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South Revillagigedo Integrated Resource Project

Draft Environmental Impact Statement
Volume 1

Forest Service
Alaska Region

Tongass National Forest
Ketchikan Misty Fjords
Ranger District

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August, 2020

Cover photo: Misty muskeg near Licking Creek (Ben Limle)

United States Department of Agriculture | Forest Service | Tongass National Forest Alaska Region | 648 Mission Street Ketchikan, AK 99901 907-225-3101

File Code: 1950
Date: August 20, 2020

Dear Planning Participant,

The Tongass National Forest is seeking public comment on the Draft Environmental Impact Statement (EIS) for the South Revilla Integrated Resource Project (South Revilla Project) which proposes, over a 15-year time period, to implement a variety of resource management actions on the Ketchikan Misty Fjords Ranger District. The Draft EIS, with appendices is available online at https://www.fs.usda.gov/project/?project=53477. Paper copies of the South Revilla Integrated Resource Project EIS are available upon request. If you require a paper copy or electronic media, or need additional information, please contact the Ketchikan Misty Fjords Ranger District at (907) 225-2148 during regular business hours, Monday through Friday, 8:00 a.m. to 4:30 p.m.

The intent of the South Revilla Project is to contribute jobs and labor income in local and regional communities in the timber and tourism sectors, contribute to improved terrestrial and aquatic conditions, support access to subsistence resources, and provide safe access to Forest users. Actions proposed include, but are not limited to, cabin construction, timber harvest, stream restoration, and road construction. The Draft EIS describes four alternatives in detail – a no-action alternative (Alternative 1) and three action alternatives (Alternatives 2, 3 and 4). The action alternatives are designed to achieve the purpose and need for action, while simultaneously addressing issues raised by the public. A project-specific Forest Plan amendment that would adopt lower scenic integrity objectives (SIOs) is proposed for Alternatives 2 and 3. Estimated effects of each alternative were analyzed and compared in terms of meeting management objectives and possible impacts to resources. A preferred alternative is not identified at this time.

Written comments on this draft environmental impact statement will be accepted for 45 days following the date of publication of the Notice of Availability (NOA) of the Draft EIS in the Federal Register (https://www.federalregister.gov/documents/current). While a public notice will also be published in the Ketchikan Daily News, the publication date in the Federal Register is the exclusive means for calculating the 45-day comment period. Do not rely on dates or timeframes provided by any other source. If the comment period ends on a Saturday, Sunday, or federal holiday, comments will be accepted until the end of the next federal working day (11:59 p.m.).

The South Revilla Project is subject to the objection process defined by 36 CFR 218, subparts A and B. More information can be found at https://ecfr.federalregister.gov/current/title-36/chapter-II/part-218. Only individuals or entities who submit timely and specific written comments about this proposed project during this or another public comment period established by the responsible official will be eligible to file an objection. Persons submitting comments must provide: name and address; project title; and signature or other verification of identity upon request. It is the responsibility of the sender to ensure timely receipt of comments submitted. Names and contact information submitted with comments will become part of the public record and may be released under the Freedom of Information Act.

It is important to this planning process that you as a reviewer provide comments. Specific written comments should be within the scope of the proposed actions, have a direct relationship to the proposed actions, and must include supporting reasons for the responsible official to consider. Comments should be submitted prior to the close of the public comment period, and should be as specific as possible, clearly stating your concerns (40 CFR § 1503.3).

Specific written comments may be submitted via the website https://cara.ecosystem-management.org/Public/CommentInput?Project=53477, by email to SM.FS.AtkmComments@usda.gov (please note this is a new email address), by Fax to (907) 225-8738, and by mail or by hand-delivery to the address listed below. Electronically submitted comments may be submitted by email in word (.doc), rich text format (.rtf), text (.txt), and hypertext markup language (.html). Comments may be mailed or hand-delivered to the following address:

> Shane Walker, District Ranger
> ATTN: South Revilla Integrated Resource Project
> USDA Forest Service
> Tongass National Forest, Ketchikan Misty Fjords Ranger District
> 3031 Tongass Avenue
> Ketchikan, AK 99901.

Hand-delivered comments will be accepted by appointment only due to continued safety precautions during the pandemic. To schedule hand-delivery, please contact the Ketchikan Misty Fjords Ranger District at (907) 225-2148 during regular business hours, Monday through Friday, 8:00 a.m. to 4:30 p.m.

A public meeting and subsistence hearing(s) will be held in Ketchikan during the 45-day comment period. A notice on the project web page (https://www.fs.usda.gov/project/?project=53477), in the Ketchikan Daily News, and through public service announcements on the radio will be issued once date(s) and location are finalized. Written comments on the South Revilla Project will be accepted at the meeting(s).

Along with the South Revilla Integrated Resource Project interdisciplinary team, I would like to thank those who take the time to review and comment on the project. Your input is valued and important to a successful outcome.

Sincerely,

for

M. EARL STEWART
Forest Supervisor, Tongass NF

South Revillagigedo Integrated Resource Project
Draft Environmental Impact Statement
Ketchikan Misty Fjords Ranger District, Alaska

Lead Agency:	USDA Forest Service Tongass National Forest
Responsible Official:	M. Earl Stewart, Forest Supervisor Tongass National Forest Federal Building 648 Mission Street Ketchikan, AK 99901
For Information Contact:	Shane Walker, District Ranger Ketchikan Misty Fjords Ranger District 3031 Tongass Ave. Ketchikan, AK 99901 michael.s.walker@usda.gov

Abstract

The South Revillagigedo Integrated Resource Project (South Revilla Project) is a project-scale National Environmental Policy Act (NEPA) analysis that will result in a decision whether to authorize activities on the Ketchikan Misty Fjords Ranger District over the next 15 years. The South Revilla Project is proposed to meet multiple objectives: contribute to jobs and labor income in local and regional communities in the timber and recreation sectors, contribute to improved terrestrial and aquatic conditions that support subsistence resources, and provide safe access to Forest users on the Ketchikan Misty Fjords Ranger District. These would be accomplished through a variety of activities and management strategies for: timber management, watershed management, recreation management, and access management. Exact locations and implementation methods will be guided by conditions identified in the preferred alternative.

The Draft Environmental Impact Statement (Draft EIS) describes four alternatives: no action (Alternative 1), the proposed action (Alternative 2), and two other action alternatives (Alternatives 3 and 4). Alternatives 2 and 3 include a project-specific Forest Plan amendment that would lower scenic integrity objectives, which would allow larger timber harvest units, and additional acres of even-aged management than is currently allowed. This would generate more timber harvest volume from a unit, and reduce logging costs by allowing the use of conventional logging systems, such as cable or shovel logging, rather than helicopter logging. The alternatives represent different project designs intended to address issues, wildlife habitat and recreation and scenery raised by the public, while achieving the purpose and need for action. This Draft EIS describes the effects of implementing each alternative and compares them in terms of meeting management objectives and estimated impacts to resources.

Tongass National Forest Supervisor Earl Stewart is the Responsible Official for this project. The Responsible Official will ensure that activities are implemented within the bounds of the analysis and the decision made.

Summary

Introduction

The Forest Service has prepared this environmental impact statement (EIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations to disclose the direct, indirect, and cumulative environmental impacts that could result from the proposed action and alternatives proposed on the Ketchikan Misty Fjords Ranger District. The project is located in the southeastern area of the Tongass National Forest on Revillagigedo Island, 17 miles northeast of Ketchikan, Alaska.

Geographic information system (GIS) data and product accuracy may vary. All numbers in this document calculated from the GIS data should be considered as approximate. Map products in this document are also produced from the GIS data and prepared by the Forest Service for use in analysis and visual representation.

1 – What actions are proposed?

The South Revillagigedo Integrated Resource Project (South Revilla Project) Draft EIS is a project-level NEPA analysis that will support a decision whether to authorize a variety of integrated resource management activities on the Ketchikan Misty Fjords Ranger District, based on Forest Service, agency and public input received during project scoping and past discussions to be implemented over a 15-year period. The intent of this project is to contribute to supporting jobs for local and regional communities in the timber and recreation/tourism sectors, contribute to improved ecological conditions that support subsistence resources, and provide and maintain access to Forest users.

Project activities would include:

- **Timber management**, consisting of old-growth and young-growth commercial harvest, and silvicultural intermediate treatments to achieve various management objectives such as promoting timber production, improving wildlife habitat, or improving riparian habitat. The proposed action includes harvest of up to 5,247 acres of old-growth timber and up to 1,239 acres of young-growth timber in the modified landscape and timber production land use designations (LUDs) using a variety of harvest methods and offered in one or more timber sales.

  As part of this analysis, Alternatives 2 and 3 include a project-specific Forest Plan amendment[1] that would lower scenic integrity objectives, which would allow larger timber harvest units, and additional acres of even-aged management than is currently allowed (USDA Forest Service 2016a, p. 4-54). This would generate more timber harvest volume from a unit, and reduce logging costs by allowing the use of conventional logging systems, such as cable or shovel logging, rather than helicopter logging. The amendment would apply only to this project and applies to the analysis for Alternatives 2 and 3. The analysis for this amendment is in Chapter 3.

- **Recreation management** on National Forest System (NFS) lands, including construction of new recreation facilities and trails. Recreation facilities include a cabin, parking areas, shelters, picnic areas, trails, dispersed camping sites, outhouses, viewing areas and platforms, non-motorized boat

[1] Forest Plan amendments may be project-specific if a proposed project is not consistent with the Plan. In these instances, the Responsible Official has the option to propose a plan amendment that, if approved, would accommodate the project. If the plan amendment applies only to a single project, the amendment is subject to the project review process (Forest Service Handbook 1909.12, section 21.31).

launch, and interpretative kiosks identified in the 2018 Shelter Cove Area Recreation Master Plan (appendix D).

- **Access management**, consists of new temporary road and NFS road construction, closed NFS road maintenance needed for log haul, access and travel management recommendations of new NFS road and changes to road management of the existing NFS road system, and construction, reconstruction, and maintenance of marine access facilities (Shelter Cove and Shoal Cove). These activities are intended to maintain and manage a, cost-effective transportation system that supports management activities and provides Forest users access to subsistence, recreation and traditional use opportunities, while minimizes effects on wildlife and fish habitat, riparian habitat, and wetlands.
- **Watershed management**, consisting of riparian thinning, placing large wood both in streams and floodplains, and replacing or removing culverts impeding aquatic organism passage. Additional fisheries and stream habitat enhancements would include natural instream barrier modifications. To accomplish these activities a combination of hand tools, heavy machinery and explosives would be used. These are proposed to maintain, improve, or restore the natural range of habitat conditions in the project area to support wildlife, fish and plant populations for subsistence, traditional and cultural uses, and to sustain diversity.

2 – Why is the project being proposed?

Existing conditions within the South Revilla Project area were compared with the desired conditions (desired long-term landscape attributes) defined in Chapter 2 of the 2016 Tongass National Forest Land and Resource Management Plan (Forest Plan), resulting in the identification of specific needs for the project area. In other words, where desired conditions are not being met, a need exists. The purpose of the South Revilla Project is to meet the identified needs to attain Forest Plan goals and objectives, and land use designation (LUD) goals, objectives and desired conditions (USDA Forest Service 2016a, pp. 2-2 to 2-6, 5-2 to 5-3, 5-6, 5-8, 5-13 and 5-14).

3 – Alternatives: What other action would meet the same need?

The South Revilla Project interdisciplinary team developed alternatives using information gathered from the public, state, tribes, and other federal agencies, as well as using agency information which helped identify where the current conditions within the project area either do not meet or will not be expected to meet desired conditions described in the Forest Plan. GIS queries were used to determine potential areas where some treatments/activities may occur based on existing conditions. This included but was not limited to existing vegetation, stream reaches, and aquatic organism passage restrictions at road crossings.

Chapter 2 - Proposed Action and Alternatives includes a description of each alternative as well as alternatives considered but eliminated from detailed study. A summary of the alternatives is below.

More site-specific information regarding the proposed timber harvest units and roads can be found in appendix A and B. A description of the proposed recreation sites is in the Shelter Cove Recreation Master Plan in appendix D.

Alternative 1 (No Action)

Alternative 1 is the No-Action Alternative. Under this alternative, none of the proposed activities would take place in this project, unless they are authorized by a previous or subsequent NEPA decision. A no-action alternative is required by the Council on Environmental Quality Regulations (40 CFR Section 1502.14(d)) to provide a baseline to measure and compare impacts of the various action alternatives and represents the existing condition in the project area.

Alternative 2 (Proposed Action)

Alternative 2 is the proposed action designed to address the purpose and need. Activities included in the proposed action are described above (see element "1 – What action is proposed?"). This alternative would include a project-specific Forest Plan amendment to lower adopted scenic integrity objectives. This may result in larger even-aged openings than would have been allowed by the Forest Plan adopted scenic integrity objectives.

Alternative 3

Alternative 3 addresses public comments related to the importance of old-growth habitat and travel corridors that connect high (summer habitat) and low (winter habitat) elevation habitat for wildlife. Removing old-growth habitat may fragment wildlife habitat and lead to a loss of old-growth connectivity important to species including deer, wolf, mountain goat, and bear. This alternative is designed to mitigate the effects to deer habitat, retaining areas of high-value deer habitat and elevational travel corridors by deferring or modifying harvest units in these areas. This alternative would include a project-specific Forest Plan amendment to lower adopted scenic integrity objectives. While this may result in larger even-aged openings than would have been allowed by the Forest Plan adopted scenic integrity objectives, the wildlife design elements in this alternative would break-up larger even-aged units with travel corridors.

Alternative 4

Alternative 4 focuses on reducing effects to scenery and recreation. This includes the effects of proposed timber harvest to scenic values in the project area and proposed recreation sites. Visual priority routes and use areas in or adjacent to the project area include planned Saddle Lakes Recreation Area; Harriet Hunt [Ketchikan] to Shelter Cove Connection Road; Shelter Cove Boat Ramp; Carroll Inlet; George Inlet; Thorne Arm; and the Fish Creek Cabin and buoy.

The project-specific amendment to allow lower adopted SIOs below the Forest Plan adopted SIOs would not be applied to this alternative. This results in more uneven aged management and increased helicopter logging and smaller even-aged openings.

4 – What would it mean to not meet the need for project action?

Not meeting the purpose and need is represented by Alternative 1, the no-action alternative. Under Alternative 1, none of the specific management activities as proposed in the Final EIS would be implemented to accomplish project goals and objectives. Natural disturbances and current management of the project area would continue as before. Ongoing activities such as road and trail maintenance, stream restoration, and other routine forest management activities not associated with this decision would continue as authorized by previous decisions.

If the need for a continuous supply of timber for forest products is not met, then local and regional mills would need to obtain this timber supply elsewhere on the Tongass or from other non-NFS lands. Local mills that could not obtain their timber supply outside of the project area may close and the local community economies may be impacted.

Although some restoration activities in the project area have been authorized by previous decisions, delayed authorization of all restoration needs will likely result in continued degradation of aquatic and terrestrial resources and lost opportunities to efficiently integrate projects and leverage restoration funding in the near future.

The recreation program would continue its focus on maintenance, and improvements for health and safety. Local residents and visitors would be able to continue using the area for roaded activities and dispersed camping, but no new sites would be developed from the Shelter Cove Area Recreation Master Plan under this project. Visitor use of the area may still increase, but Forest Service contribution to this growth or additional amenities would not occur.

The integrated approach seeks to coordinate the implementation of several types of activities to share mobilized equipment, personnel, and related costs where possible, resulting in greater efficiency and cost savings. While these activities could continue to be proposed and analyzed as separate projects, they could be subject to longer timelines, lack of available funds and personnel, and may require more funding than using an integrated approach.

5 – How do the alternatives respond to issues identified during scoping?

The Forest Service identified three potentially significant issues from public comments received during scoping, following publication of the Notice of Intent (NOI) to publish an EIS, and during public meetings. See Issues section in Chapter 1. The South Revilla Project interdisciplinary team (IDT) developed alternatives to the proposed action to address these issues. Chapter 2, Proposed Action and Alternatives, presents the alternatives in full, describing how the alternatives respond to the issues, and compares proposed management options in the comparison of alternatives tables at the end of Chapter 2. Chapter 3, Environment and Effects, examines the existing condition and compares the potential effects of the alternatives to project area resources and the environment. The following summarizes these effects:

Issue 1 – Timber Supply and Economics

Issue 1: *The proposed quantity and quality of old-growth and young-growth timber and the logging costs associated with the logging systems and silvicultural prescriptions would affect Southeast Alaska's forest products industry and the ability of the industry to contribute to the diversity and stability of local and regional economies*.

Timber harvest is proposed to provide a sustained and predictable flow of old and young-growth timber to support jobs and income in timber production and supporting industries during the transition period to young-growth timber management. By supplying 79 (Alternative 3) to 92 (Alternative 2) million board feet (MMBF) of old-growth and young-growth timber from the project area over 15 years the Forest Service can better maintain flexibility and stability in the timber sale program.

Alternative 2 provides the most potential volume, and makes more high-volume acres available than Alternatives 3 or 4. Alternative 2 would offer additional flexibility for the Forest Service to provide a range of available timber products and the size of potential timber offers to meet industry demands, market conditions, and local needs identified through public involvement.

- Alternative 2 would provide an estimated 70 MMBF of old-growth timber and 22 MMBF of young-growth timber for a total volume of 92 MMBF over 15 years.
- Alternative 3 would provide an estimated 60 MMBF of old-growth timber and 19 MMBF of young-growth timber for a total volume of 79 MMBF over 15 years.
- Alternative 4 would provide an estimated 68 MMBF of old-growth timber and 21 MMBF of young-growth timber for a total volume of 89 MMBF over 15 years.

Issue 2 – Wildlife Habitat and Subsistence Use

Issue 2: *Proposed timber harvest and road construction, combined with past management activities, could affect the quantity and quality of habitat and habitat connectivity for deer and other wildlife and could affect subsistence use.*

Timber harvest can affect wildlife species dependent on or associated with old-growth habitat. Commenters were concerned that additional harvest of high-value habitat used by deer in winter and lack of elevational connectivity in areas of timber harvest could affect deer populations.

Wildlife Habitat

All action alternatives would reduce deer model habitat capability, elevational connectivity, and winter habitat important during heavy snow accumulation (deep snow habitat). The effects would occur immediately after even-aged harvest (stand initiation) and intensify at 25 to 30 years as the harvested stands transition into the stem-exclusion stage. Reductions in habitat capability and deep snow habitat could lead to a decline in the deer population, particularly following severe winters within the project area.

Subsistence

Consistent with Section 810 of the Alaska National Interest Lands Conservation Act (ANILCA), the South Revilla project area was evaluated for potential effects on subsistence, as described above. Based on that evaluation, the South Revilla project may have a significant possibility of a significant restriction of subsistence uses on deer due to changes in abundance and competition. The Ketchikan to Shelter Cove Road would cumulatively add to the effects by increasing access to deer, which may affect the demand and/or the amount of hunting competition in the South Revilla project area.

Based upon community use information and other species analyzed, the South Revilla project would not result in a significant restriction of other wildlife subsistence uses.

Issue 3 – Scenic Values and Recreation Opportunities

Issue 3: *Proposed timber harvest and road construction could affect scenic values and recreational opportunities in the project area.*

Scenic Values

Alternative 4 meets the Forest Plan standards and guidelines for scenery. Areas of the project that are likely to be viewed closely by the public may appear slightly altered, but the impacts of the project will be subordinate to the view and will blend with the surrounding landscape.

Alternatives 2 and 3include a project-specific Forest Plan amendment to lower adopted scenic integrity objectives (SIOs) to allow larger even-aged openings with impacts from the project likely to be more visible from areas viewed by the public.

Recreation Opportunities

Dispersed and developed recreation opportunities for all action alternatives would be identified using guidance from the 2018 Shelter Cove Area Recreation Master Plan (appendix D). This plan identifies a range of recreation opportunities associated with improved access from the city of Ketchikan to the Shelter Cove area via the recently constructed State of Alaska Ketchikan to Shelter Cove road.

Alternatives 2 and 4 would have a greater number of acres converted into the roaded modified Recreation Opportunity Spectrum (ROS) than Alternative 3. However, the number of acres converted under each alternative would have negligible effects to recreation opportunities.

Alternatives 2, 3, and 4 would temporarily close motorized trails in the project area but access would be restored once any harvest activities are complete.

6 – What factors will be used when making the decision among alternatives?

The decision will be informed by how the alternatives respond to the Forest Plan's multiple-use direction and how they move the project area toward desired conditions in the Forest Plan. This will be based on how the alternative components integrate to meet multiple resources objectives. These objectives are: improve forest ecosystem health, support community resiliency, provide economic development as compared to effects to subsistence resources, logging operators and their ability to contribute to regional and local economies, water quality and fish habitat, and wildlife habitat and connectivity.

7 – Are there any ways to mitigate adverse effects?

The action alternatives are consistent with Forest Plan direction, best management practices (BMPs) designed for the protection and management of forest resources, as well as other relevant federal and state laws and regulations, and Forest Service Manual and Handbook direction. Possible effects may occur from implementing the actions proposed under each alternative. Measures have been formulated to mitigate or reduce adverse effects, guided by direction in the Forest Plan. Resource specialists used on-the-ground inventories, computer (GIS) data, and aerial photographs to assess project area conditions. Unit and Road cards prepared for the project (appendices A and B) and the Shelter Cove Recreation Master Plan (appendix D) describe specific design features as well as BMPs and resource-specific guidelines and requirements related to affected resources.

8 – What project monitoring is necessary?

Project monitoring would be used to determine how well specific design features or mitigation work in minimizing adverse impacts, achieving resource objectives. The project would be monitored during implementation to ensure that timber sale contract provisions and resource protection measures are followed.

Monitoring would also be used for Forest Plan requirements to confirm the activity status of inactive wolf dens, probable goshawk nest stands, and inactive heron and raptor nests; and of bald eagle nests to comply with the Bald and Golden Eagle Protection Act. The Forest Plan monitoring program, including BMP implementation and effectiveness evaluation using national protocols, may include sites in the project area.

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Figures

Chapter 1. Purpose of and Need for Action

Introduction

The USDA Forest Service has prepared this environmental impact statement (EIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This EIS discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives.

The South Revillagigedo Integrated Resource Project (South Revilla Project) EIS is an environmental analysis that will be used to inform a decision on whether to authorize integrated resource management activities within the project area over the next 15 years. The intent of this project is to:

- contribute to jobs and labor income and opportunities in local and regional communities associated with timber, recreation, tourism, and aquatic and terrestrial resource management;
- sustain and improve aquatic and terrestrial habitat conditions that support commercial, sport, and subsistence resources; and
- provide access to forest resources by commercial, subsistence, and recreation users.

Additional documentation may be found in the project record located at the Ketchikan Misty Fjords Ranger District in Ketchikan, Alaska.

Project Area

The project area is located within the Ketchikan Misty Fjords Ranger District on Revillagigedo Island, approximately 17 miles northeast of Ketchikan, Alaska in the Shelter Cove and Shoal Cove areas adjacent to Carroll Inlet (figure 1). The project area covers about 44,371 acres of National Forest System lands, and includes 8,224 acres currently proposed for exchange with the Alaska Mental Health Trust Authority under the Alaska Mental Health Trust Land Exchange Act of 2017 (Public Law 115-31).

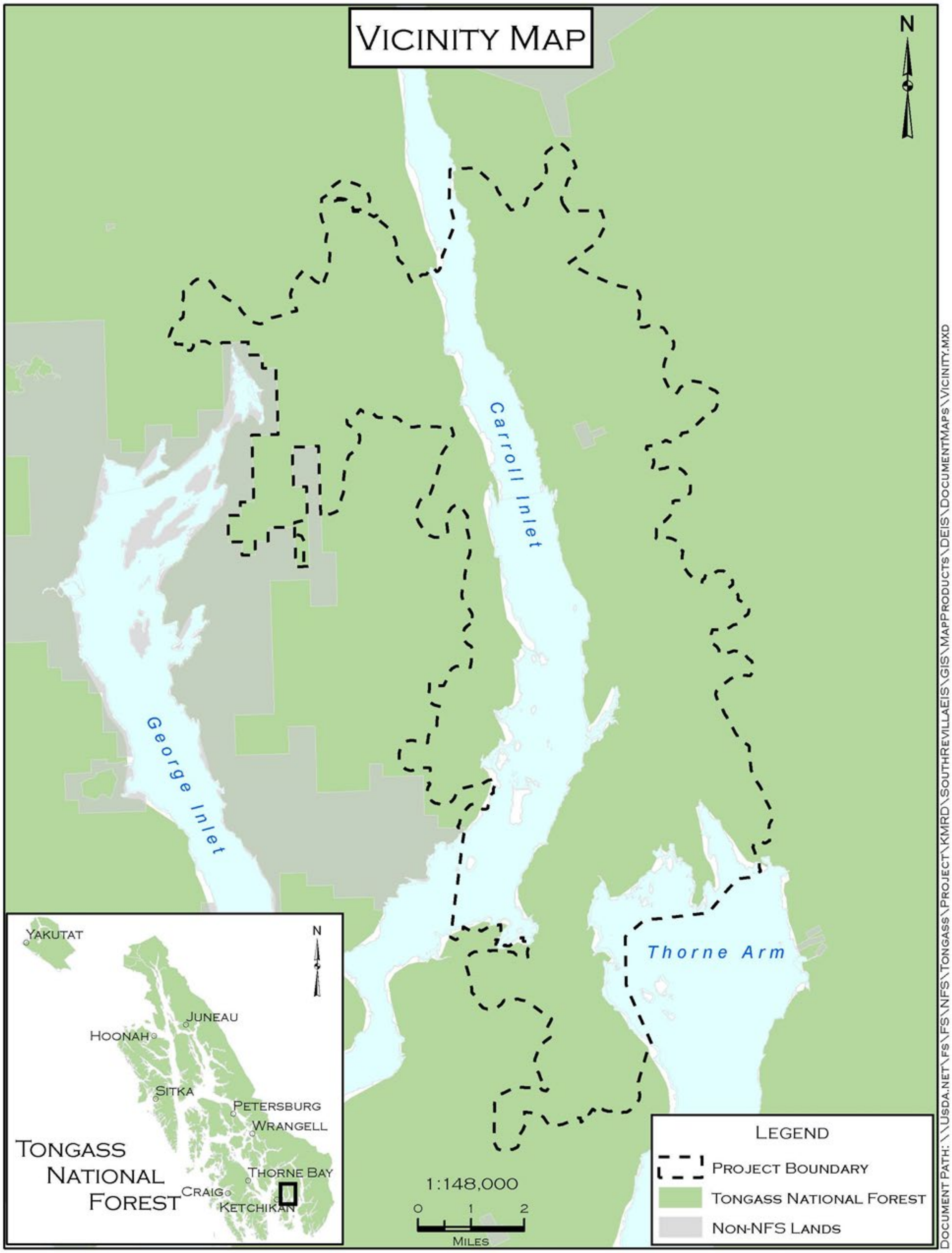

Figure 1. Vicinity map

Forest Plan

The 2016 Tongass National Forest Land and Resource Management Plan (Forest Plan) guides all natural resource management activities and establishes management direction for the Tongass National Forest (Forest Plan, Chapter 1).

Unless otherwise specified, all references to the Forest Plan are to the 2016 Tongass Land and Resource Management Plan (Forest Plan). National Forest planning takes place at several levels: national, regional, forest, and project. The Forest Plan is based on a forest-level, programmatic analysis that provides land and resource management direction for the Tongass National Forest. The Forest Plan can be accessed at https://www.fs.usda.gov/detail/tongass/landmanagement/planning/?cid=stelprd3801708.

The South Revilla Project is a project-level analysis; its scope is confined to addressing the issues and environmental effects specifically related to this project. It is consistent with Forest Plan direction, and is designed to achieve the management direction of the Forest Plan as outlined in the purpose and need statement. Where appropriate, the South Revilla Project EIS tiers to and incorporates by reference the analysis done for the Forest Plan (40 CFR 1508.28).

All areas of the Forest are allocated to Land Use Designations or LUDs, each containing specific management direction for different uses or activities that are applied to the defined area of land (Forest Plan, Chapter 3). Some LUD allocations are for development of resources, such as timber production, and some are for non-development, such as old growth and wilderness. All projects and activities must be consistent with applicable Forest Plan direction (Forest Plan, p. 6-2). Table 1 displays the LUD types within the South Revilla project area. Additional information and maps for the resources analyzed in this EIS, can be found on the Tongass National Forest website at https://www.fs.usda.gov/detail/tongass/landmanagement/?cid=stelprd3801708.

Table 1. Land use designations in the project area

Land Use Designation (LUD)	Acres
Modified Landscape	17,213
Old-growth Habitat	2,402
Geologic Special Interest Area	185
Semi Remote Recreation	334
Timber Production	24,237
TOTAL	**44,371**

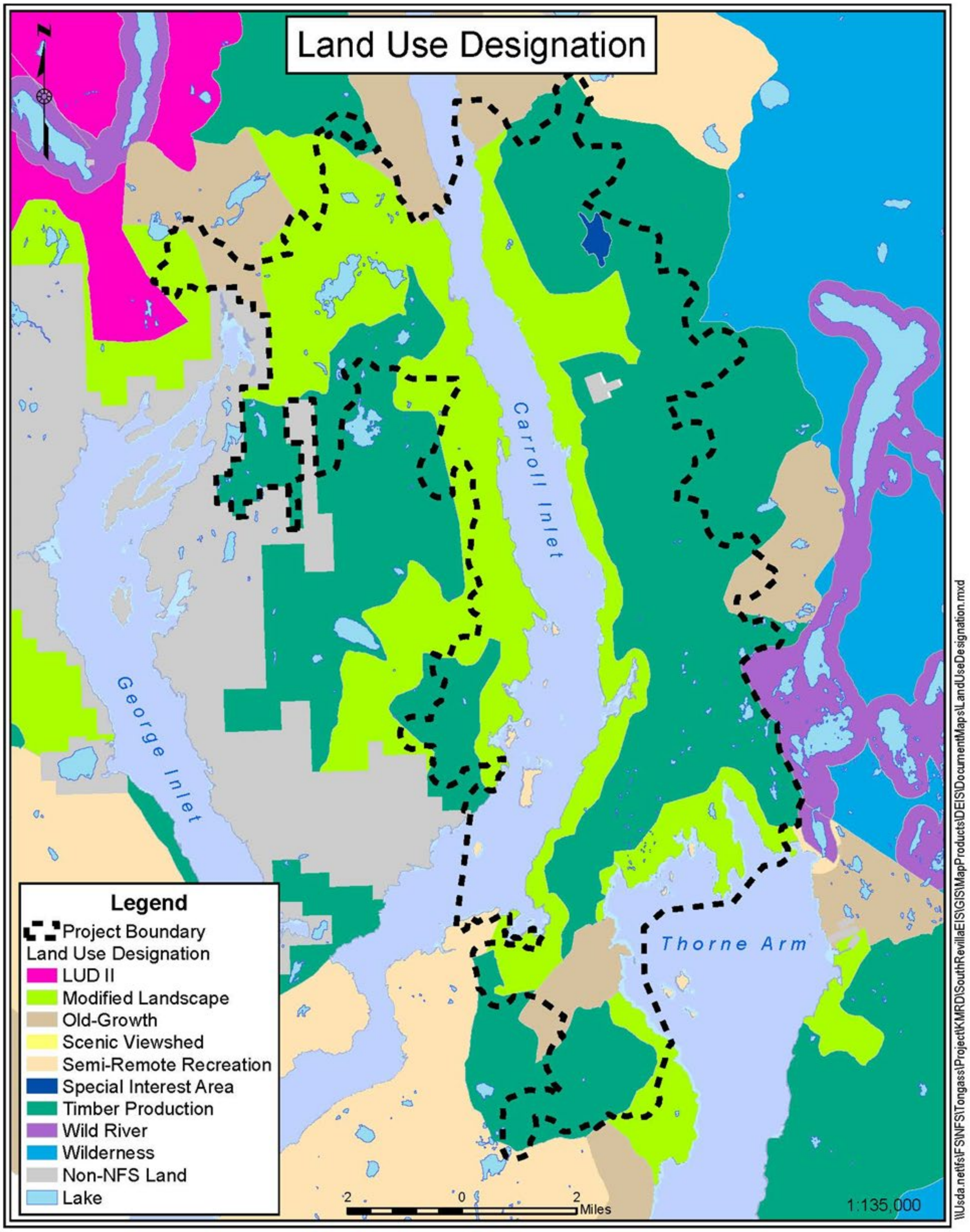

Figure 2. Land use designations (LUDs)

Purpose and Need for Action

The relationship between the desired conditions and the existing conditions of Forest resources in the South Revilla project area were compared with the Forest desired conditions defined in Chapters 2 and 3 of the Forest Plan, resulting in identification of specific needs and opportunities in the project area. Consistent with applicable Forest-wide multiple-use goals and objectives (Forest Plan, Chapter 2), the following resource objectives were identified in the project area.

Managing the timber resource for sawtimber production and other wood products

There is a need to provide a sustainable level of forest products to contribute to the economic sustainability of the region. Providing old-growth timber and currently merchantable young-growth timber would maintain the timber industry during the transition to young-growth management and would provide jobs and other economic opportunities.

Improving aquatic and terrestrial habitat conditions

Where past management activities have affected aquatic and terrestrial habitat conditions in the project area, there is a need to restore and improve the natural range of habitat conditions to support wildlife, fish, and plant populations and to sustain diversity and production. Restoration would contribute to traditional, cultural, recreational, commercial and subsistence uses.

Providing a range of recreation opportunities to meet public demand

There is a need to provide sustainable recreation opportunities to a diverse and growing group of forest users. A sustainable recreation program in terms of operations and maintenance is needed to maintain infrastructure at an acceptable level. Maintaining and expanding opportunities for the recreation and tourism sector would also contribute to the local economy.

Project objectives are to balance commercial and non-commercial opportunities, and provide and maintain high-quality experiences for all forest users over the long-term, while maintaining or improving land and resource conditions.

Proposed Action

The USDA Forest Service proposes a variety of management activities that are designed to be implemented using an integrated approach, over the course of 15 years in the South Revilla project area (figure 5 through figure 7), to support Southeast Alaska communities by providing jobs and economic opportunities. A summary of proposed activities is provided below. (See Chapter 2 for detailed information).

Timber Management

Up to 5,247 acres of old-growth timber and up to 1,239 acres of young-growth timber would be authorized by for harvest in identified harvest units in the Modified Landscape and Timber Production LUDs using a variety of harvest methods and offered in one or more timber sales (figure 5 through figure 7).

Access Management

New NFS and temporary roads would be built and existing closed NFS roads would be opened and maintained to provide access to timber resources (figure 5 through figure 7). Existing NFS roads would be managed following the Ketchikan District's Access and Travel Management (ATM) Plan except where changes have been recommended to close a road, keep a road open for the long term, or allow other uses such as OHV use under 50 inches in width (OHV) on a closed road. The ATM would be updated accordingly to reflect changes in road management, and the addition of new proposed NFS roads (See figure 30 through figure 32 Transportation section Chapter 3).

Watershed Management

Watershed restoration and enhancement activities would be designed to sustain the diversity and production of fish and other freshwater organisms, and reestablish proper stream and floodplain functioning conditions. In-stream activities would use heavy equipment, hand tools, and/or helicopter methods to place large wood instream and in adjacent floodplains to maintain and improve habitat condition. Additional habitat improvements would include modifying natural instream barrier, managing riparian vegetation, and replacing or removing culverts impeding fish passage.

Wildlife Habitat Management

Wildlife habitat would be improved using variable-density thinning, girdling, pruning, small gap creation, tree release, leaving unthinned patches and corridors, and treating or mitigating slash; or a combination of these treatments. Treatments would occur in young-growth stands in the Old-growth Habitat LUD, beach and estuary fringe, and riparian management areas.

Recreation Developments

Recreation opportunities would be developed using guidance from the 2018 Shelter Cove Area Recreation Master Plan (appendix D) and ongoing public input via National Visitor Use Monitoring, site-specific NEPA analysis, public feedback, outfitter and guide proposals and other sources. The Master Plan identifies a range of recreation opportunities on NFS lands that can be accessed from the State of Alaska's Ketchikan to Shelter Cove Road. The District's ATM Plan, and its associated motor vehicle use map would be reviewed and updated as needed (see Access Management above).

Project-specific Forest Plan Amendment

As part of this analysis, the Forest Service is analyzing a project-specific Forest Plan amendment[2] that responds to Issue 1. The amendment would lower adopted Scenic Integrity Objectives (SIOs) (USDA Forest Service 2016a, p. 4-54) for all timber analysis areas. Consistent with 36 CFR 219.13, the South Revilla environmental analysis identifies a need to modify the 2016 Forest Plan for this project.

The proposal to amend Scenic Integrity Objectives (SIOs) is being analyzed to determine if it would improve timber economics in the project area (Issue 1), contribute to a reliable and predictable flow of old-growth timber from the project area to support jobs and produce income during the transition to young-growth timber production.

The need for this project-specific Forest Plan amendment is supported by the direction provided in the 2016 Forest Plan ROD (USDA Forest Service 2016b, p. 46).

> Providing economic timber sales in Southeast Alaska has always been a challenge and is expected to remain so in the future….Timber sale planning and the manner in which Forest Plan management direction is applied to specific timber sales can have significant cost consequences on the sales…. If it is determined that the Plan unnecessarily affects the ability to produce economic

[2] Forest Plan amendments may be project-specific if a proposed project is not consistent with the Plan. In these instances, the Responsible Official has the option to propose a plan amendment that, if approved, would accommodate the project. If the Plan amendment applies only to a single project, the amendment is subject to the project review process (FSH 1909.12 21.31).

> timber sale projects, the Forest Plan amendment process will be initiated, focusing on opportunities to promote economic timber sales without compromising the Forest Plan's goals, objectives, and desired conditions.

The Forest Plan further illustrates the need to support the transition to young-growth timber production (pp. 5-13 and 5-14).

> **O-TIM-01**: Seeking to accelerate a transition to primarily young-growth harvest, offer an average of 46 MMBF annually in a combination of old growth and young growth. When young-growth offered is less than 41 MMBF, provide old growth to make up the difference and achieve the average annual projected timber sale quantity of 46 MMBF. After the transition, offer an average of 5 MMBF of old growth annually to support Southeast Alaska mills.

> **O-TIM-02**: Seek to provide an economic timber supply sufficient to meet the annual market demand for Tongass National Forest timber, and the market demand for the planning cycle. The volume of young growth as part of the yearly offer will increase from an average of 9.2 MMBF annually in the first decade to an average of 25 MMBF annually in years 11-15 as the program nears full transition.

The South Revilla project area accounts for approximately 16 percent, or 70 million board feet (MMBF), of the 435 MMBF old-growth component for the Projected Timber Sale Quantity (PTSQ) expected from the Tongass National Forest over the next 15 years (USDA Forest Service 2017d). In the project area, most suitable timber is on a road system not connected to an active mill or export site, which can negatively affect timber sale economics.

The existing condition of the South Revilla project area makes it unlikely that the visible effects of the proposed old-growth harvest would be absorbed while complying with the current 2016 Forest Plan direction without using silvicultural prescriptions that have little visible impact.

Allowing the use of a very low SIO would not increase the acreage of the suitable timber base, which is defined by the Forest Plan (appendix A). A very low SIO would allow larger even-aged old-growth timber harvest units, and additional acres of even-aged management than is currently allowed. This would generate more timber harvest volume from a unit, and reduce logging costs by allowing the use of conventional logging systems, such as cable or shovel logging, rather than helicopter logging.

The amendment would add a provision to the adopted scenery integrity objectives presented in the Forest Plan (see table 2 below) in the South Revilla project area. The proposed modification for the amendment is footnote 10.

The amendment would apply to all old-growth harvest units and associated roads in Alternatives 2 and 3. The analysis for this amendment is included in Chapter 3 under Issue 1, Timber Economics and in the Scenery section.

If the Responsible Official finds that the effects analysis supports the need for the proposed Forest Plan amendment as part of the Selected Alternative, the amendment will be included in the draft Record of Decision, and will identify which substantive requirements of the 2012 Planning Rule are likely related to a proposed land management plan amendment, as required by the Rule (36 CFR § 219.13 (b) (2)). Which substantive requirements are directly related to the project-specific variance, and consideration of those requirements within the scope and scale of the amendment (36 CFR 219.13(b)(5)), must be determined based on the purpose and effects (beneficial or adverse) of the amendment. At this time, the Responsible Official has determined the following requirements of the Rule are related: 36 CFR § 219.8 (a) (1) and (b)

(2) - Sustainability; 36 CFR § 219.10 (a) (1) and (b) (1) (i) - Multiple use; and 36 CFR 219.11 (d) (3) - Timber requirements based on the NFMA.

Table 2. Adopted scenery integrity objectives for each land use designation [1, 9] (USDA Forest Service 2016a). The proposed amendment to these objectives[10] would apply to the South Revilla project area.

Land Use Designation	Foreground from Priority Travel Routes and Use Areas	Middleground from Priority Travel Routes and Use Areas	Background from Priority Travel Routes and Use Areas	Seldom Seen/ Non-Priority
Wilderness Wilderness Nat. Monument Research Natural Area Special Interest Area [2, 4] Remote Recreation Old-growth Habitat [4] LUD II [4]	High	High	High	High
Special Interest Area [3, 4]	Low	Moderate	Moderate	Moderate
Semi-remote Recreation [4]	Moderate	Moderate	Moderate	Moderate
Wild River [6]	High	High	High	High
Scenic River [4, 6]	High	Moderate	Moderate	Low
Recreational River [4]	Moderate	Low/Moderate [6]	Low/Moderate [6]	Very Low
Scenic Viewshed [4, 3, 10]	High	Moderate	Moderate	Very Low
Modified Landscape [4, 10]	Moderate	Low	Low	Very Low
Timber Production [10] Minerals Experimental Forest [5]	Low	Very Low	Very Low	Very Low
Municipal Watershed [7]	High	High	High	High
Nonwilderness Nat. Monument [8]	High	High	High	High

1 The foreground, middleground and background Scenic Integrity Objectives (SIOs) are adopted as seen from the Visual Priority Travel Routes and Use Areas (Appendix F). Non-priority travel routes and use areas, and those areas not seen from the Visual Priority Routes and Use Areas, are managed according to the direction listed in the "Seldom Seen/Non-Priority" column.

2 Except for the developed recreation and interpretive portions of Special Interest Areas such as Mendenhall Glacier, Ward Cove and Blind Slough.

3 Applies only to the developed recreation and interpretive portions of Special Interest Areas such as Mendenhall Glacier, Ward Cove and Blind Slough. Undeveloped areas are managed according to the guidance on the previous line.

4 Exceptions for small areas of non-conforming developments, such as recreational developments, transportation developments, log transfer facilities and mining development, may be considered in these LUDs on a case-by- case basis.

5 The SIO may vary depending on the research objectives of the Experimental Forest.

6 Apply the Moderate SIO in corridors where scenic quality is included as one of the "outstandingly remarkable" values for that corridor. If it is not, apply the lower SIO.

7 SIO is High, but may range down to Very Low as a result of the municipality's watershed management objectives.

8 SIOs will range from High, in those portions of the Monument without access, to Very Low in those portions developed in connection with mineral activities. SIOs will be identified in the specific Plan of Operations for mineral development.

9 See Young Growth, Renewable Energy and Transportation Systems Corridors Plan Components in Chapter 5 (S- YG-SCENE-01, S-RE-SCENE-01 and S-TSC-SCENE-01).

10 For old-growth harvest implemented within the South Revilla project area on the Ketchikan Misty Fjord Ranger District, the SIOs of harvest units and associated roads may be lowered to achieve a positive timber sale offer to meet the volume objectives outlined in the purpose and need.

Allowing the use of less restrictive scenic integrity objectives would apply to this project only. It would be subject to the notification requirements and project review and objection procedures of 36 CFR 218 (subpart A).

Alaska Mental Health Trust Land Exchange Act of 2017

The Alaska Mental Health Trust Land Exchange Act was enacted on May 5, 2017 (Consolidated Appropriations Act, 2017, Public Law 115-31). It directs the Forest Service to complete a land exchange with the Alaska Mental Health Trust Authority in two years and in two phases. Phase 1 of the land exchange was completed Monday, January 29, 2019 for 2,400 acres near Naukati, Alaska on Prince of Wales Island, and 2,500 acres in Ketchikan. Phase 2 is currently underway and should be finalized in early 2021. Under the Act, the land exchange is an equal value exchange. As a mechanism for balancing values, parcels can be dropped from the land exchange beginning with the prioritized Federal parcels. Depending on the outcome of the title case at the Alaska Supreme Court regarding 3,374 acres of non-federal land and final real estate appraisal value, approximately 8,224 acres in the South Revilla project area may or may not be exchanged to Alaska Mental Health Trust Authority under the Act. Because there is uncertainty as to whether these lands will be conveyed to the Alaska Mental Health Trust Authority, and these lands currently remain in the National Forest System, these 8,224 acres are included in the South Revilla Project as National Forest System lands.

Public Involvement

Scoping

A Notice of Intent (NOI) to prepare an environmental impact statement for the South Revilla Project was initially published in the Federal Register on August 8, 2018 (83 FR 39050). Comments received, in addition to field surveys, identified the need to expand the project area boundary for additional timber harvest to meet the purpose and need.

A revised NOI was published on July 1, 2019 (84 FR 31288), which included the following modifications to the proposed action:

- Replacing the timber volume unit of measure of board feet with harvest acres;
- Adding a young-growth timber harvest component;
- Revising the road miles; and

Adding harvestable acreage in the area currently proposed for exchange under the Alaska Mental Health Trust Land Exchange Act of 2017 (Public Law 115-31). (See section Alaska Mental Health Trust Land Exchange Act of 2017 above).

A public open house was held in Ketchikan on July 23, 2019 which was attended by 11 members of the public, including representatives of *Ketchikan Daily News*, a Congressional staffer, the Ketchikan Indian Community, and the Alaska Tribal Conservation Alliance. Four attendees submitted written comments at the open house.

Eleven responses were received during the initial scoping period, which generated 175 individual comments. Eleven responses were received on the revised NOI, including those from the open house; which generated 85 comments. All scoping responses are available in the public reading room here: https://www.fs.usda.gov/project/?project=53477.

Tribal Engagement and Government to Government Relations

Since February 2018, the Ketchikan Misty Fjords Ranger District has provided monthly updates about the South Revilla Project to local federally recognized Alaska Native Tribes and Alaska Native Corporations.

Prior to initial scoping in August 2018, government-to-government consultation on the South Revilla Project occurred between the Forest Service and the Ketchikan Indian Community on May 2, 2018. District Ranger Susan Howle provided an introduction to the South Revilla Project, including a discussion about the importance of tribal input with specific local knowledge and technical expertise and how those attributes would benefit this project. Members of the South Revilla Project interdisciplinary team were also in attendance and discussed their resource as it related to the proposed project.

The Tongass National Forest invited the local federally recognized Alaska Native Tribes to be a cooperating agency on the South Revilla Project EIS. The Tongass National Forest and the Ketchikan Indian Community signed a Memorandum of Understanding on November 18, 2019, establishing the tribal organization as a cooperating agency for the South Revilla Project Environmental Impact Statement.

Issues

The interdisciplinary team identified issues from public and internal scoping comments during the two scoping periods. Significant issues are the focus of the EIS (40 CFR 1502.1). Significant issues are those related to the proposed action and represent a cause and effect relationship with significant or potentially significant effects that are within the scope of the analysis; have not been decided by law, regulation, or previous decision; and are subject to scientific analysis rather than conjecture.

The following significant issues were identified and used to shape the proposed action and alternatives:

Issue 1: Timber Supply and Economics

The proposed quantity and quality of old-growth and young-growth timber and the logging costs associated with the logging systems and silvicultural prescriptions would affect the Southeast Alaska's forest products industry and the ability of the industry to contribute to the diversity and stability of local and regional economies

A steady supply of economic timber is needed to support Southeast Alaska's forest products industry and the ability of the industry to contribute to the diversity and stability of local and regional economies.

Table 3. Issue 1 units of measure

Indicator	Unit of Measure
Indicated advertised rate	dollars per MBF[1]
Volume by species for young-growth and old growth harvest	MMBF[2]
Logging system (shovel, cable, helicopter) by young growth and old growth	acres of young- and old-growth by logging system
Road construction/maintenance costs	dollars per MBF
Logging costs	dollars per net MBF
Employment supported by the project	number of annualized jobs supported for domestic processing and export

1 – MBF = thousand board feet
2 – MMBF = million board feet

Issue 2: Wildlife Habitat and Subsistence Use

Proposed timber harvest and road construction, combined with past management activities, could affect the quantity and quality of habitat and habitat connectivity for deer and other wildlife and could affect subsistence use.

The project area includes important low-elevation old-growth habitat for wildlife. Removing old-growth habitat may fragment wildlife habitat and lead to a loss of old-growth connectivity important to species including deer, wolf, mountain goat, marten and bear.

Because of its proximity to subsistence users and sport hunters on Revillagigedo Island and surrounding areas, the project area is considered an important deer hunting area. Increased accessibility and road density may affect wildlife.

Table 4. Issue 2 units of measure

Indicator	Unit of Measure
Wildlife Habitat	
Productive Old-growth	Acres and percentage of Productive Old-growth maintained
Acres of high-value deer winter range (HPOG[1]) habitat maintained	Acres of south facing, low elevation (<800ft), High volume POG in project area (existing / alternative)
Connectivity/Fragmentation in the project area	corridor analysis
Road density	Total / open road density mile per mi^2 (subsistence)
	Total / open road density below 1200 feet elevation mile per mi^2
Deer habitat capability	Deer habitat capability (estimated deer/mi^2 that habitat can support)
Subsistence Use	
Deer abundance	percent change in deer habitat capability

1 – HPOG = high-volume productive old-growth

Issue 3: Scenic Values and Recreational Opportunities

Proposed timber harvest and road construction could affect scenic values and recreational opportunities in the project area.

There are concerns about the effects of proposed timber harvest to scenic values in the project area.

There are also concerns regarding the effects of timber management on recreation opportunities and experiences in the Shelter Cove and Saddle Lakes area. These are the most likely places within the project area where recreation opportunities will be available or developed, including; motorized and nonmotorized access, dispersed camping, kayaking and canoeing (see appendix D, Shelter Cove Recreation Area Master Plan).

Table 5. Issue 3 units of measure

Indicator	Unit of Measure
Scenery	
Scenic integrity objectives	Acres changed by classification
	Acres affected by classification
Recreation	
Recreation Opportunity Spectrum system classification	Acres of changed classification
Changes to access	Miles of non-motorized access Miles of motorized access

Federal and State Permits and Authorizations

The Forest Service will ensure all necessary permits or authorizations from other federal and state agencies are in place, including, but not limited to:

1. State of Alaska, Department of Environmental Conservation, Alaska Pollutant Discharge Elimination System (APDES):
    a. General permit for marine access facilities in Alaska
    b. Review Spill Prevention Control and Countermeasure Plan
    c. Certification of Compliance with Alaska Water Quality Standards (401 Certification)
    d. Storm Water Discharge Permit/ National Pollutant Discharge Elimination System review (Section 402 of the Clean Water Act)
    e. Solid Waste Disposal Permit
2. U.S. Army Corps of Engineers:
    a. Approval of discharge of dredged or fill material into the waters of the United States under Section 404 of the Clean Water Act
    b. Approval of the construction of structures or work in navigable waters of the United States under Section 10 of the Rivers and Harbors Act of 1899
3. State of Alaska, Division of Natural Resources:
    a. Authorization for occupancy and use of tidelands and submerged lands
4. State of Alaska, Department of Fish and Game:
    a. Fish Habitat Concurrence (Title 16)
5. State of Alaska, State Historic Preservation Office:
    a. Concurrence with Determination of Effect (Section 106 of the National Historic Preservation Act)
6. U.S. Fish and Wildlife Service:
    a. Eagle take permit (Bald and Golden Eagle Protection Act)
    b. National Marine Fisheries Service:
        i. Concurrence with not likely to adversely affect determinations for Humpback Whale Mexico Distinct Population Segment and Steller Sea Lion Western Distinct Population Segment (Section 7 of the Endangered Species Act)

Availability of the Project Record

The project record contains supporting material that documents the NEPA process and analysis from the beginning of the project. The project record is available by request from the Ketchikan Misty Fjords Ranger District in Ketchikan, Alaska.

Map and Data Disclaimers

All map products in this document are produced from geospatial information prepared by the Forest Service. Geographic information system (GIS) data and product accuracy may vary. The Forest Service reserves the right to correct, update, modify, or replace GIS products without notification.

Chapter 2. Proposed Action and Alternatives

Introduction

This chapter describes and compares the alternatives considered for the South Revilla Project, including a description and map of each alternative considered. The Forest Service developed four alternatives, including the no-action and proposed action alternatives, in response to significant issues. This section also presents the alternatives in comparative form, clearly identifying the differences among the alternatives and providing a clear basis for choice among options by the decision maker and the public.

Alternatives Considered in Detail

Activities Common to the Action Alternatives

Access Management

Each action alternative proposes:

- New National Forest System (NFS) road construction to access timber units
- Closed NFS roads opened for log haul. These roads are reclosed after their use.
- Existing open roads used for log haul
- New temporary road construction to access timber units and may be kept open for public access up to 3 years for gathering firewood
- Changes to the district’s Access and Travel management which include changes in designations of existing NFS roads and adding new NFS road system. These include:
  - ♦ 16.7 miles of NFS road would be closed after proposed harvest activities. These include 4.0 miles of existing NFS road currently designated open and 12.7 miles of new NFS road.
  - ♦ 2.7 miles of NFS road would be designated open for the long term. These include leaving 1.0 mile of existing NFS (ML1) road open instead of closing and leaving 1.7 miles of new NFS road open after proposed harvest activities.
  - ♦ Allow OHV use on 0.4 miles of closed road. This increases the number of miles designated for OHV use from 13.7 to 14.1 miles.
- The use of two existing MAFs, Shelter Cove and Shoal Cove.

Marine Access Facility Maintenance and Reconstruction

The two MAFs include the Log Transfer Facilities used for moving logs and timber products between land- and water-based transportation systems. Log transfer facilities include log raft storage areas, and adjoining associated facilities (Forest Plan appendix G). Discharge of bark and wood debris into the coastal water is authorized, with required permits.

- Shelter Cove Reconstruction would include adding a drive down ramp for loading and unloading logs and machinery and improving stormwater drainage. Reconstruction activities would require an amendment to the existing U.S. Army Corps of Engineers permit. Heavy equipment used for reconstruction and maintenance may include tugboat, barge and support vehicles for equipment maintenance and refueling.

- Shoal Cove MAF Maintenance would occur on the existing footprint to improve drainage, reduce brush, and add shot rock.

Recreation Management

Nine dispersed and developed recreation opportunities have been identified using guidance from the 2018 Shelter Cove Area Recreation Master Plan (appendix D).

Proposed Shelter Cove Recreation Master Plan Activities

The proposed Shelter Cove Area Recreation Master Plan activities listed in table 6 and identified in figure 3 have been determined to be the most feasible at this time. The letters on figure 3 correspond with the alphabetized descriptions in table 6. For more detailed descriptions of the proposed recreation developments refer to the Shelter Cove Area Recreation Master Plan in appendix D.

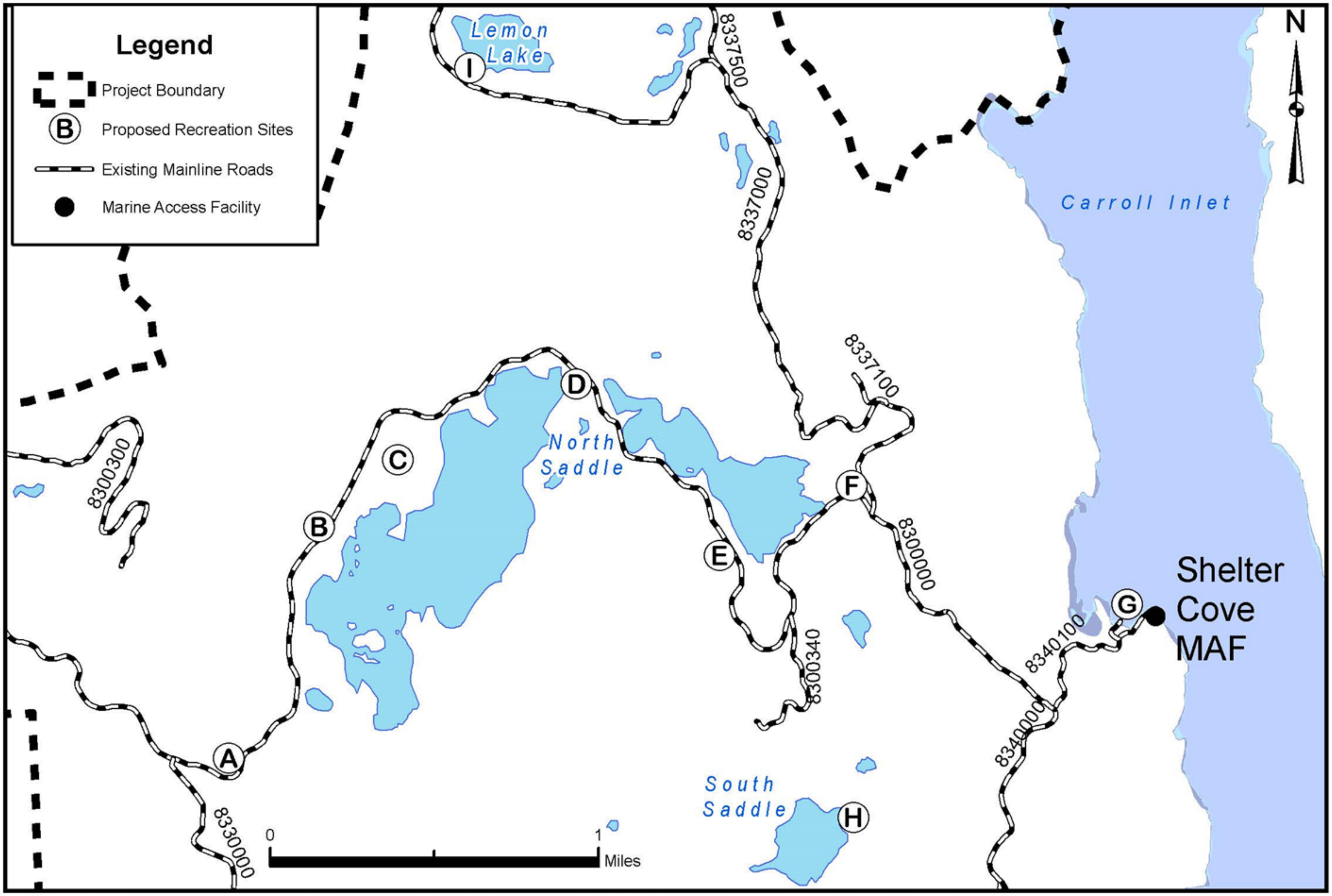

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Figure 3. Shelter Cove Area Recreation Master Plan map and activity key

Table 6. Key for figure 3

Proposed Recreation Site	Details	Equipment Used
A - Shelter Cove Area Recreation Gateway: parking, signage, and interpretive kiosks	Vegetation removal and gravel fill for up to five parking spaces with split rail fencing for safety barrier.	Dump trucks, excavator, backhoe, grader
B - Overlook 1: parking area	Vegetation removal and gravel fill for up to five parking spaces with split rail fencing for safety barrier.	Dump trucks, excavator, backhoe, grader
C.-.Upper Saddle Lake Access: parking, outhouse, connector trails, boardwalk trail/nature viewing platforms, cabin, and nonmotorized boat launch	Vegetation removal and gravel fill for nonmotorized boat launch and two parking areas (one with two spaces for cabin users and one with five spaces for day use). Split rail fencing for safety barrier at parking areas. Excavation for cabin and two vault toilets (one adjacent to cabin and one adjacent to day use parking area). Vegetation removal and gravel fill for connector trail to cabin and nonmotorized boat launch, and vegetation removal for boardwalk trail and up to five connected nature viewing platforms.	Dump trucks, excavator, backhoe, grader, motorized wheelbarrow, forklift
D - .Overlook 2: parking area and interpretive kiosk	Vegetation removal and gravel fill for up to five parking spaces with split rail fencing for safety barrier.	Dump trucks, excavator, backhoe, grader
E - Overlook 3: parking area and interpretive kiosk	Vegetation removal and gravel fill for up to five parking spaces with split rail fencing for safety barrier.	Dump trucks, excavator, backhoe, grader
F - Lower Saddle Lake Access: parking area, trails, interpretive kiosks, and nonmotorized boat launch	Vegetation removal and gravel fill for non-motorized boat launch and up to five parking spaces to accommodate trailers (for ATVs that use trail to Lemon Lake). Split rail fencing for safety barrier at parking areas. Vegetation removal and gravel fill for connector trail to non-motorized boat launch.	Dump trucks, excavator, backhoe, grader, motorized wheelbarrow
G - Shelter Cove Access Area: parking, outhouse, interpretive kiosks, upgraded dock (with expanded float), improved boat ramp, connector trail, boardwalk trail/fishing platforms, and cabin	Vegetation removal and gravel fill for up to 13 parking areas, 3 handicap accessible spaces above boat dock, and overflow parking near MAF. Split rail fencing for safety barrier at parking areas. Excavation for double vault toilet at end of State Highway above boat dock. Vegetation removal and gravel fill for improved motorized boat launch. Vegetation removal for boardwalk trail and up to five connected fishing platforms. Vegetation removal and gravel fill for connector trail to cabin and excavation for vault toilet adjacent to cabin.	Dump trucks, excavator, backhoe, grader, motorized wheelbarrow, forklift
H - South Lake Camping: parking area, trail, and dispersed camp sites	Vegetation removal and gravel fill for up to five parking spaces with split rail fencing for safety barrier. Vegetation removal and gravel fill for connector trail to dispersed camp sites (up to three tent pads) and burn toilet.	Dump trucks, excavator, backhoe, grader, motorized wheelbarrow
I - Lemon Lake: trail improvements for ATVs, foot trail, 3-sided shelter, outhouse, interpretive kiosk, and nonmotorized boat launch	Vegetation removal and gravel fill for connector trail from three-sided shelter to burn toilet, and non-motorized boat launch. Excavation for three-sided shelter and burn toilet.	Dump trucks, excavator, backhoe, grader, motorized wheelbarrow, forklift

Watershed Management

To sustain the diversity and production of fish and other freshwater organisms, and to enhance stream and floodplain functioning conditions, the South Revilla Project would conduct restoration and enhancement activities in the project area (figure 35, Chapter 3). These include riparian thinning, placing large wood both in stream and floodplain, and replacing or removing culverts impeding fish passage using a combination of hand tools, explosives, helicopter, and heavy machinery. Additional fisheries and stream habitat enhancements would include natural instream partial barrier modifications using explosives and hand tools.

Wildlife Habitat Management

Wildlife habitat treatments would occur in young-growth stands in the stem exclusion stage of development to enhance habitat for deer and other wildlife. Treatments may include thinning, girdling, pruning, and slash treatments (travel corridors), or a combination thereof and may be based on the Interagency Wolf Management Recommendations document (WTC 2017). Treatments would occur in the old-growth habitat land use designation, beach and estuary fringe, and riparian management areas.

Alternative 1 - No Action

The No Action Alternative, is required by the CEQ Regulations (40 CFR Section 1502.14(d)) represents the existing condition in the project area and provides a baseline to measure and compare impacts of the various action alternatives against and represents the existing condition in the project area (figure 4).

Under this alternative, natural processes would continue to occur, and current management and ongoing projects and activities as authorized by previous decisions would continue.

Alternative 2 - Proposed Action

The proposed action addresses issue 1: Timber Supply and Economics, maximizing economically viable timber harvest. This alternative includes the project-specific plan amendment to lower the scenic integrity objectives in the project area as described in Chapter 1, allowing the use of even-aged management in more areas. It would harvest the most timber volume (up to 92 million board feet (MMBF)) and uses the most efficient logging systems, reducing logging costs to achieve a more financially efficient sale (figure 7).

The District's access travel management plan and its motor vehicle use map would be reviewed and updated as needed based on road management objectives for new NFS and temporary road construction, as well as NFS road maintenance of closed roads needed for haul.

Timber Supply and Economics

Alternative 2 would harvest up to 92 MMBF of timber volume on 6,202 acres.

- 70 MMBF of old-growth timber from 5,115 acres.
  - 1086 acres are scheduled for uneven-aged management using a helicopter yarding system.
- 22 MMBF of young-growth timber volume from 1,087 acres using a conventional logging system (shovel or cable yarding).
- Logging costs for stump to truck and stump to mill, including NFS road construction costs, are $248 per thousand board feet (MBF) and $436 per MBF, respectively.

- The Indicated Advertised Rates[3] for High[4] and Low[5] markets are $(89.57)/MBF[6] and $(43.81)/MBF, respectively.
- Under high and low market conditions, Alternative 2 would support approximately 354 and 338 annualized jobs respectively.

Access Management

Travel management and MAFs needed by the project are described in Activities Common to All Action Alternatives above. Alternative 2 proposes:

- 14.4 miles of new National Forest System (NFS) road construction to access timber units costing $3,600,000.
- 34.1 miles of closed NFS road would receive maintenance to open for log haul, costing $1,364,538. These roads are reclosed after use.
- 34.0 miles of new temporary road construction to access timber units, costing $6,792,941.

Wildlife Habitat

- 4,606 acres of productive old-growth would be harvested
- 402 acres of high-value winter range (south facing, low elevation (under 800ft), high volume productive old growth) would be harvested
- No areas identified through corridor analysis[7] would be maintained for wildlife travel
- Following implementation, the project area could support an estimated 16.3 deer per square mile

Scenic Values

- This alternative would include a project-specific Forest Plan amendment as described in Chapter 1.
- Alternative 2 would allow the use of the very low scenic integrity objectives of 1,752 acres within the project area, approximately 28 percent of all harvest acres.

Recreation

Alternative 2 would result in changes to recreation opportunity spectrum system classification on 126 acres from semiprimitive nonmotorized to roaded modified.

Alternative 3

This alternative addresses Issue 2: Wildlife Habitat and Subsistence, and would exclude from harvest areas of uncut travel corridors and areas identified as high-value deer winter habitat (figure 10).

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[3] Indicated Advertised Rate: Pond Log Value minus stump to truck costs and other associated costs (camp, lodging, Profit and Risk margin, etc.). The indicated advertised rate includes a profit and risk of 14.53% for the purchaser.

[4] Represents a high market condition with maximum Alaska manufacturing of larger old-growth hemlock 20+ inches at small end diameter, old-growth Sitka spruce 18+ inches at small end diameter and all western redcedar. All Alaska yellow-cedar is exported outside Alaska.

[5] Represents a lower market condition with 100% of hemlock and all Alaska yellow-cedar exported. Alaska manufacturing of old-growth Sitka spruce 18+ inches at small end diameter and all western redcedar.

[6] ( ) indicates a negative value. Only contracts that appraise positive can be offered. Although the alternative appears not to appraise positive using preliminary information, positive sales can be achieved at implementation through unit and road design.

[7] A corridor analysis was done and leave areas(corridors) were identified in harvest units that would allow wildlife to move freely among habitats and elevations, so there is no reference number other than the number of leave areas identified for alternative 3.

Protecting travel corridors and high-value deer winter habitat would reduce harvested opening sizes and reduce old-growth harvest by 705 acres, for timber harvest up to 79MMBF or about 13MMBF less than Alternative 2.

Timber Supply and Economics

This alternative would harvest the least timber volume (79 MMBF). The proposed Forest plan amendment to lower SIOs would allow even-aged management to be used in more areas. Maximizing even-aged management, which can be accomplished using ground-based logging systems, would reduce logging costs to achieve a more financially efficient sale.

- Alternative 3 would harvest up to 79 MMBF of timber volume on 5,320 acres.
  - 60 MMBF of old-growth timber from 4,410 acres.
  - 954 acres are scheduled for uneven-aged management using a helicopter yarding system.
- 19 MMBF of young-growth timber volume from 910 acres using a conventional logging system (shovel or cable yarding).
- Logging costs for stump to truck and stump to mill, including NFS road construction costs, are $245 per thousand board feet (MBF) and $440 per MBF, respectively.
- The Indicated Advertised Rates for High and Low markets are $(96.87)/MBF and $(51.01)/MBF, respectively.
- Under high and low market conditions, Alternative 3 would support approximately 307 and 293 annualized jobs respectively.

Access Management

Travel management and MAFs needed by the project are described in Activities Common to All Action Alternatives above. Alternative 2 proposes:

- 13.1 miles of new National Forest System (NFS) road construction to access timber units costing $3,275,000.
- 33.8 miles of closed NFS road maintenance to open for log haul, costing $1,351,261. These roads are reclosed after use.
- 31.7 miles of new temporary road construction to access timber units, costing $6,334,297.

Wildlife Habitat

- 3,931 acres of productive old-growth would be harvested
- 30 acres of high-value winter range (south facing, low elevation (under 800ft), high volume productive old growth) would be harvested
- 38 areas identified through corridor analysis within the proposed harvest units would be maintained for wildlife travel
- Following implementation, the project area could support an estimated 16.4 deer per square mile, which is slightly higher than Alternatives 2 and 4.

Scenic Values

- This alternative would include a project-specific Forest Plan amendment as described in Chapter 1.

- Alternative 3 would allow the use of the very low scenic integrity objectives of 1,752 acres within the project area, approximately 28 percent of all harvest acres.

Recreation

Alternative 3 would result in changes to recreation opportunity spectrum system classification on 39 acres from semiprimitive nonmotorized to roaded modified. This means 87 acres remain semiprimitive nonmotorized in Alternative 3 which become roaded modified in Alternative 2.

Alternative 4

This alternative addresses Issue 3: Scenic Values and Recreational Opportunities (figure 13). This alternative does not lower scenic integrity objectives in the project area, resulting in more uneven-aged management and reduced impacts to scenery in the Saddle Lakes and Shelter Cove recreation areas.

Timber Supply and Economics

Alternative 4 would harvest up to 89 MMBF. The proposed Forest Plan Amendment to lower SIOs would not be applied, resulting in less even-aged management, approximately 440 and 572 more acres of uneven-aged management and more helicopter logging than Alternatives 2 and 3 respectively.

- Alternative 4 would harvest up to 89 MMBF of timber volume on 6,202 acres.
    - ♦ 68 MMBF of old-growth timber from 5,115 acres.
    - ♦ 1,526 acres are scheduled for uneven-aged management using a helicopter yarding system.
- 21 MMBF of young-growth timber volume from 1,087 acres using a conventional logging system (shovel or cable yarding).
- Logging costs for stump to truck and stump to mill, including NFS road construction costs, are $247 per thousand board feet (MBF) and $431 per MBF, respectively.
- The Indicated Advertised Rates for High and Low markets are $(83.49)/MBF and $(37.87)/MBF, respectively.
- Under high and low market conditions, Alternative 4 would support approximately 344 and 328 annualized jobs respectively.

Access Management

Travel Management and MAF's needed by the project are described in Activities Common to All Action Alternatives above. Alternative 4 proposes:

- 13.7 miles of new National Forest System (NFS) road construction to access timber units costing $3,425,000.
- 33.4 miles of Closed NFS road maintenance to open for log haul, costing $1,334,848. These roads are reclosed after use.
- 31.8 miles of new temporary road construction needed to access timber units costing $6,353,100.

Wildlife Habitat

- 4,606 acres of productive old-growth would be harvested
- 402 acres of high-value winter range (south facing, low elevation (under 800ft), high volume productive old growth) would be harvested

- No areas identified through corridor analysis or maintained for wildlife travel
- Following implementation, the deer model estimates the analysis area could support 16.3 deer per square mile

Scenic Values

Alternative 4 maintains scenic integrity objectives in the project area, to improve the project's visual and recreation values

- There would be 280 acres of new clearcut harvest in Moderate SIO, 919 acres in Low SIO, and 2,969 acres in Very Low SIO ground. There would be 85 acres of new patchcuts (less than 20 acres each) created by two-aged harvest in Moderate, 47 acres in Low and 235 acres in Very Low SIO ground.
- 13,915 acres of Low SIO, 4,623 acres of Moderate SIO, and 2,586 acres of High SIO ground would remain unmodified

Recreation

Alternative 4 would result in the same changes as Alternative 2 to recreation opportunity spectrum system classification, moving 126 acres from semiprimitive nonmotorized to roaded modified.

Project Design Features and Mitigation Measures for Action Alternatives

To reduce or avoid the overall impacts of this project, design features have been incorporated into the design of the harvest units for all action alternatives based on Forest Plan direction. The intent of these standards and guidelines are to help avoid, minimize, or mitigate possible adverse impacts due to project activities. Applicable best management practices and site-specific project design features are identified in the unit and road cards (appendices A and B).

Best Management Practices

Best management practices (BMPs) are methods, measures, or practices to directly or indirectly protect water quality, and abate or mitigate adverse water quality impacts while meeting other resource goals and objectives identified in Forest Service Handbook 2509.22, Region 10 Soil and Water Conservation Handbook. They are the result of collaboration between the Forest Service and the State of Alaska to identify practices to ensure timber harvest activities minimize soil erosion and protect aquatic habitat to meet the requirements of the Clean Water Act. In addition to having the State-approved BMPs in place, the Forest Service issued National Core BMPs in 2012 (USDA Forest Service 2012).

Best management practices are applied to all management activities including timber harvest and road construction, reconditioning, and maintenance.

Hazardous Materials

All activities with potential for spills of hazardous materials would comply with all State and federal permits and laws regarding hazardous materials storage and cleanup. They would also comply with BMPs and other requirements such as a spill prevention control and countermeasure plan.

Streams

Riparian management areas (RMA) encompass the zone of interaction between aquatic and terrestrial environments associated with stream, lakeshores, and floodplains. Considered areas of special concern to fish, other aquatic resources, and wildlife, the no-harvest stream buffer boundaries are defined by their extent (see appendix A, USDA Forest Service 2016A, and USDA 2001 – Aquatic Management Handbook 2090.21). Riparian management areas are identified and delineated in areas where resources are extracted or ground disturbing activities occur.

Riparian management areas vary in width according to channel process group; stream value class; the extent of the floodplain, riparian vegetation or soils, and riparian associated wetland fens; and the location of side-slope breaks (USDA Forest Service 2016A, and USDA Forest Service 2001). At the forest level, a GIS model depicts the first approximation of RMA. At the site level, RMA is refined based on field observations.

Additionally, the Tongass Timber Reform Act (TTRA) requires, as a minimum, no commercial timber harvest within 100 feet horizontal distance on either side of Class I streams and Class II streams that flow directly into Class I streams. TTRA buffers are incorporated in RMAs.

Units considered to have increased risk of windthrow would have additional buffer width for reasonable assurance of windfirmness (RAW) using RAW guidelines.

Chapter 5 and Appendix D (RMA direction) of the Forest Plan allows for young-growth timber harvest within RMAs (outside of TTRA buffers) (USDA Forest Service 2016a). Harvest prescriptions within RMAs focus on facilitating a more-rapid recovery of late successional forest characteristics while also producing a commercial timber byproduct. Exhibit 2 of the Tongass Young Growth Management Strategy (2014) provides guidance on refining treatments in the RMA. Any modifications to no-harvest buffers, such as young-growth harvest, need to follow Forest Plan Appendix C (Watershed Analysis) and Appendix D (Riparian Management) (USDA Forest Service 2016a).

Silviculture

Where specified, uneven-aged management (partial harvest) would harvest a maximum of one-third of the stand's basal area leaving a minimum of two-thirds to provide for visual, wildlife, and other resource values. Openings would be limited to less than 2 acres in size, and harvest would be spread evenly throughout the unit.

Soils

Effects to soils would be minimized by using existing roads, landings, and rock quarries for timber harvest activities when present. Where feasible, temporary road locations would use topography to minimize disruption of natural drainage patterns. Areas identified for shovel yarding generally only occur on slopes less than 35 percent and outside riparian management areas. Slash or puncheon mats would be used to protect soils by distributing the weight of the mechanized harvest equipment in exposed soil areas. The leading end of logs would be suspended during yarding operations, reducing the footprint of logs as they are dragged on the soil surface. Helicopter yarding would provide full suspension of logs. Fine organic matter and coarse woody debris from cull logs and broken tops and branches remaining on the ground would provide nutrient recycling.

Wildlife

In units designated for uneven-aged management (partial harvest), a maximum of one-third of the stand would be removed leaving a minimum of two-thirds to provide for wildlife values. The remaining stand would provide cavity-nesting habitat and other habitat values. In areas of uneven-aged management, standing and felled snags would provide wildlife habitat. These are based off of the Interagency Wolf Habitat Program Recommendations (WTC 2017).

Wetlands

Roads would be located to avoid wetlands to the extent practicable. Drainage structures would be designed to accommodate drainage and maintain natural hydrologic conditions. Ditching would be minimized to prevent diversion. Ground-based logging systems would be required to place slash to float the equipment to minimize wetland disturbance.

Invasive Plants

Require rock material from existing quarries for construction of new roads to be inspected and documented as being free of any high priority invasive species; require erosion control material (such as seed mixes) to be certified as “weed-free” for the local ecosystem; and maintain crushed rock stockpiles and active quarries in a “weed-free” condition.

Scenery

To reduce the visual impact of harvest areas, uneven-aged or two-aged management would be used, and unit boundaries would be shaped and feathered to emulate natural openings and reduce hard edges that appear as artificial features on the landscape.

Monitoring

Project monitoring is used to determine how well specific design features or mitigation work in minimizing adverse impacts and achieving resource objectives. The project would be monitored during implementation to ensure that timber sale contract provisions and resource protection measures are followed.

Harvest activities would be monitored as part of timber sale contract administration. Harvest units would be monitored with regeneration surveys to ensure adequate stand regeneration as required by the National Forest Management Act. Project harvest units and roads would be incorporated into the Forest-wide BMP monitoring program.

Soil disturbance would be monitored through the Forest-wide BMP and soils monitoring programs.

Bark accumulation at the Shoal and Shelter Cove marine access facilities would be monitored as required by the Alaska APDES Permit AKG700000 – Log Transfer Facilities in Alaska.

Project activities would be monitored to ensure that any previously unknown historical or cultural sites that are found would be adequately protected.

Roads and bridges associated with the project would be monitored as part of the Forest-wide roads and bridges inspection program.

Goshawk habitat would be inventoried in accordance with Forest goshawk monitoring protocols and the forest plan prior to implementation. Any probable goshawk nests as well as inactive wolf dens, and heron and raptor nests would be monitored for activity status prior to nearby implementation in accordance with the forest plan. Activity status of bald eagle nests may be monitored prior to nearby implementation to ensure compliance with the Bald and Golden Eagle Protection Act.

Alternatives Eliminated from Detailed Study

Rationale for eliminating an alternative includes:

- The alternative does not meet the purpose and need;
- The alternative is outside the scope of this EIS; and
- The content of the alternative is contained in other alternatives or within the range already being analyzed in detail.

No Commercial Timber Harvest

The project should consider means other than timber harvest for generating similar levels of employment and wages in other competitive regional industries, including recreation development and watershed restoration, while still fulfilling the agency's multi-use mission.

Reason not Analyzed in Detail

This alternative does not meet the purpose and need for this project, which includes "contributing to jobs and labor income in local and regional communities associated with timber, recreation, tourism, and aquatic and terrestrial resource management." Elements of this proposed alternative (recreation development and watershed restoration) are included in other alternatives being analyzed in detail.

No New Road Construction

This project should use existing National Forest System roads that do not require extensive reconstruction and eliminate road construction to the extent practicable to minimize sediment transport, subsurface flow interruption, habitat fragmentation and disturbance, weed spread, and fire danger.

Reason not Analyzed in Detail

The existing road system accesses much of the project area; however, new segments added to this road system would increase access to additional lands suitable for timber production and reduce the need for helicopter logging which reduces logging costs. The existing road system in the project area does not access all units proposed for harvest in this project. Existing roads access about 34 percent of the proposed old-growth harvest acres. This alternative does not meet the purpose and need.

Harvest Old-growth by Even-aged methods only, No Helicopter Logging

Timber harvest should be even-aged (clearcut) only because the species mix of regrowth is generally the same as the original stand, and the trees mature in about half the time compared to trees that regenerate after uneven-aged harvest.

In addition, there is insufficient helicopter logging projected on the Tongass in the near future to be an economical venture for helicopter companies that log.

Reason not Analyzed in Detail

The content of this proposed alternative is included in the range of alternatives analyzed in detail. The proposed action maximizes even-aged management while reducing the amount of helicopter yarding. Helicopter yarding provides additional volume from units that may not support road construction costs.

Harvest and Thinning Should Mimic Natural Disturbance and Stand Development Processes

The timber harvest component of this alternative should only include prescriptions that model natural disturbance and stand development processes (uneven-aged management). This approach would maintain forest structure, composition, and function, especially in areas near or adjacent to stream corridors.

Reason not Analyzed in Detail

Uneven-aged prescriptions proposed for portions of this project will mimic natural disturbances to some degree. The prescription for uneven-aged harvest typically removes 33 percent of the area occupied by trees. Exclusive use of this prescription would not provide enough timber volume to be economical for a logging company, and may not be salable.

Timber Harvest within the Inventoried Roadless Areas

A suggestion was made to include timber harvest units within the roaded portion of the inventoried roadless area (#526) in the northeast part of the project area.

Reason not Analyzed in Detail

An alternative was considered to maximize the timber stands available for harvest by expanding potential harvest into 2001 Inventoried Roadless Areas (IRAs) even though lands within 2001 IRAs are not suitable for commercial harvest under the Forest Plan. If a new Alaska roadless rule is issued, it may alter or remove certain prohibitions currently applicable in IRAs under the 2001 Roadless Rule, including the IRA within the South Revilla project area, but would not authorize specific activities on the ground (Alaska Roadless Rule DEIS, p. 2- 2). The rulemaking could result in a change in the distribution of harvest across the Forest, including the South Revilla project area, but would likely not increase or decrease acres or volume actually harvested. This project complies with the 2016 Tongass Land and Resource Management Plan (Forest Plan).

The IDT reviewed the project area to determine if harvest in the IRA could help better achieve project objectives, but due to the amount of road construction that would be needed and the low timber volume in the area, they determined that timber harvest would not be economic and that project objectives were better achieved outside of the IRA. Therefore, none of the South Revilla project alternatives propose old-growth or young-growth harvest, new roads, or road construction or reconstruction within the IRA.

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in the table is focused on the significant issues and activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 7. Comparison of alternatives by indicators: issue 1

Issue 1: Timber Supply and Economics					
Indicator	**Unit of Measure**	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Forest Plan Amendment – Scenic Integrity Objectives	Yes/No	No	Yes	Yes	No
Indicated Advertised Rate High market [2, 4, 5]	Dollars per thousand board feet (MBF)	0	$(89.57)[6]	$(96.87)	$(83.49)
Indicated Advertised Rate Low market [3, 4, 5]	Dollars per MBF	0	$(43.81)	$(51.01)	$(37.87)
Estimated Timber Offered - Timber Volume by Species					
Sitka Spruce	MBF - Old-growth	0	10,463	9,109	10,159
	MBF - Young-growth	0	15,352	13,063	14,908
Hemlock	MBF – Old-growth	0	41,155	35,831	39,958
	MBF – Young-growth	0	6,579	5,598	6,389
Western Redcedar	MBF - Old-growth	0	13,253	11,539	12,868
Yellow-cedar	MBF	0	4,883	4,251	4,740
Total Net Volume	**MBF**	**0**	**91,685**	**79,391**	**89,022**
Proposed Acres of Timber Harvest by Logging System					
Shovel	acres - Young growth	0	776	651	776
Cable	acres - Young growth	0	311	259	311
	total acres	0	1,087	910	1,087
Shovel	acres - Old growth	0	2,092	1,894	2,114
Cable	acres - Old growth	0	1,937	1,562	1,474
	total conventional logging acres	0	4,029	3,456	3,588
Helicopter	acres old-growth	0	1,086	954	1,526
	total old growth acres	**0**	**5,115**	**4,411**	**5,115**
Logging Cost Stump to Truck	Dollars per net MBF	0	$247.67	$245.46	$246.59
Stump to Mill cost [1]	Dollars per net MBF	0	$435.83	$439.94	$431.11
Road Construction					
NFS Road Construction	Miles	0	14.4	13.1	13.7
NFS Road Construction Cost	Dollars	0	$3,600,000	$3,275,000	$3,425,000
Temporary Road Construction	Miles	0	34.0	31.7	31.8
Temporary Road Construction Costs	Dollars	0	$6,792,941	$6,334,297	$6,353,100

Issue 1: Timber Supply and Economics					
Indicator	**Unit of Measure**	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Maintenance of Closed NFS road (ML1) to Open for Log Haul	Miles	0	34.1	33.8	33.4
Maintenance of Closed NFS road (ML1) to Open for Log Haul (ML1) Costs	Dollars	0	$1,364,538	$1,351,261	$1,334,848
Total Log Transfer Facility Costs	Dollars	0	$550,000	$550,000	$550,000
Road Storage Costs	Dollars	0	$83,500	$77,000	$77,500
Total Transportation Costs	**Total dollars**	**0**	**$12,390,979**	**$11,587,558**	**$11,740,448**
Total Jobs Estimated High market [2, 4] (includes export and domestic processing)	Number of annualized jobs supported	0	354	307	344
Total Jobs Estimated Low market [3, 4] 100% hemlock export	Number of annualized jobs supported	0	338	293	328

1 – Stump to mill costs includes cost of NFS road construction.

2 - Represents a high market condition with maximum Alaska manufacturing of larger old-growth hemlock 20+ inches at small end diameter, old-growth Sitka spruce 18+ inches at small end diameter and all western redcedar. All Alaska yellow-cedar is exported outside Alaska.

3 - Represents a lower market condition with 100 percent of hemlock and all Alaska yellow-cedar exported. Alaska manufacturing of old-growth Sitka spruce 18+ inches at small end diameter and all western redcedar

4 – Indicated Advertised Rate: Pond Log Value minus stump to truck costs and other associated costs (camp, lodging, Profit and Risk margin, etc.).

5 - Includes a Profit and Risk of 14.53 percent for the purchaser

6 - ( ) indicates a negative value. Only contracts that appraise positive can be offered. Although the alternative appears not to appraise positive using preliminary information, positive sales can be achieved at implementation through unit and road design.

Table 8. Comparison of alternatives by indicators: issue 2

Issue 2: Wildlife Habitat and Subsistence Use					
Indicator	**Unit of Measure**	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Forest Plan Amendment – Scenic Integrity Objectives	Yes/No	NO	YES	YES	NO
Productive Old-growth	Acres of productive old-growth proposed for harvest	0	4,606	3,931	4,606
	Percentage of existing productive old-growth in the project area proposed for harvest	0%	22.1%	18.8%	22.1%
High-value deer winter range	Acres of south facing, low elevation (<800 feet), high volume productive old growth proposed for harvest	0	402	30	402
	Percentage of existing high value deer winter range in the project area planned for harvest	0%	21.8%	1.6%	21.8%
Connectivity / Fragmentation	Corridor analysis[1]	No change to wildlife travel	Wildlife travel corridors lost in at least 38 areas	38 areas maintained for wildlife travel	Wildlife travel corridors lost in at least 38 areas
Road density	Total / open road density mi per mi^2 (subsistence)	2.4/1.2	3/1.2	3/1.2	3/1.2
	Total / open road density below 1200 feet mi per mi^2	2.4/1.2	3/1.2	3/1.2	3/1.2
Deer habitat capability	Deer habitat capability (estimated deer/mi^2 that habitat can support)	16.8	16.3	16.4	16.3

1 - A corridor analysis was done and leave areas(corridors) were identified in harvest units that would allow wildlife to move freely among habitats and elevations, so there is no reference number other than the number of leave areas identified for Alternative 3.

Table 9. Comparison of alternatives by indicators: issue 3

Issue 3: Scenic Values and Recreational Opportunities														
Indicator	**Unit of Measure**	**Alternative 1**	**Alternative 2**				**Alternative 3**				**Alternative 4**			
Forest Plan Amendment – Scenic Integrity Objectives	Yes/No	NO	YES				YES				NO			
Harvest by SIO	Acres affected by classification		**Clearcut**	**Uneven-aged 33% retention**	**Two-aged 20%**	**Two-aged 50%**	**Clearcut**	**Uneven-aged 33% retention**	**Two-aged 20%**	**Two-aged 50%**	**Clearcut**	**Uneven-aged 33% retention**	**Two-aged 20%**	**Two-aged 50%**
High	Acres	0	0	0	0	0	0	0	0	0	0	0	0	0
Moderate	Acres	0	0	0	0	0	0	0	0	0	280	498	78	0
Low	Acres	0	0	0	0	0	0	0	0	0	884	651	8	.2
Very Low	Acres	0	4756	1070	99	277	4058	993	5	264	3004	519	1	279
Total	**Acres**	**0**	**4756**	**1070**	**99**	**277**	**4058**	**993**	**5**	**264**	**4168**	**1668**	**87**	**279**
Changes to Recreation Opportunity Spectrum system classification	Acres changed by classification	0	125.72				39.26				125.72			
Changes to access	Miles of nonmotorized and motorized access	13.72	0.4				0.4				0.4			

1 – All scenic integrity objectives (SIOs) drop to very low class for all activities in Alternatives 2 and 3 per project specific Forest Plan amendment.

