



United States Department of Agriculture

Mt. Baker Geothermal Consent to Lease FINAL Environmental Assessment



**Forest
Service**

**Mt. Baker-
Snoqualmie
National Forest**

**Mt. Baker
Ranger
District**

**Whatcom and
Skagit
Counties,
Washington**

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Reader's Guide

This Environmental Assessment (EA) contains information about a proposal for the US Forest Service (FS) to Consent to Lease, with stipulations, lands identified as suitable for potential geothermal exploration and development of geothermal energy. This Consent is made to the Bureau of Land Management (BLM) which must decide whether to offer the National Forest System (NFS) land for geothermal leasing.

The information in this EA is organized to allow the public, the Forest Supervisor of the Mt. Baker-Snoqualmie National Forest (MBS) to consider the potential future environmental effects of this consent, and the BLM Spokane District Manager to consider potential impacts of competitive leasing. The Forest Supervisor is responsible for deciding whether or not to select the No Action alternative (Alternative 1) or the Proposed Action alternative (Alternative 2). The BLM District Manager is responsible for leasing if Alternative 2 is selected.

Understanding the structure of this document is important to an overall understanding of the information required in an EA. This document includes:

Table of Contents: A table of contents is presented at the beginning of the document. Lists of tables and figures are also included.

Introduction: This section provides the background and location of the project as well as a description of the geothermal leasing process.

Need for the Proposal: This section describes the Purpose and Need for the Proposed Action. It includes Management Direction for the project, the Decision Framework and other Related Decisions. Public Involvement and the Issues generated by scoping are also explained here.

Proposed Action and Alternatives: This section includes a description of the alternatives considered, the No Action and Proposed Action. Stipulations and Standards and Guidelines (related to minerals) to reduce potential resource impacts are documented in this section.

Affected Environment and Environmental Consequences: This section describes the current physical, biological, and social and economic environments within the Project Area. This information provides the baseline for assessment of the potential impacts. In order to facilitate comparison of information provided, this chapter is organized alphabetically by resource.

Agencies and Persons Consulted: This section provides a list of the agencies and tribes that were consulted during the development of this EA. It also lists the interdisciplinary team members, their position within the organization and their role in the development of this project.

Appendices: The appendices provide more detailed information to support the analyses presented in the EA.

Additional documentation, including more detailed analyses of project area resources, may be found in the project planning record located at the Mt. Baker Ranger District, Sedro-Woolley, WA.

Acronyms Used in this Document

ACS – Aquatic Conservation Strategy

ATM – Access Travel Management Plan

BLM – Bureau of Land Management

BMP – Best Management Practice

BMU – Bear Management Unit

CEQ – Council on Environmental Quality

CFR – Code of Federal Regulations

CSU – Controlled Surface Use

EA – Environmental Assessment

ESA – Endangered Species Act

FEIS – Final Environmental Impact Statement

FERC – Federal Energy Regulatory Commission

FLPMA – Federal Land Policy and Management Act

FS – United States Forest Service

FSM – Forest Service Manual

FSR – Forest System Road

GHG – Green House Gas

HUC – Hydrologic Unit Code

ID – Interdisciplinary

IRA – Inventoried Roadless Area

IPCC – Intergovernmental Panel on Climate Change

LRMP – Mt. Baker-Snoqualmie Land and Resource Management Plan

LSR – Late Successional Reserve

MA – Management Area

MBRD - Mount Baker Ranger District

MBS – Mt. Baker-Snoqualmie National Forest

MIS – Management Indicator Species

NEPA – National Environmental Policy Act

NFMA – National Forest Management Act

NFS – National Forest System

NMFS – National Marine Fisheries Service

NSO – No Surface Occupancy

NRCS – Natural Resources Conservation Service

NRIS – National Resource Information Systems

NWFP – Northwest Forest Plan

PEIS – Programmatic Environmental Impact Statement

RARE II - Roadless Area and Evaluation Project

RFD – Reasonably Foreseeable Development

RM – River Mile

ROD – Record of Decision

ROS – Recreation Opportunity Spectrum

SaSI – Washington State Salmon and Steelhead Stock Inventory

TESP – Threatened, Endangered and Sensitive Species

TL – Timing Limitation

TMDL – Total Maximum Daily Limit

USDA – United States Department of Agriculture

USDI– United States Department of the Interior

USDC – United States Department of Commerce

USGS – United States Geologic Survey

USFWS – United States Fish and Wildlife Service

VQO – Visual Quality Objective

WEM – Waiver, Exception, or Modification

WSR – Wild and Scenic River

Chapter 1 Introduction

The Forest Service (FS) proposes to determine surface suitability for potential geothermal exploration and development, with stipulations, on approximately 81,820 acres of National Forest System (NFS) lands on the Mt. Baker Ranger District (MBRD) of the Mt. Baker-Snoqualmie National Forest (MBS) (Figure 1).

Forest staff prepared this environmental assessment (EA) to determine whether effects of the proposed activities may be significant enough to prepare an environmental impact statement. This project implements a land management plan, not authorized under the Healthy Forests Restoration Act of 2003 that is subject to subparts A and B of the Predecisional Administrative Review Process. For more details of the proposed action, see the “Proposed Action and Alternatives” section of this document.

This analysis is in response to a request from the Bureau of Land Management (BLM) for the Consent to Lease lands administered by the MBS, MBRD. BLM is responsible for managing geothermal resources on federal lands. In this case, industry nominated a portion of the area under analysis to lease for potential geothermal exploration and possible energy development. BLM forwarded this nomination to the FS for consideration. In order to improve administrative efficiency, the Forest Service proposed additional lands for concurrent analysis.

Industry nominated lands (unparceled) are shown in Figure 2 as 2013 Nomination (shaded in salmon color) and Forest Service proposed (shaded in yellow). If the FS consents to lease portions of the area, BLM would then offer those areas for sale by competitive lease. Only after the lands are leased and a lessee submits a plan for exploration would any ground disturbing operations be analyzed. The BLM, with assistance from the FS, would conduct additional environmental analyses of any leased locations proposed for geothermal exploration and/or development. These future analyses would evaluate effects at a more site specific level than found in this analysis.

The consent to lease and leasing would in and of themselves have no direct, indirect, or cumulative impacts on any resources as no ground disturbing actions would be authorized. Impacts associated with any post leasing activity would be attributed to geothermal exploration and possible subsequent development, which would require additional site-specific environmental analyses. For lands selected for leasing, the FS would identify any necessary stipulations that would be incorporated into any BLM leasing action that would guide subsequent surface disturbing activities.

Background

In May of 2011, the FS received written notification from the BLM that a company had expressed interest in exploring and potentially developing geothermal energy on lands within the MBS. In response, the FS consulted with Tribes, conducted public scoping, and drafted an EA to analyze the suitability of leasing the nominated area; 5,500 acres situated between Mt. Baker and Baker Lake.

In March of 2013, the MBS received a second nomination letter from the BLM to lease an additional estimated 14,640 acres. In order to avoid duplicating efforts and creating two similar EA documents in a short timeframe, the FS decided to stop the analysis begun for the 2011 nominations and broaden the analysis to include the new nominations. Subsequently, and not related to this decision, the 2011 nomination to lease 5,500 acres was withdrawn. However, the interest in obtaining leases on the additional 14,640 acres remains and must be evaluated.

In order to efficiently address potential future nominations in one EA, the FS proposes to analyze an area that includes all NFS lands managed by the MBRD surrounding Mt. Baker that are eligible for mineral

entry, whether formally nominated or not. This results in a Project Area of approximately 81,820 acres. Of the 81,820 acre analysis area, 14,640 acres were nominated for geothermal leasing by a third party in 2013. In order to take a holistic approach to the analysis and to find administrative efficiencies, the FS is proposing to analyze an additional 67,180 acres (including the 5,500 acre area nominated in 2011 that was dropped) for potential leasing. This would allow the analysis to take a broad view of leasing opportunities and constraints at a landscape scale, and would reduce the administrative burden of several similar analyses.

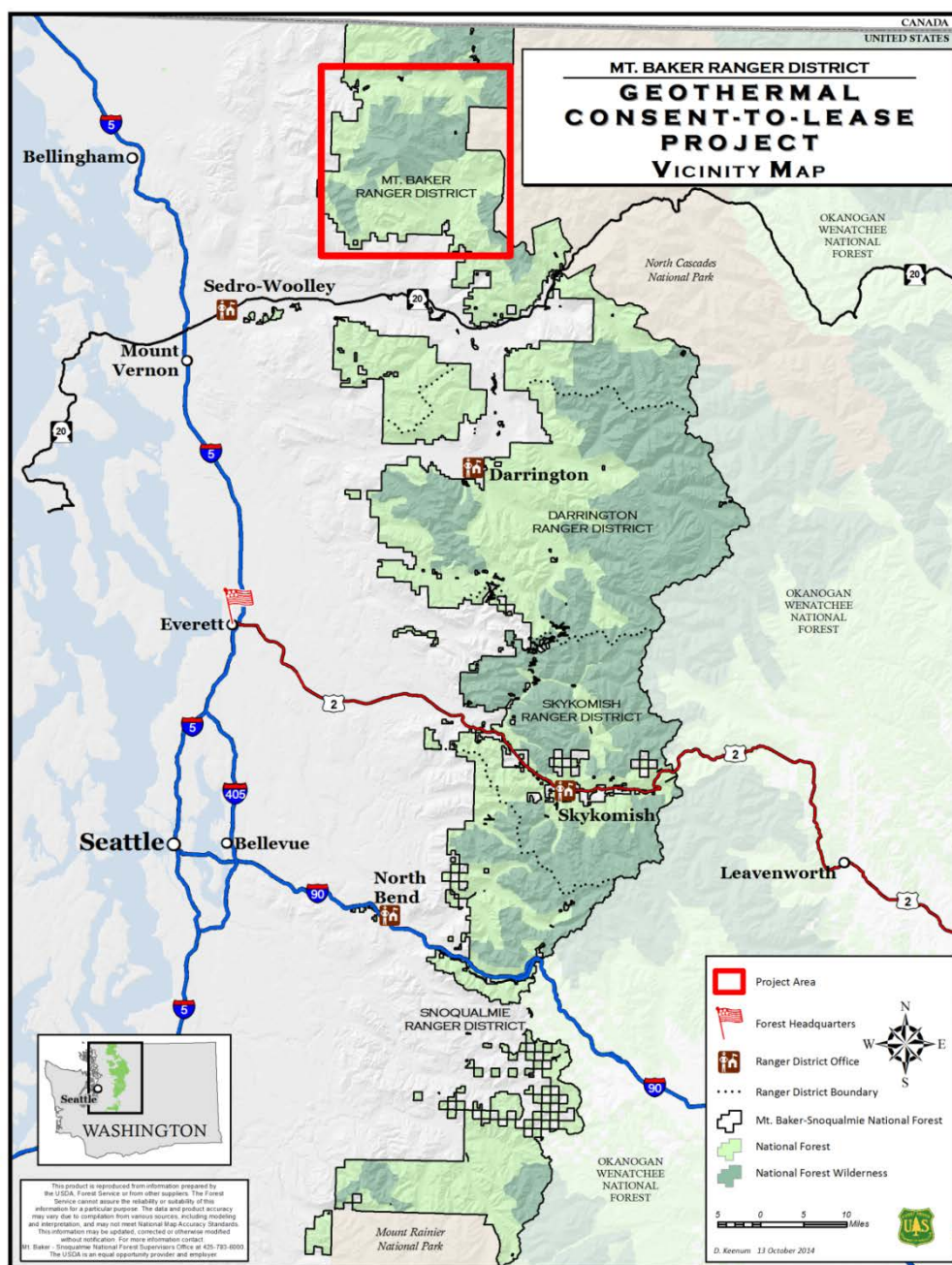


Figure 1. Vicinity Map



The project area does not include an 8,350 acre area between Mt. Baker and Baker Lake, as the MBS already responded to a Consent to Lease this area in a Record of Decision dated August 4, 2010 (refer to blue-shaded area in Figure 2). The 2010 Record of Decision was based on a Programmatic Environmental Impact Statement prepared by the BLM and FS in 2008 (PEIS) that analyzed potential geothermal lease areas throughout the western United States, including at Mt. Baker.

This analysis evaluates the surface suitability of the Project Area (consisting of the industry nominated and FS proposed acres). Following the analysis, the FS determines if the lands may be leased, leased with stipulations, or withdrawn from further consideration for geothermal leasing and possible subsequent development. For lands selected for leasing, the FS will also identify stipulations that would protect existing surface resources.

The BLM is the federal government's manager of the mineral estate on federal lands and is responsible for issuing geothermal leases, including on NFS lands, but can only do so if the FS determines its lands are available and consents to lease. This project will not make a decision to grant leases or authorize any geothermal exploration or development activities. This project will only analyze whether to consent to the BLM to offer specified NFS lands for geothermal lease sales.

Leasing in itself has no direct impacts on any resources, aside from establishing an encumbrance on the leased lands. Subsequent post-leasing exploration or development could potentially have impacts on resources. However, these impacts would be avoided, minimized or mitigated through the application of lease stipulations and the implementation of Best Management Practices (BMPs) if and when future exploration or development is proposed. Any post-leasing exploration or development would be subject to further environmental analysis.

In accordance with NEPA, an interdisciplinary (ID) team of resource specialists conducted an analysis of the MBRD Geothermal Consent to Lease project. The ID Team performed the necessary research, conducted an assessment of the project's specific proposed action, sought public involvement, considered alternatives to the proposed action, and determined which stipulations would be required to protect natural resources if consent were authorized and leasing occurred.

This EA documents potential environmental effects related to the Proposed Action. The EA gives sufficient detail to the public and the decision maker (the Forest Supervisor) to provide an understanding of the environmental effects (consequences) of the alternatives, and to provide enough information to make a reasoned choice between alternatives. The Forest Supervisor will use the EA as the basis of the decision, which will be documented in a Decision Notice and Finding of No Significant Impact. The BLM will use the EA as a basis for deciding whether to offer the specified land for competitive geothermal leasing.

The project, if implemented, would authorize the BLM to conduct geothermal lease sales for those NFS Project Area lands the FS determined to be suitable for geothermal development. For lands selected for leasing, the FS would identify any necessary stipulations that would be incorporated into any BLM leasing that would guide subsequent surface and subsurface activities.

Location of the Proposed Project Area

The Project Area is located approximately 23 miles east of Bellingham, WA and 16 miles northeast of Sedro-Woolley, WA, (Figure 1). The majority of the Project Area is within Whatcom County with some portions straddling the Skagit - Whatcom County line (Figure 2). Table 1 contains the legal land description and acres by township and range of NFS lands proposed for analysis within the Project Area. The Project Area does not include the Mt. Baker Wilderness, Mt. Baker National Recreation Area,

Sulphur Creek Botanical Area, or the North Fork Nooksack Research Natural Area. These areas are excluded from mineral leasing, either by Statute or Forest Plan direction.

Table 1. Project Area Acres by Legal Land Description

Township	Range	Project Area Acres
36N	7E	3,220
	8E	580
37N	6E	90
	7E	11,450
	8E	12,040
	9E	2,850
38N	6E	2,530
	7E	8,330
	8E	1,830
	9E	10,660
	10E	2,280
39N	6E	1,270
	7E	12,080
	8E	11,110
	9E	1,500

Geothermal Leasing Process

Leasing geothermal resources on Federal lands is authorized under the Geothermal Steam Act of 1970, as amended by the Energy Policy Act of 2005. The BLM is the federal government's minerals manager and is responsible for issuing leases on NFS lands, but can only do so if the FS consents to leasing.

The BLM receives nominations from applicants for leases for potential geothermal exploration and development, which may include proposed tract configurations for parcels. The BLM then forwards the proposals to the FS, who is responsible for conducting NEPA analysis for consenting to lease, identifying appropriate lease stipulations under which the lease may be developed, and ensuring that leasing is consistent with the Mt. Baker-Snoqualmie Land and Resource Management Plan (LRMP) and complies with other regulation and policy. Figure 3 provides a visual display of the geothermal leasing process, which includes both non-ground disturbing and ground disturbing actions.

Subsequent to leasing, if exploration is proposed on leased lands by the lessee, the permit application is submitted to the BLM. The BLM coordinates the NEPA review with the FS, which proposes permit conditions of approval involving surface issues. The BLM then determines if the permit application should be approved and, if approved, what conditions of approval would be attached to the permit. Following exploration, if an operator proposes to drill wells intended for production or injection or to utilize the geothermal resource (which are lease exclusive operations), the BLM is responsible for review and final approval of these types of operational permit applications, after consultation with the FS. Under most circumstances, a single NEPA document would be prepared with the BLM as lead and the FS as a cooperating agency.

Leasing geothermal resources by BLM vests with the lessee a non-exclusive right to future exploration and an exclusive right to develop, produce, and use the geothermal resources within the leased area (subject to existing laws, regulations, and formal orders) under the terms, conditions and stipulations in or

attached to the lease form. Lease issuance alone does not authorize any ground-disturbing activities to explore for or develop geothermal resources without site specific approval for the intended operation.

A lease is issued for a primary term of 10 years and may be extended for two five-year periods. Each of these extensions is available provided the lessee meets the work commitment requirements or made payment in lieu of minimum work requirements each year. At any time a lease may receive a 5-year drilling extension. Once commercial production is established, the lease may receive a production extension of up to 35 years and a renewal period of up to 55 years. The lease must continue to produce to remain in effect. The BLM may grant a suspension of operations and production on a lease when justified by the operator (see 43 CFR 3207).

Lifecycle of the Geothermal Leasing Process: Environmental Review Stages

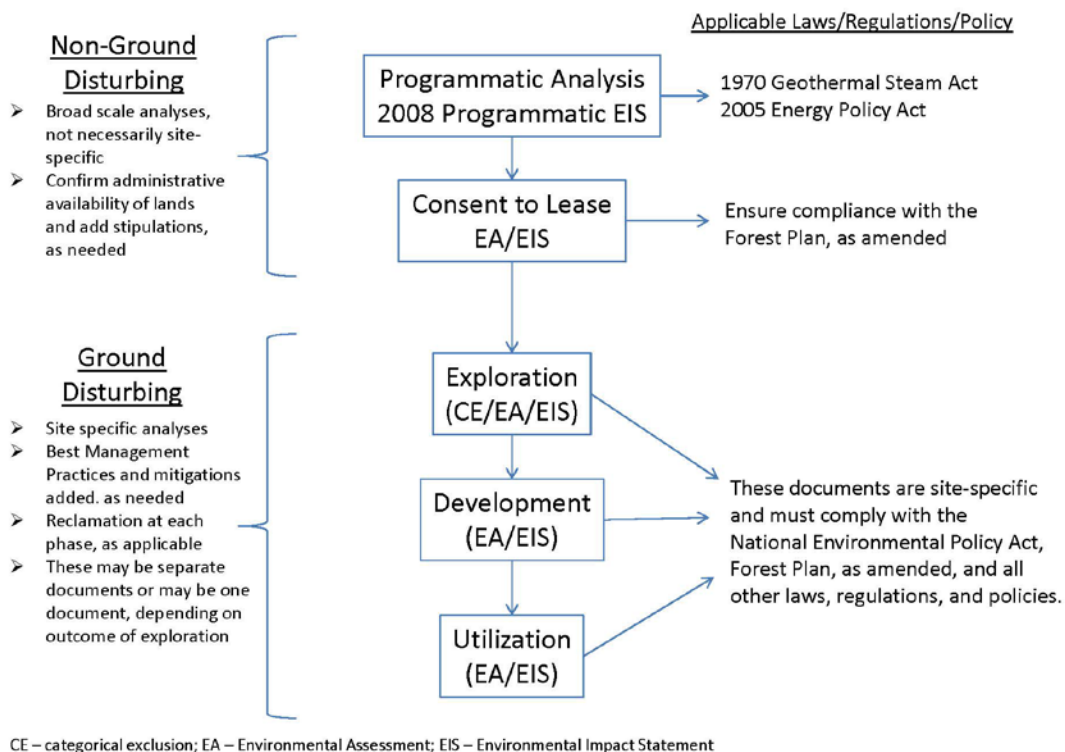


Figure 3. Flowchart of the Geothermal Leasing Process

Geothermal exploration and production on Federal land conducted through leases is subject to terms and stipulations to comply with all applicable Federal and state laws pertaining to various considerations for tribal interests, sanitation, air and water quality, wildlife, safety, cultural resources, and reclamation.

The FS would deny lands from further consideration when leasing would violate current law, regulation, or management direction. For lands determined to be suitable for leasing and potential development, the FS would develop stipulations, which BLM is required to incorporate into any lease offered for competitive auction, to reduce or eliminate adverse environmental impacts associated with exploration and subsequent development of geothermal resources.

Need for the Proposal

The purpose and need of the proposal has three elements:

1. *There is a need to determine what NFS lands are administratively available for leasing for potential geothermal exploration and development.*

Background. Specifically, in accordance with the Energy Act of 2005, the FS needs to coordinate with BLM to issue decisions on pending lease applications. The Act responds to policy directives for clean and renewable energy, meeting the increasing energy demands of the nation while reducing reliance on foreign energy imports, reducing greenhouse gas emissions, and improving national security. Likewise, the Geothermal Steam Act of 1970, as amended guides the leasing of lands containing geothermal resources.

2. *For lands determined suitable for leasing, there is a need for identification of appropriate resource protection stipulations to those lands.*

Background. In accordance with the Acts above, the FS identifies geothermal lease stipulations where potential leasing may conflict with land management direction. If the leasing of lands for the development of geothermal energy causes impacts to public lands or resources prohibited in other direction (law, regulation, or policy), the BLM does not have a right to lease that land. It is the responsibility of the FS to identify where potential resource degradation may occur and develop stipulations to minimize or eliminate negative impacts.

3. *There is an administrative need to be efficient and responsive to mineral leasing applications through the NEPA process.*

Background. In order to take a holistic approach to the analysis and to find administrative efficiencies, the FS is proposing to add 67,180 acres for potential leasing to the nominated 14,640 acres for a total project area of 81,820 acres. This would allow the analysis to take a broad view of leasing opportunities and constraints at a landscape scale, and would reduce the administrative burden of several similar analyses.

Decision Framework

The Forest Supervisor for the MBS is the Responsible Official for determining whether or not to consent to leasing of any or all of the 81,820 acres in this project. The Forest Supervisor will make three decisions:

1. Whether to Consent to Lease nominated lands with no added stipulations,
2. Whether to Consent to Lease nominated lands with stipulations, or
3. Whether to deny the Consent to Lease nominated lands on the National Forest.

The Forest Supervisor will document her decision and rationale in a Decision Notice and Finding of No Significant Impact consistent with the requirements of Forest Service NEPA regulations (36 CFR 220.7(c)). The Decision Notice will determine consistency with the Forest Plan, as amended.

The BLM Spokane District Manager is the Responsible Official for determining whether or not to lease any or all of the NFS lands to which the Forest Supervisor has given consent, inclusive of any FS stipulations for resource protection.

Authorities: Federal, State and Local Regulatory Considerations

The leasing of geothermal resources is subject to a number of Federal, state, and local laws, regulations, and plans. The following are many of the Federal and state policies, plans, and laws taken into consideration in developing this EA: Geothermal Steam Act of 1970, Mining and Minerals Policy Act of 1970, Energy Policy Act of 2005, Executive Order 13423, National Forest Management Act of 1976 (NFMA), Federal Land Policy and Management Act of 1976 (FLPMA), the Endangered Species Act, Clean Water Act, FS policy on mineral leasing, and the State of Washington Renewable Portfolio Standard Program.

Tribal Consultation

In accordance with Section 106 of the National Historic Preservation Act and Executive Order 13175, consultation with the following tribes was initiated in a letter dated April 9, 2012 on the initial Consent to Lease project as described in the Background Section: Lummi, Nooksack, Samish, Swinomish, Sauk-Suiattle, Tulalip, and Upper Skagit Tribes. Consultation was reinitiated with the same tribes in a second letter dated October 23, 2014 describing the changes to the original Consent to Lease project and asking for information to be considered during development of the current project. Consultation letters and comment letters received are available in the Project Record.

Responses were received from the Skagit System Cooperative (representing the Swinomish and Sauk-Suiattle Tribes), and the Tulalip Tribe. The FS also met with the Upper Skagit Tribe on March 13, 2015. Documentation of this consultation is available in the Project Record.

Consultation continued with letters dated February 4, 2015 to the same seven tribes announcing the opportunity to comment on the Draft EA. In addition, the District Ranger met with representatives of the Upper Skagit Tribe on March 13, 2015 to discuss this project. Comment letters received and notes from the meeting are available in the Project Record.

