear on the road surface; however, this would be mitigated by the reconstruction and road maintenance requirements of pre-haul, during-haul, and post-haul operations. In addition, the surface rock replacement deposits by the

timber purchaser would provide a means to maintain/repair/replace the crushed aggregate surfacing, assisting in a lasting difference beyond the end of the timber haul. Past actions are considered if they are still contributing to cumulative effects, otherwise, past actions were considered as part of the baseline condition. Timber Sale road maintenance should provide a beneficial effect to the road system beyond the close of the project.

Overall, the cumulative effects of past, present, and reasonably foreseeable future projects would be a positive effect on road facilities due to improvement of safe access and resiliency of road system, and reduced road maintenance needs would allow the Forest to apply limited funding to higher priority roads within the affected area.

Wildlife

Affected Environment

Wildlife species and habitats considered for effects included Federal listed Threatened and Endangered Species (as administered under the Endangered Species Act (ESA)), Regional Forester's Sensitive Species, Forest Management Indicator Species (MIS), Northwest Forest Plan Survey and Manage Species, Management Area habitat and species; and neotropical migratory birds.

Federal listed Threatened and Endangered species are addressed in a Biological Assessment that is submitted for consultation with the U.S. Fish and Wildlife Service (FWS) if projects may affect listed species or critical habitat. FWS consultation for this Project is currently incomplete, however preliminary determination of effects for ESA listed species and habitat is displayed below.

- Spotted owl and marbled murrelet – LAA for noise disturbance during the breeding season
- Critical habitat for spotted owl and marbled murrelet – NLAA – removal of Primary Constituent Elements within critical habitat would not substantially change the suitability of the critical habitat for the listed species use
- Grizzly bear and gray wolf – NLAA – potential for disturbance from activities, with no net change in core habitat

Forest Sensitive Species, Forest MIS, Survey and Manage Species, Management Area habitat and specie, and neotropical migratory birds are addressed in the Wildlife Background Information Report in the Project Record and summarized in the Wildlife Effects Analysis of this EA. Wildlife reports as well as other figures, tables and supporting information are available in the Project Record and incorporated here by reference.

The current condition of wildlife habitat is strongly influenced by age of forest stands, and by forest or plant association. The project area includes both old forest (approximately 60% of the Finney AMA >200 years of age) and young, dense stands (approximately 40% < 80 years of age.) In the Finney AMA, the Pacific Silver Fir Zone occupies about 60% of the area, the Mountain Hemlock Zone is 24% and Western Hemlock Zone is 16% of the area. The Pacific Silver Fir Zone forests (PSFZ) do not usually include the large sized trees of forests at lower elevations since silver fir trees do not grow as big or as tall as Douglas-fir or western hemlock (WHZ), so habitat definitions that include large size as a major criterion can misrepresent the nature of old-growth Pacific silver fir forests (USDA, Forest Service 2011). Large and old trees are important for having desired nesting structure for a variety of species including marbled murrelet and spotted owl. Succession of forest stands also varies by vegetation zone: "In the more productive, lower elevation WHZ forests, forest stands progress rapidly through succession, moving from pioneer stage to an early seral stage to a mid-seral stage in 20-30 years, and from an early seral to a late seral stage in 200 years. In the silver fir and mountain hemlock forests of the higher elevations, this

development takes 20-80 years for the pioneer to mid, and over 200 years for the mid to late." It takes longer in the cooler upper elevations to attain desired old forest stand characteristics.

Wildlife habitat is therefore influenced by the age of forest stands, and by the forest vegetation zone. In the silver fir and mountain hemlock zones, stands of 20-80 years of age may still be categorized as early seral while 80-year-old western hemlock stands may be approaching mid to mature stand characteristics. Within the project area, most of the early seral acres are concentrated in the moist silver fir and upper elevation mountain hemlock zone (20 to 80 years of age), so early seral habitat is not evenly distributed across the landscape. There is little to no early seral habitat or young forests (< 20 years of age) in the lower elevation (WHZ) where a diverse mix of vegetated species would provide forage and cover not found in the old forest stands. Habitat for early seral associated species, such as deer/elk, bees, butterflies, and other pollinators is limited in the project area.

Other wildlife habitat such as down wood and snags is influenced not only by vegetation zone, and age, but by past management practices. Histograms of down wood and snags in the NF Stillaguamish watershed illustrate the difference in historic and current conditions, with forest stands which were harvested for timber often lacking in large diameter snags and having less down wood than unmanaged forest stands.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Effects of the No-Action Alternative

This alternative would retain a high proportion of the second-growth forest stands in high stocking levels; approximately 55 percent of the project area is in marginal or unsuitable habitat for owls and murrelets**.** Stands would continue in their current dense condition with suppression mortality providing small diameter snags and promoting height growth as trees compete for canopy light. Tall trees without crown development can be more susceptible to breakage, windthrow and attack by insect and disease. These second growth forest stands would provide limited owl and murrelet nesting habitat, and limited roosting cover or foraging due to tight canopy and little understory for owl prey species. While the treatment stands do not provide nesting habitat, maturing second growth and old forest would provide ample dispersal habitat This alternative would provide 50 percent of the landscape in the project area with 40 percent canopy and 11-inch diameter at breast height (dbh) trees (Thomas et al., 1990), providing for dispersal habitat across the landscape.

Forest stand management would not occur at this time, and there would be no adjustment in upland forest or in Riparian Reserves toward desired Aquatic Conservation Strategy objectives. There would be a delay in the development of large trees within the stands, with an extended period of within stand tree competition. The densely stocked stands would have limited increases in tree diameter and volume due to competition for limited growing space (USDA Forest Service, 2001). Nesting habitat and old forest structure would continue to be limited, with growth on individual trees restricted by the tree-to-tree competition. Large trees with defect or large diameter branches suitable for spotted owl and marbled murrelet nesting habitat would not be expected for another 100 years or more (D.R. Thysell and A.B. Carey 2000). Large snags may take even longer to develop, 100 to 200 years depending on mortality events (Van Pelt and Nadkarni, 2004).

Much of the forested area identified within elevation ranges for deer and elk forage production would continue to be in the stem-exclusion stage of forest stand development (Oliver and Larson 1996), providing very limited forage. The closed canopy in the stem-exclusion stage limits sunlight to the forest floor, limiting growth of understory vegetation that could provide forage. Open stand conditions would

not be present until a disturbance event such as a fire, disease, a large insect outbreak or wind event occurs. Over 92 percent of the project area would continue to have limited forage for deer, elk, and other early seral species.