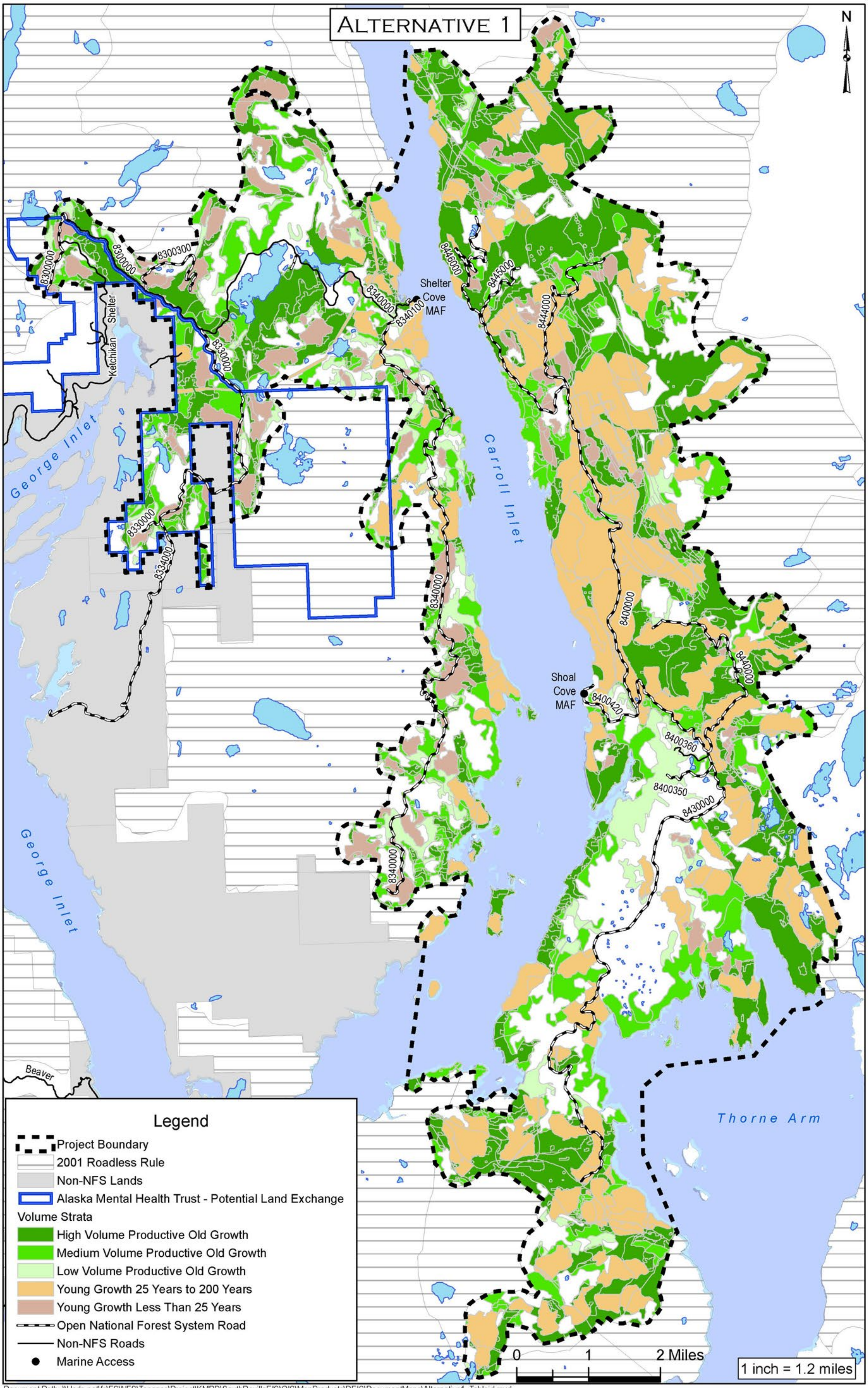

Figure 4. Alternative 1 no action

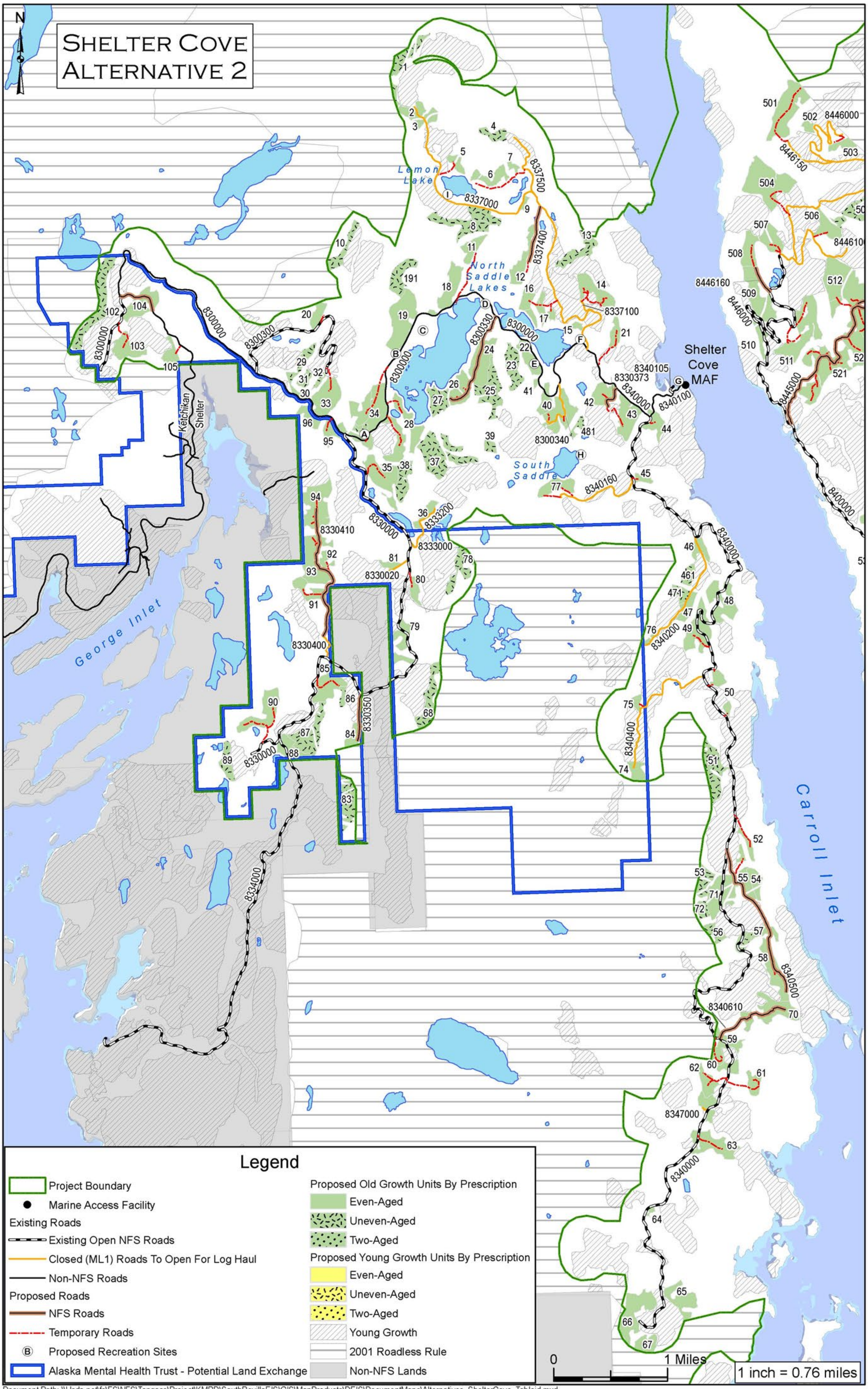

Figure 5. Alternative 2 the proposed action Shelter Cove

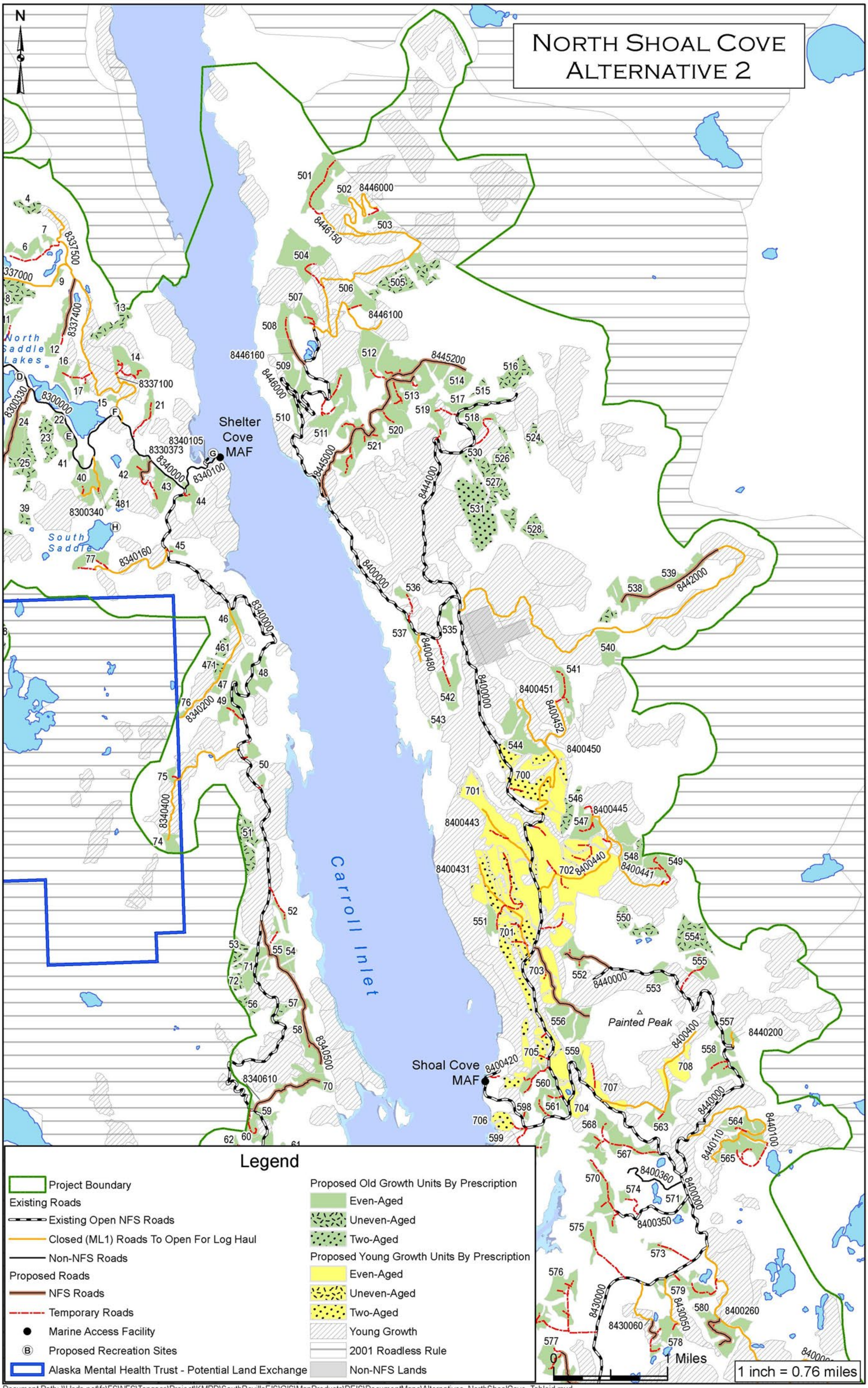

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Figure 6. Alternative 2 the proposed action north Shoal Cove

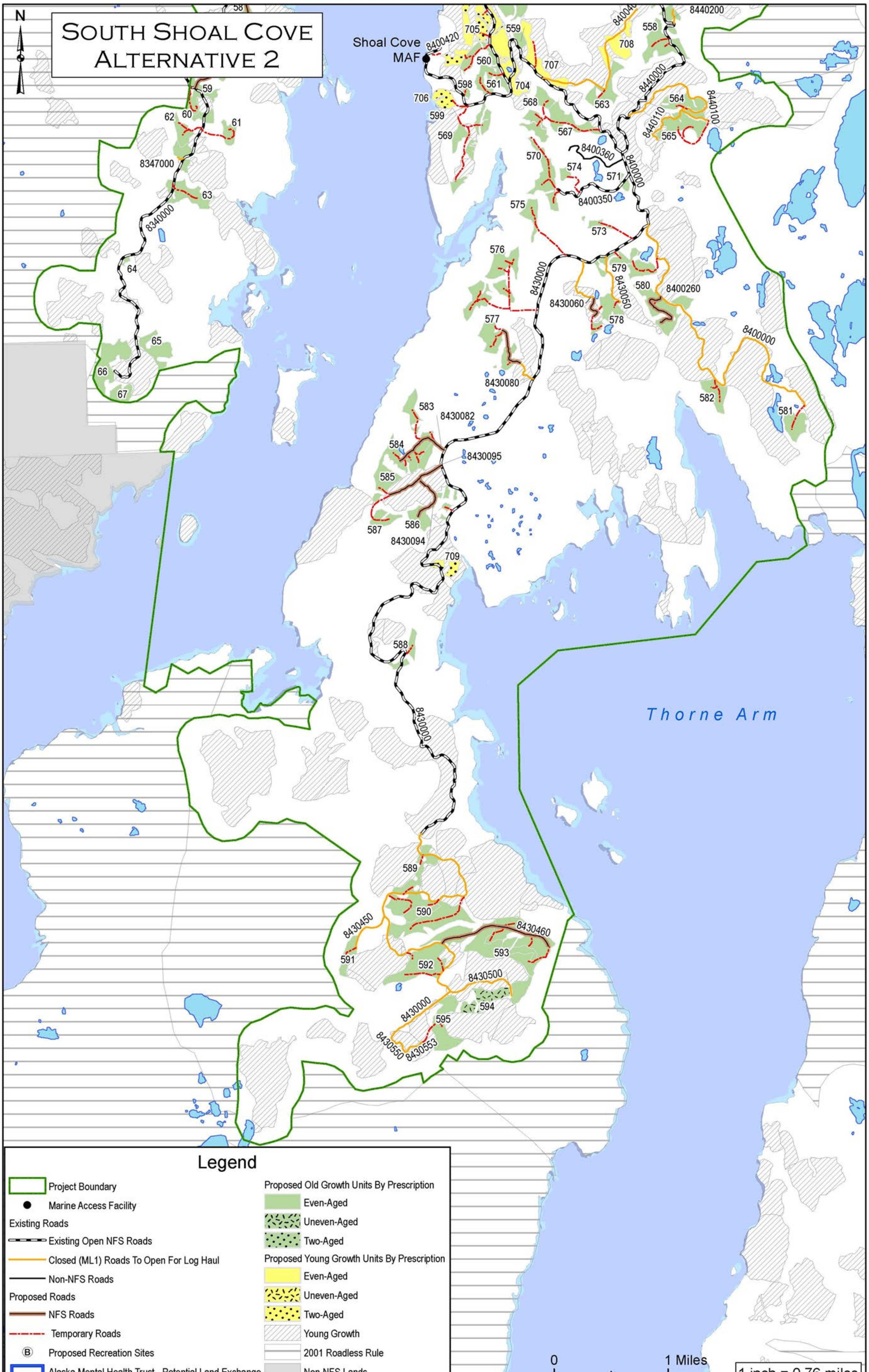

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Figure 7. Alternative 2 the proposed action south Shoal Cove

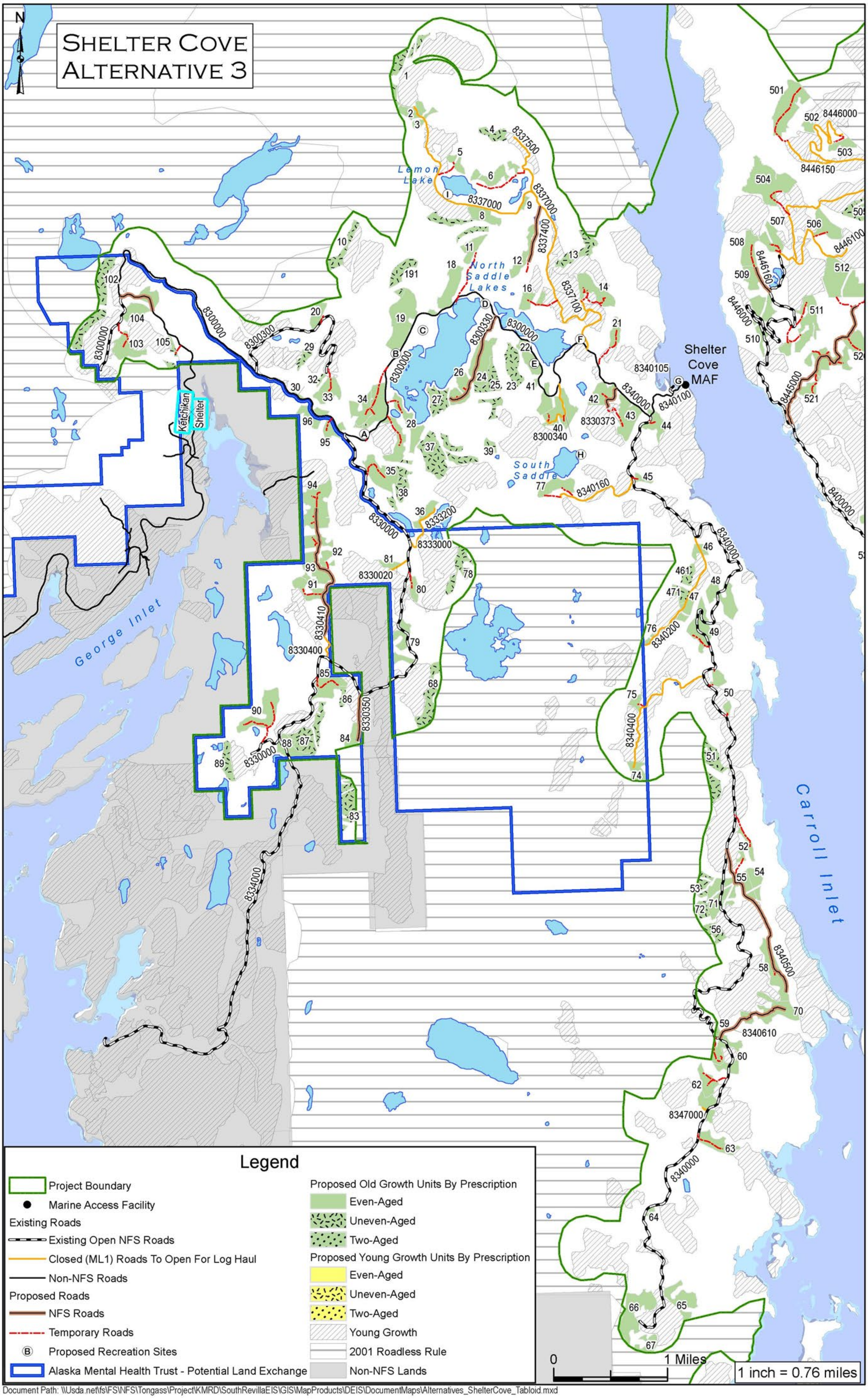

Figure 8. Alternative 3 Shelter Cove

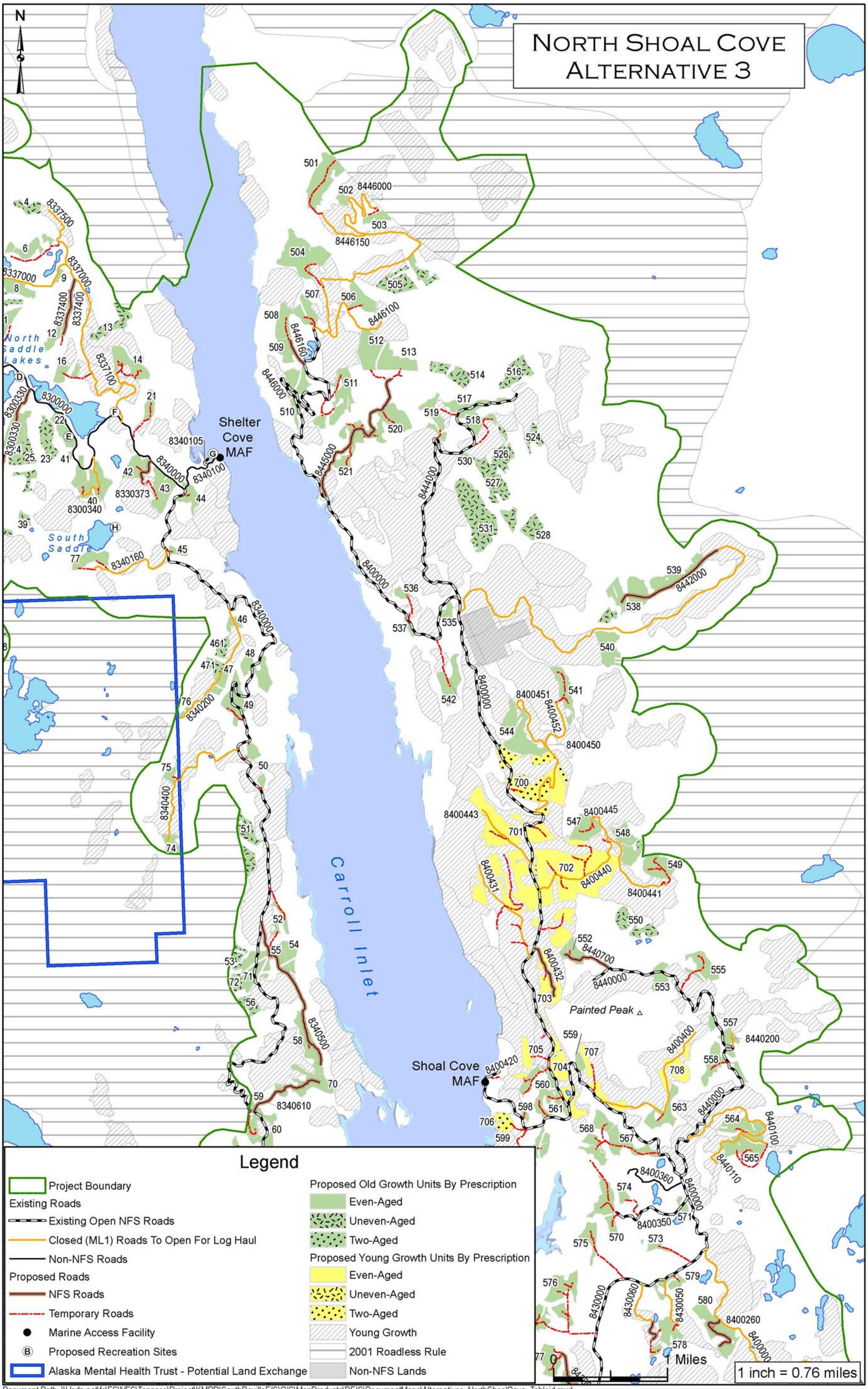

Figure 9. Alternative 3 north Shoal Cove

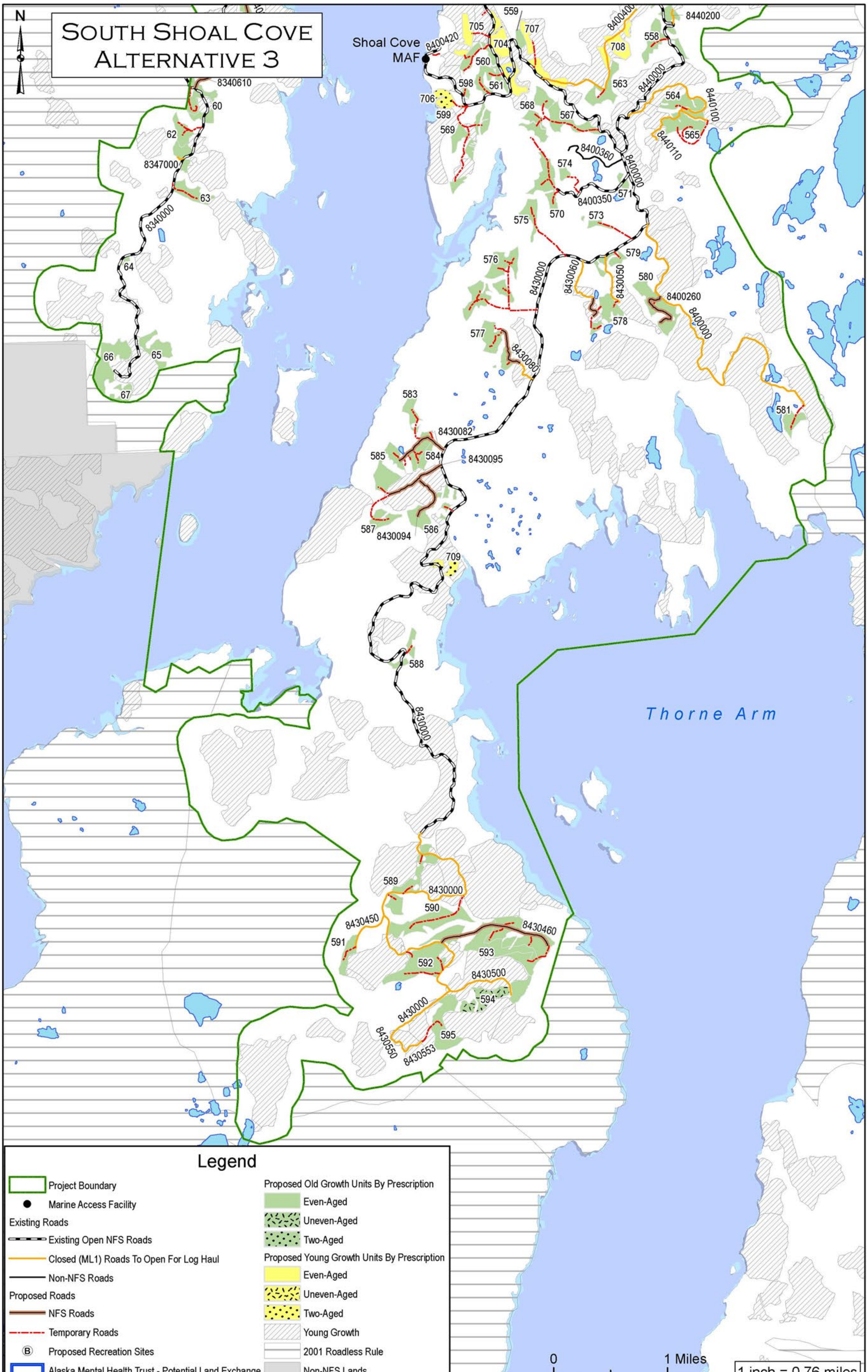

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Figure 10. Alternative 3 south Shoal Cove

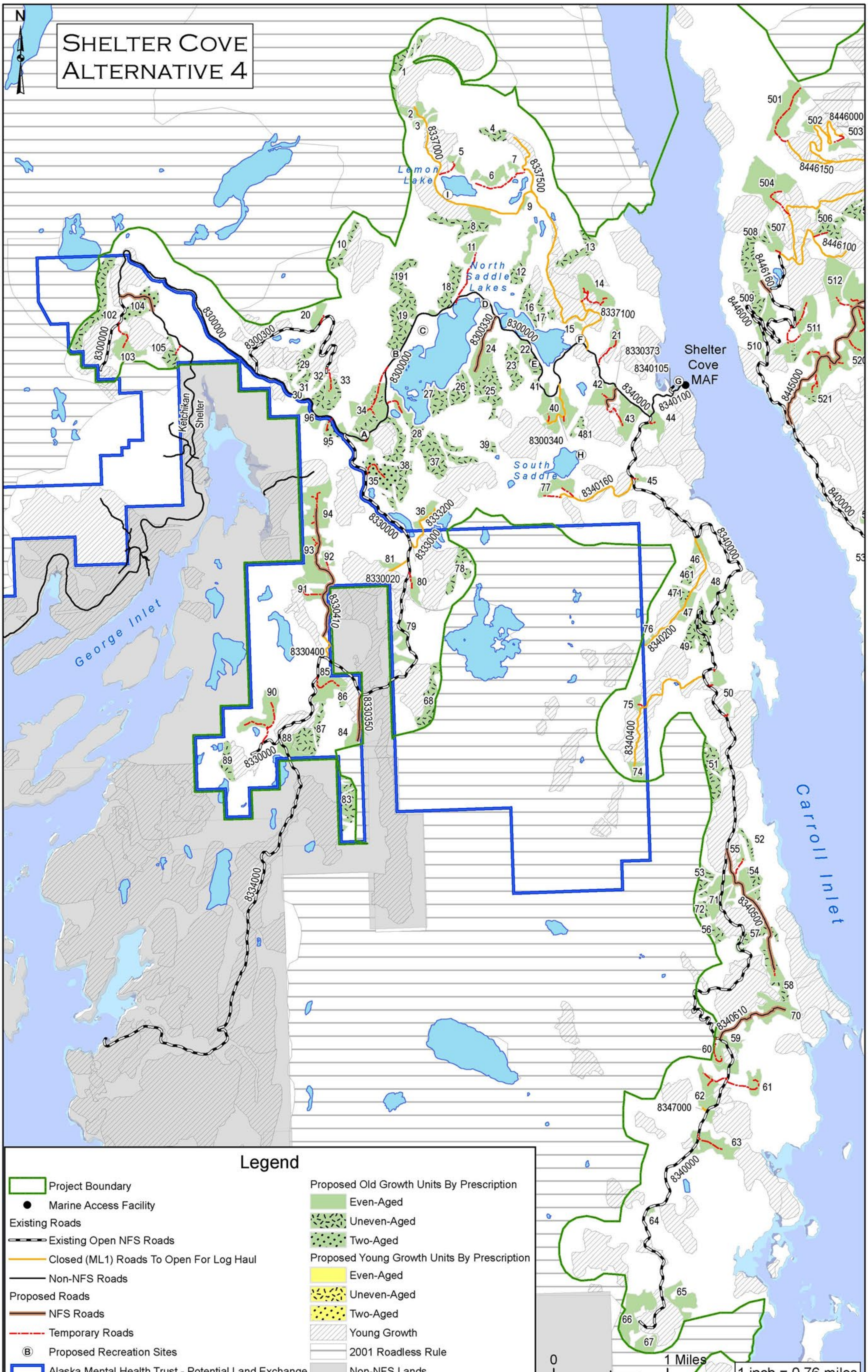

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Figure 11. Alternative 4 Shelter Cove

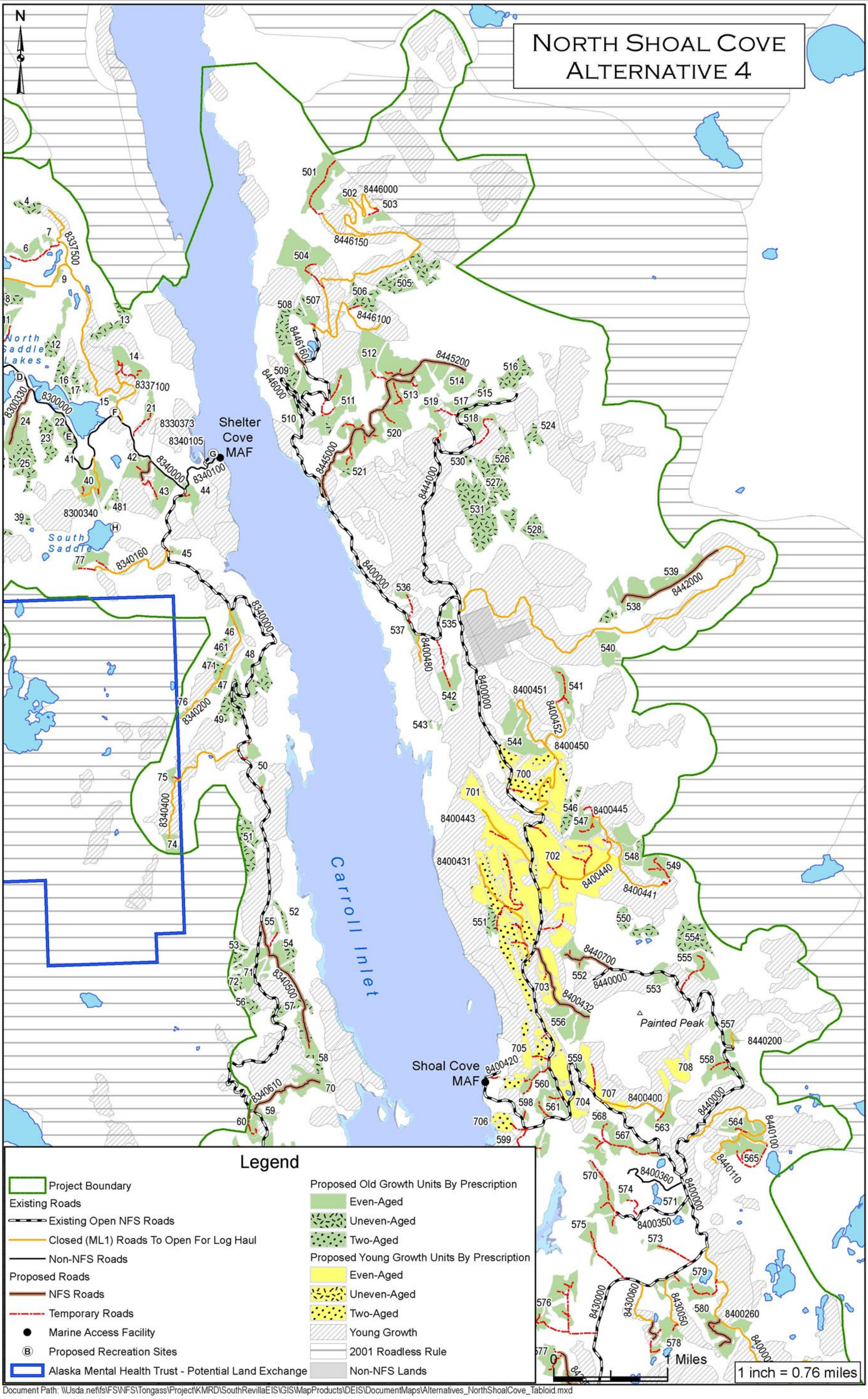


Figure 12. Alternative 4 north Shoal Cove

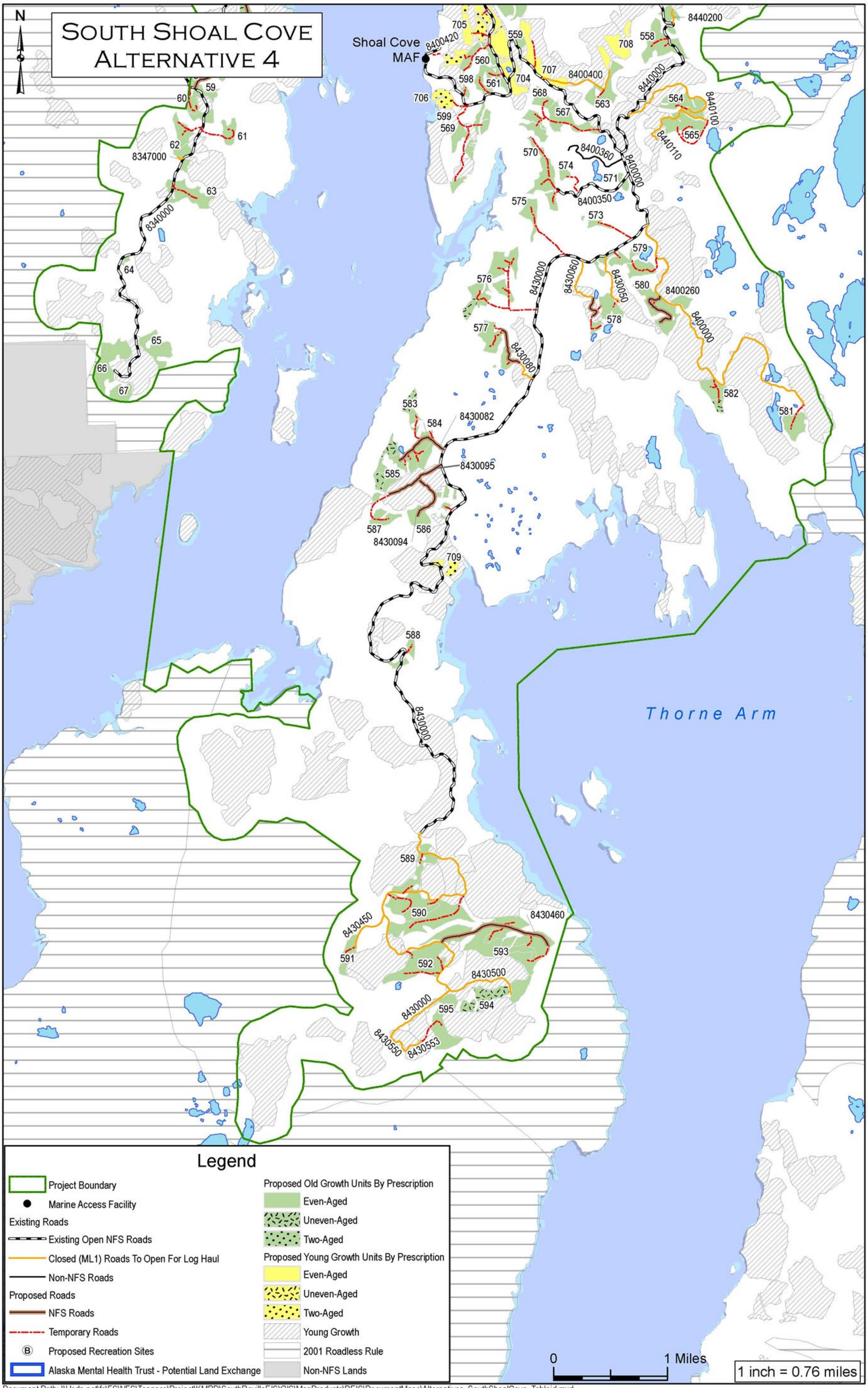


Figure 13. Alternative 4 south Shoal Cove

Chapter 3. Environment and Effects

Introduction

This chapter describes the affected environment within the project area and the environmental impacts of the alternatives. The 1997 Forest Plan revision FEIS, the 2008 Forest Plan amendment FEIS, and 2016 Forest Plan amendment FEIS and supporting planning records provides background information and analyses not included here.

Ecological and Administrative Land Divisions

The land area of the Tongass National Forest has been divided in several different ways to describe resources and allow analysis of how they may be affected by 2016 Forest Plan and project-level decisions. These divisions vary by resource since the relationship of each resource to geographic conditions and zones also varies. The allocations of 2016 Forest Plan land use designations (LUD), discussed in Chapter 1, are one such division. Other divisions important to describe the affected environment and perform analyses are described briefly here.

Biogeographic Province

There are 21 ecological subdivisions of Southeast Alaska that are identified by generally similar physiogeography, climate, vegetation patterns and physical barriers such as mountains or saltwater (distinct ecological and biogeographic features). Plant and animal species composition, climate, and geology within each province are generally more similar within than among adjacent provinces (Forest plan Glossary). The South Revilla project is within the North Revilla/ Cleveland Peninsula biogeographic province.

Game Management Unit (GMU)

Game management units are geographical areas defined by the Alaska Department of Fish and Game (ADF&G) to manage wildlife populations. The South Revilla project area is within game management unit 1A, which includes Revillagigedo Island, adjacent islands, the southern half of the Cleveland Peninsula, and the adjacent mainland all the way to the Canada border.

Wildlife Analysis Areas (WAA)

Wildlife analysis areas are land divisions used by the Alaska Department of Fish and Game for wildlife analysis and regulating wildlife populations. The project area includes portions of wildlife analysis areas 405 (Thorne Arm area), 406 (Carrol Inlet area), and 407 (George Inlet area). The wildlife and subsistence analyses use information by wildlife analysis area for estimating effects.

Value Comparison Units (VCU)

Value comparison units are distinct geographic areas, each encompassing a drainage basin containing one or more large stream systems or portion of a stream system. The project area includes portions of value comparison units 7460, 7470, 7530, 7560, and used for some of the wildlife analysis.

Watersheds

Activities for this project were analyzed at the watershed 7th level hydrologic unit code (HUC). Hydrologic unit codes are unique identifiers used in a standardized watershed classification system, the Watershed Boundary Dataset, developed by the USGS. Hydrologic units are watershed boundaries organized size and location, and can be viewed as the “address” of a particular watershed. Watersheds, identified by hydrologic unit code, are uniformly mapped for the entire United States. The project boundary includes 31 watersheds with at least a portion of their drainage areas within it.

Geographic Information System Database and Quantification for this EIS

The Forest Service uses its computerized geographic information system (GIS) database to conduct spatial analysis of alternatives and effects, and to display resource information in map format. Much of the GIS data consist of map “layers,” each representing a particular resource or attribute (such as forest type, soil type, or recreation places). These GIS data layers originated from aerial imagery interpretation and are updated from field inventories using standard data collection procedures. GIS layers allow the consistency of using the same base data for individual resource effects analysis. GIS data and product accuracy may vary.

This analysis used the best available information and included habitat variables such as vegetation, slope, and elevation. Potential habitat is based on the presence of habitat characteristics as described in available scientific literature, previous habitat surveys, recorded observations, and from other credible sources of natural biotic information. This project was analyzed and assessed with consideration of the best available science, 2016 Forest Plan components, research and life history literature, approved survey protocols, and professional judgment. The assumptions about the proposed treatments that were used to make the determination of effects for the resources are found in the individual resource sections below.

The baseline numbers used to describe the existing condition may depend on overlaying of multiple layers which may not always line up (for example, along property boundaries, saltwater shorelines, lake edges). This may produce variation in acreage estimates. These differences can amount to hundreds of acres or more, especially when the calculations are for a large project area. The slivers of area creating these discrepancies, on a percentage basis, are insignificant.

Numbers presented are generally rounded to the nearest whole acre, 1/10 mile, or whole percent, except for road densities. No attempt has been made to adjust the numbers to force the sums of rounded numbers to equal the totals. Therefore, the sum of rounded individual numbers may be different than the expected sum, and all numbers calculated from GIS should be considered as approximate.

GIS data are always changing due to the input of on-going field surveys and inventories plus changes that occur naturally. GIS data generated for analysis represent the most-current information available for what is on the ground at the time the analysis is conducted.

Incomplete and Unavailable Information

There is incomplete knowledge about many of the relationships and conditions of wildlife, fish, forests, climate change, jobs, and communities. The biology of fish and wildlife species prompts questions about population dynamics and habitat relationships; and the interaction of resource supply, the economy, and communities is the subject of an inexact science. However, the basic data and central relationships are sufficiently well-established in the respective sciences for the responsible official to make a choice among the alternatives, and to adequately assess and disclose the possible adverse environmental effects.

Comprehensive stream, rare and sensitive plant, invasive plant, geology, soil, landslide, wetlands, wildlife, timber and cultural surveys have not been conducted within the entirety of the project area, but are ongoing throughout the project planning process including implementation. In addition, as more resources or technology become available, they will also contribute to the process of gathering more information on the project area and continuing to refine existing condition information. For example, Tongass National Forest is anticipating extensive coverage of this project area soon from a type of remote sensing called LiDAR (Light Detection and Ranging), which will help inform decision making on the project. It is likely that additional streams, plant populations, karst features, unsuitable soils, landslides, wetlands, nests, dens and cultural sites may be found prior to implementation in currently un-surveyed areas, though knowledge of these additional occurrences is not essential for a choice among alternatives. Any newly discovered sites would receive the appropriate protections under the 2016 Forest Plan and relevant laws or regulations.

Information on past, present, and foreseeable projects on non-NFS lands is not always complete and readily available. Available information was used, or assumptions documented, to support sufficient direct, indirect, and cumulative effects analysis. See appendix C and supporting materials in the project record.

Analyzing Effects

Environmental consequences are the effects of implementing an alternative on the physical, biological, social, and economic environment. The Council on Environmental Quality (CEQ) regulations implementing the National Environmental Policy Act (NEPA) include the following specific categories for the analysis of environmental consequences.

Direct, Indirect, and Cumulative Effects

Direct environmental effects are those occurring at the same time and place as the initial cause or action. Indirect effects are those that occur later in time or are spatially removed from the activity. Cumulative effects result from incremental effects of actions, when added to other past, present, and reasonably foreseeable actions, regardless of what agency or person undertakes such actions.

In the environmental effects sections, the direct and indirect effects are presented first, followed by cumulative effects. For all resources, private lands and other public lands outside the jurisdiction of the Forest Service (such as tribal and state land and private property) are included in the direct and indirect effects analysis because some activities may extend into other land ownerships for continuity and integration of planning and implementation. Any such project must be supported and authorized by the other landowners, usually through formal agreements. For evaluating cumulative effects, the interdisciplinary team (IDT) considered all lands in the project area. The direct, indirect, and cumulative analysis area for each resource is described in the appropriate section later in this chapter.

Cumulative Effects Analysis

Past Projects

Past projects considered in cumulative effects analysis generally are physically located on the landscape, such as roads. The past projects combined with the natural environment, represent the affected environment described for each resource in this chapter. These projects include timber harvest, thinning of harvested stands, recreation developments, road construction and log transfer and marine access facility construction; stream restoration and enhancement, and road construction.

To understand the contribution of past actions to the cumulative effects of alternatives, this analysis assumes that current environmental conditions are a result of effects from past actions. This is because existing conditions reflect the aggregate effect of all preceding human actions and natural events that have affected the environment and might contribute to cumulative effects. Therefore, cumulative effects discussions for this analysis quantify the effects of past actions by type and decade rather than by adding up all previous actions on an action-by-action basis.

Present and Reasonably Foreseeable Projects

Present and reasonably foreseeable projects are cataloged in the *Catalog of Past, Present and Reasonably Foreseeable Activities* (appendix C). Present actions considered are within or adjacent to the project area and include Forest Service projects, special use authorizations, and other agency activities. These are actions that are either already occurring or scheduled to begin in 2020, as shown in appendix C.

Reasonably foreseeable projects are those with either a developed proposed action or a GIS layer or map displaying a spatial location. These are various multi-year actions with a timeframe of “2020 and beyond” or “ongoing” and including Forest Service projects, tourism, special use authorizations, pre-commercial thinning, stream restoration, partnerships, and actions by other agencies, as shown in appendix C.

Unavoidable Adverse Effects

Implementing any action alternative could cause adverse environmental effects that cannot be effectively mitigated. Unavoidable adverse effects often result from managing the land for multiple resources. The unit and road cards described in appendix A and B and available online describe proposed activities; the interdisciplinary process used for making these guides incorporated design criteria that eliminate or reduce adverse effects. Applying 2016 Forest Plan direction, best management practices (BMP), and activity-specific design features limit the extent, severity, and duration of potential effects. Alternatives and their actions are designed to reduce or avoid adverse environmental effects; however, some adverse impacts to the environment that cannot be completely mitigated could occur. This chapter discloses these effects in the individual resource analyses.

Short-term Use and Long-term Productivity

Short-term uses and their effects are those that occur annually or within the first few years of project implementation. Long-term productivity refers to the capability of the land and resources to continue producing goods and services long after the project has been implemented. Under the Multiple-Use Sustained Yield Act and the National Forest Management Act, all renewable resources are to be managed so they are available for future generations. By meeting 2016 Forest Plan direction, this project meets the requirements of the Multiple-Use Sustained-Yield Act and the National Forest Management Act.

Irreversible and Irretrievable Commitments of Resources

Irreversible and irretrievable commitments of resources are listed by resource at the end of this chapter.

Irreversible Commitments is a term that describes the loss of future options. It applies primarily to the effects of using nonrenewable resources, such as minerals or cultural resources, or to those factors such as soil productivity, that are renewable only over long periods of time (USDA Forest Service 2016, p. 7-27).

Loss of soil due to erosion and mass failures is an irreversible commitment of resources. The loss of soil resources would be minimized to the extent feasible for all activities by following Region 10 Soil Quality Standards, incorporating BMPs and applying design features specified in this document.

Road and parking lot construction is an irreversible action because of the time it takes for a constructed road or parking lot to revert to natural conditions. The development or expansion of rock quarries for roadbuilding or other uses is also an irreversible commitment. See the transportation and soils sections in this chapter.

Soils and wetlands displaced by road construction activities are irreversible commitments of project resources, due to the long-term loss of soil productivity. It is irreversible because the soils and wetland resources have deteriorated to the point that renewal can occur only over a long period of time or at a great expense, or because the wetland soils have been destroyed or removed. In road construction, wetland soils are either scraped away or are buried beneath road fill, greatly limiting their pre-disturbance productivity. See also the soils wetlands sections in this chapter.

Loss of heritage resource sites resulting from accidental damage or vandalism would be an irreversible commitment of resources. The 2016 Forest Plan standards and guidelines, surveys prior to activities, and design features specified in this document provide reasonable assurance that no irreversible loss of heritage resources would occur. See also the cultural resources section in this chapter.

Irretrievable Commitments apply to the loss of production, harvest, or use of natural resources. These decisions are reversible, but the production opportunities foregone are irretrievable (see USDA Forest Service 2016a, p. 7-27). Old-growth forest structure converted to even-aged forest structure by timber harvest can be considered an irretrievable commitment of the old-growth structure, especially if the land is continually managed for timber production. It is not expected that old-growth characteristics would naturally reoccur within harvest areas for 150 years or more; however, old-growth forest structure would eventually return to the landscape.

Foregoing timber harvest opportunities in certain areas at this time, due to resource concerns or economics, may represent an irretrievable commitment of resources because that volume cannot be harvested. The commitment is irretrievable rather than irreversible because future entries could harvest those areas if they are still classified as part of the suitable timber base, however, the volume and value of the timber may be reduced at that time.

The effects to scenery for an area due to clearcutting timber would be an irretrievable commitment of resources for about 40 years. Young-growth trees will have the color and height needed to be unnoticeable to the casual observer after this time.

Issue 1: Timber Supply and Economics

The proposed quantity and quality of old-growth and young-growth timber and the logging costs associated with the logging systems and silvicultural prescriptions would affect the Southeast Alaska's forest products industry and the ability of the industry to contribute to the diversity and stability of local and regional economies

A steady supply of economic timber is needed to support Southeast Alaska's forest products industry and the ability of the industry to contribute to the diversity and stability of local and regional economies (2016 Forest Plan Amendment ROD). Factors influencing the ability of the Forest Service to meet this need include following all relevant laws, policy, Forest Service Handbooks and Manuals, Timber supply is influenced by Forest Plan direction for other resources, including soils, watershed and aquatics, wildlife habitat, sensitive and rare plants and scenery. Further detailed reconnaissance, logging plan development, and an appraisal would be completed prior to offering timber for bid during the implementation phase of this project.

Resource Indicators and Units of Measure

Table 10. Issue 1 units of measure

Indicator	Unit of Measure
Estimated Indicated advertised rate	dollars per MBF
Volume by young growth and old growth	MMBF
Logging system (shovel, cable, helicopter)	acres of young- and old-growth by logging system
Logging costs	dollars per net MBF
Employment supported by the project	number of annualized jobs supported both through export and domestic processing.

Methodology

First the proposed timber harvest units were identified for possible including into the proposed action. Using these units, a very basic financially efficiency analysis was done using readily available information.

Timber Harvest Unit Identification

The lands deemed suitable for timber production were identified through the process described in the 2008 Forest Plan, Appendix A. These lands were used to develop the Forest-wide Logging System and Transportation Analysis (LSTA) completed in 2006 for the 2008 Forest Plan Amendment FEIS analysis. The Forest-wide LSTA was developed using existing information including topographic maps, aerial photographs, and data from past timber sales; it was not field verified. Model implementation reduction factors were used to provide a more reasonable estimate of volumes and acres for the Forest Plan decision (USDA Forest Service, 2016d, Appendix B). This suitability analysis process was updated for the 2016 Forest Plan Amendment, based on FSH 1909.12, Chapter 60 and removed some forested lands from the suitable forest base, notably those acres with the Inventoried Roadless Areas and old-growth acres from Phase 2 and 3 of the Tongass Timber Program Adaptive Management Strategy.

Field surveys were conducted in 2013 through 2019 to verify and collect information in the project area. This LSTA was refined into the project LSTA based on these surveys. Potential harvest units were identified and reviewed for consistency with the Forest Plan. Although field work has been ongoing, the units have not been completely verified and are not ready for a timber contract.

This field verification has continued in 2020 and will continue throughout implementation. Because of this, units may change design shape. This may be due to several factors, such as finding more resource features that need protected, such as streams, unstable slopes, sensitive or rare plants, wolf dens and raptor nests. Or the design may change to allow for more efficient logging set-up or to accommodate a shift in a proposed road. To allow for opportunities and flexibility to create an economic timber offer, the proposed units are generally larger than the final units will end up being. These changes are then compared to the effects analyzed to see if they are within the scope of this environmental analysis (FSH 1909.15, Section 18).

Another change may be in the volume estimates since the volume used has been based on common stand exams or other reconnaissance plots but not a statically valid cruise as required for a contract. This often results in less volume especially in old-growth as more defect (35 to 45 percent) is identified through the scrutiny of certified cruisers. Since many stands on the Tongass are a mosaic of forest and non-forest,

forest edges are often dropped from a potential unit due to poor quality timber or to avoid wetlands. For these reasons, the estimates in this project are exactly that and may change often resulting in considerably less acres and volume harvested than analyzed in this document.

Financial Analysis Spreadsheet Tool - RV

The Financial Analysis Spreadsheet Tool - RV (FASTR, version June 22, 2020) was used to compare alternatives for financial efficiency. The FASTR model uses the same logging and manufacturing costs developed for the Alaska Region timber sale Residual Value appraisal program.

The harvest volumes, indicated value, costs, and net stumpage values used in this analysis are estimates based on the best available information. Future changes in regional and global timber markets and other factors such as fuel costs can dramatically affect stumpage values and logging costs at the time of implementation and harvest. These estimates are used primarily to compare the relative differences among alternatives. FASTR is a tool developed for financial analysis and alternative comparisons. It does not provide an actual sale appraisal. Project economics can vary greatly depending on the quality of timber that is being harvested and the marketability of that species. FASTR assumes regional averages regarding stand quality and characteristics and provides an approximation of actual stand conditions.

At the time of project implementation, merchantable timber within units and any road right-of-way located on NFS lands will be cruised to determine the quantity, quality, and value of timber for the contract. The final sale appraisal would be based on the current appraisal bulletin, current cost information, and a normal profit and risk allowance to determine the minimum advertised stumpage value at the time of offering.

Spatial and Temporal Context for Effects Analysis

The spatial boundary for the direct and indirect effects analysis for timber supply and economics is the South Revilla project area. This project area has two developed road systems. Both the Shoal Cove and the Shelter Cove road systems are accessed by a Log Transfer Facility. The Shelter Cove road system is connected to the City of Ketchikan through non-NFS lands.

The spatial boundary for analyzing the cumulative effects to timber supply includes all suitable forested lands on National Forest System (NFS) lands with emphasis on those projects either completed through the NEPA process or ongoing. Timber from non-NFS lands are included to reflect the relationship with the calculated planning cycle demand (Forest Plan, Appendix G, p 3).

The temporal boundary for direct, indirect, and cumulative effects for timber supply is 15 years to align with the timeline of the project and the transition to young-growth management timeframe. The temporal boundary for direct effects for the financial efficiency analysis is the time of this analysis since future estimates of the value of the timber cannot be foretold.

Affected Environment

Existing Condition

About 72,915 people live in more than 30 towns and villages, (most with less than 1000 people), located in and around the Forest in 2017, most of which are located on islands or along the narrow coastal strip (Alaska Department of Labor [DOL] 2018). The South Revilla project area is located on Revillagigedo Island, which has historically played an important role in the region’s forest products industry. Communities located in the vicinity of the South Revilla project area include Ketchikan, Saxman and

Metlakatla. None are located within the project area boundary. Ketchikan is the third largest city in southeast Alaska with a population of 8,300.

The communities of Southeast Alaska depend on the Tongass National Forest in various ways, including employment in the wood products, commercial fishing and fish processing, recreation, tourism, and mining and mineral development sectors. Many residents also depend heavily on subsistence hunting and fishing to meet their basic needs. Federal lands comprise about 95 percent of Southeast Alaska, with 80 percent of the region located on the Tongass National Forest. Appropriate management of the forest's natural resources is, therefore, important for local communities and the overall regional economy. More information is in the 2016 Forest Plan Amendment FEIS (USDA Forest Service 2016c).

Forest Products Industry in Southeast Alaska

The forest products industry has historically been an important part of the economy and growth of Southeast Alaska. Timber employment in Southeast Alaska peaked at the end of the 1980s, with slightly more than 3,500 jobs in 1989 and 1990. Timber employment dropped sharply in the 1990s following closure of the large pulp mills in Sitka (1993) and Ketchikan (1997) but has since stabilized. However, this employment remains important to certain communities and provides economic diversity to others. Local sawmill employment has historically been supported by Forest Service old-growth timber sales, with a contribution from State timber harvest. Young-growth timber from Forest Service and State lands has generally been exported due to lack of southeast Alaska markets. Most timber from Native Corporations lands is exported.

Table 11. Timber industry employment in Southeast Alaska, 2007-2018 (number of workers)

Year[1]	Tongass Logging	Tongass Sawmill	Total Tongass-Related Employment	Other Logging	Other Sawmill	Total Other Timber Employment	Total Timber Industry Employment
2007	44	70	114	225	54	279	393
2008	52	70	122	118	24	142	264
2009	48	39	87	110	19	129	216
2010	61	43	104	133	7	140	244
2011	62	47	109	150	3	153	262
2012	42	47	89	144	11	155	244
2013	75	48	123	106	14	120	243
2014	86	60	146	96	7	104	249
2015	104	58	162	63	12	75	237
2016	81	70	151	76	1	77	228
2017	25	37	62	108	32	140	202
2018	25	37	62	94	37	131	193

[1] Data are presented by calendar year. Source: Daniels 2020.

Current Mills and Timber Purchasers in Southeast Alaska

The largest mill in southeast Alaska is Viking Lumber located in Klawock, Alaska with a capacity at 80,000 MBF. Alcan Timber Inc. is also a major purchaser of Forest Service timber. Alcan does not have a mill but supplies local mills and exports timber, notably young-growth timber. Many smaller sawmills operate across the region, often on a seasonal, part-time, or contingent basis. A review of business licenses in December 2019, information from the Forest Service Timber Information Manager (TIM) and local knowledge, identified 50 sawmills and timber purchasers. This may not be a complete list since the number of active mills and timber operators in Southeast Alaska varies at any given time.

Table 12. Sawmills or purchasers in Southeast Alaska based on a 2018 review of business licenses and Forest Service records

Mill Name	Location
Alaska Milling & Fabrication LLC (David Lapeyrouse)	Naukati
Alaska Musicwood Industries, LLC (John Helliwell)	Craig
Alaska Specialty Wood (Brent Cole)	Craig
Alcan Timber Inc	Ketchikan
Jerry Baker	Craig
Ralph Dean Blankenship	Thorne Bay
Cedar Street Enterprises	Port Alexander
Sterling C Chew	Tenakee
Chilkat Valley Sawmill	Haines
Luther J. Coby	Kake
Jerod Cook	Petersburg
Cornerstone Excavation Services LLC (Tim Lindseth)	Thorne Bay
Andrew Cohen	Petersburg
Crew Lumber	Edna Bay
Cutting Edge Wood Products	Ketchikan
D and L Woodworks	Hoonah
Dale R. Bakula Construction	Ketchikan
Dark Horse Lumber	Haines
Ernie Eads	Thorne Bay
Fair & Square Milling (Don Nicholson)	Coffman Cove
Falls Creek Forest Products	Petersburg
Dan Fanning	Hoonah
Glacier Bay Woodcraft	Gustavus
James Harrison	Thorne Bay
Icy Straits Lumber & Milling Co.	Hoonah
JK Forest Products LLC (J. Kohn)	Thorne Bay
JRS Custom Lumber (James Stevens)	Thorne Bay
Wesley Johnson	Craig
K & D Lumber (Keith Landers)	Thorne Bay
William Kaufman	Craig
Kevin Merry	Kake
Mike Allen Enterprizes	Wrangell
Mud Bay Lumber Company, LLC	Haines
William Musser	Naukati
Peavey Log (Dan Peavey)	Thorne Bay
Pitch Enterprises (Cary Pitcher)	Thorne Bay
Spencer Pitcher	Thorne Bay
Seakwood.com	Petersburg
Shortcut Timber Salvage (Robert Patten)	Craig
Joe Sieling	Klawock
Spruce Point Mill	Petersburg
St. Nick Forest Products	Craig
Tenakee Logging Company	Tenakee Springs
The Mill	Petersburg
Thuja Plicata Lumber (Ernie Eads)	Thorne Bay
Viking Lumber Co.	Klawock
Western Gold Cedar Products (James Harrison)	Thorne Bay
Windy Point Sawmill and Bobcat Service (Fred Ensign)	Craig
The Woodshed	Petersburg
Yakutat Supply	Yakutat

Source: Alaska DCCED 2018, TIM, Tongass National Forest Volume under Contract records

Environmental Consequences

Factors Affecting the Economics of Timber Offers

Many factors can influence the cost of timber harvest, adding economic risks for potential purchasers and affecting the ability of the Forest Service to offer timber sales. Road construction, helicopter yarding, complex silvicultural prescriptions, setting size and other factors may increase costs, which would then decrease the timber value for the offering. The value of the timber offered must be sufficient to cover costs and offer a percent of profit to purchasers. Because markets fluctuate, volume made available this project should allow the Forest Service to better respond to these conditions when preparing to offer timber sales. Also, the larger the timber sale volume available to offer, the better an operator can respond to market conditions to increase the volume they have under contract.

Project-specific Forest Plan Amendment

Acres harvested would not change with the amendment; however, more timber volume may be available because lowering scenic integrity objectives to very low would allow for more even-aged harvest and larger unit sizes which increase logging efficiency and reduce costs. Without the amendment, the analysis assumed partial harvest would be required for more acres to meet current 2016 Forest Plan SIOs and helicopter logging would be necessary to reduce the damage to the residual trees. Helicopter logging makes uneven-aged harvest more costly by about $159/MBF compared to conventional logging systems. Helicopter logging also requires enough volume for the mobilization of a helicopter of sufficient size for logging. This may limit the potential purchasers to those with more capital.

Logging Costs – Stump to truck includes falling and bucking

Of the potential logging systems proposed, helicopter logging is the most expensive. The analysis of logging costs was done using the Financial Analysis Spreadsheet Tool – Residual Value (FASTR) for the South Revilla project area. The estimated average helicopter logging cost of $404 per MBF was for old-growth timber. It is assumed no helicopter yarding would occur in young growth. Shovel and cable logging are both considered conventional logging systems for even-aged management. An average cost of $332 per MBF is predicted for cable systems in old growth. An average cost of $167 per MBF was estimated for shovel systems in old growth. In young growth, the costs for cable and shovel yarding are estimated to be $257 per MBF for cable and $148 per MBF for ground-based systems.

Table 13. Proposed acres of timber harvest by logging system

Logging System	Unit of Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Shovel	Young Growth Acres	0	776	651	776
Cable	Young Growth Acres	0	311	259	311
	Total Acres	0	1087	910	1087
Shovel	Old Growth Acres	0	2092	1894	2114
Cable	Old Growth Acres	0	1937	1562	1474
	Total Conventional Logging Acres	0	4029	3456	3588
Helicopter	Old Growth Acres	0	1086	954	1526
	Total Old Growth Acres	0	5115	4411	5115
	Total Acres		6202	5320	6202

The increased cost of applying partial harvest silvicultural systems was considered to avoid damaging the residual trees from logging activity. For some units, shovel logging and even with uphill cable logging depending on the terrain can be used for uneven-aged management, to compare the alternatives prior to identifying the logging systems for the harvest units, all uneven-aged management units for old growth were considered logged by helicopter, and therefore, the increased costs of doing partial harvest is factored into the cost of helicopter logging old growth.

Road Costs

National Forest Service road construction, and maintenance involve substantial costs and strongly affect timber sale economics. By using the most cost-effective transportation system while maintaining the appropriate design standards to meet resource requirements, these costs can be reduced. These costs are described in the transportation section of this DEIS.

Temporary roads are considered part of the harvest unit. These roads are shown on the unit card maps and the alternative maps. The final location is determined at the time of harvest and often changes from the planned design. The costs of constructing these roads is in the transportation section. After timber harvest, these roads are decommissioned usually by the purchaser. At that time post-haul maintenance is done on the NFS roads to keep them at the objective maintenance level. See table 65 in the transportation section of Chapter 3 for estimated storage cost by alternative.

Haul Costs

Haul costs used in the analysis presented in this document are based on truck haul and water tow to Viking Lumber near Klawock, AK and to the Lewis Reef export site. In addition, a cost of $500,000 is needed to reconstruct the Shelter Cove LTF.

Truck Haul Costs

Truck haul to the Shelter Cove Log Transfer Facility or Shoal Cove Log Transfer Facility, would also be needed with water tow costs to mills in other locations. Hauling to Ketchikan on the newly constructed State of Alaska Ketchikan to Shelter Cove Road was considered. This road is not yet open for public use. Currently, there is not a log transfer facility in the city of Ketchikan that could handle the logs for shipping to an Alaska sawmill or for export. Leask Cove, on non-NFS lands, is also a possible export point. Final determination of both the mill location and/or export point is determined after the contract is awarded. Export is done at the request of the purchaser and not required.

Log Tow Costs

Log towing occurs from the log transfer facility located in the project area to a mill that can process this amount of volume or to a designated export point for that timber appraised for export may include the use of barge and or raft. For alternative comparison, all volume is considered harvested in one entry. In actuality, multiple sales may be offered. For this analysis, it was assumed all domestically processed logs would be rafted to the closest mill, Viking Lumber in Klawock, 233 miles since rafting is less expensive for long distance. For shorter distances, barging is more economic and this analysis assumed exported timber would be barged to Lewis Reef on Gravina Island across the Tongass Narrows from Ketchikan, Alaska, 30 miles away. Part of the old-growth volume (34 to 39 MMBF) is appraised to Klawock, AK, the location of the sawmill that can handle that amount of volume and part to Lewis Reef for export (26 to 30 MMBF). All young-growth volume is destined to Lewis Reef for export since the sawmill in Klawock is not designed to handle young-growth. See figure 29 for these tow routes.

Table 14. Log tow costs

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Total Rafting and Barging Costs	$0	$6,500 k	$5,538 k	$6,208 k
Rafting or Barging Costs $/MBF	$0	$70.44	$70.48	$70.39

Source: FASTR v6222020 LogCost Calc. 06292020

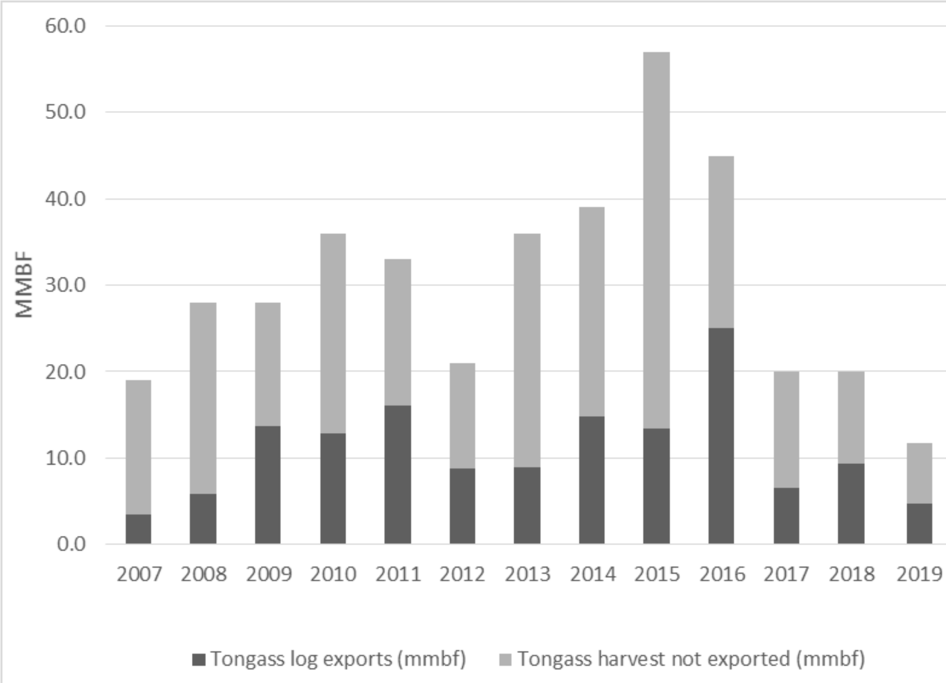
Estimated Employment and Income

Direct employment and income likely to result from timber harvest is estimated by converting board feet to jobs and income. The amount of timber volume and type of timber volume (old growth verses young growth) would have an effect on employment as shown in table 15, which displays the estimated direct employment that would result from volume if timber sales were offered from this project. The direct employment and income displayed assume the total maximum design criteria of potential volume for each alternative would be harvested, thus reflecting the totals for the 15-year timeline.

Table 15 displays estimated direct logging, transportation, and sawmilling-related employment and income based on old-growth volume. The number of jobs supported and related income shown in table 15 reflect the difference in for a higher market with more domestic processing as compared to a lower market with more export based on the Limited Export policy for a relative comparison of the alternatives. The market scenarios are based partly on cost collection data and an analysis of the current trends from 2014 through 2017 (Petaisto 2019). No analysis was done for 100 percent domestic processing except for western redcedar. Although some domestic processing may occur, the smaller, lower value hemlock and Sitka spruce are considered exported. The analysis of number of jobs supported used the jobs per MBF coefficients from the Daniels 2019 report and does not represent actual jobs.

Young-growth volume is assumed to be 100 percent exported because there is currently no established market for domestically sawn young-growth harvest. This was assumed true for the life of this project since the estimated amount of young-growth available on the Tongass in the next 15 years would not be enough to warrant the construction of a mill especially designed to handle young-growth logs. Recent young-growth contracts with domestic processing have not been fully successful for the purchasers due to a lack of local markets for sawn young-growth. Contracts where export of young-growth was allowed have been more successful for purchasers. Past log export and interstate shipments are reported annually on the public website: http://www.fs.usda.gov/detail/r10/landmanagement/resourcemanagement/?cid=fsbdev2_038785.

Figure 14 shows the total volume of timber harvested from the Tongass and the volume exported as logs to demonstrate the variation in the proportion of exports over time. This includes both international and domestic exports to the lower 48. Except for 2016, the majority of timber harvested from the Tongass has not been exported in log form and remained in-state for processing. Timber harvest data were collected from the cut and sold reports that are also available on the Forest Management Reports and Accomplishments page on the Alaska Region website. While this shows past export volume, it gives no indication or trend in the amount of volume that may be exported in the future.



Year	Tongass log export volume (%)	Tongass harvest not exported (%)
2007	18	82
2008	21	79
2009	49	51
2010	36	64
2011	49	51
2012	42	58
2013	25	75
2014	38	62
2015	24	76
2016	56	44
2017	33	67
2018	47	53
2019	41	59

Figure 14. Tongass National Forest timber harvest volume and proportion of harvest exported in round log form, 2007-2019

The jobs per MBF are based on annualized employment data from sawmill surveys and the Alaska Department of Labor. Annualized jobs are considered all the Alaska jobs (excluding indirect jobs) supported by offered timber volume. Actual annualized jobs may vary by timber sale purchaser and specific business practices. Total jobs supported depends on the amount of volume offered from sales that appraise positive at time of advertisement. In other words, deficit value timber sales cannot be offered under current law and would support “zero jobs”.

Alternative 1 would not support timber harvest-related jobs since no timber would be offered. The action alternatives would have indirect impacts to the economies of the local communities. Alternatives 2, 3, and 4 could offer a mix of timber sale sizes and material to help support the regional industry. This may change as less old-growth is offered over the next 15-year period and limited young-growth markets make it difficult to appraise positive offers. This reduction in the amount of old-growth offered under the action alternatives may cause the last remaining mid-sized sawmill in the region to reduce its number of employees or the length of time of operation, such as closing for part of the year. This may cause some employees to seek work elsewhere.

Predicted jobs from young-growth harvest may increase over the next 15 years as young-growth timber grows larger and is more likely to provide economic timber sales. Currently all young-growth timber and smaller diameter old-growth spruce and hemlock timber is mostly appraised for export. Although log export does not provide sawmilling jobs, it does result in other jobs supported such as stevedoring for export ships which helps provide a diversity of employment opportunities.

Table 15. Annualized timber industry and associated jobs supported by alternative for old growth and young-growth timber all species

	Alt 1	Alternative 2		Alternative 3		Alternative 4	
Projected Alaskan employment income	**No action**	**Maximum Alaska manufacturing[1]**	**100% hemlock export[2]**	**Maximum Alaska manufacturing[1]**	**100% hemlock export[2]**	**Maximum Alaska manufacturing[1]**	**100% hemlock export[2]**
Local jobs related to logging	0	211	211	183	183	205	205
Local jobs related to sawmill and export mfg.	0	63	42	54	37	61	41
Transportation and other services related to Alaska domestic manufacturing	0	18	12	16	11	18	12
Transportation and other services related to export	0	62	73	54	63	60	71
Total jobs	0	354	338	307	293	344	328

1 Represents a high market condition which encourages Alaska manufacturing of old-growth hemlock 20+ inches at small end diameter, old-growth Sitka spruce 18+ inches at small end diameter and all western redcedar. Export of old-growth hemlock less than 20 inches at small end diameter, old-growth Sitka spruce less than 18 inches at small end diameter, all Alaska yellow-cedar and all young growth timber is exported outside Alaska.

2 Represents a lower market condition where more export is expected - 100 percent of old-growth hemlock, old-growth Sitka spruce less than 18 inches at small end diameter, all Alaska yellow-cedar and all young-growth timber is exported. Alaska manufacturing of old-growth Sitka spruce 18+ inches at small end diameter and all western redcedar.

Forest Service Costs

Average Forest Service costs have been derived from the Alaska Region’s budget allocations over five years. These include costs for environmental analysis and documentation (NEPA), sale preparation, sale administration and engineering support. Table 16 summarizes the estimated administrative expenditures associated with the project. Forest Service administrative costs play no part in the calculation of appraised value.

An average cost of $56/MBF for sale planning includes inventory, environmental analysis and documentation (NEPA) is based on the proposed action. This cost of $5,109,625 is considered “sunk” since it has already been allocated to be spent or spent and is the same for all alternatives including the no-action alternative. Sale preparation costs include unit layout, cruising, appraisal, and contract development. Sale administration consists of administering the timber sale contract from the time the sale is awarded until the sale is completed. Costs are associated with field inspection, office documentation, timber sale accounting, and discussion with contractors.

Average Forest Service costs are $56/MBF for projected sale preparation cost and $37/MBF for projected sale administration cost. Engineering support of 22 percent is included in these costs. (Petaisto 2020).

Sale preparation and administration costs increase significantly when implementing and administrating partial-harvest (single-tree or group-selection) units, as compared to clearcut units. Accessibility to the units is another major cost factor. All of these factors could cause the cost estimates in table 16 to be higher or lower than regional averages.

Table 16. Estimated Forest Service costs

Forest Service Costs	Alt 1	Alt 2	Alt 3	Alt 4
Sale preparation	$0	$5,127 k	$4,439 k	$4,978 k
Sale administration	$0	$3,359 k	$2,908 k	$3,262 k
Total project costs	$0	$8,486 k	$7,348 k	$8,240 k

Source: FASTR, June 2020

Alternative 1 – No Action

Direct and Indirect Effects

No timber would be offered from South Revilla project under this alternative. This would affect the amount of timber available for purchasers involved in timber industry within the project area and other parts of Southeast Alaska. These effects may indirectly affect the communities on Prince of Wales and Ketchikan, Kake, Wrangell and Petersburg that benefit from timber industry employment. If their livelihood decreases this may result in less expenditures on community goods and resources. However, at this scale, these expenditures cannot be estimated (Alexander 2012).

Cumulative Effects

Under this alternative, no timber would be offered from this project to add to the supply of timber for offer in Southeast Alaska, and therefore less volume available to offer. Potential purchasers would have to rely on timber from other landowners or from other Forest Service projects.

Direct and Indirect Effects Common to all Action Alternatives

All action alternatives will provide relatively the same amounts of timber. The largest distinguishing factor determining timber harvest costs for alternatives is the use of helicopter logging for partial harvest units to achieve other than timber production objectives. All alternatives may require full camp costs due to the distance of the project area from nearby towns.

The size of both old-growth and young-growth timber offerings would be determined during implementation. It is anticipated that potential timber offerings from this project would be offered in variety of sizes to meet market conditions and industry demand for the 15-year project timeline. Individual sales offered may be exclusively old-growth or young-growth timber, or a combination of the two.

Alternative 2 – Proposed Action

Direct and Indirect Effects - Alternative 2

This alternative would supply the most volume of timber (estimated 91.6 MMBF net sawlog) and direct annualized jobs (338 to 354) to meet the purpose and need for this project relative to the other action alternatives. This alternative has a negative indicated advertised rate ($94.60) to ($48.85) per MBF net sawlog) dependent on the amount of hemlock exported. This amount is usually dependent on the available market and purchaser export request.

This alternative has the lowest percentage (21.2 percent) of old-growth harvest acres using the most expensive yarding system, helicopter, at $404 per MBF net sawlog for partial harvesting.

Alternative 3

Direct and Indirect Effects - Alternative 3

This alternative was designed to mitigate some of the effects to wildlife habitat by eliminating or reducing the size of 38 units from the proposed action. This would maintain wildlife corridors and deer winter habitat.

This alternative would supply the least volume of timber (an estimated 78.5 MMBF net sawlog) and direct annualized jobs (290 to 304) to meet the purpose and need for this project. This alternative has the lowest negative indicated advertised rate ($104.09) to $($58.23) per MBF net sawlog dependent on the amount of hemlock exported relative to the other action alternatives.

This alternative has 21.6 percent of old-growth unit acres utilizing the most expensive yarding system, helicopter ($409 per MBF net sawlog) for partial harvesting. In proportion to total volume, this alternative would have the highest road cost per net MBF and constructs the second-most miles of new roads for all action alternatives.

Alternative 4

Direct and Indirect Effects - Alternative 4

This alternative was designed to meet the current Forest Plan SIOs. More units needed to use helicopter yarding uneven-aged management in old-growth areas to achieve these SIOs (table 17).

Table 17. South Revilla project acres and percentages by logging method to achieve proposed SIOs

Alt.	Conventional Logging Methods[1/] (acres)	Helicopter Logging (acres)	Helicopter Harvest (percent of total harvest)	Forest Plan Amendment (Yes or No)
1	0	0	0%	No
2	4029	1086	21.2%	Yes
3	3457	954	21.6%	Yes
4	4675	1526	29.8%	No

Source: USFS Tongass National Forest GIS
1/ Includes clearcut method.

This alternative would supply slightly less volume of timber (about 88.2 MMBF net sawlog) and direct annualized jobs (325 to 341) to meet the purpose and need for this project than the proposed action. This alternative has the best negative indicated advertised rate (($89.71) to ($44.41) per MBF net sawlog) depending on the amount of hemlock exported relative to the other action alternatives.

This alternative has the highest (29.8 percent) old-growth timber unit acreage using the most expensive yarding system, helicopter ($400 per MBF net sawlog) for partial harvesting. This may limit timber offers to larger operators who can afford moving a helicopter crew on site and reduce the opportunities for small sales. In addition it reduces the number of acres for future young-growth management. In proportion to total volume, this alternative exhibits the highest road cost per net MBF and constructs the second-most miles of new roads for all action alternatives.

A comparison of the effects of project activities on timber sale economics is provided in table 18.

Table 18. Alternative comparison of the measures on timber supply and timber sale economics

Measure	Alt 1	Alt 2	Alt 3	Alt 4
Estimated Timber Offered - Timber Volume by Species				
Sitka Spruce Volume (MBF) - Old-growth	0	10,463	9109	10,159
Sitka Spruce Volume (MBF) - young-growth		15,352	13,063	14,908
Hemlock Volume (MBF) – Old-growth	0	41,155	35,831	39,958
Hemlock Volume (MBF) – Young-growth	0	6,579	5,598	6,389
Western Redcedar Volume (MBF) - Old-growth	0	13,253	11,539	12,868
Yellow-cedar Volume (MBF)	0	4,883	4,251	4,740
Total Net Volume (MBF)	0	91,685	79,391	89,022
Silviculture Prescription (acres) for Old-growth				
Even-aged Management	0	4011	3456	3419
Two-aged Management	0	99	5	87
Uneven Aged Management	0	1005	949	1609
Total Acres	0	5115	4411	5115
Silviculture Prescription (acres) for Young-growth				
Even-aged Management	0	745	601	749
Two-aged Management	0	277	264	279
Uneven Aged Management	0	65	44	59
Total Acres	0	1087	910	1087
Logging Systems (Acres) for Old-growth				
Cable	0	1937	1562	1474
Shovel	0	2092	1894	2114
Helicopter	0	1086	954	1526
Total Acres	0	5115	4411	5115
Logging Systems (Acres) for young-growth				
Cable	0	311	259	311
Shovel	0	776	651	776
Total Acres	0	1087	910	1087
Costs				
Logging Cost ($/ net MBF) Stump to Truck	$0	$247.67	$245.46	$246.59
Stump to Mill cost [1] ($/net MBF)	0	$496.11	$505.73	$490.03

Measure	Alt 1	Alt 2	Alt 3	Alt 4
NFS Road Construction/Reconstruction Cost ($/net MBF)	0	$54.15	$58.27	$53.47
Indicated Advertised Rate High market [2, 4, 5] $/MBF	0	$(94.60)	$(104.09)	$(89.71)
Indicated Advertised Rate Low market [3, 4, 5] $/MBF	0	$(48.85)	$(58.23)	$(44.41)
Jobs Supported				
Total Jobs Estimated High market [2, 4] (includes export and domestic processing)	0	354	307	344
Total Jobs Estimated Low market [3, 4] 100% hemlock export	0	338	293	328

Source: FASTR v62220

1 – Stump to mill costs includes cost of specified road construction and costs of opening closed NFS roads for timber haul .

2 - Represents a high market condition with maximum Alaska manufacturing of larger old-growth hemlock 20+ inches at small end diameter, old-growth Sitka spruce 18+ inches at small end diameter and all western redcedar. All Alaska yellow-cedar is exported outside Alaska.

3 - Represents a lower market condition with 100 percent of hemlock and all Alaska yellow-cedar exported. Alaska manufacturing of old-growth Sitka spruce 18+ inches at small end diameter and all western redcedar

4 – Indicated Advertised Rate: Pond Log Value minus stump to truck costs and other associated costs (camp, lodging, Profit and Risk margin, etc.).

5- Includes a Profit and Risk of 14.53 percent for the purchaser

6 - ( ) indicates a negative value. Only positive appraised contracts can currently be offered.

Cumulative Effects Common to all Action Alternatives

Past timber sales have contributed to the development of the existing roaded infrastructure that would be used for both action alternatives. Timber harvest has occurred in the project area for more than 70 years. Industrial-scale logging activity began in the mid-1950s. These harvest units have regenerated into young-growth stands some of which now form the young-growth timber component of this project.

Remaining volume under Forest Service contracts, not including settlement sales, was 52 MMBF as of June 2020. A list of these contracts is on the Alaska Region public website under Land and Resource Management, Resource Management, https://www.fs.usda.gov/detail/r10/landmanagement/resourcemanagement/?cid=fsbdev2_038785 and is updated monthly. While there are other sources of timber volume currently available both on NFS and non-NFS lands, the South Revilla Project is one part of the Forest Service's plan to meet the goals of the Forest Plan (cite, p. 2-5) and provide an orderly flow of timber to the local and regional industry. The objective is to provide a two- to three-year supply to those mills. Sawmill employment in Southeast Alaska has historically been supported by Forest Service timber sales, with a smaller contribution from state timber harvest (USDA Forest Service 2012b). Much of the timber from non-NFS lands is exported. Since most sawmills within the project area rely on old-growth timber, the timber from this project is considered necessary to maintain these mills and the jobs skills needed to transition to a young-growth management program.

Reasonably foreseeable timber management projects within southern Southeast Alaska, identified for the cumulative effects analysis, are summarized in Appendix C, Interrelated projects, of this document. Future projects include 7.4 MMBF of old-growth timber from the Wrangell Island project, 23 MMBF from Kuiu Timber Area Project, 25 MMBF from the Central Kupreanof Timber Harvest, and 3 MMBF of remaining old-growth timber from the Navy Timber Sale; 15 MMBF of old-growth and 15 MMBF of young growth from the Big Thorne Project. Small sales, generally less than 1 MMBF, as well as micro-sales, which consist of dead or down and limited to 50 MBF or less, from the decisions on Brown Mountain Fuelwood CE, Wrangell Roadside EA, the Central Kupreanof EIS, Mitkof Microsale CE and Mitkof Island Commercial Firewood and Individual Tree Sales CE are expected to harvest less than 4 MMBF of old-growth over the next 15 years. The proposed Central Tongass project would supply approximately 65 MMBF of old-growth timber and 32 MMBF of young-growth on Mitkof Island, Zarembo Island, Wrangell Island and Thomas Bay on the mainland.

The current estimate for Alaska Native Corporation lands in Southeast Alaska is 304 MMBF of old-growth timber and 10 MMBF of young-growth timber for the next 5 years. Volume from native lands is generally exported overseas and does not contribute to local sawmilling-related employment.

The volume from the State of Alaska may be less given their budget uncertainties but an estimated 9 MMBF of old-growth and 15 MMBF of young-growth harvest may occur based on their predictions for the next 5 years. On NFS lands and State of Alaska lands on Gravina Island, Ketchikan-Misty Fjords Ranger District, a Good Neighbor Authority sale is under contract. The young growth proposed for harvest is primarily Sitka Spruce, western hemlock and red alder containing approximately 9,569 MBF of timber; 2,729 MBF. The old growth proposed for harvest is approximately 5,615 MBF. Another 982 MBF of small log and utility wood is estimated in the harvest units for a total of 16,166 MBF. The University of Alaska Trust offered timber for sale timber 1308 acres on Gravina Island in 2017. Additional old-growth timber volume on the Alaska Mental Health Trust Lands, should the whole tract be exchanged, would be available on an estimated 4,031acres. Whether this exchange will occur is uncertain and what timber harvest would occur is speculative at this time. If the exchange does occur, then there would be less timber from the South Revilla project, approximately 7.9 MMBF for Alternative 2 and 7.5 MMBF for Alternatives 3 and 4.

These future sources may contribute to meeting the planning cycle demand for Southeast Alaska. However, not all these sources may happen due to the availability of funds, personnel, litigation or other reasons. Therefore, this project contributes to the certainty of meeting the market demand as described in the decision for the 2016 Forest Plan.

In the absence of a multiple-year stable supply of economic timber of the desired type and species from this project or elsewhere, the future of existing mill operators could be negatively affected. Closure of one or more mills could result in a further reduction in jobs in the logging and sawmilling industries and could also affect regional businesses that provide goods and services to these industries.

Issue 2: Wildlife Habitat and Subsistence

Proposed timber harvest and road construction, combined with past management activities, could affect the quantity and quality of habitat and habitat connectivity for deer and other wildlife and could affect subsistence use.

Public and agency comments, as well as internal scoping, expressed concerns about project effects on wildlife, wildlife habitat, old-growth connectivity, and subsistence use in the project area. Of special concern are project effects on deer because of their importance to wolves and subsistence users. The project area includes low-elevation (less than 1,500 feet), old-growth habitat important for old-growth dependent wildlife species. Removing old-growth habitat fragments wildlife habitat and leads to a loss of old-growth connectivity important to dependent species including goshawk, deer, wolf, bear, marten and other species.

Because of its proximity to the residents of Ketchikan and Saxman, the South Revilla project area is considered an important deer hunting area for these communities. The cumulative effects on old-growth habitat associated with additional harvest, combined with past harvest, and increasing accessibility and road density were noted concerns.

Wildlife Habitat

Methodology

Spatial Scale:

The various species in this analysis use vastly different geographic areas for their daily and seasonal activities, have varying degrees of mobility, varying ability to cross water, and may have differential habitat thresholds at different scales. Therefore, the spatial scale at which effects to any species or resource are assessed varies and is discussed in detail in the analysis for that species. Direct and indirect effects are assessed on National Forest System (NFS) land only, while cumulative effects consider both NFS land and non-NFS. The Mexico Distinct Population Segment (DPS) humpback whale and the western DPS of the Steller sea lion will also be analyzed in marine waters along likely log raft/barge routes. Spatial scales used for wildlife analysis:

- **Game Management Unit (GMU)-**. The project area is within GMU 1A, which includes Revilla Island, adjacent islands, the southern half of the Cleveland Peninsula, and the adjacent mainland all the way to the Canada border.
- **Biogeographic Province**- The project area is within the Revilla Island/Cleveland Peninsula Biogeographic Province.
- **Wildlife Analyses Area (WAA)-** Wildlife Analysis Areas (WAA) 405 (Thorne Arm area), 406 (Carrol Inlet area), and 407 (George Inlet area) are part of the project area.
- **Value Comparison Unit (VCU)-** Portions of Value Comparison Units (VCU) 7460, 7470, 7530, 7542, and 7560 are within the project area.

Temporal Scale:

The temporal scale is the time (into the past and into the future) for which effects are considered. The Project has been designed to be implemented over the next 10 to 15 years.

The time period for long-term effects to wildlife resources extends 160 to 200 years or more into the future, to account for time for old-growth conditions to redevelop where clearcut harvest may occur in old-growth. In clearcut areas, after the stand initiation and stem exclusion phases, the understory begins to develop substantially again when they reach the age of 140 to 160 years (Alaback 1982). Depending on the productivity of the particular site, it could take many more years of additional time for a decadent stand structure to develop, particularly for some of the largest trees in the stand to begin to die and become large snags for cavity nesting species, and to eventually fall onto the forest floor as the large woody debris that is a crucial characteristic of old-growth habitat conditions.

Table 19. Species considered in this analysis, brief summary of habitat associations, potential for occurrence in the project area, and project level indicators or potential for project impacts

Species	Status	Distribution and habitat association	Potential for occurrence in or near the project area	Project level indicators
Humpback Whale Mexico DPS	Threatened	Associates with marine habitat	Occurs throughout the project area in marine waters 2.1 percent probability of any whale being Mexico DPS (Wade 2016).	Log Transfer Facility reconstruction, Sound disturbance from rock quarries, barge routes from log transfer facilities
Steller Sea Lion Western DPS	Endangered	Associates with marine habitat	Occurs along barge routes North of Sumner Strait	Barge routes from log transfer facilities
Queen Charlotte Goshawk	R10 Sensitive Species	Associated with late seral coniferous forests with multi-storied dense canopy.	Occurs throughout the project area.	Acres of High POG below 1000 ft.
Alexander Archipelago wolf (*Canis lupus ligoni*)	MIS	Habitat generalist, POG provides habitat for prey. Deer are the primary prey of wolves in Southeast Alaska, and the significance of predator/prey interactions on wolf populations leads to the conclusion that wolf persistence is directly linked to deer habitat capability. Can be susceptible to overharvest by humans.	Occurs throughout project area with deer as primary prey.	Deer habitat capability and road density.
American marten (*Martes americana*)	MIS	Associated with late seral coniferous forest with multi-storied dense canopy and high density of snags and logs, and closer to coastal and riparian areas.	American marten occurs throughout the project area.	Acres of high-POG ≤800 feet elevation (deep snow winter habitat. Road density
Black bear (*Ursus americanus*)	MIS	Bears use habitats from sea level to the alpine but appear to prefer estuarine, riparian, and forested coastal habitats. Use includes small openings, and areas such as wetlands, young clearcuts, and subalpine meadows for foraging. Brown bears are generally more associated with productive anadromous fish habitat, and large unroaded areas with availability of summer alpine habitat.	Black bears are common throughout the project area.	Denning habitat - acres of POG. Foraging - POG within 500 feet of anadromous fish streams.

Species	Status	Distribution and habitat association	Potential for occurrence in or near the project area	Project level indicators
Sitka black-tailed deer (*Odocoileus hemionus sitkensis*)	MIS	The quantity, quality, distribution and arrangement of winter habitat are considered the most important limiting factors. However, spring, summer, and fall habitats (non-winter) are also important for deer reproduction and population recovery following severe winters, and for building up pre-winter body reserves.	Common throughout the project area. Low elevation POG that intercepts snow and provides forage and cover during severe winters with high snow accumulation is the most limiting habitat type; high volume POG below 800 feet elevation and on south facing slopes is the most valuable.	Deep snow winter habitat (High POG below 800 feet elevation, south facing slopes) deer habitat capability outputs from the interagency deer model. Elevational habitat connectivity.
Bald eagle (*Haliaeetus leucocephalus*)	Bald and Golden Eagle Protection Act MIS	Eagle nesting habitat is primarily old-growth trees along the coast and within riparian areas.	Common throughout the project area. Over 90 percent of the known nests on the Tongass are within 500 feet of the saltwater beach (1997 Forest Plan FEIS, p. 3-363).	Blasting at rock quarries, helicopter use, or use of explosives near nests.
Migratory forest birds	Migratory Bird Treaty Act	All habitats in project area.	Numerous migratory birds occur throughout the project area.	Old growth habitat loss and disturbance for some species.
Subsistence				Changes in abundance, distribution, access, and competition for deer

Defining Levels of Influence and Determination of Effects

No impact: The action would have no effect to individuals or population.

Negligible: The action would affect individuals, but the change would be so small that it would not be of any measurable or perceptible consequence to the individuals or populations.

Minor: Individuals would be affected but the change would be small. Impacts would not be expected to have any long-term effects on species or their habitats, or the natural processes sustaining them. Occasional responses to disturbance by some individuals could be expected, but without interference to reproduction, or other factors affecting population levels. Minor effect would equate with a “not likely to adversely affect" determination for threatened and endangered species and the "may impact individuals but not likely to cause a trend to federal listing or a loss of viability" determination for sensitive species.

Moderate: Individuals would be noticeably affected. The effect could have some long-term consequence to individuals or habitat. Breeding animals of concern are present; animals are present during particularly vulnerable life-stages, such as migration or juvenile states; or interference with activities necessary for survival can be expected on an occasional basis. Frequent response to disturbance by some individuals could be expected, with some negative impacts to feeding, reproduction, or other factors affecting short-term population levels. Moderate effect can equate with a “likely to adversely affect” determination for threatened and endangered species and the "may impact individuals but not likely to cause a trend to federal listing or a loss of viability" determination for sensitive species.

Major: Populations would be affected with a long-term, vital consequence to the individuals, populations, or habitat. Impacts on species, their habitats, or the natural processes sustaining them would be detectable. Population numbers, population structure, genetic variability, and other demographic factors for species might have large, short-term declines with long-term population numbers significantly depressed. Frequent responses to disturbance by some individuals would be expected, with negative impacts to feeding, reproduction, or other factors resulting in a long-term decrease in population levels. Major effect would equate with a “likely to adversely affect” determination for threatened and endangered species and the "likely to result in a trend to federal listing or a loss of viability" determination for sensitive species.

Assumptions

All applicable Forest Plan direction, Project Design Features, and other direction from law, regulation, or policy, will be followed during implementation. Where these measures mitigate the effects to any particular resource, it is discussed as a component of the effects analysis for that particular resource.

It is assumed any roads that are built, whether they are temporary or will be maintained as open roads, will facilitate access in relation to effects to wildlife. The facilitation of human access is especially pertinent for species that are prone to overharvest by humans.

Under current Forest Plan scenarios, the gradual decline in old-growth habitat from timber harvest and road construction may be considered an irreversible commitment (USDA Forest Service 2016c FEIS pg. 3-2) or a non-renewable resource (Cotter 2007). Most wildlife species within the project area are associated with old-growth forest stand conditions, and timber harvest on a 100 year rotation would result in stands being re-harvested before they return to fully functioning old growth condition.

The interagency deer model was run to provide a comparison of average winter habitat capability under the various alternative scenarios. The deer model was run with the following parameters for direct and indirect effects (Brainard and Stangl 2007 and Logan 2011):

- Model was run by the GIS analyst and interpreted by project biologist.
- Corporate GIS layers were used.
- Size density model (SDM) was used for vegetation.
- Only NFS lands in WAAs 405, 406, and 407 were used for direct effects.
- Standardized coefficients of 0.0 to 1.0 were used (2008 Forest Plan Amendment FEIS, p. 3-266).
- 100 deer/mi^2 multiplier applies to HSI = 1.0.
- Only even -aged management was considered for the model and no modifications were made to the model results to account for uneven-aged management Model was run for historic (1954), existing, initial implementation at 2020, and stem exclusion (26+ year) conditions.
- All elevations were used when calculating deer density.
- Freshwater lakes were excluded from calculations.

Limitations of the Analysis

The terms "habitat capability" and "population" are not interchangeable. Habitat capability is synonymous with carrying capacity or the maximum number of animals the habitat can support during a typical year, whereas the population is the number of animals actually present at a given time. The current deer model uses habitat capability values to estimate changes that result from timber harvest and do not reflect actual known deer numbers. Populations may temporarily exceed habitat capability (e.g.: due to a series of mild winters). However, most populations are usually below what the habitat is capable of producing due to predation, winter mortality, or other ecological factors.

When old-growth habitat is harvested, the habitat capability for old-growth associated species declines. If the population is near carrying capacity, the population will also decline. If the population is below carrying capacity, habitat modification through timber harvest may not have immediate effects on the population. However, the potential for the population to recover following a decline (e.g., caused by severe winters, predation, or disease) may be reduced where timber harvest has occurred.

Ecological relationships between wildlife and their habitats are very complex and many times the limiting factors for a species, population, or individuals are not known or can only be inferred from limited information. Predator-prey relationships are often cyclical and compound the complexity, along with natural environmental cycles. Analyses cannot exactly mirror natural relationships. Suitable habitat and population trends are interpreted with caution using the best available information.