Public Involvement

To formally solicit public input on the proposed action, the MBS published a press release on October 31, 2014 in the Everett Herald, and posted a public scoping letter and map information on the MBS Schedule of Proposed Actions web site. Also on October 31, the Forest mailed 136 scoping letters and emailed 284 scoping notices (which included a link to the Forest's project website) to individuals, organizations, local, state and federal agencies, companies and local land owners. The Associated Press (AP) published a story about the project on October 31, 2014. The AP story was also published by the *Everett Herald*, *Seattle Times*, *Seattle Post-Intelligencer*, *the Columbian*, and *Skagit Valley Herald* newspapers. Radio Station KIRO FM 97.3 aired a news story on November 7 and posted the story on their website MyNorthwest.com. The story also appeared on KIRO TV, KING TV, and Northwest Cable News on October 31. A public service announcement about the project aired on KSER FM 90.7 on November 21, 2014. The Notice of Opportunity to Comment asked for the public to comment on the proposal by December 1, 2014.

The FS received 17 written and oral comments from interested individuals, organizations and government agencies. The scoping letter and comments received are available in the Project Record.

Public involvement continued with the publication of a Legal Notice of Opportunity to Comment on the Draft EA on February 2, 2015 in *The Everett Herald*. On February 4, 2015, the FS mailed a notification letter and CD of the EA to 35 parties who commented during the scoping period, including interested agencies, organizations, and individuals, that the Draft EA was available for review and comment. Oregon Public Broadcasting and KUOW aired a news story and published a story about the

project on April 13, 2015. NPR published the same story on April 20, 2015 on their website. Six written letters (one representing eleven different organizations) were received. The specific comments are listed, along with the agency response, in Appendix B - Public Comments and Forest Service Responses, to this Decision Notice. The comment letters received are available in the Project Record.

Issues

Identification of the Issues

Issues are points of discussion, debate, or dispute about environmental or social effects that may occur as a result of the proposed action. Issues provide focus and can influence alternative development and development of mitigation measures to address potential adverse effects. Issues are also used to compare the effects between the proposed action and any other alternative regarding a specific resource. The ID team assigned to the project reviewed public comments received during scoping to determine if there are any key issues to be addressed based on criteria from the Council on Environmental Quality (CEQ) regulations at 40 CFR 1501.7. The Following is a discussion of the types of issues for this project:

Key Issues

Key issues are those that represent a point of debate or concern that cannot be resolved without consideration of the trade-offs involved. These issues spur the design of alternatives to the proposed action that provide a different path to achieve project objectives. Trade-offs can be more clearly understood by developing alternatives and displaying the relative impacts of these alternatives weighed against the proposed action.

Key issues are used to develop alternatives, identify mitigation measures, or track environmental effects. Issues may be “key” due to the extent of their geographic distribution, the duration of their effects, or the intensity of public interest or resource conflict.

This project is unique in that there is no ground disturbance related to the proposed action under analysis. The analysis is a consistency evaluation, to determine whether existing law, policy, or regulations allow leasing NFS land for potential geothermal exploration and development. Further, without a site specific proposal, environmental effects are speculative. Therefore, no key issues were identified that would provide a clear reason to develop other action alternatives than to lease, with stipulations, or to deny leasing the nominated parcels.

Non-Key Issues

Non-key issues are identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The CEQ NEPA regulations require this delineation in Sec. 1501.7, “...identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)...” Non-key issues and reasons regarding their categorization as non-key are as follows:

- Deny leasing because it would not be consistent with management direction.

Geothermal leasing would conform to all public laws, executive orders, and LRMP standards and guidelines.

- The EA does not address future action on leases.

This EA only pertains to whether or not the FS should consent to lease all or portions of the Project Area with stipulations to be consistent with LRMP direction as a basis for BLM's decision for potential leasing action consistent with the FS consent. This project does not propose any geothermal activity that would have direct, indirect or cumulative impacts on NFS lands or resources. This document does analyze potential effects of geothermal exploration and development based on the Reasonably Foreseeable Development scenario as described in the PEIS (pp. 2-34 through 2-49) and incorporated by reference. If post lease an application for geothermal activities is subsequently received, site specific analysis would be conducted and appropriate stipulations applied for protection of resources. Figure 3 provides a visual description of the geothermal leasing process.

Proposed Action

The Forest Service proposes to consent to the BLM to offer specified NFS lands for geothermal lease sale, subject to stipulations. The MBS will evaluate the suitability of approximately 81,820 acres for Consent to Lease and develop appropriate stipulations to protect resources (e.g., late-successional reserve and riparian habitat; threatened, endangered and sensitive species; heritage resources; geologic resources) for those lands deemed suitable. The Section on Resource Protection Measures (pp. 24-29), describes in detail the stipulations that would limit or preclude surface occupancy in the event of geothermal associated activities.

Management Direction

Development of this EA follows implementing regulations of the National Forest Management Act (NFMA); Title 36, Code of Federal Regulations, Part 218 (36 CFR 218); Title 36, Code of Federal Regulations, Part 220 (36 CFR 220); Council on Environmental Quality, Title 40; CFR, Parts 1500-1508, NEPA. This section describes applicable Forest Plan management direction as well as current laws, regulations, and executive orders. It also provides a consistent basis for decision by the BLM regarding geothermal leasing pursuant to 43 CFR 3200 – Geothermal Resource Leasing.

MBS Land and Resource Management Plan (LRMP), as Amended

The MBS LRMP (1990), as amended, guides all natural resource management activities and provides standards and guidelines for the MBS, including the potential for geothermal exploration and development. This project is tiered to the Final Environmental Impact Statement (FEIS) for the Mt. Baker-Snoqualmie Land and Resource Management Plan, as amended. In accordance with FLPMA, as amended, for leased lands, BLM regulations require that activity on geothermal and other leases conform to the MBS LRMP. The LRMP provides statutory guidance for all Forest management activities.

Goals

The goals of the LRMP provide for the (1) exploration, development, and utilization of energy resources, (2) inclusion of special stipulations to integrate exploration and development with the protection and management of other resources and uses, and (3) minimization of adverse environmental effects of energy resource exploration, development and extraction on other resources and uses (LRMP p. 4-6).

Desired Future Condition

The LRMP desired future condition for energy resources predicts an increasing interest in geothermal resources (LRMP p. 4-11).

Forest-wide Standards and Guidelines

The LRMP identifies the following forest-wide standards and guidelines that apply to minerals and energy, including geothermal activities (LRMP, page 4-136):

- An appropriate environmental analysis and documentation will be used as a basis for making recommendations in leasing or licensing and in determining necessary stipulations for the protection of other resources. FW-297 – Permits for leasable minerals shall provide for protection and rehabilitation of surface resources.
- Processing and administration of all mineral, oil and gas and geothermal leases, exploration proposals, and development proposals will be in accordance with State and Federal rules, regulations, and standards.
- Mineral exploration and mineral removal are permitted throughout the forest, except withdrawn areas.
- All geothermal exploration and development activities which involve significant disturbance of the surface resources require a notice of intent and/or an operating plan be submitted and processed in accordance with Oil and Gas Resources 36 CFR 228.E. 2012.
- Reclamation standards will be developed to insure land restoration to a productive condition to the extent practicable. Opportunities to enhance other resources will be considered. Concurrent reclamation will be required and bonded.
- For mineral lease applications submitted by BLM, appropriate stipulations will be required for leases as necessary to achieve Management Area prescriptions. "No surface occupancy" stipulations will be incorporated in lease recommendations when: (a) surface occupancy would cause significant resource disturbance which cannot be mitigated by other means; (b) where resource impacts would be irreversible or irretrievable; or (c) the activity proposed is incompatible with the surface management prescription.

Additional Forest-wide standards and guidelines from the LRMP pertinent to resource protection are found in the Project Record. Of particular importance is:

- **Unstable Soils:** For soils that are identified as Unstable or Very Unstable in the LRMP (Soil Class S-8, Figure 4), a No Surface Occupancy stipulation will be included in a lease recommendation. Areas classified as irreversible soils (S-8) will generally be considered as unavailable for road construction and timber harvest (LRMP, p. 4-117).



Northwest Forest Plan Standards and Guidelines

The Final Supplemental Environmental Impact Statement on Management of Habitat for Late Successional and Old-growth Forest Related Species within the Range of the Northern Spotted Owl, commonly known as the Northwest Forest Plan (NWFP) (USFS and BLM 1994), is an overall plan for the Pacific Northwest that would

“maintain a healthy forest ecosystem with habitat that will support populations of native species (particularly those associated with late-successional and old-growth forests), including protection for riparian areas and waters; and maintain a sustainable supply of timber and other forest products that will help maintain the stability of local and regional economies on a predictable and long-term basis.”

The 1994 Record of Decision (ROD) for the NWFP includes seven land allocations, which amended or “merged” with the allocations of the 1990 Forest Plan. There is considerable overlap of NWFP and most LRMP allocations in the Project Area, and more than one set of standards and guidelines may apply. In all instances, the standards and guidelines that are more restrictive or provide greater benefits to late-successional forest-related species would apply. The 1994 ROD also includes Region-wide Standards and Guidelines, in addition to those in the LRMP, and an Aquatic Conservation Strategy (ACS) designed to maintain and restore the ecological health of aquatic ecosystems at the watershed scale. A comprehensive description of the standards and guidelines is available in the 1994 NWFP ROD and incorporated by reference here.

The nominated lease areas are predominantly located within designated Late-Successional Reserves (LSR) and Riparian Reserves. The following guidance applies:

Late-Successional Reserves

LSRs are to be managed to protect and enhance old-growth forest conditions. Any non-silvicultural activities within late-successional reserves are allowed where such activities are neutral or beneficial to the creation and maintenance of late-successional habitat (1994b ROD, p. C-16). The Forest-wide Late Successional Reserve Assessment was completed in 2001 and is available at the MBRD in Sedro-Woolley, WA.

Developments in LSRs

Development of new facilities that may adversely affect Late-Successional Reserves should not be permitted. New development proposals that address public needs or provide significant public benefits, such as power lines, pipelines, reservoirs, recreation sites, or other public works projects will be reviewed on a case-by-case basis and may be approved when adverse effects can be minimized and mitigated. These will be planned to have the least possible impacts on Late-Successional Reserves. Developments will be located to avoid degradation of habitat and adverse effects on identified late-successional species. (1994b ROD, p. C-17)

Riparian Reserves

As a general rule, standards and guidelines for Riparian Reserves prohibit or regulate activities in Riparian Reserves that retard or prevent attainment of the Aquatic Conservation Strategy objectives. Land use activities need to be limited or excluded in those parts of the watershed prone to instability. The distribution of land use activities must minimize increases in peak stream flows. Headwater riparian areas need to be protected, so that when debris slides and flows occur they contain coarse woody debris and boulders necessary for creating habitat farther downstream (1994b ROD, p. B-9).

Minerals Management in Riparian Reserves

For leasable minerals, prohibit surface occupancy within Riparian Reserves for oil, gas, and geothermal exploration and development activities where leases do not already exist. Where possible, adjust the operating plans of existing contracts to eliminate impacts that retard or prevent the attainment of Aquatic Conservation Strategy objectives (1994b ROD, p. C-35).

Other Forest Plan Amendments

Other major Forest Plan amendments since 1990 include:

- Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and Other Mitigation Measure Standards and Guidelines (USFS and BLM 2001).
- Record of Decision for the Pacific Northwest Region Invasive Plant Program: Preventing and Managing Invasive Plants (USFS 2005a).

Land Allocations

The 1990 LRMP and 1994 NWFP provide management guidance for the MBS. Activities are guided by which Land Allocation and Management Area (MA) they are located in and the Standards and Guidelines that apply to that particular Land Allocation and MA. There is considerable overlap of NWFP and most LRMP allocations in the Project Area, and more than one set of standards and guidelines may apply. In all instances, the standards and guidelines that are more restrictive or provide greater benefits for late-successional forest-related species would apply. Figure 5 displays the most restrictive land allocations (with the exception of Riparian Reserves) throughout the Project Area. Certain other restrictions may apply and would be determined with site specific analysis following receipt of a lease application.

The following 3 primary land allocations from the NWFP overlay most of the other LRMP allocations on NF lands in the analysis area:

Riparian Reserves

The Aquatic Conservation Strategy was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands. Riparian Reserves include those portions of a watershed directly coupled to streams and rivers, that is, the portions of a watershed required for maintaining hydrologic, geomorphic, and ecologic processes that directly affect standing and flowing water bodies such as lakes and ponds, wetlands, streams, unstable, and potentially unstable areas. In addition, Riparian Reserves overlay all other management areas, and the Riparian Reserve standards and guidelines apply wherever Riparian Reserves occur (including Late-Successional Reserves). There are approximately 25,260 acres of Riparian Reserves within the project area. They are not depicted in Figure 5 due to their extensive nature in the Project Area.

Late-Successional Reserves and Late Successional Old Growth

The main objectives for these reserves, in combination with other land allocations and standards and guidelines, is to maintain a functional late-successional and old-growth forest ecosystem as habitat for late-successional and old-growth related species. Proposed projects within LSRs must be consistent with Late Successional Reserve Standards and Guidelines. Specifically, projects shall be designed and located, and include mitigation measures, to minimize detrimental effects, so that project activities are neutral or beneficial to the creation and maintenance of LSR habitat. The majority of the Project Area (79,200 acres) is located within NWFP LSRs.

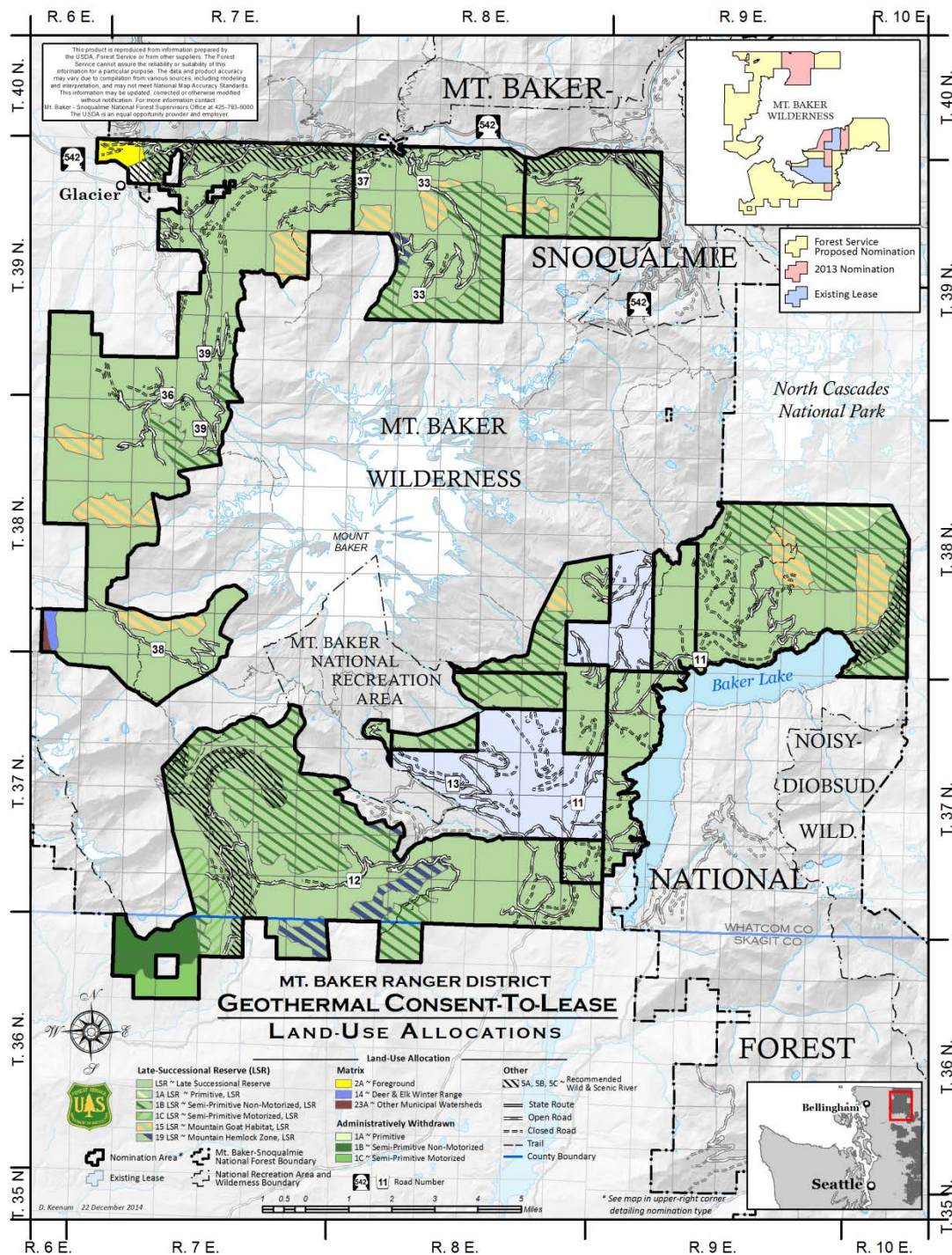


Figure 5. Land Allocations

The following LRMP MAs, described in detail in the LRMP and incorporated by reference, were merged with LSRs.

- MA 1A LSR: Primitive Recreation (LRMP p. 4-158 – 4-160)

- MA 1B LSR: Semi-Primitive Non-motorized Recreation (LRMP p. 4-160 – 4-163)
- MA 1C LSR: Semi-Primitive Motorized (LRMP p. 4-164 – 4-166)
- MA 5A LSR: Recommended Recreation River (LRMP p. 4-189 – 4-191)
- MA 5B LSR: Recommended Scenic River (LRMP p. 4-192 – 4-194)
- MA 5C LSR: Recommended Wild River (LRMP p. 4-194 – 4-196)
- MA 15 LSR: Mountain Goat Habitat (LRMP p. 4-233– 4-236)
- MA 19 LSR: Mountain Hemlock Zone (LRMP p. 4-257– 4-260)

Administratively Withdrawn Areas

These are unroaded areas allocated in the 1990 LRMP (and affirmed by the 1994 NWFP) which emphasize recreation, scenery, wildlife, or other resources, and do not include programmed timber harvest. Administratively withdrawn areas within the Project Area include approximately 1,840 acres of LRMP MAs:

- MA 1A Primitive Recreation
- MA 1B Semi-Primitive Non-motorized Recreation
- MA 1C Semi-Primitive Motorized

In addition, to the above 3 land allocations, the following land allocations are also found within the Project Area and depicted in Figure 5.

Inventoried Roadless Areas

Portions of Inventoried Roadless Areas (IRAs) as identified in the LRMP Final Environmental Impact Statement (FEIS) and incorporated by reference (LRMP FEIS p. III-196 – III-201) overlap the above Administratively Withdrawn management allocations (MAs-1A, 1B, and 1C) within the Project Area. Specific LRMP direction prohibits road construction and reconstruction, and timber removal within IRAs. Existing roads and trails may be maintained for exploration activities. The Project Area includes an estimated 42,650 acres of IRAs.

Matrix Lands

The NWFP Matrix allocation includes LRMP allocations not merged with the other three primary NWFP allocations. These are areas in which scheduled full and partial yield timber harvest or other activities may occur, subject to LRMP standards and guidelines. Matrix may also include non-forested areas and lands that are technically unsuited for timber harvest. Matrix lands within the Project Area include approximately 780 acres of LRMP MAs:

- 2A Scenic Viewshed, Foreground (LRMP p. 4-169– 4-172)
- MA 5B Recommended Scenic River (LRMP p. 4-192– 4-194)
- MA 14 Deer and Elk Winter Range (LRMP p. 4-230– 4-233)
- MA 23A Other Municipal Watershed (LRMP p. 4-269– 4-272)

LRMP and NWFP goals, direction, standards and guidelines land management allocations that apply to geothermal leasing are summarized in Table 2.

Table 2. Summarizes LRMP and NWFP Goals, Direction, Standards and Guidelines

Management Area	Summary of Leasing	Guidance, Standards and Guidelines, and Stipulations
LRMP, PEIS, Forest Wide Goals and Standards and Guidelines		
Forest Management Goal for Minerals and Energy		Provide for exploration, development, and production of mineral and energy resources while minimizing effects on the surface resources.
Unstable Soils (S-8)	Leasing with No Surface Occupancy Stipulations (NSO)	NSO for areas containing Soil Class S-8 Unstable and Very Unstable; also unavailable for road construction and timber harvest.
Slopes greater than 40%		NSO for slopes in excess of 40% to protect soils.
Slopes from 30 to 40%	Leasing/Allowed Occupancy with Conditional Surface Use Stipulations (CSU)	CSU to protect erodible soils on slopes between 30 and 40%. A project applicant shall submit a Plan of special design, construction, operation, mitigation, and/or reclamation measures, to be determined through NEPA analysis.
NWFP and LRMP Management Area Standards and Guidelines, as Amended		
Riparian Reserves	Leasing with No Surface Occupancy Stipulations (NSO)	NSO to protect Riparian Reserves, as prohibited by NWFP.
Recommended Wild, Scenic & Recreation Rivers (WSR)		NSO to protect LRMP-recommended WSR river outstandingly remarkable values (MA's 5A, 5B, 5C).
Primitive Areas		NSO to protect setting of primitive recreation areas and Scenery Management System visual integrity level of Very High (preservation) (MA-1A).
Late Successional Reserves (LSR)	Leasing/Allowed Occupancy with Conditional Surface Use Stipulations (CSU) or Timing Limitations (TL)	CSU/TL to protect important habitat conditions within LSRs; design mitigation measures that minimize detrimental effects to LSR habitat, per NWFP. A project applicant shall submit a Plan of special design, construction, operation, mitigation and/or relocation that meets LSR habitat management objectives.
Inventoried Roadless Areas (IRA)		CSU prohibiting road construction, road reconstruction and all timber removal within LRMP IRAs (overlaps portions of MA's 1A, 1B, 1C, 14, 15, 19 and 23A). Existing roads and trails may be maintained for exploration only.
Foreground Scenic Viewshed		CSU requiring activities/improvements to be located, designed, and maintained to be either not evident or visually subordinate to the natural landscape. Applies to visual integrity level of High (VQO Retention) in MA 1B and within foreground areas of primary viewsheds (i.e., Mt. Baker Highway, Baker Lake Highway, and other portions of MAs 1B, 1C, 2A, and 14).
Deer and Elk Winter Range		CSU/TL requiring the applicant to submit a Plan of Operation with mitigation measures to protect and optimize winter range habitat, and minimize disturbance/harassment, including seasonal road closures. Location of new roads shall not adversely impact habitat, and construction/reconstruction timed (MA-14).
NWFP and LRMP Management Area Standards and Guidelines, as Amended		
Mountain Goat Habitat	Leasing/Allowed Occupancy with Conditional Surface Use Stipulations	CSU/TL requires the applicant to submit a Plan of Operation with mitigation measures to protect habitat and winter range, and prevent harassment. No new road construction. Reconstruction of existing roads

Management Area	Summary of Leasing	Guidance, Standards and Guidelines, and Stipulations
	(CSU) or Timing Limitations (TL)	shall be timed (MA-15).
Mountain Hemlock Zone		CSU prohibiting disturbance of mountain hemlock study plots. No new road construction, except temporary roads are allowed to access areas outside of mountain hemlock zone (MA-19).
Municipal watershed		CSU requiring the applicant to submit a Plan for special design, construction, operation, mitigation, and/or reclamation measures to protect water quality, to be determined through NEPA analysis (MA-23A).

Selected Forest Plan Standards and Guidelines

Refer to the Project Record for a list of selected Forest Plan Standards and Guidelines relevant to this project. Refer to the “Forest Plan Consistency” section at the end of each resource area in Chapter 3 of the EA for an assessment of project consistency with these Standards and Guidelines.

The Project Area lands are predominantly allocated as Late Successional Reserves with a variety of Land Management Allocations overlaying them (Figure 5).

Other Laws, Direction and Analyses

This Consent to Lease analysis tiers to the 2008 *Final Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States* (PEIS). The PEIS was used as a framework for analyzing the proposed Consent to Lease for potential environmental effects and is incorporated by reference. Analysis of environmental effects, best management practices, and stipulations determined for the previous lease (2010 Record of Decision) were used as a basis for determining which other NFS lands in the vicinity of Mt. Baker may be suitable for geothermal leasing. Included are stipulations and BMPs (PEIS pp. 2-16 through 2-21) and the Reasonably Foreseeable Development Scenario (PEIS pp. 2-40 - 2-48).

The Department of Agriculture adopted the Roadless Area Conservation Rule in 2001 (36 CFR Part 294.12 and 294.13) which provides protection for Inventoried Roadless Areas (IRAs) by establishing prohibitions on road construction, road reconstruction, and timber harvest in IRAs on NFS lands.

A further list with a description of applicable laws, direction, and analyses is available in the Project Record and incorporated by reference in this Environmental Assessment.