There would be no change in current road conditions and maintenance levels. Open road density for the project area and Deer and Elk Winter Range MA would continue to be under 2 miles/sq. mile. Limited open road mileage is expected to benefit wildlife species that are sensitive to human use or avoid human presence (G. Shannon et. al. 2016, and F. Turina and J. Barber. 2003). The road system in the project area would be maintained with portions of roads in storage/non-drivable condition at this time. Lack of vehicle traffic would continue to limit human disturbance and benefit those wildlife species avoiding human presence. There would be no change in long-term development of core areas with little disturbance for wildlife. The storage of roads would not change current access for potential future development of desired wildlife habitat such as with beaver dam analogs, huckleberry enhancement or development of stand characteristics whether for old forest characteristics or future deer/elk habitat.

Cumulative Effects

There would be no cumulative effects due to no management activities for interaction with other past, present, or foreseeable future actions.

Alternatives 2 and 3

These effects are common to both action alternatives.

Road Haul System Used and Rock Sites

Habitat Effects: There would be limited change to the forest structure from use of the proposed road system in both action alternatives. The addition of approximately 19 miles of new temporary road could remove trees, however this change in habitat is negligible in the project area acres and comparable to some blowdown events. Road use and reconstruction would not substantially change habitat for wildlife species assessed within the project area. Repair of damaged roads would mean more drivable roads, with open road density rising during implementation before decreasing open road mileage post implementation (see engineering and hydrologist specialists' report). The project would increase the open road density during the thinning operations with the addition of temporary roads, but open road density would be reduced post implementation for the project area.

Disturbance Effects: Action alternatives would result in localized disturbance from road use for haul. Road use (and density) is often associated with a reduction of wildlife use due to disturbance as described in the westside elk habitat modeling (Cook et al. (2018) and Wisdom et al. (2018b)), the "no net loss of grizzly bear core habitat" assessment Grizzly Bear Committee (IGBC) and in other grizzly bear provinces. (A.A. Sorensen et al. 2015). Security habitat is considered areas of quality habitat used by wildlife, such as grizzly bears, where there is a minimum of 300 meters from any road accessed by motorized vehicles and high-use trails. (USDA and USDI, 1997). Use of open roads is a concern for the potential to reduce habitat effectiveness for other species, such as spotted owls and marbled murrelets. In a study by Wasser et al. (1997), nesting success was not negatively affected by road proximity, however stress hormone levels were significantly higher in male northern spotted owls (but not females) when nests were located <0.25 mile from a major logging road.

Road reconstruction and stormproofing would not change core habitat in this portion of the Finney Bear Management Unit (BMU). There would be a short-term increase in open road density during implementation of the forest stand treatments, with use of temporary roads and a corresponding short-term reduction of approximately 610 acres of late core habitat. This would impact <0.6 percent of the federal acres' contribution to the Finney Bear Management Unit and would not substantially reduce

security habitat provided in the Finney Bear Management Unit for grizzly bear or gray wolf. Therefore, the project may affect, but is not likely to adversely affect either grizzly bear or gray wolf.

Road Management Objective Level changes common to both alternatives: There would be no net increase of permanent roads associated with this project with all temporary roads closed following use. The action alternatives include slightly different objective level of system roads to be retained, both with fewer miles than currently. Differences in road management objectives by alternative are discussed more below, but both Action alternatives would decrease open road density and contribute to additional core or security habitat acres (> 1/3 mile from open road or high-use trail) for both grizzly bear and gray wolf.

Road reconstruction and maintenance of system roads would provide upgrades in aquatic organism passage, improving conditions for amphibians and mollusk movements within stream drainages where roads are obstructions to aquatic species movements. Reconstruction and maintenance of roads would also provide a more open edge effect along the road corridor which can provide forage plant species for ungulates, bears, bees and butterflies.

Rock source development would be in existing sites and any expansion expected to be less than a total of 7 acres of second growth habitat, with expansion not to exceed ½ acre at any one site. This vegetation removal at rock source sites is not expected to impact the function of dispersal habitat in the project area or critical habitat units due to the limited scale and scope of the action on the landscape. Spotted owls regularly disperse through highly fragmented landscapes that are typical in western Washington and western Oregon (Forsman et al. 2002).

Slash disposal: Brush disposal would be used to abate the slash created by the thinning activities. Burning operations that use power equipment may harass any owls or murrelets and other wildlife that might be present in un-surveyed nesting habitats, and smoke may be a disturbance factor to nesting birds. Impacts to wildlife from brush disposal through burning would be minimized by scheduling burning activities outside of the breeding season for most wildlife (PDCs, Appendix B).

Huckleberry Enhancement: These treatments in immature second growth stands would provide localized increase in forage for a variety of wildlife from bears to birds, as wells as providing nectaring plants for pollinator species of butterflies to bumble bees. While there are up to 300 acres of huckleberry enhancement in the action alternatives, treatments in the non-commercial stands represent a minor adjustment in the Mt. hemlock zone (approximately <1 percent), the treatments would enhance habitat for a variety of wildlife species and promote a more diverse mosaic of forest conditions on the landscape while providing increased connectivity of this limited habitat.

Stand Improvement: Treatment of immature second growth stands would leave cut material on site or scattered to maintain mobility of wildlife that may cross the treated area. Leave material may be used for sheltering or over-wintering habitat by black bears, marten, and other wildlife species such as small prey and birds. These treatments can promote understory development, providing short-term forage for wildlife and cover for rodents, prey for other key wildlife species (USDA, 2011b). Depending on slash disposal, limited wildlife forage opportunities would be provided for approximately 10-15 years, and may provide for localized increase in forage for deer and elk populations (Rowland et al., 2018).

Beaver Dam Analogs – Riparian Enhancement: Both action alternatives would provide for beaver dam analog construction. Beaver dam analogs can encourage beaver colonization and enhanced dam construction and pool development. This supports maintaining and restoring the structural diversity of the riparian reserve plant community, contributing to well-distributed populations of native species associated with the riparian areas. While both alternatives would provide opportunities for the beaver dam analogs, Alternative 2 would have a smaller no-cut buffer with opportunities for more thinning in the riparian reserve, supporting both a shrub and hardwood component needed by beaver as forage.