As with many species and geographic areas, a limiting factor for this analysis is the available information, particularly that specific to Southeast Alaska species and their habitat requirements and interactions. Unless local information regarding a species of habitat exists within the project area, studies of habitat use in other areas of Southeast Alaska, or other geographic areas, are used to provide information to estimate or infer habitat use within the proposed project area and to inform the analysis of effects. Existing peer-reviewed literature was used when possible.

The Tongass Forest Plan was developed under the 1982 NFMA planning rule and as such has some limitations; one of those is that the Management Indicator Species concept is not universally accepted. The ability of selected Management Indicator Species and their associated habitat conditions to adequately represent all other vertebrates that utilize similar habitats may not fit for all circumstances, and our overall knowledge of Management Indicator Species is limited.

Local population trend information is generally not available; general trends for Southeast Alaska are included where available. Given the data limitations, actual populations may vary considerably from those predicted by this analysis. However, the procedures provide the best available estimate of general population effects in response to habitat change that are available at the present time.

Existing Condition

Project Area

The area is a mix of old growth, previously harvested areas, forested muskeg, and open muskeg. There are also small wetlands, estuaries, and riparian areas throughout the project area. There are freshwater streams including numerous streams with anadromous fish, and freshwater lakes including larger lakes such as the saddles lakes. Parts of the project area have extensive low-lying muskeg complexes, especially the southeast end of the project area, The elevation ranges from sea level up to about 2200 feet, with the higher elevations at the northeast end of the project area. On the west side of Carrol Inlet, the ridges are at varying orientations, and the closest high alpine habitat is about 2.5 miles to the north of the project area. On the east side of Carrol Inlet, the ridges are generally at an east to west orientation connecting to the high alpine habitat north east of the project areas.

Old Growth Habitat

The oldest harvests on the Tongass tended to be on the higher productivity sites at lower elevations, adjacent to the beach and within floodplain riparian areas where large Sitka spruce were available and abundant. POG forest stands, particularly low elevation stands and high value deer winter habitat (High-POG below 800 feet and south facing slopes), have been affected the most by human modification through timber harvest (USDA Forest Service 2016c, p. 3-189 to 3-192). The following seven POG types have been defined which illustrate the progression between the volume strata approach and the SDM (USDA Forest Service 2016c, p.3-191).

Table 20. Categories of habitat

Habitat	Size Density Map Classes
POG	SD4H, SD4N, SD4S, SD5H, SD5N, SD5S, SD67
High-POG	SD5N, SD5S, SD67
Medium POG	SD4N, SD4S, SD5H
Low-POG	SD4H
Forested muskeg	FM
Non-forested	NF
All young growth	HS1, HS2, HS3, S1, S2, S3

Past Activities

Timber harvest has been the primary land use activity throughout the area, but mostly along the shorelines and the few road systems that exist. Timber harvest dates to as early as the 1920s, but most timber harvest didn’t occur until after 1954. The harvest on Revillagigedo Island has mostly occurred along the southern and western sides of the island, while much of the eastern side has had little past harvest because of its ruggedness, steepness, and congressional designation as wilderness in 1980 (figure 4). Most of the mainland surrounding Revillagigedo Island is in natural condition, as well as Duke and Mary Islands.

Surveys and Site Visits

Field visits have previously occurred from numerous past project planning efforts including Saddle Lakes EIS, Sea Level EIS, and Licking Creek EIS. Forest Service wildlife personnel have conducted recent field visits in 2018, 2019 and 2020 mostly for goshawk surveys. Goshawk surveys would be carried out for 2021 on any proposed units for a 2021 timber harvest offer below 1000 feet.

Environmental Consequences

The effects analysis assesses the direct, indirect and cumulative effects of the proposed action on wildlife resources in the analysis area. Table 19 shows the species that will be considered further in this analysis. Other species present in the analysis area were considered and found to have no impacts, negligible, discountable, or minor effects. The effects to those species are shown in the effects common to all species.

The effects analysis is based on information provided by forest staff, relevant references and technical literature, and subject matter experts. Technical reports from the published literature describing the most susceptible aspects of species life cycle and/or habitat needs were used as a guide. Quantitative and qualitative information was gathered regarding the presence and status of these species within the analysis area. Professionals were contacted on the Forest staff, Alaska Department of Fish and Game (ADFG), U.S. Fish and Wildlife Service (FWS), and the State Division of Natural Resources (DNR) as necessary for unpublished information and professional judgments regarding the status of species, habitats, special habitat features, and the Tongass Old-growth Habitat Conservation Stategy.

General criteria were developed to assess the intensity or level of influence of the effects. Where applicable, we defined mitigation measures to offset or minimize potential adverse impacts.

Effects common to all alternatives and species

Many of the project activities and supporting actions consist of the same or similar activity components (table 21). For example, many project activities include the use of heavy equipment, a few may involve the use of helicopters, a few involve the use of explosives, and vegetation management would involve habitat alteration on a measurable scale. The analysis is structured based on these specific components that could cause effects to wildlife. Alternatives 2 through 4 are the same for most activity types, differing only in the volume of commercial harvest of old-growth or young-growth.

Table 21. Project activities and components that could affect wildlife in the project area

Project Activity	Activity components that could affect wildlife
Stream and Floodplain Restoration	Use of heavy equipment and hand tools
	Use of helicopter
	Harvest of trees including root wad for instream placement
	Stream habitat improvement
Recreation Facility Construction, Reconstruction, Improvement, Decommissioning, and Maintenance	Construction of new facilities. Use of heavy equipment, small scale earth moving equipment, chainsaws, or other equipment.
	Decommissioning cabins and associated structures
Old-Growth Timber Harvest (Commercial)	Use of heavy equipment and yarding systems, including cable, tracked shovel, and helicopter
	Timber harvest resulting in a change in habitat type on a measurable scale
	Loading of logs at marine access facilities, and transportation of logs on marine waters and FS roads.
Young-Growth Timber Harvest (Commercial)	Use of heavy equipment and yarding systems, including cable, tracked shovel, and helicopter
	Timber harvest resulting in a change in habitat type on a measurable scale
	Loading of logs at marine access facilities, and transportation of logs on marine waters and FS roads.
Silvicultural Intermediate Treatments (Pre-commercial)	Use of chainsaws and other mechanical equipment by hand crews
	Thinning of forest stand (may include other treatments such as pruning, leave strips, gaps, etc.)
	Creation of slash on the forest floor

Project Activity	Activity components that could affect wildlife
NFS Road Construction	Use of heavy equipment and blasting
	Permanent increase in road density and public access
Temporary Road Construction	Use of heavy equipment
	Temporary increase in road density and public access (without physical closure, may provide longer term access)
Aquatic Organism Passage	Use of heavy equipment
	Use of explosives
	Improvement in aquatic ecosystem function
Marine Access Facility Reconstruction and Maintenance	Use of heavy equipment during construction and log transfer operations
	Construction of bulkheads and ramps
	Conversion of habitat (including log raft make-up areas, log storage areas, sort yards, and seafloor where logs are rafted)
	Increase in public access on land and use of boats in marine area
	Potential use of stored road (which is maintenance level 1) as motorized trail or illegal use by public
Quarry Development	Use of explosives
	Use of heavy equipment

Disturbance

Most activity components which would cause noise and/or human presence on land (such as use of ground-based heavy equipment or machinery, use of hand tools, management activities, human use of recreational developments, building or decommissioning roads, use of helicopter, use of explosives, construction activities, quarry development, use of log transfer facilities, etc.) could cause localized disturbance to varying degrees. Some species are more susceptible to disturbance, and especially during certain periods of the year such as during breeding, fawning, nesting, or denning. Raptors including goshawks and bald eagles can be especially prone to disturbance near their nests, especially during certain periods (nesting season) and when activities occur near active nests sites and if the individuals are not accustomed too or routinely exposed to disturbance factors. Some mammals such as bears, and wolves may avoid areas entirely if humans are present or could abandon their den sites due to disturbance. The largest potential for detrimental effects would occur during critical periods of the year within a species' preferred habitat, or where nesting is most likely to occur. For many species such as various smaller birds and some mammals, unless the activity was in the immediate vicinity of active nesting, denning, or other critical time periods (e.g., fawning), it would not be likely to cause consequential impacts, though individual behavior would likely be altered. The most likely behavior for many species would be avoidance of the immediate area for the period the disturbance factor is present. At some locations, such as at developed recreation sites, or in association with marine access facilities, a small level of disturbance would likely become a normal periodic occurrence throughout the life of the developed site. Depending on how often it occurs, and the timing (e.g., during nesting or during winter) and magnitude (e.g., relatively high or low numbers of people or noise) of the disturbance, it could cause some measure of long-term avoidance of the immediate area. However, because of the widely scattered nature of these types of disturbances across the project area, localized disturbances would not be consequential to the overall species' use or population in the project area.

Habitat Alteration

"Small-scale" alteration of habitat (e.g., which would occur with recreation site construction, removal or conversion of a developed facility, construction associated with a marine access facility that does not contain log transfer facilities, construction associated with trails, soil restoration, and sign installation), could slightly change the use of the habitat in the immediate area by various species, though it would be very unlikely to be consequential to individuals unless it occurred immediately where nesting, denning, or other important activity (e.g., fawning, roosting) occurs. Single tree selection or group selections (openings less than 2 acres), or construction associated with a log transfer facility, would have similar effects to small-scale alteration of habitat, though the magnitude and likelihood of effects to nesting or denning would be greater. Regardless, because of the size and distance between these small habitat alterations, localized changes would not be consequential to overall species' use or populations in the project area.

"Large-scale" alteration of habitat (e.g., commercial old-growth and young-growth timber harvest) will be analyzed under the individual species. Because the species analyzed here use habitat in different ways, large scale alteration of habitat focuses on the effects to each species' preferred habitat. For more information see the species sections below.

Habitat and Stream Management Activities

Vegetation treatments (e.g., precommercial thinning, riparian thinning, etc.) would promote tree growth, and therefore in the long term would improve habitat conditions for these species that prefer older forest types. A caveat, however, is that if the thinned stands reach merchantable size and occur within a development LUD they may be harvested again before any substantive benefits to these species is realized. Silvicultural intermediate treatments in old growth habitat LUD or other areas where the intent is to promote old-growth conditions, such as riparian management areas and beach fringe, would in the long term benefit these species that prefer POG. Where thinning treatments occur, the slash generated can impede wildlife movement, which is a known detriment for deer being able to access the forage within these areas. Additional measures such as bucking, or girdling (to kill trees while they stand instead of dropping them on the forest floor, thus slowing the pulse of slash on the forest floor) can be used to mitigate effects to wildlife movement, though these measures are expensive and are therefore not routinely used. Other slash mitigation measures such as cutting slash when it is smaller (e.g., < 12 cm diameter), direction felling in small gaps, and leaving uncut patches and corridors are more financially feasible.

Reducing impediments of man-made features to aquatic organism passage (e.g., road crossings), in-stream habitat improvement, facilitation of unnatural aquatic organism would improve prey species availability for species that use aquatic resources, such as eagles, bears, marten, and river otters.

Access

Changes in access (NFS or temporary road construction, road storage, increase in access to shoreline, change in use of marine waters, etc.) would not be likely to cause effects to most species, except for species that avoid human presence such as bears and wolves, and species that are hunted or trapped by humans.

Changes in marine habitats (e.g., any marine habitat changes associated with LTFs) would not cause effects to terrestrial wildlife species, except possibly as disturbance of nearby breeding sites during reconstruction or operation.

Old-growth Habitat Conservation Strategy

The Forest Plan contains a comprehensive conservation strategy using a system of old-growth habitat LUDs designed to provide old-growth reserves in combination with a matrix, protected corridors (e.g. beach fringe and riparian management areas) within development LUDs to maintain viable populations of native and desired non-native fish and wildlife species and subspecies that may be associated with old-growth forests (USDA 2016b, p. 3-183). This strategy, in addition to the implementation of Forest Plan standards and guidelines, was developed to maintain species viability across the Tongass National Forest. The application of the Forest Plan standards and guidelines (USDA 2016a, pp. 4-85 to 4-98) is integral to protecting and providing habitat to maintain viable fish and wildlife populations. Population viability would be maintained for all species addressed in this document because the proposed action is consistent with the Forest Plan conservation strategy and would implement Forest Plan standards and guidelines.

This analysis considered effects to the old-growth reserve system as designated in the Forest Plan Old-growth Habitat Conservation Strategy. There would be effects on the old-growth reserve system because activities, such as watershed and wildlife restoration treatments occurring within non-development land use designations (LUD) would have short-term impacts and long-term beneficial effects. PCT thinning of older 30+ year YG (even with girdling, which can come down quickly with wind events) will likely have slash impacts that are observable, short-term, and may reduce resource integrity due to fawn mortality, suggesting minor to moderate impacts, but it will also have some short- and especially long-term benefits. We could do the treatments in a way that minimize impacts to negligible and maximizes benefits: some variable-density PCT thinning with girdling, but also leave patches and corridors and small gaps (or radial tree release = small gap with a larger tree in it) in unthinned patches using girdling and directional felling. Aim is to promote accessible winter deer forage (with low slash and snow impacts for deer as well as habitat diversity for other species) while also promoting development of old-growth characteristics.

Legacy Standard

The Forest Plan requires the Legacy Standard to be applied in VCUs with high concentrations of past timber harvest. The Legacy Standard and Guideline Section D (USDA Forest Service, 2016a, p. 4-87) lists the VCUs where legacy forest structure needs need to be applied. The legacy standard is designed to retain enough residual trees and snags within VCUs where past timber harvest has been concentrated. This standard applies to even-aged harvest units greater than 20 acres. Within the project area, the legacy standard applies to VCU 7560.

The 2016 Forest Plan Amendment requires that VCUs be verified during project-specific planning and analysis to see if the Legacy Standard applies to additional VCUs, based on thresholds identified on Forest Plan pages 4-86 and 4-87. Based on this analysis, there are no additional VCUs where the Legacy Standard would apply.

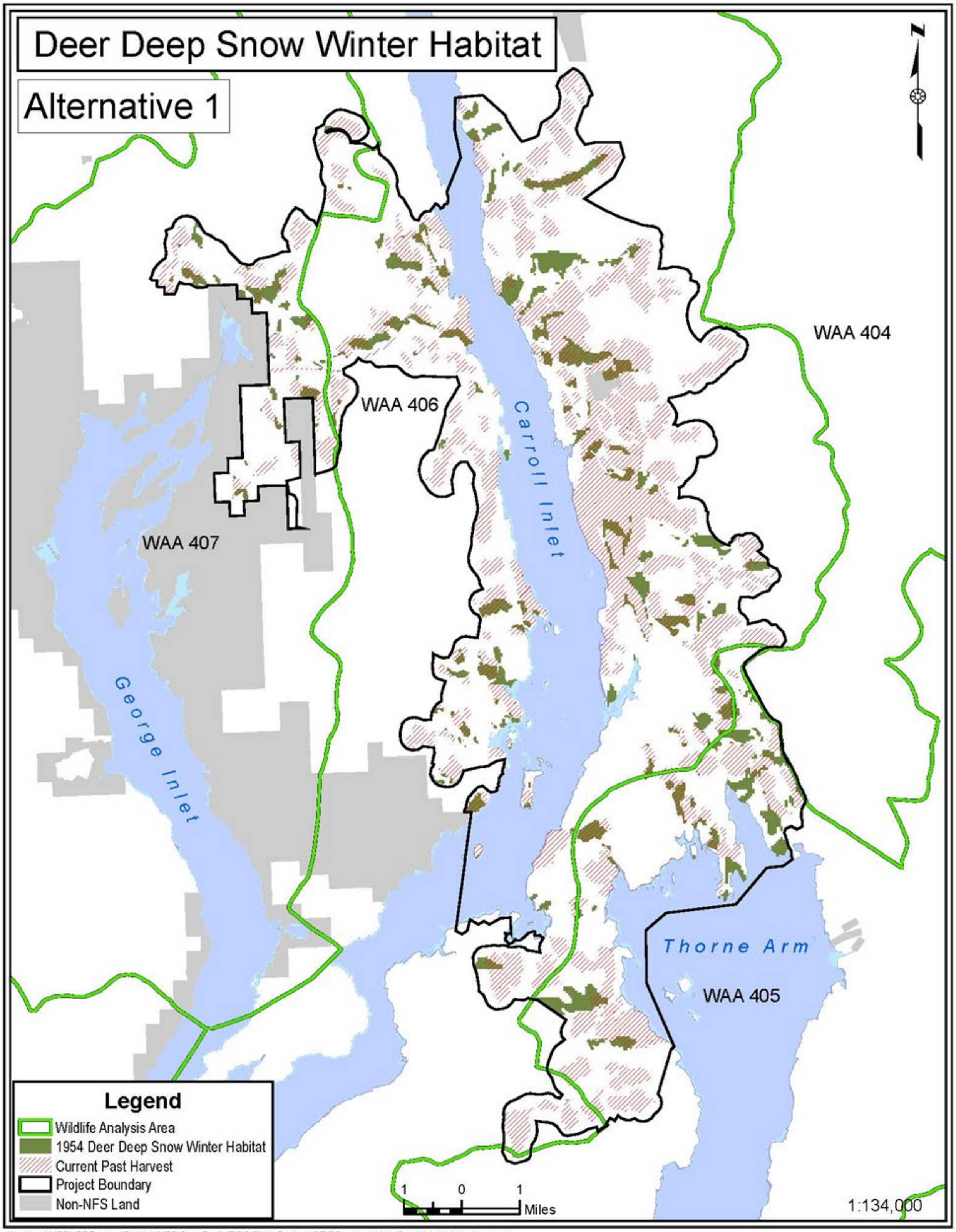


Figure 15. Historic (1954) deer high value deep snow habitat in relation to past harvest within the South Revilla project area

Effects by Species

Sitka Black-tailed Deer

Summary

Timber harvest and associated actions under Alternatives 2, 3 and 4 would reduce modeled deer habitat capability, elevational connectivity, and deep snow winter habitat. The effects would occur immediately after even-aged harvest (stand initiation) and intensify at 25 to 30 years as the harvested stands transition into the stem-exclusion stage. Considering cumulative effects, reductions in habitat capability and deep snow habitat could lead to a decline in the deer population within the project area, particularly following severe winters.

Alternative 1 would maintain the highest theoretical deer density, elevational connectivity, and deep snow habitat to support deer. Of the action alternatives, Alternative 3 ranks highest followed by Alternative 4 and then 2. Alternative 4 ranks slightly better than 2 owing to more uneven-aged management and smaller even-aged units in Alternative 4.

Affected Environment

Within GMU 1A, deer populations tend to fluctuate seasonally in response to winter weather and wolf and bear predation (Porter 2018). Annual variability in weather patterns and snowfall can have noticeable impacts on deer distribution, population density, and hunter accessibility (McCoy et al. 2009). Abundant deer forage is available within old-growth stands in the project area, but light to moderately browsed indicating that the deer population may be below carrying capacity. Since 2013, Southeast Alaska has experienced a series of mild winters which has allowed deer abundance to increase (Dorendorff 2020).

The quantity, quality, and distribution of winter habitat (figure 15) is considered the most important limiting factor for deer in Southeast Alaska (USDA 2008c, p. 3-230). Hanley (1984) states that the overall effect of snow restricts the range of suitable habitats mostly to old growth and lowers the quality of all habitats. The project area is classified as an intermediate snow area during average winters based upon long-term yearly averages.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no effect on deer. All existing deep snow habitat (figure 15) would remain to support current deer populations during winters with above average snowfall. Under Alternative 1, the level of fragmentation would remain unchanged, except for naturally occurring events (e.g., windthrow). Alternative 1 would not cause additional habitat fragmentation; deer would not be more susceptible to hunting or predation (see deer-wolf interactions in wolf section). Current deer population trends would not change unless affected by natural causes such as weather or disease.

Cumulative Effects

This alternative would not contribute to cumulative effects in the project area.

Alternatives 2, 3, and 4

Direct and Indirect Effects

There would also be reductions in deep snow habitat, which is a limiting habitat type for deer in Southeast Alaska. Table 22 shows this impact with a reduction of current deep snow habitat in a range from 0.03

percent (WAA 405 in Alternative 3) - 11.6 percent (WAA 406 in Alternatives 2 and 4) from current conditions. All action alternatives may reduce deer density (table 22) based on outputs from the deer model with Alternatives 2 and 4 having about the greatest reduction in all WAAS.

Table 22. Acres retained and percent loss of deep snow deer habitat (5S, 5N, and SD67 productive old growth below 800 feet on south facing slopes) on NFS lands by alternative for the WAAs in the project area

WAA	Existing/Alt 1 Acres	Alt 2 Acres/ % reduction	Alt 3 Acres/ % reduction	Alt 4 Acres/ % reduction
405	1,358	1,302/ 4.1	1,355/ 0.03	1,302/ 4.1
406	2,458	2,174/ 11.6	2,441/ 0.07	2,174/ 11.6
407	935	874/ 6.5	925/ 1.1	874/ 6.5
Total	**4,751**	**4,350/8.5**	**4,721/0.6**	**4,350/8.5**

Timber harvest and associated actions under all action alternatives would increase forest fragmentation. Fragmentation contributes to declines in deer populations and an overall loss of population resiliency (McNay and Voller 1995). Person et al. (1996) recommended avoiding further habitat fragmentation, especially at lower elevations where wolves commonly prey on deer in winter to enhance the likelihood of maintaining deer populations [and consequently wolf populations] in southeast Alaska. Additionally, if high-quality, high-volume old growth is preserved but unevenly distributed, deer appear less likely to select it (Gilbert et al 2017).

Connectivity across the landscape would be reduced in Alternatives 2 and 4 by proposed even-aged harvest units and could affect elevational movement. This could impact deer yearly elevational migrations in the project area and may concentrate deer in areas making them easier prey for wolves and bears. Alternative 3 addresses this loss of connectivity by maintaining 38 travel corridors in old growth and older young growth. These would reduce, but not eliminate connectivity impacts to deer in Alternative 3. Alternative 4 will have slightly less fragmentation and connectivity impacts than 2 because of increased uneven-aged management and smaller even-aged units.

Cumulative Effects

Past and current clearcut logging has altered deer habitat in Unit 1A and in the project area. The most effects are shown in higher volume stands below 800 feet elevation, which are critical habitat for deer during winters with heavy snowfall (McNay and Voller 1995). This habitat has been reduced by 24 percent, 40 percent, and 63 percent in WAAs 405, 406, and 407 respectively (table 23). Although young clearcuts can provide considerable forage for deer during snow-free times of year, 25-30 years later, regenerating trees begin to shade out shrubs and forbs that are important forage species. Closed canopy young-growth forest has low habitat value for deer. Recent timber sales by the Alaska Mental Health Trust Authority and the State of Alaska on Gravina Island. The pending land exchange with Alaska Mental Health Trust would further reduce DHC for deer in these Unit 1A hunting areas.

Forest fragmentation has occurred on much broader scale when all ownerships are considered. Most early harvest was concentrated along the beach and at low elevation along major drainages and therefore within areas used by wolves. The ongoing decline in deer numbers in Unit 1A is likely to continue as the remaining 15–30 year old clearcuts regenerate into closed canopy young-growth forest and available winter range is reduced. This can be seen with the deer habitat capability model (table 25), which shows a 48 percent reduction from 1954 in WAA 407, 31 percent reduction in WAA 406, and a 14 percent reduction in WAA 405.

Table 23. Cumulative loss of deep snow deer habitat (5S, 5N, and SD67 below 800 feet on south facing slopes) on all lands within the project area by alternative.

WAA	1954 Acres	Existing/Alt 1 Acres/ % reduction	Alt 2 Acres/ % reduction	Alt 3 Acres/ % reduction	Alt 4 Acres/ % reduction
405	1,714	1,361/ 20.6	1,305/ 23.9	1,358/ 20.8	1,305/ 23.9
406	4,161	2,776/ 33.3	2,492/ 40.1	2,759/ 33.7	2,492/ 40.1
407	2,987	1,180/ 60.5	1,119/ 62.5	1,170/ 60.8	1,119/ 62.5
Total	**8,862**	**5,317/40.1**	**4,916/44.6**	**5,287/40.3**	**4,916/44.6**

Alexander Archipelago Wolf

Summary and Conclusion

Timber harvest would decrease habitat capability for deer, the primary prey for wolves, for up to 150 years or longer. Current modelled deer densities in WAAs 406 and 407 are below the Forest Plan guideline of 18 deer per square mile. Therefore, the project may result in higher risk that there will be insufficient number of deer to sustain both wolves and hunter demand. The South Revilla project would have relatively minor impacts on deer density (approximately 1 deer/mi^2 reduction). However, cumulative management actions and activities in WAAs 406 and 407 have reduced theoretical deer densities by 33 and 48 percent, respectively, which has likely affected predator/prey equilibriums. This may cause wolf home ranges to expand or lead to reductions in pack size or condition. This concern exists despite the availability of alternative prey such as mountain goat, beaver and salmon. Alternative prey may delay a decline in wolf numbers.

Roads facilitate movement by wolves and may enhance the ability for wolves to move into areas where deer are concentrated. The South Revilla project would have a minor impact on road density (<1 percent). Roads constructed could provide easier human access into new areas and possibly increase trapping/hunting. Wolf populations within GMU 1A are currently thought to be stable with unlimited trapping allowed (Porter 2018). However, timber harvest and road building activities along with cumulative reduction in DHC and increased road density effects could result in a declining trend in the wolf population within WAAs 406 and 407, and biogeographic province.

Alternative 1 would maintain the highest deer density to support wolves and the lowest road density to help prevent over harvest. Of the action alternatives, Alternative 3 ranks highest followed by Alternatives 4 and then 2, based on effects to deer and road density.

Affected Environment

Wolf home ranges on Revillagigedo Island average 279 km2, with an average of 5.4 (range 2-12) wolves/pack (Smith 1987). Most wolf use is at elevations below 1,200 feet (Person et al. 1996). Smith et al. (1987) identified one wolf pack, which he called East Chuck pack, between George and Carroll Inlets. The East Chuck wolf pack overlaps the project area.

While wolves may benefit short-term from concentrations of deer, overall declines in deer populations could lead to widely fluctuating wolf populations and result in less wolves over the long-term. Person (2001) found a strong positive relation between wolf pack size and proportion of deer winter habitat within home range, apparently reflecting greater habitat capability for wolves where deer densities are high. Deep snow deer habitat would be reduced 24, 40, and 63 percent, respectively from historic levels. As a result, wolf home range sizes may have already been forced to expand to contain sufficient deer or wolves may have already shifted to other less advantageous prey sources. Forest fragmentation has occurred on much broader scale when all ownerships are considered. Most early harvest was concentrated along the beach and at low elevation along major drainages and therefore within areas used by wolves. Historic timber harvest and road construction on all ownerships has reduced deer habitat capability and therefore theoretical deer densities (deer/mi^2) as calculated by the deer model. Harvest has likely affected predator/prey relationships by concentrating deer in the remaining deep snow winter range where they are more susceptible to predation (McNay and Voller 1995, Smith et al. 1987).

Due to lack of actual population data, the interagency deer habitat capability model (Logan 2011) has been used as an indicator to assess the ability of an area to support deer populations capable of maintaining sustainable wolf populations and meeting human harvest demands. The deer model is a linear model and as such has limitations (see deer model section above). These theoretical model defined deer densities (deer/mi^2) from the analysis do not represent actual populations, but represent the functioning of the predator-prey system dynamic (USDA 2008c, p. 3-282). Person et al. (1997) clarified that habitat capability of at least 18 deer per square mile is needed to support wolves and deer hunter demand on a sustainable basis. That density of deer "provides the envelope within which the predator-prey dynamics between wolves and deer has a high probability of functioning and persisting" (Person 2014).

On July 15, 2020 the wolf was petitioned to be listed with the USFWS by Center for Biological Diversity, Alaska Rainforest Defenders, and Defenders of Wildlife. This petition requests that the USFWS recognize Alexander Archipelago wolves in Southeast Alaska as a DPS and evaluate the Southeast Alaska DPS for listing as threatened or endangered (CBD 2020). In the alternative, Petitioners request that the Service evaluate the Alexander Archipelago wolf subspecies for listing, where Southeast Alaska and coastal British Columbia constitute the range and Southeast Alaska constitutes a significant portion of that range.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct effects on deer habitat or deer density and therefore, no effect on deer/wolf interactions. Wolf populations would continue to fluctuate based upon natural processes such as prey availability after average and severe winters.

Cumulative Effects

Alternative 1 would not contribute to cumulative effects. However, previously harvested stands have decreased, and will continue to decrease, deer density as additional stands move into stem exclusion. As a result of land selections and past timber harvest, deer densities within WAAs 406 and 407 are now below 18 deer/mi^2 (table 25).

Person (2001) considered critical (i.e. deep snow) winter habitat to be a good measure of habitat quality for southern Southeast Alaska wolves. Deep snow habitat has decreased 21 percent in WAA 405, 33 percent in WAA 406, and 60 percent in WAA 407 (see table 23). Therefore, over one-third of the quality habitat for deer, the primary prey of wolves, has also been decreased by past actions.

Alternatives 2, 3, and 4

Direct and Indirect Effects

Reduction of deer habitat and deer densities from clearcutting and habitat fragmentation can affect wolf populations. Alternatives 2, 3 and 4 may not meet forest plan standard and guidelines for maintaining 18 deer/mi^2 (table 24) for all WAAs in the project area. WAA 405 would meet the guidelines with a DHC of a minimum 21.0 at stem exclusion stage. The deer density guideline was meant to assure wolf and deer population resilience, not a population level of either species (Person 2014). Person (2014) clarified that a small change in carrying capacity for deer (DHC) may result in a large change in actual deer numbers resulting from predation.

Wolves have the ability to use a variety of habitat types, although limit the use of human-caused early succession forests and avoid seral forests >30 years of age. Additionally, forest management to enhance habitat value in older seral forests (> 30 years) did not extend the period of favorable conditions for use by wolves (Roffler et al. 2018).

Under all action alternatives, total road densities within WAAs would stay below the forest plan standard and guideline of 0.7 mi/mi^2, (table 24). Current forest plan standards and guidelines (USDA 2016, WILD1.XIV, p. 4-91) state that total road densities of 0.7 to 1.0 mile/mi^2 or less may be necessary to address mortality concerns if road access and associated human-caused mortality is identified as a substantial cause of unsustainable wolf mortality. Road density effect on wolf mortality has not been an issue in WAAs 405, 406, and 407. All action alternatives maintain this road density at the WAA scale. Road densities also correlate with habitat fragmentation which could have an impact on denning habitat, as wolves like to have dens placed away from roads.

Table 24. Deer and road densities by WAA showing historic, existing, and alternatives on NFS lands. Road densities are from total roads on NFS lands below 1200 feet.

WAA		Historic	Existing / Alt. 1	Alt. 2	Alt. 3	Alt. 4
WAA 405	Deer Density	24.2	21.4	21.1	21.2	21.1
	Deer Density stem exclusion[1]		21.3	20.9	21.0	20.9
	Total road density (mi/mi^2)		0.1	0.2	0.2	0.2
WAA 406	Deer Density	17.0	12.9	12.4	12.6	12.4
	Deer Density stem exclusion		12.8	11.9	12.1	11.9
	Total road density (mi/mi^2)		0.25	0.4	0.38	0.38
WAA 407	Deer Density	17.9	16	15.3	15.4	15.3
	Deer Density stem exclusion		15.9	15	15.1	15
	Total road density (mi/mi^2)		0.37	0.42	0.42	0.37

1 - stem exclusion occurs about 25 years post-harvest

Cumulative Effects

The action alternatives would not provide 18 deer/mi^2 to support wolves across all ownerships in WAAS 406 and 407. Also, WAAS 406 and 407 have never been above that threshold. WAA 405 would remain above 18 deer/ mi^2. Instead, deer densities would be further reduced from historic condition (table 25). Alternatives 2-4 would reduce deer densities in WAA 406 down to roughly 11 deer/mi^2 at stem exclusion. Deer densities in WAA 407 would drop to roughly 9 deer/mi^2 at stem exclusion.

Table 25. Deer and road densities by WAA showing historic, existing and alternatives on all lands. Road densities are from total roads on all lands below 1200 feet.

		Historic	Existing / Alt. 1	Alt. 2	Alt. 3	Alt. 4
WAA 405	Deer Density	24.1	21.3	21.0	21.1	21.0
	Deer Density stem exclusion		21.2	20.8	21.0	20.8
	Total road density (mi/mi^2)		0.3	0.4	0.4	0.4
WAA 406	Deer Density	16.4	12.5	12.0	12.1	12.0
	Deer Density stem exclusion		12.4	11.4	11.7	11.4
	Total road density (mi/mi^2)		0.7	0.8	0.8	0.8
WAA 407	Deer Density	17.8	11.1	9.5	9.6	9.5
	Deer Density stem exclusion		11.0	9.3	9.4	9.3
	Total road density (mi/mi^2)		1.3	1.3	1.3	1.3

Total road densities under Alternatives 2 through 4 would be below 1.0 mi/mi^2 in WAAs 405 and 406, but up to 1.3 mi/mi^2 in WAA 407. Mortality of wolves from higher road densities has not been a concern in the past, however high road densities within WAA 407 may lead to wolf mortality concerns in the future.

American Marten

Summary and Conclusion

The action alternatives, combined with past and foreseeable future management actions, could reduce marten deep snow habitat by up to 60 percent. If linear relationships also apply to winter habitat (i.e., the limiting factor for marten), populations could be reduced in project area WAAs. Affected marten may inhabit suboptimal habitat where they spend excessive energy on hunting prey and have lower reproductive success, may increase or shift home ranges into vacant territories resulting from overwinter mortality, or could abandon home ranges causing localized gaps in distribution. Alternative 3 would have the lowest impact on marten deep snow habitat. This could lead to reduced overwintering success, cause a shift in use, or directly impact individuals. Cumulatively, all Alternatives 2, 3 and 4 could lead to a decline in population for marten in the biogeographic province.

Affected Environment

The American marten is considered an MIS in the Tongass because of its close association with old-growth forests and its susceptibility to habitat fragmentation from forest management practices. Marten were specifically considered in the design of medium-sized old-growth reserves (10,000 to 40,000 acres) and connectivity under the Tongass Old-Growth Habitat Conservation Strategy (Suring et al. 1993; Flynn et al. 2004; USDA 2008a). Marten also are important furbearers on the Tongass, and Southeast Alaska trappers are more interested in marten than other furbearers (Porter 2010). Natural populations of marten are found on the mainland and on Revillagigedo, Etolin, Kuiu, Kupreanof, Mitkof, Woewodski, and Wrangell Islands and were introduced on Baranof, Chichagof, and Prince of Wales Islands (MacDonald and Cook 2007). Marten on Revillagigedo Island belong to the subspecies M. a. americana (Small et al. 2003b).

In Southeast Alaska, marten are dependent on high-quality winter habitat that includes low-elevation, productive old-growth forest. Habitat requirements reflect a strong interaction between food, cover, and climate, with forest cover being particularly important for travel, denning and resting sites, hunting, avoiding avian predators, and thermoregulation (Flynn et al. 2004). Consequently, the quantity and quality of winter habitat is a limiting factor for marten in Southeast Alaska (USDA 2008c, p. 3-234).

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct or indirect effect on marten or marten habitat. Existing winter and year-round habitat would be maintained and would continue to function at current levels with no change in habitat connectivity or carrying capacity. Population dynamics would continue to function. No changes in patch size or home range would occur except through natural processes such as windthrow. Prey abundance would continue to fluctuate from natural causes. Therefore, current hunting efficiency and social interactions should continue.

Cumulative Effects

Alternative 1 would not contribute to cumulative effects across the project area.

Alternative 2, 3, and 4

Direct and Indirect Effects

Alternatives 2, 4, and 6 would reduce marten winter habitat within project area WAAs (table 26). Impacts would be slightly less under Alternative 3 and slightly more under Alternatives 2 and 4.

Table 26. Marten deep snow habitat (HPOG below 800 feet) and percent reduction from existing conditions on NFS lands

WAA	1954	Existing acres Alt 1	Alt. 2 acres / % reduction	Alt. 3 acres / % reduction	Alt. 4 acres / % reduction
405	9,467	6,834	6,550/ 4.2	6,617/ 3.2	6,550/ 4.2
406	20,617	12,153	11,132/ 8.5	11,477/ 5.6	11,132/ 8.5
407	6,277	4,844	4,504/ 7.1	4,563/ 5.9	4,504/ 7.1
Total	**36,361**	**23,831**	**22,186/ 6.9**	**22,657/ 5.0**	**22,186/ 6.9**

Home ranges of affected individuals would likely increase in size. Marten could inhabit suboptimal habitat where they spend excessive energy on hunting and have lower reproductive success or territories could be abandoned causing gaps in distribution within the project area. Habitat for important prey species would also be reduced under all alternatives.

Alternative 4 would have less impacts than Alternative 2 because there is more uneven-aged management and the even-aged management units are smaller. This would lead to less fragmentation across the landscape and would allow for martens to have better movement through the landscape.

Research in Southeast Alaska by Flynn et al. (2004) supports the conclusion that all action alternatives would further reduce the effective patch size and connectivity of marten habitat since marten do not use younger or older young growth. Other research has shown that clearcuts affect marten movements. Reduction in available habitat and connectivity could change marten foraging behavior and foraging efficiency, change movement path selection, cause marten to inhabit suboptimal habitat, spend excessive energy on hunting, cause marten to have less time available for social interaction and breeding, and affect female body index reducing reproductive success. Reduction in available habitat and connectivity may force juveniles to disperse farther distances where they experience poorer body condition and suffered twice the mortality risk.

All alternatives would increase open and total road densities by 0.1 mi/ mi^2 in WAAs 405, 406, and 407. Roads would not cause a shift in access from boats to vehicles but would provide additional walk-in access for trappers and facilitate easier access into additional areas. Habitat suitability for marten begins to decline when road density reaches 0.2 miles/mi^2 and decreases sharply when road density reaches 0.6 miles/$mile^2$ (Suring et. al. 1992). An increase in road access can increase trapping pressure on marten as they are easily trapped along roads accessible to vehicles (Flynn et al. 2004). Open roads receive the highest and most consistent use and therefore are likely to have the greatest effect on marten. Closed roads facilitate additional access (e.g., off-highway vehicle, snowmobile, pedestrian).

Cumulative Effects

Alternatives 2, 3 and 4 would reduce marten deep-snow winter habitat within project area WAAs by approximately 30 to 60 percent (table 27). Impacts would be slightly less under Alternative 3. As a result, and with a 100-year timber rotation, localized permanent gaps in distribution would likely occur throughout the project area landscape. Affected marten may inhabit suboptimal habitat where they spend excessive energy on hunting prey and have lower reproductive success, may increase or shift home ranges into vacant territories resulting from overwinter mortality, or could abandon home ranges causing localized gaps in distribution.

Total road densities ranging from 0.4 to 1.3 within project WAAs (table 25) could affect habitat suitability and lead to overharvest of marten. Alternative 3 would have the least cumulative effect of the action alternatives on marten habitat and marten populations. Cumulative effects of Alternatives 2 and 4 are roughly equal and rank second of the action alternatives.

Table 27. Marten deep snow habitat (HPOG below 800 feet) and percent reduction from historic conditions on all lands

WAA	1954	Existing acres Alt 1	Alt. 2 acres / % reduction	Alt. 3 acres / % reduction	Alt. 4 acres / % reduction
405	9,476	6,842	6,558/ 30.8	6,625/ 30.1	6,558/ 30.8
406	21,763	13,207	12,186/ 45.1	12,531/ 42.5	12,186/ 45.1
407	14,804	6,189	5,849/ 60.5	5,908/ 60.1	5,849/ 60.5
Total	**46,043**	**26,238**	**24,593/ 47.1**	**25,064/ 45.6**	**24,593/47.1**

Queen Charlotte Goshawk

Summary and Conclusion

A determination of "no impact" is made for goshawks under Alternative 1. A determination of "may adversely impact individuals, but not likely to cause a trend to federal listing or a loss of viability in the Planning Area" is made for goshawks for Alternatives 2, 3 and 4. Alternative 4 would have less impacts than the other alternatives because of more harvest units prescribed as uneven aged management. If goshawk nests are found, buffers will be applied and timing restrictions implemented. Forest Plan standards and guidelines require the maintenance of an area of at least 100 acres of POG, generally centered over the nest tree or probable nest site, preferably with a multi-layered, closed canopy and providing foraging opportunities for young goshawks. No commercial timber harvest is permitted, and no continuous disturbance likely to result in nest abandonment is permitted within the surrounding 600 feet from March 15 to August 15.

Affected Environment

There is one historic goshawk nest in the southeast area of the project area. The nest was found in 2002, and checked during the nesting season in 2003, 2004, 2005, 2006, and 2018. The check in 2003 found signs that the nest had been used, but no birds were seen or heard near the nest. Nest checks in 2005 and 2006 found no sign of nesting, although a faint response to a call station was heard in 2006. The nest could not be relocated in 2018.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct or indirect impact on goshawks because no timber harvest activities would occur. All existing nesting and foraging habitat would remain intact to support current levels of goshawks and prey (table 28). Natural processes such as weather and fluctuations in prey as well as existing levels of habitat fragmentation would continue to influence whether goshawks nest in any given year.

Cumulative Effects

Alternative 1 would not contribute to cumulative effects.

Alternative 2, 3, and 4

Direct and Indirect Effects

Timber harvest may locally limit the availability of nest sites through the removal of suitable nest trees. Timber harvest may also decrease foraging habitat quality since Large forest openings are devoid of prey species associated with old forests (USFWS 2007); however, as forest succession progresses the abundance and availability of prey changes (USFWS 2007). Some prey species benefit from small forest openings, such as those associated with habitat edges (Steller's jays) (Russell 1999).

Young-growth stands become too dense for goshawks to fly through efficiently, thereby limiting prey availability (USFWS 2007). Ultimately, reductions in foraging habitat quality may cause individual goshawks to expand their home ranges and associated foraging effort to include adequate foraging areas. The availability of adequate prey resources has been linked to goshawk territory occupancy and breeding success (Salafsky et al. 2007). The system of old-growth reserves (OGRs) and other non-development LUDs help maintain habitat for this species, although one study suggests that some uncertainty remains with respect to the ability of Forest Plan conservation measures to contribute sufficient habitat to sustain well-distributed, viable populations of northern goshawks throughout Southeast Alaska (Smith 2013).

Table 28. Project area impacts to goshawk nesting habitat (HPOG below 1000 feet) on NFS lands

VCU	1954	Existing acres / Alt 1	Alt. 2 acres/ % reduction	Alt. 3 acres/ % reduction	Alt. 4 acres/ % reduction
7460	12,832	8,803	7,238/ 17.8	7,508/ 14.7	7,238/ 17.8
7470	6,497	5,140	4,391/ 14.6	4,462/ 13.2	4,391/ 14.6
7530	13,124	8,714	7,732/ 11.3	7,925/ 9.1	7,732/ 11.3
7560	5,681	3,621	3,090/ 14.7	3,179/ 12.2	3,090/ 14.7
Total	**40,088**	**26,278**	**22,451 / 58.4**	**23,074 / 49.2**	**22,451 / 58.4**

Uneven-aged management, which is greater in Alternative 4, removes single trees or groups of trees has less effect on goshawks because it retains older trees for nesting, maintains relatively high value foraging habitat in a variety of areas across the landscape, and maintains habitat for a diverse suite of prey (Iverson et al. 1996). Uneven-aged management is likely to have less impact on goshawk foraging than clearcuts, provided that the remaining trees have branches adequate to support goshawk perching (Detrich and Woodbridge 1994 as cited in USFWS 2007).

Cumulative Effects

Additional impacts to goshawks result from past timber harvest on all ownerships. Current high levels of fragmentation and impacts on nesting habitat (up to 58 percent reduction from historic levels in WAA 407) could be affecting goshawk use of the area and limiting nesting. Research in British Columbia suggests that landscapes should be managed for at least 40 to 50 percent mature and old-growth forest to provide adequate nesting and foraging habitat for Queen Charlotte goshawks (Doyle 2005, Northern Goshawk Recovery Team 2008). Up to 33 percent of the productive old-growth in a watershed was considered capable of sustaining goshawks (Iverson et al. 1996, USDA Forest Service 1997a appendix N pages N-38 thru N-41). Harvesting at a rate exceeding this and creating an excess amount of early (0-100 year old) forest would increase the risk of not sustaining goshawks (1997 USDA Forest Service 1997c, p. 3-393). Habitat alteration and fragmentation can affect goshawk survival and productivity at the population level if it decreases foraging habitat quality across the landscape (USFWS 2007).

WAAs 406 and 407 would be at increased risk of not supporting goshawks as a result of timber harvest from this project combined with past, present, and foreseeable harvest on all lands. This is because greater than 33 percent of goshawk habitat will have been harvested in those WAAs (table 29). VCUs 7460, 7470, 7530, and 7560 are currently at increased risk with more than 33 percent of the suitable habitat harvested. This could affect breeding and nesting success, force goshawks to range further to forage and increase the risk of nest abandonment. Habitat for key prey items such as red squirrels, hairy woodpeckers, and red-breasted sapsuckers would also be affected.

Table 29. Cumulative effects to goshawk nesting habitat (HPOG below 1000 feet) on all lands

VCU/WAA	1954	Existing acres/ Alt 1	Alt. 2 acres/ % reduction	Alt. 3 acres/ % reduction	Alt. 4 acres/ % reduction
VCU 7460	12,938	8,805/31.9	7,240/ 46.0	7,510/ 42.0	7,240/ 46.0
VCU 7470	9,264	6,658/28.1	5,909/ 36.3	5,980/ 35.5	5,909/ 36.3
VCU 7530	14,304	9,895/30.8	8,913/ 37.7	9,105/ 36.5	8,913/ 37.7
VCU 7560	5,683	3,622/36.3	3,091/ 45.6	3,181/ 44.1	3,019/ 45.6
WAA 405	10,609	7,786/26.6	7,482/ 29.5	7,549/ 28.8	7,482/29.5
WAA 406	27,562	17,300/37.2	15,924/ 42.2	16,313/ 40.8	15,924/ 42.2
WAA 407	17,329	7,689/55.6	7,288/ 57.9	7,352/ 57.6	7,288/ 57.9

Bald Eagle

Summary and Conclusion

There would be impacts to bald eagles from this project. These impacts would be minor by following Forest Plan standards and guidelines along with the USFWS guidelines. The effects of this project would not contribute to population declines and populations of bald eagles are expected to remain stable.

Affected Environment

The bald eagle is a MIS in the Tongass because of its association with coastal forested habitats, and because nesting and foraging habitats could be affected by forest management activities in Southeast Alaska. The bald eagle is protected under the Bald and Golden Eagle Protection Act, which provides for special management of bald eagles, their young, and their nests.

Bald eagles are common year-round residents in Southeast Alaska, where they nest and winter in high numbers. The Tongass, historically and presently, has supported the largest breeding population of bald eagles in the world. Populations in Southeast have increased from a corrected plot sample of 8,473 adult birds in 1967 to 12,934 birds in 2007; populations increased until 1982 and have remained stable thereafter. (Hodges 2011). Due to funding limitations, USFWS has not flown nest surveys on Revillagigedo Island in recent years. However, approximately 300 nests have been recorded on the island in the past with 87 nests occurring in George or Carroll Inlets.

The Bald and Golden Eagle Protection Act provides specific protections for bald eagles and their nests. An amendment to the Bald and Golden Eagle Act (50 C.F.R. § 22.26), finalized in November of 2009, authorizes the USFWS to issue “take” permits to applicants associated with development projects or other activities that may impact eagles or their nests. In conjunction, USFWS Alaska Region developed step-by-step guidelines to assist landowners in determining if new or intermittent activity near an eagle nest is likely to take or disturb bald eagles and conservation measures that can be adopted to avoid that disturbance (USFWS 2009a).

Alternatives 1 through 4

Direct and Indirect Effects

Forest Plan beach/estuary standards and guidelines (USDA 2008b, pp. 4-4 to 4-5) maintain old growth within the 1000 foot wide beach fringe that protects bald eagle nesting, perching and roosting habitat. There are young-growth treatments proposed within this habitat buffer and the USFWS conservation measures for avoiding take under the Bald and Golden Eagle Protection Act will be used to minimize potential impacts. Young-growth harvest within this area will be done in a way to accelerate development of old-growth characteristics while also providing timber products.

The proposed rock pit at milepost 4.2 on Road 8340000 is mapped at the edge of the 0.5 mile blasting restriction (0.51 mile from nest) and actual location may require timing restrictions to prevent disturbance. With timing restrictions, there would be no effect on bald eagle habitat or bald eagles under any alternative. Natural processes such as windthrow and weather could continue to affect bald eagle habitat.

Cumulative Effects

The project would not add measurable effects to bald eagle cumulative effects under any alternative.

Black Bear

Summary and Conclusion

Past, present, and future management actions have reduced bear denning habitat by up to 25 percent and foraging habitat along streams up to 21 percent (table 31), and have reduced bear populations as a result. Alternative 1 would have no direct impact on current bear habitat or populations. Alternative 3 would have the next lowest impact followed by Alternative 4, and then Alternative 2. The ADF&G expects bear numbers to decline as clearcut areas reach the stem exclusion stage and the long-term effects of clearcut logging, even with precommercial thinning, could lead to reductions to black bear populations in GMU

1A (Bethune 2011). The effects of this project combined with cumulative effects could lead to population declines within the project area and biogeographic province.

Affected Environment

The current harvest ratio, proportion of females, average skull size, and age structure of the harvest all suggest a stable bear population (Harper and McCarthy 2014).

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no effect on black bear denning habitat, foraging habitat or foraging habitat/cover within 500 feet of Class I streams. No roads would be constructed so hunting access would continue to be predominantly by boat with no change in access. Existing young growth stands would continue to move toward stem exclusion and individual den sites could be affected by natural processes such as windthrow.

Cumulative Effects

Alternative 1 would not contribute to cumulative effects.

Alternative 2, 3, and 4

Direct and Indirect Effects

Alternatives 2, 3 and 4 would reduce bear denning habitat from existing conditions by 3 percent (table 30). It would maintain roughly 98 percent of existing bear denning habitat in WAA 406 and roughly 96 percent in WAA 407. Impacts to bear denning from clearcutting would be long term until second growth reached sufficient size to provide the trees and snags necessary to accommodate bear use. Large remnant stumps provide den sites in greater than 30 year old young-growth until they degrade (Porter et al. 2020). This loss of habitat could result in increased predation and loss of thermally efficient dens. The uneven-aged management with partial removal prescriptions could maintain denning structures, particularly in large unmerchantable trees. Uneven-aged management prescriptions could affect suitable denning habitat if large diameter trees are removed or if large trees with rot are felled for safety reasons. Uneven-aged units would continue to provide forage (Deal 2007); actual change in available forage would depend upon individual tree removal patterns.

Effects from clearcutting of POG are the removal of large trees used for denning, reduction in foraging habitat long-term, which can lead to lower bear reproductive success and population density (Schoen and Peacock 2007). Clearcutting can also increase dispersal distance and subsequent mortality (Schoen and Peacock 2007). Davis et al. (2012) found that conversion of late-successional forests to younger even-aged stands was detrimental to the supply of black bear dens in coastal British Columbia which may lead to decreased black bear populations from increased cannibalism, predation by other bears or wolves, or increased energetic costs from using less thermally advantageous dens.

Secondary losses occur when young clearcuts transition into stem exclusion and understory forage is reduced, due to the inability of light to penetrate the dense conifer regeneration. Young clearcuts (3-20 years after logging) provide bears with an abundance of forage, but forage decreases with the onset of stem exclusion. In addition, young-growth stands often lack the root masses and large hollow trees used as denning sites (Bethune 2011) though large remnant stumps may be used in > 30-year old young-growth forest (Porter et al. 2020).

Effects of road densities on bear hunter access would be similar to those discussed for wolf.

Table 30. Project area impacts on bear denning habitat and POG within 500 feet of Class I streams by WAA on NFS lands

WAA	Habitat Type	1954	Existing/Alt 1 acres	Alt 2 acres	Alt 3 acres	Alt 4 acres
405	Denning	25,870	22,760	22,172	22,261	22,172
	POG 500' of Class I[a]	4,620	4,016	3,947	3,948	3,947
406	Denning	61,304	49,615	46,406	46,913	46,406
	POG 500' of Class I	7,738	6,336	5,993	6,061	5,993
407	Denning	19,816	17,918	17,109	17,188	17,109
	POG 500' of Class I	2,326	2,199	2,139	2,145	2,139

a – USDA Forest Service 2016 p 4-88

Cumulative Effects

All past and current timber harvest and associated activities within WAAs 405, 406 and 407 have affected bears or bear habitat in some manner. Changes in denning and foraging habitat have contributed to reductions in black bear populations in GMU 1A (Bethune 2011). Due to conservation concerns over reduced bear populations and increased harvest of black bears by non-resident hunters, ADF&G recently enacted draw permits and harvest tickets to limit bear hunting in GMUs 1, 2 and 3. Timber harvest, particularly even-age management prescriptions, has had the greatest impact on bear habitat as these stands are currently in stem exclusion or will be in stem exclusion within 30 years.

Recent clearcut harvest on AMHT lands at Leask Lakes removed 3,726 acres of denning habitat, but currently provides short-term forage. This foraging habitat will be lost long-term with the onset of stem exclusion. If the AMHT land exchange is finalized, 8,224 acres would be taken out of NFS ownership and Forest Plan standards and guidelines, including old-growth reserves, beach buffers and RMAs would no longer apply. Without these buffers, and with the assumption that all available old-growth would be harvested denning and foraging habitats would be further reduced.

Table 31. Cumulative impacts to bear denning habitat and POG within 500 feet of Class I streams on all lands within the project area by WAA

WAA	Habitat Type	1954	Existing/Alt 1 acres	Alt 2 acres	Alt 3 acres	Alt 4 acres
405	Denning	26,605	22,954	22,366	22,455	22,366
	POG 500' of Class I	4,712	4,107	4,038	4,039	4,038
406	Denning	63,639	51,844	48,635	49,142	48,635
	POG 500' of Class I	8,565	7,162	6,819	6,887	6,819
407	Denning	35,856	25,596	24,787	24,866	24,787
	POG 500' of Class I	5,806	3,600	3,540	3,560	3,540

Migratory Birds

Summary and Conclusion

None of the alternatives are anticipated to impact migratory bird populations, although individuals and their nests may be impacted. Suitable habitat is maintained for neotropical migratory birds at the Revillagigedo Island scale in old growth reserves, IRAs, beach and stream buffers, and other areas deferred from harvest.

Affected Environment

The Migratory Bird Treaty Act of 1918 (MBTA; amended in 1936 and 1972) prohibits the taking of migratory birds, unless authorized by the Secretary of Interior. Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds) provides for the conservation of resident and migratory birds and their habitats and requires the evaluation of the effects of federal actions on migratory birds, with an emphasis on species of concern. An authoritative list of species occurring in the Ketchikan area (Revillagigedo Island) has been prepared (Heinl and Piston 2009). Of the roughly 150 bird species that regularly occur in the Ketchikan area on an annual basis, only 37 species (25 percent) are resident year round (Heinl and Piston 2009). The remaining 113 species (75 percent) occur as summer or winter visitants, or primarily during migration; 70 species (47 percent) are confirmed breeders in the region.

Twenty bird species are identified as species of concern in Southeast Alaska by the Boreal Partners in Flight program (BPIF 1999; USDA 2008c, Table 3.10-3, pp. 3-247 & 3-248). The USFWS lists another 29 species of conservation concern for Southeast Alaska (USFWS 2008). Sixteen of these species are linked to hemlock/spruce/cedar forest and could be affected by the proposed timber harvest. Four species are linked to shrub thickets and could be affected by stem exclusion. For other species, important habitats include, marshes, cliff bluffs and screes, moraines, alluvia and barrier islands, beach and tidal flats, rocky shores and reefs and inshore and offshore waters.

Alternative 1

Direct and Indirect Effects

Alternative 1 would maintain all existing habitat for neotropical migratory birds and have no effect.

Cumulative Effects

Alternative 1 would not contribute to neotropical migratory bird cumulative effects. Previously harvested habitat would remain unsuitable for many species into the long-term future.

Alternative 2, 3, and 4

Direct and Indirect Effects

Direct habitat and disturbance related effects to migratory birds would occur under Alternatives 2, 3 and 4. As with other species, clearcut harvest would have the greatest impacts to habitat. The primary effect to birds would be nest destruction or abandonment if management activities occur in suitable nesting habitat during the breeding/nesting period, which generally begins April 15 and continues until July 15 when young birds have fledged (USFWS 2009b). The normal timber operating season is April 1 through November, but activities may occur outside this season if weather permits. Therefore, there is substantial overlap with the breeding/nesting period of migratory birds and impacts are likely.

Species most likely to be affected are those that nest in hemlock/Sitka spruce forests (e.g., Pacific-slope flycatcher, brown creeper) where timber harvest occurs, and thus the amount of harvest proposed under the alternatives is a measure of the extent of potential effects (USDA Forest Service 2008c pp. 3-288 & 3-

289). Changes in POG habitat can be used to assess changes in nesting habitat for migratory bird species that use hemlock/spruce/cedar forest as primary or secondary habitats. Nesting birds repeatedly disturbed by people and project activities in proximity to the nest could abandon the effort.

Species that use early successional or shrub habitats (e.g. Pacific wren, McGillivray's warbler,) may benefit short term (1 to 25 years) from the proposed timber harvest due to increased shrub production in clearcuts. Habitat would be reduced long term with the onset of stem exclusion.

Impacts to species using other habitats (e.g., cliffs, tide flats, rocky shorelines, riparian) would be negligible at the population level, because harvest would not occur in these areas.

Cumulative Effects

Past activities have removed habitat suitable for forest related migratory birds. POG would be reduced by up to 33 percent from historic levels.

Humpback Whale Mexico DPS and Steller Sea Lion Western DPS

Summary

The no-action alternative (Alternative 1) would have No Effect to the humpback whale Mexico DPS and Steller sea lion Western DPS. For Alternatives 2 through 4 a determination of not likely to adversely affect for the selected alternative owing to discountable effects from LTF reconstruction, LTF and MAF operation, acoustic disturbance, very low levels of contaminants, and very low probabilities of vessel strike given slow vessel speeds would be required before the project could occur. With the project design features that minimize the potential for effects to humpback whales and Steller sea lions, activities proposed in all action alternatives (Alternatives 2-4), "may affect but would not likely adversely affect" humpback whale Mexico DPS and Steller sea lion Western DPS individuals.

Affected Environment

The humpback whale was listed as endangered under the Endangered Species Conservation Act (ESCA on June 2, 1970 (35 FR 8491 (baleen whales listing; 35 FR 18319, December 2, 1970 (humpback whale listing)). Congress replaced the ESCA with the ESA in 1973, and humpback whales continued to be listed as endangered. NMFS recently conducted a global status review and changed the status of humpback whales under the ESA and divided the species into 14 DPS's. Under this final rule, the Mexico DPS (which includes a small portion of humpback whales found in Southeast Alaska) is listed as threatened, and the Hawaii DPS (which includes the majority of humpback whales found in Southeast Alaska) is not listed (81 FR 62260; September 8, 2016).

Relatively high densities of humpback whales occur throughout much of Southeast Alaska and northern British Columbia, particularly during the summer non-breeding season. Humpback whales in Southeast Alaska are comprised primarily of Hawaii DPS individuals, though a small proportion are Mexico DPS individuals (2 percent based on the most recent estimate; Wade 2017). Although migration timing varies among individuals, most whales depart for Hawaii or Mexico in fall or winter and begin returning to Southeast Alaska in spring, with continued returns through the summer and a peak occurrence in Southeast Alaska during late summer to early fall. However, there are significant overlaps in departures and returns (Baker et al. 1985, Straley 1990), and some whales remain through the winter.

Given their widespread range and their opportunistic foraging strategies, Mexico DPS humpback whales may be in the action area year-round.

There are two Steller sea lion populations in Alaska: the western DPS generally occurs west of Cape Suckling, and the eastern DPS generally occurs east of Cape Suckling (144°W). Steller sea lions are not known to migrate annually, but individuals may widely disperse outside of the breeding season (late-May to early-July) (Allen and Angliss 2015). The Steller sea lion was listed as a threatened species under the ESA on November 26, 1990 (55 FR 49204). In 1997, NMFS reclassified Steller sea lions as two DPSs based on genetic studies and other information (62 FR 24345); at that time the eastern DPS was listed as threatened and the western DPS was listed as endangered. On November 4, 2013, the eastern DPS was removed from the endangered species list (78 FR 66139).

We expect some Steller sea lions in the action area to be from the western DPS (Jemison et al. 2013, NMFS 2013), primarily in those portions of the action area north of Sumner Strait. Fritz et al. (2013) estimated an average annual breeding season movement of western DPS Steller sea lions to Southeast Alaska of 917 animals. Hastings et al. (2020) estimates the probability of western DPS animals occurring in the vicinity of the action area to be less than one percent.

In addition to the designated critical habitat discussed below, there are other sea lion haulouts in the general vicinity of the action area and surrounding marine waters. These include: Grindall, Easterly, Etolin, Lisehoi, Horn Cliff, Sukoi Islets, Turnabout, Pinta Rocks, Yasha, Patterson Point, Puffin Bay, Larch Bay, Cape Bartolome, Wolf Rock, Point Marsh, and Point Islet.

Humpback Whale Proposed Critical Habitat

Critical habitat has been proposed for federally-listed humpback whales was proposed in October 2019 (NMFS 2019; 84 FR 54354) and includes all marine waters in the action area. Reliable access to and a sufficient density of prey was identified as the essential habitat feature by NMFS in the proposal for designating critical habitat (NMFS 2019; 84 FR 54354).

Steller Sea Lion Designated Critical Habitat

In Southeast Alaska, three major rookeries on the outer coast—White Sisters, Hazy Island, and the Forrester Island complex, the largest rookeries for the eastern population stock—and 13 major haulout sites were designated as critical habitat (NMFS 1993; 58 FR 45269). Two of the haulout sites designated in northern Southeast Alaska—Biali Rocks and Graves Rock—have since become rookeries (DeMaster 2009). DeMaster (2009) also listed 38 other haulouts sites that have been surveyed in recent years by NMFS.

NMFS designated critical habitat for Steller sea lions on August 27, 1993 (58 FR 45269; 50 CFR §226.202).

Critical habitat includes protection zones described below, only items 1-3 below are within the area of potential influence of the SRIP.

1. Terrestrial zones that extend 3,000 feet landward from each major haulout and major rookery.
2. Air zones that extend 3,000 feet above the terrestrial zone of each major haulout and major rookery in Alaska.
3. Aquatic zones that extend 3,000 feet seaward of each major haulout and major rookery in Alaska that is east of 144º W longitude.
4. Aquatic zones that extend 20 nm seaward of each major haulout and major rookery in Alaska that is west of 144º W longitude.

The action area occurs east of 144º W longitude. Two rookeries and six haulouts of designated Steller sea lion critical habitat occur in the general vicinity of the action area and in the marine waters that may be in the vicinity of log haul routes (table 32, figure 16). There are no designated foraging areas near the action area.

Table 32. Steller sea lion designated critical habitat in the general vicinity of the action area

Location	Major Rookery	Major Haulout	Designation
Forrester Island	X		National Wildlife Refuge
Hazy Island	X		Wilderness
Cape Ommaney		X	Semi-Remote Recreation
Coronation Islands		X	Wilderness
Timbered Island		X	Wilderness
Cape Addington		X	LUD II

Figure 16. Steller sea lion designated critical habitat in Southeast Alaska

Direct and Indirect Effects

Since many of the potential effects to humpback whale Mexico DPS and Steller sea lion western DPS would be similar, the effects are discussed together. Effects to proposed and designated critical habitat for these species are discussed separately. Most activity types would have no effect if the activity and any associated actions occur wholly within terrestrial lands.

Alternative 1 – No Action Alternative

With no action under this project, there would be no direct or indirect effects and the environmental conditions would remain as described in the Affected Environment section.

Alternatives 2, 3, and 4

Acoustic disturbance/noise from vessels and aircraft

Many of the proposed activities would have no potential for effects to listed marine-associated species or designated critical habitat if the activity and any associated actions occur wholly within terrestrial lands. However, depending on the specific activity location, many of the proposed activity types could require transportation on marine waters via administrative, recreational, or commercial vessels or aircraft to access project sites or MAFs. It also includes maintaining, constructing, or improving 69 marine access facilities (MAFs) such as docks, boat ramps, and floats. In addition, commercial harvest of old-growth or young-growth may also require the transport of the logs by barge or ship to processing locations. The proposed action includes maintaining 2 log transfer facilities (LTFs), The existing and proposed LTFs and approximate log-haul routes on marine waters are shown in figure 17. Use of marine waters by vessels and aircraft to access project sites, marine access points, creates the potential for disturbance of marine mammals and generate noise in marine waters, and create a potential for collision (ship strike) with marine mammals. The loudest noise generated by the proposed action is likely in the in-water sound associated with marine vessel operation. Individual vessels produce unique acoustic signatures that vary with vessel size, speed, load, and activities taking place on the vessel (Au and Green 2000, Hildebrand 2009). The significance of potential impacts of noise to marine mammals is dependent on a number of factors including the magnitude of sound pressure levels, species receiving the sound, exposure type (e.g., continuous vs. pulse), duration, site characteristics, species' auditory characteristics, and individual characteristics (e.g., habituation, season, motivation) (Dazey et al. 2012, Ellison et al. 2012). Humpback whales appear to be highly flexible in their ability to use and occupy habitats with varying soundscapes, and based on the best data available the threat of anthropogenic noise received a ''low'' rating for all DPSs of humpback whales in the 2015 NMFS Status Review (Bettridge et al. 2015, NMFS 2019; 84 FR 54354). These sound source levels caused by the proposed action are not expected to approach levels of concern for marine mammals, as any change in behaviors are not likely to result in substantive disruption of normal behaviors. Vessel and aircraft traffic on or over marine waters associated with project activities will be infrequent and distributed over a large area.

Forest Service authorized or permitted activities are required to comply with all prohibitions and regulations to minimize the potential for effects to marine mammals. Project design features for aircraft operations and vessel operations have also been developed to minimize any potential for disturbance effects to marine mammals and include minimum distance requirements and standard operating procedures for aircraft and vessels. Barge and helicopter traffic required to implement the proposed action will be restricted to areas outside the above identified buffer zones for each major haulout and major rookery as well as other areas of sea lion aggregations. With these design features, any changes in individual behavior would be very temporary and there would be no potential for harassment of individuals from authorized or permitted Forest Service activities. While disturbance of marine mammals is plausible, these effects would be so small in intensity and inconsequential that they cannot be meaningfully evaluated above baseline and would therefore be insignificant particularly with application of the project design features. Adherence to distance protections will minimize any potential for impacts to Steller sea lions in their haul out locations. In addition, these sorts of potential noise/disturbance effects would likely be indistinguishable from other vessel traffic or disturbance/noise already occurring in the marine waters of the project area. For these reasons we conclude that any effects are so small as to be insignificant.

Effects from noise generated along shorelines in association with MAFs and LTFs

Noise generated on the uplands or on along shoreline in association with MAFs and LTFs could have disturbance effects to marine mammals if they occur in the immediate vicinity of the shoreline activity. Certain activities requiring explosives, pile driving, or other impact noises occurring below mean high tide where the Forest does not currently have sufficient details for an adequate analysis cannot be meaningfully evaluated for their effects except on a site-specific basis and therefore are not included in this analysis. Noise would also be expected to be generated by the rafting and loading of logs onto barges or ships at LTFs. These activities would be isolated to specific locations and for limited durations of time. While disturbance of marine mammals is plausible, these effects would be so small in intensity and inconsequential that they would be insignificant. Any effects would be expected to be undetectable, not measurable, or so minor that they would be insignificant or discountable.

Ship strike

Vessel collisions with marine mammals can either result in 1) blunt-force impacts from contact of the animal with some non-rotating component of the vessel, or 2) sharp-force injuries from a chopping or cutting wound typically resulting from contact of the animal with the propeller or skeg of a vessel (Moore et al. 2013). The probability of strike events depends on the frequency, speed, and route of the marine vessels, as well as distribution of marine mammals in the area.

Marine vessel traffic that is associated with timber harvest will primarily consist of log barges pulled by tugboats. Barges engaged in the proposed action will typically be less than 150 feet in length and operate at 10 knots or less, with unloaded barges travelling at 7 knots while loaded barges may travel at 5-6 knots. One barge trip from Project Area LTF's to the mill in Klawock is expected to take approximately 27 hours. This travel route is expected to be repeated throughout the life of this project, when harvest units on one island are completed harvest activities would relocate to other parts of the project area, transferring use to other LTFs.

Due to low barge transportation speeds and the requirement of all Forest Service authorized or permitted activities are required to comply with all prohibitions and regulations to minimize the potential for effects to marine mammals. Project design features for vessel operations include minimum distance requirements and standard operating procedures for vessels, making a ship strike extremely unlikely and therefore discountable.

Habitat alteration and risk of entanglement

There may be potential effects to shoreline/nearshore habitat from the construction, reconstruction, maintenance, or use of MAPs, MAFs, and LTFs, including shoreline noise generated during these activities.

The proposed action includes maintaining 2 log transfer facilities (LTFs). It also includes maintaining, constructing, or improving 69 marine access facilities (MAFs) such as docks, boat ramps, and floats. The existing and proposed LTFs are shown in Figure 22 along with Steller sea lion designated critical habitat and other rookeries and known haulouts.

Habitat alteration or degradation from the use of Log Transfer Facilities (LTFs) and their associated camps, movement of log rafts from LTFs to mills, and potential development of MAPs and MAFs such as other docks, mooring buoys, or marine access points and associated facilities for mining, recreation, or other Forest uses and activities could potentially affect marine mammal prey habitats. At a smaller scale, access points for paddlers would consist of trails providing access to marine waters. Site-specific maintenance of LTFs or MAF access points may be required periodically. This could include grading and or fill of access points above or below mean high tide within the original footprint of the LTF or MAF to facilitate truck to barge access and log to raft transport.

BMPs and erosion control measures would be implemented for construction, reconstruction or maintenance of LTFs or MAFs when necessary to minimize effects, and shoreline integrity and bank stability would be maintained (USDA Forest Service 2012). To mitigate bank/shoreline damage it may necessary to construct access structures (e.g., stairs, boardwalks) above mean high tide. Waste oil and fuels will be managed in compliance with all State and Federal regulations to prevent pollution impacts to marine mammals. Erosion control measures will be implemented for relevant construction activities. Particularly with the protective measures in place for these shoreline sites, any habitat alteration would have such minimal effects to marine mammal prey or shoreline habitats that it would be insignificant.

Fixed lines in the water that would typically be associated with LTFs, MAFs, or barges, and any lines associated with docks, floats, buoys, and rafting of logs create the risk of entanglement for marine mammals. Entanglement and ingestion of marine debris is known to contribute to humpback whale and Steller sea lion injury and mortality. LTF and MAF use by barges and other vessels is expected to require stabilization through the use of anchor lines and mooring as well as additional lines associated with docks, floats, buoys, and rafting of logs. Diameters of cables utilized for mooring and anchor cables will generally range from 0.75-1.5 inches in diameter or be chains. No ropes are expected to be used in this capacity. These lines and associated structures will be regularly maintained by SCUBA certified personnel as required in the project design features.

Potential for harm to listed marine species from entanglement is minimal as the number of vertical lines in the water will not exceed the threshold of 120 in any location at any given time and regular monitoring of improved sites will reduce potential for project related marine debris.

Project design features would also require the location of authorized and approved facilities, and concentrated human activities as far as feasible from marine mammal concentration areas. This would both minimize the potential exposure of marine mammals to potential entanglement by lines in the water and minimize alteration of important marine mammal habitats.

Habitat alteration or fixed lines in the water associated with these sites would be such a small scale that it would be immeasurable and inconsequential to any of the listed species or their prey given the small scale of such alteration or degradation or risk of entanglement, especially in consideration of the overall range, habitat availability, and distribution of the listed marine mammals, and such effects are insignificant or discountable.

Cumulative Effects

Cumulative effects under ESA are those effects of future State, city/county, or private activities that are reasonably certain to occur within the action area. Cumulative effects do not include future Federal activities that are physically located within the action area of the particular Federal action under consultation. Activities that occur on other land ownerships within and adjacent to the Tongass have the potential to affect marine mammals. Activities on non-NFS lands include, but are not limited to, timber harvest, residential development, mining, recreation and tourism, and road construction. Prediction of the future extent and intensity of such activities has a high degree of uncertainty associated with it on a Forest-wide basis over a broad time scale. It is assumed that the construction or reconstruction of

LTFs/MAFs would also occur on lands in other ownerships as would barge traffic from the planned logging activities on other lands but would be temporary in nature.

Since any effects to Mexico DPS humpback whales or Steller sea lion western DPS from the proposed activities would be insignificant or discountable, they would not add substantively to any future non-federal actions that may occur in the action area.

Determination for Humpback Whale Mexico DPS and Steller Sea Lion Western DPS

Most activity types would have no effect if the activity and any associated actions occur wholly within terrestrial lands.

With the various types and quantities of activities proposed, there may be a slight increase in vessel or aircraft traffic on or over marine waters in order to access project sites, Marine Access Points (MAPs), Marine Access Facilities (MAFs), and Log Transfer Facilities (LTFs) in association with project activities. This includes the transport of logs by barge or ship to processing locations. Avoidance distances are specified in the project design features to minimize the potential for disturbance of marine mammals. Disturbance, including noise, from vessels or aircraft in marine waters would have insignificant effects. The risk of ship strike is discountable.

There may be potential effects to shoreline/nearshore habitat from the construction, reconstruction, maintenance, or use of MAPs, MAFs, and LTFs, including shoreline noise generated during these activities. Minimum distances from marine mammal haul outs, rookeries, and known concentration areas are specified in the project design features to minimize potential effects, therefore any shoreline/nearshore habitat alteration would have insignificant effects.

Fixed lines in the water associated with docks, floats, buoys, and rafting of logs causes a risk of entanglement but project design features would minimize this potential, therefore any effects are discountable.

Since any effects are insignificant or discountable, our determination is that the project may affect but is not likely to adversely affect humpback whale Mexico DPS and Steller sea lion western DPS.

Effects and Determination for Federally-listed Humpback Whales Proposed Critical Habitat

Shoreline/nearshore habitat alternation or degradation from the construction, reconstruction, maintenance, or use of MAPs, MAFs, and LTFs, could affect humpback whale prey species in a similar way as described for the federally-listed sturgeon and salmonid ESUs/DPSs. Therefore, these shoreline activities would have an insignificant effect to the essential prey feature identified in the proposed critical habitat designation.

Since the effects are insignificant, it is our determination that the project may affect but is not likely to adversely affect humpback whale Mexico DPS proposed critical habitat.

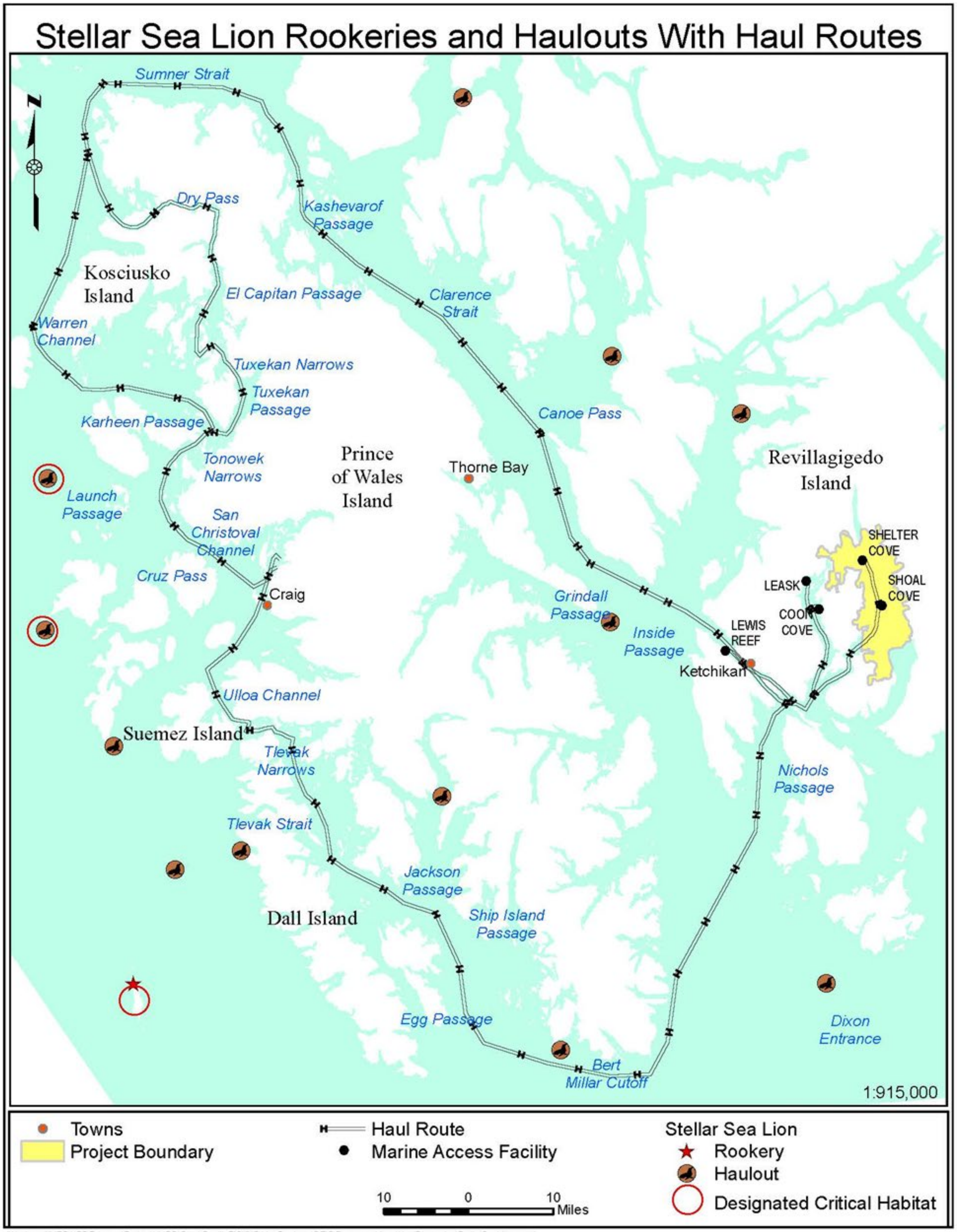


Figure 17. Log transfer facilities and barge routes

Effects and Determination for Steller Sea Lion Designated Critical Habitat

The Forest Service and associated contractors and applicants are required to comply with all State and Federal regulations including provisions in the Marine Mammal Protections Act, the Endangered Species Act, and NMFS's Marine Mammal Viewing Guidelines and Regulations as part of the proposed action.

The Forest Service has agreed to implement the following Mitigation Measures and Best Management Practices as part of the proposed action to avoid impacts to marine mammals in the action area:

- Forest Service operators/contractors will use flight paths that avoid known sensitive areas, including haul-outs and rookeries.
- Vessels will remain at least 100 yards from marine mammals and rookery/haul-outs.
- Waste oil and fuels will be managed in compliance with all State and Federal regulations to prevent pollution impacts to marine mammals and listed fish.

As a result of implementing avoidance buffers and other conservation measures as indicated above, no impacts to Steller sea lion critical habitat are expected.

Subsistence

Methodology

Unit of Measure

Deer abundance and competition estimated by hunter demand as a percent of Deer Habitat Capability (DHC).

Incomplete and Unavailable Information

Current subsistence use information is lacking. Accurate data cannot be derived from ADF&G harvest records since some Saxman residents have a Ketchikan mailing address.

Existing data is sufficient to determine that deer are the main land mammal used and that use of deer is minor compared to marine resources.

Affected Environment

The South Revilla project area (WAAs 405, 406, and 407) fall within the community use areas of Metlakatla, Saxman, and Ketchikan. Metlakatla and a portion of Saxman are classified as rural and receive subsistence priorities under the Alaska National Interest Conservation Act (ANILCA). Ketchikan is classified as a non-rural community and residents do not have a subsistence priority under ANILCA.

Subsistence use areas vary by community, but the highest use generally occurs within a 15-mile radius of the community. Wolfe (2004) contrasts the difference between subsistence objectives and sport hunting:

- Subsistence users typically hunt and fish in ways to efficiently optimize food output per investment of effort and money. Special trips to more distant parts of the community use area occur seasonally for special resources, or on certain years when local fish and game are scarce;
- Sport hunting commonly promotes principles of "fair chase," high-quality hunts, and greater opportunities for participation by other sportsmen. Less emphasis is placed on using the most efficient harvest technique or on distance traveled.

Salmon and other finfish, shellfish, marine plants and mammals, terrestrial wildlife including deer and other mammals, as well as berries, cedar bark, and timber are all subsistence resources harvested by rural communities in Southeast Alaska.

Community Profiles

Subsistence research conducted in Southeast Alaska over the past two decades has included community studies, use area mapping, household surveys, and studies of specific subsistence harvests. The Tongass Resource Use Cooperative Survey (TRUCS) was completed in 1988. The 1997 Forest Plan Revision FEIS provided a comprehensive analysis of subsistence resources and potential effects, both Tongass-wide and for each rural community of Southeast Alaska. Detailed community use information is available in the 1997 Forest Plan Revision FEIS (USDA Forest Service 1997a, pgs. 3-419 to 3-435, 3-575 to 3-714, and Appendix H). This information was updated in the 2008 Forest Plan Amendment FEIS (USDA Forest Service 2008c, pp. 3-419 through 3-433), and the 2016 Forest Plan Amendment FEIS (USDA Forest Service 2016, pp. 3-420 through 3-424).

Metlakatla

Metlakatla is located on Annette Island, 15 miles south of Ketchikan. It is a Federal Indian Reservation and a traditional Tsimshian community with a subsistence lifestyle. Metlakatla residents harvest an average of 70 pounds of wild resources per person per year. In 1987, Metlakatla residents harvested 55 pounds of fish and marine invertebrates per person, which comprised 78 percent of the total resource harvest (ADF&G 1999b). Deer and other mammals comprised 17 percent. Deer comprised almost 11 pounds per person or roughly 15 percent of harvested resources.

The majority (70 percent) of deer harvest by Metlakatla residents takes place in three WAAs (101, 202, and 405) located in the vicinity of the community (USDA Forest Service 2008c, p. 3-649). WAA 405 is in the project area, but only makes up a small portion of the project area, northwest of Thorne Arm. Therefore, while some Metlakatla residents may hunt in the South Revilla area, it is currently not a major use area for deer.

Saxman

Saxman is located 2 miles south of Ketchikan on the South Tongass Highway. Tlingits from the old villages of Tongass and Cape Fox resettled at the present site of Saxman in 1894. Today Saxman continues as a predominantly Tlingit community, with its own city and tribal governing bodies. Saxman is a recognized Native village with most residents maintaining a subsistence-based lifestyle.

Previous data suggests that as much as 75 percent of deer harvested by Saxman residents comes from WAA 406, however this data needs to be updated. Hunting use on Gravina Island has significantly increased in recent years, possibly distributing some Saxman hunters from WAA 406 to WAA 101. With the completion of the Ketchikan to Shelter Cove road, use within WAAs 406 and 407 is expected to increase.

Fish and marine invertebrates comprised 70 percent of per capita subsistence harvest in Saxman in 1999 (ADF&G 2000). Deer accounted for 18 percent of the harvest. Harvest of all land mammals (including deer) dropped to only 13 percent (ADF&G 2000).

Ketchikan

Ketchikan does not have subsistence priority under ANILCA. However, many Ketchikan residents use the Tongass National Forest for personal hunting and fishing. Historically WAAs 406 and 407 is where Ketchikan residents obtained most of their annual deer harvest, however, since 2015 a substantial percentage of deer harvested by Ketchikan hunters has come from Gravina Island (WAA 101). In recent seasons as much as 50 percent of deer harvested by Ketchikan hunters has come from WAA 101, reducing the percentage harvested in WAAs in the South Revilla project area from 70 percent in 2011 to 44 percent in 2018. Although deer harvest has substantially increased on Gravina Island, with the completion of the Ketchikan to Shelter Cove road, use within WAAs 406 and 407 is still expected to increase.

No comprehensive household harvest survey has been conducted for Ketchikan. In 2006, the Ketchikan Indian Community (KIC) conducted their own survey using ADF&G standard household survey protocols adapting the household survey questions which had been used in Saxman (Garza et al. 2006). According to their survey results, Ketchikan residents harvest an average of 90 pounds of wild resources per person, per year. Ketchikan residents harvested 70 pounds of fish and marine invertebrates per person in 2006, which comprised 78 percent of total resource harvest (Garza et al. 2006). Total large land mammal harvest comprised roughly 15 percent. Deer comprised 10.5 pounds per person or roughly 12 percent of harvested resources.

Environmental Consequences

ANILCA requires the analysis of the potential effects on subsistence uses of all actions on federal lands in Alaska. This analysis most commonly focuses on those food-related resources most likely to be affected by habitat degradation associated with land management activities.

Marine resources account for more than half of the total per capita harvest in all Southeast Alaska communities. As a result, management activities that restrict access for subsistence harvest of land mammals have had a relatively small effect on overall subsistence harvest by weight. The subsistence resource most likely to be affected by the proposed South Revilla project is Sitka black-tailed deer, therefore only effects to deer were analyzed in detail.

Three factors related to subsistence uses are specifically identified by ANILCA: 1) resource distribution and abundance, 2) access to resources, and 3) competition for the use of resources.

Effects on Subsistence Use of Deer

Distribution and Abundance

Deer populations on Revillagigedo Island were thought to be at very low levels (Porter 2011a) 10 years ago, but harvest numbers and anecdotal evidence suggest populations have improved in recent years. Ketchikan area wildlife biologist with the Alaska Department of Fish & Game stated in personal communications (July 2020) that the current status of deer populations in GMU 1A are moderate, and moderate to low on Revillagigedo Island specifically. Populations fluctuate seasonally in response to winter weather and predation, and long-term in response to clearcutting (Porter 2011a). Under all alternatives, including the no-action alternative, theoretical deer habitat capability will decrease as a result of existing young-growth stands entering the stem exclusion stage as well as from proposed harvest. Under the action alternatives analyzed in this EIS, the possibility of a change in abundance or distribution would be roughly the same for Alternatives 2 and 4, but slightly less for Alternative 3. The South Revilla project would reduce deer habitat capability from existing conditions. Although there would be short-term increase of forage in the new clearcuts, it would be temporary. Refer to the Sitka black-tailed deer section for more information.

Some localized shifts in deer distribution could occur in response to the reduction in POG forest and habitat connectivity and to disturbance caused by harvest activities. However, this is not expected to cause a mass migration of deer to adjacent WAAs (Colson et al. 2012, BC Ministry of Deer 1999, McNay and

Vollner 1995). The remaining POG would be further away from roads so deer could be less accessible to hunters or require more effort to obtain.

Access

ANILCA Section 811 states that rural residents engaged in subsistence uses shall have reasonable access to subsistence resources on the public lands. None of the alternatives would limit the use of public lands for the purposes of subsistence gathering activities. Beach access would not be affected by the South Revilla project. Access to most deer hunting in the area is currently by boat, but the road systems are used to access additional areas and road use will increase upon completion of the Ketchikan to Shelter Cove road connection.

The 2008 KMRD Access Travel Management Plan (ATM) Decision Notice (DN) and Finding of No Significant Impact (FONSI) determined which roads on Revillagigedo Island would remain open to public use. Roads closed under the ATM decision are technically closed even though not all physical barriers have been installed to date. The South Revilla project decision would update the ATM to include project constructed roads, but would not change access decisions made in the ATM. Closed roads would provide easier walk-in access for hunters until such time as brush and alder make the roads impassable.

The recently constructed Ketchikan to Shelter Cove Road connects additional areas in WAA 407, and connects the area in WAA 406 west of Carroll Inlet to the communities of Saxman and Ketchikan. This new road access is expected to increase hunting pressure within the South Revilla project area and could lead to increased competition between user groups (see Competition section below). Communities having new road access to previously under-used subsistence areas are likely tocapitalize on the opportunity to expand their range. Subsistence use from Metlakatla may also expand given the daily ferry service between Metlakatla and Ketchikan. The Ketchikan to Shelter Cove Road will make access less weather dependent than boating.

Competition for Deer

For analyzing competition, these assumptions are made consistent with the Forest Plan Amendment FEIS (USDA Forest Service 2016, p. 3-429):

- Habitat reductions will result in increased competition if regulations allow sport use to remain constant, with the same number of users seeking fewer huntable resources.
- The demand for resources will remain constant or increase slightly as the habitat capability remains the same or declines over time.
- Analysis includes both rural and non-rural hunters

Changes in deer abundance from timber harvest and increased road access to deer by both rural and non-rural hunters may affect competition for deer. Increased competition may result when less expensive access to the area or within the area is provided. Such is the case when road systems are established to local communities as occurred with the Ketchikan to Shelter Cove road. Previously access had to be occur by boat.

Over 90 percent of GMU 1A hunters are local residents living within GMU 1A (Porter 2011a). From the 1999 data, Saxman residents harvested an estimated 198 deer whereas Ketchikan residents harvested 760 deer in GMU 1A (ADF&G 1999).

Because actual hunter demand is unknown, ADF&G deer harvest survey reports were used in this analysis to estimate the hunter demand.

Deer harvest for WAAs 406 and 407 show an increase in harvest from 2011 to 2018, while WAAs 404 and 405 have had little change. The number of hunters using the WAA's in the project has also seen an increase since 2011, mostly in WAAs 406 and 407.

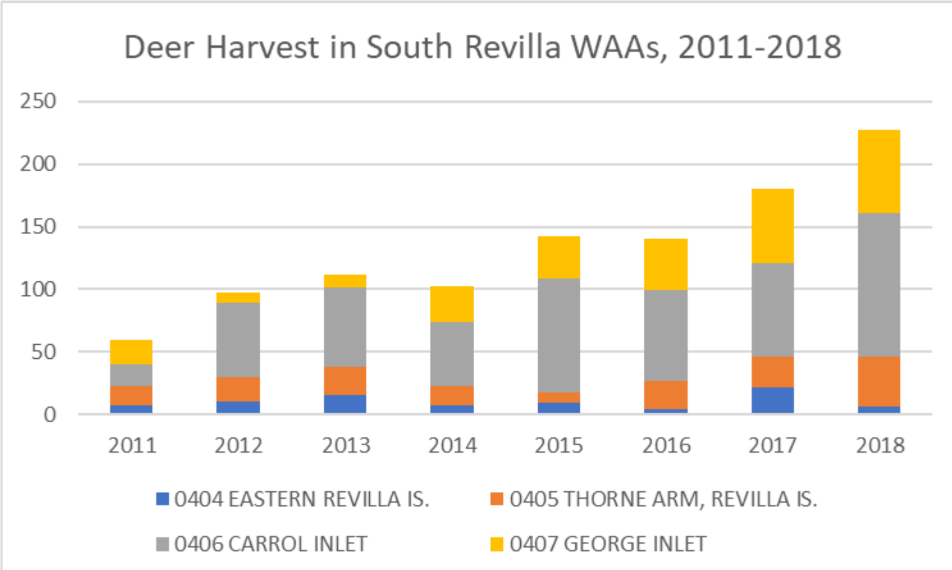


Figure 18. Deer harvest in South Revilla wildlife analysis areas from 2011 - 2018

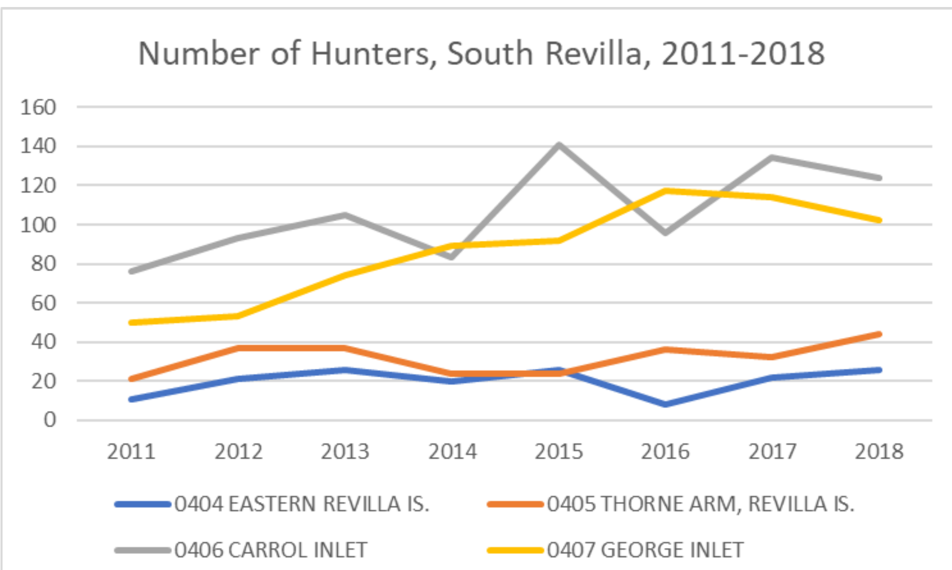


Figure 19. Number of hunters in the South Revilla project vicinity 2011-2018

Trends are not likely to change as a result of the South Revilla project. Ketchikan residents would continue to harvest the greatest number of deer from the WAAs within the project area. Therefore, reductions in habitat capability to support deer could lead to increased competition between rural and non-rural hunters for available resources. Demand may also increase with the Ketchikan to Shelter Cove road connection. Use from Metlakatla may increase causing additional competition between rural subsistence users. Additional non-rural and non-resident hunters may hunt the area given the easy access to and from Ketchikan. If future restrictions are necessary due to increased demand and/or less deer, then Ketchikan and other non-rural hunters would be restricted first. If further restrictions become necessary, then an ANILCA section 804 determination could be made for Saxman and potentially Metlakatla restricting other subsistence.