Related Decisions

2010 MBS Geothermal Leases ROD

A decision by the Mt. Baker-Snoqualmie Forest Supervisor, Y. R. Iwamoto, in 2010 (USFS 2010) provided consent determination for 8,355 acres of the MBS to become administratively available for geothermal leasing. The existing lease areas are situated between Mt. Baker and Baker Lake (Figure 2 blue shaded parcels) and are adjacent to lands being evaluated for suitability for geothermal resource development in this document. The 2010 Record of Decision to Consent to Lease this area was based on site specific analysis contained in the 2008 PEIS. There are differences between that document and this document with respect to Late-Successional Reserves and Viewshed stipulations.

Late-Successional Reserves

In the 2010 Decision it was determined that:

All lease areas are within the Baker Lake Late Successional Reserve that is managed to recover populations of northern spotted owls and marbled murrelets. All lease areas are also designated critical habitat for both species and contain the primary constituent elements of critical habitat for nesting. Surface occupancy would result in the destruction of critical habitat for both species. Therefore within old-growth forests of all lease areas, no surface occupancy will be permitted.

The FS agrees with the 2010 decision that No Surface Occupancy is appropriate when the standard terms and conditions, other less restrictive lease stipulations and best management practices for permit approval are determined to be insufficient to achieve the resource protection objectives. The FS would also follow guidance for Designated or Proposed Critical Habitat for listed species under the Endangered Species Act (as amended) as follows:

- Relevant stipulations designed to minimize impacts include NSO for designated or proposed critical habitat for listed species under the Endangered Species Act of 1973 (as amended) if activities would adversely modify the habitat. For listed or proposed species without designated habitat, NSO would be implemented to the extent necessary to avoid jeopardy.

However, the NWFP does provide guidance for non-silvicultural activities within LSRs as follows:

LSRs are to be managed to protect and enhance old-growth forest conditions. Any non-silvicultural activities within late-successional reserves are allowed where such activities are neutral or beneficial to the creation and maintenance of late-successional habitat (1994b ROD, p. C-16).

The impacts of ongoing and proposed mining actions will be assessed, and mineral activity permits will include appropriate stipulations (e.g., seasonal or other restrictions) related to all phases of mineral activity. The guiding principle will be to design mitigation measures that minimize detrimental effects to late-successional habitat (NWFP 1994 p. C-17).

Therefore, this document includes analyses of the RFD within LSRs. It is important to note that the proposed action is related to leasing the nominated and FS proposed lands only, and does not authorize any surface disturbing activities. Appropriate BMPs would be identified and applied within LSRs during site specific analysis upon receipt of a Plan of Operation.

Scenic Viewshed Foreground

The 2010 Decision identifies portions of leases W AOR 056027, W AOR 056028, and W AOR 056029 that are allocated to Scenic Viewshed Foreground (Management Area 2A). It further states:

Activities in this management area are either not evident, or visually subordinate to the natural landscape. Because the Reasonably Foreseeable Development Scenario anticipates disturbed areas of 10 to 15 acres, they could not be visually subordinate to the natural landscape. With [in] this management area in leases WAOR056017, WAOR 056028 and WAOR 056029, no surface occupancy will be permitted.

The 2010 Decision was based on the Visual Management System (VMS) from the Landscape Aesthetics Handbook which is the guidance provided in the LRMP. However, in 1995 the FS revised this handbook and developed the Scenery Management System (SMS) which maintained many of the basic inventory elements of the VMS. At that time direction was provided to begin using the SMS concepts and terms in the revised handbook on new projects. This revised handbook did not amend the LRMP. Therefore, until the LRMP is revised or amended the MBS must incorporate both the VMS and SMS in evaluating

impacts and incorporating appropriate stipulations in managing viewsheds to be consistent with the Forest Plan.

There is not a direct correlation between the VMS and the SMS. Under the SMS only those MAs with a Visual Integrity Level of Very High (designated as Preservation in VMS) are eligible for a NSO stipulation (i.e., 1A Primitive). Under the SMS, Foreground areas of scenic viewsheds receive a Visual Integrity Level of High (i.e., Retention in VMS), which results in a CSU as opposed to a NSO stipulation as applied in the 2010 Decision. Therefore, as this document incorporates both the VMS and SMS management of NFS lands, a CSU stipulation would apply in Foreground areas within MAs 2A, as well as 1B, 1C, and 14.

In addition, the majority of lands within the Project Area are considered Late-Successional Reserves. As stated above, the standards and guidelines that are more restrictive or provide greater benefits to late-successional forest-related species would apply. LSR standards and Guidelines are more restrictive and would therefore be used to manage lands with both visual and LSR allocations.

Baker Lake and SF Nooksack River Access and Travel Mgmt. Plan

The Baker Lake and South Fork Nooksack River Access and Travel Management Plan (USFS 2005b) provides direction on management of 156 miles of roads within the Baker Lake and South Fork Nooksack River Watersheds. The decision includes direction to upgrade, place in storage, decommission, or maintain to standard roads within these watersheds that are considered at risk of failure. This Plan will be referenced when considering future geothermal activities within the Baker Lake or South Fork Nooksack River Watersheds.

Project Record

This EA incorporates by reference the Project Record (40 CFR 1502.21) documenting this NEPA process. The Project Record contains specialist reports and other technical documentation used to support the analysis and conclusions in this EA. These specialist reports address air quality, botanical resources, climate change, environmental justice, fisheries, heritage, hydrology and soils, inventoried roadless, land special uses, minerals, prime forestland, prime farmland and prime rangeland, recreation and special designations, visual resources, wetlands and floodplains, wild and scenic rivers, wildlife, and other considerations. In addition, Specialist Reports document the detailed analytical framework, methods and conclusions employed to assess impacts on these resources.

The section on Affected Environment and Environmental Consequences describes the baseline conditions and the potential environmental consequences of implementing either of the alternatives.

Relying on Specialist Reports and the Project Record helps implement the CEQ Regulations' provision that agencies should reduce NEPA paperwork (40 CFR 1500.4). The objective is to furnish enough site-specific information to demonstrate a reasoned consideration of the environmental impacts of the alternatives and how these impacts may be mitigated, without repeating detailed analysis and background information available elsewhere. The Project Record is available for review at the MBRD office in Sedro-Woolley, Washington.

Maps and Acres Precision

All map boundaries, miles of roads, and acreage figures are approximations based on the best available information at the time and are based on aerial photography and map interpretation. Acreages have been rounded to the nearest 10 acres. Actual figures may vary based on future site specific ground verification and project layout.

Chapter 2 Proposed Action and Alternatives

Introduction

This section describes Alternative 1 (No Action) and Alternative 2 (Proposed Action) in detail, identifies stipulations, then compares the alternatives in terms of meeting the project's underlying needs as described in the Need for Proposal Section. This chapter defines the differences between the alternatives for the public and the Responsible Official and provides a basis for choice between them. This section also provides a description of the Reasonably Foreseeable Development Scenario that this environmental analysis is based on.

Alternatives Considered

Alternative 1 (No Action) – Consent to Lease Denied

This alternative serves as a baseline for comparing the effects of Alternative 2 (Proposed Action). Current management plans would continue to guide management. Under the No Action Alternative, there would be no change in the level of ongoing management activities within the Project Area. If this Alternative is decided upon, the decision would not Consent to Lease the nominated parcels and no management activities related to geothermal exploration and development would occur. Existing processes and trends within the project area would continue.

Alternative 2 (Proposed Action) – Consent to Lease with Stipulations

The Forest Service proposes to consent to BLM to offer for sale new geothermal leases, with stipulations on NFS lands. The MBS will evaluate the suitability of approximately 81,820 acres for Consent to Lease and develop appropriate stipulations to protect resources (e.g., late-successional reserve and riparian habitat; threatened, endangered and sensitive species; geologic resources) included in subsequent leases for those lands deemed suitable. The Section on Resource Protection Measures (pp. 24-29), describes in detail the various stipulations that would limit or preclude surface occupancy in the event of geothermal associated activities.

Table 3 provides information regarding each legal land description, its' associated Management Areas and Inventoried Roadless Area acres that are proposed or nominated for Consent to Lease. Table 4 provides information on the amount of acres suitable for leasing, subject to Controlled Surface Use and No Surface Occupancy stipulations by legal land description. Appendix C provides a list of stipulations specific to geothermal leasing with a short explanation for the reasons for the stipulations.

The proposed action is related to consenting to lease the nominated and FS proposed lands only, and does not authorize any surface disturbing activities.

Table 3. Legal land description, LRMP Management Areas and Inventoried Roadless Area Acres

Legal Land Description		LRMP Management Areas (MA) and Inventoried Roadless Area (IRA)	Acres
Township	Range		
36N	7E	MAs: Primitive, Semi-primitive Nonmotorized, Semi-primitive Motorized; LSR, Potential WSR, IRA, Administratively Withdrawn (AW), Mtn. Hemlock Zone	3,220

Legal Land Description		LRMP Management Areas (MA) and Inventoried Roadless Area (IRA)	Acres
Township	Range		
	8E	MAs: Semi-primitive Nonmotorized, LSR, Mtn. Hemlock Zone	590
37N	6E	MAs: LSR	90
	7E	MAs: LSR, Semi-primitive Nonmotorized, Semi-primitive Motorized, Potential WSR, Mtn. Hemlock Zone, AW	11,450
	8E	MAs: Semi-primitive Nonmotorized, LSR, Mtn. Hemlock Zone	12,040
	9E	MAs: LSR	2,860
38N	6E	MAs: Deer & Elk Winter Range, Mtn. Goat Habitat, Matrix, LSR, Timber Harvest, Moderate Recreation	2,530
	7E	MAs: Semi-primitive Nonmotorized, LSR, Mtn. Goat Habitat	8,330
	8E	MAs: Semi-primitive, LSR, Mtn. Goat Habitat	1,830
	9E	MAs: Primitive, Semi-primitive Nonmotorized, Potential WSR, LSR, Mtn. Goat Habitat	10,660
	10E	MAs: Primitive, Semi-primitive Nonmotorized, LSR, Potential WSR, Mtn. Goat Habitat	2,280
39N	6E	MAs: LSR	1,270
	7E	MAs: Semi-primitive Nonmotorized, Potential WSR, LSR, Matrix, Mtn. Goat Habitat, Scenic Viewshed – Foreground	12,070
	8E	MAs: Semi-Primitive Nonmotorized, Potential WSR, LSR, Mtn. Hemlock Zone, Mtn. Goat Habitat	11,100
	9E	MAs: Semi-primitive Nonmotorized, Potential WSR, LSR	1,500
Total Acres			81,820

Table 4. Type of Lease Stipulation and Associated Acres

Legal Land Description		Acres			
Township	Range	Controlled Surface Use (CSU) ¹	No Surface Occupancy (NSO) ¹	Inventoried Roadless Area (IRA)	Acres
36N	7E	190	2,310	720	3,220
	8E	40	550	0	590
37N	6E	0	80	10	90
	7E	540	9,920	990	11,450
	8E	3,240	8,120	680	12,040
	9E	1,850	1,000	0	2,850
38N	6E	0	1,910	620	2,530
	7E	1,020	5,830	1,490	8,340
	8E	270	1,400	160	1,830

Legal Land Description		Acres			
	9E	2,270	7,590	800	10,660
	10E	10	2,210	50	2,270
39N	6E	0	960	310	1,270
	7E	2,430	8,990	650	12,070
	8E	1,200	8,700	1,210	11,110
	9E	10	1,200	290	1,500
Total Acres		13,070	60,770	7,980	81,820

Refer to the Resource Protections Section for a determination of No Surface Occupancy (NSO) and Controlled Surface Use (CSU).

Alternatives Considered but Eliminated

The Interdisciplinary Team considered evaluating only those parcels currently nominated for geothermal development. This alternative was eliminated because the FS had received two nominations in a relatively brief period of time (2011 and 2013) and thought there was potential to continue to receive additional nominations in the foreseeable future. In order to take a holistic approach to the analysis and to find administrative efficiencies it was decided to evaluate most NFS lands surrounding Mt. Baker that are eligible for mineral development.

Reasonably Foreseeable Development Scenario

The Reasonably Foreseeable Development (RFD) scenario, the four typical phases of geothermal development and the estimated acres of disturbance for each phase are described in detail in the PEIS (pp. 2-34 through 2-49), and are incorporated by reference. Table 5 provides a summary of the objectives and activities that could occur during each of the four phases of geothermal development under the Reasonably Foreseeable Development Scenario. The RFD serves as the basis for analyzing environmental impacts that could potentially result from potential future leasing and development of Federal geothermal resources over the next 20 years. A variety of factors (e.g., economic, social, and political), beyond the control of the Forest Service, may influence the future demand for geothermal resources. Therefore, the RFD scenario is a best professional estimate of what may occur if NFS lands are leased.

Table 5. A Summary of Objectives and Activities of Geothermal Development under the RFD Scenario

Typical Phases in Geothermal Development		Objectives	Activities
Phase One	Geothermal Resource Exploration	Exploration for evidence of geothermal resources; generally 1 to 5 years to complete	Includes, but not limited to, geophysical operations, site clearing, drilling but not reaching geothermal resource, access roads & trails.
Phase Two	Drilling Operations	Exploration wells to test the geothermal reservoir	Flow testing; chemical evaluation of geothermal fluids; inject fluids into a geothermal reservoir; construct sumps or pits; development of minor infrastructure.
Phase Three	Utilization	Infrastructure for commercial operations	Access roads; drill site development install wellfield equipment, construct a power plant,

Typical Phases in Geothermal Development		Objectives	Activities
			install electric transmission lines; reclamation.
Phase Four	Reclamation and Abandonment	Well abandonment following production; reclaim disturbed areas	Plugging, capping, and reclaiming well site. Remove power plant & all surface equipment and structures, re-grade site & access roads to pre-disturbance contours, replant vegetation.

Resource Protection Measures

Resource protection measures are derived from but not limited to: the Mt. Baker-Snoqualmie National Forest LRMP and the Northwest Forest Plan goals, objectives, and standards and guidelines; best management practices; conservation measures, invasive plant prevention practices, and previous projects where measures have been shown to be effective.

Resource protection measures include lease stipulations and best management practices that reduce or eliminate unwanted effects and ensure that potential geothermal activities comply with management direction. Best management practices would be identified and applied during site specific analysis upon receipt of a Plan of Operation.

Lease Stipulations

Lease stipulations are constraints that would be applied by the BLM to any new leases for lands that are available for geothermal leasing. A lease stipulation is a condition of lease issuance that provides a level of protection for other resource values or land uses by restricting lease operations during certain times or at certain locations, or by mitigating unavoidable impacts, to an extent greater than standard lease terms or conditions. A stipulation is an enforceable term of the lease contract, supersedes any inconsistent provisions of the standard lease form, and is attached to and made a part of the lease. Lease stipulations further implement the Forest Service's regulatory authorities to protect resources or resource values. Maps depicting lease stipulations pertaining to the Project Area are found in Appendix B.

The following describes, in general terms, stipulations that may be applied to any new leases for lands that are available for geothermal leasing:

No Surface Occupancy (NSO) Stipulations

No Surface Occupancy (NSO) stipulations are considered a major constraint as they do not allow for surface development on specific portions of lease parcels. For example, a lessee of an NSO area must develop any surface infrastructure outside the NSO area and would need to use advanced technology, such as directional drilling, to access the geothermal resource under the NSO area. These NSO stipulations are applied to the standard lease form as a condition of the lease. An NSO is appropriate when the standard terms and conditions, other less restrictive lease stipulations and best management practices for permit approval are determined to be insufficient to achieve the resource protection objectives.

- Designated or proposed critical habitat for listed species under the Endangered Species Act of 1973 (as amended) if activities would adversely modify the habitat. For listed or proposed species without designated habitat, NSO would be implemented to the extent necessary to minimize or avoid adverse impacts.

- Within the boundary of properties designated or eligible for the National Register of Historic Places, including National Landmarks and National Register Districts and Sites; and additional lands outside the designated boundaries to the extent necessary to protect values where the setting and integrity is critical to their designation or eligibility.
- Areas with important cultural and archaeological resources, such as traditional cultural properties and Native American sacred sites, as identified through consultation.
- Segments of rivers determined to be potentially eligible¹ for Wild and Scenic Rivers (WSR) status by virtue of a WSR inventory, including a corridor of 0.25 miles from the high water mark on either side of the bank (MA's 5A, 5B, 5C).
- Primitive Dispersed Recreation area and designated important viewsheds, including NFS lands with a Scenery Management System visual integrity level of Very High (Preservation) (MA-1A, Primitive Areas).
- Slopes in excess of 40 percent and/or soils with high erosion potential (Soil Class S-8, Unstable and Very Unstable).
- Water bodies, Riparian Reserves, wetlands, playas, and 100-year floodplains (as defined by the NWFP).
- Developed recreational facilities, special-use permit recreation sites (e.g., ski resorts and camps), and areas with recreational use with which geothermal development is deemed incompatible; excluding direct use applications.

Controlled Surface Use and Timing Limitation Lease Stipulations

Where standard lease terms and permit-level decisions are deemed insufficient to protect sensitive resources but where an NSO is deemed overly restrictive, the BLM (working in concert with the FS) would apply controlled surface use (CSU) stipulations or seasonal or timing limitation (TL) stipulations to leases.

In general, timing limitations are used to protect resources that are sensitive to disturbance during certain periods. Such stipulations are generally applicable to specific areas, seasons, and resources. They are commonly applied to wildlife activities and habitat, such as winter range for deer, elk, and moose; nesting habitat for raptors and migratory birds; and breeding areas. Buffer zones are also used to further mitigate impacts from any human activities. The size of buffers can also be specific to species and location, and can change based on findings of science or movement of species. Therefore, timing limitations would be applied by the authorizing officer as appropriate for the specific lease areas and in compliance with the LRMP. The FS would consult with the appropriate agencies (e.g., state wildlife agencies) in establishing the periods and extent of area for timing limitations.

A CSU allows the FS to require any future activity or development be modified or relocated from the proposed location, if necessary, to achieve resource protection. As part of site-specific analysis of a subsequent exploration or development proposal the project applicant will be required to submit a plan to meet the resource management objectives through special design, construction, operation, mitigation, or reclamation measures, and/or relocation. Unless the plan is approved, no surface occupancy would be allowed on the lease. The following CSU/TL stipulations would be applied by the authorizing officer as appropriate for the specific area and site conditions.

¹ The BLM, and FS, have the obligation to protect the lands along eligible river segments until a "suitability" determination has been made as part of the land use planning process. If the river or river segment is found to be "non-suitable," the lands along the river then would be available for other uses (PEIS 2008).

Controlled Surface Use

- **Protection of erodible soils and soils on slopes from 30 to 40 percent.** This stipulation would be applied to minimize the potential for adverse impacts to erodible soils as defined as severe or very severe erosion classes based on Natural Resources Conservation Service (NRCS) mapping.
- **Protection of riparian and wetland habitat.** This stipulation would be applied within 500 feet of riparian or wetland vegetation to protect the values and functions of these areas. Measures required will be based on the nature, extent, and value of the area potentially affected.
- **Late Successional Reserve Stipulation.** A Controlled Surface Use (CSU) stipulation would be included in the lease for the purpose of protecting the important habitat conditions within the Late Successional Reserve (LSR) land allocation of the MBS LRMP. Because there is no specific habitat-disturbing proposal associated with this lease application, there are no specific LSR stipulations or restrictions. In the event of geothermal exploration and development, “the guiding principle will be to design mitigation measures that minimize detrimental effects to late-successional habitat” (Northwest Forest Plan, Record of Decision, p. C-17). This CSU will allow the BLM and FS to require any future activity or development on the lease to achieve necessary resource protection. The project applicant would be required to submit a plan to meet the resource management objectives of the LSR through special design, mitigation, or relocation. If this plan is not approved by the BLM and FS, no surface occupancy will be allowed on the lease. This stipulation is necessary to provide protection for late successional forests in the lease and to ensure that any subsequent geothermal development within LSRs would be conducted in such a manner as to be neutral or beneficial to the creation and maintenance of late successional habitat.
- **Protection of important habitat and migration corridors.** This stipulation would be applied to protect the continuity of migration corridors and important habitat.
- **Protection of deer and elk winter range.** This stipulation would be applied in MA-14 to protect and optimize winter range habitat for deer and elk, and minimize disturbance and harassment, which may include seasonal timing limitations or road closures. Location of new roads shall not adversely affect habitat, and construction or reconstruction shall be timed.
- **Protection of mountain goat habitat.** This stipulation would be applied in MA-15 to protect habitat and winter range for mountain goat, and prevent harassment. No new road construction is allowed. Reconstruction of existing roads shall be timed.
- **Protection of mountain hemlock zone.** This stipulation would be applied in MA-19 to prevent disturbance of mountain hemlock study plots. No construction of a permanent road(s) is allowed, except temporary roads are allowed to access areas outside of the mountain hemlock zone.
- **Protection of Inventoried Roadless Areas.** This stipulation would be applied to Inventoried Roadless Areas (IRA) to protect the roadless character. Specifically, no new road construction or reconstruction or timber removal is allowed in IRAs. Existing roads and trails may be maintained for exploration only. If future legislation or regulations change the roadless area designation, the restriction would be revised along with any appropriate environmental review.
- **Protection of visual resources.** This stipulation would be applied to NFS lands with a Scenery Management System integrity level of High (MA-1B, Semi-Primitive Non-Motorized, with a Visual Quality Objective of Retention); and within the foreground of primary and other sensitive viewsheds, such as the Mt. Baker and Baker Lake Scenic Highways, National Scenic and Historic Trails, or near residential areas. Activities and improvements shall be located, designed, and maintained to be either not evident or visually subordinate to the natural landscape.

- **Protection of recreational areas.** This stipulation would be applied to minimize the potential for adverse impacts to recreational values, both motorized and non-motorized, and the natural settings associated with the recreational activity.
- **Protection of municipal watershed.** This stipulation would be applied to protect water quality within MA-23A. Specifically, the applicant of an exploration or development proposal must submit a plan of special design, construction, operation, mitigation, and/or reclamation measures.
- **Compatibility with urban interface.** This stipulation would be applied to minimize the potential for adverse impacts to residential areas, schools, or other adjacent urban land uses.

Other Lease Stipulations

Endangered Species Act Stipulation

In accordance with BLM Instruction Memorandum No. 2002-174, the BLM shall apply the following stipulation on any leases where threatened, endangered, or other special status species or critical habitat is known or strongly suspected. Additionally, the BLM will provide a separate notification through a lease notice to prospective lessees identifying the particular special status species that are present on the lease parcel offered.

“The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species. BLM may recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that would contribute to a need to list such a species or their habitat. BLM may require modifications to or disapprove proposed activity that is likely to result in adverse impacts to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of a designated or proposed critical habitat. BLM will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended, 16 USC 1531 et seq., including completion of any required procedure for conference or consultation.”

Sensitive Species and Other Species of Concern Stipulation

For agency fish, wildlife, and botanical species designated as Sensitive or Of Concern, a lease stipulation (NSO, CSU, or TL) would be imposed for those portions of high value, key, or crucial species habitat where other existing measures are inadequate to meet agency management objectives.

Cultural Resources Stipulation

In accordance with BLM Instruction Memorandum No. 2005-003, the BLM will apply the following stipulation to protect cultural resources:

“This lease may be found to contain historic properties and/or resources protected under the National Historic Preservation Act (NHPA), American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, E.O. 13007, or other statutes and executive orders. The BLM will not approve any ground disturbing activities that may affect any such properties or resources until it completes its obligations under applicable requirements of the NHPA and other authorities. The BLM may require modification to exploration or development proposals to protect such properties, or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized or mitigated.”

Protection of Geothermal Features

Under the following situation, the BLM or FS would apply stipulations to protect the integrity of geothermal resource features, such as springs and geysers. If it is determined that geothermal operations are reasonably likely to result in a significant adverse effect to such a feature, then BLM would decline to issue the lease.

- Any leases that contain thermal features (e.g., springs or surface expressions) would have a stipulation requiring monitoring of the thermal features during any exploration, development, and production of the lease to ensure that there are no impacts to water quality or quantity.

Best Management Practices

In addition to lease stipulations, during any geothermal phases of activity, the FS would apply appropriate project-specific mitigation measures to permits. The agency's first priority is to minimize impacts on-site. When the agency determines that impacts cannot be minimized to an acceptable level onsite, it may be necessary to develop mitigations, deny the permit, or ask the applicant to modify the proposal. Best Management Practices are state-of-the-art conservation and protection measures and may be incorporated into the permit application by the lessee or may be included in the approved use authorization by the BLM as conditions of approval, with cooperation of the FS. Conditions of approval are not lease stipulations, but they are site-specific and enforceable requirements to minimize or prevent impacts to resources from an intended operation. Conditions of approval can limit or amend the specific actions proposed by the operator.