Instream Enhancement – Large Woody Debris and Aquatic Organism Passage: Both action alternatives would include enhancing stream complexity with large woody debris supplements in stream systems and restoring aquatic organism passage at road crossings where there at barriers to migration. These activities support maintaining and restoring the structural diversity in the flora and fauna communities of the riparian reserve, which in turn supports well-distributed populations of native species associated with the riparian areas.

Recreational Use – Dispersed Camping and Texas Pond Recreational Area: Both action alternatives would use a condition-based management of the dispersed camping sites in the area. The proposed actions would support reducing negative impacts from recreational use and restoring streambanks and vegetation which in turn supports well-distributed populations of native species associated with the riparian areas.

Texas Pond – Dam Repair and Maintenance and Recreational Area: Both action alternatives would provide repair and maintenance of the earthen dam at the outlet to Texas Pond with vegetation management in the 0.25 acres surrounding the dam. The vegetation to be removed is second growth trees, and low shrubs, and would not impact listed species or sensitive species. Recreational management site would shift use from the pond to upland sites with accompanying riparian restoration of dispersed camping sites. Replacement camping sites would include input from aquatic and terrestrial biologists to minimize resource impacts. While Texas Pond recreational site is within deer and elk winter range, the adjustments to the existing camping sites would consolidate activities away from habitat along the pond edge, and the recreational use would be primarily during the nonwinter seasons.

Spotted Owl and Marbled Murrelet

Habitat – While no suitable spotted owl or marbled murrelet nesting habitat would be degraded or removed, there would be activity in second growth stands that are adjacent to old forest with suitable habitat. To better assess potential noise disturbance to old forest associated species, 32 autonomous recording units (ARUs) were located in old forest habitat adjacent to proposed forest stand treatment areas within the Project Area (June 2022). Recording results are expected to better assist in determining limited operating periods. Currently the Forest conservatively assigns all owl and murrelet suitable nesting habitat an “occupied” status, treating unknown use areas as potentially occupied.

Suitable owl habitat would remain at current levels for functional fitness thresholds in core area and home range habitat conditions. It is desirable for a core area to have > 50% suitable nesting habitat, and a spotted owl home range to have >40% suitable habitat to maintain these species life history functions associated with any given site.

The proposed variable density thinning includes openings up to 2 acres in 3 to 10 percent of the treatment area (outside of the riparian reserve). Treated stands would retain structural elements of the harvested stand to develop old forest structure (Franklin et al., 2007, Franklin and Johnson, 2011, 2012 and 2018). This has the potential to support future habitat for nesting owl and murrelets. Based on the retention of approximately 40 percent canopy cover and the limited scale of the proposed treatments on the landscape, the project area would continue to function as spotted owl dispersal habitat.

Disturbance – While removal of trees is designed to develop murrelet and spotted owl habitat, tree removal would impact Primary Constituent Elements (PCEs) in critical habitat for spotted owl and marbled murrelet, resulting in more edge effect. Elevated noise levels during tree removal activities have the potential to disturb spotted owl and marbled murrelet during the breeding season.

Table 28. Potential disturbance for spotted owls and marbled murrelet habitat from commercial treatments

Alternative	Northern Spotted Owl Commercial Stand 65-yd Proximity to Suitable & Highly Suitable Habitat*		Marbled Murrelet Commercial Stand 110-yd Proximity to Moderately High & Highest Likelihood of Suitable Habitat	
	Outside & Within Critical Habitat (Noise Disturbance Acres)	Within Critical Habitat (Edge Effect Acres)	Outside & Within Critical Habitat (Noise Disturbance Acres)	Within Critical Habitat - 65 yards into suitable habitat (Edge Effect Acres)
Alternative 2 Riparian Reserve Condition 1	1,465 acres	968 acres	1,424 acres	896 acres
Alternative 2 Riparian Reserve Condition 2	1,385 acres	917 acres	1,368 acres	859 acres
Alternative 3	1,287 acres	859 acres	1,282 acres	805 acres

In Alternatives 2 and 3, a range of 1,287 to 1,465 acres of suitable spotted owl nesting, roosting, and foraging habitat occurs within 65 yards of commercial treatment areas with expected noise generating activities. This includes areas both within and outside designated Critical Habitat for the Northern Spotted Owl. A similar number of acres of suitable murrelet nesting habitat is within 110 yards of variable density thinning activities. While the noise disturbance distance is greater for murrelets, there is less of the old forest habitat providing suitable nesting structure for murrelets than for spotted owls. Alternative 3 would have a slightly smaller number of acres of potential noise disturbance due to the wider riparian buffers resulting in smaller treatment units.

Acres with potential noise disturbance represent approximately 4 to 5 percent of the suitable spotted owl nesting habitat (approximately 28,420acres) in the project area and approximately 6 to 6.5 percent of the suitable murrelet nesting habitat (22,020 acres) in the project area. Some existing old growth acres in the project area are fragmented in scattered and edge parcels, so all acres with potential noise disturbance may not be fully utilized by the owls or murrelets. Limited Operating Periods are applied to limit disturbance to owls or murrelets (PDCs, Appendix B).

As a result of potential noise disturbance from thinning activities, all action alternatives are rated as “may affect, likely to adversely affect” for the spotted owl and marbled murrelet during the breeding season. Due to the limited scale and scope of the disturbance, and the proposed operating limitations (Appendix B), the action alternatives would not contribute to a negative trend in the viability of spotted owl as a management indicator species on the Forest.

Spotted owl and marbled murrelet critical habitat

Both action alternatives propose variable density thinning within critical habitat, but with different upper diameter limits and riparian reserve area treated. In Alternative 2, there would be potential for tree removal up to 26 inches dbh. There would be no effects to current primary constituent elements of nesting habitat in critical habitat for either spotted owl or marbled murrelet. However, variable density thinning within a portion of second growth stands is projected to reduce canopy closure approximately 40% within second growth stands in critical habitat for both owls and murrelets. There is potential for an edge effect to suitable nesting habitat in adjacent critical habitat forest stands. Edge effect from thinning was assessed with potential effects to interior forest within approximately 60 feet for marbled murrelet (Lorentz, et al. 2021) and spotted owl.