Effects on Subsistence Use of Fish

For Metlakatla and Saxman fish is by far the major subsistence resource harvested, averaging 59 percent of the total subsistence harvest. During 2011, sockeye salmon made up 80 percent of the regional harvest for the Ketchikan subsistence and personal-use combined fisheries area, which includes Metlakatla and Saxman (ADF&G 2013). Currently there is no regulated sockeye subsistence or personal-use fishery within the South Revilla project area. Other fisheries resources include eulachon, shrimp, sea cucumber, and Dungeness crab. The federal subsistence fishery for eulachon has been closed in the Ketchikan area (Commercial Fishing District 1) since 2012 following unexpectedly low returns of eulachon to the Carroll River in beginning in 2011. There are no known freshwater subsistence activities taking place in the project area.

The effects to fish and aquatic habitat from the South Revilla project would be minimal. The Tongass Timber Reform Act (TTRA), Forest Plan Riparian Standards and Guidelines, and best management practices (BMPs) would help protect aquatic resources.

Findings

Wildlife Resources

The direct and indirect effects and cumulative effects associated with any of the action alternatives for this project may present a significant possibility of a significant restriction of subsistence use of deer due to potential effects to abundance and distribution, and competition.

The 2016 Forest Plan Amendment Final EIS (USDA Forest Service 2016c) included a cumulative effects analysis of resource development on subsistence resources. The finding was that full implementation of the 2016 Forest Plan "may result in a significant restriction to subsistence use of deer due to the potential effects of projects on the abundance and distribution of these resources, and on competition for these resources." (Forest Plan ROD: USDA Forest Service 2016b, p. 43). For this reason, timber harvest activities cannot completely avoid cumulative landscape effects to subsistence uses.

Consistent with Section 810 of ANILCA, the South Revilla project area was evaluated for potential effects on subsistence, as described above. Based on that evaluation, the South Revilla project may have a significant possibility of a significant restriction of subsistence uses on deer due to changes in abundance and competition. The Ketchikan to Shelter Cove Road would increase access to deer affecting the demand and/or the amount of competition in the South Revilla project area.

Based upon community use information and other species analyzed, the South Revilla project shall not result in a significant restriction of other wildlife uses.

To be in compliance with ANILCA, and consistent with current Forest Service policy (FSH 2090.23), as a result of the finding of may significantly restrict subsistence uses, the Regional Forester must be notified and request concurrence, then proceed to Notice and Hearings.

Fisheries Resources

Effects from action alternatives are expected to be minor to subsistence fishery resources. Therefore, the South Revilla project is not expected to result in a significant restriction of fisheries subsistence uses.

Notice and Hearings

If the above evaluation results in the finding of a significant possibility of a significant restriction of subsistence uses and the responsible line officer decides to proceed, the official shall:

- Give notice to the Alaska Department of Fish and Game (for wildlife and fisheries subsistence uses);
- Give notice to the appropriate Subsistence Regional Advisory Councils and local fish and game advisory committees (for wildlife and fisheries subsistence uses); and
- Give notice and hold a public hearing in the vicinity of the area involved.

Notice shall not be less than 30 days and may be extended. Notices may run concurrently.

There will be public hearings during the public comment period for the South Revilla Project.

Issue 3: Scenic Values and Recreation Opportunities

Proposed timber harvest and road construction could affect scenic values and recreational opportunities in the project area.

Resource Indicators and Measures

The following indicators and units of measure were used to evaluate effects of the proposed action and alternatives to the proposed action to scenery and compare alternatives:

Table 33. Issue 3 units of measure

Indicator	Unit of Measure
Scenery	
Change in scenic integrity objectives	Acres changed by classification
Recreation	
Changes to Recreation Opportunity Spectrum system classification	Acres of changed classification

Methodology

The methodology used to evaluate the scenery impacts for this project is called the scenery management system (SMS) and is described in Landscape Aesthetics (USDA Forest Service, 1995b). The scenery management system provides the systematic framework used by the Forest Service for the inventory of scenic resources and provides measurable standards for its management.

Scenery analysis:

- Evaluates whether the standards and guidelines for scenery established by the Forest Plan for each alternative are met.
- Quantifies the effects on scenery—not only the direct and indirect effects of this project, but also the cumulative effects—considering this project in the context of other projects happening, or recently implemented, in the area.
- Considers recommendations for any mitigation, enhancement, and monitoring deemed necessary. Is there anything that can be done to reduce the impacts of the effects?

Spatial and Temporal Context for Effects Analysis

The analysis area for scenery is the project area, approximately 44,371-acres. In some instances, particularly the cumulative effects analysis, the project area is broken down into smaller areas, in which case HU 14 watersheds are used. Watersheds are used to represent a viewshed because they have similar spatial boundaries.

Direct effects are short-term impacts and are associated with the time period in which the activity is implemented. Indirect and cumulative effects are measured over the long term after implementation is complete. For example, the noise of trucks and heavy equipment operating would be considered short-term direct effects for recreation, whereas the harvested unit or new NFS road may impact the visual quality of the site in the long term as an indirect effect.

Affected Environment

Elements that comprise the existing condition of the scenery resource in the project area include visual priority routes and use areas (VPRs), and existing scenic integrity (ESI). The desired condition is represented by the scenic integrity objectives (SIO), and land use designations (LUDs). All together these comprise the affected environment.

Scenic Integrity

Scenic integrity is a term used to describe the visual condition of the landscape while avoiding the use of the value judgements associated with scenery. Different people will have different opinions of what is good, ugly, pretty, boring, or worthwhile when discussing scenery, but they should be able to agree on the level of integrity, or “intactness” of the landscape they are viewing. Scenic integrity is used to describe both existing conditions, future conditions, or management goals, all referring to how “whole” the view looks or will look from the viewer’s perspective. The viewer is a “casual observer,” someone like a tourist, or a boat passenger, that is not studying the view but is observing it, possibly while doing something else.

Table 34. Scenic integrity definitions

Scenic Integrity Level	Definition
Very High	Landscapes that are intact, with only minute, if any, deviations.
High	Landscapes that appear intact. Deviations are not readily evident to the casual observer.
Moderate	Landscapes that appear slightly altered. Deviations are noticeable to the casual observer, but do not dominate the landscape.
Low	Landscapes that appear moderately altered. Deviations can begin to dominate a scene, but must blend with the surrounding landscape, as viewed by the casual observer.
Very Low	Landscapes that appear heavily altered. Deviations clearly dominate but must blend to some degree.
Unacceptably Low	Landscapes that appear extremely altered. Deviations are extremely dominant and borrow little, if any, form,line, color, texture, pattern or scale from the landscape character.

Photographic examples of the levels of scenic integrity can be found in the Forest Plan (USDA 2016a, pages 4-58 to 4-60).

Scenery analysis uses scenic integrity in three ways. First, is to describe the existing condition of a landscape, before a project is implemented. Second is to describe the future condition of the landscape after a project has been implemented. Third, the SIOs, is a target condition with which a project should comply. The SIOs are the most important factor of scenery analysis on the Tongass National Forest. The Forest Plan defines SIOs for all the Tongass, and projects are designed to meet or exceed the SIOs, to be consistent with the Forest Plan (see USDA Service, 2016a Chapter 6)

Scenic Integrity Objectives (SIO)

Scenery integrity objective (SIO) is the term used to describe the desired visual condition of the landscape and is applied to any activity that has the potential to affect the scenic character of the landscape. The SIO is also used to describe the degree of acceptable alteration of the characteristic landscape, and each LUD is assigned SIOs.

For this project, as seen in figure 21, the highest SIOs (moderate) are found along the Ketchikan to Shelter Cove State Road, around Saddle Lakes, and are areas within modified landscape LUD close to VPRs. The units of measure look more closely at areas of higher SIOs as it is more difficult to have timber harvest in these areas and keep the visible activity subordinate to the landscape. Most of the project area is low SIO (table 34) and managed as landscapes that may appear heavily altered.

Existing Scenic Integrity (ESI)

Using the levels of scenic integrity previously discussed, the land was mapped according to the existing condition, and this mapping is called existing scenic integrity (ESI). Existing scenic integrity is defined as the current state of the landscape, considering previous human alterations (USDA 1995, p. I-2).

Existing scenic integrity changes over time, as some alterations may revegetate and begin to blend in with the surrounding landscape, or as new projects that impact scenic integrity are implemented. It is important to compare the ESI of the project area to the adopted SIO of the LUD to determine if the existing condition conflicts with management goals (SIO), and how much additional disturbance is allowed (table 35).

Table 35. Existing scenic integrity (ESI) and scenic integrity objective (SIO) types in the South Revilla Project Area

Scenic Integrity Level	ESI 1/ (Percent of Project Area)	SIO 2/ (Percent of Project Area)
Very High	7.41%	0%
High	2.43%	5.82%
Moderate	13.11%	10.39%
Low	68.47%	31.29%
Very Low	8.56%	52.26%

1/ Source: USFS Tongass National Forest GIS, existing (2005) visual conditions layer (EVC).
2/ Source: USFS Tongass National Forest GIS

When comparing ESI to SIO in the project area, the majority of the project area is low and very low ESI, which means almost three quarters of the project area appears altered. With a small percentage of the project area managed to high SIO, it is expected that activities will occur to reduce the scenic integrity of what is currently high, moderate or low ESI. Three quarters of the project area is managed for low or very low SIO, and able to accommodate visual changes such as clearcuts. A small percentage of the project area is managed for moderate SIO, including the Saddle Lakes Recreation Area. These areas are the focus of several of the units of measure for this issue.

Visual Priority Routes and Use Areas (VPR)

The Forest Plan identifies visual priority routes and use areas (VPRs) to recognize routes and areas from which scenery will be emphasized. These VPRs include towns, campsites, trails, roads, waterways, and dispersed recreation areas, and are listed in Appendix F of the Forest Plan. VPRs indicate areas from where people are likely to be viewing the landscape. The VPRs in and adjacent to the project area are shown in table 36, and shown in figure 21.

Table 36. Visual priority routes in and adjacent to the South Revilla Project Area

VPR	VPR Type
George Inlet	Saltwater Use Areas
Carroll Inlet	Saltwater Use Areas
Thorne Arm	Saltwater Use Areas
Thorne Arm	Boat Anchorage
Gokachin Trail	Hiking Trail
Slivis Lake Trail	Hiking Trail
Ketchikan, Ward Lake, and Harriet Hunt Mtn Ranges	Dispersed Recreation Areas
Gokachin, Mirror, Fish, and Low Creeks	Recommended Wild, Scenic, and Recreational River
Harriet Hunt to Shelter Cove Connection Road	Routes not constructed or NEPA Cleared: Planned or Opportunities
Saddle Lakes Recreation Area	Routes not constructed or NEPA Cleared: Planned or Opportunities
Shelter Cove Boat Ramp	Routes not constructed or NEPA Cleared: Planned or Opportunities

Source: USFS Tongass National Forest GIS; USDA Service, 2016a, Appendix F, pp. F-22 –F-23.

Three of the VPRs in this analysis are identified in the Forest Plan as “Routes not constructed nor NEPA Cleared: Planned or Opportunities.” (USDA Service, 2016a, Appendix F, pp. F-22 –F-23) For this analysis, these “planned” VPRs were treated as existing and were given equal weight as VPRs. It is anticipated that the Ketchikan to Shelter Cove State Road, Saddle Lakes, and Shelter Cove Boat Ramp will see increased use since the Ketchikan to Shelter Cove Road now connects these areas to the Ketchikan road system (see Recreation Cumulative Effects section).

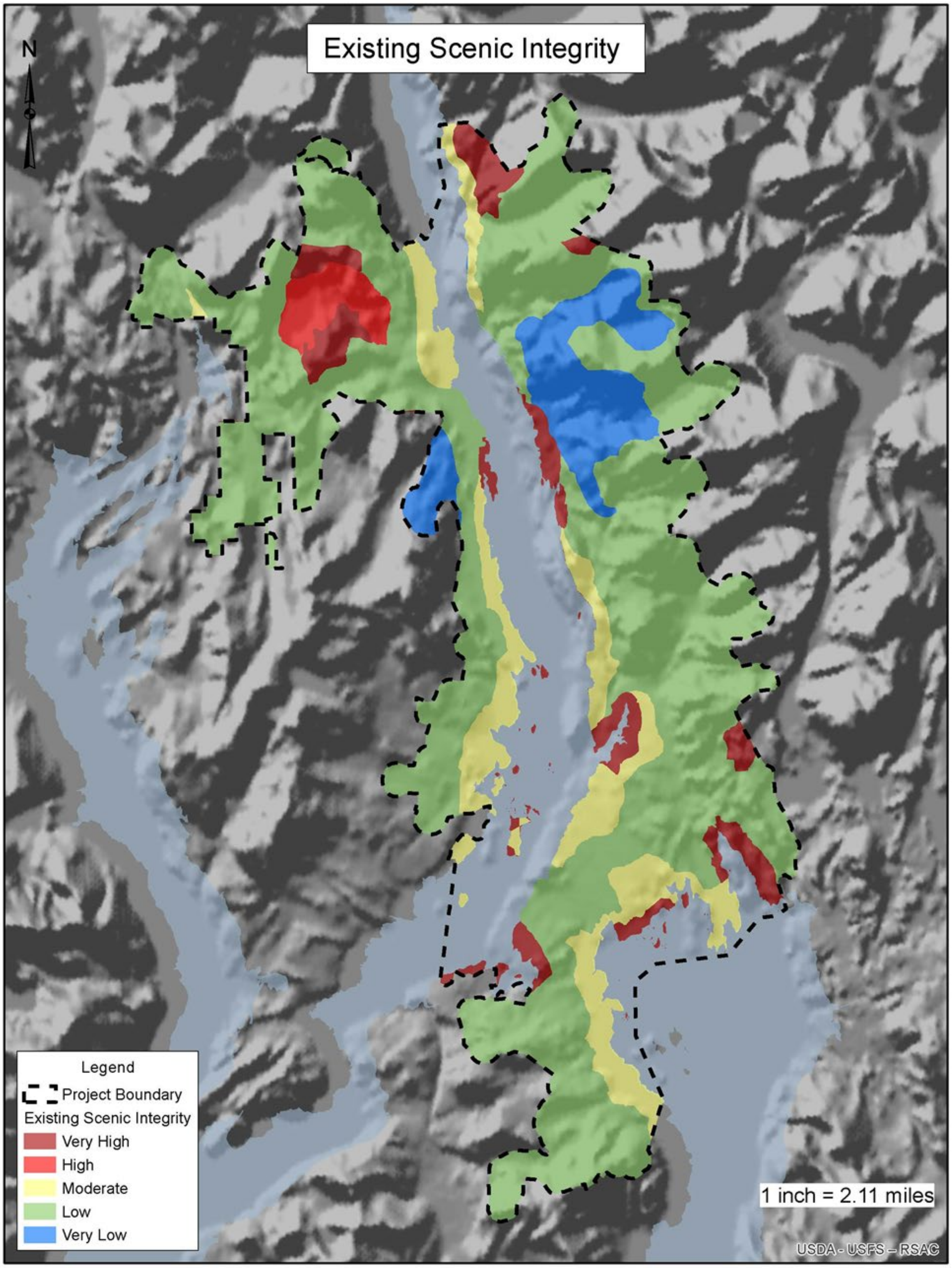


Figure 20. Existing scenic integrity (ESI) current condition for the South Revilla Project Area

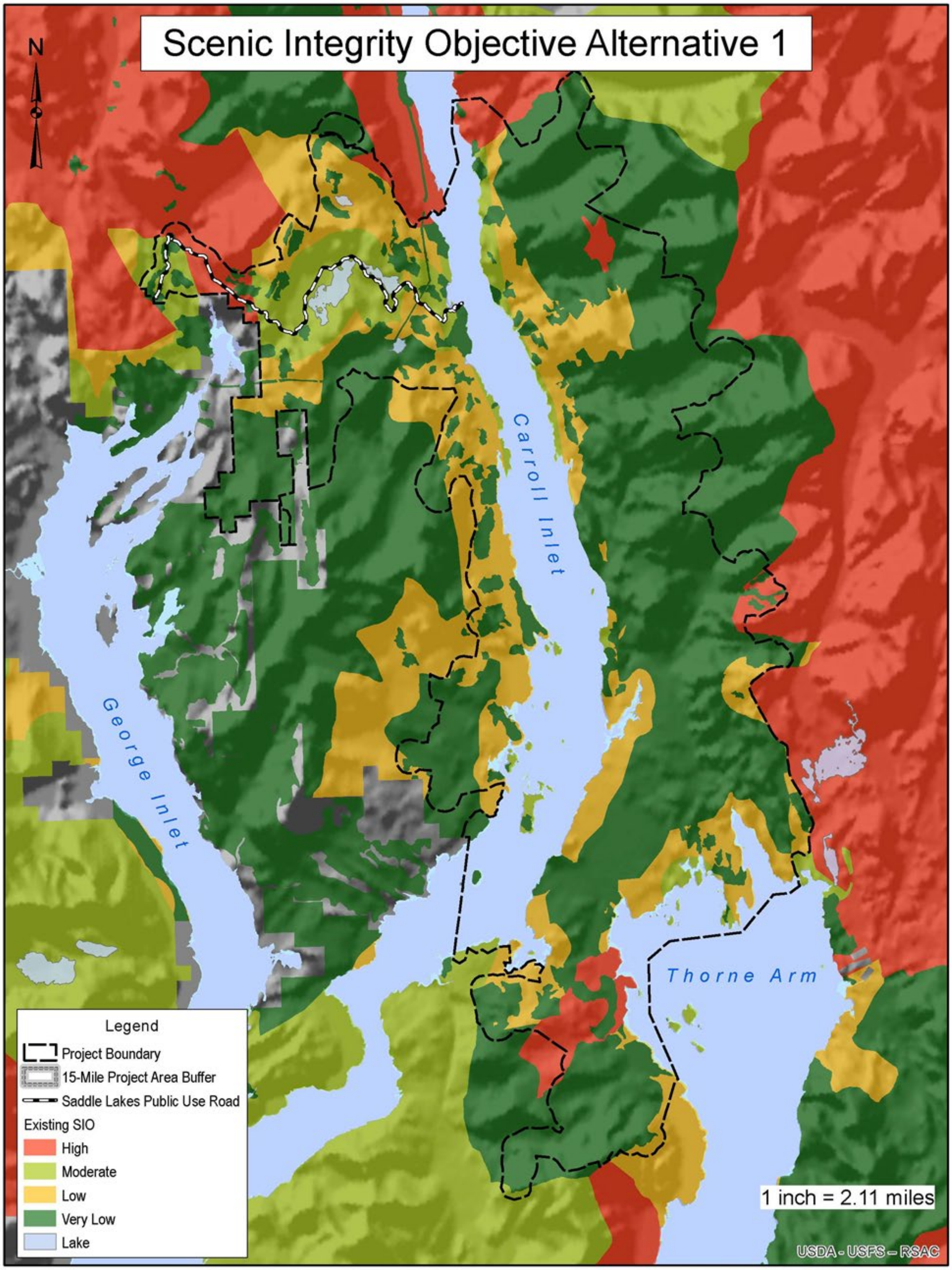


Figure 21. Scenic integrity objective (SIO) current condition for the South Revilla Project Area

Project-specific Forest Plan Amendment

Alternatives 2 and 3 would include a project-specific forest plan amendment to allow lower scenic integrity objectives (SIO) to be used to address Issue 1: Timber Supply and Economics. The purpose and need for this project specific amendment in regard to scenery is to allow adopted SIOs to be lowered to a less-restrictive SIO, in an effort to allow more even-aged management to occur. More specifically, the amendment will lower SIOs between very high and low down to the least restrictive SIO, very low, for the project activities. Lowering the scenic integrity objectives would apply to this project only. The effect of allowing the use of lower SIOs for this project would be areas where existing scenic integrity levels remain below the Forest Plan adopted SIOs until the harvested areas blend into the surrounding landscape, which can take years.

Environmental Consequences

Alternative 1 – No Action

Alternative 1 will have no direct effects on the scenery resource because no project activities would occur. There would be a continued improvement of the existing scenic integrity (ESI) (e.g., from very low to low, or low to moderate) due to regrowth of previously harvested stands. As trees grow larger, the areas with visual disturbances from initial harvests would become less noticeable and the project area would become more natural appearing over time. It can take 40 years for ESI to blend back into the natural surroundings.

Direct and Indirect Effects Common to all Action Alternatives

Timber Harvest and Associated Actions Direct and Indirect Effects

Table 37 presents a summary of timber harvest and road construction actions associated with the action alternatives, including the project-specific forest plan amendment proposed for Alternatives 2 and 3, which changes the Forest Plan scenery standards and guidelines to attain project consistency.

Table 37. South Revilla Timber Sale activities

Alt.	Even-aged Silvicultural Methods[1/] (acres)	Uneven-aged Silvicultural Methods[2/] (acres)	NFS Road Construction (miles)	Forest Plan Amendment (Yes or No)
1	0	0	0	No
2	5710	776	82.9	Yes
3	4899	672	78.6	Yes
4	5169	1317	78.8	No

Source: USFS Tongass National Forest GIS
1/ Includes clearcut method.
2/ Includes only uneven-aged silvicultural methods (UA33; 33 percent basal removal).

The effects associated with the three silvicultural prescriptions in this project are quite different. In a very general sense, the clearcut and two aged 50 percent retention (2A50) prescription may create visible impacts while the uneven-aged 33 percent retention (UA33) and two aged 30 percent retention (2A30) prescription usually does not. Clearcuts can be designed to blend well with the landscape, and therefore may not be very noticeable, while impacts from the UA33 prescription may be visible at a close distance, but not create much visual disturbance. For this analysis, units of UA33 and 2A30 percent retention are assumed to not be noticeable to the casual observer, and views exclusively consisting of units of UA33 would appear visually intact.

The following tables display effects for the action alternatives (Alternatives 2 to 4) and will be referred to in the alternative effects analyses that follow. Table 38 summarizes the silvicultural prescription acres in SIO by alternative. Table 39 summarizes road construction by SIO for each alternative. Table 40 summarizes the harvest within the Saddle Lakes Recreation Area viewshed by prescription for each alternative.

Table 38. Acres of harvest by existing scenic integrity objective (SIO) for the South Revilla Integrated Resource Project

	Alternative 2				Alternative 3				Alternative 4			
Scenic Integrity Objective (SIO)	CC	UA33	2A 20%	2A 50%	CC	UA33	2A 20%	2A 50%	CC	UA33	2A 20%	2A 50%
High	0	0	0	0	0	0	0	0	0	0	0	0
Moderate	0	0	0	0	0	0	0	0	280	498	78	0
Low	0	0	0	0	0	0	0	0	884	651	8	0.2
Very Low	4756	1069	99	277	4057	992	5	264	3004	519	1	279
Prescription Totals	**4756**	**1069**	**99**	**277**	**4057**	**992**	**5**	**264**	**4168**	**1668**	**87**	**279**
Totals	**6201**				**5319**				**6201**			

Source: USFS Tongass National Forest GIS. Note: Numbers may not add due to rounding

Table 39. Miles of proposed roads by alternative and scenic integrity objective (SIO) for the South Revilla Project

Scenic Integrity Objective (SIO)	Alt. 2	Alt. 3	Alt. 4
High	0	0	0.1
Moderate	0	0	4
Low	0	0	10
Very Low	44	40	26
Total	**44**	**40**	**40**

Source: USFS Tongass National Forest GIS. Note: Numbers may not add due to rounding.

Table 40. Acres of harvest within Saddle Lakes Recreation Area viewshed, by prescription

Prescription	Alt. 2	Alt. 3	Alt. 4
CC	724	635	592
UA33	178	205	364
2A 20%	55	0	0
2A 50%	50	51	51
Total	**1007**	**891**	**1007**

Source: USFS Tongass National Forest GIS.

Alternative 2 – Proposed Action

The proposed timber harvest in Alternative 2 does not meet Forest Plan scenery standards and guidelines and would require a project-specific Forest Plan amendment. Alternative 2 includes 1,752 more acres of even-aged harvest than Alternative 4, with 13 percent of the total harvest as UA33 while Alternative 4 is 25 percent (table 38).

Under this alternative, there are no harvests in areas categorized in high, moderate, or low SIO, as a result of the project-specific Forest Plan amendment. The amendment would lower 2,399 old-growth harvest acres to very low SIO. For this alternative to be consistent with the forest plan scenic integrity objectives, it requires an amendment to the forest plan SIOs. The Forest Plan amendment would lower the existing SIO of all old-growth harvest and associated road activity-affected SIOs to very low. The lowered SIOs in the project area would apply to the South Revilla project only and not future projects. The amendment is temporary and will only last for the duration of the project, however, there will be long-term effects to scenery as it takes up to 40 years for a harvested unit to naturalize back into its surroundings.

The greatest impacts would be seen from Saddle Lakes (i.e., the “Saddle Lakes Recreation Area” see figure 22, which currently have very high and high existing scenic integrity. For this alternative, the Forest visitors in these areas would be seeing landscapes where harvest activities dominate the scenery. To help visualize the changes, the following figures were developed to show both the existing view and the location of proposed units on the same view. The red overlay shows the unit locations but is not intended to be a photorealistic depiction of the future view. The map in figure 22 indicates the location at which the photo was taken, the direction of the view, and the prescription of the units. Figure 23 shows the existing view at the eastern lake within the Saddle Lake Recreation Area, with figure 24 showing the proposed units in Alternative 2 superimposed on the existing view.

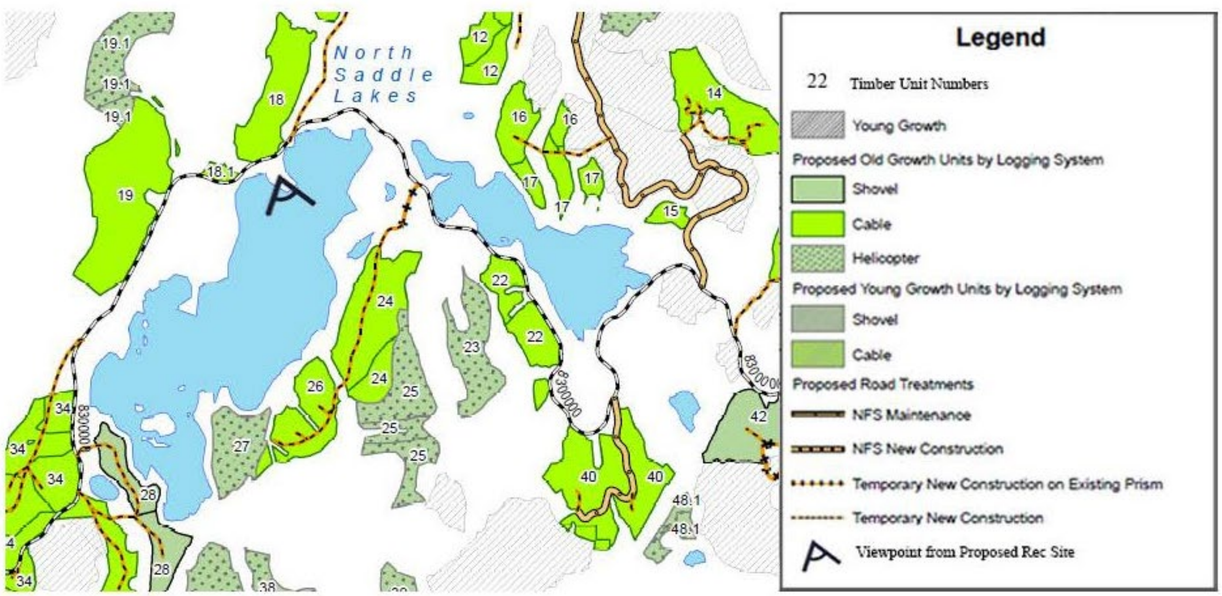


Figure 22. Location of view in figure 23 and figure 24

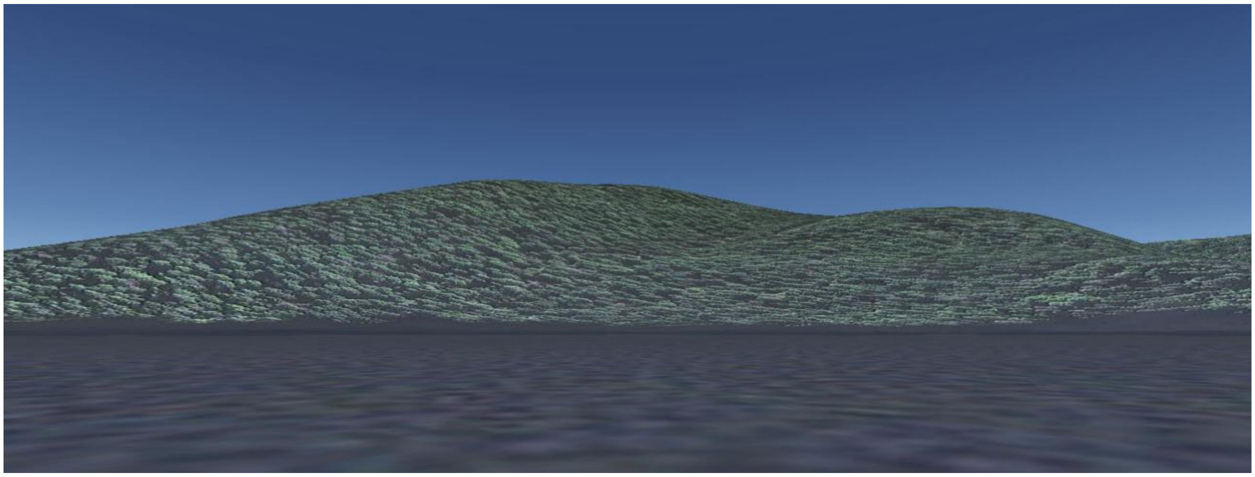


Figure 23. Existing view from proposed Saddle Lake recreation site (ESI very high, SIO moderate)

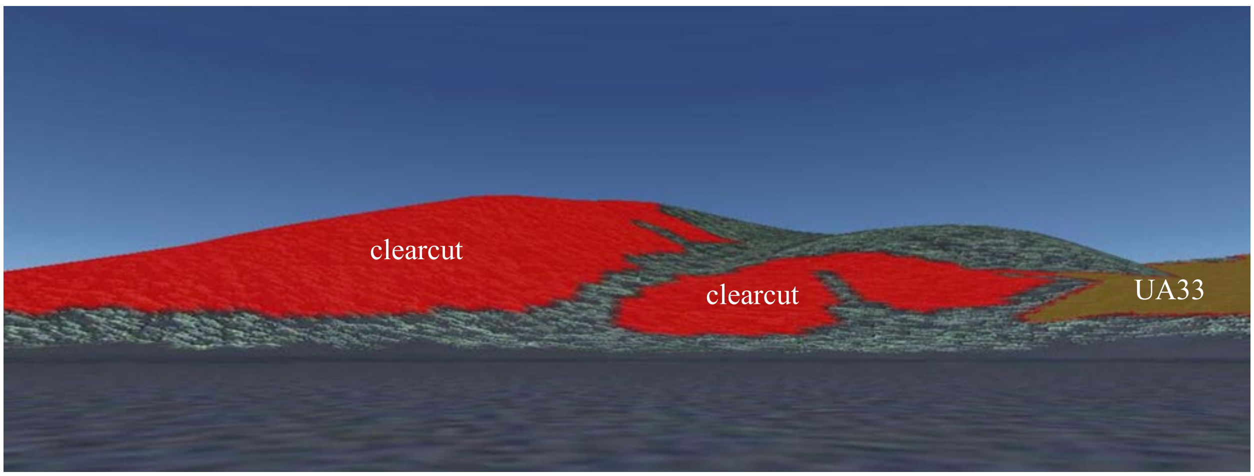


Figure 24. Proposed timber harvests for Alternative 2 from Saddle Lakes recreation site (example of a very low SIO). UA33 = uneven-aged 33 percent retention

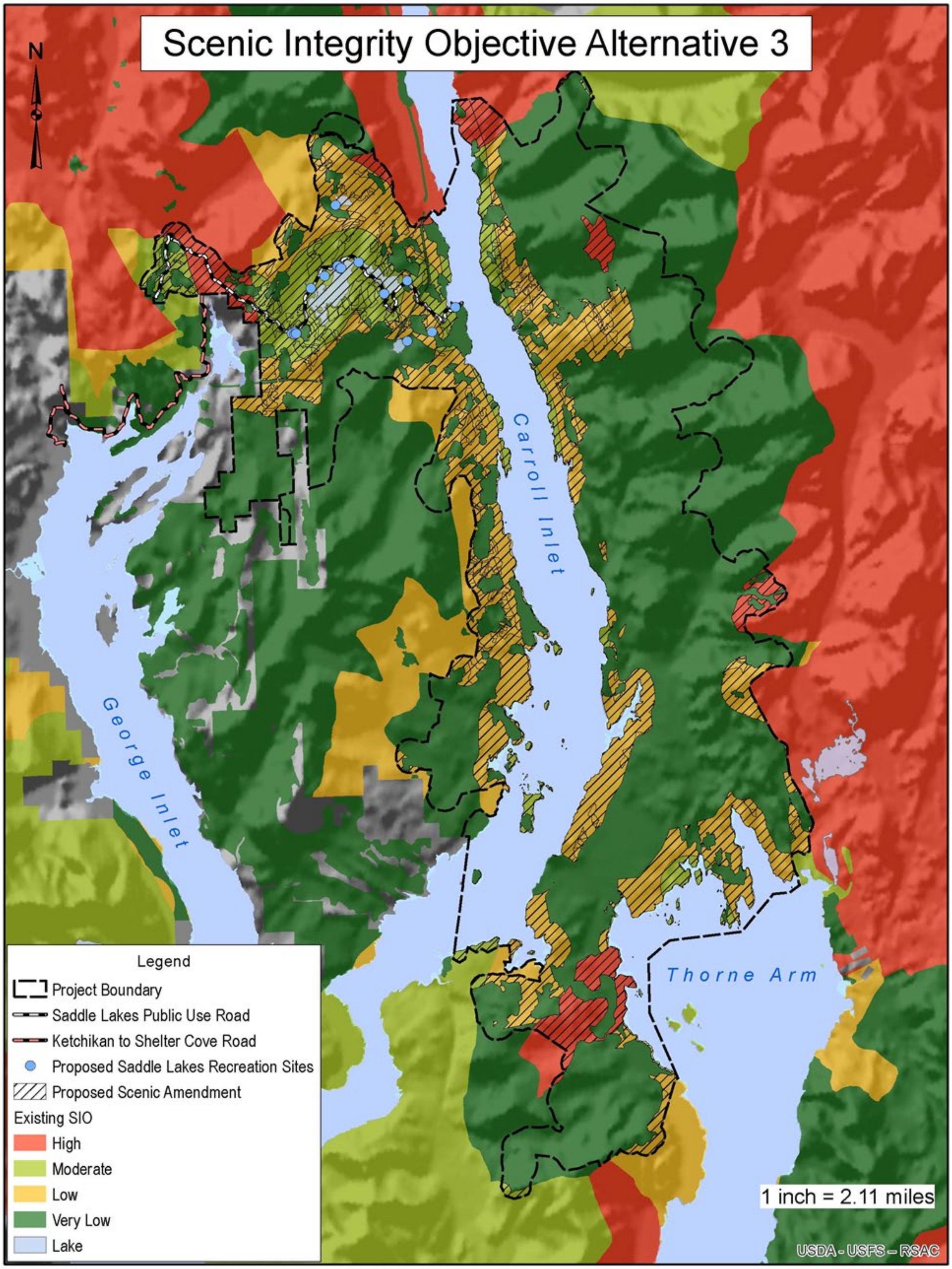


Figure 25. Existing scenic integrity with Alternative 2 proposed harvests

Alternative 2 has the most effects to the scenery resource of all the action alternatives.

Alternative 3

Proposed timber harvest in Alternative 3 does not meet forest plan scenery standards and guidelines and would require a project-specific Forest Plan amendment. Alternative 3 would harvest less uneven-aged acres than Alternative 4. Alternative 3 harvests 1,752 more acres of even-aged than Alternative 4 Within the Saddle Lakes Recreation Area viewshed, 891 acres would be harvested, 71 percent which would be even-aged management (table 40). The Forest Plan amendment would lower the existing SIO of all old-growth harvest and associated road activity-affected SIOs to very low. The lowered SIOs in the project area would only apply to the South Revilla project only and not future projects. Alternative 3 would have very similar effects to scenery as Alternative 2, but with 882 less acres of harvest.

Alternative 3 ranks second highest for effects to the scenery resource of all the action alternatives.

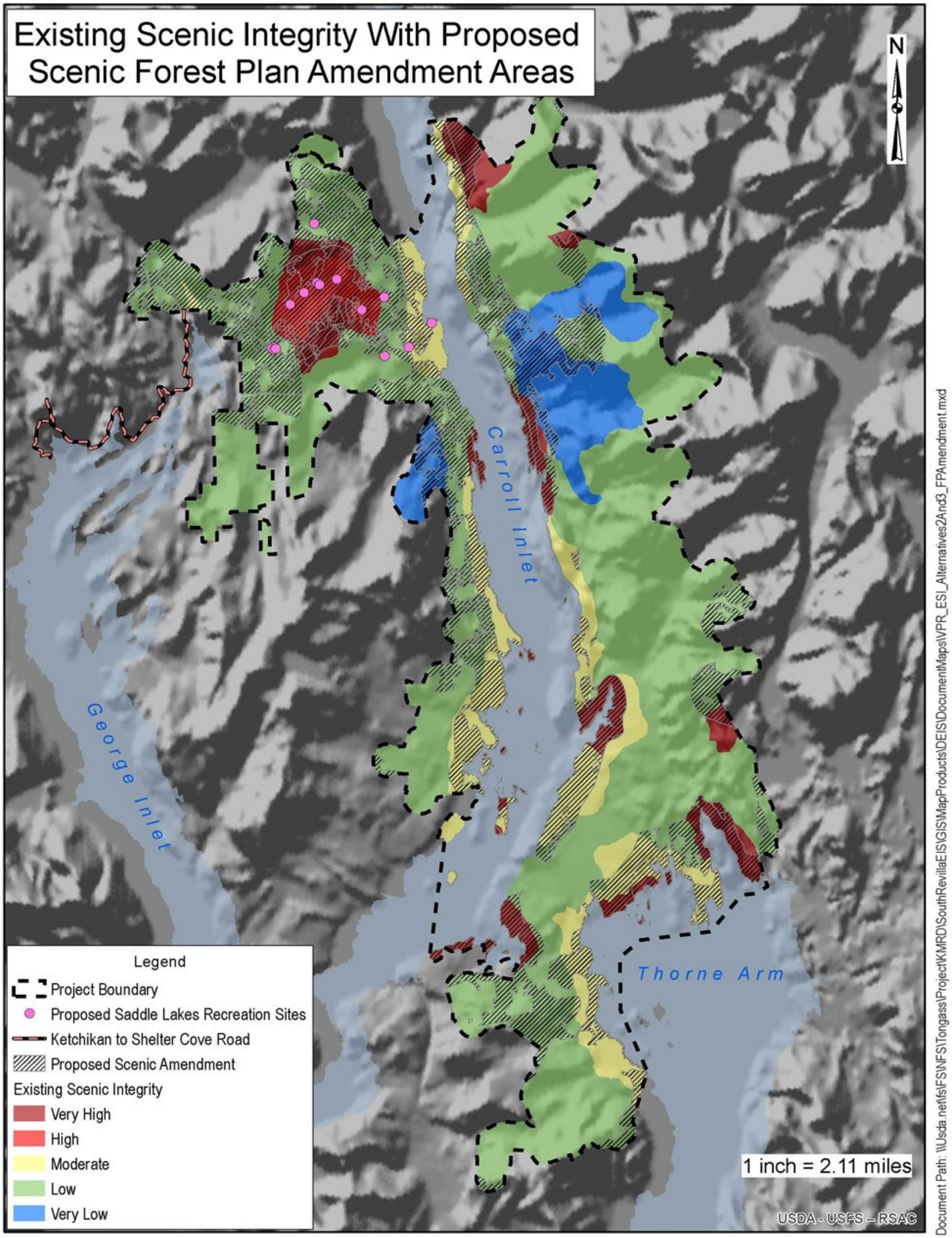


Figure 26. Existing scenic integrity with Alternative 3 proposed harvests

Alternative 4

Alternative 4 is designed to maximize timber harvest while meeting the Forest Plan scenery standards and guidelines. This alternative would harvest 856 acres (14 percent of total project acres) within areas of moderate SIO. Alternative 4 would require the construction of road within areas of moderate SIO, but no changes of SIO acreage inside or outside of the project area would occur. Forest visitors in the visual priority route areas of the modified landscape LUD would see a landscape where harvest activities are allowed, but do not dominate the existing landscape character. In other words, as the viewer looks at the scenery, it may not be immediately obvious that timber harvest has occurred within their view. Within the Saddle Lakes Recreation Area VPR viewshed, a total of 1,007 acres of timber would be harvested with 42 percent being partial harvest (table 40).

Alternative 4 ranks highest among the action alternatives in terms of having the least effects to the scenery resource.

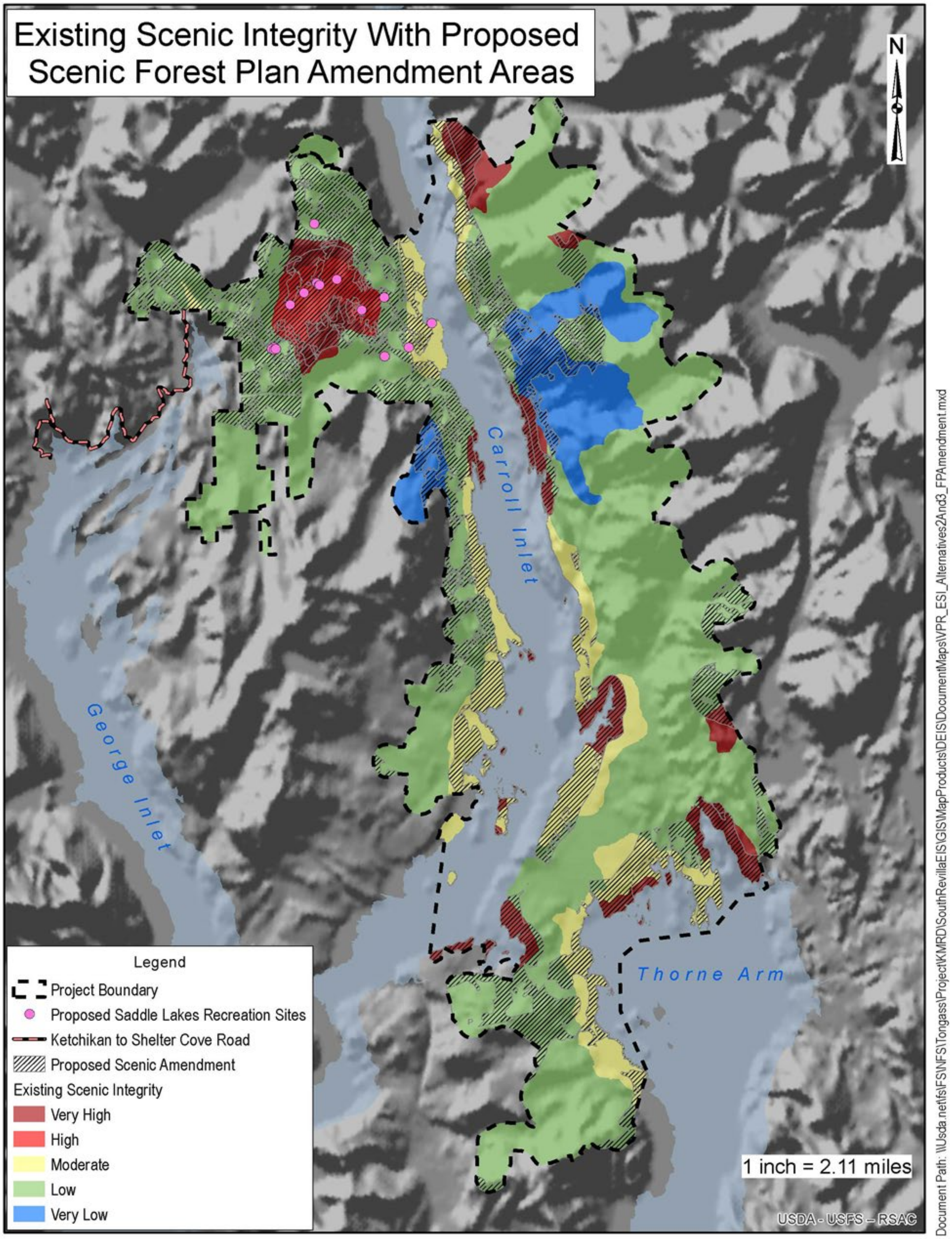


Figure 27. Existing scenic integrity with Alternative 4 proposed harvests

Cumulative Effects

Appendix C includes the interrelated projects (i.e., past, present and reasonably foreseeable future actions) that have been considered in the scenery cumulative effects analysis. These effects include timber harvest, roads, rock quarries, landings, and other management activities. Previous development in the project area has modified the scenic environment of many areas from a natural appearing condition to a condition where some landscapes appear heavily altered. This includes, all harvest areas 30 years-old or younger as past disturbance and are assumed to have been harvested using even-aged silvicultural methods (i.e., clearcutting). The Swan Lake powerline corridor clearing. As well as the potential for 8,170 acres of National Forest System land exchanged under the Alaska Mental Health Trust Authority and the subsequent timber harvests on this land. Change in land ownership could add or subtract to scenic integrity depending on the goals of the AMHT. Young-growth thinning (e.g., precommercial thinning) is not included because it would likely have a minimal effect on scenery.

Cumulative effects for scenery resources in all affected viewsheds are estimated using quantifiable measures as indicators for actual effects. The cumulative effects scenery analysis area is best represented as a viewshed, and using VCUs to represent viewsheds, includes VCUs 7460, 7470, 7530, 7542, and 7560.

Percent Allowable Visual Disturbance represents an index of cumulative effects modeled as the expected visual consequences of timber harvest and is described the Forest Plan FEIS (USDA 2008c, Appendix B, p. B-23). Visual disturbance outcomes vary by the scenic objectives for each of the LUDs available for timber harvest. Visual disturbance is calculated by adding the past, present, and reasonably foreseeable harvest acres and dividing by the acres of suitable land within a viewshed or VCU. It is calculated from a "birds-eye" view and not based on the view from specific viewpoints.

Table 41 represents a comparison of the expected cumulative visual disturbance by Alternative.

Table 41. Expected cumulative visual disturbance by alternative in the South Revilla Project Area

VCU	LUD	Total Acres in VCU w/in Project Area	Suitable Land (Acres)	Suitable Land (%)	Alternative 1 Total Disturbance (% of Suitable Land)	Alternative 2 Total Disturbance (% of Suitable Land)	Alternative 3 Total Disturbance (% of Suitable Land)	Alternative 4 Total Disturbance (% of Suitable Land)
7460	ML	7,973	2,297	29%	1%	52%	46%	52%
	TP	8,280	2,088	25%	1%	39%	32%	39%
7470	ML	2,822	1,106	39%	2%	48%	42%	48%
	TP	1,697	495	29%	0	36%	35%	36%
7530	ML	3,965	533	13%	0	35%	31%	35%
	TP	9,653	2,541	26%	0	34%	27%	34%
7540	TP	35	23	64%	0	0%	0	0
7542	TP	4	3	82%	0	0%	0	0
7560	ML	2,278	176	8%	0	20%	7%	20%
	TP	4,611	1,139	25%	0	40%	34%	0%
7570	ML	181	9	5%	0	1%	1%	1%
	TP	0.1	0	0%	0	0	0	0

VCU	LUD	Total Acres in VCU w/in Project Area	Suitable Land (Acres)	Suitable Land (%)	Alternative 1 Total Disturbance (% of Suitable Land)	Alternative 2 Total Disturbance (% of Suitable Land)	Alternative 3 Total Disturbance (% of Suitable Land)	Alternative 4 Total Disturbance (% of Suitable Land)
Project Area	ML	17,218	4,120	42%	<1%	47%	42%	47%
	TP	24,281	6,289	39%	<1%	37%	30%	37%
	Total	41,499	10,709	40%	<1%	41%	35%	41%

Recreation

This section discusses the potential effects to recreation assets and visitor use of National Forest System (NFS) lands in the South Revilla Integrated resource project (South Revilla project) area. Recreation assets are evaluated using quantitative and qualitative measurements to analyze potential effects. Quantitative analysis relies on potential inventory changes to the existing Recreation Opportunity Spectrum (ROS) classes and potential changes to access, while qualitative analysis examines potential effects to the physical resources and facilities actively maintained by the Forest Service and the potential changes that could occur to current recreation uses in the area.

Summary

Alternative 1 would result in no change to recreation opportunities in the South Revilla project area, while Alternatives 2, 3, and 4 may result in minor to moderate impacts, depending on the nature of the activity being implemented.

Regulatory Framework

Tongass Land and Resource Management Plan

Management activities on NFS lands must be consistent with the 2016 Forest Plan and comply with federal and state laws. For Forest users there is an expectation that the Forest provides a range of recreation opportunities consistent with public demand, emphasizing locally popular recreation places and those important to the tourism industry (USDA Forest Service 2016a, p. 2-4). The 2016 Forest Plan contains forest-wide direction along with specific standards and guidelines for recreation and tourism that apply and provide for resource protection across the Forest (USDA Forest Service 2016a, Chapter 4). In addition, the Recreation Opportunity Spectrum (ROS) Class Standards and Guidelines are included in Appendix I of the 2016 Forest Plan.

Recreation opportunities are defined as an opportunity to participate in a specific recreation activity in a particular recreation setting to enjoy desired recreation experiences and other benefits that accrue (36 CFR 219.19).

Other Relevant Direction

The following resources were used to as guidance in developing recreation projects and analyzing effects for this project:

- *Executive Order 12962* (Aquatic Systems and Recreational Fisheries) directs federal agencies to conserve, restore and enhance aquatic systems to provide for increased recreational fishing opportunities.

- September 2019 *Shelter Cove Area Master Plan* guides the development of recreation opportunities in the Shelter Cove area.
- January 2012 decision based on the *Ketchikan-Misty Fiords Outfitter and Guide Management Plan* allocates use to outfitters and guides in specific areas within the Ketchikan Misty Fjords Ranger District.
- *Connecting People with America's Great Outdoors: A Framework for Sustainable Recreation, USDA Forest Service 2010* directs agency personnel to sustain the benefits of outdoor recreation for present and future generations, through recreation programs that address and work toward a sustainable balance among the three spheres of environmental, social, and economic conditions.
- January 2020 *Sustainable Cabin Strategy* is a Tongass-wide initiative to "right-size" the Tongass cabin program to meet current recreation trends, foreseeable budget constraints and deferred maintenance needs. This strategy is likely to influence proposed cabin projects.

Methodology

Spatial and Temporal Context for Effects Analysis

Direct effects are short-term impacts and are associated with the time period in which the activity is implemented. Indirect and cumulative effects are measured over the long term after implementation is complete. For example, the noise of trucks and heavy equipment operating would be considered short-term direct effects, whereas the harvested unit or a new NFS road may impact the visual quality or remoteness of a recreation site in the long term.

Direct and Indirect Effects Boundaries

The spatial boundaries for analyzing the direct and indirect effects to recreation are an area just outside the project boundary that are within hearing and visual range of proposed activities. Man-made noise and activity have the potential to directly impact visitor experiences near any active project activities. The direct effects for harvest activities will be adjacent to harvest unit boundaries and along roads with timber harvest activities. Indirect effects will be within hearing and visual range of harvest units and roads. For road construction, direct effects are analyzed in the road corridor with indirect effects being analyzed within hearing and visual distance of the road construction activity. Direct effects of recreation is within the construction footprint and indirect effects within hearing and visual range of the construction footprint.

The temporal boundaries for analyzing the direct and indirect effects are during the timeframe of proposed activities because direct effects to recreation will cease when proposed activities, such as timber harvesting, stop.

Cumulative Effects Boundaries

Cumulative effects for recreation are analyzed at a larger scale than the project area. There is no set area with a firm boundary. Included in the area are the Ketchikan to Shelter Cove road and proposed AMHT land exchange.

The temporal boundary for analyzing indirect and cumulative effects extends beyond the proposed project timeline, because cumulative effects are likely to become more apparent over the long-term.

Units of Measure

Table 42. Resource indicators and measures for assessing effects to recreation

Resource Element	Resource Indicator	Measure
Recreation Opportunity Spectrum	Acres of ROS class affected by proposed activities	Acres
Recreation Sites	Number of identified recreation sites	Number of sites in project area
National Forest System Trails	Miles of Trail	Miles of trail in Project Area
Visitor Use	Number of visitors in project area	Outfitter and Guide use, undocumented tracking
Increased Recreational Opportunity	Number of main recreation activities participated in.	Survey responses to future NVUM surveys

Effects to ROS are analyzed assuming proposed activities are implemented, followed by re- mapping the ROS classes as they would be inventoried once the development was complete. Analyzing the resulting acreage changes to an area can give an overall impression of how the character of the land involved will change as developments occur.

Recreation Assets and associated infrastructure were identified using GIS and Natural Resource Management (NRM). GIS was used to determine the number of acres for each ROS class. Miles of trail were determined using GIS.

Visitor Use is informed by The Ketchikan-Misty Fiords Outfitter and Guide Management Plan to determine the availability of opportunities for commercial outfitting and guiding. Existing outfitter and guide special use permits and the outfitter and guide database are used to determine any guided use in the area. The 2014 National Visitor Use Monitoring (NVUM) survey results are used to determine non-guided recreation use types across the Ketchikan Misty Fjords Ranger District.

Incomplete and Unavailable Information

National Visitor Use Monitoring (NVUM) surveys are the primary method by which visitor activity is gathered and compiled. NVUM surveys are forest-level surveys that analyze use across the entire national forest. Due to the remote nature of the site and lack of defined developed recreation opportunities no NVUM surveys have ever been conducted for the project area. As a result, no statistical data exists for recreation activities in the project area.

District wide surveys were conducted during 2019, however the results have yet to be published, consequently the most recent general use data for the Ketchikan Misty Fjords Ranger District is not available. 2014 NVUM survey results are used to show recreation activities across the Prince of Wales-Ketchikan Misty Fjords Ranger District survey area.

Recreation management is based largely on qualitative measures to determine social trends. These qualitative data may be interpreted in various ways.

Affected Environment

Existing Condition

Most of the South Revilla Project area is undeveloped and primarily used for dispersed and undeveloped recreation. Boating, fishing, beachcombing, and hunting are the primary known dispersed recreation activities that take place within the project area.

While most areas of the Forest have the potential to provide recreation opportunities to a varying degree, patterns of use tend to be associated with existing road systems, known protected boat anchorages, boat landings, high quality fishing streams and spectacular natural features such as glaciers or caves.

Recreation Opportunity Spectrum (ROS)

The ROS classes represent a spectrum of possible experiences, from those with a high probability of self-reliance, solitude, challenge, and risk; to those with a relatively high degree of interaction with other people. The setting, activities, and probable recreation experience opportunities associated with each ROS setting are described in Appendix I of the 2016 Forest Plan. The following ROS classes are present in the project area:

- Semi-Primitive Non-Motorized (SPNM)
- Semi-Primitive Motorized (SPM)
- Roaded Natural (RN)
- Roaded Modified (RM)
- Rural (R)

The ROS system does not specify or prescribe what types of activities are allowed in an area. Land use designations (LUDs) defined in the 2016 Forest Plan (Chapter 3) prescribe allowable management activities in conjunction with federal, state, and local laws and regulations. If a LUD allows for increased development, timber harvest, or increased recreation use, the ROS class associated with the LUD typically aligns with the designation. If expanded development occurs within a project area based on an area's LUD, the 2016 Forest Plan allows a change in ROS setting. Changes to existing inventoried ROS classes were anticipated as part of the 2016 Forest Plan implementation, and direction on how to make changes was incorporated into the Plan.

Table 43. Recreation opportunity spectrum classes in the project area

ROS Class	Acres	Percent of Project Area
Primitive (P)	0	0
Semi-Primitive Non-Motorized (SPNM)	906.8	2.04
Semi Primitive Motorized (SPM)	95.05	0.21
Roaded Natural (RN)	43.95	0.10
Roaded Modified (RM)	43,409.39	97.61
Rural (R)	0	0
Urban (U)	0	0
Uncoded	19.2	0.04
Total	**44,474.39**	**100**

Semi-Primitive Non-Motorized acres border the Primitive ROS class and are also found on lands where very few developments are found beyond any road access.

Semi-Primitive Motorized acres rarely have road access but are close waterways with the expectation of hearing boats, planes and vehicles and the likelihood of more frequent social encounters than in the more primitive ROS classes.

The Roaded Natural ROS class is found in those areas with access routes (usually waterways) with frequent social encounters, but very few developments that are obvious to users.

The Roaded Modified ROS class is most often associated with the road construction and vegetative changes that occur during timber harvest.

The Rural ROS class is most often found next to regularly used travel corridors. Developments are noticeable and visitors can expect to encounter other users.

The conversion of acres inventoried for less developed ROS classes to the Roaded Modified class is often the most useful measurement to describe the overall land character changes expected from project implementation.

Existing Recreation Assets

Marine Access Facilities

The only existing recreation asset within the project area is the Osten Island mooring buoy. Marine Access Facilities at Shoal Cove and Shelter Cove provide recreation access incidental to their intended use as transfer facilities.

Trails

The project contains three motorized NFS trails, totaling approximately 13.7 miles. Most trails are less than 5 miles long, exist within the road prism and consists of hard packed gravel designed to NFS road specifications. Because these trails follow existing roadbeds, they do not cross multiple ROS settings.

These trails are classified for motorized use for off highway vehicles (OHV) measuring 50” or less in width. OHV use is popular in association with subsistence activities and sport hunting. OHV owners from Ketchikan transport OHVs to Shoal and Shelter coves to ride the road systems and OHV trails, often in search of game.

Recreation Visitation and Use

Recreation uses within the project area include dispersed camping, hiking, hunting, fishing, relaxing in the outdoors and boating (motorized and non-motorized). The NVUM provides some general information about the percentages of visitors participating in these activities on the Tongass National Forest.

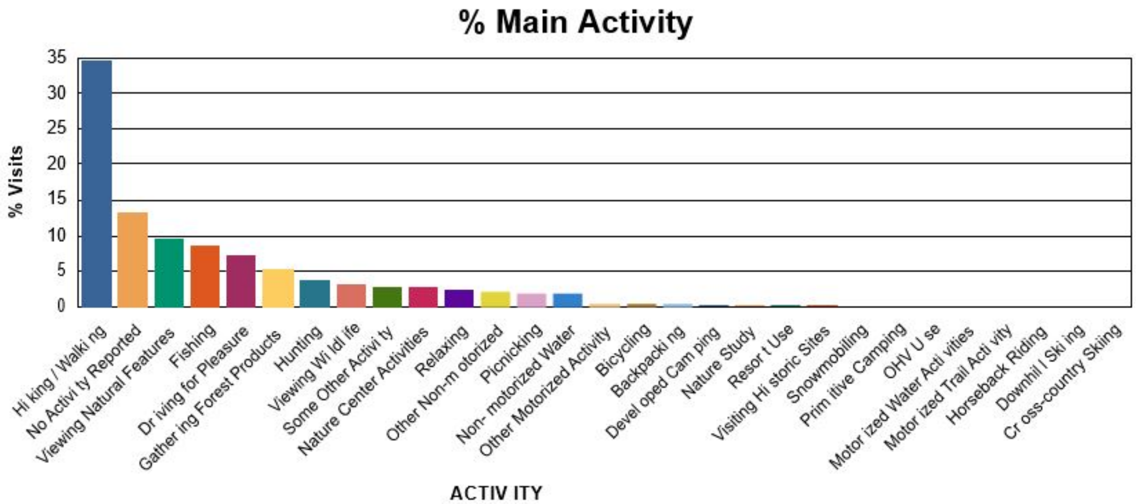


Figure 28. NVUM Ketchikan-Prince of Wales 2014 recreation activity participation

Outfitter and guide use are not a major component to visitor use within the project area. Currently there are no outfitters or guides permitted to operate in the project area.

Environmental Consequences

Recreation effects are expressed qualitatively by analyzing proposed changes in ROS; specifically, the potential for acres to be converted to higher development ROS classes, along with a qualitative assessment of potential effects to the project area's recreation assets and established visitor use. Proposed activities associated with the action alternatives that may directly, indirectly, or cumulatively affect recreation assets are described here.

Direct and Indirect Effects Common to all Action Alternatives

New NFS Road Construction

New National Forest System road construction would increase vehicle access to new parts of the project area and increase motorized recreation opportunities. Construction activities produce noise, dust, and increased construction traffic in the project area that may adversely impact the recreation experience of visitors in the short-term. These effects are limited to areas in, and adjacent to, roads under construction and roads that service construction activities.

New Temporary Road Construction

Temporary road construction may cause disruption to dispersed recreation activities, such as hunting, within the vicinity of construction activities due to noise, dust, and construction traffic and would provide easier access to new recreation opportunities until roads are decommissioned and grown over with vegetation; post decommission and rehabilitation, temporary road corridors would continue to provide easier access to non-motorized recreation opportunities as the road-bed would make it easier than cross-county travel to recreation opportunities. The effects of temporary roads on recreation would last for several years until the decommissioned roads were grown in enough to prevent access.

Marine Access Facility Reconstruction

Shelter Cove and Shoal Cove marine access facility reconstruction and maintenance is likely to have direct and indirect effects on recreation opportunities. Some visitor-created sites have been established at these MAFs, and short-term closures of these sites could occur during timber harvest activities thus reducing recreation opportunities associated with MAFs. Marine access facilities also provide incidental recreation access to uplands within the project areas such harvest activities could impact the ability of forest visitors to use these facilities to access these upland areas. Indirect effects would occur as recreation visitors discover the MAFs and use them for recreation purposes because they provide access to and from uplands to saltwater, often on a road system. MAFs would still be available for motorized and non-motorized uses such as hiking, biking, and hunting when not being used for harvest activities.

Rock Quarries

Up to 98 existing and 8 new rock pits are proposed for construction, reconstruction, and maintenance of roads and facilities including marine access facilities, recreation facilities and infrastructure. Existing recreation activities in the immediate vicinity of proposed and existing rock pits will be disrupted by quarrying activities in the short term due to noise, dust, and increased traffic. Expanded and new rock pits have the potential to alter recreation opportunities in the long-term as they would provide new opportunities such as target shooting and dispersed camping areas, to forest visitors,

Proposed Shelter Cove Area Recreation Master Plan Activities

The development of proposed recreation infrastructure would have a negligible effect to the overall landscape. Variations in the distribution and types of recreation infrastructure across the project area would not result in changes to the ROS. Development of proposed recreation sites would create approximately one-half mile of new non-motorized trail. It would increase recreation sites in the project area from one to ten. The proposed recreation developments will have a long-term impact to recreation opportunities in the project area through the construction of new sites that are not currently present in the project area.

Sites may be subdivided into types based on the extent of ground coverage that may result in potential ground disturbances. We do not have site-specific designs for proposed sites; therefore, for this analysis an allowance of 80 percent of a site's base structure(s) area has been added to account for design variables such as boardwalks, trails, and accessibility considerations, and user activities (exploring, firewood gathering, etc.) adjacent to the site. The extent of camp sites, day-use/picnic areas, and interpretative areas are based on conceptual perimeters that would contain all of a site's features; therefore, the 80 percent allowance is not added.

Types of proposed discrete sites and their ground coverage (see figure 3):

- Shelter Cove Area Recreation Gateway (Site A): Parking area with five parking spaces, interpretive kiosks, ad gateway monument sign. Area approximately 1,500 square feet (0.034 acre).
- Overlook #1 (Site B): Parking area, interpretive kiosks. Area approximately 1,500 square feet (0.034 acre).
- Upper Saddle Lake Boardwalk, Interpretive, and Boat Access (Site C): Nature viewing platforms, outhouse, non-motorized boat launch, parking spaces, boardwalk trail. Area approximately 8,000 square feet (0.18 acre).
- Overlook #2 (Site D): Parking area, interpretive kiosks. Area approximately 1,500 square feet (0.034 acre).

- Overlook #3 (Site E): Parking area, interpretive kiosks. Area approximately 1,500 square feet (0.034 acre).
- Lower Saddle Lake Access (Site F): Trailhead with trailer parking, non-motorized boat access, connector trail. Area approximately 4,000 square feet (0.091 acre).
- Shelter Cove Access Area (Site G): Parking, outhouse, interpretive kiosks, upgraded dock (with expanded float), improved boat ramp, connector trail, boardwalk trail/fishing platforms, and cabin. Area approximately 10,000 square feet (0.22 acre).
- South Lake Camping (Site H): Dispersed camping, parking area, connector trail. Approximately 4,500 square feet (0.1 acre).
- Lemon Lake (Site I): Trail improvements for ATVs, foot trail, 3-sided shelter, outhouse, interpretive kiosk, and nonmotorized boat launch. Area approximately 1,700 square feet (0.03 acre).

Ground coverage for trails is measured by the length of the route and the width of the trail (typically 4 feet). This analysis estimates a total of about one-half miles of trail would be constructed at four sites: Lemon Lake, South Lake, North Saddle Lake, and Lower Saddle Lake.

Overall the ground-disturbing activity involved with the development of proposed recreation infrastructure would have a negligible impact on the overall landscape. Existing trails total approximately 17 acres, while proposed sites could contribute an additional 1 acre to the recreation infrastructure. Existing recreation infrastructure directly affects less than 1 percent of the acres of NFS land in the project area. The addition of all the proposed projects would directly affect less than 1 percent of NFS lands. Based on the quantity of proposed recreation sites and their individual footprints, implementation would result in negligible effects at the landscape level. Implementation of proposed activities would result in localized ground disturbance, but these activities would be contained within limited areas.

Development of sites may result in user concentrations, but this would be relative to ongoing project-wide use levels. This may result in some disturbances but would generally be of short duration and would not result in alterations to the natural state of the landscape.

Watershed Management

Stream restoration work generally benefits recreation assets because it could increase fish populations and fishing opportunities. Nevertheless, stream restoration work may use heavy equipment for excavation, placement of large trees and wood into streams, explosives, hand tools, and creation of temporary puncheon trails for stream access.

Direct effects to recreation opportunities may be noise disturbance, temporary site closures and potential changes in water levels at popular fishing areas. Indirect effects may be increased fishing opportunities and increased wildlife viewing because better fish runs draw more wildlife to streams.

Wildlife Habitat Management

Wildlife habitat management could measurably impact subsistence and sport hunting and perhaps cross-country use and sightseeing. Pre-commercial thinning occurring in riparian areas or near estuaries could displace game that would be targeted by hunters in the short term till slash produced from proposed treatments decomposes sufficiently, but long-term benefits to game species would be expected.

Alternative 1 – No Action

Direct and Indirect Effects

Alternative 1 would have no direct or indirect effects on recreation because there would be no proposed activities under this alternative and repair and maintenance of existing recreation assets would continue at present levels based on available program resources and prior approved plans.

Cumulative Effects

If the potential AMHT land exchange does occur, an estimated potential 8,224 acres of NFS lands would decrease opportunities for recreation use on NFS lands. 4,019 acres of old-growth timber harvest may occur on non-NFS lands and up to 51 miles of road construction may occur on non-NFS lands in the project area over the next 20 years. Harvest and road activities could result in a change of ROS class on NFS lands adjacent to non-NFS harvest activities should those activities occur close enough to the property boundary. This could result in a change in existing recreation opportunities in impacted areas.

A reasonably foreseeable action of the Ketchikan to Shelter Cove road is a major increase in visitor use to the project area over historic levels due to new road access. Visitors to the area will use existing trails and undeveloped sites as well as create new dispersed sites as they seek recreational opportunities.

Alternatives 2, 3 and 4

Direct Effects and Indirect Effects

Table 44. South Revilla project ROS change

ROS Class	Existing acres	Alternative 2 and 4 +/- acres	Alternative 3 +/- acres
Semi-Primitive Non-Motorized (SPNM)	906.8	-126	-39
Semi Primitive Motorized (SPM)	95.05	0	0
Roaded Natural (RN)	43.95	0	0
Roaded Modified (RM)	43,409.39	+126	+39
Uncoded	19.2	0	0
Total acres	44,474.390	126	39
Percent change		0.03% Converted to RM	0.001% Converted to RM

Table 45. Summary comparison of how the alternatives address the Issues

Issue	Indicator/ Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Changes to Recreation Opportunity Spectrum system classification	Acres of changed classification	0	-126 SPNM +126 RM	-39 SPNM +39 RM	-126 SPNM +126 RM
Changes to access	Miles of nonmotorized and motorized access	0	+0.5 non-motorized miles +0.4 miles motorized trail	+0.5 non-motorized miles +0.4 miles motorized trail	+0.5 non-motorized miles +0.4 miles motorized trail

Recreation Opportunity Spectrum

Implementation of Alternatives 2 and 4 would result in a greater change of the SPNM ROS than Alternative 3. However, given that the change in ROS is a small portion of the project area direct impacts to recreation opportunities in the SPNM ROS is negligible across all three action alternatives.

Recreation Assets

Alternatives 2, 3, 4 would have minor direct impacts on the recreation assets in the project area. Mooring buoy users would experience short-term impacts from passing barge and raft traffic related to noise and wake. Long term impacts to recreation assets would be primarily related to changes in scenery and are discussed in the scenery section.

National Forest System Trails

Under Alternatives 2,3, and 4 harvest activities would occur on motorized trails currently dual designated as roads and would have short-term impacts for motorized trail users. Delays and interruptions from harvest activities could impact the experience of trail users on existing motorized trails. Long term, there would be an increase of 0.4 miles of motorized trail after harvest operations are complete. 0.5 miles of non-motorized trail would be created under the proposed Shelter Cove Recreation Plan developments

Visitor Use

Alternatives 2, 3, and 4 would have short-term impacts on outfitter/guide use but is not expected to have long-term impacts on the ability of outfitter/guides to operate in the project area. Currently there are two recorded guided use days in the project area. Visitor use may be impacted by disturbances and delays in harvest activities that could result in localized drop in visitor use in the project area.

Availability of Recreational Opportunity

Alternatives 2, 3, and 4 would have short-term impacts to the availability of recreational opportunities as a result of harvest activities. Opportunities adjacent to harvest activities may be interrupted, disrupted or disturbed by noise and harvest activities occurring on, or adjacent to, roads. Alternatives 2 and 4 proposes to harvest more acres of old-growth forest than Alternative 3 which would result in impacts to recreation opportunities located in old-growth areas. Long term impacts to recreation opportunities would be primarily related to changes in scenery and are discussed in the scenery section.

Alternative 2 proposes to construct the most miles of new NFS road and would thus potentially create more new motorized recreation opportunities than any action alternatives. Alternative 4 would construct 13.6 miles and Alternative 3 would construct the least amount of new road at 13.1 miles.

Alternative 2 proposes to construct the most temporary roads at 34 miles with Alternatives 3 and 4 constructing 31.7 and 31.8 respectively. All action alternatives would provide increased access to recreation opportunities along temporary roads with Alternative 2 providing the most access to recreation opportunities.

Cumulative Effects

Past and present natural and human caused disturbances or modifications including timber harvest and road construction are evident throughout the project area. The influence of these activities on recreation opportunities in the area is reflected in the current ROS settings. As a result, all three action alternatives are not expected to contribute to long-term changes to overall patterns of recreation use in the project area. Existing opportunities would continue to be available for those seeking remote and dispersed recreation experiences and those seeking access to fishing and hunting opportunities would continue to have those opportunities.

The potential Alaska Mental Health Trust (AMHT) land exchange would shift 8,224 acres of NFS lands to other ownership. This would decrease in the opportunity for recreation use on NFS lands including the potential for recreation development. Changes in land ownership could disrupt accessibility to, and connectivity between, recreation opportunities on NFS lands, which could result in sites becoming isolated and experiencing reduced or no use and a potential change in ROS class. ROS classes adjacent to non-NFS lands could see a change to less primitive ROS classes should harvest or road building activities occur close enough to NFS-lands.

Short-term cumulative impacts could occur if one or more of the reasonably foreseeable projects were to coincide in time and space with the project. This could result in additional temporary disruptions to recreation use and could affect the quality of the recreation experience in localized areas. These types of impacts would be limited to the duration of road building and harvest activities in a location.

The Ketchikan to Shelter Cove Road affects recreation opportunities through motorized access from Ketchikan to potential recreation sites by vehicle. This, in turn, opens opportunities for new recreation facility construction and reduces the remoteness of the project area. It is easier to travel between Ketchikan and the project area and recreation use would likely increase.

Forest Vegetation

The South Revilla project proposes old-growth and young-growth timber harvest and restoration activities that would affect forest structure, species composition, and stand health.

Methodology

Project area information was obtained from the Tongass National Forest GIS library, aerial photos, and the Forest Service Activity Tracking System database (FACTS). Old-growth stands have had walkthroughs, and/or plots using the Common Stand Exam protocol to quantify stand characteristics. Data were inventoried and summarized using the Forest Planning and Projection System (FPS).

Young-growth Inventory

Young-growth inventory data in stands 40 years in age or older have been collected through two different inventories in the project area over the past several years.

- Stands considered for commercial harvest or potentially “near-term operable”, which equates to roughly 55 years and older, were inventoried under the Challenge Cost Share Agreement with a plot intensity of one plot for every 2.5 acres.
- A sample of younger stands roughly 40-54 years old were inventoried under the Common Stand Exam protocol with a plot intensity of one plot for every 5 acres.

These young-growth data are incorporated into the Forest Planning and Projection System database (FPS). The FPS program allows data from inventoried stands to be extrapolated into non-inventoried stands with similar species composition, stocking levels and volume classes. FPS also allows stands to be “grown forward” using a Tongass calibrated growth and yield model. For more information see the Young Growth Inventory Portal at:
https://usfs.maps.arcgis.com/apps/MapJournal/index.html?appid=e748ce92139c4100a65ad8b12510d620#

Information derived from these datasets is used in developing silviculture prescriptions.

Incomplete and Unavailable Information

Windthrow risk assessments are incomplete for some of the proposed harvest units. A windthrow risk assessment is required for every unit's final prescription; where windthrow risk has not yet been assessed, prescriptions are based on other information currently available, such as levels of disease and decay and stand structure. Field surveys are still ongoing at this time, and windthrow risk assessments will be completed by interdisciplinary specialists for every proposed harvest unit.

Spatial and Temporal Context for Analysis

The analysis area for direct and indirect effects to forest vegetation is National Forest System lands in the South Revilla project area. The cumulative effects analysis area includes all lands within the South Revilla project area. The timeframe used to analyze effects is the next 100 years or the projected time between defined stages of stand development.

Units of Measure

Measures used to disclose the effects on vegetation from the proposed timber harvest include:

- Forest Structure: changes to stand structure
- Forest Health and Productivity: changes to forest health and a stand's ability to produce timber volume
- Regeneration and Species Composition: changes in regeneration and species composition
- Windthrow Risk: effects of wind hazard

Affected Environment

Introduction

The South Revilla project area is a mosaic of coniferous forests in managed and unmanaged conditions, interspersed with muskeg, scrubland, and alpine plant communities. Old-growth stands proposed for harvest are dispersed among even-aged young-growth ranging from 10 to 95 years old. Proposed old-growth harvest units are structurally complex stands where stand-level growth is generally being offset by decay, resulting in decadent stands of timber which are stable over time but subject to both small and large wind-driven disturbance. Understory vegetation is abundant but advanced tree regeneration is often lacking, except where canopy openings have been created by natural disturbance.

Young-growth stands proposed for commercial timber harvest originated primarily from even-aged harvest that occurred between 1957 and 1974, and are concentrated in the Shoal Cove area on the eastern side of Carroll Inlet. These stands are growing rapidly and typically in the stem exclusion stage of stand development, although productivity varies dependent on soil type, slope and aspect. Predominant species tend to be western hemlock and Sitka spruce in these areas.

This project proposes commercial harvest of young growth not only in timber production areas, but also in both Riparian Management Areas (RMAs) outside of TTRA buffers and beach fringe, in which providing for timber supply while improving wildlife habitat and riparian functions are primary drivers of active management (USDA Forest Service, 2016a, p. 5-2).

Many stands harvested prior to 1974 have now grown to a size where they could be thinned commercially to achieve both ecological and timber supply objectives. However, most have not reached the culmination of mean annual increment (CMAI), which is defined in the National Forest Management Act as the point in time when the average annual growth is at its maximum for a stand of trees. On the Tongass, the point where stands meet national requirements that allow for even-aged harvest is referred to as “95 percent of CMAI” (USDA Forest Service, 2016a, 4-67). Current projections indicate that CMAI will not be reached within any of the young-growth stands in the project area until about 2040; however, P.L. 113-291, Sec. 3002, relaxed this requirement by allowing the harvest of trees prior to CMAI to aid in moving toward a predominantly young-growth timber industry. Stands not meeting CMAI requirements are included for harvest in the South Revilla project due to this allowance.

Species Composition

The primary species in the old-growth and mature forests are western hemlock (*Tsuga heterophylla*), Sitka spruce (*Picea sitchensis*), mountain hemlock (*Tsuga mertensiana*), western redcedar (*Thuja plicata*), Alaska yellow-cedar (*Callitropsis nootkatensis*), and Pacific silver fir (*Abies amabilis*). Higher percentages of Sitka spruce are found along streams and other well-drained sites. Forested muskegs occur throughout the project area and contain a high percentage of Alaska yellow-cedar. Muskeg areas also support shore pine (*Pinus contorta*) and mountain hemlock, which is also more prevalent at higher elevations. Red alder (*Alnus rubra*) is found on disturbed sites such as roadsides, previously harvested stands, and along stream banks. Pacific silver fir is a notable stand component in some locations, particularly west of Carroll Inlet around Saddle Lakes, and on the southern end of the project area between Carroll Inlet and Thorne Arm.

Pacific silver fir occurs in small, disjunct, moderately-to-highly productive, complex stands where western hemlock is the dominant species, and is often present in all levels of the canopy with regeneration occurring in and around small openings (Larson and Franklin 2006). Pacific silver fir occurs within units with both even-aged and uneven-aged harvest proposed. Due to its relatively low occurrence on the Tongass, it is considered a rare plant in the Forest Plan. However, there are not regeneration concerns as surveys have recorded ample regeneration in stands planned for harvest and documented presence in young-growth.

Young-growth stands are primarily composed of western hemlock and Sitka spruce. They generally contain less cedar as the earlier harvests focused on high volume spruce and hemlock stands that grew on productive sites and at lower elevations. Sitka spruce was the favored tree in early precommercial thinning operations. Post-harvest planting of yellow-cedar began in the early 1990s, and emphasis shifted to yellow-cedar and redcedar as crop trees for selection during precommercial thinning about 2010.

Table 46. Project area species composition on lands proposed for harvest (percent trees per acre)

Species	Old Growth	Young Growth
Sitka spruce	5	34
Western hemlock	64	53
Western redcedar	18	6
Alaska yellow-cedar	9	< 1
Pacific silver fir	< 3	< 1
Mountain hemlock	< 1	< 1
Red alder	< 1	~ 5

Understory shrubs are primarily blueberry (*Vaccinium* spp.), huckleberry (*Vaccinium parvifolium*), and rusty menziesia (*Menziesia ferruginea*). Many other species of plants, lichens, and mosses occur throughout all forest types. The amount, distribution and mix of understory plants varies between old-growth and young-growth stands and is dependent on many components, including stand structure, site quality and typical species found with a stand type.

Stand Productivity

Productivity of forests is largely defined in terms of site quality, which is usually measured in terms of timber volume an acre can produce in a given period of time. Site quality is the sum of many environmental factors including soil depth and drainage, aspect, microclimate, etc., and varies both within and among individual stands.

Old Growth

Old-growth forest lands are stratified into high, medium and low volume strata as a proxy for estimating site productivity (Caouette and DeGayner, 2005). The acres of existing old-growth forest by volume strata for each alternative is shown in table 47. Table 48 shows the old-growth harvest acres identified in the action alternatives (see table 7 for harvest acres by alternative).

Table 47. All old-growth forest acres across all LUDS by volume strata on NFS lands in the South Revilla Project Area

	High	Medium	Low
Project Area Total	11,931	6,451	2,304

Table 48. Proposed old-growth even-aged harvest acres by alternative and volume strata and also as a percent of total existing volume strata acres

Alternative	Proposed Even-Aged Harvest Acres			Percent of Existing (from table 47)		
	High	Medium	Low	High	Medium	Low
2	1,199	532	323	10	8	14
3	760	437	201	6	7	9
4	1,040	557	141	9	9	6

Forest Structure

Forest stand structure is defined as the horizontal and vertical distribution of trees within an area and influences characteristics such as tree height and diameter, crown layers, shrubs, understory plants, snags, and wood on the forest floor (Helms 1998).

Old-growth structure varies depending on forest conditions but generally contains large trees over 150 years in age, complex canopies, and shrubs in the understory. Structural complexity has developed through small, intermittent disturbance events, such as windthrow and insect/disease activity. Coarse, woody material is abundant on the forest floor as large, decaying logs. Some whole trees may lay horizontally, uprooted by windthrow.

Young-growth structure varies by forest type but also varies by age, site quality and whether the stand has been thinned or had other intermediate treatments. Young-growth stand development typically follows predictable stages that move from stand initiation, to stem exclusion, to understory reinitiation, and finally to the old-growth phase defined by Oliver and Larson (1996).

Stand age does not directly correlate to a particular stand structure, however there are loosely defined age and size ranges that help define the typical young-growth stands in the project area. A variety of other stand attributes including tree diameter, trees per acre, basal area, and live crown ratio also contribute to a stand's overall structure but do not, individually, describe it completely (Tongass Young Growth Management Strategy, 2014).

Commercial Young Growth

The commercial viability of young-growth stands depends on age, site productivity, and past management. The oldest young-growth stands in the project area occur on low elevation, relatively high productivity sites (Tongass Young Growth Management Strategy, 2014). Many of these older young-growth stands contain acreage that fall within beach corridors, alluvial deposits and productive salmon streams where timber harvest is limited by the Forest Plan or excluded by law.

Many of these stands have never been precommercially thinned and remain in the stem exclusion phase. Some of the oldest stands (70+) are beginning to enter the understory re-initiation phase as natural disturbance and gap dynamics begin to take effect, particularly along shorelines, riparian edges, and sites with high exposure to storm winds.

Forest Health and Natural Disturbance

Hemlock dwarf mistletoe (*Arceuthobium tsugense*), decay fungi, Alaska yellow-cedar decline, and wind disturbance are the primary concerns related to forest health and natural disturbances in the South Revilla project area. Additionally, Southeast Alaska is experiencing a hemlock sawfly (Neodiprion tsugae) outbreak beginning in 2018. In young-growth forests the primary concern is windthrow hazard from adjacent even-aged harvest openings or in uneven-aged harvest units with high exposure to storm winds. Assessments of forest health are performed during prescription development (see unit cards, appendix A).

Dwarf Mistletoe

The occurrence of dwarf mistletoe in late successional western hemlock stands is widespread in the project area at varying infestation levels. Dwarf mistletoe produces cankerous swellings at the point of infection of limbs or main stems. It reduces the vigor and growth rate of infected trees and reduces the quality of timber. Growth loss in heavily infested stands can reach 40 percent or more (Thomson et al. 2008). Clearcut harvest is an effective method of controlling hemlock dwarf mistletoe if reduction or eradication of the disease is consistent with management objectives (USDA Forest Service 2001). Substantial reductions to timber are only associated with high disease levels, however. High levels of hemlock dwarf mistletoe will only result in regenerated stands if numerous large, intensely infected hemlocks are well distributed after harvest (USDA Forest Service 2007b: p. 44). In young-growth, data show trace amounts of dwarf mistletoe present throughout the project area, with higher concentrations existing along boundaries with old-growth stands and in stands with infected residual hemlock trees present.

Decay Fungi

Approximately one-third of the old-growth timber board foot volume in Southeast Alaska is defective, largely due to decay from heart-rot fungi (USDA Forest Service 2015b). Heart- and root-rotting fungi in trees can weaken the support structures, thereby leading to breakage. Decay-causing fungi are present in all old-growth stands within the project area. Decay fungi is most abundant in late successional western hemlock stands, and volume loss associated with the decay is concentrated in hemlock and to a lesser extent spruce. Redcedar and yellow-cedar are considered less susceptible to infection by disease and decay fungi. Data on commercial-sized young-growth stands within the project area show defect and decay levels are extremely low throughout. Isolated incidents of decay and defect in young-growth is generally where residual hemlock remain from the original harvest or in stems that have died due to competition from other trees.

Alaska Yellow-cedar Decline

Yellow-cedar decline functions as a classic forest decline and is linked to climate change (Hennon et al. 2016). Yellow-cedar trees are killed by freezing injury to fine roots, especially on wetter sites, where there is insufficient snowpack to insulate them from lethal cold temperatures (less than 23 degrees F) and a shallow rooting zone. An increased rate of yellow-cedar mortality began around 1900, spiked in the 1970s and 1980s, and continues today. (Hennon et al. 2016)

Recent surveys have identified yellow-cedar decline on 1,820 NFS acres in the South Revilla project area (USDA Forest Service 2018). Silvicultural tools for conserving and expanding yellow-cedar's presence in the project area may include uneven-aged management, planting, and precommercial thinning to favor yellow-cedar.

Hemlock Sawfly

Hemlock sawfly is a defoliating insect native to the Tongass, feeding on older foliage during the larval stage. Activity is constant across the forest, with populations usually kept at endemic levels by parasites and predators, particularly fungal parasites. Fungal parasites are more abundant during cool/wet summers; recently the region has experienced warmer and drier than average summer conditions which limited fungal parasites, allowing sawfly populations to build to outbreak status first observed in 2018. Outbreaks tend to last several years, potentially causing topkill and growth loss in affected trees, but tree mortality is usually limited.

No hemlock sawfly activity was observed within the South Revilla project area during the 2018-2019 aerial surveys, but has been observed in and around proposed harvest units the project area during the 2020 field season. Weather conditions have been favorable for fungal parasites in 2020, but increased presence of sawfly in the project area is probable if dry conditions persist through winter of 2020 and into 2021.

Wind Disturbance and Windthrow Risk

The major natural disturbance agent in Southeast Alaska is wind. Wind influences stand structure and development, including beneficial effects, such as exposure of mineral soil and mixing of soil associated with uprooted trees, which favors the regeneration of Sitka spruce and cedar, and the creation of ecologically beneficial large woody material. Old-growth stand structure develops naturally through a process called gap dynamics, whereby small openings in the forest canopy occur, created by trees falling or dying (Nowacki and Kramer 1998). Even-aged stand structure occurs when a large wind event occurs and the stand regenerates.

The severity and frequency of wind disturbance is determined by many factors. These influencing factors include tree size and vigor, tree height-diameter ratio and crown size, slope, aspect, soil characteristics, stand composition, canopy structure and the characteristics of the surrounding topography, which influence wind flow (Harris 1999). Timber harvest also has the potential to exacerbate the rate of windthrow in adjacent forest stands.

In the South Revilla project area, risk of high wind disturbance is generally found in areas with topographical exposure to prevailing southwest wind direction, or adjacent to newly created openings. The amount of existing windthrow in a stand is an important indicator of windthrow hazard. These characteristics and the stand's windthrow history are used to evaluate the windthrow hazard for each stand when the silvicultural prescription is developed during implementation (Stathers et al. 1994, pp. 15 to 17).

Windthrow and Young Growth

In general, the young-growth stands in the South Revilla project area show little sign of any significant wind or weather damage. Continuous canopy and tight growing conditions have resulted in tall trees with low bole taper, particularly in older stands considered commercially-viable. Once stands are opened up by harvesting, road construction or a large-scale wind event, tall thin trees are more likely to succumb to windthrow or stem breakage than trees with more pronounced bole taper. Tree taper can be managed using stand treatments like precommercial and commercial thinning, provided that the trees have not already grown to a point that there will be too much at risk to attempt the treatment. Precommercial thinning early in stand development has proven to be an effective, low-risk method to create more wind-resistant stem taper. Table 49 shows young-growth acres with and without PCT by age class.

Table 49. Young-growth acres with or without precommercial thinning (PCT), by age class[1]

Age Class	Acres with PCT	Acres without PCT	Total Acres
0-20	0	1036	1036
21-54	6182	4491	10673
55+	68	1083	1151
Totals	6250	6610	12860

1 - Age classes are broken out according to cost-effectiveness. PCT at the tail end of stand initiation (roughly 0-20 years) is most cost-effective, as the healthiest trees have begun to express dominance and slash is manageable for wildlife. Between ages 21-54, stands enter the stem exclusion phase, a period of self-thinning during which PCT becomes less cost-effective as the stand develops. At about 55, stands begin to carry enough volume per acre to make commercial thinning or even-aged harvest economically viable (see Commercial Young-Growth above)

Environmental Effects

Direct, indirect, and cumulative effects for the vegetation resource are estimated using quantifiable measures or indicators for actual effects. The level of effects are also assessed in terms of how widespread the effect is likely to be and how long it is likely to last. The following discussion of effects covers characteristics of the timber resource including stand structure, forest health and productivity, regeneration and species composition, and windthrow risk.

Silvicultural Systems

Silvicultural systems are defined as planned series of treatments for tending, harvesting, and reestablishing a stand of timber (Helms 1998). A silvicultural system is proposed that best achieves that alternative's objectives as well as stand-specific objectives and desired conditions defined by the underlying Forest Plan LUD. Site-specific objectives that influence prescriptions include but are not limited to:

- Retaining old-growth characteristics, or developing of old-growth structural characteristics in young-growth.
- Providing for favorable timber sale economics and a sustainable level of forest products through time.
- Protecting or enhancing soils, watershed and aquatics, wildlife habitat, and scenery characteristics.
- Improving stand health and productivity.

The Forest Plan provides direction on using silvicultural systems (USDA Forest Service, 2016a, 4-68). An overview of each system is included in the Introduction to Unit Cards in Appendix A. A complete silvicultural prescription for the entire length of the rotation will be written for each unit selected for harvest. These prescriptions provide guidance for treatments following the proposed timber harvest for this project, and may include additional activities for future treatments.

Silvicultural systems proposed for commercial harvest in this project are as follows:

- Even-Aged Management (Clearcutting) – openings no larger than 100 acres
- Two-Aged Management (Patch Clearcutting and Clearcutting with Reserves)
    - ♦ Old-growth – at least 20 percent unit area retention, openings no larger than 20 acres.
    - ♦ Young-growth - at least 50 percent unit area retention with openings no larger than 20 acres, except for units within the beach fringe where 65 percent of the unit will be retained with openings no larger than 10 acres.
- Uneven-Aged Management (Single Tree or Group Selection) – at least 66 percent basal area retention, openings no larger than 2 acres

Intermediate Treatments

Intermediate treatments are used to enhance health and growth in a stand and to adjust the species and/or structural composition of the stand. Treatments planned in this project include roughly 300 acres of thinning and gap creation in non-commercial young-growth. The objective of these treatments would be to benefit watershed function and habitat, specifically riparian stand development and deer winter range relative to the desired conditions of the LUD, and would generally increase the structural complexity of the stands while improving individual tree and forest health.

Table 50. Acres by silvicultural prescription

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Silviculture Prescription (acres) for Old-growth				
Even-aged Management	0	4011	3456	3419
Two-aged Management	0	99	5	87
Uneven Aged Management	0	1005	949	1609
Total Acres	0	5115	4411	5115
Silviculture Prescription (acres) for Young-growth				
Even-aged Management	0	745	601	749
Two-aged Management	0	277	264	279
Uneven Aged Management	0	65	44	59
Total Acres	0	1087	910	1087

Direct and Indirect Effects on Species Composition and Regeneration

Alternative 1 – No Action

Alternative 1 proposes no new harvest in either old growth or young growth. Future species composition would depend on the current conditions and site quality of individual stands. However, in general, as natural processes create small openings in the forest canopy western hemlock would have a competitive advantage over other species. Eventually, it is expected that some stands would suffer larger-scale disturbance from a severe storm event, leading to regeneration of those stands. Regeneration would contain a species mix similar to the former stand. There would be no opportunity to manage for desirable species through intermediate treatments.

Alternatives 2, 3 and 4 – Old-Growth Harvest

Even-aged and Two-aged Management

Where even-aged and two-aged management is prescribed, the resulting tree regeneration is expected to be abundant with a species mix representative of the former stand. Regeneration survey data show previously harvested stands in the project area are comprised of about twice as much Sitka spruce, about equal or slightly more cedar and somewhat less hemlock trees per acre than what is estimated to have occurred prior to harvest.

Both cedar species and Sitka spruce thrive in larger openings created by even-aged and two-aged management because of the increase in sunlight. Pacific silver fir can tolerate low levels of sunlight and can regenerate in closed canopy conditions and is expected to be more prevalent in stands as time progresses. Stands regenerated from even-aged and two-aged management have structures and conditions that allow for treatments such as tree planting and precommercial thinning to occur. Opportunities could exist where yellow-cedar could be planted on well-drained sites and where it is currently absent. Precommercial thinning and inter-planting could be used to increase the abundance of desirable species in the post-harvest stand.

Uneven-aged Management

Where uneven-aged management is prescribed for old-growth harvest, any changes to understory regeneration would be limited to parts of the stand where harvest occurs.