Best management practices would be identified and applied during site specific analysis upon receipt of a Plan of Operation.

Monitoring

All conservation, protection and mitigation measures, including lease stipulations and conditions of approval as well as the general operation of geothermal developments, would be monitored by the lessee or the appropriate Federal agency to ensure their continued effectiveness through all phases of development. Using adaptive management strategies, where such measures are determined to be ineffective at meeting the desired resource conditions, the FS would take steps to determine the cause and require the operator to take corrective action. This information would also be used to inform future geothermal leasing and development.

Lease Exceptions, Waivers, and Modifications

To ensure leasing decisions remain appropriate in the light of continually changing circumstances and new information, the BLM develops and applies lease stipulation waiver, exception, or modification (WEM) criteria. A lessee or operator may request a WEM; however, granting WEMs are discretionary acts on the part of the agencies and require specific review which may include additional environmental analysis. A WEM may be approved by the agencies if the record shows that circumstances or relative resources values have changed, or that the lessee can demonstrate that operations can be conducted without causing unacceptable effects. Granting a WEM may result in application of additional stipulations or conditions of approval to mitigate effects of the WEM. Descriptions of WEMs are:

- A **waiver** is a permanent exemption from a lease stipulation. The stipulation no longer applies anywhere within the leasehold.

- An **exception** is a one-time exemption for a particular site within the leasehold; exceptions are determined on a case-by-case basis; the stipulation continues to apply to all other sites within the leasehold. An exception is a limited type of waiver.
- A **modification** is a change to the provisions of a lease stipulation, either temporarily or for the term of the lease. Depending on the specific modification, the stipulation may or may not apply to all sites within the leasehold to which the restrictive criteria are applied.

Chapter 3 Affected Environment and Environmental Consequences

Introduction

This section of the environmental assessment provides a description of the biological, physical, and socioeconomic characteristics, including human uses that could be affected by any future actions (including but not limited to any decisions to lease or develop geothermal resources). This section also discloses the direct, indirect, and cumulative effects of implementing either the No Action or Proposed Action alternative. The discussion of direct and indirect effects is based on guidance provided in 40 CFR 1508.8. In brief, direct effects are those consequences which are caused by the action and occur at the same time and place while indirect effects are later in time or farther removed in distance, but are still reasonably foreseeable. Cumulative effects are those effects that result from the incremental effects of the action when added to other past, present, or reasonably foreseeable future actions (40 CFR 1508.7).

At this stage of the geothermal development process, the Consent to Lease stage, there would be no ground disturbing actions. The FS would only consent to allow the BLM to advertise and lease with stipulations NFS lands for potential exploration and development of a geothermal energy resource. This Environmental Analysis is predominantly an exercise to determine 1) whether geothermal leasing is allowed under established law, policy, and regulation, and 2) if so, what baseline protections (stipulations) should be brought forward into any further analyses and development plans. As there are no ground disturbing activities associated with consenting to lease there would be no direct or indirect effects to the environment. Therefore, there would be no cumulative effects in either time or space for any resources. As a result, the direct, indirect, and cumulative impacts for all resources are addressed as a whole under the Environmental Consequences for All Resources section instead of including it within individual resource sections.

Potential effects, discussed by resource under the Evaluation of Reasonably Foreseeable Development (RFD) Scenario section, are based on the assumption that geothermal development could occur sometime in the future.

Environmental Consequences for All Resource Areas

Proposed Action Alternative

Direct, Indirect, and Cumulative Effects

Under the Proposed Action, the FS would consent to the BLM to advertise and award leases. Leasing in itself would not initiate any human disturbance that would cause an impact to surface resources. Impacts associated with any lease activity would occur only with subsequent geothermal exploration, development, utilization, or reclamation. Therefore there would be no direct or indirect effects occurring under the Proposed Action alternative. In addition, there would be no cumulative effects associated with the Proposed Action alternative as there would be no overlap of effects in time and space. Before any on-the-ground actions can be taken for any of these phases, a site-specific environmental analysis would take place and effects would be documented at that time.

No Action Alternative

Direct, Indirect, and Cumulative Effects

Under the No Action Alternative, the FS would not Consent to Lease the nominated lands; therefore BLM would deny the pending lease applications. There would be no direct or indirect effects to existing resources beyond what is already occurring. No exploration or development of geothermal resources would occur at this time, although the lands could be nominated in the future. Current land management would continue to follow LRMP direction. As there would be no overlap of effects in time and space there would also be no cumulative effects under the No Action alternative.

Evaluation of Reasonably Foreseeable Development (RFD) Scenario

The methodology for the following impact assessment conforms to the guidance found in the following sections of the CEQ regulations for implementing NEPA: 40 CFR 1502.24 (Methodology and Scientific Accuracy); 40 CFR 1508.7 (Cumulative Impact); and 40 CFR 1508.8 (Effects). CEQ regulations require that agencies “rigorously explore and objectively evaluate” the impact of all alternatives. Since the action alternative presented in this EA proposes allocating NFS lands as open or closed to geothermal leasing, neither of which has any effects as explained above, the focus of this analysis is on broader impacts as determined by the RFD scenario.

In order to ensure consistency with the Forest Plan and all applicable laws and regulations, the RFD scenario (as described in the Proposed Action and Alternatives Section) was evaluated to determine what stipulations would be required to adequately protect resources. Note that this RFD scenario allows for a general evaluation of the types of impacts that may occur on NFS lands, based on land management direction and resource conditions. However, the RFD scenario cannot predict the magnitude or extent of these impacts. Only after the leases are offered, and a lessee submits a plan for exploration and development, can accurate predictions be determined for the magnitude and extent of environmental effects.

Therefore, this section outlines potential impacts to resources from the RFD scenario and validates that the stipulations addressed under Resource Protection Measures would protect resources as required by relevant law, policy, and regulation. This section is organized by resource area, with each section including an affected environment segment, an analysis of the RFD impacts on the specified resource, application of the stipulations if applicable, and an assessment of Forest Plan consistency.

As noted in the Project Record Section, Specialist Reports were prepared to fully document the analysis completed for the main resource areas of concern. These reports provide more detailed information regarding the analysis and also include a description of the affected environment, which provides context for the description of impacts. Specialist Reports for Air Quality, Botanical Resources, Climate Change, Environmental Justice, Fisheries, Heritage Resources, Hydrology and Soils, Inventoried Roadless, Land Special Uses, Minerals, Prime Forestland, Prime Farmland, Rangeland, Recreation and Special Designations, Visual Resources, Wild and Scenic Rivers, Wildlife and Other Considerations are incorporated by reference (40 CFR 1502.21) and are available in the Project Record maintained at the MBRD Office, Sedro-Woolley, WA.

The following resource disciplines are not addressed in this section as they are not found within the proposed project area and are not relevant to the discussion: wild horses or burros, livestock grazing, and historic trails.

General Setting

The Project Area, located within the MBRD, lies approximately 23 miles east of Bellingham, WA and 16 miles northeast of Sedro-Woolley, WA with some portions straddling the Skagit - Whatcom County line (Figure 2). The Project Area, consisting of the nominated lands and FS proposed lands nearly surround Mount Baker which, at an elevation of 10,778 feet, is a prominent feature on the landscape. Elevations within the Project Area range from approximately 440 feet above sea level to a high point of nearly 5,920 feet.

The climate in the area changes drastically with elevation. The majority of precipitation occurs during the months of October through April with deep winter snowpack accumulating in the high elevations. Vegetation is typical of the west slopes of the Cascades and includes cedars, Douglas-fir, true firs, western and mountain hemlock trees and, at higher elevations, alpine meadows. Rock and permanent glaciers are found on mountains and higher ridges. Several congressionally designated areas are found within the Project Area including the Mt. Baker Wilderness, the Skagit Wild and Scenic River and the Mt. Baker National Recreation Area. In addition, portions of the project area are within both the North Fork and South Fork Nooksack Tier 1 Key Watersheds. These Key Watershed Analyses are available at the MBRD office in Sedro-Woolley, WA.

In a related action, a Record of Decision, dated August 4, 2010, authorized 8,355 acres of the MBRD as administratively available for geothermal leasing subject to lease stipulations (USFS 2010). The existing lease areas are adjacent to the current Project Area being evaluated for geothermal lease suitability in this EA (Figure 2). BLM awarded a lease to a company for the lands determined to be administratively available in 2010, but has not received an application for any exploration or development at this time.

Air Quality

Overview

The Clean Air Act was passed to regulate air pollution and improve air quality. It regulates air emissions from area, stationary, and mobile sources. This law also authorizes the U.S. Environmental Protection Agency to establish National Ambient Air Quality Standards to protect public health and the environment (PEIS 2008 p. 1-33). Air quality, the National Ambient Air Quality Standards, and the typical emissions associated with geothermal energy are discussed in detail in the PEIS (pp. 3-96 to 3-106) and incorporated by reference.

Ninety-five percent of the Project Area is located in Whatcom County while five percent is within Skagit County. The average air quality index in both Counties is rated as good, with levels well below the National and State averages (USA.com 2014). Due to the relatively remote location of the Project Area, air quality is considered to be good with little potential to affect public health.

Reasonably Foreseeable Developments

A complete assessment of the common impacts on air quality associated with geothermal development is available in the PEIS (pp. 4-48 to 4-55) and incorporated by reference. However, the following provides a brief summary of those potential impacts.

If RFDs are proposed, initial exploration activities such as surveying and sampling would have minimal air quality impacts. Some emissions and fugitive dust could be produced from vehicle and sampling activities.

Emissions generated during any exploration and drilling phase would include exhaust from vehicular traffic and drill rigs, fugitive dust from traffic on paved and unpaved roads, and the release of geothermal

fluid vapors (especially hydrogen sulfide, carbon dioxide, mercury, arsenic, and boron, if present in the reservoir).

Activities associated with any development such as site clearing and grading, road construction, well pad development, sump pit construction, and the drilling of production and injection wells would have more intense exhaust-related emissions over a period of 1 to 5 years.

Impacts would depend upon the amount, duration, location, and characteristics of the emissions and the meteorological conditions (e.g., wind speed and direction, precipitation, and relative humidity).

Anticipated future actions following leasing may require State and local permits and air quality monitoring programs.

Future actions for geothermal development would undergo site-specific analysis to determine impacts on air quality. Proposed future actions would follow stipulations, management requirements, and best management practices (BMPs).

Forest Plan Consistency

1990 Forest Plan, as amended

The Consent to Lease with stipulations is consistent with the Forest Plan standard and guidelines for Air Quality. The PEIS mitigation measures and BMPs for Soil, Water, Riparian, and Air apply to Air Quality.

Should a lessee submit a site-specific proposal for geothermal exploration or development Forest Plan consistency will be identified during the NEPA process. Terms and conditions as part of an exploration or development permit may include design features and/or mitigation measures to minimize adverse effects on air quality.

Botanical Resources

Overview

The Project Area is located along the slopes of Mt. Baker within the Northern Cascades Physiographic Province (Franklin and Dyrness 1973) on the MBRD of the MBS, Washington.

Vegetation within the project area is varied. Vegetation can be delineated by dominant species occurring within similar environmental variables (Henderson et al. 1992). Table 6 lists the acreage for each vegetation zone within the Project Area. The Pacific silver fir (*Abies amabilis*) zone occurs across the largest amount of area within the Project Area. The mountain hemlock (*Tsuga mertensiana*) zone is the second largest. Lands within the Project Area range in elevation from approximately 440 to 5920 feet. Forest age within the Project Area, range from old-growth to early successional.

Table 6. Approximate Acres per Vegetation Zone within the Nominated Leases

Zone	Acres
Mountain Hemlock Zone (MHZ)	26190
Pacific Silver Fir Zone (PSFZ)	40830
Subalpine Fir Zone (SAFZ)	10
Subalpine Parkland Zone (PKLZ)	2850
Western Hemlock Zone (WHZ)	12170

Special Status Plants

On November 13, 2014, the NRIS TESP-Invasives Database was filtered for rare species, invasive species, and botanical surveys documented in the project area. No botanical field surveys were conducted specifically for this project.

Approximately one hundred botanical surveys are documented in the Project Area across approximately 1,240 acres (Attachment 1 of the specialist report). All surveys were focused on rare species. Surveys before 2004 may or may not have focused on invasives. Species of concern were documented during these surveys.

Threatened and Endangered Species

No federally listed threatened, endangered, or proposed botanical species are known to occur on the MBS. No formal consultation is required.

Rare Species

Approximately eighty-five occurrences of rare plants, collectively occupying approximately 20,940 acres, are documented in the Project Area. All documented occurrences are listed in Attachment 2 of the specialist report.

Invasive Plants

Approximately seventy-five invasive plant occurrences, occupying approximately 360 acres, are documented within the project area. Most of the invasive plant infestations occur along roadsides. All occurrences are listed in Attachment 3 of the specialist report.

Reasonably Foreseeable Development Scenario

Future geothermal development (exploration, drilling, utilization, and reclamation) could potentially affect botanical species of concern. The lease stipulation for Sensitive Species and Other Species of Concern applies to Special Status and invasive species within this analysis.

Rare Plants

Potential effects to rare plants or suitable habitat may include: 1) injury or mortality; 2) solar exposure alteration; 3) hydraulic pattern alteration; 4) soil alteration; 5) air quality alteration; and, 6) invasive species introduction, establishment, and/or spread.

Rare species are documented within the project area. Until site specific actions are proposed, it is unknown what occurrences may be impacted. Any future actions for geothermal development would be analyzed for site-specific effects on rare species at that time. Proposed future actions would follow stipulations, management requirements, and BMPs. Botanical surveys for rare species would be required to be consistent with the Forest Plan, as amended. In addition, protection and/or avoidance buffers to protect species would be recommended and implemented. Management actions, or lack thereof, for Survey and Manage species would also be determined and implemented at that time.

Invasive Plants

Potential effects of the RFD scenario could result in the introduction, establishment, and/or spread of invasive species, which may include: 1) alteration in vegetation composition, 2) decreased wildlife habitat, and 3) decreased habitat for native pollinators.

Invasive plants are documented within the project area. Future actions for geothermal development would undergo site-specific analysis to determine impacts on invasive species. Proposed future actions would

follow stipulations, management requirements, and Best Management Practices (BMPs). Treatments of all class A, B, and C species would be required prior to implementation of an action.

Forest Plan Consistency

1990 Forest Plan, as amended – Sensitive Plants

The Consent to Lease with stipulations is consistent with the Forest Plan, as amended, standards and guidelines for Sensitive Plants. The lease stipulation for Sensitive Species and Other Species of Concern applies to Sensitive plants.

1990 Forest Plan, as amended – Invasive Plants

The Consent to Lease with stipulations is consistent with the Forest Plan, as amended, standard and guidelines for invasive plants. The lease stipulation for Sensitive Species and Other Species of Concern applies to invasive plants.

1994 Northwest Forest Plan, as amended – Survey and Manage Plants

The Consent to Lease with stipulations is consistent with the Northwest Forest Plan, as amended, standard and guidelines for Survey and Manage plants. The lease stipulation for Sensitive Species and Other Species of Concern applies to Survey and Manage plants.

In the future, if a lessee submits a site-specific proposal for geothermal exploration or development, Forest Plan consistency would be identified during subsequent NEPA analysis. Terms and conditions as part of an exploration or development permit may include design features, BMPs, standards and guidelines and/or mitigation measures, beyond what is required by stipulations, to minimize impacts to botanical resources. A complete list of LRMP standards and guidelines relevant to geothermal development is available in Project Record.

Climate Change

Overview

A complete discussion on the Federal governments' comprehensive plan to address climate change (pp. 1-22 – 1-24) and an overview of global climate change (pp. 3-102 – 3-104) are available in the PEIS and incorporated by reference. However, the following provides a brief summary of information.

Ongoing scientific research has identified the potential impacts of anthropogenic (manmade) greenhouse gas (GHG) emissions and changes in biological carbon sequestration due to land management activities on global climate. Through complex interactions on a regional and global scale, these GHG emissions and net losses of biological carbon sinks cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Although GHG levels have varied for millennia, recent industrialization and burning of fossil carbon sources have caused CO₂(e) concentrations to increase dramatically and are likely contributors to overall global climatic changes. The Intergovernmental Panel on Climate Change (IPCC) recently concluded that “warming of the climate system is unequivocal” and “most of the observed increase in globally average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations” (PEIS pp. 3-102).

Several activities contribute to the phenomena of climate change, including emissions of GHGs (especially carbon dioxide, methane, and nitrogen) from fossil fuel development, large wildfires, and activities using combustion engines; changes to the natural carbon cycle; and changes to radiative forces

and reflectivity. It is important to note that GHGs will have a sustained climatic impact over different temporal scales. For example, climate scientists generally believe that recent emissions of carbon dioxide may influence climate for 100 years (PEIS 3-103).

Global climate models are used to envision global climate in the future (Mote and Salathé 2010). However, there are many uncertainties associated with these models (Mote et al. 2011) making it difficult to determine effects of climate change from a specific project. Projected changes are likely to occur over several decades to a century; and may remain within the range of natural variability; therefore, many of the projected changes associated with climate change described below may not be measurably discernible within the reasonably foreseeable future.

In environmental analyses such as this Environmental Assessment, the Forest Service considers two types of climate change effects:

- Type 1 - The effect of a proposed project on climate change, specifically effects to greenhouse gas emissions and carbon cycling. Examples include short-term greenhouse gas emissions and alteration to the carbon cycle caused by hazardous fuels reduction projects, greenhouse gas emissions from oil and gas field development, and avoiding large greenhouse gas emissions pulses and effects to the carbon cycle by thinning overstocked stands to increase forest resilience and decrease the potential for large scale wildfire.
- Type 2 - The effect of climate change on a proposed project. Examples include effects of expected shifts in rainfall and temperature patterns on the seed stock selection for reforestation after timber harvest, and effects of decreased snow fall on a ski area expansion proposal at a marginal geographic location, such as a southern aspect or low elevation.

Reasonably Foreseeable Development

Future geothermal development (Exploration, drilling, utilization, and reclamation) would likely contribute minimally to global climate change (Type 1).

The primary sources of GHG from the RFD would be through construction operations, vehicle emissions, and plant operations. The tools necessary to quantify climatic impacts from specific emissions sources are presently unavailable (USGS 2008). As a consequence, impact assessment of specific effects of anthropogenic activities and specific levels of significance cannot be determined. Therefore, climate change analysis for the Type 1 effects, for the purpose of this document, is limited to accounting for and disclosing GHG emissions (and other factors that contribute to climate change) that may result from future activities analyzed in this document.

Effects of climate change on the proposed project (Type 2) may impact operations and maintenance of infrastructure of future geothermal development, but not the geothermal resource itself.

On a regional basis, reports from the University of Washington Climate Impacts Group (Littell et al. 2009) predict a scenario for the Pacific Northwest with future warming of approximately 0.5°F per decade with temperatures increasing in all seasons, but particularly in June through August. A larger percentage of winter precipitation would fall as rain rather than snow, with an earlier spring snowmelt, lower summer stream flows, droughts becoming more common, and a greater risk of floods and wildfires.

Roads, powerlines, and the plant itself may be subject to these changing conditions, particularly floods, wildfires, and water availability for operations. Mitigation measures and BMPs, which would be identified during site-specific proposals, may reduce the impact of climate change on projects.

Forest Plan Consistency

There is currently no guidance in the Forest Plan specifically related to climate change. In 2009, when the US EPA determined that current and projected concentrations of specific GHGs in the atmosphere threaten the public health and welfare of current and future generations they became regulated pollutants under air quality regulatory programs (75 FR 66496). Managing national forest within the context of climate change can be done by continuing the practice of sustainable resource management and including climate change among existing management considerations.

Environmental Justice

Over the past decade, the concept of Environmental Justice has emerged as an important component of Federal regulatory programs, initiated by Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. This Executive Order directs each Federal agency to “make achieving environmental justice by avoiding disproportionately high or adverse human health or environmental effects on minority and low-income populations” part of its mission. The Order emphasizes that federally recognized Native Tribes or bands are to be included in all efforts to achieve environmental justice (Sec. 6.606).

Demographics within the Project Area were examined to determine the presence of minority, low-income, or Tribal populations. Tribal Councils were also sent letters as part of the consultation process. Race and ethnic profiles were generated from the American Community Survey (USDC 2014) and are presented in Table 7.

Table 7. Race and Ethnicity, Poverty, and Income Profiles by County within the Project Area*

Race or Ethnicity	Percentage of Population		
	Skagit County	Whatcom County	State of Washington
White	87.7	86.5	78.5
Black or African American	0.6	0.9	3.6
American Indian	1.7	2.6	1.4
Asian	1.7	3.9	7.3
Hispanic or Latino (of any race)	17.1	8.2	11.5
Reporting Two or More Races	3.8	3.8	4.8
Poverty Level			
Persons below poverty level, percent, 2009-2013	13.5	16.4	13.4
Income			
Mean Annual Household Income (2013)	\$66,665	\$65,626	\$78,582

* The data in this table are calculated by American Community Survey using annual surveys conducted during 2009-2013 and are representative of average characteristics during this period.

Reasonably Foreseeable Development

Under the RFD, minerals and energy development would provide very limited employment for people living in Skagit (0.1 percent) and Whatcom Counties (0.1 percent). Minerals related jobs in the counties are typically within nonmetallic minerals mining or mining related jobs such as oil and gas pipeline and related structures or pipeline transportation (USDC 2014).

There is a potential for an increase in the community economy from fuel, lodging, and food purchases by geothermal development employees. The amount and length of time of this increase is dependent on the number of employees that stay in the community and the length of time development occurs. In all cases it is unlikely that geothermal development in the nominated sites would reduce the percent of the population living below the poverty level as the four phases of geothermal development require employees experienced in that field. In addition, all phases, except operations, are limited in time and scope while operations would require the fewest long term employees. However, there would be additional permanent, high-skilled, full-time jobs at the facility that would pay well above the minimum wage. This would cascade through the community as a single expenditure and could have repercussions throughout the entire economy (USFS and BLM 2008).

In addition to expenditures within the community, the state would receive 50 percent of the royalties; counties would receive 25 percent and the federal government would receive 25 percent. Counties, where the facility is constructed, would also receive funds from property taxes (PEIS pp. 3-199).

Effects on traditional and cultural use by Tribal elders and members are discussed in the Heritage Resource section. Neither of the alternatives would have any disproportionately high or adverse effects to low-income, women, or minority populations listed in Table 7.

A general discussion of the impacts of geothermal leasing for a 50-MW plant is provided in the PEIS under *Socioeconomics and Environmental Justice* (pp. 4-134 to 4-143) and is incorporated by reference. Similar impacts to those discussed in the PEIS are likely for this Project Area. Due to the lack of residential areas in the vicinity of the Project Area, there would be no disproportionate impacts on minority or low-income populations.

Forest Plan Consistency

There is currently no guidance in the Forest Plan specifically related to environmental justice. However, Executive Order 12898 directs each Federal agency to make achieving environmental justice part of its mission. Therefore, should a lessee submit a site-specific proposal for geothermal exploration or development guidance found in the Executive Order would be used to determine Forest Plan consistency for environmental justice.

Fisheries

Overview

The lands proposed for potential lease drain to: the North Fork Nooksack River between about river mile (RM) 57 near Cornell Creek and RM 72 above Highway 542 and Swamp Creek, the Middle Fork Nooksack River between about RM 9 and above Rankin Creek near RM 17; the South Fork Nooksack River near McGinnis Creek and RM 28 to the headwaters; the entire west side of the Upper Baker reservoir including Baker Lake. The South and North Fork Nooksack Rivers are Tier 1 Key Watersheds (USFS and BLM 1994); designated for their direct contribution to conservation of at-risk anadromous salmonids, bull trout, and resident fish species. No areas of Baker Lake or the Middle Fork Nooksack River are designated Tier 1 Key Watersheds.

Throughout the MBS, there are eight fish species of interest, displaying either anadromous or resident life histories. These fish generally depend on cold, clean water, suitable sized spawning gravels, and a variety of slow- and fast-water habitat types to meet their needs at various stages of their lives. Table 8 shows the miles of habitat these fish species have been documented to occur on the MBS.

Table 8. Fish Species of Interest, Documented by Miles of Presence, on the MBS.

Fish species	Miles of Documented Presence on the MBS¹
Chinook salmon (<i>Oncorhynchus tshawytscha</i>)	106
Bull trout (<i>Salvelinus confluentus</i>)	560
Steelhead (<i>Oncorhynchus mykiss</i>)	379
Coho salmon (<i>Oncorhynchus kisutch</i>)	524
Pink salmon (<i>Oncorhynchus gorbuscha</i>)	220
Chum salmon (<i>Oncorhynchus keta</i>)	121
Sockeye salmon (<i>Oncorhynchus nerka</i>)	158
Cutthroat trout (<i>Oncorhynchus clarkii</i>)	763
Rainbow trout (<i>Oncorhynchus mykiss</i>)	503

¹From WDFW 2002a; does not include miles on NFS lands with “suspected” occupancy, or on other land ownerships.