Table 29 Summary of treatment acres within critical habitat

Alternative	Northern Spotted Owl Critical Habitat within Project Stands				Marbled Murrelet Critical Habitat within Project Stands			
	Commercial Stands		Non-commercial Stands		Commercial Stands		Non-commercial Stands	
	Outside & Within Critical Habitat (Acres)	Within Critical Habitat Only (Acres)	Outside & Within Critical Habitat (Acres)	Within Critical Habitat Only (Acres)	Outside & Within Critical Habitat (Acres)	Within Critical Habitat Only (Acres)	Outside & Within Critical Habitat (Acres)	Within Critical Habitat Only (Acres)
Alternative 2 RR 1	10,572	5,692	6,492	5,732	10,572	5,682	6,492	5,798
Alternative 2 RR2	9,504	5,118	5,932	5,215	9,504	5,109	5,932	5,281
Alternative 3	8,842	4,824	5,644	4,958	8,842	4,815	5,644	5,022

Spotted Owl Critical habitat - Thinning activity in both action alternatives would remove second-growth trees within spotted owl critical habitat and reduce tree canopy in treated portions to approximately 40 percent canopy cover. Proposed activities represent a minor amount of Spotted Owl Critical Habitat Unit (CHU) #4, West Cascades subunit 1 (WCN-1) which consists of approximately 438,255 acres in Whatcom, Skagit, and Snohomish Counties. The spotted owl CHU includes 51,152 acres in the NF Stillaguamish project area. Using treatment acres in the CHU, either action alternative would impact approximately 7 percent of the CHU in the project area. While canopy cover is reduced in the thinning area, due to the relatively small portion of the CHU with canopy reduction, the CHU would continue to meet both spotted owl and marbled murrelet nesting habitat and spotted owl dispersal habitat on both a project and a landscape scale.

All action alternatives' thinning prescription are consistent with the final rule on spotted owl critical habitat (USDI, 2012) for active management to improve stand conditions and forest resiliency for the benefit of the long-term recovery of the spotted owl (USDI, 2011). As described in the Silviculturist Report, it is expected that these areas, would develop into spotted owl nesting, roosting, and forage habitat earlier than if left untreated. While long-term effects would be beneficial, short-term effects from these alternatives were rated as "may affect, likely to adversely affect" spotted owl designated critical habitat in the short term.

Marbled murrelet critical habitat - There would be no removal of current nesting habitat in murrelet critical habitat, however variable density thinning, is expected to remove second growth trees considered primary constituent elements. To minimize impacts to adjacent old growth forest, second growth trees with interlocking branches with suitable nest structure for murrelets would be retained in the treated units. Dominant trees (> 20 inches dbh) infested with dwarf mistletoe would be retained in the thinned stands; thinning would enhance light for branch growth feeding the mistletoe for development of future platforms.

While there would be a reduction in canopy cover from thinning, the focus of the thinning is on the long-term development of desired structural components for nesting murrelets. Thinning would have short-term impacts to canopy cover in unsuitable habitat, with potential for long-term beneficial effects from reduced stocking levels in the second growth and development of future nesting habitat. Reduced stocking levels would reduce within-stand competition, allowing development of growth on fewer residual trees. This would promote large diameter trees with more pronounced crowns and potential development of large, lateral branches for future nesting habitat (USDA Forest Service, 2001).

As a result of short-term impacts from alternative 2 and 3, the risk determination for murrelets is rated as "may affect, likely to adversely affect" marbled murrelet and its designated critical habitat.

Habitat within the Riparian Reserve

Both action alternatives provide some treatment in the riparian reserve which would benefit terrestrial species (Cook et al. (2018) and Wisdom et al. (2018b), and NWFP ROD B-13 (1994), but with condition-based management buffers, alternative 2 has the potential to provide slightly more acres of treatment than alternative 3. Commercial riparian reserve treatments would provide more dispersal habitat and future

nesting habitat for spotted owls, future nesting habitat for marbled murrelets, future down large wood for marten, development of species structure and diversity, especially hardwood species that host insects that can feed bats. The thinning treatments include no-cut buffers and residual trees for canopy cover to provide a variety of mesic conditions for amphibians. Due to the limited scale and scope of the proposed treatments, untreated portions of the riparian reserve would continue to provide substantial habitat conditions for wildlife.

Forage for Deer, Elk, and Other Early Seral Species

Variable density thinning in both alternative 2 and 3 would include the potential for up to 2-acre openings (gaps) or heavy thinning on 3-10% of the treated area outside of riparian reserves. Both alternatives would reduce canopy cover to a range of 40 to 50%. Thinning would provide additional light to the forest floor promoting understory development in the short term. The gaps would provide openings with potential alternate forage species for deer and elk. Larger openings have an advantage of less edge effect and impact from the surrounding forest. Alternative 2 would thin more acres, including the potential range of acres to be thinned in riparian reserves under either condition 1 or condition 2 riparian buffers. Models show alternative 2 would provide slightly more acres in the good class nutrition than alternative 3, and would provide more localized benefits to deer, elk, and early seral species.

Road Management Proposed Changes

Proposed road management changes in alternatives 2 and 3 would support “no net increase of open roads” for the Finney Bear Management Unit (BMU), with the project area having more acres of core habitat after implementation. Alternative 2 proposes to store more roads (ML 1) than alternative 3, with both alternatives resulting in closed roads and more acres of core habitat in the Finney BMU.

Both Alternative 2 and 3 would support meeting the goal of open road density of 2.0 miles /Sq. mile for wildlife in the MA-14 area, deer and elk winter range. Alternative 2 would have result in more roads placed in a stored condition, while alternative 3 would decommission more roads. Both stored and decommissioned roads contribute to a reduction in open road density. The storage of roads could provide more flexibility for future management of habitat for wildlife and other management area goals, while maintaining a limited open road system that would be favorable to species disturbed by human presence.

Forest Sensitive Species

There would be no impact from the proposed activities of any of the action alternatives on Regional Forester sensitive species of: peregrine falcon, common loon, giant Palouse earthworm, shiny tightcoil snail, broadwhorl thightcoil snail Melissa arctic, valley silverspot, Larch Mountain salamander, Van Dyke’s salamander, Cascade red fox or mountain goat. There would be no impacts due to one or more of the following: 1) a review of available records and or pre-project surveys did not detect these species or habitat, 2) the area does not support suitable habitat for these species, or 3) the suitable habitat that is present in or near the project area would not be affected, directly or indirectly, by implementation of the alternatives.