It is expected that there will be an increase in silver fir regeneration in harvested areas. Natural regeneration would occur in the harvested portions of the stand at levels similar to an unharvested stand; however, the limited openings and low ground disturbance created during harvest would favor hemlock and silver fir regeneration and may limit the regeneration of spruce and the cedars (Larson and Franklin, 2006).

To offset tree regeneration by species that can tolerate shade, spruce and cedar advanced regeneration, and smaller-diameter intermediate spruce and cedar trees with good vigor will be retained (Deal and Tappeiner 2002). In all uneven-aged management units where it occurs, silver fir would be retained to the extent possible.

Uneven-aged prescriptions are written to prevent significant change in species composition (See appendix A, Introduction to Unit Cards). Single tree and group selections do not provide a good opportunity to manage species composition through planting or thinning, but these activities could occur in some of the larger group selections.

Table 51. Summary of direct and indirect effects on species composition and regeneration in old-growth stands

Silvicultural System	Effects	Alternative 1 (No Action)	Alternative 2 (Acres)	Alternative 3 (Acres)	Alternative 4 (Acres)
Even-Aged and Two-Aged	Better conditions for establishment of cedars and spruce in regenerated stands and increased opportunities for planting and managing regenerated stands for desirable species	No foreseeable change on FS lands within project area	4,029	3,456	3,588
	Potential decrease in the number of naturally occurring silver fir		108	108	62
Uneven-Aged	Likely increase in percentage of hemlock as stand component over time		1,085	954	1,529
	Likely increase in percentage of silver fir regeneration in harvested areas		131	127	167

Alternatives 2, 3 and 4 – Young-Growth Management

Even-aged Management

Even-aged management in commercial young-growth would produce a flush of understory vegetation and abundant tree regeneration. Sitka spruce and western hemlock would naturally occupy the openings, being the dominant species in the current stands. Opportunities for planting redcedar, yellow-cedar and Pacific silver fir on favorable sites to increase diversity would be available. Side-lighting into the residual stand from the openings would enhance understory plant abundance and diversity in those adjacent areas.

Two-aged Management

The effects of two-aged management on species composition and regeneration are essentially the same as even-aged management. In openings created, vigorous young stands of spruce and hemlock would be initiated. When compared with even-aged management, the increased occurrence of edge associated with two-aged management would increase the effects of edge and side-lighting in the adjacent unharvested areas. Openings created by two-aged management would create opportunities for planting redcedar, yellow-cedar and pacific silver fir on favorable sites.

Uneven-aged Management

Under an uneven-aged prescription, smaller openings from single tree harvest are expected to favor hemlock regeneration because of lower light levels. In openings approaching the allowable 2 acres, there would be an opportunity to plant less common tree species that require more light to thrive, such as redcedar. Edges created under this system would enhance understory plant occurrence and diversity over the existing condition.

Table 52. Summary of direct and indirect effects on species composition and regeneration in young-growth stands

Silvicultural System	Effects	Alternative 1 (No Action)	Alternative 2 (Acres)	Alternative 3 (Acres)	Alternative 4 (Acres)
Even-Aged and Two-Aged	Regeneration would be maximized, with increased opportunities for managing stands for western redcedar	No foreseeable change in species composition. Regeneration would remain effectively non-existent until a natural disturbance event opened canopy space.	1087	910	1087
Uneven-Aged	Likely increase in percentage of hemlock as stand component over time		65	44	59

Direct and Indirect Effects on Stand Productivity and Forest Health

Alternative 1 – No Action

Old-growth Stands

It is expected that forest growth would continue to be exceeded by decay in old-growth stands. Insect and disease processes would persist at approximately current levels but due to the general lack of health in unmanaged stands, the forest remains at risk and vulnerable to insect and disease attack. Hemlock dwarf mistletoe, where present, would remain in the stand and may infect hemlock stems that are developing in gaps adjacent to infected overstory trees. This would reduce the health and growth rate of hemlock trees, while producing a low quality of timber, and in some cases, killing trees.

Young-growth Stands

In general, commercial size young-growth stands in the project area are typically healthy and growing well with no foreseeable insect or disease issues. Stands that have been thinned will generally be more windfirm, healthy, growing quickly. Unthinned stands may have poor growth and vigor that results in the stand having poor stability. Stands that are untreated under this alternative will be more susceptible to decay and damage as the trees that die off and fall will damage standing trees, allowing access for decay agents.

Alternatives 2, 3 and 4 – Old-Growth Harvest

Even-aged and Two-aged Management

Under an even-aged or two-aged prescription, stand productivity for the purpose of volume production would be maximized. The risk of insect, disease and decay outbreaks within the newly established growing timber crop would be minimized. The newly created stand would be comprised of vigorous, disease-free trees. The insect and disease processes at work within the stand boundaries prior to harvest would be mostly eliminated, with the exception being along the edges where stands abut residual old-growth hemlock. Along these edges, young hemlock trees would be potentially at risk of dwarf-mistletoe infection depending upon the levels of infection in the surrounding trees. This effect is heightened under a two-aged system, as these harvests have more area in close proximity to exiting old-growth that could be infected.

Uneven-aged Management

Productivity and stand health would generally decline where uneven-aged management is prescribed in old-growth. Trees retained under uneven-aged management, and any new tree growth within newly-created openings, would be at risk of infection by the disease and decay already present within the stand. This risk would generally be proportional to the health and number of trees retained. The potential for damage to retained trees during harvest activities is higher because potential wounds created during felling can expose damaged trees to decay fungi. Hemlock dwarf mistletoe would remain in the stand and likely infect the hemlock regeneration even by removing many if the infected overstory trees. Larger trees with high defect would likely be retained for wildlife, and would continue to occupy growing space while continuing to decline in vigor. These trees are not expected to increase in growth rates or health as a response to the increased light and nutrients created by harvest because of their poor existing condition.

Table 53. Summary of direct and indirect effects on forest health and productivity in old-growth stands

<table>
<tr><th>Silvicultural System</th><th>Effects</th><th>Alternative 1 (No Action)</th><th>Alternative 2 (Acres)</th><th>Alternative 3 (Acres)</th><th>Alternative 4 (Acres)</th></tr>
<tr><td>Even-Aged and Two-Aged</td><td>Forest health and productivity would be maximized</td><td rowspan="2">Decline in vigor and forest health outpaces growth until natural disturbance</td><td>4,030</td><td>3,456</td><td>3,588</td></tr>
<tr><td>Uneven-Aged</td><td>Forest health and productivity would generally decline or remain unchanged</td><td>1,085</td><td>954</td><td>1,526</td></tr>
</table>

Alternatives 2, 3 and 4 – Young-Growth Management

Even-aged Management

Even-aged management in young-growth would not change the risk of insect or disease activity or the productivity of the land. Young trees will regenerate and will experience the same risk factors as the trees they replaced. Reserve trees left within the unit boundaries may be infected with mistletoe or decay that could spread to the newly established trees. Larger openings in even-aged systems provides the lowest risk of damage to residual trees during the logging operation, a small number of trees are likely to be injured along the edges and adjacent to roads and trails.

Two-aged Management

There would be no expected increase or decrease in productivity, and a slight increase in the risk of insect or disease activity in stands where two-aged management is implemented. The retained portions of the stand are not expected to be at any major risk of declining health before they are harvested. Edges resulting from smaller, more frequent openings increase the risk of harvest-related bole wounds when compared to even-aged management. Wounds become entry points for decay organisms and may attract insects such as bark beetles.

Uneven-aged Management

Uneven-aged management carries the greatest potential for insect and disease activity among commercial young-growth treatments for two reasons. First, partial harvest exposes residual trees to harvest-related injury. Wounded trees are more susceptible to decay organisms and if stressed, may attract insects such as bark beetles. Second, uneven-aged management results in older age classes of trees occupying the landscape than the other two systems. Growing older stands allows more time for decay to develop and exposure to other damages as the older trees become less vigorous.

Table 54. Summary of direct and indirect effects on forest health and productivity in young-growth stands

Silvicultural System	Effects	Alternative 1 (No Action)	Alternative 2 (Acres)	Alternative 3 (Acres)	Alternative 4 (Acres)
Even-Aged and Two-Aged	Virtually no change in forest health or productivity	Increased susceptibility to insect and disease due to high densities on 1,087 acres	1,087	910	1087
Uneven-Aged	Slightly higher risk of insect and disease activity over time		65	44	59

Direct and Indirect Effects on Stand Structure

Alternative 1 – No Action

No additional old-growth or young-growth harvest would occur on NFS lands under Alternative 1. Timber harvest could continue to occur on those areas if already NEPA-cleared. Old-growth stands would remain in a predominantly old-growth condition. Disease and decay would continue to do work, causing eventual mortality and increasing the stands' susceptibility to frequent, small-scale wind disturbance events. Understory vegetation would occur where disturbances create canopy gaps. Stands within the project area may eventually experience larger-scale disturbance due to a strong storm event causing most or all of the trees to blowdown creating an even- or two-aged condition.

Young-growth stands would continue growing until they reach the peak of their annual growth. These stands would take longer to develop old-growth structure and may remain in a stem exclusion stage for an extended period of time, limiting the amount of understory vegetation beneficial for wildlife. Mortality from competition between trees, disease and decay, and disturbance events would eventually begin to change stand conditions allowing for new trees, snags, and downed wood to develop and become more common.

Alternatives 2, 3 and 4 – Old-Growth Harvest

The structure of the forest would be changed by harvest under all of the action alternatives. The spatial and temporal scope of this change would vary by alternative (see table 55).

Even-aged and Two-aged Management

Clearcutting or clearcutting with reserves would create relatively uniform young-growth stands without older residual trees within harvest boundaries. New stands would develop through typical development patterns from establishment to stem-exclusion where tree competition for light would shade out understory vegetation. Eventually the stand would enter the stage where overstory tree mortality opens the canopy and allows for understory plants and new trees to develop. At this stage, the stand would begin to develop characteristics of old-growth forests. The length of time any young-growth stand spends in any of these phases depends on site productivity, the susceptibility of the site to small or large-scale natural disturbance, and any future treatments that are applied, such as thinning.

Uneven-aged Management

Uneven-aged prescriptions in old-growth would result in stands with numerous residual trees remaining after harvest, dispersed throughout the stand. Openings up to 2 acres would result in increased understory vegetation and new tree regeneration. All stands are prescribed a 66 percent basal area retention, regardless of windfirmness. Periodic future harvests are expected to maintain three or more distinct age classes and a range of diameter classes in a reasonably well-dispersed manner across the stand, with the intended result being a stand of high structural diversity (Lertzman et al. 1996).

Table 55. Summary of direct and indirect effects on stand structure in old-growth stands

Silvicultural System	Effects	Alternative 1 (No Action)	Alternative 2 (Acres)	Alternative 3 (Acres)	Alternative 4 (Acres)
Even-Aged and Two-Aged	Conversion of complex old-growth structure to young-growth stands at stand initiation phase	No foreseeable change to stand structure on any NFS lands within the project area	4,029	3,456	3,588
Uneven-Aged	Stand remains in a predominantly old-growth structure post-harvest		1,085	954	1,526

Alternatives 2, 3 and 4 – Young-Growth Management

The structure of the forest would be changed by harvest under all of the action alternatives. The spatial and temporal extent of this change vary by alternative (table 56).

Even-aged Management

In young-growth stands where even-aged management is prescribed, the entire stand would be harvested and naturally regenerate. These stands would advance through the stand development process, entering stem exclusion between 15 and 30 years post-harvest and remaining there until either the next harvest entry occurs or the stand transitions naturally into understory re-initiation structure through small-scale disturbance. The length of time these structural phases last will depend upon whether the stand receives treatments (such as thinning) and the productivity of the land.

Two-aged Management

In young-growth stands where two-aged management is prescribed, at least 15 percent of the harvest area would remain intact, with retained trees either grouped or distributed throughout. Harvest openings would progress through structural changes similar to even-aged management, including treatments like thinning. Second harvest timing into these stands would be dependent on the individual stand's site quality, and would be assessed as part of the prescription development.

Uneven-aged Management

Uneven-aged management would use a mix of individual tree selection and group selection to attain structural objectives. This harvest system would be restricted to stands within RMAs outside of TTRA buffers and beach fringe, according to Young Growth Direction beginning on 5-2 of the 2016 Forest Plan Amendment.

At least 66 percent of the stand basal area would be retained, with no openings greater than 2 acres. Openings would target more productive portions of units where standing volume is higher, and regenerate as uniform young growth groups that move through the same structural stages as even-aged systems. Following this harvest, there would remain two-thirds of the stand in a modified late understory re-initiation structure that would be trending toward late seral structure, and one-third would be regenerating new growth. Trees with higher defect and/or structural characteristics such as broken/forked tops, sweep, or high taper would be retained to grow and contribute to the stand's habitat value. Harvest in this manner would result in patchy stands of high vertical and horizontal structural diversity due to the variability in age, tree size, increased effects of edge, and individual tree characteristics.

Table 56. Summary of direct and indirect effects on stand structure in young-growth stands

Silvicultural System	Effects	Alternative 1 (No Action)	Alternative 2 (Acres)	Alternative 3 (Acres)	Alternative 4 (Acres)
Even-Aged and Two-Aged	Stand regenerated from current condition to early stand initiation	Continued stand structural development	1,087	910	1,087
Uneven-Aged	Harvest creates more complex forest structure		65	44	59

Direct and Indirect Effects on Windthrow Risk

Alternative 1 – No Action

Under Alternative 1, old-growth stands would remain in a predominantly old-growth condition, experiencing relatively frequent, small-scale disturbance events until a large-scale event occurs. Windthrow risk to old-growth stands in the project area would remain unchanged.

Commercial harvest of young-growth would not occur. Trees in overstocked stands would generally have very little taper, which would decrease their long-term resistance to windthrow. In the short term, while stands remain in a dense structure and until natural processes begin to break up the canopy, risk of windthrow would remain very low.

Alternatives 2, 3 and 4 – Old-Growth Harvest

Even-aged Management

Where even-aged management are prescribed, the overstory is removed within the bounds of the stand. In these stands, windthrow risk would be eliminated. Young-growth stands that replace the harvested stand will have a more uniform canopy with healthy, flexible upper stems, and will be more windfirm. The lower wind risk of these stands is expected to last through the next rotation.

Stand edges would have increased risk of windthrow in the first few years following harvest due to the adjacent opening. Clearcuts can increase windthrow hazard by influencing wind speed and turbulence. Windthrow damage is usually concentrated within the first 30 to 60 feet of the boundary.

Stands where two-aged management is prescribed have both large openings and increased edge and may therefore have a slightly higher potential for wind damage. This may be somewhat offset by the limited opening sizes, and with strategic placement or shape of the openings during implementation.

Windthrow are assessed for each individual stand during prescription development. Stands with high windthrow risk, will be have specific measures to reduce or minimize risk to adjacent stand edges or along stream buffers that protrude into harvest openings. RMAs and streams designated for protection within harvest stands that have stream channel stability concerns and potential for windthrow, will be evaluated for RAW (Reasonable Assurance of Windfirmness). RMAs and areas with soils determined to be at risk will receive a field review, and a specific windfirming prescription would be determined.

Table 57. Summary of direct and indirect effects on windthrow risk in old-growth stands

Silvicultural System	Effects	Alternative 1 (No Action)	Alternative 2 (Acres)	Alternative 3 (Acres)	Alternative 4 (Acres)
Even-Aged and Two-Aged	Windthrow would be eliminated within the unit boundaries. Risk would be increased along edges of openings greater than +/- 3 acres	No foreseeable change.	4,029	3,456	3,588
Uneven-Aged	No foreseeable change		No foreseeable change	No foreseeable change	No foreseeable change

Uneven-aged Management

Where uneven-aged management is prescribed, windthrow risk can be mitigated by dispersing and limiting the amount of trees harvested. Wind risk would remain approximately the same as in the stand prior to harvest by limiting the breaks in the canopy created by harvesting trees. Monitoring results from the Alternatives to Clearcutting Study indicate that approximately a 5 percent post-harvest loss of basal area from windthrow with a 75 percent basal area retention prescription (McClellan 2007).

Under all Action Alternatives, stands would be prescribed no less than 66 percent retention, regardless of windthrow risk, with openings no larger than 2 acres. Above 2 or 3 acres, opening size does not appear to play a role in the amount of windthrow (Stathers et al. 1994). The mostly unbroken, continuous canopy remaining after harvest in stands would reduce the risk of windthrow along stand edges and adjacent to protection areas that protrude into the harvest area. Uneven-aged prescriptions will eliminate the need for additional windfirming treatments in RAW zones.

Alternatives 2, 3, and 4– Young-Growth Management

Even-aged Management

Where even-aged and two-aged management are prescribed, the entire overstory is removed within stands, thus eliminating windthrow risk in the stand. The future stand will be equally windfirm to the stand it replaced. Stand edges would have increased risk of windthrow in the first few years following harvest due to the adjacent opening. An old-growth stand adjacent to a recently harvested young-growth stand will have a much higher risk of windthrow than a 20-year-old, even-aged stand. Windthrow risk can be minimized through careful planning of how the shape, location, and proximity of one harvested stand relates to another.

Two-aged Management

In two-aged management the potential for wind damage to stand edges might be slightly higher than under even-aged management because of increased edges, however this may be offset by the smaller opening size associated with these prescriptions. Windthrow risk can be minimized through careful planning of the size, shape and location of openings, as well as the installation of RAW buffers.

Uneven-aged Management

Where uneven-aged management is prescribed, opening size would generally be limited to 2 acres or less, and all other harvest would occur outside of these openings as single tree selection. Harvest activities will retain at least 66 percent of the area occupied by trees in a stand. This level of canopy retention is considered to be windfirm (Stathers et al. 1994), especially in stands that have been thinned.

Table 58. Summary of direct and indirect effects on windthrow risk in young-growth stands

Silvicultural System	Effects	Alternative 1 (No Action)	Alternative 2	Alternative 3	Alternative 4
Even-Aged and Two-Aged	Windthrow risk would be increase along edges of openings greater than +/- 3 acres	Near-term resistance to windthrow would stay the same due to stem density. Long-term windfirmness would decrease as stands underwent structural development.	All even-aged and two-aged units	All even-aged and two-aged units	All even-aged and two-aged units
Uneven-Aged	Treatments would only slightly increase the risk of windthrow		65 acres	44 acres	59 acres

Cumulative Effects

The analysis area for cumulative effects is the entire South Revilla project area. The following are activities expected to have cumulative effects to forest vegetation within the next 15 years:

- Transfer of National Forest System lands under Alaska Mental Health Trust Authority, subsequent timber harvest on these lands
- Increased firewood cutting and free use sawtimber removal resulting from completion of Ketchikan to Shelter Cove Road
- Precommercial thinning on all land ownerships throughout the project area

These harvests would contribute to the approximately 12,630 acres of even-aged young-growth resulting from past harvest across all ownerships by a range of 3,459 to 4,060 acres. The action alternatives propose a range of 949 to 1,609 acres of uneven-aged harvest in old-growth, and 59-65 acres in young-growth.

Across the project area, forest health would be improved and diseases like hemlock dwarf mistletoe and stem decay would be greatly reduced. Stand productivity would be maximized with even-aged management, as slow growing stands of decadent trees would be replaced by healthy and vigorous young trees. Openings created under uneven-aged prescriptions (up to 2 acres) would improve conditions for shade intolerant trees, while single-tree selection through the matrix of these stands will favor more shade tolerant western hemlock and silver fir. Canopy openings created through harvest would improve growing conditions for understory vegetation.

Present and Reasonably Foreseeable Future Commercial Harvest on All Land Ownerships

Aside from the 103 acres of young-growth mentioned above, the project area contains no other current ownerships.

There are 5,324 acres of forested land on lands scheduled to be transferred from NFS to the Alaska Mental Health Trust. Approximately 1,305 of these acres are even-aged young-growth of which 476 are currently greater than 50 years old and are anticipated to be commercial within the next 15 years. The remaining 4,019 acres are currently old-growth with at least 8 MBF per acre.

This land exchange is anticipated to be finalized in early 2021. The rate and location of future old-growth harvest for other ownerships is unknown and considered proprietary, but estimates can be made based on public 5-year schedules, rates of past harvest, and capacity of the local industry. Based on these estimates, we assume that 100 percent of these 4,019 acres will be managed through even-aged harvest, and that this harvest would result in the creation of even-aged forests in addition to those proposed in the South Revilla Project. Acres harvested on non-FS land would undergo effects similar to those harvested under an even-aged management system as described above, and any future precommercial activities would have effects as outlined above.

The rate and location of future young-growth harvest on other ownerships is subject to the same unknowns as that of old-growth. For the purpose of estimating effects, it is assumed that all 476 acres considered to be approaching a commercially viable age class will be harvested under even-aged management over the next 15 years.

Regeneration is expected to be vigorous and representative of the approximate species mix of the former stand. Slight changes in species composition in the project area may occur as a result of harvest operations and follow-up treatments such as precommercial and commercial thinning. It is unknown whether or to what level non-NFS landowners would use management approaches such as planting and thinning to mitigate the effects of yellow-cedar decline.

Transportation

Introduction

National Forest System (NFS) roads are constructed to provide access to NFS lands and are included in the Forest Development Transportation Plan (USDA Forest Service 2016b, Chapter 4, Transportation Forest-wide Standard and Guidelines). NFS roads, are intended to be maintained for the long term, though can be placed into storage between uses.

For the Tongass road construction has primarily been for access to timber resources. The maintenance requirements of the existing system depend mainly on the volume of timber hauled and, to a lesser extent, on recreational use. The amount of road construction within the project area is determined by the need to access timber resources.

The transportation section considers the future management of NFS roads within the project area, whether to maintain a road open for the long term, or place a road into storage, and the type of vehicle or allowed uses of a road.

The management of NFS roads is regulated through the Code of Federal Regulations, including 36 CFR parts 212, 251, 261 and 295. Forest Service direction for management of transportation systems is found in Forest Service Manual (FSM) 7700, Forest Service Handbook (FSH) 7709FSH 2509.22 and FS-990a provide the Alaska Region and National Core BMPs for water quality management related to NFS roads and other projects. The 2016 Forest Plan is the governing document for management activities that take place within the Tongass National Forest including Standards and Guidelines for Transportation Forest (USDA 2016, Chapter 4).

Resource Indicators and Measures

The effects, both beneficial and adverse, of roads on resources are discussed in their respective resource sections. The following paragraphs discuss the direct, indirect, and cumulative effects of the alternatives on transportation. Differences between the alternatives are detailed in tables using the following units of measure:

- Miles of New NFS Road
- Miles of New Temporary Road
- Miles of Closed NFS Road Maintenance to open for log haul
- Transportation Costs
- Access and Travel Management

Methodology

Spatial and Temporal Context for Effects Analysis

Direct/Indirect Effects Boundaries

The analysis area for the transportation system includes the South Revilla project area.

The spatial boundaries for the transportation system analysis includes all roaded areas and potential roaded areas within the South Revilla Project area. The temporal boundary is the expected implementation timeframe of this project, about 15 years. Long-term effects include updates to the infrastructure such as to the NFS roads and LTFs.

Cumulative Effects Boundaries

The analysis area for the transportation system includes the South Revilla project area and roads leading into and out of the project area including the Ketchikan to Shelter Cove State road.

Information Sources

Information sources for the transportation analysis include the transportation Geographic Information System (GIS) data layers which house the spatial data for road locations. An inventory of road attributes for NFS roads is maintained in a national database. A complete list of road attributes and definitions of these attributes is in the project record. Cost estimates are derived from engineer estimates. The amount of new NFS and temporary roads is based on access needed for timber harvest.

Incomplete and Unavailable Information

Physical conditions of transportation resources are subject to change through natural occurrences and normal use. Road inventory and field surveys record current conditions and changes are updated on a continual basis. Traffic counts are not routinely collected on NFS roads, though the roads are managed and designed for low volume of traffic.

Affected Environment

Existing Condition

The transportation system on Revillagigedo Island consists of unconnected road systems scattered around the island's numerous inlets. The Ketchikan to Shelter Cove State road, now connects the Shelter Cove road system directly with the Ketchikan Gateway Borough road system, and should be open to the public in 2021. The Shelter Cove and Shoal Cove road systems are located on southeast Revilla Island on opposite sides of Carrol Inlet. Both road systems are currently accessed by separate Marine Access

Facilities (MAF) with log transfer capacity. All roads within the project area were constructed for timber harvest, from blasted quarry rock, and designed for off-highway. About 12.6 miles of roads are surfaced with crushed rock. Temporary roads have been decommissioned and are blocked, waterbarred, or reclaimed with vegetation and not currently available for motor vehicle use. Reference figure 4 in Chapter 1 for location of project area road systems.

Access and Travel Management (ATM)

In 2001, the Forest Service adopted a road management policy that requires the agency to maintain a safe, environmentally sound road network that is responsive to public needs and affordable to manage. The policy includes a roads analysis process designed to help better inform managers when making decisions on roads. The Forest completed a Forest-wide roads analysis for Maintenance Level 3, 4 and 5 roads in 2003.

The Decision Notice for the KMRD Access and Travel Management (ATM) Environmental Assessment was signed on July 11, 2008 and is in the project record. The ATM and project level decisions made since then designate roads and trails within the project area that are open and closed to motor vehicles, the type of vehicle use, time of year, and road storage methods.

Annually, the ranger district prepares an updated Motor Vehicle Use Map (MVUM). The MVUM displays NFS routes (roads and trails) or areas designated as open to motorized travel. The MVUM also displays allowed uses by vehicle class (for example, highway-legal vehicles, off-highway vehicles less than 50 inches wide, or motorcycles), seasonal allowances, and provides information on other travel rules and regulations. Routes not shown on the MVUM are closed to public motor vehicle travel. Exceptions are allowed for administrative uses, contracts, and permits on roads not shown on the MVUM. Motor Vehicle Use maps are available at the district offices, and at www.fs.usda.gov/main/tongass/maps-pubs.

Travel Analysis Process

Road system management regulations at 36 CFR 212.5 identify the requirements for determining the minimum road system needed. The Forest Service uses the Travel Analysis Process (TAP), a three-level system of analysis, to make this determination.

The first level is the Forest-wide Roads Analysis (Tongass National Forest – Forest-Level Roads Analysis 2003). The Forest-wide Roads Analysis provided management recommendations for maintenance level (ML) 3, 4, and 5 roads.

The second level is the *Ketchikan-Misty Fiords Roads Analysis*, which includes the South Revilla project area (USDA Forest Service 2008). This report details the analysis methods and recommendations for travel management on ML 1 and 2 roads within the District). Combined, these analyses recommended road management objectives (RMO) for all existing NFS roads on the District. Recommendations documented in the District roads analysis, supplemented by public comments, led to the proposed action developed for the Access Travel Management (ATM) Plan for KMRD (USDA Forest Service 2008).

Road management for the District is prescribed in the Forest Road Atlas and contains the road management objectives for NFS roads. The road management objectives define the motorized access for each NFS road. Access management for the NFS roads is implemented through the Motorized Vehicle Use Map (MVUM) which designates roads for motor vehicle use by vehicle class under 36 CFR 212.51.

The third level is the project-level travel analysis, conducted by the IDT following agency guidance in Forest Service Handbook 7709.55, and may include proposed, as well as existing, roads. The RMO for each proposed NFS road in the project area is detailed in the Road Cards of the EIS and those roads selected will become part of the Record of Decision. The RMO presents the OPML and OBML designated for proposed NFS road. The South Revilla project travel analysis and existing RMOs can be located in the project record.

Road Maintenance Levels

All existing NFS roads in the project area have an assigned Maintenance Level. Maintenance Level defines the level of service provided by, and maintenance required for a specific road, consistent with Road Management Objectives (RMOs) and maintenance criteria, such as requirements for the protection of adjacent resources, smoothness of the road surface, type of traffic, and season of use of the road. RMOs document the intended purpose of an individual road in providing access, as well as decisions about applicable standards for the road.

Maintenance Level 1 roads are considered closed to vehicle traffic. Maintenance Levels 2 through 5 are considered open and drivable. There are no Maintenance Level 4 or 5 roads within the project area. Decommissioning a road involves restoring roads to a more natural state.

- Maintenance Level 1 (ML1): Assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period must exceed 1 year. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activities. They may be available and suitable for non-motorized uses. Storage is also used to describe these roads.
- Maintenance Level 2 (ML2): Assigned to roads open for use by high clearance vehicles. Passenger car traffic is not a consideration.
- Maintenance Level 3 (ML3): Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car.

The Operational Maintenance Level (OPML) is the Maintenance Level assigned to a road considering today's needs, road condition, budget constraints, and environmental concerns. It defines the level to which the road is currently being maintained. It reflects the current condition and the ability to drive on the road.

The Objective Maintenance Level (OBML) is the Maintenance Level to be assigned at a future date considering road management objectives, traffic needs, budget constraints, and environmental concerns. The OBML may be the same as, or higher or lower than, the OPML. The existing RMOs for the South Revilla project area are summarized in table 59.

Maintenance of existing NFS ML 2 and higher roads is completed routinely and will continue to occur in the project area. Typically this type of work is determined to fit the category of repair and maintenance of roads that do not individually or cumulatively have a significant effect on the quality of the human environment and may be categorically excluded (36 Code of Federal Regulations (CFR) 220.6(d)(4)). The timing of this work may coincide with this analysis but is not part of this analysis. Any effects from ongoing road maintenance work are included in the cumulative effects analysis for this analysis.

Maintenance may include surface rock replacement, culvert repair and replacement, bridge replacement, slide removal, cleaning and reestablishing ditches, shoulders, and road driving surface, brushing, and other items that contribute to the preservation of the existing road and minimize adverse effects to water quality and other resources.

Table 59. Existing NFS Roads by operational and objective maintenance level (INFRA database)

	ML1	ML2	ML3	ML4	Total miles
Operational Maintenance Level Miles	67.7	48.7	13.1	0.0	129.5
Objective Maintenance Level Miles	80.3	37.2	12.0	0.0	129.5

Decommissioned roads within the project area include about 24 miles of temporary roads from past harvest activity in addition to 1.7 miles of NFS Decommissioned Road. Another 10.4 of non-NFS roads/other ownership exists within the project area. Table 60 summarizes the total road miles within the project area boundary.

Table 60. Existing total road miles in the project area

Road Type	Miles
NFS Roads	129.5
Decommissioned Temporary and NFS Roads	25.7
Private Roads	0.3
State Roads	9.4
Other Federal Agency (Coast Guard) Roads	0.7
Total Road Miles	**165.6**

Environmental Consequences

Direct and Indirect Effects Common to all Action Alternatives

- All new NFS and temporary roads extend from the existing road system.
- All temporary roads would be decommissioned after their use period.
- All road maintenance to open closed roads for haul would result in these roads being closed after their use period
- All action alternatives would reconstruct the Shelter Cove MAF and perform maintenance to the Shoal Cove MAF.

New NFS Road Construction

The need for road construction is mostly determined by the need to access timber units. The design features for each alternative determines the amount of timber to be offered. The total road miles needed for access is determined by the specific harvest units of the action alternatives and the needed transportation network. Most forest roads are single lane, constructed with blasted quarry rock, and designed for off-highway loads (See table 60). Building road over a decommissioned roadbed is defined as new road construction.

NFS roads are considered permanent and maintained as such, although some may be placed in a Storage condition between intermittent use that does not allow motorized traffic.

New Temporary Road Construction

Temporary roads are not intended to be part of the National Forest transportation system and are not necessary for long-term resource management. They are not included in a Forest Transportation Atlas. Temporary roads are authorized by contract, permit, lease, or other written authorization. These roads are generally decommissioned after timber harvest activities are complete as part of the contract. However, if there are no specific safety or resource concerns, temporary roads could provide short-term public access of up to 3 years for gathering firewood once timber harvest activities are complete. The roads will then be decommissioned.

Decommissioning roads involves restoring roads to a more-natural state. Actions preformed when decommissioning roads include reestablishing former drainage patterns, stabilizing slopes, restoring vegetation, blocking the entrance to the road, installing water bars, removing culverts, reestablishing drainage-ways, removing unstable fills, pulling back road shoulders, or other methods designed to meet the specific conditions associated with the road (See table 60).

Table 61 summarizes the miles of proposed road construction along with the miles of existing road and status for both NFS and temporary roads.

Table 61. Summary of existing and proposed roads under each alternative

Road Type	Alt 1	Alt 2	Alt 3	Alt 4
New NFS Construction	0.0	14.4	13.1	13.7
Existing NFS[1] (table 59)	129.5	129.5	129.5	129.5
Total NFS – After Implementation	**129.5**	**143.9**	**142.6**	**143.2**
New Temporary Construction	0.0	34.0	31.7	31.8
Existing Decommissioned[1] (table 60)	25.7	25.7	25.7	25.7
Total Decommissioned – After Implementation	**25.7**	**59.7**	**57.4**	**57.5**
Total Proposed NFS and Temporary Roads	**0.0**	**48.4**	**44.8**	**45.5**

1 – Existing Decommissioned = Decommissioned NFS + Temporary.

Maintenance of Closed ML 1 NFS Roads to Open for Log Haul

Many of the NFS roads throughout the project area are closed (ML 1) roads (See table 59). When needed, opening a closed road is considered maintenance and could include culvert installation, bridge installation, cleaning and reestablishing ditches, shoulder clearing, clearing the roadbed of trees and vegetation, and shaping the road surface. These roads are placed back into ML 1 storage when no longer needed, unless identified thru travel analysis as needed open for the long term, or suitable for other uses. (See section *Travel Analysis* Process below for more information).

The road miles shown in table 62 and represented in figure 30 at the end of this section are estimates for opening closed roads and improving log haul standards needed by the project. Roads used for hauling logs under a contract are maintained by the timber purchaser during the period of use. See unit cards in appendix A where closed NFS roads have been identified as needed for haul.

Table 62. Maintenance of closed ML 1 NFS roads to open for log haul and then close

Road Number	Alternative 1	Alternative 2	Alternative 3	Alternative 4
8300340	0.0	0.5	0.5	0.5
8330020	0.0	0.2	0.2	0.2
8330400	0.0	0.2	0.2	0.2
8333000	0.0	0.2	0.2	0.2
8333200	0.0	0.3	0.3	0.3
8337000	0.0	4.0	4.0	4.0
8337100	0.0	0.2	0.2	0.2
8337500	0.0	0.6	0.6	0.6
8340160	0.0	0.9	0.9	0.9
8340200	0.0	1.2	1.2	1.2
8340400	0.0	1.3	1.3	1.3
8347000	0.0	0.1	0.1	0.1
8400000 SHOAL COVE	0.0	3.4	3.4	3.4
8400400	0.0	1.4	1.4	0.8
8400431	0.0	1.0	1.0	1.0
8400440	0.0	1.2	1.2	1.2
8400441	0.0	0.8	0.8	0.8
8400443	0.0	0.6	0.6	0.6
8400445	0.0	0.1	0.1	0.1
8400450	0.0	1.3	1.3	1.3
8400451	0.0	0.7	0.7	0.7
8400452	0.0	0.3	0.3	0.3
8400480	0.0	0.3	0.0	0.3
8430000	0.0	3.8	3.8	3.8
8430050	0.0	0.5	0.5	0.5
8430060	0.0	0.5	0.5	0.5
8430065	0.0	0.1	0.0	0.0
8430080	0.0	0.2	0.2	0.2
8430450	0.0	0.4	0.4	0.4
8430500	0.0	0.7	0.7	0.7
8430550	0.0	0.2	0.2	0.2
8430553	0.0	0.2	0.2	0.2
8440100	0.0	0.3	0.3	0.3
8440200	0.0	0.1	0.1	0.1
8442000	0.0	3.2	3.2	3.2
8446000	0.0	1.7	1.7	1.7
8446100	0.0	0.9	0.9	0.9
8446150	0.0	0.5	0.5	0.5
Miles	**0.0**	**34.1**	**33.8**	**33.4**

Aquatic Organism Passage (AOP) at Road Crossings

(See Aquatics section page 189 for more information)

New NFS Road Construction

Prior to construction, road location takes into consideration the need to provide AOP, and effort is made to align roads to avoid crossing fish streams. When crossing fish streams is necessary, the type of stream crossing structure will depend on site specific conditions such as stream width, gradient, streambed material and characteristics, the need to provide debris passage, the type of road (NFS versus temporary), and the duration the road is planned for use. These structure types may include fabricated bridges, log culverts and log stringer bridges, or metal culverts specifically designed to allow for fish passage.

Existing NFS Roads

Most existing Class I and Class II fish stream crossings have been surveyed and categorized on NFS roads within the project area. Common issues with these red crossings are perched outlets (outlets greater than four inches in elevation from the stream), culvert gradients (slopes greater than 1 percent), or undersized culverts (culvert width to streambed width ratio of less than 0.5).

Aquatic organism passage design is a requirement for any installation of crossing structure on fish streams where crossings have been pulled or structures removed on existing roads. Red crossings are remediated based on criteria defined in the Aquatics section and are prioritized at the Forest level. See Aquatics section, table 71 and figure 35 for location and number of red crossings within the project.

Log Transfer Facilities (LTF)

(See the Aquatics section page 190 for more information on bark monitoring.)

There are two existing and permitted LTFs in the South Revilla project area, Shelter Cove and Shoal Cove. These facilities are used for the movement of equipment needed for logging and road building and for the transfer of logs from trucks. Logs are either placed directly into the salt water or loaded onto barges and towed to mills or export facilities. Additionally, the Shelter Cove Road could be used to transport logs to Leask Cove or Coon Cove LTFs located on non-NFS land. The type of work needed by each facility and estimated costs is found in table 63.

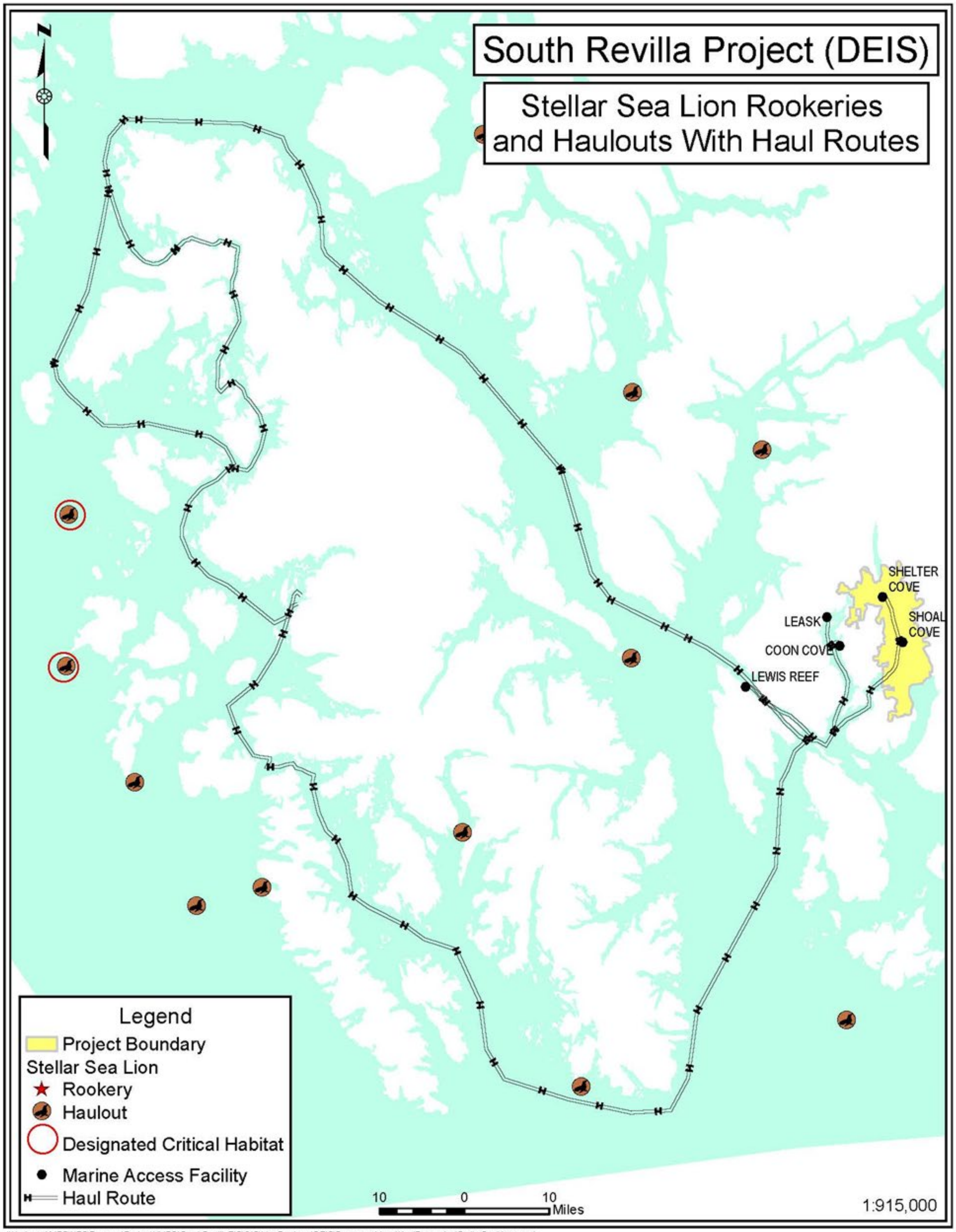


Figure 29. Log transfer facilities and barge routes

Shelter Cove MAF

The Shelter Cove LTF was constructed in 1992 as a single level, native log bulkhead and logs were placed directly into the water. The LTF also includes a seaplane and boat float, an equipment ramp, and a 1 acre sort yard within an existing rock pit. Proposed reconstruction includes adding a new ramp for log barge loading, cleaning catch basins, brushing, and adding rock to the surface of the sort yard.

Shoal Cove MAF

The Shoal Cove LTF was constructed beginning in 1969. Modifications were made in 1975, 1984, and 2005 to improve the floats, add mooring space, and improve log transfer by barge. The Shoal Cove LTF will need maintenance prior to use which includes cleaning catch basins, brushing, and adding rock to the surface of the sortyard.

Table 63. Log transfer facilities

Location	Required Work	Estimated Costs
Shelter Cove	Reconstruction	$500,000
Shoal Cove	Maintenance	$50,000

Rock Quarries

Rock sources are needed for the construction and maintenance of roads and facilities including MAFs, and proposed recreational infrastructure within the project area. To the extent feasible, existing quarries would be used rather than developing new ones. There are numerous rock quarries throughout the project area, and usually there is one within a few miles of work sites. New rock quarries, however, may be needed when constructing new roads. It is estimated, approximately one new rock source for every 2 miles of new NFS road construction may be required. The estimated number of new quarries needed for each alternative are shown below in table 64. Quarry sites would be developed within 500 feet of a road. The area footprint generally does not exceed 5 acres when expanding an existing quarry or developing new sites.

Table 64. Number of potential new quarry development sites

	Alt 1	Alt 2	Alt 3	Alt 4
Quarry sites	0	8	7	7

Road Storage

Road storage can reduce annual and deferred road maintenance costs by removing drainage structures, installing water bars, or other means to stabilize the road surface until the road is needed again. Road storagemethods, either mechanical or natural revegetation, may vary depending on road or ground conditions, resource concerns, and administrative needs. The term road storage and road closure is used interchangeably. The storage strategy is determined by the interdisciplinary team thru the travel analysis process (For more information see sections Travel Analysis Process and Access and Travel Management below). Drainage structures may be removed or bypassed with water bars to restore natural drainage patterns. Additional water bars or rolling dips may be added to control runoff.

Costs for road storage is estimated at $5,000/mile using timber sale rates and are based on regional average costs in Southeast Alaska. Table 65 displays the estimated costs for road storage of the proposed NFS roads and existing NFS roads proposing changes in travel management.

Table 65. Estimated miles and costs of NFS road storage

Route Number	Route Status	Alt 1	Alt 2	Alt 3	Alt 4
8300000	Existing	0.0	0.7	0.7	0.7
8300300	Existing	0.0	1.8	1.8	1.8
8300330	Planned	0.0	0.8	0.8	0.4
8330350	Planned	0.0	0.4	0.4	0.4
8330373	Planned	0.0	0.2	0.2	0.2
8330410	Planned	0.0	1.3	1.3	1.3
8337400	Planned	0.0	0.5	0.5	0.0
8340000	Existing	0.0	1.1	1.1	1.1
8340500	Planned	0.0	1.5	1.5	1.2
8340610	Planned	0.0	0.7	0.7	0.7
8400260	Planned	0.0	0.5	0.5	0.5
8400350	Existing	0.0	0.4	0.4	0.4
8400432	Planned	0.0	0.9	0.5	0.9
8430060	Planned	0.0	0.2	0.2	0.2
8430080	Planned	0.0	0.4	0.4	0.4
8430082	Planned	0.0	0.5	0.5	0.5
8430094	Planned	0.0	0.5	0.5	0.5
8430095	Planned	0.0	0.5	0.5	0.5
8430460	Planned	0.0	1.0	1.0	1.0
8440700	Planned	0.0	0.4	0.4	0.4
8442000	Planned	0.0	1.0	1.0	1.0
8445000	Planned	0.0	0.2	0.0	0.2
8445200	Planned	0.0	0.7	0.0	0.7
8446160	Planned	0.0	0.3	0.3	0.1
Storage of NFS Roads after use (Miles)		0	16.7	15.4	15.5
Estimated Storage costs		$0.00	$83,500	$77,000	$77,500

Total Transportation Costs

Estimated transportation development costs includes proposed NFS and temporary road construction, maintenance of closed roads to open for loghaul, road storage costs, and LTFs costs (See table 66). Rock is obtained by blasting bedrock which is then hauled and shaped into a road over typically soft, uneven terrain. Cost factors include mobilization and logistics, labor, and the amount and type of drainage structures needed. New construction over decommissioned roadbeds require less rock and generally have less impacts than an entirely new road constructed in an alternate location.

Costs per mile are based on regional averages using Timber Sale rates, for road maintenance and NFS and temporary road construction. An additional average cost per fish stream crossing is also included. The following costs were used for estimating the road development costs for each alternative.

- New NFS Road Construction – $250,000/mile
- New Temporary Road Construction – $200,000/mile

- Maintenance of closed ML 1 NFS roads to open for log haul – $40,000/mile

Table 66. Estimated transportation development costs under each alternative

Development Type	Alt 1	Alt 2	Alt 3	Alt 4
NFS Road Construction (Miles)	0	14.4	13.1	13.7
NFS Road Construction Cost	$0	$3,600,000	$3,275,000	$3,425,000
Temporary Road Construction (Miles)	0	34.0	31.7	31.8
Temporary Road Construction Costs	$0	$6,792,941	$6,334,297	$6,353,100
Maintenance of Closed NFS road (ML1) to Open for Log Haul (Miles)	0	34.1	33.8	33.4
Maintenance of Closed NFS road (ML1) to Open for Log Haul (ML1) Costs	$0	$1,364,538	$1,351,261	$1,334,848
Total LTF Costs	$0	$550,000	$550,000	$550,000
Road Storage Costs	$0	$83,500	$77,000	$77,500
Total Transportation Costs	**$0**	**$12,390,979**	**$11,587,558**	**$11,740,448**

Note: Costs are estimates presented to provide a relative comparison between alternatives when developing overall transportation costs.

Access and Travel Management

Each Action Alternative proposes varying amounts of timber harvest, road construction, and road maintenance. Travel management recommendations can affect future public and administrative access. All NFS roads constructed or opened for haul would be maintained for high clearance vehicles (ML2) during timber management operations. Upon completion of operations, and depending on the road management designation recommendation, NFS roads would be closed, left open to all vehicles, or allow OHV use to occur as a motorized trail.

Roads Designated Open to All Vehicles (Mixed Use)

These roads are open to all motor vehicles, including smaller off-highway vehicles that may not be licensed for highway use, but not vehicles that are oversized or overweight under state traffic law. An engineering suitability study has been conducted prior to designation of mixed use on the motor vehicle use map. Travel management recommendations are summarized in Table 69 and 70 below.

For all Action Alternatives:

- 1.7 miles of New NFS road would be designated Open to All Vehicles/Mixed Use and,
- 1.0 miles of Existing NFS road currently designated closed to motorized use would be changed to Open to All Vehicles/Mixed Use.

This recommendation increases the amount of NFS road open to all vehicles from 48.5 to 51.2 miles.

Roads Closed to All Vehicles/Storage

These are roads projected to have future access needs or needed for future forest management activities but assigned closure between use and designated ML 1. Each drainage structure is evaluated to determine the appropriate storage strategy. Drainage structures may be removed or bypassed with water bars to restore natural drainage patterns. Additional water bars or rolling dips may be added to control runoff.

For all Action Alternatives:

- All NFS road construction would be placed into storage after timber harvest activities are complete except those miles mentioned above.
- 4 miles of existing NFS road currently designated open to all vehicles (ML 2 and ML 3) would be placed into storage (ML 1) after timber harvest activities are complete and closed to motorized use.

This recommendation increases the amount of NFS road currently closed to motorized use from 80.3 miles to 97.0 miles for Alternative 2. For Alternatives 3 and 4, the amount of closed NFS road would increase to 95.7 and 95.8 respectively.

Off-highway Vehicles 50 inches or wider (OHV) – (See recreation access management section for more information)

Some ML 1 roads may be suitable for motorized OHV. These routes are designated as a NFS motorized trail, coincidental to the designated closed road (“dual designated”). Basic custodial maintenance of the road may occur and the road may be reopened when needed for use..

- For all Action Alternatives, allow the use of OHV on 0.4 miles of existing NFS roads once closed. There are currently about 13.7 miles of designated motorized trail within the project area on the stored road system.

This recommendation increases the amount of motorized trails on closed roads from 13.7 to 14.1 miles.

Road management objectives and travel management recommendations are summarized in table 67 and table 68. Figure 30 through figure 32 found at the end of this section display the proposed South Revilla project access management recommendations.

Comparison of Alternatives

Table 67. Proposed road management objective recommendations under each alternative (miles)

Road Type	Alt 1	Alt 2	Alt 3	Alt 4
NFS road designated as open to all vehicles (ML 2 - ML 3)	49.2	47.9	47.9	47.9
NFS road designated as Motorized Trail (OHV <50”) coincidental to closed road (ML 1)	13.7	14.1	14.1	14.1
NFS road designated closed to all vehicles (ML 1)	66.6	81.9	80.6	81.2
Grand Total	129.5	143.9	142.6	143.2

Summary of road objective maintenance levels after harvest activities are completed:

Table 68. Changes to objective maintenance levels (additions or subtractions) from current conditions (miles)

	Alt 1[a]	Alt 2	Alt 3	Alt 4
New NFS roads designated as OBML 1	N/A	12.7	11.4	12.0
Existing NFS roads changing from OBML 2 to OBML 1	N/A	2.2	2.2	2.2
New NFS roads designated as OBML 2	N/A	1.7	1.7	1.7
Existing NFS roads changing from OBML 1 to OBML 2	N/A	1.0	1.0	1.0
Existing NFS roads changing rom OBML 3 to OBML 1	N/A	1.8	1.8	1.8
Changes in OBML 1 roads	N/A	+15.7	+14.4	+15.0

	Alt 1[a]	Alt 2	Alt 3	Alt 4
Changes in OBML 2 roads	N/A	+0.5	+0.5	+0.5
Changes to OBML 3 roads	N/A	-1.8	-1.8	-1.8
Total Project OBML 1	80.3	96.0	94.7	95.3
Total Project OBML 2	37.2	37.73	37.7	37.7
Total Project OBML 3	12.0	10.2	10.2	10.2
Total All	**129.5**	**144.3**	**142.6**	**143.1**

a - From existing conditions table 59

Cumulative Effects

The cumulative effects analysis area for the transportation resource is the project area boundary. Cumulative effects examines the impacts to the transportation infrastructure from past, present, and reasonably foreseeable activities over the 15 year time frame of this project. The complete list of these projects is located in Appendix C of this DEIS. The projects that may affect the transportation resource are:

Ketchikan Misty Fjords Ranger District Outfitter/Guide Management Plan

The *Ketchikan Misty Fjords Ranger District Outfitter/Guide Management Plan* determines use levels for outfitter and guides and allocates about 50,671 service days annually for outfitter and guide use on the District (January 2012 Decision). The highest guided actual use annually (2005–2009) was 2 service days within the project area.

State of Alaska Department of Transportation & Public Facilities (ADOT&PF) Ketchikan to Shelter Cove Road

The State of Alaska Department of Transportation & Public Facilities (ADOT & PF) Ketchikan to Shelter Cove Road once completed will add up to 1 mile of road in the project area and provide access from the city of Ketchikan, surrounding Ketchikan Gateway Borough, and other private ownership land within the project area. The road is planned to be completed in 2021.

The State of Alaska would assume the maintenance responsibilities of this mile of NFS road 8300000, Forest Service would no longer be responsible for maintenance.

The Alaska Mental Health Trust Authority

The Consolidated Appropriations Act of 2017 (Public Law 115-31) was enacted and authorized an exchange of lands between the Alaska Mental Health Trust Authority (AMHT) and the USDA Forest Service. The land exchange is occurring on a phased approach with different land tracts being exchanged throughout the Forest at different times, or phases. The proposed land exchange within the project area is expected to occur during the final phase and it is unknown the extent it would affect existing NFS roads and access. There are currently 11 miles of NFS roads within (either partially, wholly, or adjacent to) the proposed land exchange area. Roads, or portions of roads, not providing access to NFS lands after the exchange would likely be transferred to the AMHT as part of the exchange. No additional roads proposed by this project would be constructed.

The Ketchikan to Shelter Cove Road connection once it is opened would likely increase the road use in the project area. While the State of Alaska would assume the maintenance of this road itself, traffic would likely increase on the NFS roads connecting to this mainline especially to the recreation sites proposed in this project. This may increase Forest Service maintenance costs on 13 miles of road. If the AMHT parcel is exchanged, wholly or in part, then a maximum 11 miles of NFS roads would no longer be maintained by the Forest Service. These effects would be common to all alternatives including the no-action alternative.

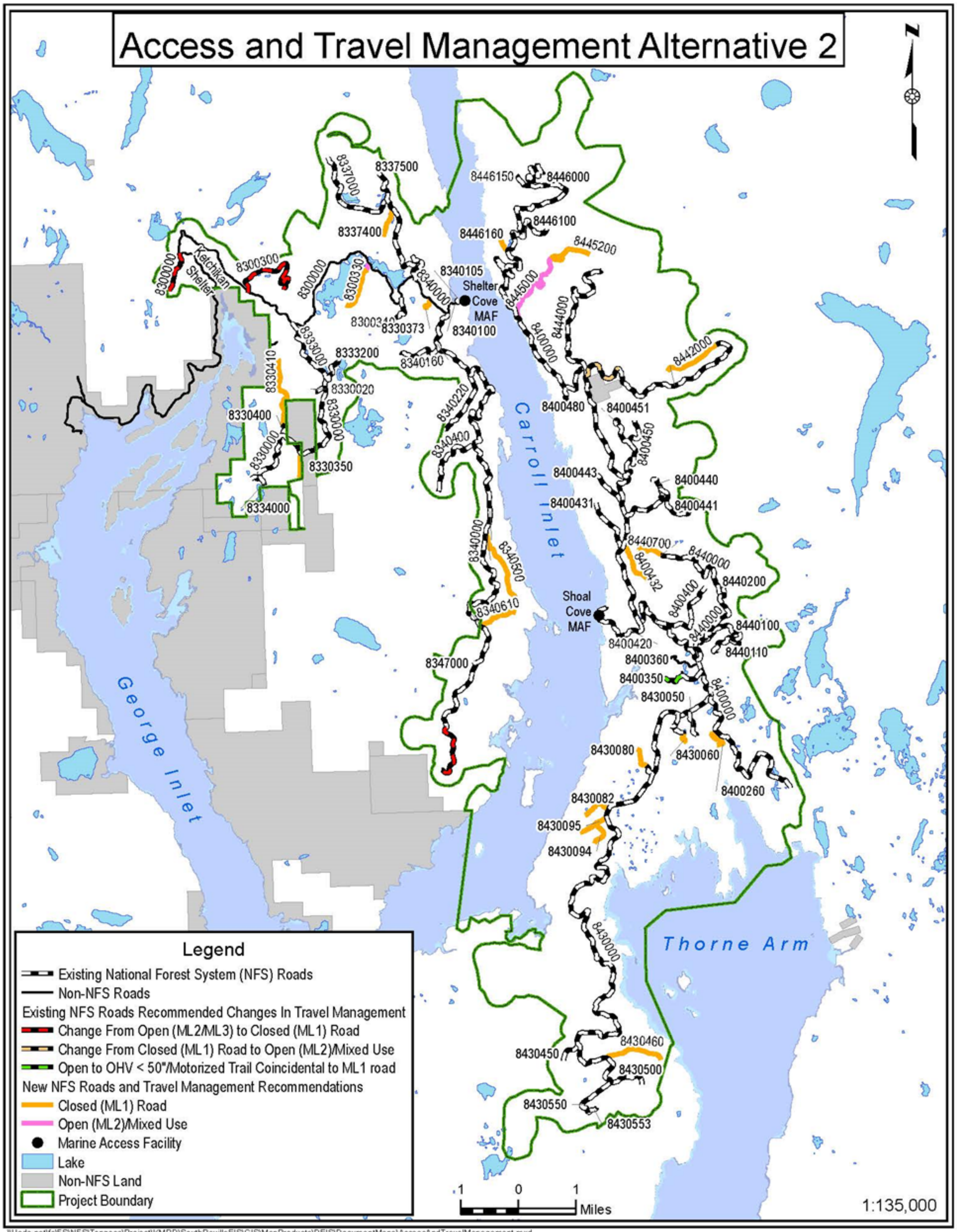


Figure 30. Alternative 2 proposed action transportation

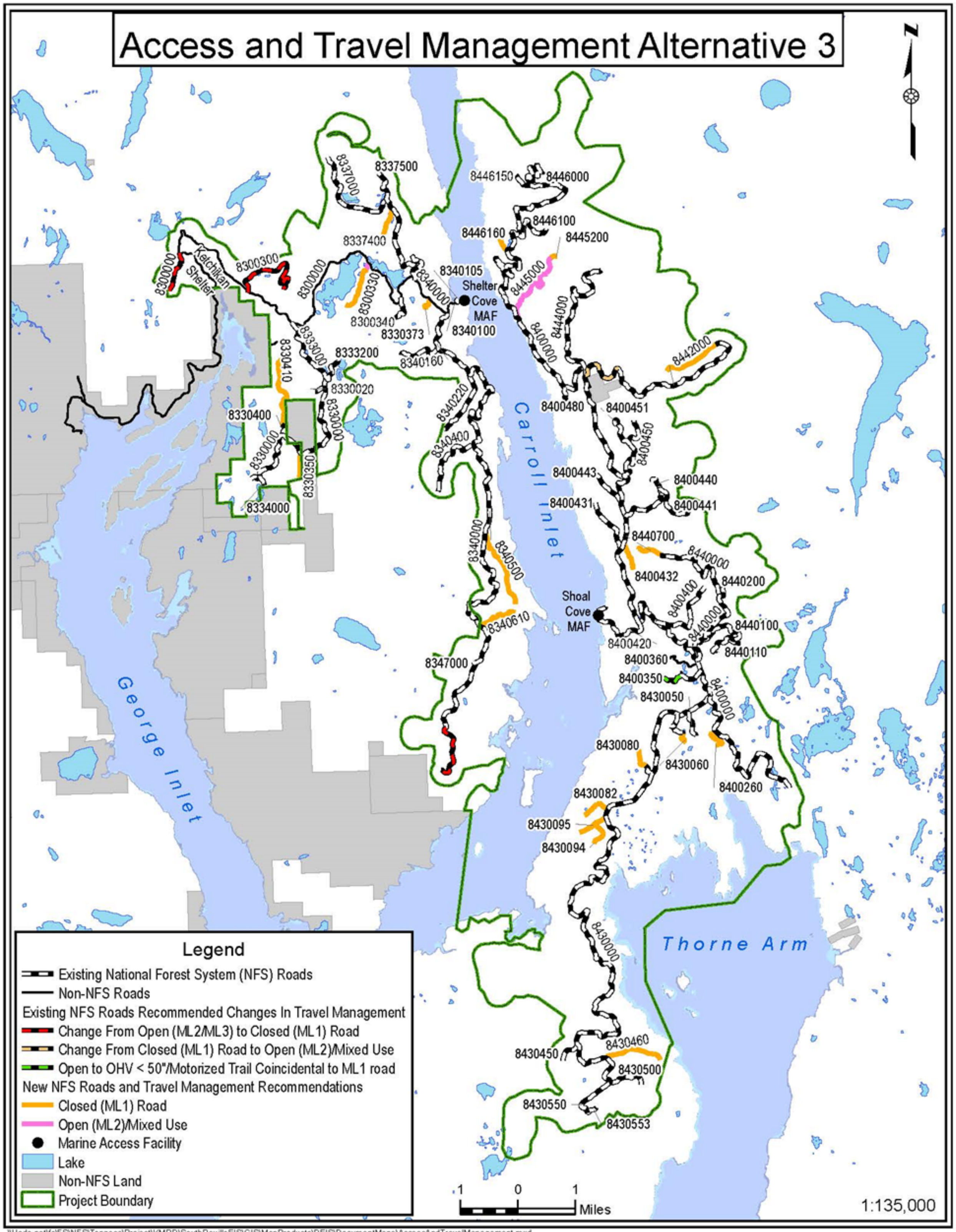


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Figure 31. Alternative 3 transportation

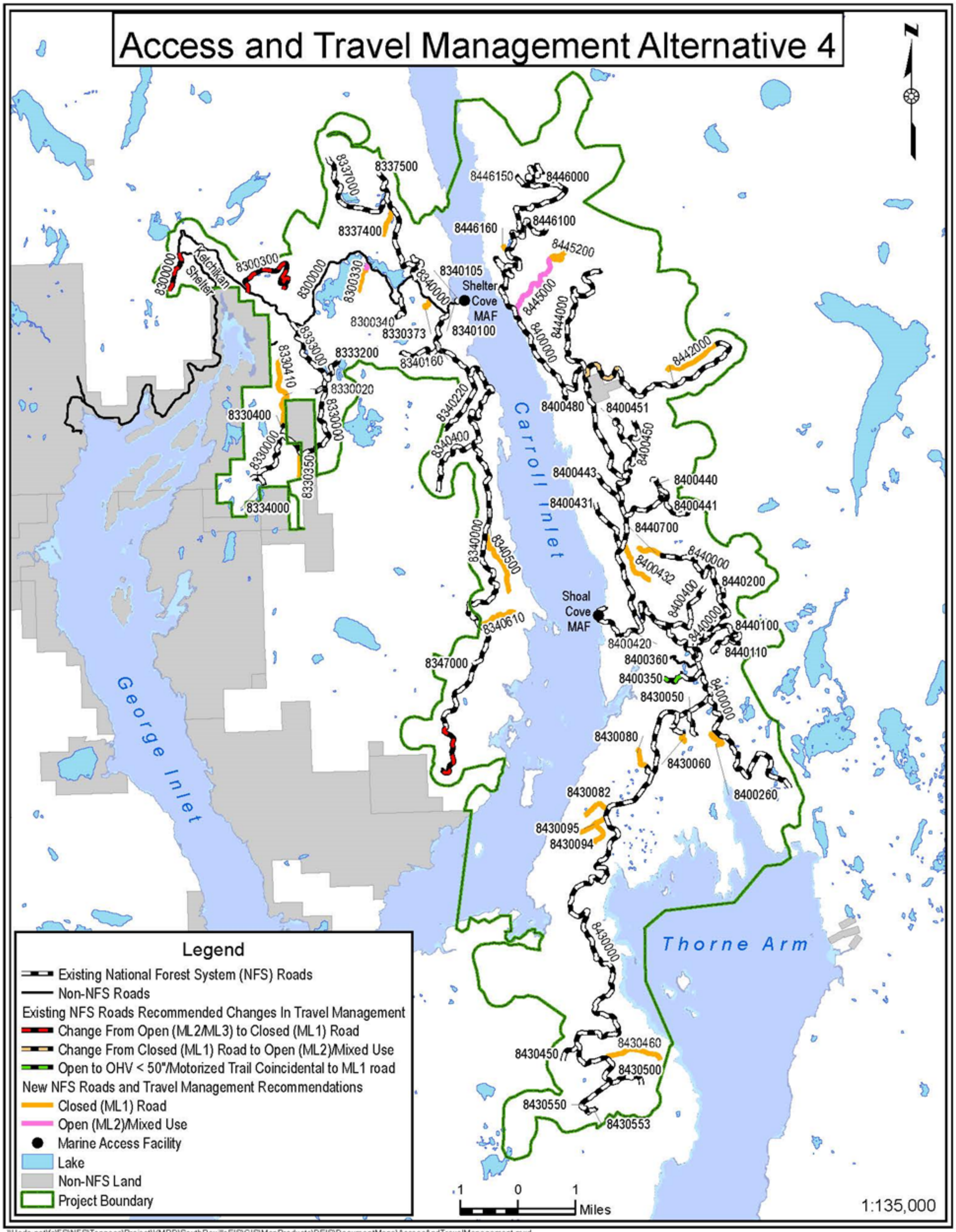

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Figure 32. Alternative 4 transportation

Aquatics

Overview

Timber harvest, road use, and construction have the greatest potential for effects on aquatic resources. Other proposed activities that have the potential to impact aquatic resources are recreation site development, aquatic restoration, and habitat enhancement.

Direct, indirect, and cumulative effects from proposed timber harvest and road construction actions vary by watershed. Adverse effects from changes in peak flow are minor in most watersheds, and major in two project area watersheds, potentially remaining detectable up to 30 years. Partial harvest methods would reduce effects disclosed. Adverse effects on water quality range from negligible to minor, and short in duration.

Cumulative effects to stream flow are expected with any additional timber projects identified in appendix C, and the AMHT land exchange, as any additional harvest could amplify the effects of climate change on stream dynamics.

Resource Indicators and Measures

Direct, indirect and cumulative effects for all affected watersheds are estimated using quantifiable surrogate measures (table 69) for actual effects (for example, stream crossings are a measure for increased sediment) as supported by the literature cited. The analysis discloses maximum effects (assuming maximum levels of implementation), while incorporating the design features listed in Chapter 2 to avoid or minimize adverse effects to aquatic resources. The effectiveness of many of these design features is supported by annual water quality best management practices monitoring (USDA Forest Service 2019, 2017, 2016, 2015, and 2012; and Tucker and Thompson 2010).

Table 69. Resource indicators and measures for assessing effects to aquatic resources

Resource Element	Resource Indicator	Measure
Stream Flow	Peak Flow Events	Cumulative harvest levels (%) since 1990 in affected watersheds
Water quality	Sediment delivery	Number of stream crossings
Water quality	Sediment delivery	Road Density & % Basin Roaded
Water quality	Stream Temperature	Timber harvest in Riparian Management Area (miles)
Fish passage	Fish blocking culverts (red crossings)	Number of red crossings

The following units of measure were used to evaluate current watershed condition, the effects of the proposal, and to compare alternatives:

- Increased peak flow: 30-year cumulative harvest levels within project-area watersheds
- Water Quality -- Increased sediment: Road-related metrics include percentage of basin area comprised of roads (from existing and proposed new road construction), and number of existing and new stream

crossings. Other activities such as stream and floodplain restoration, stream enhancement, wildlife habitat enhancement, road decommissioning, and construction of recreation sites, such as cabins and trails, are discussed qualitatively, since the effects of these activities tend to be site-specific and effects occur primarily as a function of proximity to aquatic resources.

- Water Quality -- Increased stream temperature: Stream temperature related metrics include miles of timber harvest in Riparian Management Areas (RMA).
- Fish Passage: Number of red crossings.

Methodology

The analysis was based on GIS and field data collected by Forest Service personnel. Field surveys focused on verifying fish habitat and mapping new streams. Field surveys will continue to delineate and evaluate riparian areas prior to any project or activity.

The relative risk of an activity resulting in effects which would adversely impact aquatic resources is characterized as:

- Low
- Moderate
- High

The level (magnitude and intensity) of effects is characterized by descriptors which account for how measurable the effect would be, how widespread the effect is likely to be, and how long it is likely to last. Descriptors of effects include:

- Negligible: Effects would be undetectable or if detected, would be considered slight, detectable only at the site, and last less than a day.
- Minor: Effects would be measurable, although the changes would be small, localized to the site or affected stream reach, and last less than a week.
- Moderate: Effects would be measurable at the stream reach or subwatershed scale, and last more than a week.
- Major: Effects would be readily measurable at the stream reach or subwatershed scale and would last for years.

Exceptions to risk characterizations and these descriptors are noted as applicable.

Incomplete and Unavailable Information

Stream flow and water quality data are unavailable for the affected watersheds; therefore, the effects analysis is based on known cause and effects relationships supported by peer reviewed literature.

Field surveys are ongoing, and any remaining unmapped streams will be documented, mapped, and buffered prior to implementation to meet Forest Plan protection measures. For the current analysis, GIS data and aerial imagery was used to fill in gaps in field data. Contributions made by remaining unmapped streams are not expected to impact this analysis.

A lack of stream gauge data and the incomplete cataloguing of classified streams within the project area were not critical for the analysis. Analysis of potential effects was based on the assumption that risk to aquatic habitats was possible with all existing and proposed new disturbances, and that implementation of Forest Plan standards and guidelines and BMPs would minimize these risks.

Spatial and Temporal Scales

We analyzed direct, indirect, and cumulative effects of the proposed activities on aquatics resources spatially and temporally using the 7th level hydrologic units (HU) (HU-14) watershed level, referred to as 'watershed(s)' hereafter, unless otherwise noted. Specifically, the effects to streamflow, water quality, fish and other aquatic organisms, and the physical stream and floodplain habitat that supports them.

The longest anticipated temporal effects to aquatic resources in the project area originate from road building and timber harvest. For this analysis all roads were analyzed regardless of age or use (temporary or permanent) due to their continued impacts to natural flow patterns. Previous harvest is analyzed as a 30-year cumulative total for hydrologic recovery (Grant et al. 2008, and Moore and Wondzell 2005) The timeframe for potential effects of management activities is included within descriptors characterizing the level (magnitude and intensity) of effects, described in the Environmental Effects section.

The potential effects of climate change on aquatic resources are difficult to determine in the context of "existing condition" within the project area; however, scientific literature highlights likely changes and potential consequences. Changes to water temperature, snow characteristics, streamflow patterns, and channel morphology are some key points anticipated to stress salmonid populations (Mantua et al. 2010; Goode et al. 2013; Littell et al. 2018). Indicators such as peak flow and stream temperature were used to evaluate the possible effects of climate change between alternatives.

Present and Foreseeable Activities Relevant to Cumulative Effects Analysis

The present and foreseeable activities within the South Revilla Integrated Resource Project (listed in Appendix C) affecting watershed and fisheries resources vary in their scope and intensity. Present activities with the most potential to affect these resources include the potential timber harvest on non-NFS lands including Alaska Mental Health Trust Timber Sales, including their associated road building activities, and the potential land exchange with the Alaska Mental Health Trust.

Projects with negligible anticipated cumulative effects to aquatic resources include the remainder of those listed in appendix C.

Risks of adverse impacts to aquatic resources are mitigated through the application of Forest- wide direction, project-specific BMPs, Alaska Department of Environmental Conservation (ADEC) and Clean Water Act (CWA) regulations and permitting processes, contractual project requirements, and Project Design Features and Mitigation measures listed in Chapter 2. Cumulative effects to aquatic and riparian resources from past, present, and future projects will occur, with potential risk levels associated with each alternative described below.

Affected Environment

The project area consists of 31 watersheds, 175 miles of class I anadromous fish habitat, and 204 miles of class II resident fish habitat. Approximately 164 miles of roads occur in project area watersheds (about 93 miles closed or decommissioned, 62 miles of open, and 9 miles of non-NFS). This estimate includes all known NFS and temporary roads ever built regardless of age. Currently, there are 87 total stream road crossings, 32 of which are red crossings (25 red crossing on NFS roads), with 18.5 miles of class 1 and 2 fish habitat currently inhibited by red crossings.

Fish presence information comes from field observations, and/or the Alaska Department of Fish and Game's Anadromous Waters Catalogue (AWC).

Streamflow

All but two of the watersheds within the project area have portions of their area located within the Transient Snow Zone (TSZ) (>800ft elevation), and all but seven of the 31 project area watersheds have cumulative harvest levels currently below 10 percent in the past 30 years (figure 33). Three watersheds have cumulative harvest levels that exceed the threshold for detection of changes in peak flows (Grant et al. 2008). These are 19010102050309, 19010102050604, and 19010102050304 (Licking Creek).

No active or historic gages exist within the project area. The nearest U.S. Geological Survey (USGS) stream gage is located approximately one mile southeast of the project area boundary on Fish Creek on Revillagigedo Island in east side of the Thorne Arm Inlet (figure 34). The Fish Creek hydrograph is indicative of streams within the project area due to similar elevations and precipitation patterns. The hydrograph displayed in figure 34 shows mean monthly streamflow, from 2010 to 2019, in the Fish Creek watershed in cubic feet per second (CFS). The hydrograph shows a small snowmelt peak in the spring, common in streams within the transient snow zone, followed by lower flows in summer months when groundwater stores are depleted, with maximum flows occurring in conjunction with heavy rainfall in the fall and rain-on-snow events in winter months.

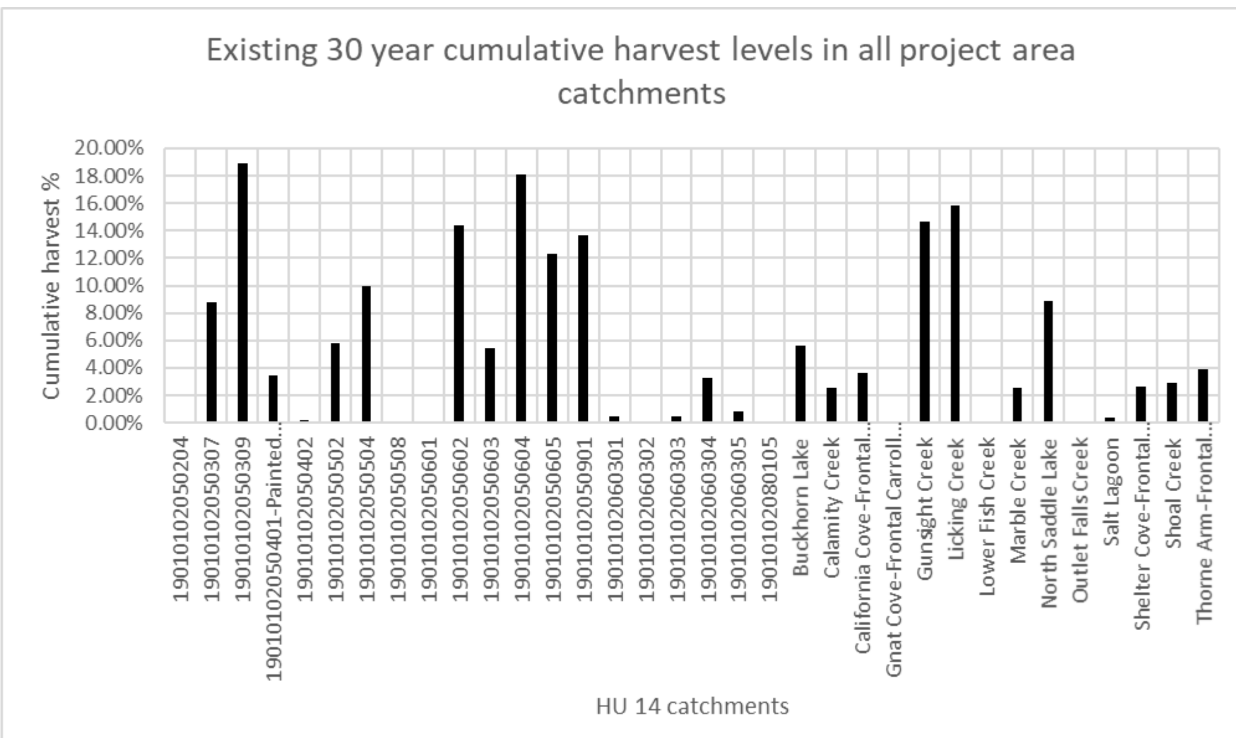

Figure 33. Existing 30-year (1990 to present) harvest areas for all catchments within the harvest area

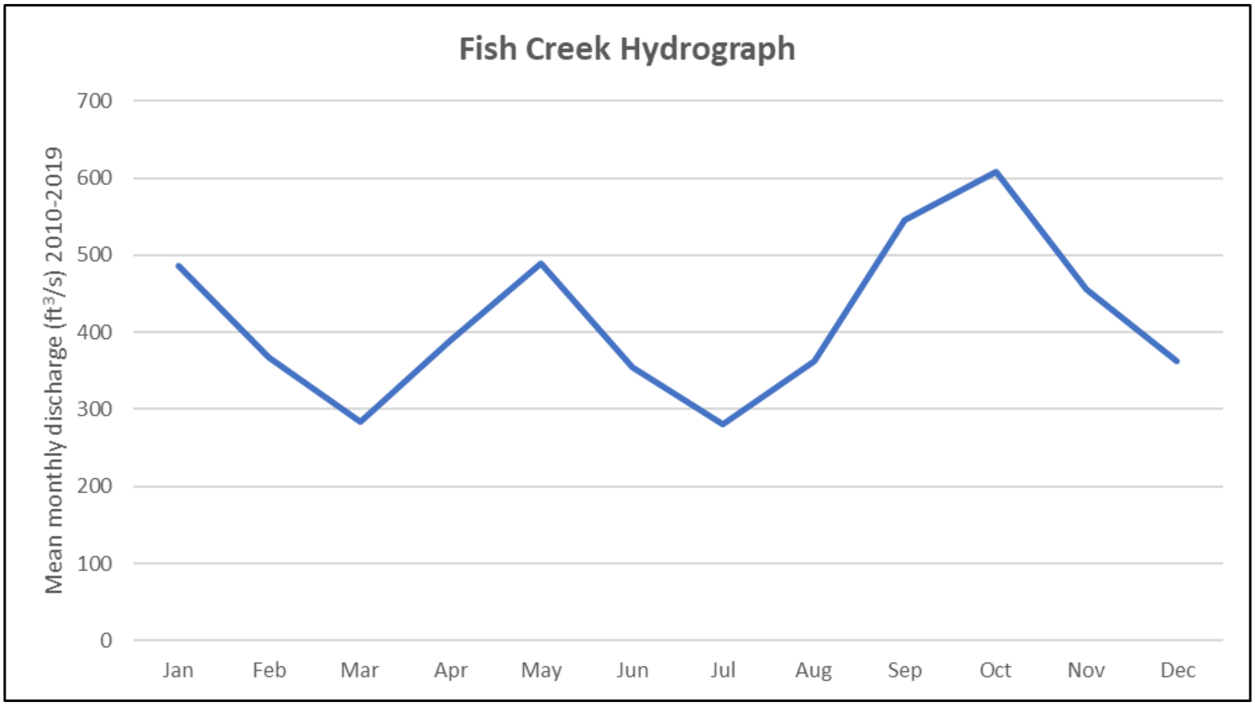

Figure 34. Hydrograph depicting mean monthly flow of Fish Creek from 2010-2019, on Revillagigedo Island, east of Ketchikan Alaska, approximately one mile SE of the project area boundary

https://nwis.waterdata.usgs.gov/nwis/monthly?site_no=15072000&por_15072000_363=623108,00060,363,1915-06,2019-12&start_dt=2010-01&end_dt=2019-01&partial_periods=on&format=html_table&date_format=YYYY-MM-DD&rdb_compression=file&submitted_form=parameter_selection_list.

Water Quality

The primary water quality parameters potentially affected by timber harvest and road building are suspended sediment loads, turbidity, and stream temperature.

Municipal Uses of Waters in the Project Area

Waters in Alaska are protected for all uses according to standards outlined in the Alaska Water Quality Standards (ADEC 2020). The Alaska Integrated Water Quality Monitoring and Assessment Report provides information on water bodies within the state that do not fully or partially support their designated beneficial uses, known as the Alaska Impaired Waters list. None of the streams within the project area, or bordering the project area, are included on ADEC's list of impaired waters (ADEC 2020).

There are no municipal water supplies in the project area. Project Design Features and Mitigation measures listed in Chapter 2 protect drinking water and are consistent with 2016 forest plan direction.

In 2009 a private landowner filed an application with the Federal Energy Regulatory Commission (FERC) for a hydropower project. The proposed Marble Creek Hydroelectric Project would include: (1) a 50-foot-long, 5-foot-high intake structure on Marble Creek; (2) a 48-inch-diameter, 850-foot-long penstock; (3) a powerhouse containing a 500-kW Francis-type generator; and (4) appurtenant facilities. The proposed project will not be connected to an interstate grid. The project will not occupy federal lands. FERC determined a license was not required. To date no construction has occurred (Personal Communication).

Sedimentation and Turbidity

Currently, approximately 164 miles of roads occur in project area watersheds (about 93 miles closed or decommissioned, 62 miles of open, and 9 miles of non-national forest). This estimate includes all NFS and temporary roads ever built, regardless of age. None of the 31 project area watersheds have an existing roaded area that exceeds 2.5 percent of the basin area (table 74).

Temperature

Water temperature is a key aspect of water quality and stream ecosystem health, determining the rate of many chemical, physical, and biological processes in rivers and streams (Beschta et al.1987; McCullough et al. 2009). The 2016 Forest Plan Amendment EIS (pp 3-56 and 3-72) discuss analysis of stream temperature data within southeast Alaska and found no detectable effect of watershed-scale timber harvest on stream temperature (Walters and Prefontaine 2005, and Tucker and Thompson 2010).

Forest Plan direction provides for the protection of riparian buffers on all fish-bearing and Class III streams through designation of riparian management areas (RMAs). Riparian management area buffers reduce the risk of increased stream temperatures through shading provided by the riparian vegetation. Previous harvest within the RMA occurred in many of the project area watersheds prior to the passage of the 1990 *Tongass Timber Reform Act* (TTRA), which subsequently provided buffers for all fish-bearing streams. This harvest may have raised stream temperatures on isolated stream reaches; however, enough vegetation regrowth has occurred for previously harvested riparian areas to recover. In previously harvested RMAs, reach-level stream habitat conditions may decline in the future along discrete reaches due to lack of large wood recruitment from the riparian forest.

Fisheries

Streams and lakes within the project area watersheds provide habitat and contribute to the production of fish that support subsistence, sport, and commercial fisheries of the area, and are a major food source for many wildlife species. Fish and aquatic resources on the Tongass National Forest provide subsistence, commercial, and sport fisheries, as well as traditional and cultural values. Abundant rainfall and watersheds with high stream densities provide for the diversity of freshwater habitats.

Threatened and Endangered Fish Species

Currently there are no threatened or endangered fish species within the territorial boundaries of the Tongass National Forest (USDA Forest Service 2016a, pp. 4-14), and therefore they do not occur in or around the analysis area. Though the following federally listed fish stocks may occur in the marine waters within the boundary of the Tongass national Forest (NMFS 2020):

Endangered species:

- Snake River sockeye salmon
- Upper Columbia River spring-run Chinook salmon

Threatened species:

- Green Sturgeon – Southern DPS
- Hood Canal summer-run chum salmon
- Lower Columbia River coho salmon
- Lower Columbia River steelhead
- Middle Columbia River steelhead
- Snake River Basin steelhead
- Upper Columbia River steelhead
- Upper Willamette river steelhead
- Snake River Sockeye Salmon
- Lower Columbia River Chinook salmon

- Puget Sound Chinook salmon
- Snake River fall Chinook salmon
- Snake River spring/summer Chinook salmon
- Upper Willamette River Chinook salmon

These listed stocks of salmon and steelhead are only occasionally present in the inside marine waters of Southeast Alaska where they may feed on prey resources originating within marine and estuarine waters of the Tongass National Forest (USDA Forest Service 2016b, p. 3-118 to 3-120). Critical habitat has not been designated for these fish species in Alaskan waters.

Aquatic Habitat

Stream habitat is determined by mapping and classifying streams within the project area according to process group and channel type (Paustian 1997, rev 2010). Fluvial process groups describe the interrelationship between watershed runoff, landform relief, geology, and glacial or tidal influences on fluvial erosion and deposition processes. Channel types further categorize streams using physical attributes such as channel gradient, channel width, channel pattern, stream bank incision and confinement, and riparian plant community composition. High value fish habitat (for spawning and/or rearing) is present in estuary (ES), palustrine (PA), flood plain (FP), and moderate gradient mixed control (MM) process groups. Process groups with moderate fish habitat potential include low gradient contained (LC), and moderate gradient contained (MC) channels. If fish bearing, high gradient contained (HC) channels are typically comprised of small resident populations.

Streams on the Tongass National Forest are given values of Class I to IV indicating levels of habitat use by fish populations and are delineated according to the criteria described in the Aquatic Habitat Management Handbook (Forest Service Handbook 2090.21). The quantity and overall quality of Class I and II streams and lakes in the project area indicate high fisheries value.

These stream classifications are:

Class I - Streams and lakes with anadromous or adfluvial fish or fish habitat; or high-quality resident fish waters, or habitat above fish migration barriers known to be reasonable enhancement opportunities for anadromous fish.

Class II - Streams and lakes with resident fish or fish habitat and generally steep (6-25 percent or higher) gradient (can also include streams with a 0-6 percent gradient) where no anadromous fish occur, and otherwise not meeting Class I criteria.

Class III – Streams are perennial and intermittent streams with no fish populations or fish habitat, but have sufficient flow or sediment and debris transport to have an immediate influence on downstream water quality or fish habitat capability. For streams less than 30 percent gradient, special care is needed to determine if resident fish are present.

Class IV - Other intermittent, ephemeral, and small perennial channels with insufficient flow or sediment transport capabilities to have immediate influence on downstream water quality or fish habitat capability. Class IV streams do not have the characteristics of Class I, II, or III streams, and have a bankfull width of at least 0.3 meter (1 foot).

Non-streams - Rills and other watercourses, generally intermittent and less than 1 foot in bankfull width, little or no incision into the surrounding hillslope, and with little or no evidence of scour.

The Watershed Condition Framework (WCF) and its accompanying technical guide uses specific habitat indicators for a combined overall score and condition rating (USDA Forest Service 2011a; USDA Forest Service 2011b). The system uses multiple data sources to establish criteria for indicators describing three watershed condition classes - “1 = functioning properly”, “2 = functioning at risk”, and “3 = impaired function" (ibid). The WCF evaluation was completed on all watersheds in the Forest Service system, including the watersheds analyzed for this project.

Higher scores are possible within these categories and suggest certain attributes may be approaching the next category. Although all streams within the project area have a score within the "functioning properly" category, four watersheds scored at 1.4 suggesting certain attributes may be approaching at risk status. These scores help guide where to focus restoration efforts (table 70). Management practices prior to the 1990 *Tongass Timber Reform Act* (TTRA) that included timber harvest and road building along fish streams and within floodplains, resulted in degraded habitat requiring restoration in some locations.

Surveys identified two watersheds in the project area for restoration and enhancement actions. Stream enhancement opportunities within stream systems identified within the project area include Painted Creek (a.k.a. Shoal Creek) and Licking Creek.

- **Painted Creek** (a.k.a. Shoal Creek) watershed (figure 35), has a WCF score of 1.4. Surveys within the Painted Creek watershed revealed past riparian harvest has altered habitat and reduced the abundance of large wood along the stream. Restoration and enhancement efforts would focus on adding large wood to the flood plain, using downed trees or previously cut logs, like those currently stored at shoal Cove LTF, and treating up to 100 acres of riparian stands to promote conifer growth for future large wood recruitment into streams.
- **Licking Creek** watershed (figure 35) watershed has a WCF score of 1.4. Surveys within Licking Creek watershed revealed past road construction and riparian harvest has altered and impeded flow paths and impeded fish passage. Restoration and enhancement activities within this watershed would focus on improving drainage along NFS road 8446000 by replacing culverts with bridges and adding additional crossing structures where needed and treating up to 90 acres of riparian stands to promote conifer growth for future large wood recruitment into streams.

Table 70. Watershed condition framework (WCF) scores per HU12 watersheds

HU12 NAME	HU12 CODE	Watershed Condition Framework Score
Falls Creek	190101020502	1.1
Calamity Creek-Frontal Carroll Inlet	190101020503	1.4
Shoal Creek	190101020504	1.4
Marble Creek-Frontal Carroll Inlet	190101020505	1.3
Salt Lagoon	190101020506	1.1
George Inlet-Frontal Carroll Inlet	190101020509	1.4
Fish Creek	190101020601	1
Thorne Arm-Frontal Revillagigedo Channel	190101020603	1.4
Hassler Lake-Frontal Revillagigedo Channel	190101020801	1

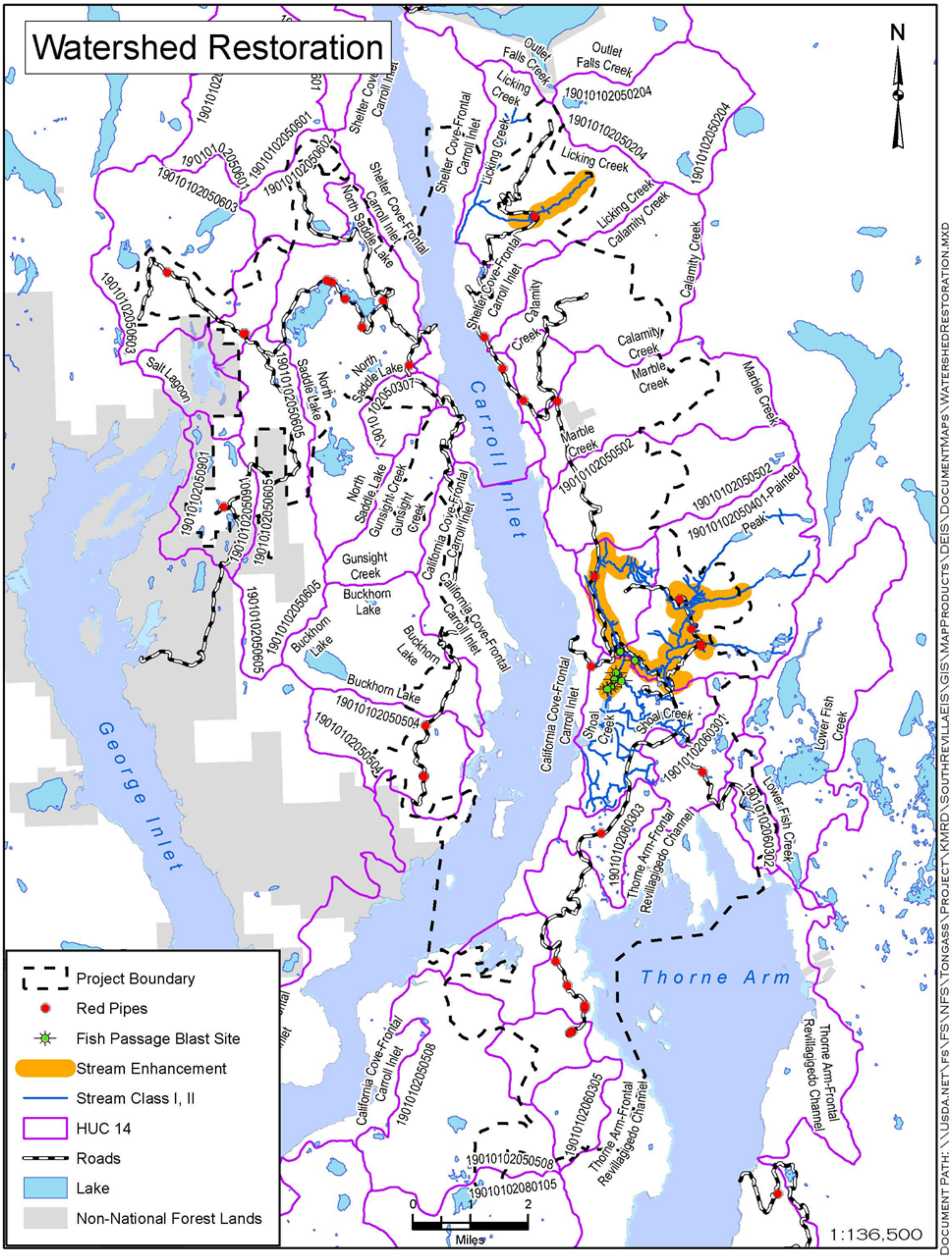

Figure 35. Aquatics habitat restoration & enhancement, crossings, and fish passage projects

Fish Habitat Improvement

Fish Passage

Existing effects to fish passage are related primarily to road crossings but may also be affected by landslides (see the *Soils* section in this document). Potential changes in peak flow, and timing related to timber harvest and road building could increase the number of red crossings by creating flow-related passage barriers to juvenile fish.

Hiking trails are not typically associated with fish passage issues due to their location on the landscape, the size streams crossed, and the use of bridges rather than culverts. Currently there are no designated hiking trails within the project area.

District-wide aquatic organism passage (AOP) field surveys are used in conjunction with GIS to determine number of stream crossings, number of culverts with fish passage issues, and streams requiring additional information or field verification. As part of these surveys, each existing road crossing structure in a fish stream was assessed for its ability to provide unimpeded passage.

Fish crossings are categorized based on a stream crossing structures (culvert) ability to allow the uninhibited movement of fish at a range of flow conditions using a color-coded system:

- A red fish crossing has a high certainty of not providing juvenile fish passage at all desired stream flows, while a green crossing has a high certainty of providing adequate passage.
- Green fish crossings allow unrestricted fish movement across a range of stream flows.
- Gray crossings are those where the structure measurements need to be further analyzed to determine fish passage status.
- Black crossings have information missing for determining status.

In the project area, there are 87 total fish crossings. Of those, there are 32 red crossings (7 of these are on State managed road), 4 gray crossings, and 4 black crossings (table 71). Additionally, table 72 documents the miles of upstream habitat inhibited by the red crossings.