The Project Area generally provides habitat for most fish species of interest, though a couple species have unknown distribution in this area. Table 10 in the Fish Species section lists the species of interest and areas of utilization associated with the Project Area.

Fish Habitat Conditions

Watershed Findings

North Fork Nooksack River

A baseline condition assessment was completed for the North Fork Nooksack River in 2000 (USFS 2000c) evaluating 19 habitat indicators for Chinook and Bull trout. None of the indicators were of particular concern for the North Fork, though several indicators were considered to be not functioning as well as they could be due to glacially derived sedimentation and mass wasting. Debris torrents and glacial flour are the primary reasons for elevated sediment deposition to spawning and rearing habitat within the North Fork Nooksack River. While this assessment was aimed at federally listed fish, these habitat conditions can be generally extrapolated for all fish in the North Fork.

Middle Fork Nooksack River

A baseline condition assessment was completed for the South and Middle Fork Nooksack River in 1999 (USFS 1999a) evaluating 19 habitat indicators for Chinook and Bull trout. Most of the environmental baseline condition indicators are functioning at risk. Sediment deposition in spawning areas in the Middle Fork due to natural instability, and forest management on federal lands up to 1990 created conditions to be functioning at an unacceptable risk. Since then, these lands have been in a hydrologic recovery process (no forest management with some active watershed restoration). Riparian condition and Large Woody Debris recruitment potential is functioning appropriately in the Middle Fork Nooksack River. While this assessment was aimed at federally listed fish, these habitat conditions can be generally extrapolated for all fish in the Middle Fork.

South Fork Nooksack River

A baseline condition assessment was completed for the South and Middle Fork Nooksack River in 1999 (USFS 1999a) evaluating 19 habitat indicators for Chinook and Bull trout. Most of the environmental

baseline condition indicators are functioning at risk. Sediment deposition in spawning areas in the South Fork due to natural instability, and forest management on federal lands up to 1990 created conditions to be functioning at an unacceptable risk. Since then, these lands have had been in a hydrologic recovery process (no forest management with some active watershed restoration). Road density on federal land in the South Fork is 2.75 miles/sq. mi. Many road crossing sites in the South Fork are on unstable soil areas. Since the floods of 1995 and 1997, additional road damage has occurred in the South Fork at these sites. While this assessment was aimed at federally listed fish, these habitat conditions can be generally extrapolated for all fish in the South Fork.

Baker River

A baseline condition assessment was completed for the Baker River in 1999 (USFS 1999b) evaluating 19 habitat indicators for Chinook and Bull trout. Most of the environmental baseline condition indicators are functioning at risk. In the hydrologic cumulative effects assessment of the MBS LRMP (1990), many of the stream systems flowing into Baker Lake lacked the ability to store sediment due to past channel scouring. Sedimentation within the Baker River mainstem did not pose problems for salmonid spawning and incubation. Since the late 1980's little or no timber harvesting or road building has occurred on federal land in the Baker River Watershed. In addition, the land status and designations within the watershed are pushing the sedimentation trend to resemble the natural sediment regime. In Baker Lake there is a moderate road density that has affected the road drainage network in the past, but recent road decommissioning projects are reducing road-related resource damage.

Riparian Reserves

Riparian Reserves are a land allocation that overlays all other land allocations. These areas are delineated by on-the-ground criteria rather than mapped locations. Until watershed or site specific analysis is completed, interim riparian reserve widths are prescribed for:

- fish bearing streams
- permanently flowing nonfish-bearing streams
- constructed ponds and reservoirs, and wetlands greater than 1 acre
- lakes and natural ponds, and
- seasonally flowing or intermittent streams, wetlands less than 1 acre, and unstable and potentially unstable areas

Table 9 displays the acres and percent of Riparian Reserves by total Project Area and then broken out by watersheds. The Baker River Watershed contains the greatest acreage of Riparian Reserves.

Table 9. Acres and Percent of Riparian Reserves by Project Area and Watershed

Area	Acres of Riparian Reserve	Percent Riparian Reserves by Area
Project Area	25,000	30
North Fork Nooksack River Watershed	7,800	9.5
Middle Fork Nooksack River Watershed	2,520	3.1
South Fork Nooksack River Watershed	5,400	6.6
Baker River Watershed	9,510	11.6

Fish Species

Table 10 displays the fish species of interest, their conservation status, habitat designations, and use of the Project Area.

The North Fork Nooksack River is known to provide spawning and rearing habitat for Chinook Salmon, Bull Trout, and steelhead, Coho Salmon, Pink Salmon, Chum Salmon, Riverine Sockeye Salmon, and resident Coastal Cutthroat Trout, Rainbow Trout, and sea-run cutthroat trout, are found up to the natural barrier near RM 65.0 at the North Fork Nooksack Falls. Non-native Brook trout and Rainbow Trout are observed above the falls.

The South Fork Nooksack River is known to provide spawning and rearing habitat for Chinook, Bull Trout, and steelhead, Coho, Pink, Chum, resident Coastal Cutthroat Trout, Rainbow Trout, sea-run cutthroat trout, and Riverine Sockeye Salmon. Chinook are known to migrate upstream of Sylvester's Canyon at RM 25.0 up to the cascades at RM 30.4. Bull Trout and steelhead are known to migrate to the headwaters of the South Fork Nooksack River above Bell Creek.

The Middle Fork Nooksack River is known to provide spawning and rearing habitat for Chinook, Bull Trout, and steelhead, Coho, Pink, Chum, resident Coastal Cutthroat, Rainbow Trout, sea-run cutthroat trout, and Riverine Sockeye Salmon up to the City of Bellingham's diversion dam near RM 7.2. Bull Trout, coastal Cutthroat Trout, and Rainbow Trout are all known to occur above the diversion dam.

Baker River above Baker Lake dam is known to provide spawning and rearing habitat for Bull Trout, Coho, Pink, Chum, resident Coastal Cutthroat Trout, Rainbow Trout, and sea-run cutthroat trout.

Table 10. Fish Species of Interest, Status, Special Designations and Areas of Utilization

Species (Stock)	Status¹	Utilization Associated with Analysis Area²
Chinook (NF Nooksack; MF Nooksack; SF Nooksack River; Baker River)	NMFS—Listed threatened (3/99); Designated critical habitat (9/05); Essential fish habitat FS—MIS; WA—Candidate; SaSI 2002—Depressed	Known to use mainstem North Fork Nooksack to about RM 65.0, MF Nooksack to about RM 7.2, and SF Nooksack to about RM 30.4. Same for critical habitat and EFH. Juveniles could use lower gradient portions of the small tributaries. Chinook are not passed above the Upper Baker dam.
Bull trout (NF Nooksack; MF Nooksack; SF Nooksack; Baker River)	USFWS—Listed threatened (11/99); Revised designated critical habitat (10/10) FS—MIS; WA—Candidate; SaSI 1998—Healthy	Known to use NF Nooksack to about RM 65.0. MF Nooksack River up to about RM 17.8 and the SF Nooksack to the headwaters above Elbow Creek. Baker River throughout the drainage. Same areas designated critical habitat.
Steelhead (NF Nooksack; MF Nooksack; SF Nooksack; Baker River)	NMFS—Listed Threatened (5/07; anadromous only); critical habitat not yet designated FS—MIS (anadromous and resident form) SaSI 2002—Unknown	Known to use NF Nooksack to about RM 65.0. MF Nooksack River up to about RM 17.8 and the SF Nooksack to the headwaters above Elbow Creek. Steelhead are not passed above the Upper Baker dam.
Coho (NF Nooksack; MF Nooksack; SF Nooksack; Baker River)	NMFS—Candidate; Species of Concern (7/95); Essential fish habitat FS—Sensitive, MIS; SaSI 2002—Unknown	Known to use NF Nooksack to about RM 65.0. MF Nooksack River up to about RM 7.2 and the SF Nooksack to Sylvester's Canyon at RM 25.0. Coho are known to use the Baker Lake Reservoir and nearly all accessible tributaries to the reservoir including Baker River into the North Cascades National Park.

Species (Stock)	Status ¹	Utilization Associated with Analysis Area ²
Pink (NFNooksack; MF Nooksack; SF Nooksack; Baker River)	NMFS—Not Warranted (10/95); Essential fish habitat FS—MIS; SaSI 2002—Healthy (MF/NF) Unknown (SF)	Known to use NF Nooksack to about RM 65.0. MF Nooksack River up to about RM 7.2 and the SF Nooksack to Sylvester's Canyon at RM 25.0. Pink transported to the Upper Baker reservoir but if very limited numbers.
Chum (NFNooksack; MF Nooksack; SF Nooksack; Baker River)	NMFS—Not Warranted (3/98) FS—MIS; SaSI 2002—Unknown (Mainstem/SF) Healthy (NF)	Known to use NF Nooksack to about RM 65.0. MF Nooksack River up to about RM 7.2 and the SF Nooksack to Sylvester's Canyon at RM 25.0. Pink transported to the Upper Baker reservoir but if very limited numbers.
Coastal cutthroat (Nooksack)	NMFS—Not Warranted (4/99) FS—Sensitive, MIS (anadromous and resident); SaSI 2002—Unknown	Anadromous and resident use NF Nooksack to about RM 65.0. MF Nooksack River up to about RM 17.8 and the SF Nooksack to the headwaters above Elbow Creek.. Both sea-run and resident coastal cutthroat trout are transported to Upper Baker reservoir.
Sockeye (Baker River stock)	NMFS—Not Warranted (Baker River stock in Skagit; 3/99) FS—Sensitive (Baker River)	Baker river sockeye use the reservoir and the majority of accessible tributary habitat in the Baker River drainage.

1 NMFS—National Marine Fisheries Service; FS—Forest Service (USFS 1990 and USFS 2011a); USFWS—United States Fish and Wildlife Service; WA—Washington State Threatened and Endangered status at <http://wdfw.wa.gov/conservation/endangered>; SaSI—Washington Salmonid Stock Inventory (WDFW 1998, 2000, 2002a); MIS—Management Indicator Species (from USDA FS 1990);

2 Sources: SaSI 2002 reports linked to WDFW website <http://wdfw.wa.gov/fish/sasi/index.htm>; Williams et al. 1975; unpublished stream survey data; and MBS Aquatics GIS Project v2.0 in ArcMap 10.

Reasonably Foreseeable Development

Potential future effects from reasonably foreseeable activities could occur, but would be assessed in a future analysis when an application is submitted. With the stipulation of no surface occupancy in Riparian Reserves, there would be no potential direct effects from the reasonably foreseeable actions, including from road/access construction, drilling, construction of facilities and infrastructure, pipelines/transmission lines, or from reclamation activities. Indirect effects to fish habitats and fish (occurring away from the project area, or later in time) would be the primary environmental effects that could occur to fish habitat and fish from a potential future site-specific proposed project. Exploration and development activities such as road or access construction, construction of facilities and infrastructure, and installation of pipelines and transmission lines, could affect fish habitat and fish from stream crossing construction, surface runoff, vibrations from use of explosive charges during seismic exploration, changes to the quantity or timing of flows and water temperature after removal of vegetation, and degradation of water quality from chemical or other contaminants associated with the equipment or facilities. Even reclamation of a site has the potential to cause sedimentation or other indirect effects to fish and fish habitat. While such effects would be minimized with a “no surface occupancy” stipulation, they could potentially occur depending on the actual scope, scale and location of the future application for exploration or development that involves ground-disturbing activities. However, the magnitude and extent of effects of a plan for exploration or development cannot be adequately analyzed until actually proposed.

Excessive sediments in streams can damage fish gills, decrease the food base and growth of rearing fish, and degrade spawning and rearing habitats by embedding spawning gravels and filling pools that reduce the survival of fish eggs and juveniles. In-water vibrations have the potential to kill rearing and spawning fish. Mechanical shock from blasting, pile driving, and seismic activity may also affect the sensitive early stages of egg and fry development while in gravels.

Forest Plan Consistency

The proposed action alternative of Consent to Lease with stipulations would be consistent with Standards and Guidelines of the Forest Plan, as amended, for fishery resources.

1990 Forest Plan (USFS 1990)

Management Area 5A, B, and C – Recommended Wild and Scenic Rivers

The Consent to Lease with NSO stipulation is consistent with the Forest Plan standard and guidelines for Management Area 5A, B, and C. in recommended wild, scenic, or recreational river corridors a NSO stipulation shall be required in mineral leases (LRMP pp. 4-95), which would maintain streamside banks in a natural condition contributing to the characteristics required for a recommended scenic river.

Other Pertinent Management Areas

The Consent to Lease with stipulations is consistent with the Forest Plan standard and guidelines for water quality. Lease stipulations for other resources indirectly apply to water quality. Site specific analysis would be conducted and appropriate stipulations applied when an application is received to maintain water quality.

1994 ROD (USFS and BLM 1994)

Key Watersheds

The Consent to Lease with stipulations is consistent with the Northwest Forest Plan standard and guidelines for key watersheds. Key watersheds are a high priority in the NWFP and stipulations within the plan apply to the North Fork Nooksack and South Fork Nooksack River Key Watersheds.

Riparian Reserves

The Consent to Lease with the NSO stipulation for riparian reserves is consistent with the Northwest Forest Plan standard and guidelines for Riparian Reserves: MM-1, MM-2, MM-4 and MM-6.

Aquatic Conservation Strategy

The Consent to Lease with stipulations is consistent with the Northwest Forest Plan standard and guidelines for the Aquatic Conservation Strategy. The lease stipulation for Aquatic Conservation Strategy applies the ecological health of watersheds and aquatic ecosystems.

In the future, if a lessee submits a site-specific proposal for geothermal exploration or development, Forest Plan consistency would be identified under additional NEPA analysis. Terms and conditions as part of an exploration or development permit may include design features, BMPs, and/or mitigation measures, beyond what is required by stipulations, to minimize impacts to aquatic resources.

Heritage Resources

Overview

Prehistoric Context

Evidence for human activity in inland western Washington starts approximately 10,000 to 12,000 years before present (B.P.), with no sites in Cascadia that are indisputably dated before about 13,000 B.P. (Ames and Maschner 1999:64). Due to highly acidic sediments, faunal remains, and bone and stone implements are not preserved, and sites from the riverine sector are characterized primarily by flaked

stone artifacts (Nelson 1990). One proposed cultural sequence for the western Cascades is presented by Hollenbeck (1987:27-30), from which the following is drawn:

From 12,000-5,000 B.P., generalized hunting and gathering occurred. Following the glacial retreat, the landscape became available to highly mobile hunters and gatherers. People lived in small groups, occupying low or mid-elevations of the major river valleys during the colder months. For the remainder of the year settlement is postulated to have consisted of a semi-nomadic foraging pattern. Small groups established temporary base camps where they processed food and manufactured tools. From these camps they moved into the uplands of the Cascades, hunting, gathering, and possibly fishing.

From 5,000-2,500 B.P., development of specialized resource use was occurring. Differences between cultural development along the coast and the mountain regions become more pronounced as people adapt to varied resource availability and needs. An inland orientation develops in the Cascades, which is influenced by or related to cultural development in the Plateau region. Artifact styles similar to those of eastern Washington become more common, and this similarity continues through late prehistoric and ethnohistoric times. A more complex system of trade is apparent. It is suggested that there was increased contact and exchange with people from across the mountains during this period.

From 2,500-250 B.P., specialized resource utilization occurred. By about 2,500 B.P., the climate became comparable to present conditions. Sites assigned to this period are considered to be representative of the fully developed subsistence activities of the ethnographic reports. In the Cascade foothills, these would include anadromous fishing of the major drainages, and land mammal hunting and plant gathering of most of the species used by the beginning of the ethnohistoric period.

250 B.P. – Present, was the ethnohistoric period. This period is characterized in the material archaeological record by the addition of objects of European and Euro-American manufacture. Many traditional tools were replaced by imported ones. Some tools were rendered unnecessary by the introduction of manufactured goods, while other tools exhibited a melding of native and imported materials.

Ethnohistoric Context

The Project Area was the traditional territory of the Nooksack and Upper Skagit Indians. The Nooksack Indians lived near the upper Nooksack River. At the time of the Treaty of Point Elliot, the Nooksack regularly, but by no means exclusively, used all the territory between the Cascade crest on the east and Puget Sound on the west, from the Canadian border south to and including Lake Whatcom (Hollenbeck 1987:112).

The Upper Skagit Indians lived along the Skagit, Cascade and Baker Rivers and their tributaries. Prior to the 1855 Treaty of Point Elliot, there were various individual groups, each with one or more winter villages, several summer camps, and resource procurement sites. Groups were linked by language, ties of marriage, joint feasting and ceremonial activities, and use of common territory, but there were no formal political institutions uniting the local groups into multiband tribes (Suttles and Lane 1990).

Settlement and land use were based on a seasonal round of resource procurement which included the lands within the Project Area. Permanent winter villages were used along the rivers and at the mouths of tributaries. From these villages, small groups would travel to various locations to join groups from other villages in fishing, root harvesting, hunting, berry picking and other economic pursuits. These activities were carried out from temporary camps that may have been reused seasonally (Collins 1974, Blukis Onat et al. 1980, USFS 2005b).

In addition to the Nooksack and Upper Skagit, the Project Area was likely used by other signatories of the Treaty, including the Lummi, the Swinomish, Sauk-Suiattle, the Stillaguamish, and the Tulalip Tribes.

The Project Area is within the Usual and Accustomed Fishing Areas of the Swinomish Tribal Community, the Lummi Tribe and the Nooksack Tribe (BIA 1980).

Within the Project Area many settings are identified in the *Inventory of Native American Religious Use, Practices, Localities and Resources* as important locations to the Lummi Tribe, the Nooksack Tribe, the Swinomish Tribe, the Samish Tribe, the Upper Skagit and the Duwamish (Blukis Onat and Hollenbeck 1981).

Historic Context

The following is modified and condensed from A Cultural Resource Overview: Prehistory, Ethnography and History: Mt. Baker-Snoqualmie National Forest (Hollenbeck 1987):

Fur trading brought the first euro-americans to the Skagit drainage, with the 1814 explorations of Alexander Ross. This was the main activity of euro-americans for the next several decades, as the northwest was increasingly settled. The Washington Territory was incorporated by 1853, existing until 1889, when it became the State of Washington. During this time, mining was the main draw for euro-americans to the vicinity of the nominated lands, with the first discovery of gold in the Mt. Baker Mining District in 1858. Continuing through the second half of the 1800s, mining became increasingly prevalent, and the logging industry also arose and started to grow. By 1902, there was a wagon road to Baker Lake, and a miners trail up Swift Creek to the Mt. Baker Gold Fields, while most of the sawmills on the upper portion of the Skagit River were not constructed until after 1900.

In 1897 the Washington Forest Reserve was established in the North Cascade Mountains and managed under the Department of the Interior. In 1905 they were transferred to the Department of Agriculture, and by 1908 the northern portion, from the international boundary to the Skagit River, was designated the Washington National Forest. The name was changed to the Mt. Baker National Forest in 1924. By 1936, the nominated lands were within the Baker River Ranger District, headquartered at the Koma Kulshan Ranger Station, just east of the nominated area.

From 1934 to 1942, the Civilian Conservation Corp worked on creating improvements in the forest, including new roads and trails, campgrounds, fire lookouts and reforestation projects.

In 1973, the Mt. Baker National Forest was merged with the Snoqualmie National Forest.

Cultural Resources

Historic and prehistoric cultural resources occur within the Project Area. For example, Baker River Archaeological District is a National Register Eligible resource on the east side of the Project Area. GIS analysis (11/13/2014) revealed no National Register Listed or Eligible archaeological sites within allowed occupancy areas (areas outside of No Surface Occupancy locations). However, when a site specific undertaking is proposed, an inventory for cultural resources would be conducted consistent with laws, regulations and policies governing federal historic preservation programs.

Reserved Treaty Rights

The proposed Project Area is located on lands ceded to the United States under the Treaty of Point Elliott. Treaty rights include rights specifically reserved in treaties signed by American Indian groups with the federal government as well as other rights not specifically taken away by treaty. They include, but are not limited to, the reserved rights to “fish at usual and accustomed grounds and stations” and “erecting temporary houses for the purpose of curing, together with the privilege of hunting and gathering roots and

berries on open and unclaimed lands.” Although “open and unclaimed lands” is not clearly defined, federal courts have ruled that certain federal public lands not set aside for uses incompatible with hunting, such as NFS lands, are considered open and unclaimed for these purposes.

These reserved rights reflect the subsistence, medicinal and spiritual aspects of the traditional lifestyle of Northwest Indian people. They are as important to Indian Tribes today as they were when their ancestors reserved these rights in the Treaty. Resources such as cedar, fish, large game and huckleberries are central to the identity of Tribes in the analysis area. For example, the Middle Fork Nooksack River is identified by the Nooksack Tribe as an area of cultural and spiritual importance, and was listed on the Washington Historic Register in 1999 (Richardson 2000).

The Project Area is within the Usual and Accustomed Fishing Areas of the Swinomish Tribal Community, the Lummi Tribe and the Nooksack Tribe (BIA 1980).

Other nearby tribes who may have used the areas historically include the Nooksack, Upper Skagit, Lummi, Sauk-Suiattle, Stillaguamish, the Tulalip Tribes, the Swinomish, the Samish and the Duwamish.

Reasonably Foreseeable Developments

Subsequent exploration and development could potentially result in effects to historic properties should historic properties be discovered in a proposed project area.

The cultural resource inventory strategy for the forest defines areas of high, medium and low probability based on environmental factors (such as slope, access to resources and transportation corridors) as well as ethnographic and historic documentation of past land use. Applying the criteria of slope to the 21,071 acres of Allowed Surface Occupancy lands, analysis revealed the following probability areas for cultural resources: 7,768 acres of high probability (0-20% slope); 9,359 acres of medium probability (20-35% slope); and 3,943 acres of low probability (>35% slope). Considering the RFD scenario, if the 51-350 acres of land utilized is located within high probability areas, subsequent surveys are more likely to reveal prehistoric or historic cultural resources in these areas. While medium and low probability areas are less likely to yield cultural resources, evidence from some historic activities (such as mining or logging) could be present.

Construction of a geothermal plant and associated infrastructure as depicted in the RFD scenario has the potential to damage or obliterate heritage site locations. Operation of a geothermal plant has the potential to disrupt private and quiet settings necessary for American Indian sacred practices. The increased human presence and operating industrial equipment has the potential to disrupt the abundance, distribution and access to floral and faunal resources crucial to conducting Native American cultural activities. These concerns would be addressed in any subsequent proposal, pursuant to the laws, regulations and policies, and the stipulations of the MBS Forest Plan, which require consultation with Indian Tribes and project level ground surveys. **All identified cultural resources require protection until they are appropriately evaluated for significance.** Consistent with the BLM Instruction Memorandum No. 2005-003 and the MBS Forest Plan, the BLM may require modification or disapprove any activity that is likely to result in adverse effects to historic properties that cannot be successfully avoided, minimized or mitigated after consultation with Tribes, the State Historic Preservation Officer and the Advisory Council on Historic Preservation.

In accordance with BLM Instruction Memorandum No. 2005-003, the BLM would apply the following controlled surface use lease stipulation to protect cultural resources (BLM 2004):

This lease may be found to contain historic properties and/or resources protected under the National Historic Preservation Act (NHPA), American Indian Religious Freedom Act, Native

American Graves Protection and Repatriation Act, E.O. 13007, or other statutes and executive orders. The BLM would not approve any ground disturbing activities that may affect any such properties or resources until it completes its obligations under applicable requirements of the NHPA and other authorities. The BLM may require modification to exploration or development proposals to protect such properties, or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized or mitigated.

Forest Plan Consistency

The Consent to Lease with stipulations is consistent with the MBS Forest Plan because the PEIS stipulations (Cultural Resources controlled surface use lease stipulation, along with the no surface occupancy lease stipulations related to heritage resources and Native American sacred sites), provide comprehensive protections for historic properties and Native American sacred sites.

When a lessee submits a site-specific proposal for geothermal exploration or development Forest Plan consistency would also be verified during the NEPA process. Terms and conditions as part of an exploration or development permit may include design features and/or mitigation measures to minimize or eliminate adverse effects on cultural resources.