Other sensitive species of bald eagle, harlequin duck, wolverine, Townsend’s big-eared bat, Little brown bat, northern goshawk, and western bumblebee have habitat within or adjacent to the project area but are not likely to have impacts due to no substantial change in suitable habitat from either action alternative. The western bumble bee does use Vaccinum species for nectaring so there is the potential for localized benefits from the huckleberry enhancement in all action alternatives for bumblebees. All action alternatives would have noise and vegetation disturbance that could result in displacement of sensitive species during the 1-3 seasons of operation in any one area. The intensity of effects would be spread over both time and space with activities potentially impacting individuals, but not likely to create a trend

towards federal listing. None of the action alternatives would contribute to a negative trend in the viability of the sensitive species listed for the Forest (2011 MIS species assessment).

Forest Management Indicator Species

Those species listed as both Forest Sensitive and Forest MIS species are discussed in the Forest Sensitive Species section above. American marten, pileated woodpecker, and primary cavity excavators are the three exclusively MIS species. All action alternatives would meet Forest Plan direction for maintaining adequate habitat on the landscape for these species and would not contribute to a negative trend in the viability of the management indicator species.

All action alternatives would maintain the suitable old forest habitat currently identified as high-quality marten habitat. Timber harvest and road work activities would provide variety in the habitat conditions for marten hunting in the thinned second growth forest but would reduce forest canopy cover in the short-term (next 10 to 15 years). Thinning of mixed western hemlock and Pacific Silver fir second growth stands would have canopy reduction and gaps persisting for up to 50 years. Thinned areas may provide additional habitat for mice and small prey and would retain the down wood component for cover for subnivean (under-snow) hunting. In the long-term (50 plus years), stand treatment could benefit marten by promoting stand diversity and structure suitable for denning habitat (mature and older forest).

Primary excavators such as pileated woodpeckers and nuthatches are forest dwelling birds that are specialized for foraging on, and nesting in, decaying wood. All action alternatives would reduce snag levels within the treatment stands. The variable density thinning treatments proposed are based on the concept of retaining structural elements of the harvested stand to develop and maintain biodiversity in managed forest (Franklin et al., 1997). Since snags are not uniform across the landscape, retaining trees in aggregate patterns would contribute to providing snags and other elements desired for complex early seral and thinned stand conditions.

Table 30. Wildlife Species and Habitat Considered, Status, Preferred Habitats, Presence in Planning Area and Effects Determinations From all Action Alternatives.

NF Stillaguamish Landscape Project				
Species or Habitat	**Forest Status**	**Preferred Habitats**	**Habitat Present in Planning Area**	**Effects Determination for All Action Alternatives**
Northern Spotted Owl[2a] *(Strix occidentalis caurina)*	Federally Threatened/MIS	Mature, old-growth forests (nesting, roosting, foraging); second growth used for dispersal	Yes	LAA – Noise disturbance, no change in nesting habitat
Critical Habitat[2], Northern Spotted Owl	Federally Designated	Mature, old growth forests	Yes	LAA, cover tree removal short term impact
Marbled Murrelet [2a](*Brachyramphus marmoratus m.)*	Federally Threatened	Mature, old-growth forests (nesting, roosting)	Yes	LAA – Noise disturbance, no change in nesting habitat
Critical Habitat[2], Marbled Murrelet	Federally Designated	Mature, old growth forests	Yes	LAA, cover tree removal, short term impact
Grizzly Bear[2] (*Ursus arctos horribilis)*	Federally Threatened/MIS	Security habitat > 300 m from road	Yes, minimal suitable habitat	NLAA, no net change in core habitat, potential minor increase in forage
Gray Wolf[2] (*Canis lupus)*	Federally Endangered/MIS	Security habitat > 300 m from road, ungulate prey base	Yes	NLAA no net change in security habitat, potential minor increase prey
American Peregrine [1] Falcon (*Falco peregrinus anatum*)	R6-Sensitive/ MIS	Cliff habitat for nesting	Potential, no historic detections	NA, no change in potential nesting habitat

NF Stillaguamish Landscape Project				
Species or Habitat	**Forest Status**	**Preferred Habitats**	**Habitat Present in Planning Area**	**Effects Determination for All Action Alternatives**
Northern Goshawk *(Accipiter gentilis)*	R6-WA Sensitive	Associated with mature to old forest stands, but has been detected in 2nd growth stands	Yes	Not likely to impact, no change in mature habitat, project cons. measures for nest sites
Common Loon (*Gavia immer)*	R6-Sensitive	Lakes for nesting and brooding young	No	NA
Bald Eagle[1] *(Haliaeetus leucocephalus)*	R6-Sensitive/ MIS	Roost, nest habitat & forage areas near lakes, reservoirs, rivers with readily available food source (fish & carrion)	Yes	Not likely to impact, no change in mature habitat for roosting, no change in forage
Harlequin Duck (*Histronicus histronicus)*	R6-Sensitive	Swift moving streams (rivers and creeks) for nesting and brooding young	Yes	No impacts due to no change in habitat
California wolverine (*Gulo gulo luscus*)	R6-Sensitive	Large expanse of minimally disturbed habitats, Avalanche chute, snow cover	Yes, minimal suitable habitat	Not likely to impact, no substantial change in dispersal habitat
Mountain Goat (*Oreamnos americanus) (*MA-15)	R6-Sensitive/MIS	Mountain goat habitat (cliffs, rock outcrops, forest cover)	Yes, minimal suitable habitat	NA, transplanted goats did not establish
Townsend's big-eared bat (*Corynorhinus townsendii*)	R6-Sensitive	Abandoned mines & other human-made structures for roosting and hibernacula; Foraging in forest edges and riparian areas	Yes – forage habitat	Not likely, not known to be in project area, minor increase in foraging hab.
Western bumble bee (*Bombus occidentalis)*	R6 -Sensitive	Early seral vegetation – pollinator	Yes	Not likely to negatively impact, minor creation of early seral forage
Suckley cuckoo bumble bee (*Bombus suckleyi)*	R6 -Sensitive	Early seral vegetation - pollinator	Yes	Not likely to negatively impact, minor creation of early seral forage
Frigid bumble bee (*Bombus frigidus***)**	R6 -WA Sensitive	Early seral vegetation - pollinator	Yes	Not likely to negatively impact, minor creation of early seral forage.
High Country bumble bee (*Bombus kirbiellus)*	R6 -WA Sensitive	Early seral vegetation - pollinator	Yes	Not likely to negatively impact, no activities in high elevation.
Little brown myotis *(Myotis lucifugus)*	R6-Sensitive/WA	Caves, mine tunnels, hollow trees, bridges or buildings as roost sites. Forest foraging	Yes	Not likely to impact, minor change in foraging habitat
Cascade red fox (*Vulpes vulpes cascadensis)*	R6-Sensitive/WA	Mixture of forest and open country	No	NA, no habitat change
Johnson's hairstreak butterfly (*Callophrys johnsoni)*	R6-Sensitive	Old-growth coniferous forests; use of mistletoe (genus *Arceuthobium*)	Yes	Not likely to impact, potential minor increase in foraging habitat
Melissa artic butterfly *(Oeneis melissa)*	R6 -Sensitive	Sedges in talus slopes, rocky summits and saddles and frost-heaved clear-cuts	No	NA