Table 71. Watershed fish crossing classifications in the project area

Watershed names	Fish Crossing Classifications				
	RED	GREEN	GRAY	BLACK	Total
19010102050309	1	1	1		3
19010102050401-Painted Peak	4	3			7
19010102050402	1	1		1	3
19010102050502	0	1			1
19010102050504	3	1			4
19010102050603	1	2			3
19010102050604	2				2
19010102050605	0	2		1	3
19010102050901	1				1
19010102060301	1	2			3
19010102060302	0	2			2

Watershed names	Fish Crossing Classifications				
	RED	GREEN	GRAY	BLACK	Total
19010102060303	1			1	2
19010102060304	2	3			5
19010102060305	0	1			1
Buckhorn Lake	0	1			1
Calamity Creek	0	1			1
California Cove-Frontal Carroll Inlet	0			1	1
Gnat Cove-Frontal Carroll Inlet	0	4			4
Gunsight Creek	0	1	1		2
Licking Creek	1	2			3
Marble Creek	1	2			3
North Saddle Lake	6	4	1		11
Shelter Cove-Frontal Carroll Inlet	2				2
Shoal Creek	1	5			6
Thorne Arm-Frontal Revillagigedo Channel	4	9	1		13
TOTAL	**32**	**48**	**4**	**4**	**87**

A stream crossing is classified as Class I (anadromous fish) or II (resident fish) if it has verified anadromous or resident fish downstream with habitat upstream or verified fish presence upstream. Upstream assessments are the most accurate estimate regarding habitat impacted by road crossings that do not meet current fish passage standards. All but seven of the 32 red crossings in the project area have had upstream assessments completed to date (table 72) to assess maximum extent of possible fish presence in the stream. Surveys on remaining seven are ongoing, therefore upstream habitat was estimated using GIS and aerial imagery.

Red crossings within the project area inhibit a total of 18.5 miles of upstream fish habitat (Class I and II). table 72 displays each of the red crossings in the project area and the available upstream habitat. Priority replacement will be given to those with the higher remediation score (table 72).

Table 72. Remediation scores for project area red crossings

Route Number	Milepost	Remediation Score	Upstream Habitat (miles)
8300000	17.971	0.0*	0.03**
8300000	19.007	0.0*	0.2**
8300000	15.465	1.8	0.02
8300000	18.386	14.5	0.28
8300000	13.528	78.5	0.09
8300000	15.447	744.9	0.64
8300000	18.082	421644.7	2.92
8337000	0.153	34976.3	3.06

Route Number	Milepost	Remediation Score	Upstream Habitat (miles)
8340000	11.224	5.6	0.04
8340000	0.929	34.1	0.10
8340000	10.081	477.8	1.13
8340000	11.252	782.2	0.49
8400000 SHOAL COVE	26.216	0.0*	0.3**
8400000 SHOAL COVE	36.969	1.2	0.01
8400000 SHOAL COVE	36.267	12.7	0.02
8400000 SHOAL COVE	31.608	37.3	0.10
8400000 SHOAL COVE	35.162	116.4	0.14
8400000 SHOAL COVE	37.631	764.2	0.62
8330000	4.65	0.0*	0.09**
8400420	0.559	60.8	0.29
8430000	7.716	0.0*	0.1**
8430000	2.734	0.0*	2.4**
8430000	8.245	7.7	0.03
8430000	7.659	13.0	0.09
8430000	8.296	143.8	0.62
8430000	7.089	615.8	0.37
8430000	6.615	2349.9	0.53
8440000	1.243	0.0*	2.6**
8440000	2.38	22.0	0.08
8440000	1.216	51.2	0.11
8440000	1.571	57.7	0.19
8446000	4.384	1724.0	0.81

* denotes incomplete data

** denotes surveys incomplete data estimated using GIS data and aerial imagery.

Partial Barrier Modifications

There are seven listed barrier falls in the Painted Creek (a.k.a. Shoal Creek) system proposed for modification in all action alternatives (figure 35). These sites are partial barriers to anadromous fish at certain flow levels. Natural instream barrier modifications are constructed to bridge natural waterfalls that historically restricted salmon at all or certain flows from accessing quality upstream spawning and rearing habitat. Typically, these modifications are non-structural “step-pools” blasted out of natural bedrock. The goal is to provide anadromous fish with improved access to additional habitat.

Aquatic Species in the Project Area

A variety of aquatic ecosystems occur within the project area that are shaped by the physical characteristics of the habitat as well as the composition of organisms that live there. Aquatic organisms in the project area include vertebrates (fish and amphibians), invertebrates (insects, zooplankton, mollusks, and worms), plants (riparian species and macrophytes [rooted and floating plants]), and microorganisms (algae, protozoa, fungi, and bacteria).

Nine fish species occur in the freshwaters of the project area. These include: coho, pink, chum, and sockeye salmon, rainbow and cutthroat trout, Dolly Varden char, 3 spined stickleback, and sculpin spp.

The annual spawning migrations of anadromous fish into freshwater are necessary for the function of many terrestrial plant and animal communities. Anadromous fish mature and spend much of their adult life in the ocean, returning to inland waters to spawn. Resident fish do not undertake migrations like anadromous fish, and many will complete their entire life cycle in fresh water. Some of the fish species in the freshwaters found in the project area have both anadromous and resident populations, and some of the resident populations also use estuarine habitats.

Marine Environment

Most watersheds have some degree of direct interaction with the marine environment, and some that contain diverse estuarian and tidal habitats areas vital for some commercially important species such as Dungeness crab, and juvenile salmon.

Log Transfer Facilities (LTFs)

There are two existing LTFs in the South Revilla project area, Shelter Cove and Shoal Cove (figure 29). These facilities are used for the movement of equipment needed for logging and road building and for the transfer of logs from trucks. Logs are either placed directly into the saltwater (rafting) or loaded onto barges and towed to mills or export facilities. Additionally, the Leask Cove or Coon Cove LTFs located on non-NFS land the Shelter Cove Road could be used to transport logs. See Transportation section for more information on LTFs in the project area. Recent dive reports describing compliance with standards for marine bark deposition on project area LTFs, located on National Forest System lands, are discussed below under Effects common to all alternatives – Fisheries-Logging Transfer Facilities.

Environmental Effects

The primary issues related to the aquatics resource from the proposed actions include potential changes in streamflow (magnitude, timing, duration) and water quality (temperature, sedimentation, turbidity). The potential of these changes to affect the physical habitat and biological components that aquatic organisms require is of primary concern.

Effects common to all action alternatives

Direct, indirect, and cumulative effects vary by activity and range from minor to major for stream flow, and negligible to minor for water quality.

All alternatives assume full implementation in 2020 and that all proposed acres are harvested. Cumulative harvest estimates assume even-aged management prescriptions except within previously-harvested beach buffers and RMAs, which are adjusted to partial harvest treatment prescriptions defined by 2016 forest plan (see the Forest Vegetation section of this DEIS). Partial harvest prescriptions are proposed in 52 units in all alternatives, with an additional 34 partial harvest units in Alternative 4. Cumulative harvest estimates include Forest Service and non-Forest Service lands and, roads, and estimated acreage for recreation and restoration activities.

Activities such as stream and floodplain restoration, fish habitat improvements, wildlife habitat improvement, and riparian treatments are expected to result in short term negligible to minor direct and indirect adverse effects to water quality, but are expected to result in long-term cumulative beneficial effects to water quality, riparian condition, and ultimately the multitude of organisms that use these areas.

Other direct and indirect short-term effects to water quality, fish habitat, and fish species are anticipated from those activities associated with proposed recreation actions such as tent platform and cabin construction/reconstruction; trail construction/reconstruction; restroom facility construction, boat ramp improvements, hiking trail construction, kiosk and parking construction, outfitter/guide and other hunting and fishing activities, dispersed recreation and subsistence gathering, and similar activities can have negligible to minor short-term site-specific impacts within discrete portions of a given watershed, but are not expected to adversely affect aquatic resources, water quality, fish species, or fish habitat on a watershed scale or in the long-term. These effects are therefore expected to be negligible and not discussed further.

BMPs and project design features mentioned in Chapter 2 help mitigate potential effects discussed above and below, and are considered when making effects determinization. All activities proposed in the project area will be inspected and assessed in the field by an aquatic resource professional to ensure compliance with all applicable BMPs, and standards and guides.

Stream Flow

All action alternatives share similar effects that would likely result in changes to the timing, magnitude, and duration of flow patterns in 12 out of 31 project area watersheds (table 73) (figure 36), with three additional watersheds close to the detection limit. Alternative 2 and 4 respectively have the highest potential for detectable changes to peak flow. These changes could impact water quality and physical stream habitat, with subsequent effects to aquatic organisms including fish. Partial harvest prescriptions are proposed in 52 units in all alternatives, with an additional 34 partial harvest units in Alternative 4. Partial harvest prescriptions in these watersheds would likely reduce effects (Grant et al. 2008).

Changes in peak flow following timber harvest primarily result from a loss of canopy interception, which increases the amount of water received on the ground. This can lead to faster development and increased volume of peak flows, higher water tables, and increased erosion resulting from overland flow (Banner et al. 2005). In temperate rainforest stands in southeast Alaska, overland flow and surface erosion is minimized on the undisturbed forest floor. The transient snow zone (TSZ) is likely the most sensitive to timber harvest effects due to rain-on-snow events common in this zone and is the predominant hydrologic regime of project area watersheds. Increases to peak flows resulting from management activities, such as timber harvest and road construction, are the primary mechanism by which channel altering changes to fish habitat may occur. Other flow-related changes resulting from timber harvest and road construction documented by the literature include the potential to affect low flows, water yield, and timing of runoff (Hicks et al. 1991, Keppeler and Ziemer 1990, Bartos 1989, Neal 2000, Neal 2010, Perry 2007, and Eviristo et al. 2019). Streamflow changes resulting from the proposed activities may occur in multiple project area watersheds in all action alternatives.

Regional trends in southeast Alaska toward a warmer, wetter climate are predicted to increase mid-and late-21st -century mean annual flood size by 17 percent and 28 percent, respectively (Shanley and Albert 2012). Littell et al. (2018) used existing precipitation and snowcourse/Snow Telemetry (SNOTEL) data in 6th level HUC watersheds in Alaska to model potential changes in percentage of snow-day fraction (PSF) and the ratio of snow fall equivalent to precipitation (SFE:P) given mid-century (2040-2069) and late-century (2070-2099) climate scenarios. The study found that changes in snowfall equivalent (SFE) vary widely throughout Alaska, but the greatest decreases occur in coastal southeast Alaska (ibid). Results show a broad switch from snow-dominated to transitional annual hydrology across most of southern Alaska by mid-century, and from transitional to rain-dominated watersheds in low elevation parts of southeast Alaska by the late twenty-first century (ibid).

Peak Flow Response

Assuming a 30-year recovery period (Grant et al. 2008, and Moore and Wondzell 2005), vegetation regrowth from previous harvest has resulted in a return to pre-harvest rates of canopy interception and evapotranspiration in most project area watersheds. However, detectable peak flow increases would be expected in 12 of 31 project area watersheds in all action alternatives (Alternative 2-4) (table 73) (figure 36 and figure 37). These impacts from peak flow increases could potentially alter fish habitat in moderate-gradient channels with less floodplain area due to channel confinement (MM, AF process groups). This may include scour of eggs and/or alevins in marginal-value spawning areas due to altered magnitude and timing of flows (Sloat et al. 2016; Littell et al. 2019).

In all action alternatives the relative risk of proposed harvest actions resulting in effects which would adversely impact aquatic resources would be ‘High’ in watersheds 19010102050402 and 19010102060305, and ‘Moderate’ in watersheds 19010102050304 (Licking Creek), 19010102050604, and 19010102050403 (Shoal Creek) and minor effects to peak flows in the rest of the watersheds, lasting as long as 30 years (figure 36).

Three watersheds have more than 2 percent of the watershed area occupied by roads, therefore the interpreted peak flow increase doubles from the predicted mean values shown in table 73, according to Grant et al. (2008). For example, the interpreted peak flow increase in watershed 19010102050402 is 21 percent in Alternatives 2 and 4, and 18 percent in Alternative 3, because more than 2 percent of this watershed is roaded the double interpreted peak flow increase would be 42 percent (table 73). Regardless of whether peak flow increases result from timber harvest, roads, climate change impacts, or a combination thereof, the effects to changes in spawning habitat are assumed to be the same.

Other activities that add to the cumulative timber harvest within a watershed include recreation-related activities. Potential harvest for recreation-related activities was assumed for all alternatives. Values assumed for each of the following recreation-related activities: cabin (~0.02 acres), restroom (~0.01 acre), and 2,704 feet of new trail (~0.4 acres).

Stream restoration activities would use downed trees. No timber harvest for building instream structures associated with restoration of streams, and floodplains would occur. Riparian thinning and wildlife habitat enhancement would use a silvicultural prescription to encourage stands to exhibit old-growth like conditions while protecting trees adjacent to the stream for bank stability and promoting growth of the largest trees within the RMA.

Table 73. Cumulative harvest levels in watersheds only4 with anticipated changes in detectable peak flows by alternative

Watershed name	Alternative 1 Existing 30-yr. cumulative harvest (%)	Alternative 2 30-yr cumulative harvest (%)[1]	Alternative 3 30-yr cumulative harvest (%)[1]	Alternative 4 30-yr cumulative harvest (%)[1]	Estimated Percent Detectable peak flow increase [2]	Double Interpreted Peak Flow Increase (>2% Basin in Roaded Condition)
19010102050309	18.89%	34.73%	32.51%	34.73%	13% in Alts 2 & 4 12% in Alt 3	No
19010102050402	0.16%	81.83%	67.77%	81.83%	21% Alts 2 & 4 18% Alt 3	Yes
19010102050502	5.81%	33.53%	29.10%	33.53%	14% Alts 2 & 4 12% Alt 3	No
19010102050602	14.41%	22.53%	21.73%	22.53%	11% Alt 2, 3, & 4	No
19010102050604	18.07%	30.41%	27.44%	30.41%	13% Alts 2 & 4 12% Alt 3	No
19010102050605	12.26%	25.87%	24.88%	25.87%	12% Alt 2, 3, & 4	No
19010102050901	13.67%	21.76%	21.60%	21.76%	11% Alt 2, 3, & 4	No
19010102060305	0.85%	41.72%	37.37%	41.72%	14% Alts 2 & 4 13% Alt 3	Yes
Gunsight Creek	14.69%	22.49%	21.56%	22.49%	11% Alt 2, 3, & 4	No
Licking Creek	15.80%	22.31%	21.60%	22.31%	11% Alt 2, 3, & 4	No
North Saddle Lake	8.88%	24.20%	23.24%	24.20%	12% Alts 2 & 4 11% Alt 3	No
Shoal Creek	2.87%	22.87%	21.64%	22.87%	11% Alt 2, 3, & 4	Yes

1 Estimates for all alternatives assume implementation in 2020 and that all proposed acres are harvested. Cumulative harvest estimates assume even-aged management prescriptions except within previously-harvested beach buffers and RMAs, which are adjusted to partial harvest treatment prescriptions defined by 2016 forest plan (see the Forest Vegetation section of this DEIS). Cumulative harvest estimates include Forest Service and non-Forest Service lands and, roads, and estimated acreage for recreation and restoration activities.

2 Values estimated from Grant et al. 2008, “Figure 10. Peak flow response in the transient snow zone”, using “mean reported change” response line.

3 “ND” indicates values below detectable limits.

4. Full table displaying all watersheds available in project record.

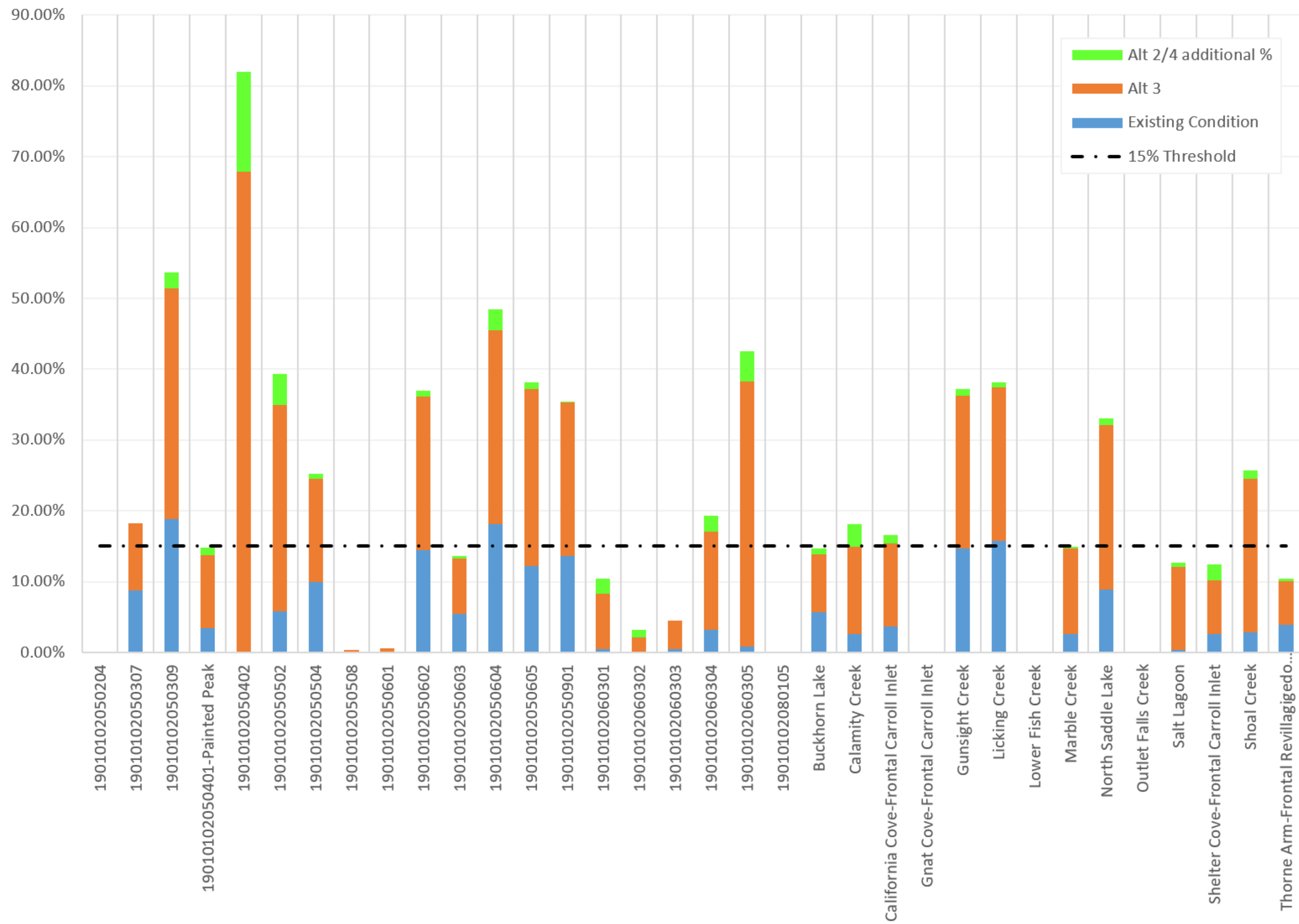

Figure 36. 30-year cumulative harvest level for all watersheds within the harvest area for all alternatives

Risk of peak flow (figure 37) increases are also affected by watershed-scale characteristics and management considerations. Characteristics such as watershed size and type (true, frontal), drainage efficiency, road density, road connectivity, harvest patch size and location, harvest prescription, presence and location of lakes and ponds, location of channel types susceptible to change, and riparian no-harvest buffers combine in complex ways to influence peak flows. The watersheds in table 73 (figure 37) were assessed using the following assumptions:

1. The transient snow zone values reported in Grant et al. (2008) are most applicable to small watersheds of 2,500 acres or less, like those within the project area. Nonetheless, values for percent increase from the above study are reported in this analysis regardless of watershed size.
2. Cumulative harvest values in all action alternatives assume even-aged management prescriptions. As such, determinations of risk due to peak flows represent a maximum possible effect. Larger clearcuts would likely increase the probability of peak flow effects more than small patches and high retention uneven-aged prescriptions. Because partial harvest is proposed in some units this assumption of clearcut prescriptions would over-estimate the potential peak flow response.
3. High road density, road connectivity to streams, and high stream density all act to accelerate surface runoff and increase peak flows.
4. The riparian management area buffers (RMAs) required on Class I, II, and III streams by the 2016 Forest Plan and TTRA reduce patch size and connectivity of disturbed areas and surface runoff to streams, thereby providing some mitigating effect.
5. Bedrock controlled stream channels (HC, LC, MC process groups) would not experience increased sediment transport or channel scour in response to increased peak flows. Palustrine streams, ponds, and lakes would diminish peak flow increases.
6. Higher elevation harvest combined with dense stream networks would be most sensitive to rain-on-snow events.
7. Predicted 17 percent increase in peak flow due to climate change may act cumulatively with peak flows predicted from timber harvest. However, peak flow increases from timber harvest are more likely to occur immediately following harvest, whereas those predicted due to climate change would occur more gradually. As such, the likelihood of a one-to-one “additive” cumulative effect to peak flows is low. Also, the length of time between predicted initiation of climate change increases (earliest in 2040) would result in significant vegetation regrowth and resultant hydrologic recovery, further diminishing the potential cumulative impact of these increases.
8. Planned harvest on non-NFS land was not included in cumulative harvest estimates.

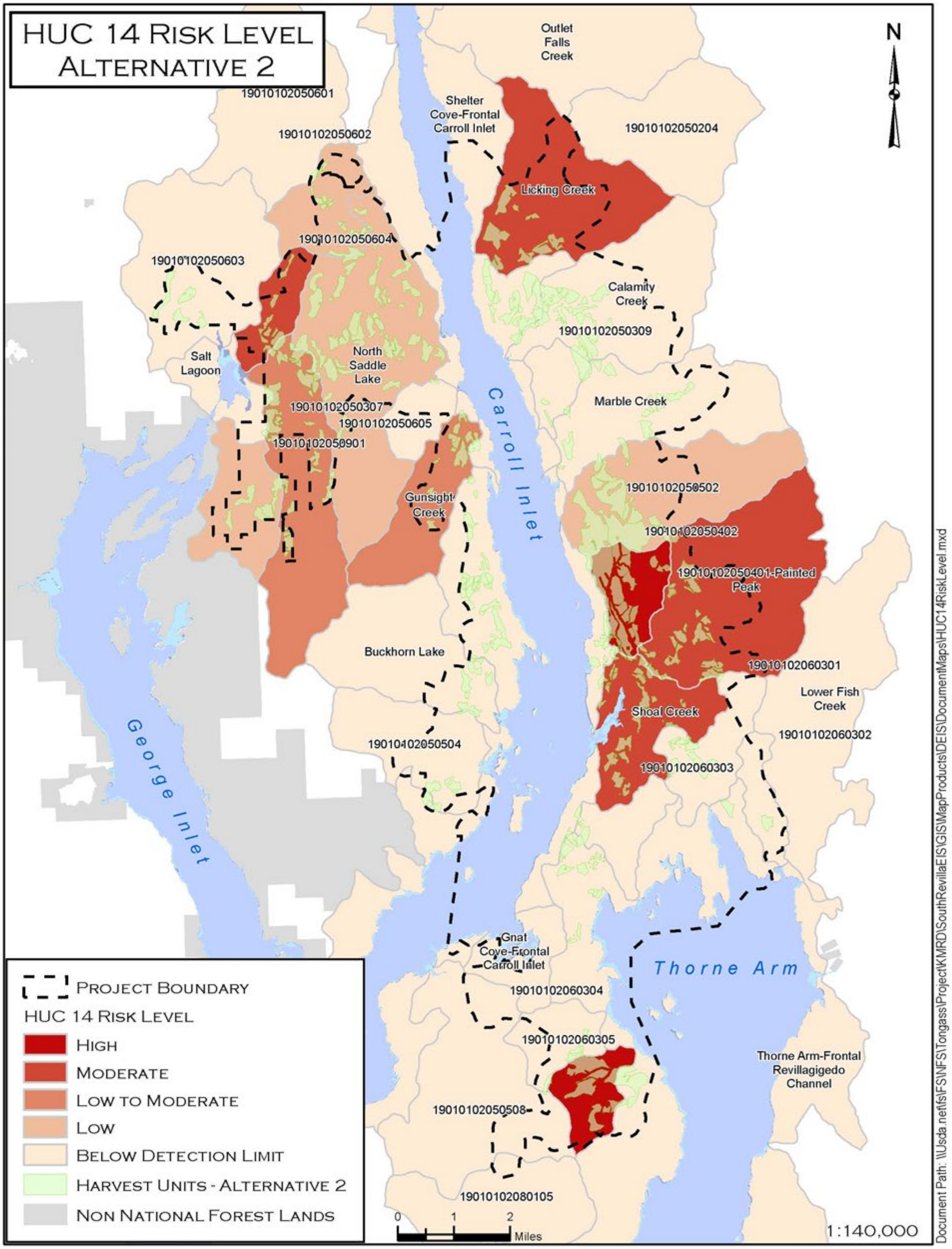

Figure 37. HU 7 map showing low, moderate and high risk for peak flow increases

The 12 project area watersheds with cumulative harvest levels above detectable levels in the action alternatives (figure 37) are described below. Channel type definitions are listed in the Affected Environment section and are highlighted below where they apply.

Watershed 19010102050309

- **Watershed Size**: 736.9 acres
- **Anadromous Fish Habitat**: None; but drains into Shoal Creek which does contain anadromous fish
- **Resident Fish Habitat**: 3.34 miles of upstream resident fish habitat in MC and PA channels.
- **30-year cumulative harvest increase**: from 18.9 percent to 34.7 percent in Alternatives 2 and 4, and 32.5 in Alternative 3; with a 13 and 12 percent, respectively, predicted increase in peak flows (table 73).
- **WCF Score**: 1.4.
- **Red Crossing(s)**: one red pipe (8400000-36.267).
- **RISK OF PEAK FLOW INCREASE**: Below detection limit (figure 37).

Watershed 19010102050402

- **Watershed Size**: 1246.4 acres
- **Anadromous Fish Habitat**: None.
- **Resident Fish Habitat**: 3.77 miles total, 1.14 miles of MC, 0.68 miles of MM, 0.66 miles of PA, and 1.29 miles of HC habitat.
- **30-year cumulative harvest increase**: from 0.16 percent to 81.83 percent in Alternatives 2 and 4, and 67.7 percent in Alternative 3 (table 73). It also has the highest predicted flow increase of 21 percent n Alternatives 2 and 4, and 18 percent in Alternative 3 due to proposed harvest levels. This watershed has more than 2 percent of the watershed area is occupied by roads under all alternatives, resulting in double interpreted peak flow increase doubling from predicted mean values listed above (Grant et al. 2008).
- **WCF Score**: 1.4.
- **Red Crossing(s)**: one red pipe (8400000-31.608).
- **RISK OF PEAK FLOW INCREASE**: High (figure 37).
- At high flow events, there is high risk of impacts to the mainstem Shoal Creek that this watershed drains into, although the main channel in this watershed are controlled primarily by bedrock and boulders and is not as susceptible to peak flow impacts. Risk of peak flow impacts to stream channels in this watershed is considered high because of the extensive amount of cumulative harvest, high percentage of roaded area, and the small size of the watershed. Though several units are partial harvest which would reduce risk.

Watershed 19010102050502

- **Watershed Size**: 3698.9 acres
- **Anadromous Fish Habitat**: Yes. includes FP (0.85 miles) and MC (0.15 miles) channel reaches
- **Resident Fish Habitat**: Yes. 2.46 miles of HC, 1.1 miles of MC, 0.31 miles of PA, 1.87 miles of MM, 0.55 miles of FP, and 0.50 miles of AF

- **30-year cumulative harvest increase**: from 5.81 percent to 33.53 percent in Alternatives 2 and 4, and 29.1 percent in Alternative 3; with a 14 and 12 percent, respectively, predicted increase in peak flows (table 73).
- **WCF Score**: 1.3
- **Red Crossing(s)**: None
- **RISK OF PEAK FLOW INCREASE**: Low (figure 37) because of the extensive amount of high gradient contained channels, and good connection with the floodplain along most of their reaches, allowing energy to dissipate during high flow events. Most of the units proposed for harvest in this watershed are partial harvest prescriptions, which would reduce risk further.

Watershed 19010102050602

- **Watershed Size**: 1541.8 acres
- **Anadromous Fish Habitat**: Yes. PA (1.14 miles) FP (0.41 miles) and AF (0.15 miles)
- **Resident Fish Habitat**: Yes. 1.09 miles of HC, 0.20 miles of PA, and 0.16 miles of AF
- **30-year cumulative harvest increase**: from 14.41 percent to 22.53 percent in Alternatives 2 and 4, and 21.7 percent in Alternative 3; with 11 percent predicted increase in peak flows (table 73) in all action alternatives.
- **WCF Score**: 1.1
- **Red Crossing(s)**: None.
- **RISK OF PEAK FLOW INCREASE**: Low (figure 37) because most of the mapped streams in this watershed are PA and FP channels with high quality spawning and rearing grounds, and the presence of lake habitat.

Watershed 19010102050604

- **Watershed Size**: 935.6 acres
- **Anadromous Fish Habitat**: Yes, 0.21 miles FP habitat
- **Resident Fish Habitat**: Yes, 2.03 miles of HC habitat
- **30-year cumulative harvest increase**: from 18.07 percent to 30.4 percent in Alternatives 2 and 4, and 37.4 percent in Alternative 3; with a 13 and 12 percent, respectively, predicted increase in peak flows (table 73).
- **WCF Score**: 1.1
- **Red Crossing(s):** Two, 8300000-5.447, and 8300000-15.465
- **RISK OF PEAK FLOW INCREASE**: Moderate (figure 37) because of the amount of cumulative harvest in the watershed and the small size of the watershed.

Watershed 19010102050605

- **Watershed Size**: 4085.8 acres
- **Anadromous Fish Habitat**: Yes, 8.47 miles upstream from salt, and is made up of 2.76 miles of MC, 2.61 miles of FP, 1.98 miles of MM, 0.90 miles of LC, and 0.22 miles of PA

- **Resident Fish Habitat**: Yes, 7.2 miles of HC channel, 0.83 miles PA, 0.80 miles of FP, and 0.18 miles of MC.
- **30-year cumulative harvest increase**: from 12.26 percent to 25.87 percent in Alternatives 2 and 4, and 24.88 percent in Alternative 3; with a 12 percent predicted increase in peak flows (table 73) in all action alternatives.
- **WCF Score**: 1.1
- **Red Crossing(s)**: None.
- **RISK OF PEAK FLOW INCREASE**: Low to moderate (figure 37) because of the large watershed size, and the majority of fish habitat is high gradient contained channel types which typically have large amounts of bedrock.

Watershed 19010102050901

- **Watershed Size**: 1822.6 acres
- **Anadromous Fish Habitat**: Yes, 0.28 miles of MC
- **Resident Fish Habitat**: Yes, 2.68 miles of HC, 1.6 miles of MC, 1.5 miles of PA, and 0.87 miles of FP connected by 11 lakes in the watershed, which total 128 acres
- **30-year cumulative harvest increase**: from 13.67 percent to 21.76 percent in Alternatives 2 and 4, and 21.6 percent in Alternative 3; with an 11 percent predicted increase in peak flows (table 73) in all action alternatives.
- **WCF Score**: 1.4
- **Red Crossing(s)**: None.
- **RISK OF PEAK FLOW INCREASE**: Low (figure 37) because of the large amount of HC channel type, numerous lake systems, and cumulative harvest levels slightly above detectable levels.

Watershed 19010102060305

- **Watershed Size**: 1058.8 acres
- **Anadromous Fish Habitat**: Yes, 0.38 miles HC
- **Resident Fish Habitat**: Yes, 0.84 miles of MM, 0.64 miles of HC, 0.26 miles of MC, and 0.09 miles of both FP and PA
- **30-year cumulative harvest increase**: from 0.85 percent to 41.72 percent in Alternatives 2 and 4, and 37.37 percent in Alternative 3; with a 14 and 13 percent, respectively, predicted increase in peak flows (table 73). This watershed has more than 2 percent of the watershed area is occupied by roads under all alternatives, resulting in interpreted peak flow increase doubling from predicted mean values listed above (Grant et al. 2008).
- **WCF Score**: 1.4
- **Red Crossing(s)**: None
- **RISK OF PEAK FLOW INCREASE**: High (figure 37) because the increase in cumulative harvest levels, high percentage of roaded area, and the small size of the watershed. Risk may be reduced slightly because partial harvest is proposed in one unit.

Watershed 19010102050308 (Gunsight Creek)

- **Watershed Size**: 2076.7 acres
- **Anadromous Fish Habitat**: Yes, 1.18 miles of MC, 0.63 miles of FP, 1.28 miles of MM, and 1.10 miles of PA
- **Resident Fish Habitat**: Yes, 1.21 miles of HC, 0.56 miles of AF, and 0.14 miles of MM
- **30-year cumulative harvest increase**: from 14.69 percent to 22.49 percent in Alternatives 2 and 4, and 21.56 percent in Alternative 3; with an 11 percent predicted increase in peak flows (table 73) in all action alternatives.
- **WCF Score**: 1.4
- **Red Crossing(s)**: None
- **RISK OF PEAK FLOW INCREASE**: Low to Moderate (figure 37) because of the large amount of MM, PA, and FP habitat types, and the increase of cumulative harvest levels above detectable levels.

Watershed 19010102050304 (Licking Creek)

- **Watershed Size**: 4120.9 acres
- **Anadromous Fish Habitat**: Yes, 0.65 miles of MC
- **Resident Fish Habitat**: Yes, 2.03 miles of FP, 0.87 miles of MM, 0.61 miles of AF, 1.04 miles of HC, 0.65 miles of MC, and 1.05 miles of LC.
- **30-year cumulative harvest increase**: from 15.80 percent to 22.31 percent in Alternatives 2 and 4, and 21.6 percent in Alternative 3; with an 11 percent predicted increase in peak flows (table 73) in all action alternatives.
- **WCF Score**: 1.4
- **Red Crossing(s)**: One, 8446000-4.384
- **RISK OF PEAK FLOW INCREASE**: Moderate (figure 37) because cumulative harvest levels exceed detectable levels, and the extensive amount of fish habitat in this system.

Watershed 19010102050305 (North Saddle Lake)

- **Watershed Size**: 5870.5 acres
- **Anadromous Fish Habitat**: Yes, 1.24 miles from saltwater, with 0.68 miles of MM, 0.46 miles of LC, and 0.10 miles of FP habitat
- **Resident Fish Habitat**: Yes, 7.01 miles of HC, 3.21 miles of MC, 1.49 miles of MM, 1.83 miles of FP, 0.79 miles of LC, 0.39 miles of AF, and 2.33 miles of PA, and 4 large lakes and multiple smaller bodies of water, totaling about 524 acres.
- **30-year cumulative harvest increase**: from 8.88 percent to 24.20 percent in Alternatives 2 and 4, and 23.2 percent in Alternative 3; with a 12 and 11 percent, respectively, predicted increase in peak flows (table 73).
- **WCF Score**: 1.4
- **Red Crossing(s)**: Six, 8300000-17.971, 8300000-18.082, 8300000-18.386, 8300000-19.007, 8337000-0.153, and 8340000-0.929.

- **RISK OF PEAK FLOW INCREASE**: Low (figure 37) because the extensive amount of HC channels and lake habitat in the system.

Watershed 19010102050403 (Shoal Creek)

- **Watershed Size**: 2337.8 acres
- **Anadromous Fish Habitat**: Yes, 2.47 miles of LC, FP, MC, and MM channels
- **Resident Fish Habitat**: Yes, 9.69 miles total of MC, PA, MM, and HC channels
- **30-year cumulative harvest increase**: from 2.87 percent to 22.87 percent in Alternatives 2 and 4, and 21.64 percent in Alternative 3; with an 11 percent predicted increase in peak flows (table 73) in all action alternatives. This watershed has more than 2 percent of the watershed area is occupied by roads under Alternatives 2 and 4, therefore it qualifies for a double interpreted peak flow increase.
- **WCF Score**: 1.4
- **Red Crossing(s)**: One, 8400350_0.28L-0.067
- **RISK OF PEAK FLOW INCREASE**: Moderate (figure 37) because cumulative harvest levels exceed detectable levels.

Water Quality

Municipal Uses of Waters in the Project Area

Implementation of the action alternatives is not expected to adversely impact beneficial uses of water within the project area because there are no municipal water supplies in the project area. Project Design Features and Mitigation measures listed in Chapter 2 would protect drinking water consistent with 2016 forest plan direction.

Sedimentation and Turbidity

Percentage of basin area comprised of roads has been used to help quantify the risk of flow- related impacts to aquatic systems, including sediment introduction into streams (Cederholm et al. 1980). As fine sediment increases, egg to fry survival decreases (Jensen et al. 2009) In Washington's Olympic Peninsula, accumulation of fine sediment in streambeds was found to be highest in basins where the roaded area exceeded 2.5 percent of the watershed area (Cederholm et al. 1980). The highest risk of impacts from sediment and turbidity input would be expected in two project area watersheds, 19010102050402 and 19010102060305 (table 73), because both exceed this threshold in Alternatives 2 and 4.

Provisional results of a case study on Prince of Wales Island suggest that turbidity (and sediment) increases during and after road construction, and during log-haul, were temporary and recovered to baseline levels without degrading water quality (Thompson and Tucker 2010). Another provisional study of turbidity during sixteen culvert installations near the Kosciusko Project area found that mean turbidity levels measured 40 meters downstream of installation recovered to less than 25 NTUs (ADEC 2020-water quality criteria for aquatic life) within two hours of installation (Konapacky 1996). Likewise, results of grab sample turbidity monitoring during drainage structure installation suggests, that under typical construction conditions, applicable BMPs, which are outlined in Project Design Features and Mitigation measures listed in Chapter 2, are effective in achieving water quality criteria within a couple of days following completion of instream work (Thompson 2002).

Table 74. Road density and percent basin area as roads in project area watersheds[1] with greater than 0.5 percent basin as roads by alternative[2 3]

HU 14 Watershed Number or Name	Watershed Area (acres)	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
		Miles Road (mi)	Percent Basin as Roads (%)	Miles Road (mi)	Percent Basin as Roads (%)	Miles Road (mi)	Percent Basin as Roads (%)	Miles Road (mi)	Percent Basin as Roads (%)
19010102050402	1246.4	4.5	1.7%	7.9	**3.1%**	6.0	2.3%	7.9	**3.1%**
19010102060305	1058.8	3.4	1.5%	5.7	**2.6%**	4.6	2.1%	5.7	**2.6%**
Shoal Creek	2337.8	4.1	0.8%	10.2	2.1%	5.8	1.2%	10.1	2.1%
19010102050309	736.9	2.4	1.6%	2.6	1.7%	2.6	1.7%	2.6	1.7%
19010102060301	1579.0	2.8	0.9%	4.4	1.3%	3.3	1.0%	4.4	1.3%
North Saddle Lake	5870.5	9.8	0.8%	15.4	1.3%	10.4	0.9%	13.7	1.1%
19010102050502	3808.4	6.7	0.9%	9.3	1.2%	7.1	0.9%	9.3	1.2%
19010102050604	935.6	1.9	1.0%	2.2	1.2%	2.1	1.1%	2.2	1.2%
19010102060303	1065.1	1.7	0.8%	2.7	1.2%	2.3	1.0%	2.6	1.2%
19010102060304	1083.5	2.1	0.9%	2.6	1.2%	2.4	1.1%	2.6	1.2%
19010102050605	4085.8	5.1	0.6%	8.3	1.0%	5.6	0.7%	8.2	1.0%
Gunsight Creek	2076.7	4.0	0.9%	4.3	1.0%	4.1	0.9%	4.1	0.9%
19010102050401-Painted Peak	5380.7	7.9	0.7%	9.7	0.9%	8.2	0.7%	9.7	0.9%
Marble Creek	3698.9	5.7	0.7%	7.2	0.9%	5.9	0.8%	7.2	0.9%
19010102050307	820.8	1.4	0.8%	1.4	0.8%	1.4	0.8%	1.4	0.8%
19010102060302	787.5	1.0	0.6%	1.2	0.8%	1.2	0.7%	1.2	0.8%
Licking Creek	4120.9	4.5	0.5%	6.0	0.7%	4.7	0.6%	5.9	0.7%
19010102050602	1541.8	1.4	0.5%	2.0	0.6%	1.7	0.5%	2.0	0.6%
19010102050901	1822.6	1.3	0.3%	2.1	0.6%	1.6	0.4%	2.1	0.6%

1 - "Percent basin area as roads" calculated as: {(Existing road miles * 5,280 ft/mi * 40 ft (assumed clearing width) / 43,560 ft2/acre) / watershed size (acres)} * 100).

2 – Alternative 1 represents existing conditions.

3 – Full table showing all watersheds available in project record.

Riparian no-harvest buffers along Class I, II, and III streams, and BMPs, as described in Chapter 2 and in the unit cards, would further minimize erosion and sediment transport to streams (Rashin et al. 2006) and maintain cool stream temperatures (Gomi et al. 2006). Where Class IV streams are within harvest units, disturbance would be minimized through BMPs described in the unit cards. Tongass National Forest monitoring data indicate that harvested areas are consistently within the established standard of less than 15 percent detrimental soil disturbance (USDA Forest Service 2005). BMP implementation and effectiveness monitoring of five harvest units and related roads by an interdisciplinary team on nearby Prince of Wales Island found effective implementation of the BMPs and no sign of erosion or sedimentation into site area streams (USDA Forest Service 2010). These findings suggest that ground disturbance during timber harvest is probably not a direct source of sediment. Timber harvest proposed in the action alternatives would have negligible direct effects on water quality at both the watershed and subwatershed scale with implementation of BMPs and project design features.

Direct adverse effects of stream and floodplain restoration in Painted and Licking Creeks includes localized temporary increases in sedimentation associated with working directly within a wetted channel during implementation, construction of puncheon trails to access stream sites, and potential use of explosives for removal of abandoned culverts and/or breaching abandoned spur roads located in active floodplains. A direct effect of this activity is improved habitat condition immediately following restoration for fish species and other aquatic organisms. Work completed in the floodplain will improve riparian condition which will indirectly benefit many other species including wildlife and native vegetation in the long term. Beneficial impacts of restoration work are anticipated to be long term.

All action alternatives would increase the number of crossings on Class I, II, III, and IV streams (table 75). All new crossings on Class I and II streams will be designed and constructed to meet current Forest Service fish passage standards for all action alternatives. Proposed road locations are estimated and may change during implementation based on need and site conditions. All crossings on proposed road segments would be verified by a fisheries biologist or hydrologist during layout for either action alternative.

Table 75. Proposed new crossings[1] on temporary and NFS road construction by stream class

	Alt 2		Alt 3		Alt 4	
Stream Class	Temp	NFS	Temp	NFS	Temp	NFS
1	2	4	2	4	2	4
2	11	14	10	14	10	14
3	26	17	25	14	24	14
4	30	10	28	6	29	9
Totals	69	45	65	38	65	41

1 Number of proposed crossings is based on GIS using the proposed road locations and currently known stream segments.
2 Includes proposed crossings for all proposed NFS road work including both new construction on an existing prism.

Log landings are often the site of intense activity, and as such have a higher probability of being a source of sediment and other pollutants. Sediment delivery to streams may increase due to higher traffic volumes resulting from log transport between landing locations and the designated log transfer facilities (LTF) and increased visitor use to the developed recreation sites. High traffic volume has been implicated in increased risk to sediment delivery (Reid and Dunne 1984; Kahklen and Hartsog 1998). Log landings would be designed and constructed outside RMAs according to BMPs 13.10 and Veg-6 (USDA Forest Service 2012a).

Temperature

Direct and indirect effects to stream temperature from implementation of proposed actions is expected to be negligible in all alternatives because Forest Plan direction will provide for the protection of riparian buffers on all fish-bearing and Class III streams through designation of riparian management areas (RMAs). Riparian management area buffers reduce the risk of increased stream temperatures through shading provided by the riparian vegetation. Proposed riparian stand treatments would use single tree selection methods and target tree species to help move the riparian area into desired conditions. The application of riparian management area (RMA) buffers provides protection and maintenance of naturally functioning aquatic ecosystems from ground-disturbing activities associated with timber harvest. The 2016 forest plan standards and guidelines require that RMAs be delineated according to stream value classification and channel type process groups, with minimum protection standards defined for harvest and road building activities (USDA Forest Service 2008; USDA Forest Service 2016a, pp. D-1 through D-20). All Class I and II streams are protected from harvest activities within a minimum horizontal distance of 100 feet from the bankfull margins. Buffer widths more than 100 feet are determined based on stream process group classification (BMP 12.6), and the application of windfirm buffers where required. Riparian buffers provide protection from nonpoint source pollution, help maintain stream temperature and maintain riparian and aquatic habitat. Additionally, while even-aged harvest prescriptions are assumed in this watershed analysis, uneven-aged management prescriptions are proposed for many units (Appendix A), which may further decrease the potential for higher stream temperatures resulting from timber harvest.

Increases in water temperatures due to climate change will alter fundamental ecological processes and the geographic distribution of aquatic species (Poff et al. 2002). Risks to salmonids include potential loss of incubating embryos due to streambed scour and loss of habitat and/or shift in spatial distribution resulting from increased water temperatures (Goode et al. 2013).

Fisheries

Riparian no-harvest buffers on Class I, II and III streams would avoid direct impacts to stream habitat. Effects would be minor to negligible and mostly limited to road-stream crossings due to the potential for culverts to become plugged with sediment and debris. The number of proposed Class I crossings is even in all action alternatives.

Threatened, Endangered and Sensitive Species

No construction or modification to marine habitat (below mean low tide) is expected with implementation of any of the action alternatives. However as discussed in the Marine Environment -LTF section below bark accumulation from Log Transfer Facility use may affect up to two acres of benthic habitat per each LTF. Because of this a determination of “may affect, but not likely to adversely affect” is documented in the biological evaluation. Effects to TES species would be mitigated by adhering to 2016 forest plan direction and all required BMPs.

Fish Habitat Improvement

Fish habitat improvement activities would have beneficial effects in the long term because they are designed to improve habitat, water quality, and increase accessible habitat for fish species present . Fish habitat improvement activities proposed in all the action alternatives on all lands within the project area include natural instream barrier modifications, riparian stand treatments, flood plain treatments, and barrier culvert removal/replacement. Stream restoration activities would use local downed trees, previously cut and decked wood (there are approximately 400 or more decked logs at Shoal Cove LTF), and cull logs from timber sale contracts. No timber harvest for building instream structures associated with restoration of streams, and floodplains would occur.

Riparian Management Area (RMA) treatments and wildlife habitat enhancement actions would use a silvicultural prescription to introduce habitat complexity into even-aged stands and to help achieve stream process group objectives (appendix A), while protecting trees adjacent to the stream for bank stability and promoting growth of the largest trees within the RMA.

Fish Passage

Effects to fish passage are assumed to be site-specific, and are related primarily to road crossings, but may also be affected by an increased risk of landslides due to timber harvest and road building. Potential changes in water yield, peak flow, and timing related to timber harvest and road building could increase the number of red fish crossings by creating flow-related passage barriers to juvenile fish. Theoretically, higher peak flows could increase the number of days fish passage is inhibited due to flow velocity through culverts for juvenile fish. It is unlikely these crossings would be complete barriers, but instead would remain passable at most flows as previously discussed.

All action alternatives propose a minimum of 34 NFS and 65 temporary new stream crossings, and Alternative 2 has highest number of crossings proposed. Crossings located along temporary roads will be decommissioned following the end of the road or timber contract. Because project design features would, listed in Chapter 2 and Appendix B, would be followed affects to fish passage are expected to be negligible. Existing red crossings on NFS roads are planned to be repaired, with priority replacement given to those with higher remediation scores. Seven of the 32 project area red crossings listed in table 72 are on a non-national forest managed road (Ketchikan to Shelter Cove Road) and would not be maintained by the U.S. Forest Service. If additional red crossings are identified during project implementation they would be replaced or removed using the same prioritization process.

Recreation has identified up to 2,704 feet of new hiking trail proposed for construction. Using the assumption of 1.6 crossings per mile of trail (derived from existing condition in Central Tongass Landscape Level aquatics analysis), there could be up to 1 new stream crossing.

Partial Barrier Modifications

Up to five partial barriers identified on the Painted Creek (a.k.a. Shoal Creek) system would be modified, using blasting and hand tools, to allow passage for coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*O. mykiss*) under all flow conditions. Barrier modification activities could have minor adverse effects on fish and fish habitat from temporary increases in sediment and displacement from blasting during the time activities occur, but these will be temporary and short in duration lasting less than a few hours. Anticipated major beneficial effects would last years and include increased overall freshwater ecosystem productivity, increased size or numbers of resident or other anadromous salmonids that prey on supplemented species in freshwater, and overall production of target species as returning adults which provide harvest opportunities. Blasting would occur during periods of low flow and would follow State of Alaska Blasting Standards which would further reduce effects, Technical Report No. 13-03: Alaska Blasting Standard for the Proper Protection of Fish (Timothy 2013). Site specific surveys would be conducted to determine feasibility and final designs of modifications.

Bursts of sediment would occur during implementation. The adverse effects to water quality would be minor because the increased turbidity would be short-term and localized. Adverse effects to fish are minimized by operating during species specific timing windows which are designed to avoid spawning adults, eggs and alevins in the gravel, and high water.

Marine Environment

Logging Transfer Facilities (LTF)

In all alternatives barging the logs would have less effect on marine species than rafting. Habitat for managed marine species and their prey may be diminished in all alternatives, but highest in Alternatives 2 and 4, due to bark accumulation resulting from rafting logs at the LTF or from the possibility of water quality degradation through oil spill contamination from either rafting or barging. A possible adverse effect of log rafting is reduced rearing capability for juvenile salmon and their prey species due to potentially reduced water quality from bark leachates. Primary and secondary production may also be reduced due to lower water quality caused by leachates from the bark debris.

The Alaska Pollutant Discharge Elimination System (APDES) permits for the LTFs authorizes discharge of bark and wood debris into the coastal water with stipulations. To minimize effects from bark accumulation dive surveys are conducted in compliance with APDES permit requirements. The last underwater survey associated with the Shelter Cove Tideland Lease was completed in 2009 and bark accumulation was 0.24 acre of continuous bark debris and 0.48 acre of discontinuous bark debris, meeting permit requirements. Shoal Cove LTFs last survey was completed in 2000 and bark accumulation was 0.6 acre of continuous bark debris. Additional dive surveys will occur with implementation of all proposed actions in accordance to APDES permit requirements. The transportation section in this chapter also discusses LTFs. Continued bark monitoring surveys would be conducted if wood is placed into the water. All LTFs would be maintained to comply with all permits, including tidelands permits, solid waste permits, COE 404 (fill on wetlands) and Alaska Department of Environmental Conservation APDES permits, and a State 401 certification.

Direct and Indirect Effects

Alternative 1 - No Action Alternative

In the no action alternative, no commercial timber harvest would occur, no roads or trails would be built, and, all other activities such as recreation improvements, wildlife habitat enhancement, fisheries improvements and aquatic organism passage red pipe remediation, and restoration of large streams using heavy equipment would not occur. Previously planned projects are summarized in appendix C and may continue as planned. The direct and indirect effects of those projects and activities have been assessed in previous NEPA documents where required. Selection of this alternative would not preclude regular maintenance of existing roads, including erosion control measures and removal or replacement of culverts. The risk of landslides associated with previously built roads is ongoing and is considered an indirect effect, because if landslides do occur, they may or may not deliver sediment to streams. Sediment delivery to streams from periodic road maintenance is expected to be minor and within water quality standards set by the State of Alaska.

Alternative 2

Alternative 2 proposes harvesting up to 6,202 acres. Direct and indirect effects of harvest activities are similar between action alternatives and would occur to the greatest extent in this alternative due to higher amounts of proposed timber harvest and road building resulting in greater potential for increased peak flow and reduced water quality from increased sedimentation. Indirect effects to streamflow may occur through peak flow increases. The relative risk, magnitude and intensity of these effects were discussed above in the Effects Common to All Alternatives section.

National Forest System and temporary road construction in Alternative 2 would result in 114 additional stream crossings, with an estimated 32 new stream crossings on Class I or Class II fish streams(table 75).

All temporary roads would be decommissioned after use, reducing long term impacts associated with roads to aquatic resources. This alternative would have the greatest potential for effects to the marine environment through bark accumulation at LTFs since it proposes to harvest more timber than Alternative 3 and 4.

Alternative 3

Alternative 3 proposes harvesting up to approximately 5,320 acres. Direct and indirect effects to stream flow discussed previously and would occur to a lesser extent in this alternative compared to Alternatives 2 and 4 due to less proposed timber harvest and road construction. Effects on water quality would be negligible to minor in Alternative 3 because none of the watersheds would have a percent roaded area great than 2.5 percent in this alternative. NFS and temporary road construction in Alternative 3 would result in 103 additional stream crossings, with an estimated 30 new stream crossings on Class I or Class II fish streams (table 75). Alternative 3 proposes about two fewer miles of NFS roads than Alternative 2, and two fewer temporary road miles. The potential direct and indirect effects of roads to water quality due to sedimentation, level of use, maintenance activities, and potential culvert blockage was discussed above in the Effects Common to All Alternatives section and are relevant in this alternative.

All temporary roads would be decommissioned after use, which is expected to improve the initial impacts associated with roads to aquatic resources. This alternative would also have potential for effects to the marine environment through bark accumulation at logging transfer facilities, but to a lesser degree than in Alternatives 2 and 4 due to lower harvest levels.

Alternative 4

Alternative 4 proposes harvesting up to 6,202 acres. Direct and indirect effects of harvest activities are similar between action alternatives and would occur to the second greatest extent in this alternative due to higher amounts of proposed timber harvest than Alternative 3. Effects would be less than Alternative 2 because there would be less even-aged harvest prescriptions. Direct effects to water quality include potential sedimentation resulting from harvest near streams not receiving RMA buffer protection (Class IV), although BMPs requiring slash clean-up in channels helps mitigate this effect. Indirect effects to streamflow may occur through potential peak flow increases, and water quality through sedimentation from management-induced landslides or windthrow, and though unlikely, temperature increases. The relative risk, magnitude and intensity of these effects were discussed above in the Effects Common to All Alternatives section.

NFS and temporary road construction in Alternative 4 would result in 106 additional stream crossings, with an estimated 20 new stream crossings on Class I or Class II fish streams(table 75). The transportation section of this DEIS details the long-term objectives for project area NFS roads. All temporary roads would be decommissioned after use, which is expected to improve the initial impacts associated with roads to aquatic resources. This alternative would have the second greatest potential for effects to the marine environment through bark accumulation at LTFs since it proposes to harvest more timber than Alternative 3.

Cumulative Effects

Alternative 1 - No Action Alternative

This alternative will not contribute to cumulative effects in the project area. Cumulative effects were assessed using the same 7th level HU (HU 14) watershed boundaries as direct and indirect effects and represent existing conditions. Foreseeable activities within project area watersheds were summarized in the Catalog of Events and described above in the Present, and Foreseeable Activities Relevant to

Cumulative Effects Analysis section. Ongoing activities relevant to this alternative include road maintenance and silvicultural thinning and pruning treatments (pre-commercial and wildlife habitat enhancements).

A timeframe of 30 years was used as a measure of the time necessary for hydrologic recovery through vegetation regrowth and for assessing the risk of peak flow effects due to cumulative timber harvest and roads. All cumulative effects of past timber harvest under this no action alternative would continue to improve with time.

Since proposed roads would not be built under this alternative, management indicators such as percent of a basin comprising roads, road density, and proximity of roads to streams would not change from existing condition. Approximately 60 percent of the roads considered to quantify existing condition are currently decommissioned, closed, or stored. Continued active road maintenance helps reduce potential sources of stream sedimentation by maintaining drainage efficiency through crossing structures. Road maintenance activities are expected to maintaining drainage efficiency through crossing structures, thereby reducing potential sources of stream sedimentation.

Most previously harvested riparian areas would continue to recover, particularly with ongoing pre-commercial thinning efforts. Streams, lakes and floodplains with declining habitat conditions due to either the intensity of previous disturbance and/or sensitivity of the location to disturbance improve more rapidly under active restoration. Active restoration of other large streams and floodplains would not occur under this alternative, and therefore cumulative condition of these affected areas may decline.

With no action proposed, the influence of climate change on Alternative 1 would be reflected in the anticipated regional changes discussed in the Existing Condition section above. These changes are expected to occur by 2040, within the timeframe of the South Revilla Integrated Resource project.

Cumulative Effects Common to All Action Alternatives

Cumulative effects would be similar among all alternatives and vary by project listed in appendix C. Cumulative effects from AMHT timber harvest activities would likely result in changes to the timing, magnitude, and duration of flow patterns in project area watersheds that share boundaries with or are within AMHT lands. These changes could add to impacts from the proposed actions on water quality and physical stream habitat, with subsequent effects to aquatic organisms including fish species. Cumulative effects on the marine environment at LTFs would be expected to increase in all alternatives with increase use from timber projects listed in appendix C, including the AMHT land exchange.

The proposed land exchange with AMHT would remove 8,224 acres of land from US Forest Service management in all alternatives, and activities proposed by this project within the watersheds that are within these acres would not occur. Watersheds within the land exchange would no longer be subject to the same level of aquatic habitat protection as those under US Forest Service jurisdiction, and as a result, cumulative effect potential is expected to increase for stream flow, water quality, essential fish habitat, in affected watersheds as a result of timber harvest in AMHT lands. The watersheds most affected by this include: Gunsight Creek, North Saddle Lake, 19010102050901, 19010102050603, 19010102050605, Salt Lagoon, and 19010102050307.

Other non-timber projects listed in appendix C would have negligible effects to aquatic resources.

Stream Flow

Cumulative effects to stream flow are expected with any additional timber from the AMHT land exchange, as any additional harvest could amplify the effects of climate change on stream dynamics.

Timber projects that may occur in the project area on AMHT lands could add to cumulative harvest levels in eight watersheds, in all alternatives, resulting in potential increased peak flow responses. These include 19010102050605, 19010102050604, 19010102050603, Gunsight Creek, North Saddle Lake, 19010102050901, Salt Lagoon, and 19010102050307. Depending on timing of AMHT harvest activities, cumulative harvest levels could increase, adding to effects listed above under Direct and Indirect Effects. Though watersheds 19010102050603, 19010102050307, and Salt Lagoon have cumulative harvest levels in Alternative 2 and 4 at 8.1 percent, 9.4 percent, and 12.3 percent respectively, which are well below peak flow detectable levels. Cumulative harvest would have to increase significantly in these three watersheds to have a measurable increase in flow.

Water Quality

Cumulative effects from increases to sediment and turbidity is expected with timber and road projects associated with AMHT. These effects would be minor, lasting less than a week. Temporary increase in sediment delivery to streams due to additional new road building, bridge construction, installation of culverts, and decommissioning of temporary roads from AMHT actions is expected with implementation of all action alternatives. Increases in sediment and turbidity in would occur in watersheds 19010102050605, 19010102050604, 19010102050603, Gunsight Creek, North Saddle Lake, 19010102050901, Salt Lagoon, and 19010102050307.

Cumulative effects to water quality are expected to be negligible from those activities associated with pre-commercial thinning and wildlife habitat enhancement, and long-term use of the recreation site or trail, because all of these activities would occur outside or above the stream and lake systems, and be designed to minimize erosion and sediment input to streams. Project design features, including BMPs, would further prevent sediment input.

Cumulative effects to stream temperature may increase with AMHT land exchange; timber harvest on non-national forest lands would not be subject to the same level of aquatic habitat protection measures; such as a minimum 100 foot no harvest buffer on fish streams, which may increase the risk of altering stream temperatures.

Fisheries

Aquatic Habitat

Cumulative effects on essential fish habitat, managed fish species, and aquatic marine ecosystem from LTF use would be expected to increase in all LTFs except Shoal Cove LTF because the AMHT activities would not use that LTF. Barging the logs would have less effect on marine species than log raft. Habitat for managed marine species and their prey may be further diminished due to bark accumulation resulting from increases in rafting logs at the LTFs, or from the possibility of water quality degradation through oil spill contamination from either rafting or barging. Reduced rearing capability for juvenile salmon and their prey species due to potentially reduced water quality from bark leachates may also increase with additional use of LTFs by AMHT. Primary and secondary production may also be reduced due to lower water quality caused by leachates from the bark debris.

Fish Passage

Stream protection measures used by the Forest Service would not apply to the same degree on non-national forest system lands, such as AMHT lands or State of Alaska managed roads (Road 8300000) in the project area. As a result, cumulative effects to fish passage in these watersheds would be expected to increase at road-stream crossings due to the potential for stream crossings to become plugged with sediment and debris. Should fish crossings become passage issues, the effects could range from minor to major depending on length of time to rectify the passage issue.

Alternative 2

Cumulative effects of harvest activities would occur to the greatest extent in this alternative in watersheds connected to or within the AMHT land exchange and non-national forest lands. The greatest affects are potential in watersheds 19010102050605, 19010102050604, 19010102050603, Gunsight Creek, North Saddle Lake, 19010102050901, Salt Lagoon, and 19010102050307. Cumulative effects to water quality include increases in potential sedimentation. Cumulative effects to streamflow may occur through potential peak flow and temperature increases.

This alternative would have the greatest cumulative potential for bark accumulation at LTFs since it proposes to harvest more timber than Alternative 3 and 4.

Alternative 3

Cumulative effects of harvest activities would be similar to those described above for Alternative 2 and would occur to a lesser extent in this alternative compared to Alternatives 2 and 4 due to less proposed timber harvest and road building.

This alternative would have the lowest cumulative potential for bark accumulation at LTFs since it proposes to harvest less timber than Alternative 2 and 4.

Alternative 4

Cumulative effects of harvest activities would occur to the second greatest extent in this alternative and be similar to those described above for Alternative 2 but to a lesser extent because there would be less clear-cut harvest in this alternative compared to Alternatives 2.

This alternative would have the second greatest cumulative potential for bark accumulation at LTFs since it proposes to harvest more timber than Alternative 3.

Essential Fish Habitat Assessment

The Magnuson-Stevens Fishery Conservation and Management Act requires consultation with the National Marine Fisheries Service (NMFS) for any activities that could affect the essential fish habitat (EFH) of federally managed fish species identified in fishery management plans developed by the North Pacific Fishery Management Council and approved by the Secretary of Commerce. Essential fish habitat includes all waters and habitat necessary for fish spawning, breeding, feeding or growth to maturity. The Forest Service has determined that activities in the South Revilla Integrated Resource may adversely affect both freshwater and marine essential fish habitat for federally managed fish species. A copy of this DEIS will be provided to the NMFS to initiate EFH consultation. Any conservation recommendations provided by NMFS will be responded to and included in the final South Revilla Integrated Resource Project Record of Decision along with a summary of the conclusions of the EFH consultation.

Several marine species use the nearshore waters surrounding the islands composing the Ketchikan Misty Fjords Ranger Districts including arrowtooth flounder, Pacific cod, walleye Pollock, dusky rockfish, shortraker/rougheye rockfish, yelloweye rockfish, sablefish, sculpin, and skates (North Pacific Fishery Management Council 2017). Pacific salmon species (chum, coho, pink, and sockeye) are included in a Fishery Management Plan (North Pacific Fishery Management Council 2018) and use freshwater habitats within the South Revilla Integrated Resource Project. The nearshore marine waters are also used by adult and juvenile salmon.

Effects on Freshwater EFH

Approximately 175 miles of Class I anadromous streams - have been identified in the 31 watersheds within the project area. Populations of federally managed species of pink, chum, sockeye, and coho salmon occur within the project area.

Effects of proposed activities to freshwater EFH are similar between action alternatives but would occur to the greatest extent in Alternative 2 due to higher amounts of proposed timber harvest and road building. Other potential effects on freshwater EFH include changes in water yield, peak flow volume and timing of flow delivery, fine sediment delivery, changes in channel configuration and in-stream complexity, invasive plant introductions and/or spread, and road-stream crossing channel disturbance.

Effects to freshwater EFH from peak flow increases is expected to be minor because most project area watersheds have a relative risk of an activity resulting in effects from peak flows ranging from 'low' to 'not detectable'. Only two watersheds in the project area have a relative risk of 'high', and only one of these watersheds have freshwater EFH present (Watershed: 19010102060305). Effects would be minor for this watershed because it only contains 0.38 miles of freshwater EFH, all of which is HC channel type. Detailed effects on peak flow are discussed in above under Direct, Indirect, and Cumulative Effects sections.

Effects to freshwater EFH from water quality in all alternatives is expected to be negligible to minor because Project Design Features and Mitigation measures listed in Chapter 2 would be followed. Other than road building and timber harvest activities sediment input is expected to be minor and short in duration (dissipating after a few hours) for recreation site development, wildlife habitat enhancement, red crossing remediation, and in stream restoration projects.

In addition to temporary adverse effects to freshwater EFH from restoration activities listed above there would also include long-term beneficial effects to freshwater EFH.

The Forest Service will minimize potential adverse effects on freshwater EFH by following Project Design Features and Mitigation measures listed in Chapter 2, which includes BMPs, 2016 forest plan direction, applicable laws and regulations, and design features.

Effects on Marine EFH

Effects on marine EFH are expected to be minor. No new Log Transfer Facilities (LTF) will be developed with this project. Project activities that could affect marine EFH include vessel and large equipment along shorelines; log loading; rafting of logs; grounding and/or anchoring of barges; and the maintenance associated with these actions. These potential effects include temporary displacement and site avoidance of federally managed fish species and their prey.

There are four logging transfer facilities (LTFs) proposed for use in the South Revilla Integrated Resource Project. All are existing, with no new LTFs proposed. The alternative maps in Chapter 2 show the LTFs considered in the South Revilla Integrated Resource project area.

Log transfer facility construction and operations in the past have been found to affect benthic resources and some EFH habitat primarily through the accumulation of bark from dumping, storage, and rafting of logs. There is also potential for runoff of sediment and oils from landing areas and beach access trails to the marine environment. Soils at onshore facilities where logs are decked can become contaminated with gasoline, diesel fuel, solvents, etc., from trucks and heavy equipment. These contaminants could leach into nearshore EFH. Out of these potential impacts to EFH habitat, the largest impact is due to bark accumulation in the marine system (Faris and Vaughan 1985).

In the past LTFs have affected approximately two acres of marine benthic habitat for the average site, mostly due to bark accumulation (Faris and Vaughan 1985). This would equate to no more than eight acres associated with the proposed action, and following permit criteria and project design features would reduce this. Depending on abundance, bark and other wood fragments that sink to the bottom can have varied adverse effects to marine areas by reducing organism diversity, burying benthic organisms, and reducing organism abundance (Sedell et al. 1991). If bark accumulations are high enough, specific benthic areas may become locally toxic or anoxic. This could result in adverse effects to organisms such as crabs, shrimp, and nearshore-rearing marine and anadromous fish. Bark can remain for extended periods (decades) but, based on dive survey results for LTF sites of concern, the bottom area covered with bark (based on bottom area with continuous coverage) can be greatly reduced within a few years once use ends. Additionally, after deposition has ceased, over time these areas can become biologically similar to areas unaffected by even large accumulations of bark and wood debris (Germano and D. Browning 2006). Log rafts and temporary beach barge access use also have the potential to cause adverse effects to habitat primarily from grounding of the rafts and barges, which can damage intertidal habitats and organisms that are present.

The Forest Service will minimize potential adverse effects on marine EFH by following Project Design Features and Mitigation measures listed in Chapter 2, which includes BMPs, 2016 forest plan direction, including 2016 Forest Plan Appendix G – LTF Guidelines, and all applicable laws and regulations. Following the guidelines and BMPs in the NPDES General Permit will reduce the amount of bark and wood debris that enters the marine and coastal environment, reduce the potential for displacement or harm to aquatic species, and reduce the accumulation of bark and wood debris on the ocean floor.

Conclusions

Based on the known effects of timber harvest, road building, and other project activities, the Forest Service concludes the South Revilla Integrated Resource Project may adversely affect freshwater EFH and marine EFH, however the direct impact on the EFH managed species would be largely temporary. This is because the primary impact directly to the fish themselves is the temporary degradation of water quality due to bark accumulations, sediment delivery from fish stream crossing construction/reconstruction, and stream restoration. Most adult fish are mobile and will actively avoid direct impacts from project activities. Some impairment of ability of EFH managed species to find prey items could occur, but this effect should be temporary and spatially limited to the immediate vicinity of activities listed above. While stream restoration, improvement activities and red crossing remediation may have temporary and localized adverse effects, these activities are expected to promote the conservation, enhancement, and proper functioning of EFH over the long term, resulting in a long-term beneficial effect to EFH. The Forest Service expects that by applying the Project Design Features and Mitigation measures listed in Chapter 2 and site-specific information in appendix A and B, negative effects to essential fish habitat will be minimized under all action alternatives. The effectiveness of BMPs is supported by recent monitoring results included in the project record.

Sensitive and Rare Plants

Forest Service policy requires that an effects analysis be conducted for activities that could affect species listed as threatened or endangered under the Endangered Species Act. The only plant in Alaska that is federally listed is Aleutian holly fern (*Polystichum aleuticum*), which is listed as endangered. It is known only from Adak in the Aleutian Islands chain and is not expected to occur on the Tongass National Forest; therefore, threatened and endangered plants will not be addressed further in this document. The plant species evaluated under this project include species listed in the Alaska Region Sensitive Species List (USFS 2009) that are known or suspected to occur in the project area, and plant species located in the project area that are currently considered by the Forest Service to be rare on the Ketchikan Misty Fjords Ranger District (Krosse 2017a).

Resource Indicators and Measures

Resource indicators and measures (FSH 1909.15, 12.5) used in analysis of sensitive and rare plants to measure and disclose effects are listed in table 76.

Table 76. Resource indicators and measures for assessing effects to sensitive and rare plants

Resource Element	Resource Indicator	Measure
Sensitive Plants	Sensitive plant occurrences	Number of occurrences impacted
	Known or suspected sensitive plant habitat	Acres of project area impacted
Rare Plants	Rare plant occurrences	Number of occurrences impacted
Sensitive and rare plant habitat	Acres of sensitive and rare plant habitat	Acres of timber harvest and recreation facilities construction Miles of new road construction

Methodology

The potential vegetation or ground disturbance footprint by alternative is considered in the analysis of effects on known sensitive and rare plant occurrences within the project area. The overall acreage in the project area impacted by activities is also used for comparing effects on sensitive and rare plant habitat by alternative (Krosse 2017a, 2017b).

Information Sources

The Forest Service Natural Resource Information System Threatened, Endangered, and Sensitive Plant (NRIS-TESP) database is the main source of information on known sensitive and rare plant occurrences in the project area. Additionally, the University of Alaska Fairbanks Museum Arctos Herbarium database (UAMH 2020) and the Consortium of Pacific Northwest Herbaria database (CPNH 2020) were consulted for sensitive or rare plant occurrences in the project area that may not have been documented in NRIS-TESP.

Project-related botanical surveys were conducted by Forest Service personnel in 2018 and 2019 and were focused on finding additional occurrences of sensitive plants in suitable habitat which were identified based on Appendix B in the Tongass National Forest Guidance for Biological Evaluations: Sensitive Plants (Krosse 2017b). All sensitive or rare plant observations or revisits were recorded in the NRIS-TESP database.

Incomplete and Unavailable Information

Data on sensitive and rare plant occurrences and habitat in the project area is largely based on field surveys associated with analysis for past projects in the area, with additional botanical surveys specific to this project occurring in 2018 and 2019. It was not feasible to survey all potential habitat in the project area, because of the size of the project area; therefore, additional undocumented occurrences may be present in un-surveyed areas.

Spatial and Temporal Context for Effects Analysis

The analysis area for direct and indirect effects to sensitive and rare plants is the project area, within which proposed activities would be implemented. The analysis area for cumulative effects is Revillagegido Island because sensitive and rare plants and habitat that occur in the project area are likely to occur across the island, and because its geographic isolation from other lands by sea passages could potentially restrict biological interactions with sensitive plant occurrences on other lands.

Direct effects to sensitive and rare plants generally occur at the time that a vegetation or ground disturbing activity is implemented, or within a single growing season. Indirect effects usually occur beyond a single growing season, and from one to several years post-activity. An impact that is expected to become apparent during a single growing season is considered a short-term effect, and an effect that becomes apparent beyond one growing season is considered a long-term effect.

Direct and Indirect Effects Boundaries

The spatial boundary for analyzing direct effects on sensitive and rare plants is the disturbance footprint of an activity, including timber harvest, road construction, and recreation and other facility construction. This footprint is the area where vegetation or ground disturbance will most likely occur and consequently will likely have direct adverse impact on plants growing in these areas. Indirect effects are most likely in areas immediately adjacent to the disturbance footprint and could result from increased soil erosion and deposition, changes in light availability, or changes in soil moisture availability. The direct effects area for timber harvest is inside the harvest unit boundary, and the indirect effects area is within a 164-foot buffer area outside the unit boundary (Krosse 2017a, 2017b). For road construction, direct effects are analyzed within an 85-foot road corridor width, and indirect effects are analyzed in a 164-foot buffer on either side of the road corridor. Direct effects analysis area of recreation or other facilities is the construction footprint, and indirect effects are analyzed in a 164-foot buffer area outside the construction footprint.

The temporal boundary for analyzing direct effects is the growing season of the year during implementation of an activity, because these effects are likely to be apparent in the short-term. The temporal boundary for analyzing indirect and cumulative effects is beyond a single growing season, because indirect effects are likely to become more apparent over the long-term.

Cumulative Effects Boundaries

The spatial boundary for cumulative effects is the estimated maximum implementation area of relevant past, present, or reasonably foreseeable projects on Revillagedo Island, in addition to the effects of the proposed activities for this project. The temporal boundary for analyzing indirect and cumulative effects is over multiple growing seasons, because cumulative effects are likely to become more apparent over the long-term.

Affected Environment

Sensitive Plants

Seventeen vascular plants and one lichen are designated as sensitive in the Alaska Region (USFS 2009). Of these species, ten are known or suspected to occur on the Ketchikan Misty Fjords Ranger District (Krosse 2017b, Appendix B). Two sensitive plant species (lesser round-leaved orchid and edible thistle) are known to occur in the project area, and six species are suspected to occur due to presence of suitable habitat (table 77). The proposed project activities would have no effect on four of the suspected species (Kruckeberg's swordfern, Henderson's checkermallow, dune tansy, and lichen; no common name) because vegetation or ground disturbance is not expected to occur in their respective suitable habitats.

Table 77. Sensitive plant species that are known or suspected to occur within the project area

Common Name	Scientific Name	Habitat	Known Occurrences In Project Area	Known Acres in Project Area
Alaska rein orchid	*Piperia unalascensis*	Dry open sites, under tall shrubs in riparian zones, mesic meadows, and drier areas in coniferous and mixed evergreen forests from low elevation to subalpine.	0	0
Dune tansy	*Tanacetum bipinnatum* subsp. *huronense*	Beaches, dunes, sandy and calcareous soils.	0	0
Edible thistle	*Cirsium edule* var. *macounii*	Damp soil montane meadows, alpine.	1	0.1
Henderson's checkermallow	*Sidalcea hendersonii*	Wet meadows, estuaries, and tidal flats in the lowland zone.	0	0
Kruckeberg's swordfern	*Polystichum kruckebergii*	Isolated patches that are highly associated with rock outcrops which are high in Mg and Fe (classified as 'ultramafic').	0	0
Large yellow lady's slipper	*Cypripedium parviflorum* var. *pubescens*	Muskeg, open forest, often calcareous substrate.	0	0
Lesser round-leaved orchid	*Platanthera orbiculata*	Low-elevation, mature to old-growth hemlock forests, often with a western red cedar component, usually adjacent to non-forested muskegs or open water, low to moderately steep slopes, mesic soils with a deep humus layer, sparse understory vegetation is relatively sparse, substantial litter and/or moss ground cover	8	2.4
Lichen, no common name	*Lobaria amplissima*	Beach fringe forests	0	0
Mountain lady's slipper	*Cypripedium montanum*	Muskeg, open forest, often calcareous substrate.	0	0
Unalaska mistmaiden	*Romanzoffia unalaschcensis*	Moist to wet stream banks, beach terraces, rock crevices.	0	0

Rare Plants

Rare plants have similar protections as sensitive plants in the Forest Plan (USFS 2016). Rare plant species known or suspected to occur in the project area are based on a list derived from Alaska Region Rare Plant Matrix (Krosse 2017a). Included are species with a NatureServe state conservation ranking of S1 (critically imperiled in the state), S2 (imperiled in the state), or occasionally S3 (rare in the state), and other species that are disjunct from or at the edge of their main natural distribution. The list of rare plants is intended to be dynamic as more is learned about their taxonomy and the distribution. Seven rare plant species are known to occur in the project area (table 78).

Table 78. Rare plant species known to occur within the project area

Common Name	Species	Habitat	Known Occurrences In Project Area	Known Acres in Project Area
Boreal bedstraw	*Galium kamtschaticum*	Wet areas, often with skunk cabbage and lady fern	1	<0.1
Broadlipped twayblade	*Listera convallarioides*	Wet open forest with lady fern and skunk cabbage	8	<0.1
Inundated clubmoss	*Lycopodiella inundata*	Bog edge, freshwater meadows, muddy substrate	3	0.7
Lanceleaf grapefern	*Botrychium lanceolatum* ssp. *lanceolatum*	Upper beach meadows, meadows, alpine meadows	1	<0.1
Pacific silver fir	*Abies amabilis*	Well to moderately drained low to mid elevation forests	4	0.4
Threeleaf foamflower	*Tiarella trifoliata* subsp. *lacinata*	Shaded, moist forests	1	<0.1
Whiteflower rein orchid	*Piperia candida*	Mixed conifer forests, serpentine soils	2	<0.1

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Effects

None of the activities in the proposed action would be implemented under Alternative 1. Natural disturbances and current management of the project area would continue as before. Ongoing activities such as dispersed recreation, road and trail maintenance, and other routine forest management activities not associated with this project would continue at current levels. Therefore, Alternative 1 would result in the least direct and indirect effects on sensitive and rare plants, because no additional vegetation and ground disturbance would result from implementation of proposed activities.

Cumulative Effects

Under Alternative 1, no vegetation and ground disturbance resulting from proposed management activities associated with this project would occur. Therefore, no adverse impacts to known sensitive or rare plant occurrences or habitats would occur. No additional cumulative effects to sensitive and rare plants on National Forest System lands from other past, present, and reasonably foreseeable actions are anticipated under this alternative.

Alternatives 2, 3, and 4

Direct and Indirect Effects

The direct effects on known sensitive and rare plants in the project area and undocumented sensitive plants that may occur in suitable habitat under the action alternatives include immediate damage or destruction from vegetation or ground disturbance, and indirect effects could include changes in species abundance and/or distribution as a result of increased erosion, changes in light availability, and/or moisture changes that may be caused by proposed activities.

Direct and indirect effects are expected to occur to the known occurrences of sensitive plants in the project area under all action alternatives (table 79). Under Alternatives 2 and 4, five of the eight known occurrences of lesser round-leaved orchid would be directly or indirectly affected by proposed activities. The other sensitive plant species that is known to occur in the project area (edible thistle) would not be affected under any action alternative. Under Alternative 3, lesser round-leaved orchid (4 of 8 occurrences) would be directly or indirectly affected by proposed activities.

Direct and indirect effects are expected to occur to known occurrences of rare plants in the project area under all action alternatives (table 79). Under Alternatives 2 and 4, five of the eight known occurrences of broadlipped twayblade, two of three occurrences of inundated clubmoss, one of four occurrences of Pacific silver fir, and the one known occurrence of boreal bedstraw would be directly or indirectly affected by proposed activities. Under Alternative 3, four of eight occurrences of broadlipped twayblade, one of four occurrences of Pacific silver fir, and two of three occurrences of inundated clubmoss would be affected under Alternative 3.

The acreage within the project area that would be disturbed most by timber harvest and recreation and other facility construction under Alternatives 2 and 4, both of which would total 6,203 acres (table 79). Alternative 3 would have the least disturbed area due to timber harvest and recreation facility construction, with 5,321 acres. Alternative 2 would have the most miles of new road construction, followed by Alternative 4 and then Alternative 3, which would have the least miles of new road corridors.

Table 79. Resource indicators and measures for analyzing project action alternatives

Resource Element	Resource Indicator	Alternative 2	Alternative 3	Alternative 4
Sensitive plants	Number of occurrences impacted	5	4	5
Rare plants	Number of occurrences impacted	9	7	9
Sensitive and rare plant habitat	Acres of timber harvest and recreation facilities construction.	6,203	5,321	6,203
	Miles of new road construction	49.8	45.8	46.4

Under all action alternatives, the consequence of adverse impacts of proposed actions on any sensitive and rare plant species known to occur and sensitive plant species suspected to occur in the project area is high because intense vegetation and ground disturbance associated with timber harvest, new road construction, and recreation facility construction would result in damage or destruction to sensitive plants located in or near the activity area.

The likelihood of adverse impacts is moderate for the lesser round-leaved orchid because most vegetation and ground disturbance is expected to occur in old-growth forests under all action alternatives, some of which may be suitable habitat for this species(table 80).

The likelihood of adverse impacts on five sensitive plant species (Alaska rein orchid, edible thistle, large yellow lady's slipper, mountain lady's slipper, Unalaska mistmaiden) is low because only minor amounts of their habitats including low-volume open forests, sphagnum bogs, stream banks, montane meadows and riparian areas may be disturbed under all action alternatives, mainly due to new road or recreation facility construction.

The likelihood of impacts on four species (dune tansy, Henderson's checkermallow, Kruckeberg's swordfern, lichen (no common name)), is none under all action alternatives because no activities are proposed in their habitats, including estuaries, beaches, beach fringe forests, and ultramafic rock outcrops.

Table 80. Comparison of the estimated consequence and likelihood of adverse impacts under all action alternatives on sensitive plant species that are known or suspected to occur within the project area

Species	Alternative 2	Alternative 3	Alternative 4
Alaska rein orchid	Low	Low	Low
Dune tansy	None	None	None
Edible thistle	Low	Low	Low
Henderson's checkermallow	None	None	None
Kruckeberg's swordfern	None	None	None
Large yellow lady's slipper	Low	Low	Low
Lesser round-leaved orchid	Moderate	Moderate	Moderate
Lichen, no common name	None	None	None
Mountain lady's slipper	Low	Low	Low
Unalaska mistmaiden	Low	Low	Low

Under all action alternatives, the consequence of adverse impacts of proposed actions on all rare plant species known to occur in the project area is high because the substantial vegetation and ground disturbance associated with proposed timber harvest, new road construction, and recreation facility construction could result in damage or destruction to rare plants located in or near the activity area, or indirect degradation of their habitats (table 81).

The likelihood of adverse impacts under all action alternatives is moderate for broadlipped twayblade, boreal bedstraw, and inundated clubmoss because vegetation and ground disturbance would directly or indirectly affect the half or more of the known occurrences of this species and their habitats. The likelihood of adverse impacts on boreal bedstraw is high under Alternatives 2 and 4 because the only known occurrence of this species would be impacted, and none under Alternative 3, which would not impact this occurrence. The likelihood of adverse impacts is low for Pacific silver fir under all action alternatives because one of the four known occurrences would be impacted due to vegetation and ground disturbance. The likelihood of impacts on lanceleaf grapefern, threeleaf foamflower, and whiteflower rein orchid is none under all action alternatives because their occurrences are not located in or near areas where project activities would occur.

Table 81. Comparison of the estimated consequence and likelihood of adverse effects under all action alternatives on rare plant species that are known to occur within the project area

Species	Alternative 2	Alternative 3	Alternative 4
Boreal bedstraw	High	None	High
Broadlipped twayblade	Moderate	Moderate	Moderate
Inundated clubmoss	Moderate	Moderate	Moderate
Lanceleaf grapefern	None	None	None
Threeleaf foamflower	None	None	None
Pacific silver fir	Low	Low	Low
Whiteflower rein orchid	None	None	None

Cumulative Effects

Considering past, present and reasonably foreseeable future actions listed in appendix C, cumulative effects are most likely to occur to sensitive and rare plant species whose suitable habitat includes mature forests, such as lesser round-leaved orchid. Timber harvest in forested habitats has comprised the majority of vegetation and ground disturbance in the project area and in non-urban areas of Revillagedo Island, and these past harvests combined with the potential direct and indirect disturbance over the life of this project will more likely affect this habitat compared to other sensitive and rare plant habitats in the project area. The effects of land exchanges may compound these effects, assuming that forested habitats on these lands would likely be harvested over the short and long term. Timber harvesting on state, municipal, and private land is governed by the Alaska Forest Resources and Practices Act (Alaska Statute 41.17). Alaska Forest Resources and Practices Regulations do not address threatened, endangered, or rare plants; however, they do recommend minimizing road construction and limiting disturbance in marshes and muskegs, which would provide some protection for the sensitive and rare plants that may occur in these habitats (ADNR 2017).

Alternative 2 has the most potential for cumulative effects to sensitive and rare plants because it has the most potential ground disturbance due to having the most proposed even-aged timber harvest and miles of new road construction, followed in decreasing potential by Alternatives 4 and 3. Present and future non-timber or non-road construction activities within the cumulative effects analysis area, such as trail and recreation facility construction, either have not had or are not expected to have additional impacts to sensitive plant occurrences or habitat. The reduced cumulative effects are due to the small footprint size of these types of activities that have been or will be implemented in suitable habitat.

Summary and Determination of Effects

Based on the rationale described above, the determination of effects for sensitive plant species are summarized in table 82 by species and alternative. Alternative 1 would have no effect on any known sensitive plants that are known to occur in the project area, nor to sensitive plants that are suspected to occur in the project area due to presence of suitable habitat. The consequences of adverse impacts expected from all action alternatives would be high for all sensitive plants that known or suspected to occur in the project area. None of these impacts are expected for four species that are suspected to occur in the project area. One known species and four suspected species have a low likelihood to be affected, and one species that is known to occur in the project area has a moderate likelihood of adverse impacts under all action alternatives.

Table 82. Biological evaluation determination of effects by project alternative on sensitive plant species that are known or suspected to occur within the project area

Species	Relative Impact of Alternatives	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Alaska rein orchid	1<3<2=4	No effect	May affect	May affect	May affect
Dune tansy	1=2=3=4	No effect	No effect	No effect	No effect
Edible thistle	1<3<2=4	No effect	May affect	May affect	May affect
Henderson's checkermallow	1=2=3=4	No effect	No effect	No effect	No effect
Kruckeberg's swordfern	1=2=3=4	No effect	No effect	No effect	No effect
Large yellow lady's slipper	1<3<2=4	No effect	May affect	May affect	May affect
Lesser round-leaved orchid	1<3<2=4	No effect	May affect	May affect	May affect
Lichen, no common name	1=2=3=4	No effect	No effect	No effect	No effect
Mountain lady's slipper	1<3<2=4	No effect	May affect	May affect	May affect
Unalaska mistmaiden	1<3<2=4	No effect	May affect	May affect	May affect

The expected effects on rare plants are summarized in table 83 by species and alternative. Alternative 1 would have no effect on any rare plants that are known to occur in the project area or their habitat. The consequences of adverse impacts expected from all action alternatives would be high for all rare plants that are known to occur in the project area. No adverse effects are expected for three species known to occur in the project area. Three known species have a moderate likelihood and one species has a low likelihood to be affected under all action alternatives. Alternative 2 has the most potential for overall effects to rare plant habitat because it has the most potential ground disturbance due to having the largest proposed timber harvest acreage and miles of new road construction, followed in decreasing potential by Alternatives 4 and 3.

Table 83. Analysis of effects by project alternative on rare plant species that are known to occur within the project area

Species	Relative Impact of Alternatives	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Boreal bedstraw	1=3<2=4	No effect	May affect	No effect	May affect
Broadlipped twayblade	1<3<2=4	No effect	May affect	May affect	May affect
Inundated clubmoss	1<2=3=4	No effect	May affect	May affect	May affect
Lanceleaf grapefern	1=2=3=4	No effect	No effect	No effect	No effect
Threeleaf foamflower	1=2=3=4	No effect	No effect	No effect	No effect
Pacific silver fir	1<2=3=4	No effect	May effect	May effect	May effect
Whiteflower rein orchid	1=2=3=4	No effect	No effect	No effect	No effect

Invasive Plants

Species are considered invasive if they are not native to an ecosystem and are likely to cause harm to human health, the economy, or the environment (Executive Order [EO] 13112)**.** Invasive plants directly compete with, and can displace native plants by site occupancy. In addition, these species can have a number of indirect effects including changes to biological diversity. This section evaluates the potential effects of the proposed alternatives on the risk of introduction and spread of invasive plants. The analysis of effects incorporates information from the project invasive plant risk assessment that is included in the project administrative record.

Resource Indicators and Measures

Resource indicators and measures (FSH 1909.15, section 12.5) used in analysis of invasive plant infestation risk to measure and disclose effects are listed in table 84.

Table 84. Resource indicators and measures for assessing effects to sensitive and rare plants.

Resource Element	Resource Indicator	Measure
Invasive Plants	Invasive plant infestation risk	Acres impacted by timber harvest, recreation and other facility construction
		Miles of new road construction

Methodology

Information Sources

The Forest Service Natural Resource Information System Invasive Species database (NRIS-IS) database is the main source of information on known sensitive or rare plant occurrences in the project area. Additionally, the Alaska Natural Heritage Program AKEPIC database (ANHP 2020a) were consulted for invasive plant infestations in the project area that may not have been documented in NRIS-IS.

Project-related botanical surveys were conducted by Forest Service personnel in 2018 and 2019 and were focused on finding additional occurrences of Alaska Region sensitive plants in suitable habitat. During these surveys, any invasive plants encountered would be documented. In addition, roadside sampling surveys were conducted on the eastern (Shoal Cove) side of the project area. Sampling plots consisting of 25-meter sections of road rights of way that were established at 0.25-mile intervals along existing forest roads, with additional surveys conducted at road intersections, stream crossings, and rock/gravel borrow pits. All invasive plants encountered were recorded and entered into NRIS-IS.

Incomplete and Unavailable Information

Data on invasive plant infestations in the project area is largely based on field surveys associated with past projects, with additional project-specific botanical surveys occurring in 2018 and 2019. It was not feasible to survey all of the project area; therefore, additional undocumented infestations may be present in unsurveyed areas.

Effects Analysis

The potential vegetation or ground disturbance footprint was considered in the analysis of effects on invasive plant infestation risk within the project area. It was also used to compare the magnitude of effects of each alternative on infestation risk (Krosse 2019). Geographic information system (GIS) maps of proposed timber harvest units, new roads, and recreation and other facilities were used as overlays to evaluate potential effects on invasive plant infestation risk under each alternative.

Units of Measure for Analysis

Because of the difficulty in estimating the amount of actual disturbance that would result under each project alternative, the total acres of proposed timber harvest and recreation and administrative facility construction and miles of proposed new road construction was used to compare the potential for establishment and spread of invasive plants under each alternative (table 84). It should be noted that although the total area proposed for timber harvest is much larger than the area proposed for timber harvest, it involves a much lower intensity of ground disturbance per acre; therefore, total miles of road construction may be interpreted as a relatively accurate comparison of the level of ground disturbance that may be expected from each project alternative.

Spatial and Temporal Context for Effects Analysis

The analysis area for direct and indirect effects to invasive plant infestation risk is the project area, within which proposed activities would be implemented. The analysis area for cumulative effects is Revillagegido Island because invasive plant infestations occur across the island, and because its geographic isolation from other lands by sea passages could potentially restrict the introduction or spread of infestation from other lands.

Direct effects to invasive plant infestation risk generally occur at the time that a vegetation or ground disturbing activity is implemented, or within a single growing season. Indirect effects usually occur beyond a single growing season, and from one to several years post-activity. An impact that is expected to become apparent during a single growing season is considered a short-term effect, and an effect that becomes apparent beyond one growing season is considered a long-term effect.

Direct and Indirect Effects Boundaries

The spatial boundary for analyzing direct effects on invasive plant infestation risk is the disturbance footprint of an activity, including timber harvest, road construction, and recreation and other facility construction. This footprint is the area where vegetation or ground disturbance will most likely occur and consequently will likely have the greatest effect on risk of introduction or spread of invasive plant infestations. Indirect effects are most likely in areas immediately adjacent to the disturbance footprint and could result from increased soil erosion and deposition, changes in light availability, or changes in soil moisture availability, which could allow invasive plant species to establish and outcompete native vegetation. The direct effects area for timber harvest is inside the harvest unit boundary, and the indirect effects area is within a 164-foot buffer area outside the unit boundary (Krosse 2019). For road construction, direct effects are analyzed within an 85-foot road corridor width, and indirect effects are analyzed in a 164-foot buffer on either side of the road corridor. Direct effects analysis area of recreation or other facilities is the construction footprint, and indirect effects are analyzed in a 164-foot buffer area outside the construction footprint.

The temporal boundary for analyzing direct effects is the growing season of the year during implementation of an activity, because these effects are likely to be apparent in the short term. The temporal boundary for analyzing indirect and cumulative effects is beyond a single growing season, because indirect effects are likely to become more apparent over the long-term.

Cumulative Effects Boundaries

The spatial boundary for cumulative effects is the estimated maximum implementation area of relevant past, present, or reasonably foreseeable projects on Revillagedo Island, in addition to the effects of the proposed activities for this project. The temporal boundary for analyzing indirect and cumulative effects is over multiple growing seasons, because cumulative effects are likely to become more apparent over the long-term.