Hydrology and Soils

Overview

The Project Area is dominated by the presence and influence of Mt. Baker, and by high elevation peaks of the Twin Sisters (North Twin 6570', South Twin 6524', and lesser peaks to the south 5836', 5902', 5505') which form the south and southwestern ridgeline. Loomis Mountain (5587') and South Fork Divide (4915') lie to the east, and Groat Mountain (5581') and Grouse Butte (5008') are to the North. Mt. Baker, at 10,778' in height, is the northern-most volcano in the Cascade Range. Steam plumes can be seen from two active vent areas on the mountain. These vents have been the sites of historic and recent-past major landslides down the Middle Fork Nooksack River which blocked the North Fork Nooksack River. Huge run-outs of sediment and deposits can be seen at the mouth of the Middle Fork (USFS 2006a).

In the last 10,000 years Mt. Baker has erupted at least four times and produced two lava flows, one pyroclastic avalanche, and numerous mudflows. The last major eruption, ending approximately 7,600-12,000 years ago, filled the Rocky and Sulphur Valleys to the east of the Project Area with 12 miles of lava flow. Four of the eight major postglacial mudflows happened during the last 600 years with an eruption in 1843 that reportedly blocked the Skagit River (Harris 1980).

Receiving extremely heavy snowfall, Mt. Baker supports 20 square miles of active glaciers. Glaciations have been an important part of the area's rich and complex geologic history, and continue to play an important role. Mt. Baker, Twin Sisters and their adjacent ridges and pinnacles form a spectacular alpine topography that dominates the landscape. Mt. Baker has one of three known crater ice cave systems in the world.

Originating in North Cascades National Park, the Baker River runs through NFS lands within the MBS, and then through state and private lands to the Skagit River. Baker River headwaters originate from glaciers and snowfields on Mt. Baker, Mt. Shuksan and in the Picket Mountain Range (greater than 7000 feet). The watershed encompasses portions of, or is adjacent to, three designated wildernesses and 2 National Recreation Areas. The mainstem Baker River is approximately 32 miles long (Williams et al. 1975). It is the lowest major tributary to the Skagit River (USFS 2002b).

The South Fork Nooksack River and its major tributaries, including Howard, Wanlick and Bell Creeks, follow fault contacts and flow through valleys that were initially stream-cut and later modified by glacial

action. Expressions of these faults can be seen today in the lower portions of the stream and river valleys. These faults caused sag ponds, active landslides, and rock falls such as the one on the South Fork Nooksack River at RM 31.

Another distinguishing feature of the area is the stream pattern within the Middle Fork and South Fork drainages. On the South Fork, rock structure and faulting has caused Bell Creek to make 90-degree bends where several faults intersect. The same is true on the Middle Fork where Upper Clearwater and Rocky Creek make 90-degree directional changes.

Details of aquatic resources conditions (hillslope processes, hydrology, water quality, fish habitat and Riparian Conditions) can be found in the North Fork Nooksack River Watershed Analysis (USFS 1995a), the Middle Fork and South Fork Watershed Analysis (USFS 2006a), and the Baker River Watershed Analysis (USFS 2002b), all of which are incorporated by reference and available at the MBRD office in Sedro-Woolley, WA.

Water Quality and Quantity

Surface Water

The Project Area is within the North, South, and Middle Forks of the Nooksack River and Baker River watersheds. All of the project area watersheds are located within the Nooksack and Skagit River Basins. Hydrologic Unit Codes of (HUC) watersheds that encompass the project area are listed in Table 11.

Table 11. Hydrologic Unit Codes of Watersheds and Their Distribution within the Project Area

HUC10 - Watershed	HUC Name	Watershed Area (mi ²)	Nominated Lands per Watershed (mi ²)	Percent of Watershed Nominated (mi ²)
1711000401	Upper North Fork Nooksack River	193.0	39.4	20.4%
1711000404	South Fork Nooksack River	185.6	23.5	12.7%
1711000403	Middle Fork Nooksack River	99.4	20.3	20.4%
1711000510	Baker River	297.6	44.6	15.0%

Washington State Water Quality Assessment and 303D List

Surface water in Washington State is governed by the Washington State Department of Ecology. The federal Clean Water Act, adopted in 1972, requires that all states restore their waters to be “fishable and swimmable”. Washington’s Water Quality Assessment lists the water quality status for water bodies in the state. This assessment meets the federal requirements for an integrated report under Sections 303(d) and 305(b) of the Clean Water Act.

There is one segment of the North Fork Nooksack River within the Project Area that is listed on the 303(d) list. Many stream segments are listed downstream of the Project Area.

The assessed waters are grouped into categories that describe the status of water quality. The 303(d) list comprises those waters that are in the polluted water category, for which beneficial uses— such as drinking, recreation, aquatic habitat, and industrial use – are impaired by pollution. The following major rivers have segments listed (tributaries with impaired segments are not listed below):

- **South Fork Nooksack River**, listings #35246 and #6230 – Category 5, “Polluted waters that require a Total Maximum Daily Load (TMDL)”, is listed for Temperature and Fine Sediment. Placement in

this category means that Ecology has data showing that the water quality standards have been violated for one or more pollutants. At this time, there is no TMDL or pollution control plan established.

- **Middle Fork Nooksack River**, listing #35237 – Category 5, “Polluted waters that require a TMDL”, is listed for Temperature. Placement in this category means that Ecology has data showing that the water quality standards have been violated for one or more pollutants. At this time, there is no TMDL or pollution control plan established.
- **North Fork Nooksack River**, listing #6234 – Category 5, “Polluted waters that require a TMDL”, is listed for Fine Sediment. Placement in this category means that Ecology has data showing that the water quality standards have been violated for one or more pollutants. At this time, there is no TMDL or pollution control plan established.

The mainstem Nooksack and Middle Fork Nooksack Rivers are surficial sources of drinking water for the City of Bellingham and several other cities in Whatcom County. A portion of the analysis area is under Land Allocation MA-23A and is managed to protect water quality and quantity for the City of Bellingham.

Groundwater

Geothermal resources primarily involve the presence and characteristics of available heat and groundwater. Groundwater is the primary water resource that is potentially affected by geothermal exploration and development.

Groundwater resources play a large role in recharging local aquifers that provide drinking water to many people in the Nooksack basin. The Washington Department of Ecology has established an instream flow rule for the mainstem and Middle Fork Nooksack River. Many streams, rivers, and the groundwater connected to them, have year round closures and seasonal closures.

Riparian Reserves

Riparian Reserves are lands along streams, wetlands and unstable or potentially unstable areas where riparian-dependent resources received primary emphasis and where special management standards and guidelines apply. Riparian and wetland habitats are of high value to fish and wildlife and perform critical environmental functions such as flood control and water purification (USFS and BLM 2008). Riparian Reserves maintain hydrologic, geomorphic, and ecologic processes that directly affect standing and flowing waterbodies such as lakes and ponds, wetlands, streams, stream processes, and fish habitats.

The National Wetland Inventory (NWI 2014) shows just over 700 acres of different wetland features within the Project Area.

Table 12 displays the miles and percent of Project Area that are within Riparian Reserves, as defined by the NWFP, and broken out by HUC10 watersheds. Retention of existing roads, construction of new roads, and construction of geothermal infrastructure associated with each phase of geothermal development all have potential to cause detrimental effects in Riparian Reserves. Projects by design along with applicable mitigation measures including BMPs have the potential to reduce or eliminate the majority of potential effects.

Table 12. Miles and Percent of Project Area in Riparian Reserves Displayed by Watershed.

HUC10 Watershed	HUC Name	Project Area Lands per Watershed (mi²)	Riparian Reserves (mi²)	% of Project Area Lands in Riparian Reserves
1711000401	Upper North Fork	39.4	12.2	31.0

HUC10 Watershed	HUC Name	Project Area Lands per Watershed (mi ²)	Riparian Reserves (mi ²)	% of Project Area Lands in Riparian Reserves
	Nooksack River			
1711000404	South Fork Nooksack River	23.5	8.4	35.7
1711000403	Middle Fork Nooksack River	20.3	3.9	19.2
1711000510	Baker River	44.6	14.9	33.4

Soils

Sedimentation from mass wasting events from unstable landforms has the potential to affect aquatic habitat conditions limiting the ability of aquatic systems to support desirable biota and ecohydraulics. Natural stability of the landscape in the project area is decreased by the presence of road crossings and facilities located on unstable landforms, soils, and steep slopes. The greatest risk of mass wasting events is associated with these unstable landforms and steep slopes in the project area.

Table 13 cross references many of the FS Soil Units, from the Soil Resource Inventory (USFS 1970), found within the Project area with the NRCS Hazard Ratings. The LRMP developed a different soil classification system than the NRCS Hazard Ratings. It classifies unstable soils as S-8 soils with a definition of “soils for which clear cutting or road building activities result in a 75% probability of doubling the mass wasting occurrence”. In addition, an area approximately 1/8 mile wide surrounding S-8 soils may have special management considerations applied, including avoidance by roads (USFS 1990).

Table 13. Unstable and Very Unstable Soils

FS Soil Unit	NRCS Hazard Rating
622	Very Unstable
066	Very Unstable
035	Very Unstable
009	Very Unstable
002	Very Unstable
705	Unstable

Source USFS Soil Units with NRCS Mass Wasting Hazard Rating (USFS 1972)

The total area of unstable, very unstable and S8 soils located in the Project Area are shown in Table 14.

Table 14. Unstable, Very Unstable, and S-8 Soils Located within the Project Area

HUC10 Watershed	HUC Name	Watershed (acres)	Unstable, Very Unstable, and/or S8 Soils (acres)	Percent of Project Area in Unstable, Very Unstable and/or S8 soils
1711000401	Upper North Fork Nooksack River	25,216	3,257	10.3
1711000404	South Fork Nooksack River	15,040	1,542	10.1
1711000403	Middle Fork Nooksack River	12,992	1,318	22.5

HUC10 Watershed	HUC Name	Watershed (acres)	Unstable, Very Unstable, and/or S8 Soils (acres)	Percent of Project Area in Unstable, Very Unstable and/or S8 soils
1711000510	Baker River	28,544	5,670	11.4

Topography is a critical factor in driving landscape evolution. Steeper slopes in particular are areas where erosion and mass earth movements are more likely. As a result, there are high risks associated with construction and retention of infrastructure on steep slopes.

Steep slopes within the Project Area were analyzed using GIS and a 10 meter Digital Elevation Model obtained from Washington State Education GIS database. Slopes between 30 and 40 percent, and greater than 40 percent were analyzed and mapped. Results presented in Table 15 are a summary of the slope data by 10th field HUC.

Table 15. Steep slopes in the Project Area

HUC 10 Watershed	Acres 30-40% Slope	Acres >40% Slope	% of Project Area < 30% slope	% of Project Area 30-40% slope	% of Project Area ≥40% slope
Upper North Fork Nooksack River	3,648	13,695	32%	14%	54%
South Fork Nooksack River	2,048	8,960	26%	14%	60%
Middle Fork Nooksack River	2,240	7,104	28%	17%	55%
Baker River	4,992	16,256	26%	17%	57%

Reasonably Foreseeable Development Scenario

The Proposed Action does not specifically propose development of a geothermal resource. For this reason, the analysis relies on the RFD, which projects future geothermal leasing and development on public and NFS lands within the western US over the next 20 years based on best professional judgment. The RFD scenario assumes all lands open to mineral leasing are available for leasing, and therefore, does not consider any allocations (lands open or closed to geothermal leasing) prescribed under the proposed action. Its purpose is to demonstrate the level of expected development and show where the potential development might occur. It is important to note that the magnitude and extent of impacts on any resource or resource use would vary depending on the amount of land apportioned for each lease.

The effects of the alternatives on the three primary “areas of concern” below:

- Water Quality and Quantity
- Riparian Reserves
- Soils

Approving or denying Consent to Lease would involve no ground disturbance or vibrations and would therefore have no effect on water quality, water quantity, Riparian Reserves, or soils. Consenting with stipulations would be subject to additional analysis when a formal site-specific application is proposed.

Forest Plan Consistency

The Proposed Action, Consent to Lease with stipulations, would be consistent with Standards and Guidelines of the Forest Plan, as amended, for water and soil resources.

Watershed analyses have been completed in the areas of the proposed geothermal lease.

Northwest Forest Plan - Aquatic Conservation Strategy Objectives

To be consistent with the 1994 Northwest Forest Plan, projects must be consistent with the ACS Objectives. A finding must be reached that a project “meets” or “does not prevent attainment” of the ACS objectives. Approving or denying Consent to Lease would involve no ground disturbance or vibrations and would therefore have no effect on water quality, water quantity, Riparian Reserves, or soils. Consenting with stipulations would be subject to additional analysis when a formal site-specific application is received. Therefore, the proposed action does not prevent the attainment of ACS objectives. The following is a brief description of how the proposed project and alternatives relate to each objective.

In the future, if a lessee submits a site-specific proposal for geothermal exploration or development, Forest Plan consistency would be identified under additional NEPA analysis. Terms and conditions as part of an exploration or development permit may include design features, BMPs, and/or mitigation measures, beyond what is required by stipulations, to meet the requirements of the ACS objectives.

Inventoried Roadless Areas

Overview

The Project Area is located along the slopes of Mt. Baker on the MBRD of the MBS, Washington. Inventoried Roadless Areas (IRAs) are located throughout the project area (Figure 6). This analysis is limited to those portions of IRAs that fall within the Project Area and outside of NSO areas. NSOs are considered major constraints in that they do not allow for surface developments on specific portions of the project area. For example, a lessee of an NSO area must develop any surface infrastructure outside the NSO area and would need to use advanced technology, such as directional drilling, to access the geothermal resource under the NSO area. Since each of the stipulations for NSOs represent higher levels of restrictions than that which the IRA stipulation requires, it is unnecessary to include IRAs within NSOs in this analysis.

Inventoried Roadless Areas and the 2001 Roadless Area Conservation Rule

IRAs are areas identified in the 2001 Roadless Area Conservation Rule in a set of inventoried roadless area maps, contained in the Forest Service Roadless Area Conservation FEIS, Volume 2, dated November 2000, which are held at the National headquarters office of the FS, or any subsequent update or revision of those maps (36 CFR 294.11). These areas were set aside through administrative rulemaking and have provisions, within the context of multiple use management, for the protection of inventoried roadless areas.

IRAs are defined as areas that do not contain system roads and are substantially undeveloped and therefore potentially eligible for designation as Wilderness. These inventoried roadless areas could have values associated with them such as the following:

- High quality or undisturbed soil, water, and air;
- Sources of public drinking water;
- Diversity of plant and animal communities;

- Habitat for threatened, endangered, proposed, candidate and sensitive species dependent on large, undisturbed areas of land;
- Primitive, semi-primitive non- motorized classes of dispersed recreation;
- Reference landscapes;
- Natural appearing landscapes with high scenic quality;
- Traditional cultural properties and sacred sites;
- Other locally identified unique characteristics.

Many of these IRAs, including within the project area, were identified in 1979 through the second Roadless Area and Evaluation Project (known as RARE II). The Forest Service's Roadless Area Conservation Rule of 2001 (promulgated in regulation at 36 CFR 294 (2001)) establishes overriding direction for inventoried roadless areas that post-date the Forest Plan. The original 2001 Roadless Area Conservation Rule is in effect and applies to this project

Specifically, the Roadless rule of 2001 prohibits road construction or reconstruction in inventoried areas, except for seven categories of exceptions, and prohibits timber cutting, sale, or removal from inventoried roadless areas except in the case of four categories of exceptions.

Table 16. Summary of IRAs within the Project Area and Eligible for Mineral Entry

	Acres of IRA within the Project Area	Acres of IRA outside of NSO	Percent IRA outside of NSO within Project Area
FS Proposed	34,072	6,448	18.9
2013 Nominated	8,633	1,581	18.3
Total	42,705	8,029	18.8

The RARE II project evaluated approximately 786,339 acres of roadless, undeveloped land on the MBS. The 1984 Washington State Wilderness Act incorporated parts of these Roadless areas into the Mt. Baker and Noisy-Diobsud Wilderness areas. Portions of the original Roadless areas remain. Some are large, contiguous areas but many are parcels made smaller by this wilderness designation.

The 1984 Wilderness Act did not call for these Roadless areas outside of the Wilderness to be protected as potential future Wilderness. Instead, the act described these lands as

being without "outstanding wilderness attributes," or as possessing outstanding energy, mineral, timber, grazing, dispersed recreation, or other values which should not now be designated as components of the National Wilderness Preservation System but should be available for non-wilderness multiple uses under the land management planning process.... (Public Law 98-339)

The 1984 Act did allow for the wilderness option to be reviewed again with each revision of the Forest Plan:

...the Department of Agriculture shall not be required to review the wilderness option prior to revisions of these [Forest] plans, but shall review the wilderness option when the plans are revised.... (Public Law 98-339)

However, management direction does not change for these lands pending new revisions:

[I]n the event that revised land management plans in the State of Washington are implemented, ... areas not recommended for wilderness designation need not be managed for the purpose of

protecting their suitability for wilderness designation prior to or during revision of such plans....
(Public Law 98-339)

The MBS finalized its Forest Plan in 1990. In this round of forest planning, the Roadless areas that remained outside of wilderness areas following the 1984 Act were not considered for wilderness designation (USFS 1990). The Forest Service Manual (FSM) directs that “Any inventoried Roadless area recommended for wilderness or designated wilderness study is not available for any use or activity that may reduce the wilderness potential of an area” (FSM 1923.03). Since the IRAs within the project area have not been recommended for wilderness or designated wilderness study, direction for its management then falls to its land use allocation in the Forest Plan.

Reasonably Foreseeable Development Scenario

This analysis uses the RFD scenario as defined in the PEIS to guide analysis as to whether the IRA stipulation given in the PEIS sufficiently protects the Inventoried Roadless resource as defined by law, regulation and policy and whether additional stipulations might be required.

Policy and law would permit certain geothermal exploration and development activities within IRAs described in the RFD scenario, provided that no roads are constructed or reconstructed, no timber is cut, sold, or removed, the actions are consistent with applicable standards and guidelines in the Forest Plan, and the appropriate environmental review process is completed.

However, for over 80 percent of the IRA acreage within the project area, more restrictive NSO stipulations would be applied due to other management area allocations that overlap IRAs, such as Riparian Reserves.

Unlike NSO stipulations, the IRA stipulation would not prohibit all surface development associated with geothermal development. However, the vast majority of the project area is covered with dense forests, which limits possibilities to accomplish ground-disturbing development without removing trees. Nonetheless, a lessee desiring access to the geothermal resource beneath an IRA would be permitted to do so from an allowable occupancy area outside the IRA. Proposals to develop facilities without roads or timber removal would be subject to further site-specific environmental analysis and are not within the scope of this analysis.

The RFD scenario defines four sequential phases: exploration, drilling, utilization, and reclamation. In each phase, substantial development in IRAs is unlikely due to the Roadless area stipulation. However, small amounts of disturbance that do not include roads or timber removal may occur. The sections below disclose in broad terms the potential disturbance for each phase of the scenario.

Phase 1: Exploration

Surveys during the exploration phase may require access by foot or helicopter to IRAs. Cutting of vegetation may be required in some areas to facilitate access, although cutting trees (timber) would be prohibited.

In some cases, gas collectors may be installed in IRAs to measure soil gases. These collectors have partially buried sensors and may disturb small areas of less than three square feet. Resistivity surveys include various methodologies from laying out long cables (up to 1,000 feet or more) on the land surface, or setting up equipment repeatedly in small areas (a few tens of square feet at the most for each measuring site). Minor, temporary disturbances are associated with each site for the burial of sensors.

While not widely used for geothermal surveys, seismic surveys would have the greatest survey impact on IRAs. These surveys typically involve setting up an array of geophones and creating a pulse or series of pulses of seismic energy. The pulse would be created either by detonating a small charge below the

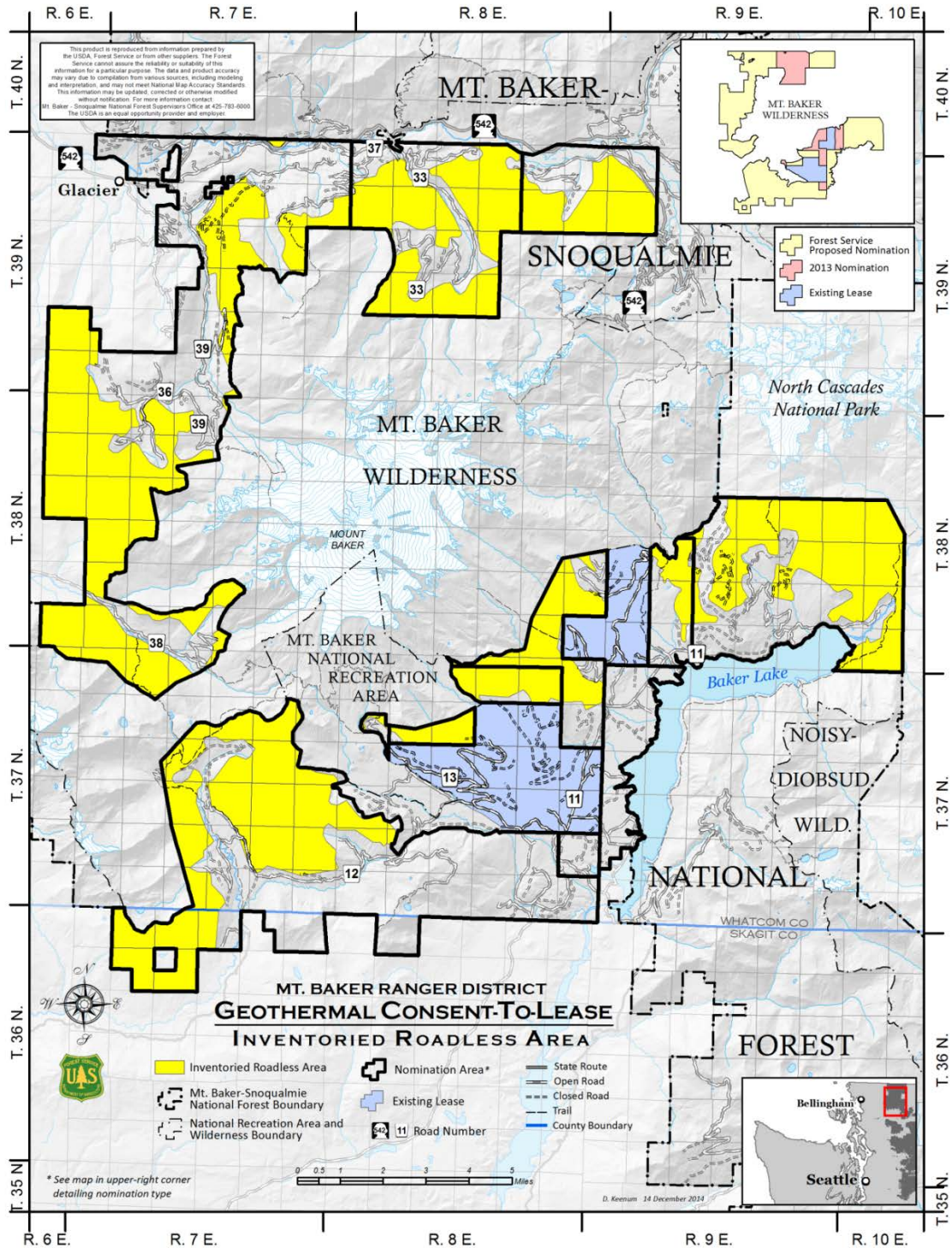


Figure 6. Inventoried Roadless Areas

ground surface (requires drilling a narrow “shot hole”) or by a vibroseis truck that is driven through the survey area on existing roads. Data is transmitted from the geophones to a central location. The geophones may be installed on the ground’s surface, in small excavations made specifically for burying the geophones, and/or in existing wells. These surveys are typically undertaken over the course of a few days. In areas where there is a lot of natural seismic activity, longer term installation of geophones may be undertaken to record naturally occurring earthquakes. Such cases do not involve a vibroseis truck.

The installation of geophysical and seismic survey equipment, which does not require road access or timber removal, would be permitted within IRAs. Table 17 provides a summary of exploration activities, the estimated amount of disturbance associated with the activity, and whether that activity would be permitted within an IRA. Drilling “shot holes” for seismic pulses or temperature gradient wells would likely use truck mounted drilling rigs. These operations would not likely be feasible without road construction or reconstruction and would be therefore unlikely in IRAs.

Table 17. Typical Disturbance for Exploration Phase of Geothermal Resource Development

Disturbance	Disturbance Estimate per Plant	Permitted in IRA outside NSO?
Geologic mapping	negligible	Yes
Geophysical surveys	30 square feet	Yes
Gravity and magnetic surveys	negligible	Yes
Seismic surveys	negligible	Yes (No drilling)
Shallow temperature measurements	negligible	Not likely
Road construction	1-6 acres	No
Temperature gradient wells	1 acre	Not likely

Phases 2 and 3: Drilling Operations and Utilization

Surface development related to drilling operations and utilization under the RFD scenario would likely require road construction and/or timber removal and therefore would not likely be feasible under the IRA stipulation.