NF Stillaguamish Landscape Project				
Species or Habitat	**Forest Status**	**Preferred Habitats**	**Habitat Present in Planning Area**	**Effects Determination for All Action Alternatives**
Valley Silverspot butterfly *(Speyeria zerene bremnerii)*	R6 -Sensitive	Open prairies and grasslands	No	NA
Shiny Tightcoil *(Pristiloma wascoense)*	R6 -Sensitive Survey & Manage	Information on habitat, ecology, population numbers & range lacking.	No	NA
Broadwhorl tightcoil snail (*Pristiloma johnsoni*)	Sensitive/survey and manage	Leaf litter deciduous-coniferous forests below 1300 m elevation	no historic detections	NA
Fisher *(Pekania pennanti***)**	R6 Sensitive	Mature to open forests, forages in edge habitat	Yes	Not likely to impact, no substantial change in habitat.
American Marten (*Martes americana)*	MIS	Old-Growth and Mature Forest, frequents Pacific Silver-fir zone.	Yes	minor decrease in habitat cover, not likely to impact viability
Pileated Woodpecker *(Dryocopus pileatus)*	MIS	Range of Old-Growth and Mature Forest	Yes	Decease in snags short term, habitat maintained in project & landscape, not likely to impact viability
Primary Cavity Excavators	MIS	Snags and Downed Logs	Yes	Decease in snags short term, habitat maintained in project & landscape, not likely to impact viability
Puget Oregonian *(Cryptomastix devia)*	Survey & Manage	Associated with hardwood logs, leaf litter, moist rocks, and talus.	Yes	Not likely to impact, no change in suitable habitat
Migratory Birds/ golden eagle	Species of Concern	Vegetation of all successional stages including meadows, shrub, snags and cliffs.	Yes	Not likely to impact, habitat maintain in project & landscape
Deer and Elk (MA -14)	Species of Concern	Vegetation providing both cover and forage (early seral vegetation)	Yes	Not likely to impact, minor increase in early seral forage on landscape scale

[a] Impacts are attributed to disturbance only during the nesting season. Nesting habitat would not be removed.
**Impacts due to disturbance would not trend a species towards Federal listing under the Endangered Species Act.
[1]Species are delisted and addressed as sensitive species
[2]Species/CHU addressed in the biological assessment
MIS=Management Indicator Species
LAA = may affect, likely to adversely effect, NLAA = may affect, not likely to adversely affect, NE = No effect
NA = not applicable

NF Stillaguamish project Species or Habitat	Status	Preferred Habitats	Occurrences in or Adjacent to Project Area [1]
Northern Spotted Owl *(Strix occidentalis caurina)*	Threatened/ MIS	Mature, old-growth forests (nesting, roosting, foraging); second-growth used for dispersal	Documented
Marbled Murrelet (*Brachyramphus marmoratus m.)*	Threatened	Mature, old-growth forests (nesting, roosting)	Documented
Grizzly Bear (*Ursus arctos horribilis)*	Threatened/ MIS	Core Security habitat with adequate forage and > 300 m from motorized roads and high-use trails	Not Suspected, habitat limitations
Gray Wolf (*Canis lupus)*	Endangered/ MIS	Security habitat with reliable prey base and > 300 m from road and high-use trails	Not Suspected, habitat limitations
American Peregrine Falcon (*Falco peregrinus anatum*)	Sensitive/ MIS	Cliff habitat for nesting near adequate prey base	Suspected, but not documented
Bald Eagle *(Haliaeetus leucocephalus)*	Sensitive/ MIS	Roost, nest habitat and forage areas near lakes, reservoirs, rivers with readily available food source (fish and carrion)	Documented
Harlequin Duck (*Histronicus histronicus)*	Sensitive	Swift, moving streams (rivers and creeks), adequate pool habitat for foraging and brooding.	Documented
Common Loon (*Gavia immer*)	Sensitive	Large lakes	Not Suspected
Northern Goshawk (*Accipiter gentilis*)	Sensitive	Mature or old forest habitat for nesting	Suspected
Townsend's big-eared bat (*Corynorhinus townsendii*)	Sensitive	Abandoned mine shafts and other human-made structures for roosting and hibernacula; Foraging in forest edges	Suspected, but not documented
Mountain Goat (*Oreamnos americanus)*	Sensitive/ MIS	Habitat of cliffs, isolated rock outcrops, forest cover in winter	Not suspected, historic releases not successful
California wolverine (*Gulo gulo luscus*)	Sensitive	Large expanse of minimally disturbed habitats, persistent snow fields, & reliable prey base.	Unknown
Giant Palouse Earthworm (*Driloleirus americanus*)	Sensitive	Native habitat consists of the bunch grass prairies of the Palouse region. The fertile soil consists of deposits of volcanic ash and rich layers of organic matter.	Not documented
Broadwhorl Tightcoil (*Pristiloma johnsoni*)	Sensitive	Includes abundant ground cover, conifer or hardwood overstory, and moderate to deep litter.	Not documented. Not in known range of found specimens
Shiny Tightcoil (*Pristiloma wascoense*)	Sensitive	Ponderosa pine and Douglas-fir forests at moderate to high elevations. Not typical habitat	Not documented. Not in known range of found specimens
Western Bumblebee (*Bombus occidentalis*)	Sensitive	A generalist forager and has been reported to visit a wide variety of flowering plants	Suspected, but not documented
Johnson's Hairstreak (*Callophrys johnsoni*)	Sensitive	Old-growth coniferous forests; associated with conifer mistletoe (genus Arceuthobium)	Suspected, but not documented
Melissa Arctic (*Oeneis Melissa*)	Sensitive	Dry tundra, talus slopes, fellfields, rocky summits and saddles, ridges, and frost-heaved clear-cuts; generally occurs above the timberline, which, in Washington, is at about 7,000 to 8,000 ft.	Not Suspected, habitat limitations
Valley Silverspot (*Speyeria zerene bremnerii*)	Sensitive	Inhabits windy peaks with nearby forest openings. It is also found in native prairies and grasslands, often tending towards more mesic sites.	Not Suspected, habitat limitations