Affected Environment

Existing Condition

The Alaska Center for Conservation Science provides a ranking system to help determine the overall invasiveness of each non-native plant species in Alaska (ACCS 2020b). The ranking process (0 to 100, low to high invasiveness score) takes into account certain criteria for each invasive plant species, such as documentation of presence in the state and known distribution, climatic comparison of Alaska's climates to other climates outside Alaska where a plant is known to thrive, biological characteristics, dispersal ability, and feasibility of control. This ranking system is used as an aid in identifying the highest priority invasive plant species for treatment and control on the Tongass National Forest. A ranking of 60 or higher is generally considered a high priority species for treatment.

Infestations of sixteen invasive plant species covering 66.4 acres in the project area have been documented (table 85). All known infestations in the project area are located in or near disturbed areas, particularly roadsides, rock and gravel borrow pits, and marine access facilities. No infestations have been documented in undisturbed areas with intact natural vegetation. Many of the infestations in the project area were recorded in plots as part of a roadside systematic plot inventory; therefore, the actual amount of infested area of these species along the road system is likely to be higher. Eight of the sixteen species in the project area have invasiveness ranks of 60 or higher. Reed canarygrass has the largest total infestation in the project area, and like the other species it is mainly found in disturbed areas. No treatments to control or eradicate invasive plant infestations have been documented in the project area.

Table 85. Invasive plant species with known infestations in the project area

Common Name	Scientific Name	Invasiveness Rank	Total Acres Infested	At-risk habitats[2] and vulnerability (Low/Med/High)
bull thistle[1]	*Cirsium vulgare*	61	<0.1	Meadows, forest openings (High)
common dandelion	*Taraxacum officinale*	58	7.2	Meadows (Med)
common eyebright	*Euphrasia nemorosa*	42	0.2	Forest openings and edges, meadows (Med)
common plantain	*Plantago major*	44	11.5	Open woodlands (Med)
common tansy[1]	*Tanacetum vulgare*	60	<0.1	Stream banks, lake and seashores (High)
creeping buttercup	*Ranunculus repens*	72	0.8	Meadows, open woodlands, lake shores, rivers banks (Med)

Common Name	Scientific Name	Invasiveness Rank	Total Acres Infested	At-risk habitats[2] and vulnerability (Low/Med/High)
field sowthistle[1]	*Sonchus arvensis*	73	3.1	Open woodlands, meadows, stream banks, lake and seashores (High)
Kentucky bluegrass	*Poa pratensis*	52	2.3	Meadows, open woodlands, riparian areas (Med)
orange hawkweed[1]	*Hieracium aurantiacum*	79	0.1	Meadows, forest edges (High)
oxeye daisy[1]	*Leucanthemum vulgare*	61	3.1	Meadows (High)
quackgrass	*Elymus repens*	59	0.2	Meadows, open woodlands (Med)
reed canarygrass[1]	*Phalaris arundinacea*	83	14.8	Stream banks, wetlands, meadows (High)
tall buttercup	*Ranunculus acris*	60	4.5	Meadows, open woodlands, (Med)
timothy	*Phleum pratense*	54	2.0	Meadows, stream banks (Med)
true forget-me-not	*Myosotis scorpioides*	54	3.1	Moist to wet areas (Med)
white clover	*Trifolium repens*	59	9.1	Moist meadows (Med)

1 Species is considered a priority for treatment and control on the Tongass National Forest.
2 Habitat information adapted from Alaska Center for Conservation Science (ACCS 2020).

Habitat Vulnerability

Soil disturbance and adequate to abundant light are factors that favor the introduction and spread of invasive plants. Large areas of human-caused disturbance, such as that associated with timber harvest and road construction, often create the source and vectors for invasive plants to be introduced and to spread. Naturally occurring ground disturbance on ocean beaches, lakeshores or floodplains, can also create conditions that are vulnerable to infestation.

Road maintenance and road brushing are ongoing potential non-project related vectors. Weed-contaminated road fill material or erosion control seed mixtures are potential vectors for new invasive plants introductions, unless weed-free materials and seed mixtures are used. In some cases, wind, water movement, and wildlife can serve as vectors, especially in combination with the human-caused vectors. For example, perennial sowthistle seeds are very light, with a structure that allows them to be transported long distances by wind or water. Reed canary grass sometimes grows in riparian areas where they can be transported by water to areas downstream.

Examples of low to moderate vulnerability areas in the project area include saltwater estuaries, muskegs, and closed canopy forests. Freshwater wetlands, floodplains, riparian areas, herbaceous meadows are moderately to highly vulnerability to infestation, and areas with frequent or persistent vegetation or ground disturbance, such as road stream crossings, roadsides, recreation and administrative sites, marine access facilities, and rock pits, are generally highly vulnerability areas.

Environmental Consequences

Effects Common to All Alternatives

Ground disturbance associated with timber harvest and construction or maintenance of roads and recreation and other facilities provides an opportunity for invasive plant introduction or expansion. Introduction and spread of invasive plants are potentially the direct effect of these activities because they disturb soil and/or remove existing vegetation, providing opportunities for invasive plants to establish or spread. Additionally, movement of equipment and personnel can also provide opportunities for transport of invasive plant seeds or propagules into new areas. Road construction material such as rock or gravel transported from infested borrow pits can introduce invasive plants into previously un-infested areas. Indirect effects can include the establishment or spread of invasive plants through the use of roads for recreation or other activities after road construction and timber harvest is completed. Similarly, disturbances from road and recreation area maintenance activities increases the risk of invasive species spread and colonization. The impacts of invasive plant spread and colonization can occasionally spread beyond the area of disturbance in certain habitats such as wetlands and riparian areas.

Changes in Southeast Alaska's climate could also create the conditions that encourage the spread of invasive plants by altering opportunities for invasive plants to colonize new areas, and could be compounded by climate change. Changing climate may also result in range extensions for some species that are native at more southerly latitudes, and they may become established or become more widespread on the Tongass as a result. Changes in growing conditions would likely favor some plant species and stress others. There is currently much uncertainty in the effect of changes in the climate on invasive plant infestation risk in the project area.

Effects Specific to Each Alternative

All of the alternatives include timber harvest, road and recreation and other facility construction, as well as related activities including development and redevelopment of rock pits and marine transfer facilities, which could directly and indirectly increase the number and spread of invasive plants. Increased disturbance increases the risk of establishment or spread of invasive plants. The effects would vary between alternatives depending on the level of disturbance, mainly from timber harvest and new roads construction.

Alternative 1 – No Action Direct and Indirect Effects

None of the activities proposed to accomplish the goals and objectives of this project would be implemented under Alternative 1. Natural disturbances and current management of the project area would continue as before. Ongoing activities such as recreation, road and trail maintenance, and other routine forest management activities not associated with this project would continue at current levels and would present a low but persistent risk of introduction and spread of invasive plants. Therefore, Alternative 1 would result in the least direct and indirect effects on invasive plant risk of the project alternatives.

Cumulative Effects

Under Alternative 1, no vegetation and ground disturbance resulting from proposed management activities associated with this project would occur. Therefore, no changes in invasive plant infestation risk would occur, and no additional cumulative effects to sensitive plants on National Forest System lands from other past, present, and reasonably foreseeable actions are anticipated under this alternative.

Alternatives 2 (Proposed Action), 3, and 4 Direct and Indirect Effects

The direct effects on infestation risk under the action alternatives, including the proposed action, include increasing opportunities for introduction and spread of invasive plants due to direct transport of invasive plant propagules resulting from proposed activities into areas with vegetation or ground disturbance. Indirect effects could include increasing the ability of invasive plants to establish and outcompete native vegetation as a result of increased erosion, changes in light availability, and/or moisture changes that may be caused by proposed activities.

The acreage within the project area that would be disturbed by timber harvest, and recreation and other facilities construction under Alternatives 2 and 4 would total 6,203 acres (table 86). Alternative 3 would have the least disturbed area, with 5,320 acres. Alternative 2 would have the most miles of new road construction, followed by Alternative 4 and then Alternative 3, which would have the least miles of new road corridors.

Table 86. Resource indicators and measures for analyzing invasive plant infestation risk by alternative

Resource Element	Resource Indicator	Alternative 2	Alternative 3	Alternative 4
Invasive plant infestation risk	Acres of timber harvest, recreation, and other facilities construction.	6,203	5,321	6,203
	Miles of new road construction	49.8	45.8	46.4

Under all action alternatives, vegetation and ground disturbance associated with timber harvest, new road construction, recreation and other facility construction could result in site conditions that are conducive to establishment and spread of infestations in vulnerable habitats. Most of this disturbance would occur in forested habitats, which are generally resistant to infestation by invasive plants. Ground disturbance and removal of the forest canopy could allow invasive plants to establish in these areas, but if trees are allowed to naturally regenerate and reestablish canopy cover, it is expected that any new infestations in these areas would decline or disappear over the long-term. If harvest and construction equipment and materials used in the above activities are contaminated with invasive plant propagules, the potential for introduction and spread of invasive plants into previously un-infested areas will increase, especially along newly constructed road rights of way and in rock/gravel borrow pits. Infestation vectors such as recreational use of new roads and recreation facilities is not expected to substantially increase over the long term because new roads constructed for timber harvest are temporary, and new recreation trails and other facilities would be limited in area. Therefore, the overall level of infestation risk from the proposed activities under all action alternatives is expected to be medium.

Cumulative Effects

For this analysis, past, present, and reasonably foreseeable future timber harvest, forest road and recreation and other facility construction on all land ownerships on Revillagigedo Island that are included in the catalog of events for cumulative effects analysis, which is included in the project administrative record, were considered to qualitatively compare the risk that the action alternatives would add to cumulative effects to sensitive plants. Considering past, present and reasonably foreseeable future actions in the project area on NFS lands, as well as on and state and private lands, cumulative effects to invasive plant infestation risk are most likely to occur in forested habitats. Timber harvest has comprised the majority of vegetation and ground disturbance in the project area and in non-urban areas of Revillagedo

Island, and these past harvests combined with the potential direct and indirect disturbance over the life of this project will more likely affect this habitat compared to non-forested habitats. The effects of land exchanges may compound these effects, assuming that forested habitats on these lands would likely be harvested over the short and long term. Timber harvesting on state, municipal, and private land is governed by the Alaska Forest Resources and Practices Act (Alaska Statute 41.17), which includes a Best Management Practice of not planting tree species that are known to be invasive in Alaska (ADNR 2017).

Alternative 2 has the most potential for cumulative effects because it has the most potential ground disturbance due to having the largest proposed timber harvest acreage and miles of new road construction, followed in decreasing potential by Alternatives 4 and 3. Present and future non-timber or non-road construction activities within the cumulative effects analysis area, such as trail and recreation facility construction, either have not had or are not expected to substantially increase invasive plant infestation risk, because the disturbance footprint of these types of activities is likely to be limited. Therefore, the overall direct and indirect effects, combined with expected cumulative effects, is expected to be low for all action alternatives if weed Best Management Practices that are recommended for this project as design features and mitigation measures are implemented as part of this project. If these design features and mitigation measures are not implemented, the expected overall infestation risk level would be expected to increase to medium under all action alternatives (table 87).

Table 87. Overall risk of invasive plant infestation by project alternative

Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Infestation Risk with Weed BMPs	Low	Low	Low	Low
Infestation Risk without Weed BMPs	Low	Medium	Medium	Medium

Karst and Cave Resources

Applicable federal, state, and municipal laws, regulations, policies which govern the management of karst include: The Federal Cave Resources Protection Act (FCRPA) of 1988 (16 U.S.C. 4301-4309; 102 Stat. 4546), 36 CFR Part 290, 36 CFR part 261, Forest Service Manuals (FSM) 2356 and 2880, and the Forest Plan, Karst and Cave Resources, Forest-wide Standards and Guidelines pp. 4-23 to 4-25, Standard S-YG-KC-02 p. 5-6, and Appendix H.

The FCRPA requires the Secretary of Agriculture to issue such regulations as he deems necessary to achieve the purposes of the Act on National Forest System lands. FSM 2880.5 states that:

> associated ecosystems shall be inventoried and classified based on resource value and sensitivity to disturbance. Cave inventories should include information about the geology, hydrology, biology, paleontology, archaeology, cave climate, abundance and quality of cave formations, recreation potential, educational and scientific values, and be considered in the preparation of land management plans. Inventory and management guidelines for associated resources, such as ground water, shall be followed where appropriate.

To meet this direction, the Tongass National Forest strives to maintain, to the extent practical, the natural karst processes and the productivity of the karst landscape while providing for other land uses, where appropriate. This strategy is designed to assess a karst resources vulnerability or sensitivity to a proposed land use, and recognize the differences in degree of karst development and glacial history across the karst landscape.

Units of Measure

To compare the effects to karst and cave resources between the four different alternatives the following measures will be used:

- Estimated acres of past management,
- Miles of existing road,
- Acres of proposed management, and
- Miles of proposed roads, either NFS or temporary.

These measures align with the Forest Plan Karst and Cave Resource direction and direction in appendix H of the Forest Plan.

Methodology

A karst resource vulnerability assessment is conducted for each project regardless of its scale.

A karst vulnerability assessment is a four-step process. It includes:

1. *Identify Potential Karst Lands*

Identify those lands underlain by carbonate rocks. As a practical matter, all lands underlain by carbonate rocks within the project area should be considered a karst landscape. These include outcrops of limestone, marble, and dolomite.

2. *Inventory Karst Resources*

At the beginning of any land-disturbing project planning effort, determine the project's proximity to or position on a karst landscape. If it is determined that karst occurs in the project area, require an inventory adequate to characterize the resources. Assess the degree and location of karst development.

3. *Delineate Karst Hydrologic System and Catchment Area*

Define, to the extent feasible, the karst hydrologic system and the recharge area watershed or catchment area for each karst system. The character of the catchment area (*i.e.*, the area, slope gradient, vegetation, water quality, soils, etc.) controls the nature of the receiving karst system and defines the volume of runoff available for infiltration into the system. Recharge area delineation is a crucial component of vulnerability mapping; it is important to know where the water comes from and resurges to credibly assess and characterize possible impacts.

4. *Assess Vulnerability of Karst Terrain to Management Activity*

The final step is to delineate the land under investigation into various vulnerability categories. An area's vulnerability rating must be sensitive to potential surface management practices based on the extent to which epikarst has developed and the openness of the karst system. Where recharge is diffused through deep soils, the underlying karst is less vulnerable to increased sediment inputs and other pollutants than in areas where recharge is discrete and soils are thin or nearly absent. Where soils are thin or nearly absent, surface disturbances will almost always result in exposure of the epikarst, providing an easy pathway for sediment and other pollutants to enter the subsurface drainage network. Discrete recharge areas are especially vulnerable to ground-disturbing activities because the flowing surface water can carry sediment and other pollutants directly to the subsurface drainage network. Karst vulnerability mapping recognizes the variability in karst terrain and uses the vulnerability concepts described here to assign a high, medium, or low vulnerability rating to an area of karst terrain. The proposed ground disturbing activity is considered when determining mitigation or applying karst management guidelines.

Incomplete and Unavailable Information

Almost all field inventories have been conducted. Portions of five proposed harvest units remain to be inventoried. These inventories should be completed between the DEIS and FEIS, or during implementation.

Data limitations

Though focused geologic mapping has been completed for much of the project area, some boundaries of the karst polygons have not been field verified. These boundaries will be verified during field reconnaissance.

Past karst resource inventory has been focused on proposed timber harvest units and the lands immediately adjacent to those units in proposed timber sale projects since 1990. Approximately 68 percent of the NFS karst lands within the project area have not been assessed as to their vulnerability. One of the benefits of this project will be completing a vulnerability assessment for these acres.

Spatial and Temporal Context for Analysis

The boundary selected for the following analysis of karst and cave resources is the same as the Project boundary. According to the karst and cave resources inventory, the project area contains approximately 3,064 acres of karst which includes all federal, state, and private lands. Also, of concern are the adjacent land whose waters flow to the karst, sinking along its margins. This number may be inconsistent from other resources due to the number of different variable combinations used in the GI tool but the differences are negligible.

The temporal bounds of all existing karst and cave resource disturbances are the beginning of land management, such as timber harvest, to the present, and through the life of the project.

Direct, indirect, and cumulative effects to karst and cave resources are assessed at the stand or harvest unit scale and by karst watershed or catchment area when defined.

The time frame for the effects analysis looks at all past disturbance, *i.e.*, past harvest, road construction, and quarry development on karst and within the karst watershed catchment areas, and proposed activities, in this case for the next 15 years. Recovery rates for impaired karst systems have not been established. For purposes of this analysis we rely on the vulnerability assessment to protect karst features and the discrete and diffuse recharge to those systems.

Affected Environment

Karst lands impose land management challenges not encountered in non-karst areas because this three-dimensional landform functions differently than other landforms. Karst resources must be evaluated according to their vulnerability to land uses affecting karst systems. Vulnerability mapping recognizes that some parts of the karst landscape are more sensitive than others to surface activities and groundwater contamination. These differences in vulnerability may be a function of the extent of karst development, the openness of the karst systems, and the sensitivity of other resources that benefit from karst groundwater systems. The vulnerability categories and their criteria are discussed below:

Low Vulnerability Karst Lands

Low vulnerability karst lands are those areas where resource damage threats associated with land management activities in the areas are not likely to be appreciably greater than those posed by similar activities on non-carbonate substrate.

A generalized characterization of these lands would be that they are underlain by carbonate bedrock that is moderately well to well drained, most commonly internally drained, but surface streams may be present. Generally, these areas have been greatly modified by glaciation, and a deep (greater than 40 inches deep) covering of glacial till or mineral soil, and little or no epikarst showing at the surface. The epikarst may be buried and/or ground off, depending on the intensity of glaciation. These lands pose little or no threat to organic, sediment, debris, or pollutant introduction into the karst hydrologic systems beneath through diffuse recharge. Often these are areas of little or no slope (less than 20 percent).

Moderate Vulnerability Karst Lands

The moderate vulnerability karst lands are those areas where resource damage threats associated with land management activities in the areas are appreciably greater than those posed by similar activities on low vulnerability karst lands.

A generalized characterization of these areas would be areas underlain by carbonate bedrock that are well drained internally. Surface streams are rare. The soils of moderate vulnerability areas are a mosaic of shallow organic (20 to 40 percent, McGilvery Soils) and mineral (80 to 60 percent, Sarkar [less than 20-inch depth] and Ulloa [greater than 20-inch depth] Soils) with minor amounts of glacial till. The epikarst is moderate- to well-developed and is visible at the surface. These areas tend to be at higher elevations (*i.e.*, greater than 500 feet, and on knobs, ridges, and on the dip-slope of carbonate bedding planes when near the surface.) The surface of these areas tends to be irregular and undulating, following the epikarst development, which is the result of solution of the bedrock surface rather than solution and/or collapse features such as sinkholes.

High Vulnerability Karst Lands

The high vulnerability karst lands are those areas where resource damage threats associated with land management activities are appreciably greater than those posed by similar activities on low or moderate vulnerability karst lands. These are the areas contributing to or overlying significant caves and areas containing a high density of karst features.

These are areas underlain by carbonate bedrock that are well drained internally. Surface streams are rare. Karst systems and epikarst are extremely well-developed and collapse karst features may be numerous. These include all collapse karst features, caves, sinking or losing streams, insurgences, open resurgences, and open grikelands (*i.e.*, those without soil or moss infilling and with open connections to the subsurface). The highest vulnerability features are those that could produce and transport the greatest amount of sediment, debris, and/or organics if disturbed. These include till-lined sinkholes and cave entrances accepting a sinking stream, whether intermittent or not. Also considered high vulnerability are karst lands in which the epikarst is well- or extremely well-developed and the soils are predominately (greater than 50 percent) very shallow organic (less than 10 inches deep, McGilvery) and (less than 50 percent) mineral (less than 20 inches deep, Sarkar). The subsurface drainage network is highly vulnerable to sediment, organic matter, logging debris, and other pollutants generated as the result of surface activities.

Within areas labeled as high or moderate vulnerability there are features that require buffering under current Forest Plan direction. These buffers were drawn as the “minimum” 100-foot radius buffer.

However, these buffers will need to be designed and laid out by a karst specialist during unit layout taking into account factors such as aspect, slope, wind throw potential, soils, etc., at which point certain buffers may need to be enlarged or modified in response to these concerns.

Since 1990, within the project area few inventories of karst and cave resources have been conducted. A few Caves have been inventoried and mapped. The full extent of the karst lands has not been mapped. No tracer dye studies have been conducted to determine karst ground water flow paths. What inventory exists has been in support of timber sale and road building projects. The table below summarizes the acres of karst within the project area and the acres of karst disturbed by various management activities.

Analysis of GIS data shows that 3,064 acres of karst exist in the project area based on current geologic mapping. Of these 2,077 acres are known to be karst but their vulnerability has not been assessed. 1,726 acres of the karst lands mapped on NFS lands have had timber harvest, 56 percent of the karst lands (table 88).

Table 88. Existing karst resource condition in the project area

Total Karst Acres	Acres	Percent
Karst within Project Boundary	3064	100
Karst by Vulnerability on National Forest System Lands	Acres	Percent
Karst within Project Boundary Karst but not Assessed	2077	68
Karst within Project Boundary High Vulnerability	200	7
Karst within Project Boundary Moderate Vulnerability	342	11
Karst within Project Boundary Low Vulnerability	268	9
Karst within Project Boundary Geologic Special Area	178	6
Total	**3064**	**100**
Harvested Karst Acres in the Project Area by Vulnerability on National Forest System Lands		
Timber Harvested, Karst but not Assessed	1311	76
Timber Harvested, High Vulnerability	69	4
Timber Harvested, Moderate Vulnerability	102	6
Timber Harvested, Low Vulnerability	244	14
Total	**1726**	**100**
Roads	Miles	
Miles of Existing Roads on Karst	13	

Environmental Effects

Effects Common to All Action Alternatives

All action alternatives propose similar activities but the amount of each activity varies between alternatives. Unit cards include specific karst and cave resource mitigation.

All alternatives will have differing effects both possibly adverse and/or desirable. Assuming all Forest Plan karst and cave management direction and unit cards are fully implemented there should be no detrimental effects to those resources.

There are no known karst lands on the proposed Alaska Mental Health Trust lands in the project area.

Approximately 34 miles of road would be maintained, and up to 14.4 miles of new NFS road and 34 miles of new temporary road would be constructed. Not all these miles would be or are on karst. Any new road construction on karst will follow the Forest Plan Karst and Cave Resources Standards and Guidelines for road construction and quarry development (Forest Plan pp. 4-23 to 4-25 and Appendix H pp. H-5 to H-7).

Alternative 2 and Alternative 4 have the highest percentage of disturbance acres of old growth and young growth harvested (table 89). All action alternatives could initially increase water flow through karst systems after initial harvest in low and moderate vulnerability karst areas and subsequent (approximately 15 years post-harvest) decrease to flow through these karst systems due to dense forest regeneration (Aley et al. 1993). An increase of turbidity and changes in water chemistry through the karst system could also occur due to these changes in flow (Aley et al. 1993). Tracer dye studies have shown that some downstream effects may be as much as a mile away within a 24-hour period, often at spring-fed anadromous streams (Prussian and Baichtal, 2007). Karst resource mitigation and prescription development will strive to minimize these effects.

Approximately 10 percent of the proposed timber harvest is on karst, some 635 acres. These include 387 acres of old-growth and up to 247 acres of young-growth. For analysis we assume that harvest of old-growth will be spread evenly across the landscape.

Table 89. Potential acres of harvest and miles of road construction on karst by alternative and percent change from existing condition

Karst Vulnerability	Alt. 1	Alt. 2	% change	Alt. 3	% change	Alt. 4	% change
Harvest in acres	**Previous Harvest**	**Proposed Harvest**		**Proposed Harvest**		**Proposed Harvest**	
Known Not Assessed	2077	170	11	162	11	170	11
High	200	0	0	0	0	0	0
Moderate	342	212	68	185	65	212	68
Low	268	252	51	212	46	252	51
Geologic special interest area	178	0	0	0	0	0	0
Total Acres	**3064**	**635**	**27**	**559**	**24**	**635**	**27**
Road construction in miles	**Existing Roads**	**Proposed Road Construction**		**Proposed Road Construction**		**Proposed Road Construction**	
Known Not Assessed	8	1	13	1	13	1	13
High	1	0	25	0	15	0	25
Moderate	2	1	22	1	21	1	22
Low	2	1	29	1	29	1	29
Geologic special interest area	0	0	0	0	0	0	0
Total Miles	**13**	**3**	**18**	**3**	**18**	**3**	**18**

Alternative 1 – No-Action

Direct and Indirect Effects

Under the No-Action Alternative, none of the specific management activities proposed in the DEIS would be implemented to accomplish project goals and objectives. Natural disturbances and current management of the project area would continue as before.

Cumulative Effects

Cumulative effects to karst and cave resources occur at a stand or harvest unit scale and by karst watershed or catchment area when defined. Since no areas are proposed for harvest and no new roads will be constructed, no cumulative effects will occur in those stands or areas on karst.

According to Forest Service GIS, 247 acres of young growth on karst are proposed for harvest. Under this project, some of these acres would be harvested with an uneven-aged management prescription. By commercial thinning of older young-growth stands on karst, the stand will have closer-to-pre-harvest tree spacing, thus hastening the hydrologic recovery of the site. The canopy of these stands is closed to varying degrees. Reducing the canopy cover could restore the 'health' of young-growth forests on karst lands by increasing the volume of throughfall, flushing sedimentation out of diffuse and discrete karst openings, and reconnecting surface to subsurface flow pathways. The management of older young-growth stands can also hasten the return to more natural stand characteristics and conditions. Considering the above discussion, a commercial thinning prescription that minimizes ground disturbance and treats the whole stand, decreasing the canopy closure to increase throughfall would be best for the karst systems and the streams and creeks which the karst systems contribute to (Karst Review Panel, 2002; Prussian, 2011). By not commercial thinning these stands possible benefits to the karst systems will not be realized.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Karst disturbance would increase by 635 acres of old-growth harvest and 3 miles of road. This equates to a 27 percent increase in harvest of karst old-growth and an 18 percent increase in miles of road on karst (table 89).

Approximately 247 acres of young-growth management would be on low vulnerability karst. Effects from harvest could initially increase flow through karst systems after initial harvest in low and moderate vulnerability karst areas and subsequently (approximately 15 years post-harvest) decrease flow through these karst systems due to dense forest regeneration (Aley *et al.* 1993). Increase to turbidity and changes in water chemistry through the karst system could also occur due to these changes in flow (Aley *et al.* 1993). Karst resource mitigation and unit prescription development will strive to minimize these effects.

Cumulative Effects

Alternative 2 will have differing effects both possibly adverse and/or desirable. Assuming Forest Plan karst and cave management direction, appendix A, and the unit cards are fully implemented there should be no detrimental effects to those resources. The karst vulnerability assessment will be used to approximate the disturbance index of specific karst watersheds and catchment areas.

Disturbance in the karst watersheds will continue to change through time, with stands aging and canopy closing in younger stands. Active management of the older stands appropriate for commercial thinning could help lessen the hydrologic effects of throughfall and canopy closure.

Alternative 3

Direct and Indirect Effects

Karst disturbance would increase by 559 acres and 3 miles of road. This equates to an 24 percent increase in harvest of karst old-growth and an 18 percent increase in miles of road on karst (table 89).

Approximately 201 acres of young-growth management would be on low vulnerability karst. Effects from harvest could initially increase flow through karst systems after initial harvest in low and moderate vulnerability karst areas and subsequently (approximately 15 years post-harvest) decrease flow through these karst systems due to dense forest regeneration (Aley et al. 1993). Increase to turbidity and changes in water chemistry through the karst system could also occur due to these changes in flow (Aley et al. 1993). Karst resource mitigation and unit prescription development will strive to minimize these effects.

Cumulative Effects

Alternative 3 will have differing effects both possibly adverse and/or desirable. Assuming Forest Plan karst and cave management direction, appendix A, and the unit cards are fully implemented there should be no detrimental effects to those resources. As an interim measure, the karst vulnerability assessment procedures will be used to approximate the disturbance index of specific karst watersheds and catchment areas.

Disturbance in the karst watersheds will continue to change through time, with stands aging and canopy closing in younger stands. Active management of the older stands appropriate for commercial thinning could help lessen the hydrologic effects of throughfall and canopy closure.

Alternative 4

Direct and Indirect Effects

Karst disturbance would increase by 635 acres 3 miles of road. This equates to an 27 percent increase in harvest of karst old-growth and an 18 percent increase in miles of road on karst (table 89).

Approximately 247 acres of young-growth management would be on low vulnerability karst. Effects from harvest could initially increase flow through karst systems after initial harvest in low and moderate vulnerability karst areas and subsequently (approximately 15 years post-harvest) decrease flow through these karst systems due to dense forest regeneration (Aley et al. 1993). Increase to turbidity and changes in water chemistry through the karst system could also occur due to these changes in flow (Aley et al. 1993). Karst resource mitigation and unit prescription development will strive to minimize these effects.

Cumulative Effects

Alternative 4 will have differing effects both possibly adverse and/or desirable. Assuming Forest Plan karst and cave management direction, appendix A, and the unit cards are fully implemented there should be no detrimental effects to those resources. As an interim measure, the karst vulnerability assessment procedures will be used to approximate the disturbance index of specific karst watersheds and catchment areas.

Disturbance in the karst watersheds will continue to change through time, with stands aging and canopy closing in younger stands. Active management of the older stands appropriate for commercial thinning could help lessen the hydrologic effects of throughfall and canopy closure.

Soils

Soil productivity is the inherent capacity of a soil to support the growth of specified plants, plant communities, or sequence of plant communities. Soil productivity may be expressed in terms of volume or weight per unit area per year, percent plant cover, or other measures of biomass accumulation. Maintaining soil productivity and minimizing soil erosion are primary concerns when managing soil resources on National Forest System (NFS) lands.

Soil quality standards established definitions and some minimum size requirements for detrimental soil conditions. The standards state that 85 percent of an activity area should be maintained in a condition of acceptable productivity potential for trees or other managed vegetation. Activity areas are individual proposed young-growth stands, old-growth stands, and timber stands for restoration projects. The threshold value of 15 percent is established for assessing detrimental soil conditions at the stand or harvest unit scale. If detrimental soil conditions approach or exceed 15 percent of an activity area, soil restoration practices should be considered.

Resource Indicators and Measures

Table 90 describes the resource indictors and measures used to analyze potential effects to soil productivity soil erosion, and slope stability (landslide risk).

Table 90. Resource indicators and measures for assessing effects to soil productivity and slope stability

Resource Element	Resource Indicator	Measure	Used to address: P/N, or key issue?	Source
Soil productivity	Estimate of detrimental soil conditions	Percent of activity areas in detrimental soil condition	No	FSM 2554 supplement, NFMA, Landwehr 2018a
Slope stability	Estimated acres of landslides	Estimated acres of landslides over a 20 year time period	No	Landwehr 2018b
Slope stability	Timber harvest on steep slopes	Estimated acres of timber harvest on slopes over 72 percent gradient	No	Forest Plan Standard
Slope Stability	Road Construction on Steep Slopes	Miles of road construction on slopes over 67 percent gradient	No	Forest Plan Standard

Methodology

Soil Quality Monitoring data collected over the last 25 years will be used to estimate the effects to soil quality. For purposes of this analysis the existing soil quality monitoring data summarized in Landwehr (2018a) is the best available data for estimating detrimental soil impacts from the various activities.

Forest facilities including NFS roads (including cut, fill, road bed, landings and log transfer facilities), trails, recreation sites, hydropower facilities, powerline corridors, rights-of-ways, and mines under an approved plan of operation are considered part of the Forest's infrastructure, and are not subject to soil quality standards. Activities within the productive land base are subject to soil quality standards and include timber harvest, stream or vegetation restoration, temporary roads and associated landings and rock quarries, and wildlife enhancement projects.

The best available landslide frequency analysis (Landwehr 2018b) will be used to estimate the effects of the alternatives on landslide production over a 20-year time period. One of the landslide studies cited by Landwehr (2018b) included the South Revilla project area and all of the studies include terrain and geomorphic landscapes similar to where activities are proposed on the South Revilla project area.

Slope data will be overlaid with the proposed roads for each alternative to estimate the miles of road proposed on slopes over 67 percent gradient. Field data will be used to estimate the amount of proposed harvest on slopes over 72 percent gradient.

Assumptions for the cumulative effects analysis

It is assumed that hand felling of small young-growth trees on the powerline corridor will not disturb soils.

Landslides will continue to occur in both previously managed stands and unharvested areas driven by storm events and soil saturation. Vegetation in previously harvested stands will continue to grow and add stability to the soils in those areas. The landslide estimates are dependent on climatic events being similar to previous 20-year time periods. Climate change may increase landslide frequency as described above.

The development of seven new recreation sites will result in areas of soil being buried by shot rock for parking areas, trails and other developments. The recreation facilities are part of the forest infrastructure and not subject to soil quality standards.

Incomplete and Unavailable Information

The lack of a landslide frequency analysis since the 1997 Forest Plan Revision is a data limitation. The 1997 Forest Plan identified slopes over 72 percent as unsuitable for timber harvest pending an on-site analysis and recommends avoiding road construction on slopes over 67 percent gradient. The 1997 Forest Plan direction effectively limited timber harvest on steep or unstable slopes, yet the landslide frequency analyses summarized in Landwehr (2018b) were all conducted prior to the 1997 Forest Plan. The analysis uses the best available information and should be considered conservative because the 1997 Forest Plan and subsequent Plan Amendments effectively limited timber harvest on slopes over 72 percent gradient. As a result, landslide frequencies for lands harvested since 1997 should have decreased.

There is an extensive body of soil disturbance monitoring data and soil quality monitoring data available on the Forest. However, the lack of exact soil and vegetation response to soil disturbances is a data limitation. In the absence of precise response information, the analysis takes a conservative approach using the best available data summarized in Landwehr (2018a).

Spatial and Temporal Context for Effects Analysis

Direct, indirect and cumulative effects to soils occurs at the stand or harvest unit scale, therefore the estimates of effects to soils are completed at the stand or harvest unit scale. The analysis of cumulative effects will also summarize detrimental soil disturbance and landslides at the project area scale.

The temporal bounds for the soil analysis dates to the time the initial management activity was accomplished. The temporal bounds for the landslide frequency analysis is within a 20-year period to account for landslides occurring after timber harvest is complete (indirect effects) and to coincide with the available landslide frequency studies. The time frame for the effects analysis depends on the rate a soil recovers from a disturbance. Small soil disturbances typically do not have adverse effects to soil productivity at the site, stand or harvest unit scale. Larger, severe disturbances (where topsoil is effectively displaced) can adversely affect soil productivity for decades or longer. Soil quality monitoring data is beginning to identify the recovery rates for soils from some levels of disturbance. Recovery rates have not been identified for all soils or groups of soils from all types of disturbances.

Affected Environment

Existing Condition

Soils on the project area range from very shallow to very deep, and very poorly drained to well drained. Mineral soils are primarily formed from glacial till deposits, with an area of post-glacial volcanic deposits around Painted Peak. Glacial outwash deposits and uplifted beach deposits occupy minor areas on the project area. Soils are typically less than a meter thick over bedrock on ridgetops and on upper mountain slopes due to localized glacial ice scouring. Valley bottoms and concave areas contain deeper soils occasionally underlain by dense glacial till deposits.

Poorly and very poorly drained deep organic deposits (greater than 1 meter thick) commonly form over bedrock or dense till and support a variety of forested and non-forested wetlands. Poorly drained organic soils less than a meter thick over bedrock are often found on broad ridgetops and glacially scoured benches or rock knobs.

The cool maritime climate causes slow organic matter decomposition and organic duff layers 5 to 20 centimeters or more thick cover most mineral soils. Displacement of the duff layer would lead to soil erosion in most circumstances.

Most soils are coarse textured and not easily compacted. Rooting depth is usually less than a meter and often less than 50 centimeters but can vary by soil drainage class. A few well-drained soils display deeper rooting depth.

Landslides are a natural erosion process and are a common form of erosion on steep slopes within the project area. The volcanic ash soils around Painted Peak are very susceptible to landsliding on steep slopes and incised stream channels. The most common landslides are debris avalanches and debris torrents. Debris avalanches and torrents are shallow, rapid failures driven by rainfall and saturated soil conditions. There are approximately 280 acres of landslides mapped on the project area.

Karst topography has developed in many areas underlain by limestone. Soils over limestone are often well drained (due to internal bedrock drainage) and are often more productive than similar soils over non-carbonate rocks. A band of carbonate rock crosses the Easy Creek, Marble Creek, Painted Creek and Licking Creek watersheds within the project area.

Well-drained organic soils can be subject to soil displacement from management activities or windthrow. Well-drained organic soils commonly occur on broken convex rocky terrain and are often less than 50 centimeters thick over bedrock. Areas of these soils are often small and occur in complex with mineral soils.

Past Activities and Soil Conditions

Soil productivity has been affected by timber harvest yarding activities, temporary road construction, borrow pits, rock quarry development, and landings. These activities have affected soil productivity through soil displacements, soil erosion, or burial with rock, and rarely through other detrimental soil conditions. In most areas within young-growth stands, soils are productive and growing the desired vegetation at the desired rate. In some areas, detrimental soil displacements and detrimental soil erosion are affecting soil productivity.

As mentioned above, NFS roads, recreation facilities, hydropower developments, and other planned infrastructure are not subject to soil quality standards. The decommissioned Coast Guard Loran Station resulted in about 2 acres of facilities and lies within the project area south of Painted Peak. The Marble Creek Mine has currently resulted in about 2 acres of soil disturbance near Marble Creek on private land within the project area. The mining claim occupies about 100 acres in the project area. By regulation, OHV use is confined to designated trails and play areas and those areas are not subject to soil quality standards.

Effects on soil productivity from proposed activities were estimated based on soil quality monitoring information (Landwehr 2018a). Landslide estimates from future activities are based on data supplied by Landwehr (2018b).

Soil monitoring data indicates that soil compaction on skid and access trails is limited and overall the trails are not detrimentally compacted. Soil bulk density data collected to date indicates that detrimental soil compaction is not a concern under normal, modern forestry practices (USDA Forest Service, 2016c. pages 3-42 and 3-43).

Field and office reviews and monitoring data associated with other projects indicate that the young-growth stands proposed for treatment in this project currently meet soil quality standards.

Existing soil conditions in the South Revilla project area are within the Region 10 Soil Quality Standards.

Past Activities and Soil Erosion and Landslides

Past activities including timber harvest, road construction, and pit development have caused soil erosion and landslides. The rate of erosion depends on the amount and intensity of rainfall, vegetative ground cover, erodibility of the soil, slope length, and steepness of slope.

Based on monitoring data, a minor amount of soil erosion is occurring along decommissioned temporary road s and along spar tree corridors in previously harvested areas.

Landslides (mass wasting) are the dominant erosion process on steep forested terrain with high soil water levels in Southeast Alaska (Swanston 1969). Topographic, geologic, and soil conditions in combination with high rainfall and soil saturation are the major factors that contribute to landslide events in Southeast Alaska.

According to the current landslide inventory, there are 280 acres of landslides in the project area. Approximately 70 acres of landslides are associated with past timber harvest and road construction. All management associated landslides are considered detrimental soil conditions, even if associated with NFS roads or other infrastructure developments. The landslide rate in young-growth areas is typically higher than in adjacent old-growth areas. As vegetation grows in previously harvested areas, the landslide rate declines (Landwehr 1994, Page 17).

The application of BMPs since the *Clean Water Act* (1972) and results from subsequent monitoring of BMPs on the Forest since 1990 have shown that soil erosion (including landslides) associated with management activities since 1990 is minimized.

Climate change is expected to result in a wetter, warmer overall annual climate than currently exists. The projected change may cause and increase in the frequency and intensity of storms and may result in an increase in landslide occurrence and soil erosion (EcoAdapt 2014, pages 61 and 62).

Harvest on Slopes Greater than 72 Percent

Past harvest has included about 668 acres of slopes over 72 percent gradient (includes harvest on non-NFS lands). Proposed harvest on slopes over 72 percent will be used as one indicator to compare potential slope instability between alternatives.

Roads on Slopes Greater than 67 Percent

The digital elevation model for the project area, when overlain with the roads layer, identifies approximately 3.7 miles of existing (NFS) roads on slopes greater than 67 percent gradient. Proposed roads on slopes over 67 percent gradient will be used as an indicator to compare slope stability between alternatives.

Environmental Consequences

Direct and Indirect Effects Common to all Action Alternatives

All action alternatives propose similar activities but the amount of each activity varies between alternatives as described in Chapter 2. All alternatives include recreation projects that include small parking areas and other gravel fills over soils that will reduce soil productivity at those sites. Recreation sites are considered facilities and not subject to soil quality standards.

Soil conservation practices and BMPs are designed to minimize effects to the soil resource given overall project objectives. Monitoring data collected since 1990 indicates that soil conservation practices and BMPs have been effective at minimizing detrimental soil conditions. While effects have been minimized, they have not been eliminated (Landwehr 2018a).

All estimates provided in table 91 assumes modern or contemporary forest practices are used and all 2016 Forest Plan direction is followed.

Table 91. Estimates of detrimental soil conditions for proposed activities that must meet soil quality standards

Activity	Estimate of detrimental soil conditions (percent of stand)	Notes
Timber harvest in unharvested areas (old-growth harvest)	-Shovel on slopes less than 35 percent and partial suspension, use 3 percent -Full Suspension) <2 percent -Shovel on slopes over 35 percent gradient, use 9 percent	Sites and conditions are highly variable but available data accounts for the variability. Assumes no detrimentally altered wetness.
Young-growth timber harvest	Same as old-growth timber harvest	
Temporary roads	Use a 40-foot disturbed corridor width or 4.8 acres per mile	Assuming BMPs are followed and natural soil drainage is not impeded.
Landings (shot rock)	0.25 acres per mile of road	Add 1.12 acres per mile of road landings, rock pits, and wood waste.
Wood waste at landings	0.42 acres per mile of road	
Rock pits	0.45 acres per mile of road	

Estimates based on Landwehr 2018a.

Based on the data presented in table 91, all of the activities, when considered alone, result in less than 15 percent detrimental soil conditions. When two or more ground-disturbing activities occur in the same activity area (stand or harvest unit), there is potential to exceed the 15 percent detrimental soil condition threshold set in the Region 10 Soil Quality Standards.

The analysis considers activity areas where more than one ground-disturbing activity may occur, and an assessment of existing detrimental soil conditions has been completed in young-growth stands where activities are proposed. None of the young-growth stands where treatments are proposed are expected to exceed soil quality standards.

Activities that historically have contributed to landslides are road construction, rock pit development, and timber harvest. In other areas of Southeast Alaska, foot trails have contributed to slope instability and landslides, but no landslides are associated with foot trails on the project area. Mining operations on steep slopes may contribute to landslide occurrence, but to date have not contributed to landslides on the project area, likely due to the gentler slopes and limestone bedrock at the one existing mine on the project area.

Table 92 provides the recommended landslide frequency rates for timber harvest, roads and rock pits, naturally forested areas, and naturally non-forested areas.

Table 92. Landslide frequency rates for harvested lands, unharvested lands, non-forested and low productivity areas, and roads and rock pits on the large landscape assessment areas

Vegetation class	Landslide rate	Average landslide size	Notes
Non-forest or low productivity forested lands	1 slide per 19,720 acres per 20 years	1.5 acres	From fresh analysis of Landwehr (1998) data. 20-year time period. One slide was a rock fall and not included here.
Unharvested commercial forest lands	1 slide per 11,720 acres per 20 years	3.1 acres	From the 1985 to 1991 time period in Landwehr (1998).
Harvested lands	1 slide per 2,849 acres per 20 years	0.5 acre	From the 1985 to 1991 time period in Landwehr (1998).
Roads and Rock Pits	1 slide per 19.3 miles of new road construction.	0.5 acre	From the 20-year time period in Landwehr (1998).

Source: Landwehr 2018b

Alternative 1 – No Action

Direct and Indirect Effects

Under Alternative 1, no new timber harvest, road building, wildlife treatments, recreation developments, or watershed restoration activities would take place, therefore no soil disturbances would occur. Existing soil disturbances would continue to recover. No road storage or decommissioning would be completed on existing roads under this project. Roads in the project area will continue to receive routine maintenance and incidental use from hunters and other visitors.

Landslides would continue to occur in unharvested areas and existing harvested areas.

Vegetation in harvested areas would continue to grow and add stability to soils on those sites.

At the project area scale, timber harvest activities and road construction would continue on non-NFS lands.

Cumulative Effects

Cumulative effects to soils occur at the stand or harvest unit scale. Since no areas are proposed for harvest and no new roads will be constructed, no cumulative effects will occur in those stands or areas.

Soils detrimentally impacted by past actions (about 584 acres) will continue to slowly recover over decades and centuries (includes past landslides existing temporary roads and soil conditions in harvest units). Landslides associated with past harvest and existing roads will result in an estimated 6.6 acres of new landslides over the next 20 years.

As a result of the AMHT land exchange reasonably foreseeable actions include an estimated potential 4,019 acres of old-growth timber harvest on non-NFS lands and up to 51 miles of road construction on non-NFS lands on the project area over the next 20 years. If all available old-growth within the AMHT parcel were logged there would be an additional 429 acres of detrimental soil conditions due to soil conditions within harvest units, temporary roads, and landslides.

Cumulatively at the project area scale, including potential harvest of AMHT lands, detrimental soil conditions would total about 1,020 acres on the project area (NFS and non-NFS lands).

Alternative 2 – Proposed Action

Direct and Indirect Effects

Application of the 2016 Forest Plan Standards and Guidelines will ensure detrimental soil conditions remain within Region 10 Soil Quality Standards in all stands where project activities are proposed. No individual stand or harvest unit is expected to exceed Region 10 Soil Quality Standards for areal extent of detrimental soil conditions.

Implementation of Alternative 2 would result in detrimental soil conditions increasing by an estimated 368 acres across the project area (includes temporary roads, soil conditions in harvest units and management related landslides over the next 20 years).

Based on field reviews 150 acres of old-growth on slopes over 72 percent gradient are suitable for timber harvest.

Based on available information, about 1 mile of road is proposed for construction on slopes over 67 percent gradient. The overlay of roads and slopes in GIS indicates that the 1 mile of road occurs on approximately 49 segments, indicating an average segment length of 108 feet proposed on slopes over 67 percent gradient. The proposed road segments greater than 67 percent gradient will be reviewed prior to implementation to ensure that the road locations on steep slopes are avoided to the extent practicable and appropriate mitigation measures are applied to protect slope stability.

Cumulative Effects

Cumulative effects to soils occurs at the stand or harvest unit scale. Based on field reviews, the existing monitoring data, and an assessment of existing detrimental soil conditions in the young-growth stands where activities are proposed, no young-growth or old-growth harvest stands are expected to exceed the 15 percent threshold for detrimental soil conditions.

Soils detrimentally impacted by past actions (about 584 acres) will continue to slowly recover over decades and centuries (includes past landslides existing temporary roads and soil conditions in harvest units). Landslides associated with past harvest and existing roads will result in an estimated 6.6 acres of new landslides over the next 20 years.

Alternative 2 will increase detrimental soil conditions by 368 acres as described above, some of which occurs on FS lands that may be subject to AMHT acquisition. If all available productive old-growth within the AMHT parcel were logged and roaded there would be an estimated additional 371 acres of detrimental soil conditions due to soil conditions within harvest units, temporary roads and landslides.

Cumulatively at the project area scale, including potential harvest of AMHT lands, detrimental soil conditions would total about 1,330 acres on the project area (NFS and non-NFS lands).

The proposed Scenery Amendment would have no additional effects to soils because the maximum disturbance footprint was analyzed for Alternative 2.

Alternative 3

Direct and Indirect Effects - Alternative 3

Application of the 2016 Forest Plan Standards and Guidelines will ensure detrimental soil conditions remain within Region 10 Soil Quality Standards in all stands where project activities are proposed. No individual stand or harvest unit is expected to exceed Region 10 Soil Quality Standards for areal extent of detrimental soil conditions.

Implementation of Alternative 3 would result in detrimental soil conditions increasing by an estimated 328 acres across the project area (includes temporary roads, soil conditions in harvest units and management related landslides over the next 20 years).

Based on field reviews 130 acres of old-growth on slopes over 72 percent gradient are suitable for timber harvest.

Based on available information, about 0.99 miles of road is proposed for construction on slopes over 67 percent gradient. The overlay of roads and slopes in GIS indicates that the 0.99 miles of road occurs on approximately 47 segments, indicating an average segment length of 111 feet proposed on slopes over 67 percent gradient. The proposed road segments greater than 67 percent gradient will be reviewed prior to implementation to ensure that the road locations on steep slopes are avoided to the extent practicable and appropriate mitigation measures are applied to protect slope stability.

Cumulative Effects – Alternative 3

Cumulative effects to soils occurs at the stand or harvest unit scale. Based on field reviews, the existing monitoring data, and an assessment of existing detrimental soil conditions in the young-growth stands where activities are proposed, no young-growth or old-growth harvest stands are expected to exceed the 15 percent threshold for detrimental soil conditions.

Soils detrimentally impacted by past actions (about 584 acres) will continue to slowly recover over decades and centuries (includes past landslides existing temporary roads and soil conditions in harvest units). Landslides associated with past harvest and existing roads will result in an estimated 6.6 acres of new landslides over the next 20 years.

Alternative 3 will increase detrimental soil conditions by 328 acres as described above, some of which occurs on FS lands that may be subject to AMHT acquisition. If all available productive old-growth within the AMHT parcel were logged and roaded there would be an estimated additional 373 acres of detrimental soil conditions due to soil conditions within harvest units, temporary roads, and landslides.

Cumulatively at the project area scale, including potential harvest of AMHT lands, detrimental soil conditions would total about 1,292 acres on the project area (NFS and non-NFS lands).

Alternative 4

Direct and Indirect Effects

Application of the 2016 Forest Plan Standards and Guidelines will ensure detrimental soil conditions remain within Region 10 Soil Quality Standards in all stands where project activities are proposed. No individual stand or harvest unit is expected to exceed Region 10 Soil Quality Standards for areal extent of detrimental soil conditions.

Implementation of Alternative 2 would result in detrimental soil conditions increasing by an estimated 349 acres across the project area (includes temporary roads, soil conditions in harvest units and management related landslides over the next 20 years).

Based on field reviews 150 acres of old-growth on slopes over 72 percent gradient are suitable for timber harvest.

Based on available information, about 0.9 miles of road is proposed for construction on slopes over 67 percent gradient. The overlay of roads and slopes in GIS indicates that the 0.91 miles of road occurs on approximately 45 segments, indicating an average segment length of 107 feet proposed on slopes over 67 percent gradient. The proposed road segments greater than 67 percent gradient will be reviewed prior to implementation to ensure that the road locations on steep slopes are avoided to the extent practicable and appropriate mitigation measures are applied to protect slope stability.

Cumulative Effects

Cumulative effects to soils occur at the stand or harvest unit scale. Based on field reviews, existing monitoring data, and an assessment of existing detrimental soil conditions in the young-growth stands where activities are proposed, no young-growth or old-growth harvest stands are expected to exceed the 15 percent threshold for detrimental soil conditions.

Soils detrimentally impacted by past actions (about 584 acres) will continue to slowly recover over decades and centuries (includes past landslides existing temporary roads and soil conditions in harvest units). Landslides associated with past harvest and existing roads will result in an estimated 6.6 acres of new landslides over the next 20 years.

Alternative 4 will increase detrimental soil conditions by 349 acres as described above, some of which occurs on FS lands that may be subject to AMHT acquisition. If all available productive old-growth within the AMHT parcel were logged and roaded there would be an estimated additional 371 acres of detrimental soil conditions due to soil conditions within harvest units, temporary roads and landslides.

Cumulatively at the project area scale, including potential harvest of AMHT lands, detrimental soil conditions would total about 1,311 acres on the project area (NFS and non-NFS lands).

Wetlands

This section discusses the potential effects to wetlands in the project area. The objectives of wetland management for this project include conducting land management activities so that loss of wetland functions and values caused by harvest, road construction, and recreation development are avoided or minimized avoided whenever practicable.

The 15 Federal Baseline Provisions (33 CFR 323) and State Approved BMPs are used to avoid and minimize impacts to wetlands. The road and unit cards incorporate 2016 Forest Plan direction for activities occurring in wetlands.

Recreation site developments and other developments not subject to the silvicultural exemption must go through the Army Corps of Engineers (Clean Water Act Section 404) permitting process. The permitting process provides further assurance that wetland impacts would be minimized or avoided.

Resource Indicators and Measures

Table 93 includes the wetland indicators and measures used to analyze effects to wetland function or reduction in wetland extent by proposed activities. Wetland extent can be reduced by the placement of fill in wetlands or other physical modification of wetlands and wetland functions can be affected by cutting the vegetation.

Table 93. Resource indicators and measures for assessing effects to wetlands

Resource Element	Resource Indicator	Measure	Source
Wetland extent	Wetlands lost due to roads, trails, recreation sites, mines or other developments	Acres of wetlands impacted by roads, trails, recreation sites and other developments	Forest Plan Standards, Executive Order 11990, 33 CFR 323
Wetland function	Wetlands impacted by timber harvest	Acres of wetlands impacted by timber harvest	Forest Plan Standards, Executive Order 11990, 33CFR 323

Methodology

Effects to wetlands will be assessed by overlaying the National Wetlands Inventory layer with existing and proposed activities. The acres of wetlands impacted by existing and proposed roads, trails, recreation sites, mines, timber harvest and other activities will be estimated. Monitoring data and literature will be used to describe the effects the various activities on wetland function.

Information Sources

To estimate effects to wetlands, research and Forest Plan monitoring data will be used, specifically, Glaser 1999, Kahklen and Moll 1999 and McGee 2000, Landwehr 2011, Reynolds and Landwehr 2019.

Incomplete and Unavailable Information

The shoreline used for the project area does not match the shoreline in the National Wetlands Inventory data. Therefore, project area acres for wetland analyses may not match those identified for other resources.

Spatial and Temporal Context for Effects Analysis

The spatial analysis area for the affected environment and direct, indirect, and cumulative effects is the same as the project area since wetlands are extensive on the project area and all wetland effects are expected to be within the project's boundary. The temporal bounds of the cumulative effects analysis include all existing wetland disturbances since the beginning of land management in the project area to the reasonably foreseeable future. Past, present, and reasonably foreseeable projects are described in more detail in appendix C of this EIS.

Affected Environment

Wetland Characterization

Wetlands are defined as "those areas that are inundated or saturated by surface water or groundwater with a frequency and duration to support, and under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions." (40 CFR 230.41 (a)(1). Wetlands are valued for their physical, chemical, and biological functions. Wetlands moderate flooding, reduce runoff and sedimentation, provide wildlife and plant habitat, and may help sustain stream flows during dry periods. Physical functions may include flood conveyance, surface and ground water regulation, sediment retention, and temperature moderation. Chemical functions include nutrient storage, pH moderation, and carbon storage. Biological functions include habitat for terrestrial, aquatic, and marine plants and animals. Forested wetlands are an important component of the forest land base.

Wetlands have been affected by past timber harvest and associated activities (road construction and rock pit development), as well as recreation developments, hydropower, and mineral developments. Stream restoration has had negligible effects on wetlands and in some instances has enhanced wetland habitats and functions.

Due to the extensive nature of wetlands on the South Revilla Project Area, wetland avoidance was not entirely feasible during past road planning and construction activities. Some areas of forested wetlands are valued for timber products and have been harvested.

The National Wetlands Inventory (Cowardin 1979) was used to identify wetland types on the project areas. An explanation of the different wetland types can be found in Cowardin (1979) and in the 2016 Forest Plan Amendment FEIS (USDA Forest Service 2016c, pages 3-89 to 3-92).

Existing Condition

Most wetlands on the project area are in an undisturbed condition. Past timber harvest (timber sales and the powerline corridor) and road construction have affected some wetlands. Table 94 summarizes the types of wetlands on the project area and the past impacts to each type of wetland.

Table 94. Wetland acres and existing wetland disturbances by wetland type in the South Revilla Project Area

Wetland type	Total Acres (% of project area)	Acres Harvested (all ownerships) (% of type harvested)	Acres disturbed by roads, rock pits and other developments (% of type disturbed)
Estuary	78 (0.2%)	23 (29.5%)	0 (0%)
Palustrine emergent	2,299 (5.1%)	80 (3.5%)	38 (1.7%)
Palustrine forested	16,883 (37.7%)	2,242 (13.3%)	344 (2.0%)
Palustrine Scrub-Shrub	943 (2.1%)	70 (7.4%)	16 (1.7%)
Riverine	1	1 (100%)	0 (0%)
Lakes and Ponds	529 (1.2%)	0(0%)	0 (0%)
Uplands	24,031 (53.7%)	10,289 (42.8%)	570 (2.4%)
Totals	44,764	12,705 (28.4%)	968 (2.2%)

Notes: Roaded acres based on a 40 foot wide road corridor and associated landings and rock pits. Totals may not match due to rounding and the use of the NWI shoreline. Harvest acres shown on palustrine emergent and palustrine scrub/shrub occurred on forested wetland complexes or inclusions in those groups.

About 14 percent of palustrine forested wetlands (2416 acres, all ownerships) have experienced timber harvest. In areas of timber harvest changes to wetland hydrology may occur until vegetation regenerates and provides interception and evapotranspiration surfaces similar to pre-harvest conditions. Based on past regeneration surveys the changed hydrologic conditions are expected to be temporary and the forested wetlands sites are expected to regenerate naturally. Due to high water tables woody vegetation tends to grow more slowly in wetlands than in adjacent upland areas. Vegetation on forested wetland harvested in the past would continue to grow toward hydrologic maturity (many stands have already reached this age).

About 398 acres of wetland have been converted to road surfaces, ditches and fill slopes and other hardened surfaces in the project area. Wetlands impacted by roads in the past will continue to be impacted. Vegetation will occupy ditch lines and in the case of closed roads, the roadbed may be occupied by red alder or other vegetation. The road prism would remain in an upland condition. Road ditches, where present, support a variety of upland and wetland vegetation depending on local conditions and seed sources.

Road construction covers wetlands with road fill and hillslope hydrologic connectivity can be lost due to road ditches and fills. Impacts to wetland hydrologic function is typically limited to a few meters on either side of the road corridor as long as proper drainage structures are installed to ensure hydrologic connectivity is maintained (USDA Forest Service, 2016c pages 3-93 and 3-94). The existing Loran station is located on wetlands and occupies about 2 acres of palustrine scrub/shrub and palustrine emergent wetlands.

Wetland Avoidance

A key requirement of wetland management on federal lands is wetland avoidance to the extent practicable. Based on the data provided in table 94, about 46 percent of the project area is wetland and about 41 percent of the existing roads are constructed on wetlands. Table 94 data also shows 81 percent of past harvest has been on upland sites. Often roads must cross wetlands to get to timber stands on upland soils on the project area. Given that wetlands are well interspersed with uplands on the project area, the numbers indicate past road construction has avoided wetlands to the extent practicable.

Environmental Consequences

Direct and Indirect Effects Common to all Action Alternatives

All action alternatives propose some level of timber harvest and road construction on forested wetlands. The effects of timber harvest (primarily increased soil moisture levels) on forested wetlands are expected to be temporary. All harvested sites are expected to regenerate naturally based on decades of regeneration surveys. Trees are expected to grow more slowly on wetland sites. No new effects to wetlands from young-growth harvest are anticipated unless new road construction is needed, which is analyzed as part of the effects of road building.

The effects of road building on wetlands varies based on the substrate (soil type) and the landscape position of the wetland. Regardless of the type and location, road construction on wetlands results in a loss of wetland acreage. Based on research and monitoring conducted on the Tongass National Forest, hydrologic effects beyond the disturbed soil (road) corridor are expected to be limited to within a few meters of the road (Glaser 1999, Kahklen and Moll 1999, McGee 2000, and Landwehr 2011).

Due to the preponderance of wetlands and the interspersed nature of wetlands with uplands on the project area, complete avoidance of wetlands from proposed road construction activities is not practicable. All proposed roads would be constructed according to State-approved BMPs as required by 33 CFR 323. All roads through wetlands would also follow the 15 baseline provisions provided in 33 CFR 323.

All action alternatives propose development of nine recreation sites near Saddle Lakes along the State road right-of-way (Ketchikan to Shelter Cove Road) (appendix D – recreation master plan). Seven of the nine recreation developments will result in gravel fill placed in wetland and upland areas. The effects of gravel fill on wetlands are similar to those described for roads and result in a loss of wetland acreage. The recreation facilities developed in wetlands will be subject to the Clean Water Act 404 permitting process, which will ensure effects to wetlands will be minimized. The development of all of the recreation sites combined is expected to impact less than 1 acre of palustrine forested and palustrine emergent wetlands.

Direct and Indirect Effects of the Alternatives

Alternative 1 – No Action

Direct and Indirect Effects

No timber harvest road construction or other activities would be implemented by the South Revilla Project decision, therefore no wetlands would be impacted under Alternative 1.

Cumulative Effects

Since no wetlands are impacted under Alternative 1 there are no cumulative effects to wetlands on NFS lands.

If lands are transferred to AMHT and all available productive old-growth logged, an estimated 1,519 acres of forested wetlands could be logged, and an additional 116 acres of wetlands could be lost due to road construction and rock pit development needed to access the timber. The effects are described above.

Open, drivable roads in the project area would continue to receive incidental use by recreation visitors. Vegetation would grow in ditch lines of all roads and on closed roads vegetation may occupy the roadway. The opening of the Ketchikan to Shelter Cove road from Ward Cove will likely bring more traffic to roads on the Shelter Cove side (west side) of the project area.

Road maintenance will continue to occur on open roads on the project area, with negligible impacts to wetlands. Powerline maintenance will also continue and have negligible impacts to wetlands.

Alternative 2 – Proposed Action

Direct and Indirect Effects

A description of the direct and indirect effects to wetlands are described in the effects common to all action alternatives. Alternative 2 proposes to harvest old-growth timber from 2,109 acres of forested wetlands. Road construction and recreation developments under this alternative would convert about 168 acres of wetlands to road.

Cumulative Effects

Cumulative effects to wetlands from reasonably foreseeable actions are described in Alternative 1 and, following implementation of Alternative 2, cumulative timber harvest from all past present and reasonably foreseeable future actions would impact approximately 4,525 acres of forested wetlands on the project area.

Cumulatively roads, recreation sites and other hardened surfaces would occupy an estimated 568 acres of wetlands. The effects are described in effects common to all alternatives.

If the AMHT land exchange parcel is transferred to AMHT ownership and all productive old-growth on the parcel is roaded and logged, an additional 98 acres of wetlands could be lost to road construction and 1,288 acres of forested wetlands would be temporarily altered by timber harvest.

Alternative 3

Direct and Indirect Effects

A description of the direct and indirect effects to wetlands are described in the effects common to all action alternatives. Alternative 3 proposes to harvest old-growth timber from 1,811 acres of forested wetlands. Road construction and recreation developments under this alternative would convert about 154 acres of wetlands to road.

Cumulative Effects

Cumulative effects to wetlands from reasonably foreseeable actions are described in Alternative 1 and, following implementation of Alternative 3, cumulative timber harvest from all past present and reasonably foreseeable future actions would impact approximately 4,227 acres of forested wetlands on the project area.

Cumulatively roads, recreation sites and other hardened surfaces would occupy an estimated 554 acres of wetlands. The effects are described in effects common to all alternatives.

If the AMHT land exchange parcel is transferred to AMHT ownership and all productive old-growth on the parcel roaded and logged, an additional 99 acres of wetlands could be lost to road construction and 1,293 acres of forested wetlands would be temporarily altered by timber harvest.

Alternative 4

Direct and Indirect Effects

A description of the direct and indirect effects to wetlands are described in the effects common to all action alternatives. Alternative 4 proposes to harvest old-growth timber from 2,109 acres of forested wetlands. Road construction and recreation developments under this alternative would convert about 159 acres of wetlands to road.

Cumulative Effects

Cumulative effects to wetlands from reasonably foreseeable actions are described in Alternative 1 and, following implementation of Alternative 4, cumulative timber harvest from all past present and reasonably foreseeable future actions would impact approximately 4,525 acres of forested wetlands on the project area.

Cumulatively roads, recreation sites and other hardened surfaces would occupy an estimated 559 acres of wetlands. The effects are described in effects common to all alternatives.

If the AMHT land exchange parcel is transferred to AMHT ownership and all productive old-growth on the parcel roaded and logged an additional 98 acres of wetlands could be lost to road construction and 1,288 acres of forested wetlands would be temporarily altered by timber harvest.

Heritage

Heritage (or cultural) resources represent the tangible and intangible evidence of human behavior and past human occupation. These resources may consist of archaeological sites, historic-age buildings and structures, and traditional use areas and cultural places important to a group's traditional beliefs, religion, or cultural practices. These types of resources are finite and nonrenewable with few exceptions. For activities on federal lands, requirements and procedures for identifying, evaluating, and mitigating effects to cultural resources have been identified within the National Historic Preservation Act (NHPA). Historic properties are those heritage (cultural) resources that have been evaluated against the National Register of Historic Places (NRHP) significance criteria found at 36 CFR 60.4 and determined historically significant and worthy of preservation.

Methodology

Ground-disturbing activities (i.e. road construction, timber harvest, recreation development, watershed restoration) that have been identified in Alternatives 2, 3, and 4 have the potential to affect historic properties or traditional cultural properties located within the project's area of potential effect (APE). The Forest Service has an existing programmatic agreement with the Alaska State Historic Preservation Office (SHPO) that allows for streamlining of the NHPA Section 106 process (more information on this document is provided below).

Analysis to date of the project's effects on heritage resources consisted of:

- Definition of the Area of Potential Effect (APE).
- Review of the Ketchikan Misty Fjords Ranger District archaeological site files, previous surveys, and atlases, Forest Service National Heritage Data Base, literature search and through tribal consultation.
- Plotting and analysis of previously identified archaeological sites and previously conducted surveys in GIS against two aspects of the high probability zone:
    - ♦ All lands, regardless of slope, from Mean High Water (MHW) to 100 feet in elevation above MHW are considered to be in the high probability zone.
    - ♦ Lakes and stream systems containing, or known to have contained, anadromous fish runs.

Known archaeological sites and the high probability zones were analyzed using GIS and cross-referencing proposed project locations. This approach is used to identify potential impacts to known cultural resources, identify future archaeological survey needs, and to determine whether or not the NHPA Section 106 process can be undertaken through the Alaska Region Programmatic Agreement. It is anticipated that some proposed activities will occur within this high probability zone and on or near known site locations.

NHPA Section 106 analysis that remains to be completed include:

- Additional fieldwork consisting of pedestrian survey to assess potential effects to historic properties.
- Development of mitigation and monitoring measures (if needed).
- SHPO and Tribal consultation

The findings of the analysis done to date for the entire Area of Potential Effect (APE) are described below. The Forest Service will continue fieldwork to identify and evaluate unknown heritage resources. Once a cultural resource inventory has been completed, the Forest Service will consult with the Alaska State Historic Preservation Office (SHPO), the Advisory Council on Historic Preservation (ACHP), Federally-recognized Tribal Governments, and other interested parties. Implementation of proposed activities will not occur until the Section 106 process is complete.

Past and Current Archaeological Surveys

Until the late 1970s, few cultural resource surveys had been conducted in the areas around Carroll Inlet and George Inlet areas. To date, there have been twenty-two (22) surveys conducted in or within 5 miles of the APE for the proposed South Revilla Project area. Three (3) surveys were conducted by private contractors and were related to the Swan Lake Hydroelectric Project (Ackerman & Shaw 1978), the Swan Lake-Lake Tyee Intertie Project (Greiser 1997) and the Mahoney Lake Hydroelectric Project (Campbell 1997). All of the other surveys were conducted by US Forest Service archaeologists. Fifteen of these surveys were conducted within or very near the proposed South Revilla Project APE. Approximately 2,660 acres have been surveyed within the project area and 3,052 acres have been previously surveyed within the APE for the proposed project. These cultural resource surveys were all completed to clear locations for previous timber sales, including timber harvest units, gravel pits, roads, bridges, and Log Transfer Facilities (LTFs). In all cases, no sites eligible for or listed on the National Register of Historic Properties were found to be located within the project areas and clearance was recommended. The SHPO concurred in all cases.

Heritage Resources in the Project Area

As a result of the above surveys, a total of 77 Alaska Heritage Resource Sites (AHRS) were identified in or within five miles of the APE for the propose South Revilla Project.

No AHRS sites or “Historic Properties” will be affected by any of the proposed activities for the project.

Thirty-three (33) other AHRS sites are located within 5 miles (8.0 km) of the APE and will also not be affected by the proposed project.

Environmental Consequences

Legal and Regulatory Compliance

While numerous federal laws and executive orders are in place that address historic preservation and tribal consultation on federal lands, the National Historic Preservation Act (NHPA) of 1966, as amended sets the legal framework for heritage resource management on Federal system lands. NHPA Section 106 directs all Federal agencies to take into account the effects of their undertakings (actions, financial support, and authorizations) on properties included in or eligible for the NRHP. Advisory Council on Historic Preservation regulations at 36 CFR 800 implement NHPA Section 106, and these regulations contain the definitions used to determine the potential effect, if any, any given undertaking will have on cultural resources.

Other laws under which heritage resource management must comply include the Native American Graves Protection and Repatriation Act (NAGPRA), the Archeological Resources Protection Act (ARPA), the American Indian Religious Freedom Act (AIRFA), National Environmental Policy Act (NEPA), and National Forest Management Act (NFMA). Executive Orders and Memorandum include 1994 Government-to-Government Relations with Native American Tribal Governments, EO 13007 Accommodations of Sacred Sites, and EO 12898 Environmental Justice as directed by the Forest Service Manual and Handbook.

The Area of Potential Effect (APE) for a given project is defined as "… the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties… The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking." [36 CFR 800.16(d)]. An Effect to a cultural resource is defined as "…alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register." [36 CFR 800.16(i)]. An Adverse Effect is found "when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association."[36 CFR 800.5(a)(1); see subsection (a)(2)]. Effects to cultural resources may be either Direct or Indirect.

Forest Service Manual 2360 and Forest Service Handbooks 1509 and 2309 outline implementation of 36 CFR 800, providing the foundation for agency policy and procedures. Forest Service Manual 2364.02 lists as the first three objectives for the protection and stewardship of Heritage resources:

1. Protect cultural resources in a manner consistent with their National Register qualities and management allocations.
2. Avoid or minimize the effects of Forest Service or Forest Service-authorized land use decisions and management activities on cultural resources.
3. Safeguard cultural resources on National Forest System lands from unauthorized or improper uses and environmental degradation.

In accordance with 36 CFR 800.14(b)(2), federal agencies have the option to pursue "Program Programmatic Agreements", which allow the agency to create a Section 106 process that differs from the standard review process and that will apply to all undertakings under a particular program. These agreements are typically used by agencies with programs that have undertakings with similar or repetitive effects on historic properties in order to avoid the need for a separate Section 106 review for each project. Long-term consultation with SHPO and Alaska Region policy has resulted in the *Programmatic Agreement Among the USDA Forest Service, Alaska Region, the Advisory Council on Historic Preservation, and the Alaska State Historic Preservation Officer Regarding Heritage Program Management on National Forest in the State of Alaska 2017,* signed July 10, 2017 (Alaska Region PA).

NHPA Section 106 Process Implementation

The Forest Service plans to use a phased approach to the Section 106 process for this EIS, meaning that any site-specific projects associated with this EIS that will require Section 106 review. Government-to-government tribal consultation will also continue to occur on a project-by-project basis. Because the project's APE covers a large area and the exact location of some proposed activities are yet to be developed, Section II.a.ii (Coordination with NEPA) and Section II.a.iv (Phased Identification and Evaluation) of the R10 PA (USFS 2017) shall be followed for the purposes of fulfilling the Section 106 requirements.

The Record of Decision (ROD) shall document that 36 CFR 800.4(b)(2) procedures are being followed and that Section 106 procedures are not concluded with the signing of the ROD. Each undertaking, when identified on the ground, will require a Heritage Specialist to apply criteria from the current Programmatic Agreement to determine whether a streamlined approach to Section 106 is appropriate for that undertaking. If a Heritage Specialist determines that a streamlined approach to Section 106 is inadequate for the purposes of the undertaking, Standard Section 106 procedures will be applied and the SHPO shall be consulted. A project area may require additional survey if a past survey does not meet current standards as described in Appendix D of the 2017 Programmatic Agreement. If, at any time, it is determined that an activity will have an adverse effect on historic properties, the SHPO, and potentially the ACHP, shall be consulted, and an agreement document may be prepared to mitigate those effects.

Alternative 1 (No Action)

Direct and Indirect Effects

The No Action Alternative consists of no change in current management. Archeological sites located within the project area will continue to be affected by natural processes (i.e. erosion) and some recreation and subsistence activities. Since these types of activities are already taking place within the project area, the extent and scope of adverse effects of these activities to archaeological sites is unknown. Opportunities for interpretative development and/or stabilization will not occur.

Cumulative Effects

Implementing the no action alternative would not contribute to cumulative effects to cultural resources because no ground disturbing activities or modifications to the built environment would occur.

Alternatives 2, 3, and 4

Direct and Indirect Effects

With respect to the South Revilla project, direct effects are those that will occur during project implementation. The potential for adverse impacts of the proposed activities on significant cultural resources relates directly to the level of development (i.e. roads and landings, road construction, recreation site development and use, etc.) and other ground disturbing activities existing and proposed within the project area. Projects requiring new ground disturbance or associated with existing structures (i.e. cabins), by definition, have the potential to adversely affect significant cultural resources.

In general, the direct effects on the cultural resources of the various activities that are proposed for this project are expected to be as follows:

1. In those project areas where no historic properties (archaeological sites meeting NRHP eligibility criteria located in 36 CFR 60.4) are present, proposed project activities have **No Potential to Affect** historic properties.
2. In those project areas in which ground disturbing activities would be carried out, where historic and/or cultural resources unevaluated against the NRHP eligibility criteria are present, and where Site Avoidance is feasible and is implemented, the proposed project activities are expected to have **No Effect** on cultural resources.
3. Where archaeological sites occur where site avoidance is not feasible, the Forest may use any of the mitigation measures described below and develop a mitigation plan that will result in a finding of **No Adverse Effect** on historic properties.
4. Where proposed activities are located within historic property boundaries that cannot avoid or be mitigated, thus causing an **Adverse Effect to Historic Properties**, the forest archaeologist will consult with SHPO, interested Alaskan tribes/organizations, and potentially the Advisory Council for Historic Preservation (ACHP) to prepare either a project-specific Memorandum of Agreement or Programmatic Agreement to mitigate those effects.

In general, project activities of the kind proposed for this project have the potential to indirectly affect cultural resources by opening up areas of the forest in which cultural resources are located to increased visitor use. Increased visitor use of an area in which cultural resources are located can render the sites vulnerable to both intentional, as well as unintentional, damage. Intentional damage can occur through the unauthorized digging in archaeological sites and unauthorized collecting of artifacts from sites. Unintentional damage can result from such activities as driving motorized vehicles across archaeological sites, as well as from other activities that disturb the ground during dispersed recreational use. Site avoidance is the preferred mitigation action pursuant to the Tongass Forest Plan. However, in situations where site avoidance is not feasible, other mitigation measures (such as, but not limited to modification of design features, restriction of proposed activities to existing road/trail prisms, or installation of boulders or barriers to limit visitor access) can be implemented that limit visitor access to archeological sites. With application of appropriate mitigation, it is not expected that the proposed project activities will increase visitor use in those areas in which archaeological sites are located. Therefore, it is not expected that implementation of the proposed activities will have indirect effects on historic properties.

Although the cultural resource surveys completed for this project are designed to identify all archaeological sites within the project area that might be eligible for the National Register, such sites may go undetected for a variety of reasons. Pursuant to the provisions found in 36 CFR 800.13, should any previously unidentified cultural resources be discovered during project implementation, activities that may be affecting that resource will be halted immediately. The resource will be evaluated by a professional archaeologist, and consultation will be initiated with the Alaska State Historic Preservation Office, as well as the Advisory Council on Historic Preservation (if required), to determine appropriate actions for protecting the resource and for mitigating any adverse effects on the resource. Project activities will not be resumed until the resource is adequately protected and until agreed-upon mitigation measures are implemented with SHPO concurrence.

Cumulative Effects

The catalog of events (appendix C) provides information on where past, ongoing and future ground disturbing projects are located in the project area. Site condition assessments for heritage resources located on the Tongass National Forest are not available for any time prior to the archaeological investigations in the early 20th century. For this reason, the original condition of most of the heritage resources on the Forest is not known, although some level of effect is assumed to have contributed to the current condition of all archeological sites on the Forest. Most of the cultural resources on federal system lands were not even recorded to professional standards until the early 1990s. Given the nonrenewable nature of heritage resources (both prehistoric and historic), any portion of a given site that is damaged or removed diminishes the site's overall cultural and scientific value permanently. Therefore, all effects to heritage resources are considered cumulative. It is expected that selection of any of the action alternatives would result in no change in condition of the heritage resources over their present condition.

While Section 106 consultation will be concluded after the signing of the decision document, some conclusions can be made about cumulative adverse effects on cultural resources, which may be unavoidable, but are allowable with mitigation under the NHPA. The loss or damage to historic properties and cultural resources through these unavoidable effects will change the archaeological record and affects our ability to fully interpret the past. Adverse effects to pre-European contact sites impacts our capacity to understand the complexity of the northern northwest coast cultural identity. The loss is irreversible and impacts the legacy of our tribal partners. Removing or changing the integrity of historic structures, like cabins and trails, affects the recreating public who, in general, appreciate historical sites and accompanying information, which adds to visitor experiences.

Air Quality and Climate Change

The affected environments for Climate, Climate Change and Air Quality are described in detail in the 2016 Forest Plan amendment FEIS (pp. 3-11 to 3-19).

Air quality and climate change are related issues that are often separated in politics and research. Both issues are addressed for the Tongass National Forest in the 2016 Forest Plan amendment FEIS (USDA Forest Service 2016c). This section describes climatic change and air quality specifically for the South Revilla Project. The spatial scale for this project is the project area, for which the conditions are considered similar to the Tongass National Forest. How carbon storage, carbon sequestration, timber harvest, vegetative regrowth and carbon emissions interact over time is very complex, making it unrealistic to define a temporal scope of analysis.

Affected Environment

Air Quality

Air quality in the project area is regarded as generally very good. Considering the prevailing winds off of the Pacific Ocean, the small size of the human population in the project area, the low levels of industrial development, and the apparent lack of large-scale wildland fire smoke emissions, there are not many long-term or large-scale air pollutant sources in the project area. However, temporary localized air pollution does occur in the form of marine vessel emissions, vehicle and diesel power emissions, wood smoke, incinerators or refuse burning, and dust from vehicle traffic on unpaved roads.

To determine if national and state ambient air quality standards are being met, we once conducted annual review of Environmental Protection Agency (EPA) and Alaska Department of Environmental Conservation (ADEC) reports level. Due to changes in the monitoring program of the Forest Service, air quality is not analyzed or considered on an annual basis. However, currently there are no non-attainment areas[8] in the project area. Air quality is monitored in two of the four wildernesses in the project area every 10 years. Lichens are considered the sensitive indicators of air quality in wilderness for 26 air pollutants including sulfur, nitrogen and heavy metals (K. Dillman 2016a).

Climate Change

Climate is important to local ecosystems as well as human health and infrastructure, since temperature, precipitation, wind speed, and metrological events (for example, timing of the first and last frosts, or severe storms causing flooding) all influence the distribution of water, soil, plants, and wildlife across the project area. Significant, lasting change to existing and historical weather patterns is commonly called "climate change". Impacts of climate change include increases in prolonged periods of high temperatures, heavier precipitation, increases in wildfire frequency and size, increase in severity of drought, ocean rise, and ocean acidification. The term "greenhouse gases" refers to a variety of gases in the Earth's atmosphere that react with sunlight in a way that influences global air temperature. Greenhouse gases are a function of air quality and include carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (EO 13514).

Long-term climate trends and decadal climate cycles have always occurred in Southeast Alaska (Neal et al. 2002). There is a growing body of literature on the topic of climate change and the likely effects on aquatic and terrestrial ecosystems of the Tongass National Forest (see the 2016 Forest Plan amendment

[8] In United States environmental law, a non-attainment area is an area considered to have air quality worse than the National Ambient Air Quality Standards as defined in the Clean Air Act Amendments of 1970 (P.L. 91-604, Sec. 109).

FEIS for detailed discussion). Melting glaciers and shifts from snow-dominated to more rain-dominated hydrology will impact terrestrial and aquatic resources in both adverse and beneficial ways (Littell, McAffee and Hayward 2018; Schoen et al. 2017).

Carbon Sequestration

Atmospheric carbon, as well as other gases (for example, methane, nitrous oxide, and water molecules) trap the sun's heat to create the natural "greenhouse effect" which makes life possible on Earth (McPherson and Simpson 1999). The balance of carbon dioxide in the atmosphere is regulated by complex interactions between the atmosphere, terrestrial environment, marine environment, and geologic processes. Forest ecosystems, such as those managed on the Tongass National Forest, represent a large terrestrial sink for carbon, such that the United Nations Framework Convention on Climate Change has recognized forest management as an effective strategy for off-setting greenhouse gas emissions (Wilson et al. 2013). A widely recognized ecosystem service provided by the Tongass is carbon flux regulation.

The relationship between timber harvests, reforestation, wood building materials, and the net storage of carbon is complicated. For example: carbon is stored in building materials, but the storage value does not last as long as a living old-growth tree, as carbon stored in buildings generally outlives its usefulness or is replaced within decades (Law et al. 2018). When considering land management practices that mitigate the loss of carbon, reforestation contributes the most to carbon sequestered, followed by reduced timber harvest practices (Law et al. 2018). For more details on carbon sequestration see the 2016 Forest Plan amendment FEIS (USDA Forest Service 2016c, pp. 3-13 to 16).

Environmental Effects

Analysis of the effects of climate and air resources is qualitative, comparing differences in the amount of old- and young-growth timber harvest as well as road building activities between alternatives. A qualitative discussion of air pollution sources, greenhouse gas emissions, and carbon sequestration was taken for disclosing air pollution and climate change implications. This qualitative discussion includes an evaluation of how climate change may modify conditions in the project area and how the proposed actions may influence levels of greenhouse gases and therefore, climate change. Although most Forest Service projects are considered unmeasurable in terms of global carbon flux, this qualitative comparison of alternatives provides insight into how proposed actions for each alternative could impact the carbon flux.

Air Quality

All action alternatives considered for the South Revilla Project DEIS would involve harvesting of varied wood products including firewood, development of recreation sites, watershed and wildlife habitat improvement projects over a period of time, as described in Chapter 2. For the South Revilla Project, the action Alternatives 2, 3 and 4, as well as the no action Alternative 1, all result in a net release of air pollution into the atmosphere through varying amounts of road maintenance and construction, timber harvest, use of vehicles of all kinds, recreation development and use, and other land management actions. Some proposed activities involve removing vegetation, grading and contouring the ground, hardening roads, extraction of materials such as gravel, soil, rock, and minerals, and constructing bridges, all of which require fuel-burning construction machinery and an increase in construction related vehicle traffic for the next 15-year period. All these construction activities would increase greenhouse gases and other fossil fuel combustion emissions, airborne dust, and particulate matter from wood burning.

The expected direct effects on air quality from proposed activities would be minimal (temporary and limited in location). Effects may be dust, smoke, and vehicular emissions as described above from logging operations, administrative, and recreational use of Forest roads. However, due to the short-lived nature of these activities coupled with the dynamic weather patterns throughout Southeast Alaska continually circulating airsheds within the project area (wind and rain throughout the year), no significant adverse effects on air quality are anticipated from these activities under any of the alternatives considered.

Indirect effects on air quality conditions could result from the use of the harvested trees for operating industrial processing sites, firewood burning, as well as emissions and dust from the private vehicles using unpaved roads. These indirect effects can be aesthetically displeasing, or have potential health risks to both humans and ecosystems of the forest. The periodic monitoring of lichens in sensitive ecosystems in wilderness help determine if non-wilderness pollution emissions are impacting wilderness air quality. Additionally the EPA and the Alaska Department of Environmental Conservation have regulatory responsibility under the Clean Air Act to manage emissions from permanent point sources. The enforcement of the applicable regulations by these agencies is anticipated to keep any potential adverse effects within the standards for air quality; therefore, no significant indirect effects are expected to occur in either South Revilla Project action alternative from activities such as timber harvesting.

Climate Change

All of the action alternatives involve old-growth and young-growth timber harvest along with road construction which would result in a net release of greenhouse gases and other pollutants into the atmosphere through varying amounts of road construction, timber harvest, use of administrative vehicles of all kinds, mining, recreation development and use, and other land management actions. Some proposed activities involve removing vegetation, grading and contouring the ground, hardening roads, extraction of materials such as gravel, soil, and rock, and the construction of bridges, all of which require fossil fuel-burning machinery and an increase in construction vehicle traffic for the next 15-year period. All these construction activities would increase greenhouse gases and other fossil fuel combustion emissions.

Effects of timber harvest and roads in Alternatives 2, 3 and 4 combined with effects of climate change could exacerbate adverse effects of peak streamflow increases on aquatic resources.

Restoration actions in Alternatives 2, 3 and 4 that improve watershed condition also increase resiliency to climate change effects by restoring stream, floodplain, and riparian function and reducing aquatic habitat fragmentation. Under Alternative 1, restoration actions would continue as authorized through past NEPA decisions, and into the future at a slower pace through individual project NEPA decisions.

Roadless Area Conservation Rule Inventoried Roadless Areas

The Roadless Area Conservation Rule (2001 Roadless Rule) identified undeveloped areas, typically exceeding 5,000 acres, which met the minimum criteria for wilderness consideration under the Wilderness Act and were inventoried during the Forest Service's Roadless Area Review and Evaluation (RARE II) process, subsequent assessments, or Forest Planning (58.5 million acres nationwide), and established prohibitions on road construction, road reconstruction, and timber harvesting on these inventoried roadless areas (IRAs). The intent of the 2001 Roadless Rule is to provide lasting protection for these IRAs within the National Forest System in the context of multiple-use management.

The Tongass National Forest completed a Supplemental Environmental Impact Statement (2003) for the 1997 Forest Plan revision to consider whether IRAs on the Tongass should be recommended for Wilderness designation. The assessment looked at potential impacts to the unique or outstanding biological, physical, or social values of the IRAs. Currently, about 9.2 million acres (55 percent) of the Tongass National Forest are in designated IRAs under the 2001 Roadless Rule.

The Tongass National Forest, and therefore the South Revilla Project, currently uses the IRAs identified on the maps associated with the 2001 Roadless Rule (USDA Roadless Area Conservation Rule, Final EIS, Volume 2, dated November 2000). These maps identify a portion of one IRA (#526) within the South Revilla project area.

In January 2018, the State of Alaska petitioned the Secretary of Agriculture to exempt the Tongass National Forest from the 2001 Roadless Rule. In response to that petition, the Secretary of Agriculture directed the Forest Service to begin working on an Alaska state-specific roadless rule in June 2018, and on August 30, 2018, the Forest Service published a Notice of Intent to begin the environmental impact statement and public rulemaking process. The DEIS and proposed Alaska roadless rule (Alternative 6, which would exempt the Tongass National Forest from the 2001 Roadless Rule) were released to the public for comment in October 2019. At this time, the final Alaska roadless rule is anticipated for release in the fall of 2020.

The Alaska roadless rule EIS analyzed a wide range of alternatives – including the No-Action Alternative (Alternative 1) and the full-exemption alternative (Alternative 6). Alternatives 2 through 6 would result in an administrative change to the timber land suitability determinations made in the 2016 Forest Plan (Alaska Roadless Rule DEIS, p. 2-2). None of the alternatives would change the projected timber sale quantity (PTSQ) of an annual average of 46 million board feet identified in the 2016 Forest Plan.

If a new Alaska roadless rule is issued, it may alter or remove certain prohibitions currently applicable in IRAs under the 2001 Roadless Rule, including the IRA within the South Revilla project area, but would not authorize specific activities on the ground (Alaska Roadless Rule DEIS, p. 2- 2). The rulemaking could result in a change in the distribution of harvest across the Forest, including the South Revilla project area, but would likely not increase or decrease acres or volume actually harvested.

Although the South Revilla Project geographically includes part of an IRA (#526) that could have its suitability designation changed under the proposed Alaska roadless rule, no timber harvest in that IRA is proposed at this time. The IDT reviewed the project area to determine if harvest in the IRA could help better achieve project objectives, but due to the amount of road construction that would be needed and the low timber volume in the area, they determined that timber harvest would not be economic at this time, and that project objectives were better achieved outside of the IRA. Therefore, none of the South Revilla project alternatives propose old-growth or young-growth harvest, new roads, or road construction or reconstruction within the IRA. No direct effects on the IRA are expected from timber harvest or road construction for any of the alternatives.

Watershed improvement activities which may include some timber harvest are included in the action alternatives. The 2001 Roadless Rule provides for ecosystem health, including wildlife and fisheries habitat improvement, and includes an exception to the prohibition on cutting of generally small diameter trees if it is designed to maintain or help restore ecosystem composition or structure to conditions within the range of variability that would be expected to occur under natural disturbance regimes of the current climatic period. This will allow the agency to manage for the full range of habitat types needed to support the diversity of native and desired nonnative species (Federal Register /Vol. 66, No. 9 / Friday, January 12, 2001 /Rules and Regulations page 3257). Consistent with this provision of the 2001 Roadless Rule, potential stream and floodplain restoration work that may include riparian timber harvest for riparian treatments and instream wood placement activities are proposed in the Licking Creek area.

No indirect or incremental cumulative effects associated with the South Revilla project alternatives should adversely affect the values of the IRA within the project area. None of the alternatives would change how the IRA meets the minimum criteria for wilderness consideration.

Land Status

Land ownership within the Tongass National Forest is complex, and land ownership has been shaped by multiple public land laws including the *Alaska Native Claims Settlement Act* (ANCSA), ANILCA, *Alaska Native Allotment Act, Alaska Statehood Act, and the National Defense Authorization Act for Fiscal Year 2015 (Sealaska Finalization Act).* Over the past few years, multiple pieces of legislation have been introduced that, if enacted, may result in additional transfer of lands out of federal ownership in the project area.

The federal land within the project area is administered as National Forest System land as part of the Tongass National Forest. Other ownerships are adjacent to the project area but none are within it.

None of the action alternatives propose to acquire or dispose of any property, therefore, there would be no effect on the surface or subsurface lands, which includes minerals.

Property boundaries may need to be surveyed if an activity is proposed within one-quarter mile of a National Forest System land boundary. This would be done during implementation.

Alaska Mental Health Trust Land Exchange

On May 5, 2017, the *Consolidated Appropriations Act,* 2017, Public Law 115-31, Div. G, Section 431(a)(2) *(Alaska Mental Health Trust Land Exchange Act of 201*7 or “the Act”) was enacted and authorized an equal value land exchange between the Alaska Mental Health Trust Authority (AMHTA) and the Forest Service. Since this law has been passed, but the final transfer of lands has not been completed, the Forest Service must determine if this project has any direct, indirect, or cumulative effects that may affect the equal value of the land exchange.

The purpose of the Act was to expedite an equal value exchange between the Alaska Mental Trust Authority (AMHTA) and the Secretary of Agriculture, acting through the Forest Service, in two phases. The Forest Service and AMHTA continue to advance the second phase of the equal value land exchange. One of the major components of an equal value land exchange, is a real estate appraisal, which is pending. The Act provided for a mechanism of balance for equalizing value based on the appraised values of the Federal and Non-Federal parcels. The mechanism of balance options included prioritization of dropping parcels as identified in the Act and also a mechanism of balance for cash equalization in which no parcels would be dropped. One of the first priority parcels that would drop out of the exchange is located in Shelter Cove, partially within the project area (see figure 7 in Chapter 2). The option still remains for AMHTA to cash equalize; then the Shelter Cove parcel would be conveyed to AMHTA under the Act. Depending on the outcome of the title case at the Alaska Supreme Court regarding 3,374 acres of non-federal land and final real estate appraisal value, approximately 8,224 acres in the project area near Shelter Cove may or may not be exchanged to Alaska Mental Health Trust Authority under the Act.

Since this land exchange is not final, it is considered a “present” activity in Appendix C – Catalog of Past, Present and Reasonably Foreseeable Future Projects. Due to the uncertainty of the final disposition of the Shelter Cove parcel, all alternatives are designed as if the land remains part of the National Forest System. The disposition of this parcel should be decided before the South Revilla Project environmental impact statement and record of decision are final. If the parcel is conveyed to the AMHT, then none of the project activities proposed for this acreage would be implemented and there would be no effect to the value of the land exchange.

The effect that the land exchange may have on individual resources is included in each resource’s cumulative effects analysis.

Wild, Scenic and Recreational Rivers

The 1997 Tongass Land and Resource Management Plan recommended certain segments of rivers in the project area to Congress for inclusion in the National Wild and Scenic Rivers System. The recommended rivers and associated mileage are listed in appendix J of the 2016 Forest Plan and the associated LUDs are discussed in the 2016 Forest Plan, Chapter 3. There are none within the project area. Therefore, there are no effects to river segments managed under the wild, scenic, or recreational river classifications are expected to be negligible and no further analysis is necessary.

Short-term Uses and Long-term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

Recreation

Construction of proposed developed recreation sites and trails would convert undeveloped land into land used for developed and dispersed recreation. Any direct productivity loss would be limited to areas disturbed by and clearing, grading, and construction. Indirect effects may occur to timber production on adjacent areas if management objectives change over time. It is unlikely that proposed recreation sites would be returned to its current use and condition, so effects on soils, timber, and other uses would be permanent. Analysis of recreation sites in the South Revilla Project area estimate about 1 acre of land could be directly affected. This minimal loss of land would not adversely affect long-term productivity.