Phase 4: Reclamation and Abandonment

Since very little ground disturbance is likely to occur within IRAs, it follows that very little reclamation would be required in these areas. Where development does occur in IRAs, disturbed sites would be reclaimed including removing equipment, regrading the site, and replanting native or appropriate vegetation to facilitate natural restoration.

Forest Plan Consistency

The Inventoried Roadless Area CSU stipulation substantially restricts geothermal development activities within IRAs, as road construction, reconstruction, and timber removal is prohibited. This stipulation, in conjunction with the array of other stipulations found in this document would be sufficient to protect the character of IRAs.

Should a lessee submit a site-specific proposal for geothermal exploration or development Forest Plan consistency would be identified during the NEPA process. Terms and conditions as part of an exploration or development permit within an IRA would include design features or mitigation measures to minimize adverse effects on resources.

Land Special Uses

Overview

Various industrial facilities are located within the Project Area and vicinity, which are authorized by the FS through special use permits. These include electric transmission lines owned by Puget Sound Energy (Nooksack Falls transmission line, and Town of Glacier distribution lines), telephone lines owned by Frontier Communications (Glacier), and communication sites (Pinus Lake, Washington State Dept. of Transportation). The Town of Glacier also relies on a water distribution system authorized by the Forest Service.

The Koma Kulshan hydroelectric facilities, owned by Covanta Energy (with facilities on Sulphur, Rocky and Sandy Creeks), are located outside of the Project Area but within the existing leased area approved in 2010. The facilities, permitted by the FS in 1990, include two water diversions, a 13 megawatt hydroelectric plant, penstock, and 4.5 miles of underground electric transmission line which parallel Forest System roads.

The Baker Lake Dam and reservoir, licensed by the Federal Energy Regulatory Commission (FERC) to Puget Sound Energy in 1959, are located just outside the southeast corner of the Project Area. This hydroelectric system has a 91 megawatt capacity and includes several ongoing resource mitigation and recreation enhancement projects under terms of the 50-year FERC license.

Reasonably Foreseeable Development Scenario

Any future actions for geothermal exploration and development would be subject to NEPA analysis including any potential site-specific effects on other permitted facilities at that time. Proposed future actions would require location surveys of any buried utilities within leased areas. Geothermal RFD actions that would occur in close proximity to permitted existing facilities would be required to not interfere with those permitted special uses by implementing protection and avoidance measures, best management practices and/or timing restrictions to reduce conflict. As a result, existing transmission lines, other utility corridors or other permitted industrial facilities would not be affected by geothermal exploration, drilling, and utilization activities. Any proposed relocation of utilities would require evaluation through the NEPA process.

Forest Plan Consistency

1990 Forest Plan, as amended – Facilities

The Consent to Lease with stipulations is consistent with the Forest Plan, as amended, standards and guidelines for Facilities which apply to Land Special Uses (LRMP pp. 4-140-141).

1990 Forest Plan, as amended – Land Uses

The Consent to Lease with stipulations is consistent with the Forest Plan, as amended, standards and guidelines for Land Uses which apply to Land Special Uses (LRMP pp. 4-137-138).

Should a lessee submit a site-specific proposal for geothermal exploration or development, Forest Plan consistency would be identified during the NEPA process. Terms and conditions as part of an exploration or development permit may include design features and/or mitigation measures to ensure compatibility with other permitted industrial special uses within leased areas.

Minerals

Overview

Geologic Setting and Hazards

The Project Area is located within the Pacific Mountain System portion of the Pacific geological province, which extends from southern California to the Kenai Fjords of Alaska. The Pacific province is one of the most geologically young and tectonically active regions in North America. This province contains several plate boundaries, which includes the Juan de Fuca and North American plates. At present the denser oceanic lithosphere of the Juan de Fuca plate is converging and sliding (subducting) beneath the lighter, more buoyant, continental crust of the North American plate. This difference in density between the two plates is what allows the subduction of the Juan de Fuca plate; at a rate of approximately 3 to 4 centimeters a year (USGS 2004).

As subduction occurs, high temperatures and pressures allow water molecules locked in minerals, mostly ocean sediments of solid rock, to escape. The water vapor rises into the ductile mantle above the subducting plate, causing partial melting of the mantle. This newly formed magma, less dense and more buoyant than the surrounding rock, rises toward the Earth's surface to erupt, forming an arcuate chain of volcanoes known as the Cascade Range. The Cascade Range extends from British Columbia to Northern California, roughly parallel to the coastline. Within this region 13 major volcanic centers lie in sequence, initially formed 36 million years ago with the range's major peaks dating back to the Pleistocene (USGS 2004).

The North Cascade Range in Washington State is part of the American Cordillera, a mountain chain extending more than 12,000 miles from Tierra del Fuego to the Alaskan Peninsula. Although only a small part of the Cordillera, mile for mile, the North Cascade Range is steeper and wetter than most other ranges in the conterminous United States. The peaks of the North Cascades do not reach great heights (generally 7,000 to 8,000 foot range) but their overall relief, mountain top to valley bottom, is commonly 4,000 to 6,000 feet. The North Cascades record at least 400 million years of Earth history. The disparate pieces of the North Cascade Range were born far from one another but subsequently drifted together, carried along by the ever-moving conveyor belt of tectonic plates that make up the Earth's outer shell. This range is divided into three domains: Western Domain, Metamorphic Core Domain, and Methow Domain (Tabor and Haugerud 1999). These domains are a geologic mosaic made up of volcanic island arcs, deep ocean sediments, basaltic ocean floor, parts of old continents, submarine fans, and even pieces of the deep subcrustal mantle of the earth. Spatially each domain is divided by two fault systems. The straight Creek Fault divides the Western Domain from the Metamorphic Core Domain and the Ross Lake Fault System divides the Metamorphic Core from rocks of the Methow Domain. All potential lease site(s) lie entirely within the Western Domain. Lithology, inside the lease boundaries, ranges in age from Holocene alluvium to pre-Devonian gneiss of the Yellow Aster Complex.

Lithology plays an important role with slope stability. Geologic instability is the downslope movement of rock, soil or related debris that includes a variety of processes such as rock fall, creep, slump, mud and earth flows that occur throughout geologic time. Unconsolidated materials are highly susceptible to both physical and chemical weathering which can increase the risk of instability. These unconsolidated materials make up approximately 24 percent of the Project Area and include alluvium, glacial drift and till, talus, and landslide deposits. Areas at risk for geologic instability include areas with steep slopes and/or areas with moderate slopes which contain unconsolidated material.

Volcanic Hazards

The Project Area is within 11 miles of the summit of Mount Baker. Mount Baker has had several volcanic explosions during the mid-19th century and numerous small-volume debris avalanches since the late 1950s. In 1975, increased fumarolic activity in the Sherman Crater area caused concern that an eruption might be imminent. Additional monitoring equipment was installed and several geophysical surveys were conducted to try to detect the movement of magma. The level of Baker Lake was lowered and people were restricted from the area due to concerns that an eruption-induced debris avalanche or debris flow might enter Baker Lake and displace enough water to either cause a wave to overtop the Upper Baker Dam or cause complete failure of the dam. Few anomalies other than increased heat flow were recorded during the geophysical surveys, nor were any other precursory activities observed to indicate that magma was moving up into the volcano. An increased level of fumarolic activity has continued at Mount Baker from 1975 to the present, but there are no other changes that suggest that magma movement is involved.

The Project Area is located in what the United States Geologic Survey (USGS) has designated as the “pyroclastic flowage hazard zone”. This zone could be affected by pyroclastic flows, pyroclastic surges, lava flows, and ballistic debris from future eruptions. During any given event, some parts of the zone may be completely unaffected by these processes, whereas other areas may be adversely affected. Additionally, certain portions of the Project Area that occupy valley bottoms are situated in the “inundation zone for Case 2 debris flows, as determined by the USGS. This zone could be affected by cohesive debris flows related to the disaggregation of moderate to small debris avalanches from Sherman Crater or upper Avalanche Gorge (Rainbow Creek). Recurrence interval for flows from either source is 100 years or less (USGS 1995).

It should be recognized that debris flows, landslides and debris avalanches are geologic processes that can occur with or without an eruption. These processes occur when loose masses of unconsolidated material such as soil and rocks, glacial deposits, or pyroclastic-flow deposits are saturated with water, become unstable, and move downslope. Factors such as “rain-on-snow” events or seismic activity could initiate these mass wasting processes.

Seismicity

Earthquakes are the result of large masses of rock moving against each other along fractures called faults. The shaking due to earthquakes can be significant for a dozen or more miles from the actual point where the quake occurred depending on the type of earthquake and the type of rock and soils beneath a given location.

Crustal earthquakes, the most common, typically occur along faults, or breaks in the earth’s crust, at shallow depths of 6 to 12 miles. Great subduction zone earthquakes occur around the world where the tectonic plates that make up the earth’s surface collide. When these plates collide, one plate slides beneath the other, where it is reabsorbed into the mantle of the earth. This dipping interface between the two plates is the site of some of the most powerful earthquakes ever recorded, often having magnitudes of eight to nine or larger. The last subduction zone earthquake affecting the project area occurred approximately 300 years ago. Deeper intraplate earthquakes occur within the remains of the ocean floor that is being subducted beneath North America. The magnitude 6.8 intraplate earthquake that struck the Puget Sound area in 2001 was much less destructive than a crustal earthquake of the same magnitude would have been because of its great depth (33 miles). This type of earthquake could occur beneath much of the Northwest at depths of 25 to 37 miles (PEIS 2008).

In Washington State more than 1,000 earthquakes occur annually. In a 10 Km radius around Mt. Baker there have been 20 seismic events since 2005, ranging in magnitude from -0.5 to 1.9 (Pacific Northwest Seismic Network 2014).

Minerals

Minerals are divided into three categories: locatable minerals (under the 1872 Mining Law, 30 U.S.C. 2 § 21 et seq.), leasable (under the 1917, 1920, and 1947 mineral leasing acts and the Geothermal Steam Act of 1970, as amended by the 2005 Energy Policy Act), and saleable materials (Materials Act of 1947).

Locatable Minerals

The MBS has a long history of mining, dating back to the late 1800's. Locatable minerals occurring in the Forest include, but are not limited to, copper, gold, molybdenum, tungsten, olivine, chromite, nickel, zinc, silver, and lead. A total of 148,187 acres within the Forest have a moderate to high potential for development of locatable minerals (USFS 1990). There are approximately 203 unpatented mining claims (BLM 2014) currently on the Forest, with the majority of these being located in the Middle & North Forks of the Snoqualmie River, Finney Block, Sultan Basin, and the Twin Sisters areas.

There are 10 unpatented mining claims in the Project Area and an additional 21 unpatented mining claims adjacent to the Project Area Boundary (Table 18). All mining claims within the Project Area are lode claims where very little activity has occurred over the last 20 years. However, the Great Excelsior Mine has submitted a Plan of Operations recently and may be conducting exploration and mine development activities in the coming years. The 21 claims located outside the Project Area are all connected to the Olivine mine. The Olivine mine is an open pit quarry occupying approximately 17 acres, with 13 acres on private land and 4 acres on NFS lands. The mine is currently operating with an approved Plan of Operations which allows for removing overburden, drilling and shooting, use of heavy equipment, crushing and screening, and hauling material off NFS lands.

Also, small scale prospecting activities could be occurring within the Project Area without the knowledge of the FS. Prospectors are not required to inform the FS of their mining activities if their actions are not creating a significant disturbance to surface resources. These prospecting activities may include small mineral sample collection with hand tools, gold panning, suction dredging, non-motorized hand sluicing, metal detecting, marking and monumenting, and utilizing open Forest System roads.

Table 18. Unpatented Mining Claims Within or Adjacent to the Project Area

Claim Name	Type	File #	Location
Olivine 28-29	Lode	ORMC 170749-50	T. 37N, R. 06E, Sec. 2, NW
Olivine 30-31	Lode	ORMC 170797-98	T. 37N, R. 06E, Sec. 3, NE
Olivine 1-6	Lode	ORMC 170788-93	T. 38N, R. 06E, Sec. 36, NE, NW & NW
Olivine 16-18	Lode	ORMC 170794-96	T. 38N, R. 06E, Sec. 35, Ne, NW & NE
Olivine 19-27	Lode	ORMC 170740-48	T. 38N, R. 06E, Sec. 35, NW & SW
Mosquito	Lode	ORMC 41523	T. 39N, R. 073, Sec. 2, SW1/4
EXC 5256	Lode	ORMC 167254	T. 39N, R. 08E, Sec. 5, NW1/4
EXC 5257	Lode	ORMC 167255	T. 39N, R. 08E, Sec. 5, NW1/4
EXC 5258	Lode	ORMC 167256	T. 39N, R. 08E, Sec. 5, NW1/4
EXC 5155	Lode	ORMC 167243	T. 39N, R. 08E, Sec. 6, NE1/4
EXC 5255	Lode	ORMC 167253	T. 39N, R. 08E, Sec. 6, NE1/4
EXC 5256	Lode	ORMC 167254	T. 39N, R. 08E, Sec. 6, NE1/4
EXC 5156	Lode	ORMC 167244	T. 39N, R. 08E, Sec. 6, NE1/4
EXC 5157	Lode	ORMC 167245	T. 39N, R. 08E, Sec. 6, NE1/4
EXC 5158	Lode	ORMC 167246	T. 39N, R. 08E, Sec. 6, NE1/4

Leasable Minerals

Only 18,225 acres in the Forest are classified as prospectively valuable for oil & gas resources (USFS 1990). Oil & gas are not thought to exist on the Forest in commercial quantities, but only limited surveys have occurred.

Although limited exploratory drilling has been conducted, the majority of the Forest (1,222,812 acres) is classified as "prospectively valuable" for geothermal energy. The MBS has identified 14 hot or mineral springs as having direct utilization potential of geothermal resources for commercial, residential, agricultural, public facilities, or other energy needs other than the commercial production of electricity (Bloomquist 1985). Mt. Baker and Sulphur Creek Hot Springs have been identified as having indirect electrical generation potential (USFS 1990).

In August of 2010, the FS consented to four geothermal leases on the MBRD; the first geothermal leases in the state of Washington on Forest lands. There has been no exploration or development of these leased lands. In addition, the MBRD received two separate nominations in 2011 and 2013, which are analyzed in this assessment. The Skykomish Ranger District also received geothermal nominations in 2011 and completed a Consent to Lease decision in 2013. All consented lands were offered for competitive lease in September of 2014; however, none of the nominated lease parcels received bids. The Skykomish lease parcels are available for non-competitive leasing for a period of two years.

Saleable Minerals

Saleable minerals, also known as mineral materials are common varieties of minerals and building materials (e.g., sand, gravel, rock). Saleable minerals have been identified in the Project Area. There are two quarries in section 28, T. 37 N., R. 8; one quarry in section 26, T. 37 N., R. 8 E.; and one quarry in section 4, T. 39 N., R7 E. All quarries are currently being utilized exclusively by the FS for in-service uses which include road maintenance and various other agency projects. One sand and gravel quarry is located outside the Project Area and could be used for operations associated with geothermal exploration and development. The future demand for these materials is likely to reflect the level of road building and maintenance needed in conjunction with timber harvest and other Forest projects.

Reasonably Foreseeable Development Scenario

Geologic Setting and Hazards

This analysis will disclose the potential effects to the surface based upon the RFD, and assess the need for stipulations to protect surface resources.

Potential effects from exploration activities related to mapping, surveying and some geophysical operations are not expected to affect land stability issues in the Project Area. Some geophysical operations, if they require roads or other surface disturbance, would have to be designed consistent with lease stipulations that limit use on steep slopes and areas of instability. The NSO stipulation of slopes greater than 40 percent is recommended to mitigate potential slope stability issues. With this stipulation, effects to land stability are expected to be minor.

Potential effects from drilling and utilization activities might occur in areas where certain geologic instabilities are present. Surface disturbance related to drilling of production/injection wells in these areas could lead to activation or acceleration of mass wasting features, which could in turn lead to increased erosion and sedimentation. Further, placement of facilities in areas of geologic instability may also pose a risk to a facility's safety and/or cause maintenance issues. Prior to construction of any facilities or infrastructure geotechnical investigations would need to be conducted to ensure that any construction can withstand strong seismic events, and proper evacuation plans would need to be in place in case of a

seismic or an eruption event. As long as operations are placed and designed with the above considerations, effects from geologic instability and volcanic hazards are expected to be minor.

Geothermal development in the Project Area may include Enhanced Geothermal Systems (EGS). EGS involves creating an underground reservoir by injecting water, under pressure, to induce shear slip on existing fractures (“hydroshearing”). This increases permeability of the geothermal reservoir and may induce microseismic events. Most seismic events induced by hydroshearing have a magnitude of less than 2.0 and are not felt at the surface. However, there has been one documented occurrence of a hydroshearing- induced seismic event reaching a magnitude of 3.7 (Cooper Basin, Australia). Until stratigraphy and tensile strength of the rock at depth is determined through exploration in the Project Area it would be very speculative to determine the intensity or quantity of induced seismicity events associated with geothermal development.

Minerals

The potential effects of leasing would result in conveying, to the lessee, non-exclusive rights to explore and exclusive rights to produce and use the geothermal resources in the Project Area.

Locatable Minerals

Potential effects would be the accumulation of new scientific knowledge (data and information) gained from exploration and development. As there are a small number of unpatented mining claims in the Project Area, effects are expected to be minor on locatable minerals. Under section 17 of the Geothermal Steam Act, lease operations shall not unreasonably interfere with or endanger operations under any lease, license, claim, or permit issued to the provisions of any other Act.

There may also be potential effects on small scale prospectors who may be operating in the Project Area, but without the knowledge of the FS. These small scale operators generally would only be using Forest System Roads for ingress and egress and would not be hauling a substantial amount of equipment. Therefore, geothermal development may have a slight effect on the ability of small scale prospectors to access and use certain areas during geothermal exploration or development activities.

Leasable Minerals

As there are no oil and gas leases in or near the project area there are no impacts expected to these resources.

Adjacent to the project area are four existing geothermal leases, awarded in 2010. Though unlikely, it is possible that two separate lessees could be operating in adjacent lease blocks at the same time with respect to exploration. Although it might be reasonable to foresee exploration activities to be on-going at the same time for exploration, it is unlikely that all leased areas could support more than the 50 MW as outlined in the RFD scenario. Impacts to individual lease holders is expected to be minor since separate lease operations may not unreasonably interfere with or endanger operations under any lease issued under the 1970 Geothermal Steam Act (Sec. 17, 1970 Geothermal Steam Act). In addition, for the purpose of properly conserving the natural resources of any geothermal pool or field, lessees may unite with each other in collectively adopting and operating under a cooperative or unit plan.

Saleable Minerals

Potential effects would be the accumulation of new scientific knowledge (data and information) gained from exploration and development. The construction of new access roads, improvements to existing roads and bridges, and installation of well sites and facilities would involve cut and fill operations. There would be an increased demand for mineral materials in support of construction and maintenance of roads, drill pads, and facilities. If large amounts of fill material would be necessary, increased demands on off-site or

Forest supplies of sand, gravel, and crushed rock could occur. This increase in demand on the limited Forest sources in the area may either deplete current resources or increase the surface disturbance at these quarries by expanding the quarry boundaries. However, mineral material use is at the discretion of the FS; therefore impacts may be mitigated by requiring the lessee to use commercial (private) sources. Also, the lease does not grant rights to the lessee for extraction of minerals materials in the Project Area. Mineral materials can only be acquired with a permit and is at the discretion of the District Ranger.

Forest Plan Consistency

The proposed action alternative of Consent to Lease with stipulations would be consistent with Standards and Guidelines of the Forest Plan, as amended, for mineral material resources. The Forest-wide standards and guidelines for Minerals and Energy apply to geothermal development (LRMP pp. 4-136).

Prime Forestland, Prime Farmland, Rangeland, etc.

Prime forestland, as defined by the Natural Resources Conservation Service, has soil capable of growing wood at the rate of 85 cubic feet or more per acre per year (USDA 1983) may be found on the MBS National Forest. There would be no impact to prime forestland as there would be no conversion of land to other uses under a consent to lease decision.

Prime farmland, as defined by the USDA, is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, and oilseed crops and is available for these uses. Rangeland is defined by the National Resources Inventory as a land cover/use category on which the climax or potential plant cover is composed principally of native grasses, grasslike plants, forbs, or shrubs suitable for grazing and browsing, and introduced forage species that are managed like rangeland. There is no Prime Farmland or Rangeland within the Project Area.

There would be no effect to prime forestland, prime farmland, or rangeland as there would be no conversion of lands under the Proposed Action.

Forest Plan Consistency

There is currently no guidance in the Forest Plan specifically related to prime forestland. However, Secretary of Agriculture Memorandum 1827 provides guidance to assure that the United States retains a forest land base sufficient to produce adequate supplies of high-quality food, fiber, wood and other agricultural products. Therefore, should a lessee submit a site-specific proposal for geothermal exploration or development guidance found in Memorandum 1827 would be used to determine Forest Plan consistency for prime forestland.

Recreation and Special Designations

Setting

The Project Area is located along the slopes of Mt. Baker within the Northern Cascades Physiographic Province (Franklin and Dyrness 1973). Recreation is an important component of the multiple use management practices carried forth by the FS. National Visitor Use Monitoring demonstrates that recreational use on NFS lands is increasing (USFS 2006b) and, as population growth continues, it is expected that the demand for recreation opportunities would also increase.

Recreation opportunities in the Project Area that may be affected include camping in a developed campground or dispersed campsites, a range of dispersed uses such as snowmobiling, hiking, fishing, hunting, and pleasure driving. Dispersed road campers generally camp near their vehicles and use spur roads and open areas along roads for camping sites. The roads also provide access for pleasure driving

and for gathering wild mushrooms and berries as well as other forest products. Hunting and fishing are also activities within the Project Area. High use recreation sites are typically occupied every weekend during the summer use season. Within the Project Area there are eight developed campgrounds, several high use dispersed sites with facilities such as toilets, picnic tables, information boards and trash receptacles, 13 trailheads, two official viewpoints and one fire lookout. These sites would carry a NSO stipulation.

Forest Service Roads 12, 1230, 13, 31, 39 and 3070 are groomed by Washington State Parks during winter snow conditions for snowmobiling and used in the summer for access to hiking, backpacking, etc. These roads are closed to wheeled vehicle access when the snow level is at least two feet deep but generally open to wheeled vehicle access beginning in April. In addition, two snow parks, (Salmon Ridge and Shadow of the Sentinels) are closed to all motorized use, including snowmobiling, during winter conditions.

Approximately 22 miles of the Pacific Northwest National Scenic Trail (PNNST) lies within the Project Area. The trail enters the Project Area at the confluence of the South Fork Nooksack River and Wanlick Creek. It then meanders through the Mt. Baker Wilderness, the Mt. Baker National Recreation Area and then along the east side of Baker Lake before heading north along Swift Creek to the Heather Meadows Visitor Center. It then crosses over the North Fork Nooksack River near Silver Fir Campground and then turns east over Hannegan Pass and into the North Cascades National Park. Portions of the trail that lie within the Mt. Baker Wilderness and National Recreation Area and along the east side of Baker Lake are not within the Project Area (Figure 2). The PNNST is expected to have a completed comprehensive management plan by 2018. Until this plan is developed for the PNNST, management will be consistent with the guidelines in use for the Pacific Crest National Scenic Trail. This plan states that National Scenic Trails will be “managed for the conservation and enjoyment of the nationally significant scenic, historic, or cultural qualities of the area through which such trails may pass” (USFS 1982). Should a geothermal lease for exploration be issued in an area surrounding the areas through which the PNNST passes, development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis that would ensure that the values for which the trail is being managed are conserved.

Recreation Opportunity Spectrum (ROS)

The Recreation Opportunity Spectrum (ROS) is both a classification system and a prescriptive tool for recreation planning, management, and research. It is used within the LRMP to describe the recreational setting by describing a combination of the physical, biological, social, and managerial conditions that give value to a place. There are seven defined ROS classes in the 1990 LRMP which are incorporated by reference.

Within the Project Area, six of the ROS classes are present. Table 19 depicts the acres per proposed ROS class. Also see ROS map in attachments.