Little Brown Myotis (*Myotis lucifugus*)	Sensitive	Conifer and hardwood forests, but also occupies open forests, forest margins, and shrub-steppe clumps of trees in open habitats, cliffs and urban areas	Documented
Cascade Red Fox (*Vulpes vulpes cascadensis*)	Sensitive	Inhabits the upper forest, subalpine parkland, and alpine areas of the Cascade Range. It is only found in Washington where it has been documented from 2,500 feet but primarily occurs above 4,500 feet.	Not Suspected, habitat limitations
Larch Mountain Salamander *(Plethodon larselli)*	Sensitive/ Survey and Manage	Associated with hardwood logs, leaf litter, and beneath cool and moist rocks and talus. Not suspected north of Highway 2.	Not documented. Not in known range of found specimens
Van Dyke's Salamander *(Plethodon vandykei)*	Sensitive/ Survey and Manage	Associated with hardwood logs, leaf litter, and beneath cool and moist rocks and talus. Not suspected north of Highway 2.	Not documented. Not in known range of found specimens
Puget Oregonian (*Cryptomastix devia*)	Survey and Manage	Mature to old growth conifers with bigleaf maples.	Suspected, but not documented
Evening Fieldslug (*Deroceras hesperium*)	Survey and Manage	Perennially wet meadows in forested habitats. Limited known site.	Not documented. Not in known range of found specimens.
American Marten (*Martes americana)*	MIS	Old-Growth and Mature Forest for denning, resting	Documented
Pileated Woodpecker *(Dryocopus pileatus)*	MIS	Old-Growth and Mature Forest	Documented
Primary Cavity Excavators	MIS	Availability of snags and downed Logs	Documented
Neotropical Migratory Birds	Species of Concern	Vegetation of all successional stages including diverse seral stages, water features and rock/cliff features.	Documented
Deer/elk Winter Range (MA-14)	Management Allocation	Forested stands, generally at 2400 ft elevation and below.	Documented
[1]Documented – species is known/documented to occur in or adjacent (w/in 1 mile) of proposed project area. Suspected, but not documented – species is known (documented) to occur within habitat found on the Forest but has not been documented within or adjacent to the project area. Some species are listed as potential, but the project is not within the known range of found species (mollusks: Burke, T.E., 2013). Not documented – species considered locally extirpated, or not documented on the Mt. Baker Ranger District. Some species have distribution into WA., but the project is not within the known range of found specimens (mollusks: Burke, T.E., 2013)			

Cumulative Effects of the Action Alternatives

See the full wildlife report for a list of projects that could spatially and or/temporally overlap with this effects analysis. Timber harvest is expected to continue on non-federal lands in the future. Ongoing road maintenance and recreational site management would continue to remove hazard trees or snags at administrative sites. Firewood removal is limited to road corridors and within 50 feet of open roads, although this would generally be limited to areas adjacent to open roads and administrative sites. These activities would have limited impact on standing and down wood levels. All action alternatives along with timber harvest on non-federal lands would have incremental reductions to snag and down wood levels for the species which use these elements, but those impacts would not be substantive when assessed on a landscape scale.

Conclusion

Alternative 2 Riparian would allow for the more treatment within the Riparian Reserve, maintaining a variety of hardwood and conifer specie that support riparian associated species. This diversity of vegetation is used by a variety of avian species, and the riparian areas are corridors for wildlife travel,

where forage for deer and elk movement is facilitated by drainages with an abundant riparian forage species.

Noise disturbance and impacts to critical habitat would be similar within all action alternatives. The differences in treatments were in the Riparian Reserve no-cut buffer width, and the upper dbh for tree removal in the thinning. Alternative 2 would allow for tree removal up to 26 inches dbh, while alternative 3 retains the upper diameter limit for tree removal at 20 inches dbh. Both action alternatives would create gaps or openings within the thinned stands. Both action alternatives would reduce canopy cover in treated areas, with a slight increase in forage. Alternative 2 would provide slightly greater forage potential. Both action alternatives would be expected to provide localize benefits to deer, elk and early seral species.

Disturbance -The analysis concluded that the activities associated with the proposed vegetation treatments would have short-term negative impacts from noise disturbance, displacement of wildlife in use areas, and loss of canopy cover reducing habitat suitability for some species and increasing habitat suitability for other species. The project would have long term beneficial impacts from development of desired old forest habitat structure in treated stands in critical habitat and is consistent with recovery plan objectives which specifically describing the use of ecological forestry in meeting habitat restoration objectives. (Chapter III of USDI 2011). Negative noise impacts within historic owl and murrelet circles would be mitigated by conservation measures and limited operating periods.

Other Required Disclosures

Forest Plan Consistency and Other Management Direction

Activities proposed by both action alternatives are consistent with Forest Plan standards and guidelines, and with the Northwest Forest Plan Riparian Reserve Standard and Guides and Aquatic Conservation Strategy (ACS) objectives. Documentation of consistency can be found in specialist reports in the project record and posted on the project website.

Prime Farmlands, Rangelands, Forestlands, and Parklands

USDA Departmental Regulation 9500-003 describes obligations of USDA agencies with respect to prime farmlands, rangelands, forestlands, and parklands. The alternatives described in this EA do not propose changes in land use as described in the regulation and would not result in the conversion of these lands to other uses.

National Forest Management Act

The National Forest Management Act of 1976 acknowledges the complex management of National Forest System lands and the multiple uses of the lands and resources over time. NFMA requires the US Forest Service to use comprehensive, multiple use analysis for management planning, and to use sound technological and ecological knowledge to inform its decision-making regarding renewable resources. This proposed action was created with NFMA compliance in mind and considers the wide variety of benefits to NFS lands and users, including timber, hydrological, biological, and recreational uses.