Proposed road re-opening as part of harvest activities would likely alter recreational access in the event of short-term closures of motorized trails for harvest activities; however closures would be temporary and trails reopened when harvest activities are completed.

Watershed restoration and wildlife treatments would disrupt recreational uses in areas directly impacted by proposed activities. However, in the long term, improved watershed and wildlife productivity would lead to increased recreational use.

Soils

Temporary roads are considered part of the productive land base and are considered a short-term use that affects long-term productivity. Detrimental soil conditions in harvest units are the result of a short-term use that affects long-term productivity.

Wetlands

Temporary road construction in wetlands is a short-term use that has a long-term effect on wetland productivity. Temporary roads on the project area typically are constructed from shot rock and decommissioned after harvest. Decommissioning typically involves removing structures and closing the road to vehicular traffic. The shot rock fill typically remains in place.

Unavoidable Adverse Effects

Scenery

Many of the South Revilla Integrated Resource Project activities take place in areas categorized as having very low, low, and moderate existing scenic integrity (ESI). Generally, proposed harvest would maintain the scenic integrity of the areas at the existing level or lower it a level or two. The Saddle Lakes Recreation Area viewshed has mostly very high and high ESI. Harvest proposed under Alternatives 2 and 3 would change the scenic integrity of the viewshed to very low. This reduction of scenic integrity is an adverse effect to the scenery of the area. The scenic integrity of the viewshed would change from one where the scenery is or appears visually intact, to one where harvest activities would dominate the viewshed (see figure 23 and figure 24 in Chapter 3).

Recreation

The re-opening of roads that are dual designated as motorized trails will result in the temporary loss of this recreation use access under all action alternatives. These effects are minor as they will only during periods of harvest activity and trail access would be restored upon completion of proposed activities.

Soils

Rock pit development and road construction are considered an unavoidable adverse effect to the soils resource while economically accessing timber.

Aquatics

Unavoidable adverse impacts to EFH associated with this project include short-term increases in sediment delivery and subsequent turbidity in streams from watershed improvement including fish passage projects, road construction and maintenance activities. Other short-term impacts include bark accumulation, leachate, and shading impacts to the marine environment near the LTF.

Heritage

There may be ground-disturbing adverse effects on cultural resources, which are unavoidable, but are allowable with mitigation under the NHPA.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road.

Recreation

The construction of new roads and pull-outs is an irreversible commitment of resources. Roads constructed into the Semi Primitive Non-Motorized ROS will result in an irretrievable commitment of semi primitive non-motorized recreation opportunities in the areas of proposed road construction.

New rock pits are and irretrievable and irreversible commitment that will permanently impact recreation resources in the area on and immediately adjacent to proposed rock pit sites. Existing recreational opportunities, such as gathering, will be lost and replaced with other recreational opportunities as a result of quarrying activities.

Soils

Conversion of productive soils to rock pits or rock roads is an irreversible commitment of the soil resource. Detrimental soil disturbances within harvest units typically result in a reduction in growth, so those areas would be considered irretrievable commitment of the soil resource.

Aquatics

This project does not propose any irreversible or irretrievable commitments of aquatic resources.

Wetlands

Road construction through wetlands and other developments that excavate surface soils or place fill in wetlands is considered an irreversible commitment of the wetland resource due to the length of time and difficulty in restoring those wetlands.

Heritage

The loss or damage to historic properties and cultural resources through unavoidable effects will change the archaeological record and affects our ability to fully interpret the past. Adverse effects to pre-European contact sites impacts our capacity to understand the complexity of the northern northwest coast cultural identity. The loss is irreversible and impacts the legacy of our tribal partners. Removing or changing the integrity of historic structures, like cabins and trails, affects the recreating public who, in general, appreciate historical sites and accompanying information, which adds to visitor experiences.

Relationship between the Short-term Use of the Environment and the Maintenance of Long-term Productivity

This section provides the tradeoffs between short-term impacts and long-term impacts to environmental resources that would occur with implementation of the proposed action. Short-term uses, and their environmental effects, are those that occur within the first 10 years following implementation. Long-term productivity refers to the capability of the land and resources to continue producing goods and services for 50 years and beyond (USDA Forest Service 2008c, p. 3-2).

The intensity and duration of the effects described in the EIS depend on the alternative and the mitigation measures applied to protect the resources. Most unavoidable effects (discussed above) are expected to be short term. Effects would be managed to comply with established legal limits in all cases, such as maximum time for regeneration. Mitigation measures and/or monitoring procedures have been planned for those areas that may be affected to reduce these effects. Specific mitigation measures are documented in the unit and road cards (located in the project record; if a decision is made to harvest, mitigation measures for harvest units and roads will be disclosed in the ROD).

Maintaining the productivity of the land is a complex, long-term objective. All alternatives protect the long-term productivity of the project area through the use of specific standards and guidelines, BMPs, and mitigation measures. Long-term productivity could change as a result of various management activities proposed in the alternatives. Timber management activities would have direct, indirect, and cumulative effects on the economic, social, and biological environment.

Short-term adverse impacts associated with the proposed action would include the temporary loss of vegetation, loss of soil productivity, temporary increase in erosion potential and sedimentation in streams, potential increase of non-native invasive species, loss of wildlife habitat and displacement of wildlife, slight increases in fugitive dust emissions and other emissions from other sources, temporary loss of public access to roads for recreation and other uses, temporary noticeable changes to the viewshed, and a temporary increase in noise. Some localized adverse effects may occur on a recurring, though temporary, basis. Effects such as road construction, timber harvest, timber hauling, and the operation of internal combustion engines may cause temporary adverse effects to air quality.

Short-term beneficial impacts would include an increase in employment and spending revenue for the local communities and an increase in employment for Southeast Alaska (primarily Ketchikan Gateway Borough and Prince of Wales Island). Counties (i.e., Boroughs) also receive a portion of the revenues generated on NFS lands through the Secure Rural Schools and Community Self Determination Act (2000) and subsequent reauthorizations of this Act. Payments are allocated to counties for use in different types of programs or projects including: schools and roads (Title I); projects to benefit forest lands (Title II); and search, rescue, and firewise community efforts (Title III).

Long-term impacts are highly dependent on the success of mitigation. The loss of the soil resource due to erosion and mass failures would be a long-term adverse impact. There would also be a long-term loss of soil productivity due to the disturbance of the soil structure, which may result in a change in vegetation productivity or an increase in invasive species. However, specific standards and guidelines, mitigation measures, and BMPs are required, and it is anticipated there would be minimal long-term impacts for most resources. Long-term impacts to resources would vary with changes in vegetation resulting in long-term adverse impacts to wildlife. Some long-term adverse effects may be unavoidable, such as a permanent loss of old-growth habitat within the development LUDs and a permanent loss of habitat capability to support wildlife populations. This could result in a long-term loss of area for productive old-growth and for forage for wildlife.

Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs “to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with …other environmental review laws and executive orders.”

Alaska National Interest Lands Conservation Act (ANILCA)

An ANILCA Section 810 and 811 subsistence evaluation was conducted. The evaluation can be found in the subsistence section of this chapter. No significant restrictions on the abundance and distribution of, access to, or competition for subsistence resources in the project area are anticipated (See the subsistence report in the project record).

However, the Forest Plan Final EIS concluded that Forest-wide, under full implementation of the Forest Plan, the only subsistence resource that may be significantly restricted in the future by federal forest management activities is subsistence use of deer. Subsistence hearings will be held as required.

Bald and Golden Eagle Protection Act of 1940 (as amended)

All alternatives would be in accordance with the interagency agreement established with the USFWS to maintain habitat to support long-term nesting, perching and winter roosting habitat for bald eagles.

Clean Air Act

Air quality would diminish on a recurring, temporary basis due to the construction of roads, timber harvest, and hauling. Limbs and logging slash would be burned at sort yards intermittently throughout the logging periods, which would deposit minor amounts of particulate matter and smoke into the air.

Emissions anticipated from the implementation of any project alternative would be of short duration and are not expected to exceed State of Alaska ambient air quality standards (18 AAC 50).

Clean Water Act

Congress intended the Clean Water Act of 1972 (Public Law 92-500), as amended in 1977 (Public Law 95-217) and 1987 (Public Law 100-4), to protect and improve the quality of water resources and maintain their beneficial uses. Section 313 of the Clean Water Act and Executive Order 12088 of January 23, 1987 address federal agency compliance and consistency with water pollution control mandates. Agencies must be consistent with requirements that apply to "any governmental entity" or private person. Compliance is to be in line with "all Federal, State, interstate, and local requirements, administrative authority, and process and sanctions respecting the control and abatement of water pollution".

The Clean Water Act (Sections 208 and 319) recognizes the need for control strategies for nonpoint source pollution. The National Nonpoint Source Policy (December 12, 1984), the Forest Service Nonpoint Strategy (January 29, 1985), and the USDA Nonpoint Source Water Quality Policy (December 5, 1986) provide a protection and improvement emphasis for soil and water resources and water-related beneficial uses. Soil and water conservation practices (BMPs) were recognized as the primary control mechanisms for nonpoint source pollution on NFS lands. The Environmental Protection Agency supports this perspective in their guidance, “Nonpoint Source Controls and Water Quality Standards” (August 19, 1987).

The Forest Service must apply best management practices that are consistent with the Alaska Forest Resources and Practices Regulations to achieve Alaska Water Quality Standards. The site-specific application of BMPs, with a monitoring and feedback mechanism, is the approved strategy for controlling nonpoint source pollution as defined by Alaska’s Nonpoint Source Pollution Control Strategy (October 2000). In 1997, the State approved the BMPs in the Forest Service’s Soil and Water Conservation Handbook as consistent with the Alaska Forest Resources and Practices Regulations. This handbook is incorporated into the Tongass Land Management Plan.

A discharge of dredge or fill material from normal silviculture activities such as harvesting for the production of forest products is exempt from Section 404 permitting requirements in waters of the United States, including wetlands [404(f)(1)(A)]. Forest roads qualify for this exemption only if they are constructed and maintained in accordance with best management practices to assure that flow and circulation patterns and chemical and biological characteristics of the waters are not impaired [404(f)(1)(E)]. The BMPs that must be followed are specified in 33 CFR §323.4(a). These specific BMPs have been incorporated into the Forest Service’s Soil and Water Conservation Handbook under BMP 12.5.

Effects on Prime Farmland, Range Land, and Forest Land

No prime farmland or range land would be adversely impacted by the action alternatives. Forest land would maintain its productivity, except for those lands permanently occupied by roads built for long-term access for forest management.

Endangered Species Act

None of the alternatives is anticipated to have a direct, indirect or cumulative effect on any threatened or endangered species in or outside the project area. A biological evaluation has been completed, following FSM 2670 direction, and analyzes threatened, endangered, and petitioned species. It is included in the Wrangell Island EIS project record.

Environmental Justice/Civil Rights

Environmental Justice Act

Executive Order 12898 requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States. Environmental Justice analysis considers whether there is a disproportionately high and adverse effect from any of the alternatives on low-income and minority populations in communities near the project area. The South Revilla Project project is a federal action that has potential environmental effects. The analysis area for environmental justice includes the communities of Ketchikan, Metlakatla, and Saxman.

The Council on Environmental Quality (CEQ) issued guidance on analyzing effects on environmental justice under NEPA in December 1997. This guidance clarified that such analyses should recognize the interrelationships between cultural, social, occupational, historical, and economic factors that may amplify the environmental impacts. Impacts on subsistence resource use also impact the social and cultural lives of residents. The CEQ guidance clarified that the identification of disproportionate effects does not preclude the agency from going forward with the proposed action, but should heighten attention to project alternatives, mitigation and monitoring needs, and the preferences of the affected communities (CEQ 1997, p. 10).

The effects of the actions are indiscriminate and not expected to have a disproportionately high and adverse effect on the health or well-being of the minority or low-income populations that use the project area. There are no cumulative or foreseeable projects within the area of analysis that would cause a disproportionately high and adverse human health or environmental effect on any minority or low-income population.

Executive Order 11593

Executive Order 11593 directs federal agencies to provide leadership in preserving, restoring and maintaining the historical and cultural environment of the Nation. The work accomplished in accordance with Section 106 of the National Historic Preservation Act for the Wrangell Island Project meets the intent of this Executive Order.

Executive Order 11988

The numerous streams in the Wrangell Island Project make it essentially impossible to avoid all floodplains during timber harvest and road construction. Forest Plan Standards and Guidelines for riparian areas exclude most commercial timber harvesting from floodplains. Roads may be constructed in or through floodplains subject to the design requirements of the best management practices. Effects on floodplains from project activities have been avoided or minimized as much as possible.

Executive Order 11990

Executive Order 11990 requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands. Because wetlands are so extensive in Wrangell Island project area, it is not feasible to avoid all wetlands. The wetlands section in this chapter describes the types and amounts of wetlands in the project area and how they would be affected. Effects to wetlands are minimized through the application of best management practices (BMPs).

Road construction through wetlands is avoided where possible. Road cards contain site-specific details on road location through wetlands and how BMPs would be implemented. Based on the analysis in this chapter, it is estimated that the alternatives would result in the loss of approximately 51 to 81 acres (which equates to a loss of about 0.1 percent of wetland acreage in the project area) due to road fill.

Executive Order 12962

Executive Order 12962 requires federal agencies to evaluate the effects of proposed activities on aquatic systems and recreational fisheries. The project minimizes the effects on aquatic systems through project design, application of standards and guidelines, BMPs, and site-specific mitigation measures. Post-project road closures could limit access to some recreational fishing opportunities to foot or permitted off-highway vehicle (OHV). However, most recreational fishing throughout the Tongass occurs by boat in saltwater, and any adverse effects would be minimal.

Executive Order 13112 (Invasive plant species)

Executive Order 13112 requires federal agencies (in part) to evaluate whether the proposed activities will affect the status of invasive species; and to not carry out activities that promote the introduction or spread of invasive species unless it has been determined that the benefits of such action outweighs the potential harm caused by invasive species; and that all feasible and prudent measure to minimize risk of harm will be taken in conjunction with the actions.

Federal Cave Resource Protection Act

There are no known significant caves in the project area.

Magnuson-Stevens Fishery Conservation Act of 1996

The Magnuson-Stevens Fishery Conservation Act (1996) requires that all federal agencies consult with the National Marine Fisheries Service (NMFS) when any federal action is determined by the Forest Service “may adversely affect” essential fish habitat (EFH). The Forest Service’s position is that constructing new roads, harvesting timber near Class I streams and the use of the marine access facility may have an adverse effect on EFH. However, by following the measures to minimize adverse effects listed in the EFH assessment, other standards and guidelines from the Forest Plan and implementing BMPs, the effects on EFH would be minimized. This DEIS, which includes the EFH assessment, will be made available to the National Marine Fisheries Service to initiate formal consultation.

National Forest Management Act

All project alternatives fully comply with the Forest Plan. This project incorporates all applicable Forest Plan Standards and Guidelines and management area prescriptions as they apply to the project area, and complies with Forest Plan goals and objectives. All required interagency review and coordination has been accomplished; new or revised measures resulting from this review have been incorporated.

The Forest Plan complies with all resource integration and management requirements of 36 CFR §219. Application of Forest Plan direction for the Wrangell Island Project ensures compliance at the project level.

National Historic Preservation Act

Cultural resource surveys of varying intensities have been conducted, following inventory protocols approved by the Alaska State Historic Preservation Officer. Native communities have been contacted and public comment encouraged. The consultation and concurrence process with the State Historic

Preservation Officer is complete. The SHPO concurred with the Forest Service finding of No Historic Properties Affected for this project.

Threatened and Endangered Species and Region 10 Sensitive Species

A biological evaluation was completed for Region 10 sensitive plants. A biological evaluation/assessment was completed for threatened, endangered and Region 10 sensitive vertebrates and consultation occurred between responsible federal agencies for threatened or endangered species potentially affected by the project activities. Standards and guidelines have been applied, as needed, to ensure that any listed threatened or endangered species or its habitat would not be adversely affected. The Forest Plan contains standards and guidelines for each designated sensitive species, and these are incorporated into the project as applicable.

Tongass Timber Reform Act

Application of Forest Plan riparian standards and guidelines ensures that no commercial timber harvest will occur within 100 feet of any Class I or II stream flowing directly into a Class I stream as required in Section 103 of the Act. The proposed project would provide timber for the Tongass timber program to seek to meet market demand if an action alternative is selected.

USDA Forest Service Transportation; Final Administrative Policy

This project is consistent with the Travel Management Rule by limiting the transportation system to the minimum amount necessary for project activities.

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Distribution of the Environmental Impact Statement

A letter or email with notification of the availability of this Final EIS, either online or via electronic media, was sent to the following parties. These parties either commented on the project, requested a copy of the EIS during scoping or at some other time during the NEPA process, or are part of the Tongass National Forest mandatory mailing list (Forest Service Handbook 1909.15, Sections 23.2 and 63.1). In addition, notification of the availability of the online copy was sent to emails on the self-subscribed email list for this project. A complete list of recipients is in the project record.

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Appendix A – Unit Card Introduction

Unit Card Overview

Unit cards are developed by the interdisciplinary team (IDT) to explain and display site-specific activities and resource-specific requirements associated with each unit. Resource-specific requirements may include: a) site specific standards and guidelines and/or other required resource protections measures; b) unit specific design or layout measures/methods; and c) site specific tracking during implementation.

Unit cards consist of the following: introduction, unit map, and unit narrative. The unit card map and narrative represent all the alternatives in the South Revilla Integrated Resource Project (South Revilla Project) DEIS (see DEIS Chapter 2 maps). The maximum unit boundary design is displayed on the unit card map, with a set of unit maps for each alternative. Each unit card consists of the narrative for that unit (Part 1 of this appendix), plus three maps – Alternative 2, Alternative 3, and Alternative 4 (Parts 2, 3, and 4 of this appendix) if the unit appears in all alternatives. The unit boundary, silvicultural prescription and yarding method for each alternative for the unit are specified in the unit narrative and on the unit maps. The alternative maps in Chapter 2 of the South Revilla Project DEIS show all the units. Units are presented in numerical order.

Unit card narratives and maps, in combination with the DEIS, resource reports and GIS data, ensure that all aspects of the project would be implemented within applicable Forest Plan direction for all alternatives. For the DEIS, there will be instances where incomplete data needs to be ground-truthed, which may lead to adjustments in the recommendations and requirements on the unit cards for the FEIS. Where this is the case, it will be noted on the DEIS unit cards. We do not expect adjustments due to any incomplete information to represent: a substantial change, significant new circumstances, or significant new information relevant to environmental concerns and bearing on the proposed action or alternatives.

Unit Card Header Information

Each unit card has a header block with information used to generally describe the unit's size, location, and volume proposed for harvest. Each header block contains the following information:

Unit Number: This is the number assigned to identify the unit. The 500 series of unit numbers indicate those units on the Shoal Cove side of the project area. All young-growth units are numbered 700 and above.

Value Comparison Unit (VCU): The VCU where the proposed harvest area is located. See Chapter 3 for an explanation. A VCU is a distinct geographic area that generally encompasses a drainage basin containing one or more large stream systems.

Land Use Designation (LUD): The proposed harvest units are located within Modified Landscape (ML) and Timber Production (TM) LUDs. Descriptions of these LUDs are in the Forest Plan, Chapter 3.

Alternatives: This identifies the alternative(s) in which the unit is proposed.

Prescription, Logging System, Acres: The silvicultural prescription proposed, the method by which the timber is planned to be removed or yarded from the unit, and acres for each different prescription or logging system if more than one is proposed.

Total Unit Acres: This is an estimate of acres within the unit using aerial photos and GIS information, by alternative. The numbers have been rounded. Where more than one logging system is proposed for a unit, the acres for each logging system may not appear to add up to the total harvest acres due to rounding, or in the case of differences between alternatives, it may incorrectly appear that the total harvest acres differ between alternatives.

Net Harvest Volume (MBF): This is the estimated volume in thousand board feet, available for harvest in the unit as determined from field estimates, by alternative.

Resource-Specific Requirements

Each unit card narrative lists resource-specific requirements concerning Forest Plan Standards and Guidelines and best management practices (BMPs) for implementation, under the table heading Summary of Concerns, Responses, BMPs, and Mitigations. The following describes the resources and requirements that may be listed on the unit card narratives as particular to each unit.

If there is no narrative for a resource, it is listed under the no resource-specific requirements heading.

Silviculture: Harvest Treatments and Silvicultural Systems

Silvicultural systems refer to the treatments used to manage forest stands and forest landscapes over long periods of time including harvest or regeneration of the stand, intermediate cuttings, and other treatments necessary for the development and replacement of the forest stand. Silvicultural prescriptions include the examination, diagnosis, and treatment regimens prescribed for the stand by a regionally-certified silviculturist. The final prescriptions, including sale layout and marking instructions, will be completed at the time the Record of Decision is signed for the project, and will be available as part of the project record. Refer to the detailed unit Rx located in the stand folder and project record.

The Silviculture prescription includes language that briefly describes insect, disease and defect ratings, and windthrow risk. These ratings are for the unit as a whole. Specific portions of the unit may vary from the overall ratings. In some instances, the windthrow discussion in the fisheries section, which is specific to riparian management areas (RMAs), may differ from the overall unit rating. The additional detail provided for RMAs is necessary for determining reasonable assurance of wind firmness (RAW) requirements along certain streams.

Desired Future Condition for Timber Production Stands in the Project Area

The desired condition for stand growth for timber production purposes in the Project Area is that they be as productive, healthy, and windfirm as possible while still retaining residual trees as needed to meet standards and guides or other objectives of the Forest Plan. The majority of old-growth stands in the project area contain trees that are over-mature and unhealthy with decay and weather damage that exceeds new growth. These stands do not currently meet the desired condition.

To meet the Forest Plan’s goals and objectives for young-growth, opportunities for economic commercial harvest must be made available. The proposed young-growth harvest stands within the project area have not yet reached the culmination of mean annual increment (CMAI, see Forest Plan 5-3), however they are growing rapidly and have potential to provide economical timber volume within the timeline of 15 years for this analysis.

Even-aged Systems (Clearcut)

An even-aged system produces stands that consist of trees of the same or nearly the same age. A stand is even-aged if the range in tree ages normally does not exceed 20 percent of the rotation age (the age at which the stand is harvested). Stands would not be re-entered for a regeneration cut until the next rotation in approximately 70-100 years. The regeneration method chosen to achieve even-aged management is clearcutting. Where this treatment is recommended, it has been determined that it is optimal for the site.

Even though all or a majority of the merchantable trees within a unit would be harvested by clearcutting, some merchantable-sized trees are often retained within the unit for resource protection requirements. These may include stream buffers along unit boundaries or those that protrude into units and visual buffers. Reasonable assurance of windfirmness (RAW) buffers may also be applied to unit edges and stream or visual buffers that are determined to be at risk for wind damage after harvest. In addition, 30 percent of the proposed opening may be retained in patches or large groups of trees within the unit boundary for the purpose of retaining legacy forest structure in VCUs where legacy is required by the Forest Plan (see below).

Units that are proposed for even-aged management have conditions that do not currently meet nor are on a trajectory to meet the desired condition. Even-aged management using clearcutting is the optimum method to move these stands from the existing condition to the desired condition. Even-aged management minimizes defect and disease in the future stand to the greatest extent possible.

Justification for the use of even-aged systems are outlined on each individual unit card.

General Direction Regarding the location of Even-aged Management Unit Boundaries

Design units approximately as shown on the unit card map with adjustments as needed to make boundaries reasonably wind-firm. For example, bring unit boundaries to the edges of existing young-growth or muskeg and to the lee side of a ridgeline where possible. Avoid sharp points, dips or other deviations in the unit boundary in areas exposed to southerly winds particularly where high wind risk timber types occur. Utilize “virtual and discernible” boundaries where units abut young-growth stands, as appropriate. Review the planned unit design with the district Silviculturist prior to layout. Where wind-firm edges cannot be located and resources are at risk external to the unit boundary, review for RAW needs. Interdisciplinary review of RAW zones as described in the fish/watershed section on the unit card or otherwise identified along boundaries should occur at the time of layout to determine the RAW zone prescriptions and verify that objectives are met.

NFMA regulations state that 100 acres is the maximum size of created openings allowed for the forest types of coastal Alaska, unless exempted under specific conditions. For the purpose of identifying a created opening size and what constitutes a break between even-aged openings the Forest Plan requires that leave strips between openings be of sufficient size to be managed as a separate stand or at least 10 acres. Where leave areas are required to reduce the size of an opening, avoid the isolation of suitable timber by leaving an economically operable setting where possible. Riparian management areas may also be used to constitute a break in unit size if they are at least 10 acres in size. Past even-aged harvest areas with adequately restocked regeneration approximately 5 feet tall are no longer considered openings for the purpose of determining the 100 acre size limit.

There are currently units or combined openings planned that exceed 100 acres. These units have not been completely surveyed by all resources at the time of this draft. It is anticipated that as layout proceeds, these units will be restricted to not exceed the 100 acre size limit. Final unit and combined opening sizes will be assessed during the FEIS. If changes are made during implementation that result in an opening larger than 100 acres, the IDT must be consulted to determine if the change is allowable under the exemptions to the 100 acre rule established in the Forest Plan.

General Direction Regarding the Implementation of the Legacy Forest Structure Standard and Guideline:

The intent of the Legacy Standard and Guideline is to ensure that sufficient late seral structure remains in timber harvest units within value comparison units (VCUs) that have had concentrated timber harvest activity in the past (USDA Forest Service, 2016a4-86).The Forest Plan lists VCUs subject to the Legacy Standard, and also states that VCUs are to be assessed during the project-specific planning and analysis to see if Legacy S&G's apply. The Project proposes harvest in one VCU which is currently identified in the Forest Plan as subject to legacy (VCU 7560).The IDT will analyze the final unit acres in these units in the FEIS/ROD to determine whether and how to apply the Legacy S&G. The required and currently mapped legacy acreage will be stated in the Silviculture section of each unit card in the FEIS. Direction is also provided regarding how legacy is placed. Legacy areas denoted on maps may be adjusted as needed so long as the objective of the placement is met. For example, if legacy is planned to coincide with areas of unsuitable soils and those areas are further refined during implementation, the legacy areas should be adjusted so they encompass the change so long as the new areas meet the standard.

Two-aged Management (2A and 2A-BEACH)

Two-aged management results in stands that have two distinct cohorts separated in age by more than 20 percent of the stand rotation age. This stand structure results naturally from stands completely regenerated after two distinct disturbance events. In order for a harvest to be considered two-aged, at least 15 percent of the original standing green tree basal area must remain after harvest. These trees can be grouped for operational and environmental concerns or be evenly distributed across the stand. If trees are grouped, the groups must be distributed somewhat evenly across the stand. Second harvest entries would occur at a time when young-growth from the first harvest has been precommercially thinned and the slash from that treatment does not limit wildlife movement.

Old-Growth Units

In old-growth stands, the objective of this prescription is to maintain and manage for two-aged stand structure primarily for wildlife and scenery by harvesting up to 80 percent of the unit area in this entry using the patch clearcutting prescription. Openings will be limited to less than 20 acres in size and should be positioned so as not to impact the scenic integrity objectives, while also located so that the residual stand is not isolated from harvest in the future. The openings created will result in regeneration that will constitute a second age class within the stand. The second harvest entry into the stand would occur in about 40 years.

Young-Growth Units

The objectives of two-aged management in young-growth is primarily to utilize the variability of the stand to facilitate harvest, while also leaving portions of the stand which are growing less rapidly. In development LUDs, up to 50 percent of the unit area will be harvested in this entry using patch clearcuts up to 20 acres in size. Openings and roads should be positioned to facilitate future harvest of the residual stand. The openings created will result in regeneration that will constitute a second age class within the stand, while introducing structural heterogeneity and edge habitat. The retained portions of the stand would be harvested in roughly 20 years.

In units 706 and 709, two-aged management is utilized to create a patchwork of clumps and openings that will set the stand on a trajectory toward more complex, late seral structure. At least 65 percent of the unit area will be retained, with openings no more than 10 acres in size. Openings and roads should be positioned to maximize edge habitat and reduce line of sight, while minimizing edge alignment with predominant wind direction. These harvests are primarily restorative in design; no future entry is planned for the portions of these units within the beach buffer.

Uneven-aged Management (UA and UA-RMA)

Uneven-aged management maintains or creates a stand with trees of three or more distinct age (size) classes, either intimately mixed or in small groups. Trees may be removed individually, or in small groups or strips generally 2 acres or less in area. There is no final rotation age as in even-aged or two-aged systems, but are instead regular, periodic entries designed to maintain three or more distinct age classes and a range of diameter classes in a reasonably well dispersed manner across the stand. This maintains a stand with relatively consistent tree cover of high structural diversity due to the high variability in tree sizes and individual tree characteristics.

This remaining structure generally provides more diverse wildlife habitat than other regeneration systems and also reduces the visual impacts of the harvest area. The timber production goal of uneven-aged management is to economically harvest a percentage of the stand while retaining timber for future economically viable and sustainable entries.

Old-Growth Units

In old-growth, a mix of single-tree and group selection is used in units that have an uneven-aged management prescription and utilize a helicopter logging system. Helicopter yarding has been proposed to reduce road construction and associated costs, reduce the impact new roads and harvest activities might have on watersheds and wildlife as well as facilitate the use of partial harvest methods needed to meet scenery objectives. In some cases uneven-aged management has been prescribed for areas adjacent to streams to facilitate a RAW buffer. Uneven-aged management would be achieved by leaving approximately 66 percent of the setting pretreatment basal area in all units, based on standing live trees greater than 16 inches left uncut. Intermediate trees of good form with low/no evidence of defect or decay will be targeted for retention. Pacific Silver Fir, regardless of size, will be retained where feasible for operational safety and will count toward residual BA.

Young-Growth Units

Where uneven-aged management is prescribed for young-growth units, the primary goal for harvest is not future timber production but to introduce heterogeneity and complexity into even-aged stands and to help achieve stream process group objectives (see aquatics section pg. 277). This prescription is limited to portions of young-growth stands within riparian management areas (RMA) outside of TTRA buffers, within larger even-aged and two-aged units. Along RMA corridors within and adjacent to units, where operationally feasible and where there is low risk of windthrow, individuals and small groups of trees are to be removed, up to 33 percent of the sub-units pretreatment basal area, based on standing live trees greater than 11 inches. Trees targeted for retention should include those with higher defect (forked tops, etc.) and early signs of decay, in addition to any dominant or co-dominant trees with visible lean toward the stream channel. These treatments are primarily restorative in design; no future entry is planned for these sub-units.

Transportation and Logging Systems

Information on the type of logging systems proposed and the road access including temporary road proposed for the unit is provided in this section. Road numbers are shown on the maps. See Road Cards

(Appendix B) for additional information on proposed NFS roads. Road construction activities will follow applicable BMPs during layout, construction and road storage work where identified.

Stored NFS Roads opened for Haul

Roads that have been stored (Maintenance Level 1) may need to be opened for access to timber harvest units timber harvest units. Maintenance items may include repairing or replacing stream crossing structures, removing vegetation from the road surface, adding surface material, and reestablishing ditches. After harvest activities place back into storage ML1 status. Follow National Core BMP road-6 (Road Storage and Decommissioning). These roads are on the unit cards labeled ML1 road maintenance.

Temporary Roads

The location of the temporary roads has been determined using aerial photos and GIS information. These locations are subject to change after final unit design is complete. The location is determined by the operator and approved by the Forest Service. These roads will be decommissioned after use. Limited (up to 3-years) public access for gathering firewood may be allowed, if there are no specific resource, safety or resource concerns once timber harvest activities are complete.

Botany

Sensitive and Rare Plants

Sensitive and rare plant occurrences located either within units or within 50 meters (164 feet) of the unit are noted on the unit cards along with possible actions to avoid or mitigate effects to populations.

If any previously undiscovered sensitive or rare plants are encountered at any time prior to or during implementation of this project, protect the sensitive plant occurrence and avoid any disturbance of habitat in the area containing the sensitive or rare plant. The district or forest botanist/ecologist must be notified immediately to evaluate the occurrence and recommend avoidance or mitigation measures.

Invasive Plant Best Management Practices

Implement Tongass National Forest Weed Best Management Practices (Krosse 2019) listed below to reduce the risk of introducing or spreading invasive plant infestations due to proposed actions.

2) Use contract and permit clauses, provisions, and/or specifications to require that the activities of contractors and permittees are conducted to prevent the introduction and spread of invasive plant species.

2.1) Before contracts are awarded or special use permits approved, incorporate appropriate contract clauses and specifications requiring measures to prevent the introduction and spread of invasive plant species. *(FSM 2903 (6) & 2904.08(14)).*

3) Make every effort to prevent the accidental spread of invasive plants carried by contaminated vehicles, equipment, personnel, or materials (including plants, wood, plant/wood products, water, soil, rock, sand, gravel, mulch, seeds, grain, hay, straw or other materials).

3.1) To meet the intent of national (FS-990a) and regional (FSM 2509.22) BMPs, standards and requirements for vehicle and equipment cleaning (including trail and road maintenance equipment, outfitter and guides equipment etc.) to prevent the accidental spread of invasive plant materials on NFS lands or to adjacent areas will follow Exhibit 4. *(FSM 2903 (7)(a))*

3.2) Mechanical equipment cleaning must occur off NFS lands (This does not apply to service vehicles that will stay on the roadway, traveling frequently in and out of the project area). If cleaning can only occur on NFS lands, permits are required (see 3.3 below)

3.3) When mechanical equipment cleaning must occur on NFS lands, reference 2509.22 (R10 BMP Handbook) No. 15.2 to prevent water contamination and risk to humans. *(FSM 2509.2, FSH 2109.14, Chapter 40 & National Technical Guide FS- 990a)*

3.4) Make every effort to ensure that all materials used on the NFS lands are free of invasive plant materials (including reproductive/propagative material such as seeds, roots, flowers). *(FSM 2903 (7)(b))*

3.5) Follow State of Alaska and Tongass N.F. weed-free gravel and straw certification programs or equivalent inspection and approval process to ensure these materials are certified prior to their use and spread on National Forest lands *(FSM 2903 (8); 36 CFR 261 and Departmental Regulation 1512-1)*

3.7) All trail crews and other field going personnel should inspect, remove, and properly dispose of weed seed and plant parts found on their clothing and equipment off NFS lands, particularly if going from one location to another that contains weeds or highly disturbed habitats. *(FSM 2904.08(9))*

5) Revegetate bare soil resulting from project activities (roads, timber harvest, mining etc.) to minimize spread of invasive plants and if prompt natural regeneration is not expected.

5.1) For guidance on revegetating disturbed sites, including transportation projects, using both native and approved non- native plant materials for erosion control and/or other restoration activities see Exhibit 6 *(FSM 2070 and FSM 2903(5))*

6) Monitor management activities, including maintenance and revegetation projects, for potential spread or establishment of invasive species in aquatic and terrestrial areas of the Forest.

6.2) Conduct inventories and report information related to invasive plant infestations, impacts and all management activities occurring on the Forest to Forest or District Invasive Species Coordinator (*FSM 2904.08 (5))*

7) Remove seed source that could be transported by passing vehicles by minimizing roadside sources of weed seeds.

7.3) Avoid blading roads or pulling ditches when weeds are in seed set stage. *(FSM 2904.08(4))*

7.4) If treatment of high priority plants is not feasible prior to maintenance or other activities, strive to work from relatively invasive plant-free areas into the infested area, rather than vice- versa.

7.5) Maintain desirable roadside vegetation. If desirable vegetation is removed during blading, ditch clean-out or other ground disturbing activities, area must be revegetated according to *All Resources BMP 5.1* and Exhibit 6.

8) Retain shade to suppress weeds.

8.1) Minimize the removal of trees and other roadside vegetation during transportation improvement projects.

9) Re-establish and monitor vegetation on bare ground due to construction activities that minimize weed spread.

9.1) For all transportation improvement projects (including grading and blading) seed all disturbed soil (except the travel way on surfaced roads) in a manner that optimizes plant establishment for that specific site. Monitor re-vegetation activities *(FSM 2070 and FSM 2903(5 and 9)) See All Resources BMP 5.1***.**

9.2) See Exhibit 6 for seeding specifications, which includes guidance on use of native plant materials for reseeding and/or restoration activities. *(FSM 2070 and FSM 2903(5*))

10) Minimize the movement of existing and new weed species caused by moving infested gravel and fill material.

10.1) Inspect all active gravel and borrow sources before use and transport. If weeds are present avoid infested areas. Avoid establishing new material sources in areas where weeds are present. *(FSM 2903(7)) See All Resources BMP 3.3, 3.4*

10.2) If new infestations occur at a borrow pit that was previously approved, that pit may not be used as a material source for that project unless *the top 8" of contaminated material is removed and stockpiled. (FSM 2903(7)) See All Resources BMPs 3.1 to 3.5* and Exhibit 5

10.3) Monitor for emerging weeds on stockpiled material at new and existing pits. Monitor the area where pit material is used to ensure that no weed seeds are transported to the use site. *(FSM 2903(9))*

11) Ensure that weed prevention and related resource protection are considered in travel management.

11.1) Consider risk of weed introduction and spread factors in travel plan (road closure) decisions during or after a project is complete. Consider road closures in areas that are weed-free and/or at unusually high risk to weed invasion. *(FSM 2903.(3))*

12.1) Do not blade after weeds have gone to seed.

13) Reduce weed establishment in obliteration/ reclamation projects.

17) Ensure that weed prevention is considered in all timber projects.

17.1) Silvicultural prescriptions and logging plans will include weed prevention measures (e.g. shade retention and minimal soil disturbance). *(FSM 2903(4))*

18.1) Collect KV or other funds to treat soil disturbance as needed after timber harvest and regeneration activities.

22) Integrate weed prevention and management in all soil, watershed and stream restoration projects.

22.1) See Exhibits 6 for seeding specifications, which includes guidance on use of native plant materials for reseeding and/or restoration activities. *(FSM 2070 and FSM 2903(5*))

24) Minimize weed spread caused by moving infested gravel and fill material.

24.1) All active gravel and borrow sources must be inspected before use and transport. If weeds are present, strip at least the top 8" and stockpile contaminated material to reduce transport of buried weed seed. *See All Resources BMP 3.4*

Aquatics (Watershed and Fisheries)

Watershed and fisheries resources are grouped as “Aquatics” because both resources reference common water quality concerns, Forest Plan direction, regulations, and best management practices (BMPs).

The combination of several activities within a watershed can result in adverse cumulative watershed effects, leading to adverse changes to peak flow, water yield, or sediment delivery to streams. These water quality concerns are minimized through the protection and improvement of riparian management areas (RMA), by implementing stream category protections and mitigations, following BMPs, and following all applicable regulations and Forest Plan direction.

Title 16 concurrence with ADF&G, Division of Habitat, is required prior to conducting any instream activities within or across all fish-bearing waterbodies. Certain activities such as fish crossing replacements on roads used for silviculture may be exempt from *Clean Water Act* permits (USEPA, Section 404(f)(1)). Consult the U.S. Army Corps of Engineers about permit requirements for activities in streams and wetlands. Section 7(a)(2) of the *Endangered Species Act* (ESA) requires consultation with NMFS, Protected Resources on activities that may affect a listed species.

The following design features should be applied to all activities:

- Follow fish timing windows for in-channel construction activities as determined in consultation with the Alaska Department of Fish and Game, Division of Habitat as per the Title 16 Memorandum of Understanding (Alaska Region BMPs 14.6, 18.3; National BMP AqEco-2, Road-3).
- Maintain, restore, or improve aquatic organism passage at all road and trail fish stream crossings (USDA Forest Service 2016a, p. 4-11). Fish stream crossing structures must be designed to meet current aquatic organism passage standards.
- Identify and prioritize suitable design features for road segments causing, or with the potential to cause adverse effects to water quality and riparian resources (National BMPs Road-2, Road-4, Road-6, Road-7).
- Adhere to Forest Plan direction for Fish, Soil & Water, and Riparian for stream and water quality protection. Identify and protect riparian areas and streams according to management objectives for the LUD in which the activity occurs (Alaska Region BMPs 12.6, 13.16; National BMP AqEco-4).
- Develop erosion and sediment control plans for projects to minimize or mitigate erosion, sedimentation, and resulting water quality degradation prior to the initiation of construction and maintenance activities (Alaska Region BMP 14.5, 16.1; National BMP AqEco-2).
- When off-road travel is necessary, use puncheon material to provide adequate bearing strength to prevent soil disturbance and rutting. De-compact and scatter puncheon trail material upon completion of the project (Alaska Region BMP 13.12).
- Apply erosion control measures (silt fences, fiber rolls) during construction activities and native revegetation (mulching, native grass seeding, planting) in areas where detrimental soil disturbance or de-vegetation may result in the delivery of measurable levels of fine sediment to streams or other waterbodies (Alaska Region BMPs 12.3; 12.17; National Core BMP AqEco-2).
- Establish hazardous material pollution prevention strategies and contingencies. Fuel gas powered equipment (chainsaws, generators, etc.) away from waterbodies in locations pre- approved by Forest Service personnel. Review equipment refueling plans prior to work commencement (Alaska Region BMPs 12.8, 12.9; National BMP Road-10).

- Identify areas suitable for staging construction materials and equipment on sites near water prior to work commencement. Fueling, maintenance, and equipment storage would occur away from waterbodies in locations pre-approved by Forest Service personnel. Maintain a spill containment kit on site. (Alaska Region BMPs 12.8, 12.9, 14.14; National Core BMPs Road-9, Road-10, Fac-2, AqEco-2).
- Identify requirements for further field surveys, whether special timing restrictions exist, key public contacts to be made, and maintain compliance to management updates as they occur (for example, commercially available timber in the RMA during the transition period as per 2016 Forest Plan direction).
- Design activities and monitor implementation to minimize any potential adverse effects to aquatic resources. On lands other than NFS, consult with landowners and partner organizations/entities prior to project initiation.
- Use non-toxic, biodegradable fluids and oils in equipment and chainsaws when working in or near streams (Alaska Region BMP 12.8; National Core BMP AqEco-2).
- Inspect and maintain trails to minimize adverse effects to water quality (National Core BMP Rec-4).

Streams

All known streams are listed on the unit cards. These streams and any additional streams found during layout will be protected by the appropriate BMPs and Forest Plan Riparian Standards and Guidelines. Specific stream characteristics and related protections are summarized below. The type and level of stream protections and mitigation is based mainly on designated stream class and channel process group.

Various stream surveys were used for the effects analysis for the DEIS. These surveys consisted of unit surveys, upstream assessments, road condition surveys, watershed improvement tracking surveys, and Alaska Fish and Game Anadromous Catalog surveys. Additional field reconnaissance will continue after completing the DEIS and any additional streams will be included in the final EIS (FEIS).

Stream Value Classes

The stream value class designations on the Tongass National Forest are based primarily on presence or absence of fish and fish type, and secondarily on stream morphology. The Forest Plan recognizes four stream classes based on the following criteria:

Class I: Streams and lakes with anadromous or adfluvial fish or fish habitat; or high-quality resident fish waters, or habitat above fish migration barriers known to be reasonable enhancement opportunities for anadromous fish.

Class II: Streams and lakes with resident fish or fish habitat and generally steep (6 to 25 percent or higher) gradient (can also include streams with a 0-6 percent gradient) where no anadromous fish occur, and otherwise not meeting Class I criteria.

Class III: Streams are perennial and intermittent streams that have no fish populations or fish habitat, but have sufficient flow or sediment and debris transport to directly influence downstream water quality or fish habitat capability. For streams less than 30 percent gradient, special care is needed to determine if resident fish are present.

Class IV: Other intermittent, ephemeral, and small perennial channels with insufficient flow or sediment transport capabilities to have immediate influence on downstream water quality or fish habitat capability.

Class IV streams do not have the characteristics of Class I, II, or III streams and have a bankfull width of at least 0.3 meter (1 foot). Not all Class IV streams have been mapped.

Riparian Management Areas

Forest Plan Standards and Guidelines direct the design of riparian management areas (RMAs) associated with each stream in the project area.

The RMAs vary in width from the edge of the stream channel according to channel type (table 95) and stream value class. In accordance with the Tongass Timber Reform Act (TTRA), commercial timber harvest is prohibited within a buffer zone of no less than 100 feet in width on each side of all Class I and Class II streams which flow directly into a Class I stream. Included in the definition of Class II streams flowing directly into a Class I stream are all Class II tributaries of a Class II stream that flow into a Class I stream without an intervening Class III segment. Depending on the channel type, RMA widths can be up to 140 feet wide on either side of some Class I, Class II, and Class III streams, as shown on the unit cards. RMAs adjacent to Class III streams are protected from commercial timber harvest, except along palustrine channel types. RMA widths on Class III streams are topographically delineated along channel types with steep side-slopes and are measured to set distances along other channel types.

Unit card maps show the location of all streams and the associated RMAs. RMA widths for each Class I, Class II, and Class III streams are prescribed in the unit card narratives.

Unit card narratives also identify those streams that will require a RAW buffer review during layout. A stream number is used to assist the reader in locating the stream. Where there is a windthrow and/or erosion concern, it is for the area adjacent to the stream.

Road crossings described on the unit cards are for temporary roads only. National Forest System road crossings are discussed on the road cards.

Process Groups and Channel Types

The Tongass National Forest defines stream channel types according to the Channel Type User Guide (Paustian et al.1992, Paustian and Kelliher 2010), the foundation upon which aquatic habitat management prescriptions are developed. Channel types are defined within the context of fluvial process groups that describe the interrelationship between watershed runoff, landform relief, geology, and glacial or tidal influences on fluvial erosion and deposition processes. Individual channel type classifications are defined by physical attributes such as channel gradient, channel width, channel pattern, stream bank incision and containment.

See the Forest Plan, Figure D-1 (p. D-4) for a visual representation of the typical distribution of channel process groups. Each unit card summarizes the protection for a particular unit. Only the channel types found in proposed timber harvest units are listed. Channel types with their Forest Plan codes are shown in table 95.

Table 95. Channel types in or adjacent to proposed harvest units

Process Group	Channel Type (C-Type) Code	Channel Type Description
Alluvial Fan	AFM	Moderate Gradient Alluvial Fan
	AFH	High Gradient Alluvial Cone
Floodplain	FPS	Small Flood Plain

Process Group	Channel Type (C-Type) Code	Channel Type Description
	FPM	Medium Flood Plain
	FPL	Large Flood Plain
High Gradient Contained	HCLw	High Gradient Low Incision, wetland
	HCL	High Gradient Low Incision
	HCV	High Gradient Upper Valley
	HCDw	High Gradient Deep Incision, wetland phase
	HCM	High Gradient Moderate Incision
	HCD	High Gradient Deep Incision
Moderate Gradient Contained	MCS	Small Moderate Gradient Contained
	MCM	Medium Moderate Gradient Contained
	MCL	Large Moderate Gradient Contained
Moderate Gradient Mixed Control	MMS	Small Moderate Gradient Mixed Control
	MMM	Medium Moderate Gradient Mixed Control
Low Gradient Contained	LCS	Small Low Gradient Contained
	LCM	Medium Low Gradient Contained
Palustrine	PAS	Small Palustrine
	PAM	Medium Palustrine
	PAB	Beaver Dam/Pond

Stream Protection and Mitigation Measures by Stream Category

The following protection measures are required:

Category A

Class I and II streams are marked with blue and white striped flagging, and shall be protected by no-cut buffers designated by process group in Forest Plan Riparian Standards and Guidelines, and identified RMAs in the Aquatic Habitat Management Handbook (table 95) (USDA Forest Service 2001). No commercial timber shall be removed from these buffers. Trees identified for harvest shall be felled to avoid no-cut buffers. Prior to any operations within a buffer, a Stream Course Protection Plan shall be developed for that buffer (BMP 13.16).

Category B

Class III streams are marked with orange and white striped flagging. These streams shall be protected by no-cut buffers within the v-notch.

Class IV streams with unstable side-slopes may also be assigned Category B protection without buffers. The following are Category B protections:

- Split yard and directionally fall trees away from Class III and IV streams without buffers (RIP2-II).

- Felled trees that inadvertently enter or cross stream courses shall not be bucked or limbed until clear of stream courses, unless limbing or bucking would reduce damage to the riparian vegetation or stream banks.
- Debris in stream courses resulting from falling or yarding shall be removed immediately to a stable location above high water mark.
- Existing natural stable debris shall be left undisturbed.
- When ground skidding systems are employed, logs shall be end-lined out of riparian areas.
- When yarding across streams or the full length of a stream or drainage, logs shall be fully suspended (BMP 13.16, RIP2-II).

Category C

Class IV streams and all other intermittent, ephemeral, and small perennial channels and V-notches designated for soil and water quality protection are marked with green and white striped flagging and shall be protected in the following manner:

- Where practicable, trees shall be felled and yarded away from stream courses.
- The trees that cannot be felled away from stream courses shall be felled to bridge the stream providing these trees will be yarded during the same operating season.
- Trees felled to bridge stream courses shall be bucked, limbed, and topped clear of the stream course and its banks.
- Debris which restrict natural water flow, adversely affect water quality or have potential for debris flow shall be removed to a stable location above high water mark before the yarder leaves the unit or upon completion of seasonal logging activities in the unit, whichever comes first (BMP 13.16).

Category A, B and C

All stream categories shall implement BMPs 12.6, 12.6a, 13.9, 13.14, 13.16, and Veg-3. In addition to road crossings, for all units with shovel logging, equipment crossing of streams must comply with BMP 13.9 13.16, and Road-7.

Geology and Karst

This narrative block notes the status of geology review and reconnaissance, whether any karst may be present, and applicable mitigation measures, if required. High-vulnerability karst areas, if present, are not harvested.

Within areas labeled as high or moderate vulnerability there are features that require buffering under current Forest Plan direction. These buffers were drawn as the “minimum” 100-foot radius buffer. However, these buffers will need to be designed and laid out by a karst specialist during unit layout, taking into account factors such as aspect, slope, windthrow potential, soils, etc., at which point certain buffers may need to be enlarged or modified in response to these concerns.

Lands and Minerals

Lands and minerals resource-specific requirements are discussed in unit card narratives unless there are no resource-specific requirements.

The boundary for the Alaska Mental Health trust parcel proposed for exchange is shown on the map.

Scenery

For the South Revilla project, mitigation to reduce scenery effects has been incorporated into harvest unit design and harvest unit prescriptions. Primary measures include:

- changing prescription to partial harvest with 33 percent basal removal.

Some areas of low and very low SIO were mitigated using the same measures in order to keep the area from falling below the required SIO.

For Alternatives 2 and 3 a Forest Plan amendment is proposed to change from a higher SIO to a lower SIO.

The following scenic integrity objectives (SIOs) from the Forest Plan provide standards for management based on the landscape's scenic characteristics and public viewing concern.

High SIO: "Design activities to not be visually evident to the casual observer" (Forest Plan, pg. 4-57). Activities may only repeat form, line, color and texture that are frequently found in the characteristic landscape. Changes in their qualities of size, amount, intensity, direction, pattern, etc. should not be evident.

Moderate SIO: Management and design activities will be subordinate to the landscape character of the area. Changes in the landscape may be evident to the casual observer but appear as natural occurrences when contrasted with the appearance of the surrounding landscape.

Low SIO: Management activities may visually dominate the characteristic landscape. Activities of vegetative and landform alteration must borrow from naturally established form, line, color, or texture so completely and at such a scale that visual characteristics are those of natural occurrences within the surrounding area or character type.

Very Low SIO: Management activities may dominate the characteristic landscape, yet when viewed as background, should appear to be a natural occurrence.

Recreation

Recreation resource-specific requirements are discussed in unit card narratives. Proposed recreation projects are shown if adjacent to the units.

Soils/Wetlands

Unit design and road locations are heavily influenced by the project area's soil resources. For instance, factors such as RMA buffers protect riparian soils and efforts to avoid slopes greater than 72 percent often determine the location of unit boundaries, temporary roads, and landings.

Factors that can influence unit design are areas designated as unsuitable for harvest due to very high landslide potential, colluvial activity, MMI4 soils, slopes steeper than 72 percent, and unstable drainages. Slopes greater than 72 percent that remain within units have been determined to be suitable for harvest with a minimum of partial suspension or full suspension yarding, occasionally with a partial harvest prescription. The factors that influence unit design and define whether slopes greater than 72 percent are suitable for harvest or not are addressed in the unit cards.

Per Forest Plan direction detrimental soil conditions in young-growth stands have been evaluated to ensure cumulative detrimental soil conditions do not exceed Region 10 Soil Quality Standards.

Temporary road crossings on wetlands are noted in the unit cards. All road construction planned for this project is for silvicultural purposes and will be located and designed to meet 33 CFR 323 guidelines and State-approved BMPs.

Shovel yarding should follow BMPs 12.5, 13.2 and 13.9 and National Core BMPs Plan-2, Veg-2, and Veg-4. Specifically, shovel operators should avoid non-forested areas to prevent rutting. Slopes over 25 percent gradient may not be suitable for shovel yarding under some soil moisture conditions. Use care when approving shovel yarding on slopes over 25 percent gradient. Generally slopes over 35 percent gradient are not suitable for shovel yarding. If shovel yarding is proposed on slopes over 35 percent gradient, plan to rehabilitate shovel trails with slash and waterbars, or contact a soil scientist for rehabilitation options. Ruts greater than 12 inches deep should be avoided. Dense slash accumulations (see Forest Plan definition) should be avoided.

All units have a minimum of partial suspension required unless otherwise stated on the unit card. Some units have areas where full suspension is required. In some areas a partial cut prescription is used to protect soil resources. Consult unit cards for details of required prescriptions for the soils resource.

The following Best Management Practices (BMPs) shall be applied to protect water quality in the project area as specified in the Forest Plan (pages C-1 to C-3) and in the National Core BMP Technical Guide (2012). Not all BMPs apply to every situation; protections are noted for site-specific conditions in the unit and road cards where appropriate.

BMP 12.5/Plan 2 and 3, AqEco-2 and 4 (Wetland Identification, Evaluation and Protection) – To identify wetland functions and value, and provide appropriate protection measures designed to avoid adverse hydrologic impacts.

BMP 12.6 /Plan 2 and 3, AqEco-2 and 4, Road-7, Veg-3 (Riparian Area Designation and Protection) – To identify riparian areas and their associated management activities.

BMP 12.6a/Plan-3, Veg-3 (Buffer Design and Layout) – To design streamside buffers to meet objectives defined during the implementation of BMP 12.6.

BMP 12.17 /AqEco-4, Veg-2 (Revegetation of Disturbed Areas) – To provide ground cover to minimize soil erosion.

BMP 13.2/Veg-1 and 8 (Timber Harvest Unit Design) – To incorporate site-specific soil and water resource considerations into integrated timber harvest unit design criteria.

BMP 13.5/Veg-1, 2, and 5 (Identification and Avoidance of Unstable Areas) – To avoid triggering mass movements and resultant erosion and sedimentation by excluding unstable areas from timber harvest.

BMP 13.9 /Veg-2, 4, 5, and 7 (Determining Guidelines for Yarding Operations) – To select appropriate yarding systems and guidelines for protecting soil and water resources.

BMP 13.16/Veg-3 (Stream Channel Protection – Implementation and Enforcement) – To provide the site-specific stream protection prescriptions consistent with objectives identified under BMPs 12.6 and 12.6a. Objectives may include the following:

- Maintain the natural flow regime.
- Provide for unobstructed passage of storm flows.

- Maintain integrity of the riparian buffer to filter sediment and other pollutants.
- Restore the natural course of any stream that has been diverted as soon as practicable.
- Maintain natural channel integrity to protect aquatic habitat and other beneficial uses.
- Prevent adverse changes to the natural stream temperature regime.

BMP 14.1/Road-1 (Transportation Planning) – To assure soil and water resources are considered in transportation planning activities.

BMP 14.2/Road-2, 4, and 11 (Location of Transportation Facilities) – To assure water resources protection measures are considered when locating roads and trails.

BMP 14.3/Road-2 and 3 (Design of Transportation Facilities) – To incorporate site-specific soil and water resource protection measures into the design of roads and trails.

BMP 14.5/Road-3, AqEco-2 (Road and Trail Erosion Control Plan) – Develop erosion control plans for road or trail projects to minimize or mitigate erosion sedimentation and resulting water quality degradation prior to the initiation of construction and maintenance activities. Ensure compliance through effective contract administration and timely implementation of erosion control measures.

BMP 14.6 /AqEco-2, Road-3 (Timing Restrictions for Construction Activities) – Minimize erosion potential by restricting the operating schedule and conducting operations during lower risk periods.

BMP 14.7 /Road-3 (Measures to Minimize Mass Failures) – Minimize the chance and extent of road-related mass failures, including landslides and embankment slumps.

BMP 14.8/Road-3, 6, and 10 (Measures to Minimize Surface Erosion) – Minimize the erosion from cutslopes, fillslopes, and the road surface, and consequently reduce the risk of sediment production.

BMP 14.9/Road-3, 6, and 10 (Drainage Control to Minimize Erosion and Sedimentation) – Minimize the erosive effects of concentrated water flows from transportation facilities and the resulting degradation of water quality through proper design and construction of drainage control systems.

BMP 14.10/Road-3 and 7 (Pioneer Road Construction) – Minimize sediment production associated with pioneer road construction.

BMP 14.11/AqEco-2, Road-3 and 7 (Timely Erosion Control Measures for Incomplete Projects) – Minimize erosion of and sedimentation from disturbed ground on incomplete projects by completing erosion control work prior to seasonal or extended shutdowns.

BMP 14.12/Road-3 and 7 (Control of Excavation and Sidecast Material) – Minimize sedimentation from unconsolidated excavated and sidecast material caused by road construction, reconstruction, or maintenance.

BMP 14.14/AqEco-2. Road-7 (Control of In-channel Operations) – Minimize stream channel disturbances and related sediment production.

BMP 14.15/AqEco-2, Road-7 (Diversion of Flows Around Construction Sites) – Identify and implement diversion and de-watering requirements at construction sites to protect water quality and downstream uses.

BMP 14.17/AqEco-2, Road-7 (Bridge and Culvert Design and Installation) – Minimize adverse impacts on water quality, stream courses, and fisheries resources from the installation of bridges, culverts, or other stream crossings.

BMP 14.20/Road-6 (Road Maintenance) – Maintain all roads in a manner which provides for soil and water resources protection by minimizing rutting, road prism failures, sidecasting, and blockage of drainage facilities.

BMP 14.22/Road-6 (Access and Travel Management) – Control access and manage road use to reduce the risk of erosion and sedimentation from road surface disturbance especially during the higher risk periods associated with high runoff and spring thaw conditions.

BMP 14.24/Road-6 (Road Obliteration) – Reduce sediment generated from temporary or short-term roads and return the land to production by obliterating roads at the completion of their intended use..

Wildlife

All units comply with required Forest Plan Wildlife Standards and Guidelines. Required surveys will be completed prior to implementation. Units or portion of units above 1000' in elevation will not require goshawk surveys. All resource-specific information, protections and mitigations will be determined before harvest activities are implemented. Any nests/animal dens discovered at any time will receive the Forest Plan standard and guideline applications.

Wolves: The Forest Plan requires a 1,200-foot buffer be applied to all known wolf den sites in the project area (Forest Plan 4-91). Wolf dens have been found in the project area and will be appropriately buffered prior to implementation Report any wolf dens to the district biologist for follow-up. Actual den locations are not displayed on unit card maps at the request of ADF&G.

Goshawks: The Forest Plan requires a 100-acre buffer on all known active goshawk nests (Forest Plan 4-95). One historic nest exists in the project area away from proposed harvest units, though recent surveys have been unable to locate the nest. No new goshawk nests have been found in the South Revilla Project area, but three sightings were recorded in 2020 (one by a USFS goshawk survey crew, and two incidentally by Alaska Department of Fish and Game biologists) and a sighting in 2019 identified a probable nest area that needs follow up surveys. If nests or sightings occur, the district biologist will be informed immediately for follow-up.

Sitka black-tailed deer: Maintaining winter habitat and reducing habitat fragmentation are important components of maintaining deer habitat. Uneven-aged harvest and commercial thinning could help maintain or enhance black-tailed deer habitat over the long-term. Corridors are planned in Alternative 3 to facilitate movement of deer across the landscape. Some units were also deferred in Alternative 3 in part to address this concern and to maintain areas of deer winter range (Forest Plan 4-88).

Black bears: The Forest Plan does not require buffers for black bear dens. Black bear den sites will be protected under the Forest Plan standard and guideline for snag and cavity nesting habitat (Forest Plan p. 4-87). Black bear dens are frequently in snags or cavities in trees and can be protected under this standard and guideline. Actual den locations are not displayed on unit card maps at the request of ADF&G.

Bald eagle: All laws and regulations regarding bald eagles will be followed (Forest Plan p. 4-88).

Heron and raptor: Protect active rookeries and raptor nests. Active nests will be protected with a forested 600-foot windfirm buffer, where available. Road construction through the buffer is discouraged.

Prevent disturbance during the active nesting season (generally March 1 to July 31) (Forest Plan p. 4-90). Numerous sharp-shinned hawks were seen during 2020 goshawk surveys, including a probable nest area. Follow up surveys are planned in 2021 to determine if re-occupancy occurs and protect a nest if found. In addition to sharp-shinned hawks, other raptors have been documented in the project are during nesting season in recent years including red-tailed hawks, barred owls, pygmy owls, and merlin.

Marbled murrelet: If nests are found during project implementation, maintain a 600-foot, generally circular, radius of undisturbed forest habitat surrounding identified murrelet nests, where available. Minimize disturbance activities within this buffer during the nesting season (May 1 to August 15). Maintain the buffer zone and monitor the site for nesting activity for not less than two nesting seasons after nest discovery. Maintain the buffer if the nest site is active during the monitoring period. Buffer protection may be removed if the site remains inactive for two consecutive nesting seasons (Forest Plan p. 4-92). Signs of a nest were found during 2020 surveys and will be appropriately protected.

Marine mammals: Ensure that Forest Service authorized or approved activities are conducted in a manner consistent with the Marine Mammal Protection Act (MMPA), Endangered Species Act, and NMFS guidelines (Forest Plan p. 4-89).

Heritage Resources

All units comply with required Forest Plan Heritage Standards and Guidelines. The Section 106 process, as defined by the National Historic Preservation Act (NHPA) and 36CFR800, were not concluded prior to the signing of the ROD; therefore, Heritage Professionals shall follow the guidelines set forth in FSM 2363 and FSH 2309.12 Chapter 30 to identify, evaluate, and allocate Heritage resources to a management category. The direction contained within FSH 2309.12 Chapter 30 applies to these activities regardless of whether they are conducted under Section 106 (§ 306101-306107) of the NHPA, the Archaeological Resources Protection Act (ARPA) (16 USC 470aa et seq.) or other authorities. Appropriate identification and evaluation research shall be carried out to the degree required to make decisions regarding any historic properties that may be affected by proposed activities. Previously identified heritage resources located within a given unit either have been evaluated for the National Register of Historic Places (NRHP) or have not been evaluated against NRHP significance criteria (under 36 CFR 60.4) but are treated as eligible per FSM 2363.22.

Heritage resource information is proprietary and is protected under provisions of NHPA, ARPA, and other state and federal historic preservation laws. As such, this information is it not shown on unit card maps. The layout crew will be provided information prior to project implementation so that buffer areas are identified to avoid disturbance of Heritage resources.

Link to Unit Cards and Maps

Individual unit cards and maps can be found on the project webpage here:
https://www.fs.usda.gov/project/?project=53477

Unit Card Map Legend

The keys shown on the unit card maps for the South Revilla Project are described below (table 96). See Forest Plan, Chapter 7, Glossary for more-detailed definitions of many of these terms. Not all legend items may appear on all maps. Scale is shown on the legend but varies by unit card map.

Table 96. Unit card map legend key

Legend Key	Legend Key Title	Description
	Project Boundary	Boundary for the project area analysis
Proposed Old-growth Units		
	Shovel	Old-growth logging settings proposed for harvest using shovel (ground-based) yarding to remove logs..
	Cable	Old-growth short span logging settings proposed for harvest using cable yarding to remove logs.
	Helicopter	Old-growth logging settings proposed for harvest using helicopter yarding to remove logs.
Proposed Young-Growth Units		
	Shovel	Young-growth logging settings proposed for harvest using shovel (ground-based) yarding to remove logs.
	Cable	Old-growth short span logging settings proposed for harvest using cable yarding to remove logs.
	Adjacent Units	Other units in the area of the unit featured on the individual unit card.
Road Treatment		
	NFS Road Maintenance	National Forest System road work such as culvert and bridge installation, cleaning and reestablishing ditches, shoulder clearing, clearing the roadbed of trees and vegetation, and shaping the road surface on Closed (ML1) roads. Use during project to reopen prior to haul. After harvest activities, place back into storage ML1 status.
	NFS Road Construction	National Forest System new road constructed to implement project activities. See Road Cards for more details.
	Temporary Road Construction	Road constructed to implement project activities, not intended to be part of the forest transportation system and not necessary for long-term resource management. Will be decommissioned after use.
	Other Existing Roads	Existing roads in the project area under ownership. This includes the State of Alaska Ketchikan-Shelter Cove Road.

Legend Key	Legend Key Title	Description
B	Proposed Recreation Site	Location proposed in the project analysis to be developed as public recreation sites in this project, for example picnic area, campground, or trailhead.
	100-foot Contours	Contour lines on a map showing elevations on the landscape at 100-foot elevational intervals
	Non-NFS Land	Non-National Forest System land includes private, state, municipal, and other agency ownerships
	2001 Roadless Rule	Inventoried roadless areas as delineated by the 2001 Roadless Rule.
	Old-Growth Habitat LUD	Old-Growth Habitat land use designation as delineated in the 2016 Forest Plan
	Non-Development LUDs	Land use designations where development activities, such as timber harvest and road construction, will not take place under the 2016 Forest Plan.
	AMHT Potential Land Exchange	National Forest System land identified for exchange to the Alaska Mental Health Trust Authority
	Young Growth	Forest growth that has regenerated naturally after previous harvest or natural disturbance such as serious fire or insect attack.
	High Vulnerability Karst	Areas underlain by carbonate bedrock, contributing to or overlying significant caves and areas with a high density of karst features. Forest Plan Appendix H-6.
	Moderate Vulnerability Karst	Areas underlain by carbonate bedrock where resource damage threats associated with land management activities are greater than those posed by similar activities on low vulnerability areas. Forest Plan Appendix H-4.
	Landslides	An area where moderately rapid to rapid downslope movement of soil and rock materials which may or may not be water-saturated has occurred
	Unsuitable Soils Areas	Slopes over 72 percent (harvest) or over 67 percent (road building); MMI4 soils are potentially unsuitable soils areas.
	Sensitive Plant Location	Areas where sensitive or rare plants have been identified.
	Beach Buffers	An area along the marine shoreline from mean high tide to 1,000 feet slope distance inland.
	Riparian Management Area	Land areas delineated in the Forest Plan Appendix D for management of riparian resources along shorelines of streams, lakes, sloughs, or other water bodies, generally 100 feet but may be wider.
	Stream Class I	Streams with anadromous or adfluvial fish habitat or high-quality resident fish waters

Legend Key	Legend Key Title	Description
	Stream Class II	Streams with resident fish populations and conditions precluding anadromous fish use; generally not meeting Class I criteria.
	Stream Class III	Perennial and intermittent streams with no fish populations but which may have an immediate influence on downstream water quality or fish habitat capability.
	Stream Class IV	Intermittent, ephemeral, and small perennial channels with insufficient flow or sediment transport capability to have an immediate influence on downstream water.
	Lake	An inland body of standing water.

Map Disclaimer

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The maps are intended to depict physical features as they generally appear on the ground and may not be used to determine title, ownership, legal boundaries, legal jurisdiction, including jurisdiction over roads or trails, or access restrictions that may be in place on either public or private land. Obtain permission before entering private lands, and check with appropriate government offices for restrictions s that may apply to public lands. Lands, roads, and trails within the boundaries of the national forest may be subject to restrictions on motor vehicle use. Obtain a motor vehicle use map, or inquire at the local Forest Service office for motor vehicle access information. Natural hazards may or may not be depicted on the map, and land users should exercise due caution. The maps are not suitable for navigational use.

Data Disclaimer

The accuracy of calculations made from GIS layers varies with the quality of the mapping itself. Numbers presented in tables in this document may not sum correctly due to rounding. Other slight anomalies due to rounding may also occur. Therefore, all numbers calculated from GIS should be considered as approximate. These numbers are accurate enough for comparison of alternatives and for a decision to be made.

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Appendix B –Road Card Introduction

This introduction is provided to supplement the information given in each of the road cards. The road cards provide road management objectives for proposed NFS road construction and changes in access travel management.

Road Management Objectives

Purpose and Use

The road management objectives (RMOs) presented in this appendix establish the intended purpose and display the design, maintenance, and operation criteria (per FSH 7709.55) for proposed NFS road construction and where updates to access travel management (ATM) are identified within the South Revilla project area. Site-specific design criteria are discussed in the second section of the RMOs; these will be used during design, construction, and initial monitoring of any road work proposed in this document. Site-specific design criteria include road location objectives, wetland information, erosion control, stream crossings, and proposed rock borrow sources. The information on the road card narrative updates the Forest Transportation Atlas, INFRA, a permanent database that can be updated periodically as access needs, issues, and budgets change (FSM 7711.03). Temporary roads do not have individual road cards since these roads are intended for short- term use.

A map accompanies the road card showing the proposed road location and identification of areas discussed in the site-specific design criteria.

Road Card Header

Each road card has a header block with information used to generally describe the road’s number, length, location on the local road system, and land use designation. Each header block contains the following information:

- Route Number - A unique identifying number is given to every NFS road.
- Route Name - Some NFS roads have names.
- Local System - The local system for the South Revilla Project roads is the Revillagigedo Island Shelter Cove or Shoal Cove road systems. The Revillagigedo Island Shelter Cove road system connects from the Shelter Cove LTF to the City of Ketchikan by a State of Alaska road. The Shoal Cove road system begins at the Shoal Cove LTF and does not connect to a community.
- Land Use Designation - From the Forest Plan, the land use designation (LUD) in which that road would be located.
- Beginning Terminus - A reference point to describe the beginning location point of the existing and/or proposed road.
- End Terminus - A reference point to describe the endpoint location of the existing and/or proposed road.
- Segment - Some roads are divided into multiple segments segregated by Route Status.
- Begin MP - The road milepost representing the beginning of a road segment.
- End MP - The road milepost representing the ending terminus of a road segment.

- Segment Length - Length of the road segment in miles, to the nearest tenth of a mile.
- Status - Description of the road segment status on the landscape and based on the proposed action (examples: 'Planned' is a new proposed road, while 'Existing' indicates a managed Existing NFS road).

General Design Criteria and Elements

These general design criteria provide various descriptions of the type of road and the intended purpose and future use of the planned NFS road. For proposed changes in ATM of the Existing roads, the current criteria and recommended criteria are displayed. Recommended criteria is what this project recommends after the life of the project. Elements used in the road cards are the following:

- Three Functional Classes are used by the Forest Service. Functional Class –They are: ARTERIAL, COLLECTOR, and LOCAL. Arterial roads function as mainlines, with collectors feeding traffic to arterials, and locals feeding traffic to collectors.
- Level of Service – A description of the roads significant traffic characteristics and operating conditions. The level reflects a number of factors, such as speed, travel time, traffic interruptions, freedom to maneuver, safety, driver comfort, convenience, and operating cost.
    - ♦ I - FLOW INTERRUPTED-USE LIMITED < 400 ADT - Interrupted traffic flow, may not accommodate some vehicles. Low design speeds. Unstable surface under certain traffic or weather.
    - ♦ J - SLOW FLOW OR MAY BE BLOCKED < 400 ADT - Traffic flow is slow and may be blocked by management activities. Two-way traffic is difficult, backing may be required. Rough and irregular surface. Travel with low clearance vehicles is difficult. Single purpose facility.
- Service Life – The length of time that a facility is expected to provide specified service.
    - ♦ C - LONG TERM SERVICE - Continuous or annual recurrent service.
    - ♦ I - INTERMITTENT TERM SERVICE - A road which is closed to vehicle traffic between periods of use. The closed period must exceed 1 year.
    - ♦ IS - INTERMITTENT STORED SERVICE - Intermittent service road, closed to traffic. The road is in a condition that there is little resource risk if maintenance is not performed.
- Surface – Description of road surface material such as crushed aggregate or shot rock.
- Width – Width of the "drivable surface" in feet.
- Lanes – Number of lanes.
- Design Speed – The design speed is used to determine the design elements and design standards of a road.
- Critical Vehicle – A vehicle type typically the largest on a road by weight, size, or unique configuration, whose limited use on the road is necessary to fulfill the Road Management Objectives. An example is a semitrailer truck pulling a "Lowboy" trailer. (FSH 7709.56, 4.1).
- Design Vehicle – A selected vehicle, with representative weight, dimensions, and operating characteristics, used to establish the design controls for the road. The design vehicle is Logging Truck.
- Primary Maintainer – The agency or party having primary (largest share) financial responsibility for road maintenance. (FSH 7709.58, 13).

Intended Purpose and Use Narrative

The general design criteria provide various descriptions of the type of road and the intended purpose and future use of the road.

Maintenance Criteria

The maintenance criteria include a discussion of the level of maintenance a road will receive during and after use. Roads used in timber sales will be maintained at Maintenance Level 2 or above during use. Road segments are described using mileposts (MP) as beginning (BMP) and ending points (EMP). For proposed changes in ATM of the Existing roads, the current criteria and recommended criteria are displayed. Recommended criteria is what this project recommends after the life of the project. Elements used in the road cards are the following:

- The OPERATIONAL MAINTENANCE LEVEL (OPML) is the maintenance level currently assigned to a road considering today's needs, road condition, budget constraints, and environmental concerns. It defines the level to which the road is maintained.
- The OBJECTIVE MAINTENANCE LEVEL (OBML) indicate the long-term maintenance plan for the roads considering future road management objectives, traffic needs, budget constraints, and environmental concerns. The objective maintenance level may be the same as, or higher or lower than, the operational maintenance level. (FSH 7709.58, Sec12.3 – Transportation System Maintenance Handbook).

The following Maintenance Levels are specific to the South Revilla project area.

- ♦ Maintenance Level 1 (ML 1): Assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period must exceed 1 year. Storage is intended to be the primary maintenance strategy on ML1 roads and only basic custodial maintenance is performed. Stored roads may be managed for Off Highway Vehicles (OHV) coincidental to the stored road as motorized trails in some cases.
- ♦ Maintenance Level 2 (ML 2): Assigned to roads open for use by high clearance vehicles. Passenger car traffic is not a consideration. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses. Maintenance at this level includes frequent cleanout of ditches and catch basins to ensure controlled drainage, roadside brushing to maintain sight distance and road surface repair as needed to maintain crown and road surface.
- ♦ Maintenance Level 3 (ML 3): Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities. Roads in this maintenance level are typically low speed, single lane with turnouts and spot surfacing. Some roads may be fully surfaced with either native or processed material. Maintenance at this level includes the same as ML 2 roads, though brushing to maintain site distance at higher speeds, plus road grading to maintain crown and a smooth road surface.

- Storage Category - Refers to the level of closure activity assigned to a road at the time of storage where identified (Appendix A of the KMRD and ATM EA).
  - ♦ 1A closure category refers to a strategy of providing environmental protection to critical resources in the form of erosion control while allowing leaving the road as passable as possible. This usually results in adding drivable waterbars to the road surface on steep grades. Limited administrative use with high clearance vehicles and OHVs would be possible until vegetation chocked out the road. Access with a bicycle is only a little more difficult than a typical NFS road.

- ♦ 1B closure category goes beyond the 1A category by removing some or all structures that cross stream sensitive to disturbance. Drivable waterbars would be added to the road surface on steep grades.
- ♦ 1C closure category would remove all drainage structures and add waterbars to the road surface on steep grades. Limited administrative access with a motorized vehicle is not possible. Access with a bicycle is very difficult.

Road storage is defined in FSH 5409.17 as the process/action of closing a road to vehicle traffic and placing it in a condition that requires minimum maintenance to protect the environment and preserve the facility for future use." Maintenance Level 1, closure and basic custodial maintenance is assigned. Road storage will follow all National Core BMPs, especially National Core BMP Road-6 (Road Storage and Decommissioning). Items of importance are as follows:

- Evaluate all stream and waterbody crossings for potential for failure or diversion of flow if left without treatment.
  - ♦ Use suitable measures to reduce the risk of flow diversion onto the road surface.
  - ♦ Consider leaving existing crossings in low-risk situations where the culvert is not undersized, does not present an undesired passage barrier to aquatic organisms, and is relatively stable.
  - ♦ Remove culverts, fill material, and other structures that present an unacceptable risk of failure or diversion.
  - ♦ Reshape the channel and streambanks at the crossing-site to pass expected flows without scouring or ponding, minimize potential for undercutting or slumping of streambanks, and maintain continuation of channel dimensions and longitudinal profile through the crossing site.
  - ♦ Use suitable measures to ensure that the road surface drainage system will intercept, collect, and remove water from the road surface and surrounding slopes in a manner that reduces concentrated flow in ditches, culverts, and over fill slopes and road surfaces without frequent maintenance.
  - ♦ Use suitable measures to stabilize unstable road segments, seeps, slumps, or cut or fill slopes where evidence of potential failure exists.
  - ♦ Use suitable measures to ensure that the road surface drainage system will intercept, collect, and remove water from the road surface and surrounding slopes in a manner that reduces concentrated slow in fitches, culverts, and over fill slopes and road surfaces without frequent maintenance.
  - ♦ Use suitable measures to stabilize unstable road segments, seeps, slumps, or cut or fill slopes where evidence of potential failure exists.
- Other System – Additional network(s) of travel ways designated over the primary route that serve a common need or purpose. NFST – National Forest System Trail - A forest trail that is under the jurisdiction of the Forest. ML 1 roads are closed to vehicular traffic, but are dual designated and managed as a motorized trail coincidental to the closed road. While managed as a trail they would be open to motorized off-highway vehicle (OHV) 50 inch or less in width until the road is needed again at a future time.

Maintenance Narrative

The maintenance includes a narrative to what level the road is to be maintained during timber haul and the maintenance received after no longer needed for harvest activities and associated timber haul.

Traffic Management Strategies

This section describes options for managing traffic on NFS roads and designation of those roads, trails, and areas that are open to motor vehicle use by class of vehicle and time of use of road if appropriate (36 CFR Parts 212, 251, 261, and 295). The following for project area roads include:

- Open to All Vehicles (Mixed Use) – These roads are open to all motor vehicles, including smaller off-highway vehicles that may not be licensed for highway use, but not vehicles that are oversized or overweight under state traffic law. The road would be displayed on the Motor Vehicle Use Map (MVUM).
- Storage (Closure) – This is intended to be the primary maintenance strategy applied on intermittent use roads during their closure cycle, and ML 1 Closure is assigned. Motorized traffic is prohibited unless the road is designated as a motorized trail. Administrative use of roads, trails, and areas not designated for motor vehicle use should be limited to what is required for administration and protection of NFS lands. The road is not displayed on (MVUM).
- Open to OHV < = 50" – Some ML 1 roads may be available and suitable for motorized OHV such as an ATV. These routes are designated as a NFS motorized trail coincidental to the designated closed road ("dual designated". Basic custodial maintenance of the road can occur and the road can be reopened when needed for use at a future time. The road is displayed on the MVUM as a NFST Motorized Trail.
- From and Thru Dates - Describes the duration of the traffic management strategy and allowed use.
- Remarks – Remarks include Operation criteria, a presentation of traffic management strategies identified in FSM 7731 (encourage, accept, discourage, prohibit, and eliminate).
    - For Maintenance Level 1: The appropriate traffic management strategies are "prohibit" and "eliminate". Roads receiving level 1 maintenance may be of any type, class or construction standard, and may be managed at any other maintenance level during the time they are open for traffic. However, while being maintained at level 1, they are closed to vehicular traffic, but may be open and suitable for non-motorized uses. (FSH 7709.58, 12.3)
    - For Maintenance Level 2 strategies are either to (1) discourage or prohibit passenger cars or (2) accept or discourage high clearance vehicles. (FSH 7709.58, 12.3)
    - For Maintenance Level 3 may either "encourage" or "accept." "Discourage" or "prohibit" strategies may be employed for certain classes of vehicles or users. (FSH 7709.58, 12.3)

ATM/ Travel Management Narrative

This section discusses the Access Travel Management Plan (ATM) of the proposed NFS road, and any recommended changes to the ATM of Existing NFS roads. The ATM Plan institutes a system of routes designated for motor vehicle use including class of vehicle, and if appropriate, time of year for motor vehicle use. The designated route system is shown on a Motor Vehicle Use Map (MVUM). The map can be updated annually and may be adjusted as conditions change.

Road Location Narrative

The road location includes a discussion of the location and intended purpose of the road. Information is also noted as to whether additional field review and data collection is required. The road location discussion documents why the road is proposed in a specific location, control points, and alternative routes considered (if any). A main location objective is to avoid crossing wetlands. At times, however, it is necessary to cross wetlands in order to minimize the total impact of a road. These areas are discussed, documenting areas of mapped wetlands and why the road is located across these areas.

Site-Specific Design Criteria for Proposed NFS Roads

The site-specific design criteria for proposed road construction include any resource information needed to be considered prior or during road construction.

Stream Crossings

All fish streams are identified, as well as non-fish streams with sufficient flow to require a 48-inch or larger culvert. Prior to actual construction of roads and stream crossings, the final location, structure type, and design criteria are designed to meet all applicable Forest Plan Standards and Guidelines, Forest Service Manual and Handbooks, best management practices and MOUs with Alaska Department of Fish and Game (when applicable).

Road card maps may not always correspond to the road card text. The text is based on the most up-to-date survey data while the map depicts GIS data which may not reflect ongoing surveys.

Wetland Avoidance

All roads through wetlands will follow BMP 12.5 and 33 CFR 323.4 Baseline Provisions and be located to avoid wetlands to the extent practicable. Where wetlands cannot be avoided roads will be designed and constructed to minimize the footprint in wetlands and minimize adverse impacts to wetlands. Rock pits will be located outside wetland areas where practicable.

Slope Stability

Roads are located to avoid steep or unstable soils. Road segments located on slopes over 67 percent gradient require geotechnical review. To maintain slope stability road design features can include full bench construction, full bench and end-haul, rock walls and other techniques. Avoiding road construction on unstable slopes is generally the most cost-effective option.

Other Resource Information

Site-specific design criteria for these and other resources are listed in appendix A starting on page 270.

Link to Road Cards and Maps

Individual road cards and maps can be found on the project webpage here:
https://www.fs.usda.gov/project/?project=53477

Appendix C – Catalog of Past, Present and Reasonably Foreseeable Future Projects

Interrelated projects are defined as activities that could potentially interact with the alternatives in a manner that could result in cumulative impacts. These activities were identified by the interdisciplinary team and have been considered in the cumulative effects sections of each resource in chapter 3. The geographic area for the cumulative impacts analysis is determined by each resource.

Interrelated projects have been grouped as past, present, and reasonably foreseeable future actions and they are listed and described below to ensure that full consideration has been given by each resource. Table 97 identifies the potential resource interactions among the interrelated projects and various resources. Not all of these activities interact with every resource because the cumulative effects analysis area varies by resource. It is important to note that the potential resource interactions among the interrelated projects shown in table 97 may not necessarily contribute to cumulative impacts. Rather, table 97 was developed by the interdisciplinary team to identify the interrelated projects that have the potential to interact with the resource.

Past Projects

Table 97. Past harvest within the South Revilla project area displayed as acres of harvest by decade

Agency	1960-1969	1970-1979	1980-1989	1990-1999	2000-2009	2010-2019	Total Acres
Forest Service (NFS lands)	880.09	4135.62	2457.4	3531.78	981.62	37.77	12,024.28
State of Alaska (Alaska Mental Health Trust Authority)[1/]	0	0	0	0	3,726	0	3,726
Cape Fox Native Corporation	0	184	0	477	86	28	775
Total	1,140	727	0	2,790	4,231	64	8,952

Sources: USDA Forest Service, GIS;

1/ Clark 2012, State of Alaska, personal communication

Timber Stand Improvement 5-Year Plan (2002-2007)

This project involved pre-commercial thinning (PCT) for timber stand improvement and pruning for riparian and wildlife habitat values on about 5,000 acres of overstocked young-growth forest on Revillagigedo Island. (February 2002 Decision)

Timber Stand Improvement 5-Year Plan (2008-2013)

This plan included pre-commercial thinning on about 3,800 acres of overstocked young-growth forest (lands suitable for timber harvest and old-growth stands) to enhance timber and wildlife habitat values (November 2007 Decision).

Ketchikan Misty Fjords Ranger District Access and Travel Management Plan

The Ketchikan Misty Fjords Ranger District (KMRD) Access and Travel Management (ATM) plan supports the goals and objectives of travel management and road maintenance. The ATM identifies the minimal road system required for forest management of public motorized use (July 2008 Decision).

Ketchikan Misty Fjords Ranger District Outfitter/Guide Management Plan

The Ketchikan Misty Fjords Ranger District (KMRD) Outfitter/Guide Management Plan determines recreation use levels for outfitters and guides, and allocates approximately 50,671 service days annually for outfitter and guide use on KMRD (January 2012 Decision). The highest guided use annually (2005-2009) was 2 service days within the project area.

Timber Stand Improvement (2012)

This project included pre-commercial thinning on about 700 acres of overstocked young-growth forest (lands suitable for timber harvest and old-growth stands) to enhance timber and wildlife and fish habitat values. Thinning was authorized to begin in 2012 in the vicinity of the Fire Cove log transfer facility (June 2012 Decision).

Present and Ongoing Projects

Ketchikan to Shelter Cove Road

The Alaska Department of Transportation and Public Facilities (DOT&PF) is in the process of finishing the construction of the Ketchikan to Shelter Cove Road. This project, once completed, will connect the previously isolated Shelter Cove road system to the community of Ketchikan via the Revilla Road, White River road, and the Leask Lake road systems. The road will be 23.6 miles long, and would use 17.6 miles of existing logging roads. Should open to the public in 2021.

Recreation use is anticipated to increase in the future from improved public access on the Ketchikan Shelter Cove road.

Alaska Mental Health Trust Authority Land Exchange

On May 5, 2017 Congress directed the Forest Service to complete the Alaska Mental Health Land Exchange in two years and in two phases in the Consolidated Appropriations Act, 2017, Public Law 115-31, Division G, Section 431(a)(2), known as the "Alaska Mental Health Trust Land Exchange Act of 2017", Phase 1 was completed in January 2019 for 2,400 acres near Naukati, and 2,500 acres in Ketchikan. Phase 2 is underway and pending finalization in early 2021. Pursuant to the Act, the land exchange is an equal value exchange. As a mechanism for balancing values, parcels can be dropped from the land exchange beginning with the prioritized Federal parcels. Depending on the outcome of the title case at the Alaska Supreme Court regarding 3,374 acres of non-federal land and final real estate appraisal value, approximately 8,224 acres in the project area south and west of Shelter Cove may or may not be exchanged to Alaska Mental Health Trust Authority under the Act.

Leftovers Timber Stand Improvement 2018

This plan includes pre-commercial thinning, crop tree release, pruning, or combination thereof using chainsaws on about 4,430 acres of young-growth stands to improve timber production, enhance wildlife habitat, and restore riparian ecosystems on the KMRD land base. These activities would take place in previously harvested stands on Revillagigedo and Hassler Islands, Southeast Alaska, and thin approximately 500 to 600 acres annually (April 2018 Decision). There are 1,965 planned acres of activity within the project area.

Powerlines and Hydroelectric

SEAPA maintains powerline corridors annually, with each segment treated at roughly 10-year intervals.

Beaver Falls Hydroelectric Project (FERC P-1922)

The Beaver Falls hydropower plant is owned and operated by the Ketchikan Public Utilities (KPU). This project consists of two dams with reservoirs and two powerhouses. Upper and Lower Silvis Lakes are formed behind concrete-faced, rock-filled dams which have a separate spillway weir and channel. Tunnels and penstocks connect Upper Silvis Lake to the powerhouse located on Lower Silvis Lake, and from Lower Silvis Lake to the Beaver Falls powerhouse located on the west side of George Inlet at tidewater. The total capacity is 5,000 kW.

Swan Lake Hydroelectric Project (FERC P-2911)

The Swan-Lake Hydroelectric Project is located northeast of the South Revilla project area. It consists of a concrete arch dam that is 174 feet high and 430 feet long. The Swan Lake Reservoir, with a surface area of 1,500 acres at normal maximum elevation, includes a power tunnel that is 2,200 feet long and 11 feet in diameter, leading from an intake structure at the north abutment upstream of the dam to the powerhouse. An indoor-type remotely controlled concrete powerhouse, containing two generating units with a total rated capacity of 22,000 kW is located at Carroll Inlet immediately north of the mouth of Falls Creek. It also includes a13.8/115-kV substation, and access facilities comprised of port facilities 1,000 feet north of the powerhouse. A staging area adjacent to the port facilities has access roads from the port facilities to the powerhouse and dam. A 115 kV transmission line extends from the powerhouse substation 30.5 miles to the existing S.W. Bailey Substation (see description below).

Swan Lake Powerline

The transmission line extends from the S.W. Bailey Substation in Ketchikan to the switchyard at the powerhouse. The 115-kV transmission line is about 30.5 miles in length. The line follows the route of the existing 34.5-kV line north from the S.W. Bailey Substation to Ward Cove. From there the line extends east along the north side of Connell Lake, then turns to follow the White River Valley to the upper end of George Inlet. The powerline extends along the north side of George Inlet (Salt Chuck) heading east to the South Saddle Lake area, near Carroll Inlet, where it turns to the north and follows the western edge of Carroll Inlet to a location opposite the powerhouse. The line then crosses the inlet via an overhead span to the Swan Lake dam, terminating at the switchyard adjacent to the powerhouse. Swan Lake dam, associated facilities (on State land) and transmission lines were placed into service between 1981 and 1985. The powerline, originally authorized under a special use permit in 1984, is currently issued to Southeast Alaska Power Agency (SEAPA).

Swan-Tyee Powerline

Located outside the project area, the Swan-Tyee Intertie is a 57-mile-long, 138-kV transmission line interconnects the electric system of Ketchikan to the Tyee Lake hydroelectric project in Wrangell, Alaska. The Forest Service issued a special use permit to Ketchikan Public Utilities (KPU) in September 2001 for its construction. Clearing of the corridor began in 2003 with line construction in 2004. The powerline was completed in 2009 when the line was energized. The powerline is currently authorized under a special use permit to the SEAPA (September 2001 Decision).

Southern Southeast Regional Aquaculture Association (SSRAA) Net Pen Rearing

SSRAA releases approximately 400,000 juvenile Chinook (King) salmon, reared at their Deer Mountain hatchery, into net pens located upper Carroll Inlet between Carroll River and falls Creek. The juvenile chinook salmon are reared in these floating net pens for about one month before release (https://ssraa.org/deer-mountain/; and https://ssraa.org/carroll-inlet-chinook-rearing/).

Shoal Cove Private Inholding

Scofield property on Marble Creek:

- There is a 2003 Plan of Operations for the Marble Mine
- The owner has an approved FERC Hydropower license for up to 750 KW at 68 cubic feet per second which he plans to use hydropower to power hydroponic greenhouses which are not yet built.
- The owner plans to build a new shop on property to hold equipment for construction this year,
    - then to build the corridor to the penstock (floodgate to regulate water on a dam) next year
    - then to build the penstock and dam at falls after that sometime. This will involve constructing a 5-foot retaining wall on top of a waterfall on Marble Creek.

Road Maintenance (Opening Closed NFS Roads for Log Haul)

Routine road maintenance is ongoing throughout the project area and will continue as needed for the foreseeable future.

Maintenance may include surface rock replacement, culvert repair and replacement, bridge replacement, slide removal, cleaning and reestablishing ditches, shoulders, and road driving surface, brushing, and other items that contribute to the preservation of the existing road and minimize adverse effects to water quality and other resources.

Reasonably Foreseeable Projects

State Aquatic Permits

There are four 10-acre aquatic farm permit/leases (Permit Number: ADL107083, ADL107084, ADL107085, and ADL107086) for suspended aquaculture sites available for the public in Carroll Inlet south of Shelter Cove LTF. Should these leases be issued, attention/care may be needed when barging or rafting logs past these areas (from State web page, get link).

Mariculture

Oceans Alaska currently has two permitted operations in the George Inlet area located about mile 8.5; one permit for a hatchery culture type, expires in 2028, and one for suspended culture type, expires in 2027 (ADFG 2019). This is an expanding industry and more permits may be issued in the future.

Alaska Roadless Rule

In 2018, the State of Alaska petitioned the Secretary of Agriculture to exempt the Tongass National Forest from the 2001 Roadless Rule. The Department of Agriculture responded, directing the Forest Service to initiate steps to examine a state-specific roadless area management direction for the Tongass. A final decision, after further public involvement, is expected in late 2020.

Karst Forest Plan Amendment

The Tongass National Forest amended the 2016 Tongass Land and Resource Management Plan (Forest Plan) on August 12, 2020. The amendment for Standard S-YG-KC-02 relates to commercial young-growth timber harvest on lands identified as moderate vulnerability karst. An interactive map showing the extent of karst features, karst vulnerability and young growth suitable for harvest on the Tongass National Forest can be found at https://usfs.maps.arcgis.com/apps/MapJournal/index.html?appid=f68102482a5d4d1eaf3ceedcb877b63e

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