Floodplains and Wetlands

USDA Departmental Regulation 9500-003 and Executive Orders 11988 and 11990 describe obligations of Federal agencies with respect to floodplains and wetlands. DR 9500-003 advocates that beneficial functions and values of wetlands and floodplains be reserved. The alternatives described in this EA do not propose changes in land use and would not result in the conversion of wetlands to other uses or other encroachment on floodplains. Beneficial functions and values of wetlands and floodplains would be

maintained or improved through implementation of the action alternatives. Effects to floodplains and wetlands are described in the Hydrology and Fisheries sections of this EA.

Executive Order 11988 directs Federal agencies to restore and preserve the natural and beneficial values served by floodplains. Consistent with this EO, the action alternatives and associated design criteria and BMPs have been designed to minimize potential harm to, or within, floodplains. Implementation activities proposed would improve the physical processes of floodplain connectivity and function. Refer to the Need for Proposal description describing the goal to enhance the health of streams and associated aquatic ecosystems by modifying the transportation system to improve floodplain structure. Effects to floodplains are described in the Hydrology and Fisheries sections of this EA. The action alternatives proposed would minimize adverse effects to the floodplains, and thus be consistent with Executive Order 11988.

EO 11990 directs Federal agencies to "avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative." The action alternatives do not propose new construction, conversion or development within wetlands; some aquatic enhancement actions may have short term adverse impacts during construction activities, but these activities are designed to improve aquatic and wetland habitats in the long term and have been designed to avoid any adverse impacts to the greatest extent feasible. Refer to the Hydrology report for a discussion of effects on wetlands.

Socioeconomics

Population demographics for the following census bureau-defined geographic areas near the project were considered for the U.S. Census Bureau of Snohomish County and the incorporated community of Darrington, WA.

The percentages of families or individuals below poverty level in the Darrington community near the project area are similar or less than the percentages reported for the US overall (approximately 7% of individuals for the Snohomish County and 15% for the community of Darrington, compared to 15% of individuals for the United States; U.S. Census Bureau 2021, Headwaters Economics 2021). The 2021 median household income is above the national poverty guideline (Headwaters Economics 2021). Based on local knowledge, some low-income populations near the project area augment incomes through actions such as gathering firewood and other forest products to sell. Long-term access to such areas would be improved through road maintenance activities associated with the proposed action. Some proposed actions in the planning area may provide job opportunities for local residents. None of the proposed actions are expected to affect farms or water quality of municipal or domestic-use water systems.

75-88% of the population self-identifies as White, compared to 59.4% nationally, while 1.3-1.6% self-identify as American Indian and less than 5% self-identify as other minority races or ethnicities (U.S. Census Bureau 2021, Headwaters Economics 2021). No adverse effects from project activities are expected to disproportionately affect members of any racial minority group. Some minority groups may culturally benefit from the proposed action through the restoration of natural resources.

Employment by occupation statistics demonstrate that in the Darrington community, the greatest percentage of employees work in management, professional, and service occupations (28-32%) with only a small percentage employed in farming, fishing, and forestry (.6%).

In summary, effects of alternatives on the human environment are expected to be similar for all human populations regardless of nationality, gender, race, or income. No disproportionately high and adverse human health or environmental effects on minority populations and low-income populations are expected

to result from any implemented alternative. Activities associated with the proposed action would be governed by Forest Service contracts, which are awarded to qualified purchasers regardless of race, color, sex, religion, etc. Such contracts also contain nondiscrimination requirements. While the proposed activities would create jobs and provide consumer goods, no quantitative output, lack of output, or timing of output associated with these projects would affect the rights, privileges, or status quo of consumers.

Conflicts with Plans, Policies, or Other Jurisdictions

This project would not conflict with any other policies, regulations, or laws. Based on information received during scoping, informal consultation meetings, and analysis in the EA, none of the alternatives under consideration would conflict with the plans or policies of other jurisdictions, including Tribes. This project would not conflict with any other policies and regulations or laws, including the Clean Water Act, Endangered Species Act, National Historic Preservation Act, and Clean Air Act. Refer to the following sections for discussions regarding these laws:

Fire, Fuels, and Air Quality – Clean Air Act

Hydrology and Fisheries – Clean Water Act

Wildlife, Botany, and Fisheries – Endangered Species Act

Cultural Resources– National Historic Preservation Act

Potential or Unusual Expenditures of Energy: Implementation of the action alternatives would require expenditures of fuel for workers to access the project area and for use of power equipment. Alternative 1 would not require the expenditure of fuel. Overall, the project would not result in any unusual expenditure of fuel compared to similar activities conducted in the area.

Agencies and Persons Consulted

Early and continuing coordination with the public and interested agencies is an essential part of the NEPA process. The project was listed in the Schedule of Proposed Actions (SOPA) February 18, 2022, and has been listed on subsequent SOPAs on a quarterly schedule. The proposed project was made available on the project's website at https://www.fs.usda.gov/project/?project=61659.

The proposal was provided to the public and other agencies for comment during scoping April 22, 2022 – May 23, 2022. Legal notice was published in the Everett Herald. 2,067 scoping notifications were sent. A public meeting was held via Zoom on May 18, 2022. Approximately 42 letters and emails were received from the public in response to scoping. The Draft Environmental Analysis was made available to the public on the Mt Baker-Snoqualmie National Forest website on February 14, 2023, the beginning of the 30-day comment period. 28 public comments were received. The complete mailing list, letters and emails received are in the project record. A public field trip was held on August 26, 2022.

The Forest Service consulted the following individuals, Federal, State, Tribal, and local agencies during development of this environmental assessment.

Table 31. Tribes

Samish Indian Nation
Sauk-Suiattle Tribal Council
Stillaguamish Tribe
Swinomish Tribal Community
Tulalip Tribes

Upper Skagit Tribal Council

Table 32. Federal, State, and Local Agencies

Advisory Council on Historic Preservation
National Oceanic Atmospheric Administration, National Marine Fisheries Service
U.S. Fish and Wildlife Service
Washington State Historic Preservation Office
Washington Department of Fish and Wildlife
Washington Department of Ecology
Washington Department of Natural Resources