Table 19. Percent of ROS within Lands Proposed and Nominated for Consent to Lease

ROS	ROS Acres within the Project Area	Percent ROS within Project Area
Primitive	1,140	1.4%
Semi-Primitive Nonmotorized	20,870	25.5%
Semi-Primitive motorized	153	0.2%

ROS	ROS Acres within the Project Area	Percent ROS within Project Area
Roaded Natural	42,410	51.8%
Roaded Modified	17,010	20.8%
Rural	240	0.3%

Management direction for the MBS is defined by both the Forest-Wide standards and the Management Prescriptions which are a set of practices scheduled for application on a specific Management Area. The following management prescriptions apply to the lease project area:

Intensity 1A Primitive

Desired Future Condition: Unmodified natural environment has been maintained with a high probability of isolation. Evidence of human activities would be unnoticed by most users. On-site controls, facilities, or modification are unlikely and would be provided only for resource protection and users safety. Roads would be generally three miles from these zones and normally one would expect to hike one to three hours to access these areas. Construction of roads, facilities or use of motorized equipment is not allowed within this management area.

Intensity 1B Semi-Primitive Nonmotorized

Desired Future Condition: Predominately natural or naturally appearing environment generally free from evidence of sights and sounds of human activities. Opportunities exist for isolation. Recreational experiences carry a moderate degree of risk and challenge. The ROS is semi-primitive nonmotorized. Concentration of users is low. Road development is prohibited and special uses are avoided within this management area.

1C Semi-Primitive Motorized

Desired Future Condition: Alternations to the natural landscape may be moderately dominant and may exist, but not draw the attention of motorized users within the area. Area is managed to minimize the presence of on-site controls and use restrictions. Motorized use is allowed, but may be seasonal in nature in some areas. Timber harvest is not appropriate.

1D Roaded Natural

Desired Future Condition: The setting for this class of recreation is characterized by an environment where modification of the natural landscape ranges from being easily noticed to obviously dominant to users. However, from sensitive travel routes and use areas, these alterations would appear subordinate to the surrounding areas. Timber harvest is permitted.

3A Developed Recreation

Desired Future Condition: Developed recreation sites may appear mostly natural to rural in setting. Physical facilities may be evident; design and construction would repeat the color, shapes, and lines of the surrounding environment. Access is by road. High use developed recreation sites are typically occupied every weekend in the summer use season. These include eight developed campgrounds and 13 trailheads which are within the Project Area. These sites fall under the NSO stipulation.

Mt. Baker National Recreation Area MA 4

Sections of the Project Area are adjacent to the Mt. Baker National Recreation Area (NRA). This area is congressionally designated to provide for public recreation, including but not limited to snowmobile use;

the conservation of scenic, natural, historic and other values contributing to public enjoyment; and manage, dispose of, and utilize other natural resources which are compatible with and do not significantly impair the purposes for which the area is established.

Reasonably Foreseeable Development Scenario

This section describes potential effects on recreation from the RFD scenario. Potential impacts on recreation opportunities and settings could occur if reasonably foreseeable actions were to:

- Conflict with existing recreational uses of the area; or
- Diminish existing recreation benefits and opportunities by altering the recreational setting or activity in an area.

Consent: Issuing geothermal Consent to Leases would not create surface disturbance activities. Therefore, current public access and recreation activities would continue unaltered until site specific geothermal operations were to begin (subject to environmental analysis and permit approval). Issuing geothermal Consent to Leases would have no effect on recreation. The development of geothermal resources could potentially alter the character of the recreation setting at the sites, thus the quality of an individual's experiences at that location could be altered.

Public access on roads would be expected to continue as only road improvements and new project roads are anticipated in the RFD. Recreation activities could potentially be disrupted by geothermal project use of roads. Throughout the various phases of geothermal development, visitors' enjoyment of the area could also be impacted by noise, vibration, dust, and visual intrusion and may continue throughout the life of the geothermal operations. Activities related to geothermal development could alter the recreational setting within the Project Area, hindering the capability of the settings to continue to produce the existing recreation opportunities.

Application of a Timing Limitation stipulation would protect resources that are sensitive to disturbance during certain time periods, in this instance, roads that are groomed for snow mobile or cross-country ski use during the winter.

Application of a CSU lease stipulation would protect recreational areas where standard lease terms and permit level decisions are deemed insufficient. The CSU stipulation would be applied to minimize the potential for impacts to recreational values, both motorized and non-motorized, and the natural settings associated with recreational activities in the Project Area. These areas include roads, hiking trails, primitive and semi-primitive management areas. It is expected that this stipulation would effectively avoid or minimize impacts to recreation and recreational areas by protecting the most significant recreation resources.

Exploration: Surveying and test drilling activities that occur during the exploration phase could temporarily reduce the area available for dispersed recreation use. This may minimally displace some recreation users and limit activities. Recreation users near exploration sites may realize a diminished recreation experience as there may be an increase in noise, vibration and dust. Additionally, exploration could temporarily shift the ROS setting of the landscape by varying degrees toward a more rural or roaded modified setting with the addition of wells, rigs, support equipment, water trucks and other vehicles.

Drilling: The drilling operations phase could result in longer term impacts on recreation resources. Similar to impacts described above under the Exploration phase, drilling operations could also shift the ROS setting, by varying degrees, toward a more rural or roaded modified setting.

Utilization: Impacts on recreation resources during the utilization phase of geothermal development would be similar to those discussed under the drilling operations phase. In addition, there is some potential to have reduced access to roads and facilities during the utilization phase. This phase could also shift the ROS setting, by varying degrees, toward a more rural or roaded modified setting. As developed recreation sites (e.g., campgrounds) lie within lands identified as NSO there would be no impacts to those sites or recreationists at those sites. However, people engaged in dispersed activities would likely be affected by construction activities (e.g., dust, noise). In addition, construction equipment and vehicles could also interfere with the traffic flow of recreational visitors.

Reclamation and Abandonment: Increased traffic from reclamation and abandonment activities could impact traffic flow as described above. All disturbed lands would be reclaimed. After reclamation is completed and all equipment and vehicles have left, landscapes would return to their previous ROS settings.

Summary: Local changes in areas available for recreation could be caused by construction of roads, well pads, pipelines, power plants, and transmission lines. The ROS setting in and around these areas could shift toward a more rural or roaded modified setting. It is assumed that the existing roads would be kept open and maintained for use by the public and recreationists, with increased traffic and some short disruptions. With the stipulation to prohibit road construction within Primitive and Semi-primitive Nonmotorized Management Areas, there would not be any major effects to the recreation setting there. The stipulation to manage the SnoPark routes for winter recreation would ensure the winter recreation activity and management goal is met.

Forest Plan Consistency

The Consent to Lease with stipulations is consistent with the Forest Plan, as amended, standard and guidelines for Recreation which is to “provide a broad spectrum of recreation opportunities and experiences on the MBS (LRMP pp. 4-84). The NSO stipulation applies to the MA-1A Primitive Management Area. The CSU lease stipulation for prohibiting road construction, road reconstruction, and timber removal applies to Semi-primitive Nonmotorized (MA1-B) and Semi-primitive Motorized (MA-1C) Management Areas. A Timing Limitation applies to closing Forest Roads to wheeled access and snow parks during winter snow conditions for winter sports activities.

These stipulations support Forest Plan goals, and standards and guidelines for recreation, and are consistent with the Forest Plan. The spectrum of ROS settings and recreational opportunities would continue under the Proposed Action.

Should a lessee submit a site-specific proposal for geothermal exploration or development Forest Plan consistency would be identified during the NEPA process. Terms and conditions as part of an exploration or development permit may include design features and/or mitigation measures to minimize adverse effects on resources.

Visual Quality

Overview

The Project Area contains scenic forested landscapes and a wide variety of visual settings or scenes. Lush, low-elevation forests contrast sharply with the glaciated peaks and ridges of Mt. Baker. Major mountain peaks located within the Forest are dominant focal points for forest visitors. Contrasting with this natural landscape are human modifications, including roads, rock pits, utility corridors, ski areas, and activities associated with timber harvest. Clear-cut patterns resulting from past timber harvest are the most visually evident. However, natural appearing environments exist on much of the Forest, even where extensive timber harvest and other activities have occurred. Other human modifications in the area include trails, developed campgrounds, dispersed camp sites, and the Baker Lake hydroelectric project and reservoir. Episodic natural disturbance events such as wind storms, wildfire, avalanches, and volcanic hazards may modify portions of the landscape. These events all contribute to a visually dynamic landscape. Panoramic views of Mount Baker and Mount Shuksan are found on several road systems in the Project Area.

Visual Management System/Scenery Management System

Scenery of the Forest is managed through the application of the Visual Management System (VMS) (USFS 1974). Based on inventory ratings and management direction, lands within the Forest are assigned Visual Quality Objectives (VQOs), listed as follows from most to least protective: Preservation, Retention, Partial Retention, Modification, and Maximum Modification. Current FS analysis incorporates both aesthetic and ecological functions based on guidance from the Scenery Management System (SMS) Handbook 701 (USFS 1995b). While many of the basic inventory elements of the Visual Management System are retained, the Scenery Management System incorporates both the natural and human processes into the idea of managing for ecosystems and is the current methodology used by the FS to inventory and evaluate impacts to scenic resources.

Scenery Management Objectives are defined in terms of Scenic Integrity Levels which describe existing conditions and whether the landscape is visually perceived to be “complete” or not. The most complete or highest rating for Scenic Integrity Levels is having little or no deviations from the landscape characteristic that makes it appealing and attractive to visitors and local residents. In addition to describing existing conditions, Scenic Integrity Levels also describe the level of development allowed and ways to mitigate deviations from the area’s landscape character.

In Scenic View Foreground areas, classified in SMS as High Scenic Integrity and in VMS as Retention, visual changes would not be noticeable to the casual forest visitor. Moderate Scenic Integrity Level in SMS would be similar to Partial Retention in VMS. Low Scenic Integrity Level in SMS compares to Modification in VMS and Very Low Scenic Integrity Level would correlate to Maximum Modification in VMS. Very High Scenic Integrity Level would be Preservation in VMS.

The following designated primary viewsheds are within the Project Area:

- The Baker Lake Highway viewshed is along FSR 11, and was assigned in the LRMP as the Baker Lake Highway Primary Viewshed corridor. Within this viewshed, the existing visual condition is considered slightly altered, and was expected to remain in a slightly altered condition for the next 50 years (by the year 2040).
- The Mt. Baker Highway viewshed is along State Route 542, and was assigned in the LRMP as the Mt. Baker Highway Primary Viewshed corridor. Within this viewshed, the existing visual condition is considered slightly altered, and was expected to remain in a slightly altered condition for the next 50

years (by the year 2040). Much of the scenic foreground within this viewshed is within MA 5 Recommended Wild and Scenic River for which there is a NSO stipulation.

The Forest Plan provides specific Standards and Guidelines for visual resources within land management allocations. Table 20 lists the Visual Quality Objective and Scenic Management System Integrity Level for each Management Area found, and its' associated stipulation, if any, within the Project Area.

Table 20. Visual Quality Objective and Scenic Management System Integrity Level for each MA

Management Area	Visual Quality Objective	Scenic Management Integrity Level	Associated Stipulation
14 Deer and Elk Winter Range	Retention- foreground primary viewsheds	High	CSU
	Partial Retention- middleground	Moderate	None
15 Mt. Goat Habitat	Consistent with adjacent MAs	NA	None
19 Mt. Hemlock Zone	Ranges from retention to modification	NA	None
1A Primitive	Primitive	Very High	NSO
1B Semi-Primitive Nonmotorized	Retention	High	CSU
1C Semi-Primitive Motorized	Retention- foreground primary viewsheds	High	CSU
	Partial Retention- middleground	Moderate	None
23A Other Municipal Watersheds	Retention- foreground primary viewsheds	High	CSU
2A Scenic Viewshed Foreground	Retention from primary road corridors	High	CSU
2B Scenic Viewshed Middleground	Partial Retention	Moderate	None
Common to All Management Areas	Retention within foreground (¼ mile) of Mt Baker & Baker Lake Highways	High	CSU

Reasonably Foreseeable Development Scenario

Changes to the visual resources and scenic quality that could occur would be the result of future geothermal operations that are associated with exploration and site development. This could include buildings and other infrastructure such as visible pipe, transformers and power lines. Increased traffic could also occur. The current natural setting in relatively localized areas would change to a more industrial appearance if development were to occur. In addition, removing or modifying vegetation could lead to deviations from the landscape character as well as lead to a conversion of vegetation type.

Any future actions for geothermal development would be analyzed for site-specific effects on visual resources at that time. Proposed future actions would require Scenery Management System analysis. Site

specific analysis for project proposals within the project area would consider the extent of potential effects on visual resources, night skies, and ambient noise levels inside and beyond National Forest boundaries. In addition, Forest Plan management requirements and mitigations, such as meeting Scenery Management System integrity levels/Visual Quality Objectives, would be recommended and implemented.

Forest Plan Consistency

Management Areas MA 1A Primitive and 5A, 5B and 5C Potential Wild and Scenic Rivers have a NSO stipulation and are therefore unavailable for surface occupancy by structures, roads, and other built features. Consequently there would be no effects to visual and aesthetic resources within these Management Areas and the project would be meet Forest Plan consistency.

Should a lessee submit a site-specific proposal for geothermal exploration or development Forest Plan consistency would be identified during the NEPA process. Terms and conditions as part of an exploration or development permit may include design features and/or mitigation measures to minimize adverse effects on resources. A CSU stipulation, requiring developments to be either not evident or visually subordinate to the natural landscape, would be applied to areas with a Scenery Management System integrity level of high (VQO retention) to ensure any activities would be consistent with the Forest Plan.

Wetlands and Floodplains

The Consent to Lease with stipulations is consistent with the Forest Plan, as amended, standard and guidelines for floodplains and wetlands. There is an NSO stipulation for Riparian Reserves. Riparian Reserves include all wetland areas and extends beyond the 100 year floodplains. Further, to be consistent with the Forest Plan, the Consent to Lease with stipulations will need to maintain or restore the Aquatic Conservation Objectives. Two of these objectives require the maintenance or restoration of the physical and hydrological connectivity of floodplains.

Should a lessee submit a site-specific proposal for geothermal exploration or development Forest Plan consistency would be identified during the NEPA process. Terms and conditions as part of an exploration or development permit may include design features and/or BMPs to avoid or minimize adverse effects on floodplain and wetland habitats, or mitigation would be required for those impacts that are unavoidable.

Wild and Scenic Rivers

Overview

To effectively manage rivers with outstanding natural, cultural, and recreational values, Congress established the National Wild and Scenic Rivers (WSR) System through the 1968 Wild and Scenic Rivers Act (Public Law 90-542). Rivers, or segments of rivers, must be free flowing and possess at least one outstandingly remarkable value, such as scenic, recreational, geologic, fish, wildlife, historic, cultural, or other features. The FS manages many rivers that, although not congressionally designated, have been found to be eligible under the Act. The outstandingly remarkable values of eligible rivers must be protected until superseded by Congress. Within the National Wild and Scenic Rivers System, three classifications define the general character of designated rivers: wild, scenic, or recreational. Classifications reflect levels of development and natural conditions along a stretch of river. These classifications are used to help develop management goals for the river.

While there are no congressionally designated Wild and Scenic Rivers in the Project Area, segments of Baker River, North and South Forks of the Nooksack River, and Bell Creek were found to be suitable for WSR designation in the 1990 LRMP (Table 21). Approximately 796 miles of rivers and streams on the

MBS were studied in the 1990 LRMP FEIS for possible inclusion in the National Wild and Scenic River System. Of these, 452 miles of 30 rivers were officially recommended. Segments of the Middle Fork Nooksack River and Wells Creek were studied for possible recommendation but found not to be suitable for WSR designation and therefore not included in the official recommendation.

Table 21. Segments of Recommended Wild and Scenic Rivers in the Project Area

Segments	Recommended Classification	Miles
North Fork Nooksack		
Nooksack Falls Diversion Dam to Nooksack Falls power plant	Recreation	1.6
Nooksack Falls power plant to the fish hatchery near Kendall	Scenic	18.8
Fish hatchery to the confluence with the South Fork Nooksack	Recreation	9.5
South Fork Nooksack		
Headwaters of the South Fork Nooksack to Bell Creek	Wild	2.3
Bell Creek to the SF Nooksack River	Scenic	4.3
Baker River		
Headwaters in North Cascades National Park near Perfect Pass to Blum Creek	Wild	11.2
Blum Creek to Baker Lake	Scenic	2.1

Reasonably Foreseeable Development

Future geothermal development within the project area would be constrained by a NSO stipulation and would therefore have no effect on recommended WSR segments within the Project Area. No surface development would be permitted. Access to geothermal resources beneath recommended WSRs could be achieved using directional drilling technology from allowed occupancy areas.

Forest Plan Consistency

Should a lessee submit a site-specific proposal for geothermal exploration or development Forest Plan consistency would be identified during the NEPA process. Terms and conditions as part of an exploration or development permit may include design features and/or mitigation measures to minimize adverse effects on recommended WSR resources.

Wildlife

Overview

Federal Threatened and Endangered Species and Critical Habitat

Listed below are federally listed threatened and endangered species and their designated critical habitat that are documented or suspected to occur on the MBS. Aquatic species are addressed in the section on Fisheries.

- Northern Spotted Owl (*Strix occidentalis caurina*)
- Northern Spotted Owl Critical Habitat

- Marbled Murrelet (*Brachyramphus marmoratus*)
- Marbled Murrelet Critical Habitat
- Grizzly Bear (*Ursus arctos*)
- Gray Wolf (*Canis lupus*)

Northern Spotted Owl

The spotted owl continues to display an apparent declining population trend across its range (as was predicted in the Northwest Forest Plan), particularly in Washington and British Columbia, Canada. However, a 5-year status review of the northern spotted owl recently completed by the USFWS concluded that the species should remain listed as threatened under the Endangered Species Act, and not moved to endangered status. The main current threats for spotted owls on the MBS appear to be residual effects on habitat from past timber harvest and competition from barred owls (Courtney et al. 2004).

The Sustainable Ecosystem Institute report (Courtney et al. 2004) identified the value of retaining large blocks of suitable nesting habitat for spotted owl recovery, and the threats of habitat loss (fire and timber harvest), and competition from barred owls.

The vast majority of lands within the Project Area occur within the 438,255 acre, West Cascades North Designated Critical Habitat sub unit WCN 1 (Unit 4) for the northern spotted owl (USFWS 2012a). Within the Project Area there are twelve historic owl activity centers. They are also within the home range (1.9 mile radius) of seven historic owl activity centers. All owl activity centers are based on historic surveys in the 1990s. Owl territories in or near the project area have not been recently surveyed to protocol. However, a single year of surveys in the Baker and upper South Fork Nooksack drainages occurred in 2008; no spotted owl activity centers were detected in or near the Project Area.

The early nesting season for spotted owl occurs from March 1 – May 30. During this time, owls initiate nesting and incubate eggs. Adverse effects from noise disturbance during the early nesting season are of concern due to the potential to interrupt optimal nest selection, or incubation success. Since most owl activities are nocturnal, noise from daytime activities are less likely to disrupt owl feeding or nesting activities. Disturbance after July 15 is not expected to adversely affect spotted owl nesting because young birds will be capable of flight and can move out of an area where noise affects them.

Almost all the lands within the Project Area occur in the Nooksack (75,050 acres) and Baker (82,100 acres) LSR and contain areas suitable for nesting by spotted owls. Because of their size and expected contribution to spotted owl production, these LSRs are very important to the success of the LSR conservation strategy adopted by the Northwest Forest Plan (USFS 1994). The LSRs are expected to be a source of owls dispersing to two neighboring LSRs and maybe a critical link to late-successional habitat in North Cascades National Park.

The Final Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011a) recommends retaining all occupied and unoccupied, high quality spotted owl habitat on all lands to the maximum extent possible. This plan does not include specific recommendations on a network of management areas for spotted owl habitat, since the USFWS is in the process of conducting a range-wide, multi-step modeling process to design, assess, and inform designation of a habitat conservation network that will help address the recovery of the spotted owl.

Marbled Murrelet

The murrelet continues to display an apparent declining population trend across its range (as was predicted in the Northwest Forest Plan), particularly in Washington. In Zone 1, there is a declining trend

of 7.4 percent of the population per year, or about a 30 percent decline in the population since monitoring began in 2001.

Numerous stressors have been identified that may be contributing to a decline in the population. The main stressors identified by the Recovery Implementation Team (USFWS 2011b) are:

- Ongoing and historic loss of terrestrial (forest) nesting habitat
- Predation on murrelet eggs and chicks in their nests
- Changes in marine forage conditions, affecting the abundance, distribution and quality of murrelet prey
- Post-fledging mortality
- Cumulative and interactive effects of factors on individuals, populations, and the species

Surveys for murrelets are limited. Marbled murrelet detections (fly-overs and vocalizations) have been made in the Baker River and South Fork Nooksack River drainages (Forest Service Files). There are numerous murrelet detections within and adjacent (within 0.5 miles) to the Project Area. The Project Area ranges from approximately 23 to 43 miles from the salt water of Puget Sound.

The murrelet nesting season, when eggs are incubated, extends from April 1 – September 23 (USFWS 2012b). During this season, it is a potential concern that adult birds could be flushed from nests due to disturbance. It is possible that eggs could cool to the point that the embryo dies during the period that the adult is absent, or that predators could more easily detect nests, or have easier access to eggs, resulting in nest failure. After the chick has hatched, adult movements to feed the young are primarily in the early morning and evening hours, while the chick remains on the nest in a downy coat of cryptic camouflage.

There is suitable marbled murrelet nesting habitat within the Project Area.

The vast majority of the Project Area occurs within a Designated Critical Habitat unit for marbled murrelet (WA-07-c) (USFWS 1996).

Grizzly Bear

The North Cascades area north of Interstate 90 is part of a recovery zone for grizzly bear as outlined in the Recovery Plan (USFWS 1993) and the Supplement (USFWS 1997). In 1997 the North Cascades Grizzly Bear Management Committee, which consists of the Park Superintendent of the North Cascades National Park and the Forest Supervisors of the Wenatchee, Okanogan, and Mt. Baker-Snoqualmie National Forests, agreed to an interim standard of "No Net Loss" of core habitat until superseded by a Forest/Park Plan amendment or revision (USFS 1997a).

Based on grizzly bear habitat use studies in Montana and British Columbia, core habitats were defined as those areas > 1/3 mile (500 m) from open roads, motorized or high use non-motorized trails. High use non-motorized trails are defined as trails with > 20 parties per week during bear seasons. The early bear season is defined as den emergence through early summer (March 15 through July 15) and the late season is defined as late summer to denning (July 16 through October 31). The baseline for the no net loss policy was based on mapped status of road and trail systems occurring in Bear Management Units (BMUs) as of July 31, 1997. Validation of road and trail status and use continues to be refined and updated with site specific project review.

The Project Area occurs within three grizzly Bear Management Units (BMUs). A status of 70 percent core habitat for interior BMUs and a status of 55 percent core habitat for exterior BMUs are considered desirable by the Interagency Grizzly Bear Committee (IGBC 2001). All the BMUs in the Project Area are considered exterior (USFS 1998). The Nooksack and Baker BMUs provide moderate quality habitat,

while the Sisters BMU is currently below the desired amount of core habitat in both the early and late season (Table 22).

Table 22. Percent Grizzly Core Habitat within the Baker and Sisters Bear Management Units

BMU	Acres	% Federal Land	% Core Early Season	% Core Late Season
Nooksack	144,410	94.6	57.4	53.0
Baker	82,380	96.7	62.2	57.0
Sisters	100,875	45.9	46.3	37.9

There are no recent Class 1 sightings (confirmed sightings) of grizzly on the Mt. Baker District. The most recent Class 1 sighting occurred in 1996 approximately 44 miles south east of the Project Area.

Gray Wolf

Wolves are not habitat specialists, but are dependent on a sizeable ungulate prey base. On the MBS, wolves would be largely dependent on deer as a food source. Elk and deer populations are currently low, compared to those that resulted from past large-scale timber harvest and the resulting early-seral habitat. The wolf prey population (deer and elk) is insufficient to support a resident reproductive wolf population, and the Forest has concluded that there is no indication of resident wolves west of the Cascade crest on the MBS (USFS 2002a). It is assumed that only transient or dispersing wolves might be expected to temporarily wander on to the MBS. In essence, the MBS is not considered suitable habitat for resident wolf pack territories.

Currently, there are no known den or rendezvous sites on the MBRD or on the MBS. On the Forest, the most recent report of wolf activity was a rendezvous site in 1990 near the Cascade crest in the North Fork Sauk watershed, well south and east of the Project Area. In recent years, 13 resident packs have been documented on the east side of the Cascade crest (WDFW 2014).

For this analysis wolf security habitat is considered the same as core habitat for the grizzly bear.

Region 6 Forest Service Sensitive Species

The species listed below are on the Regional Forester's Sensitive Animal List (updated December, USFS 2011a) for the Pacific Northwest Region, and are documented or suspected to occur on the MBS. The sections in this document addressing these species meets the requirements for Sensitive Species as described in FSM 2670 (2005c).

- Bald Eagle (*Haliaeetus leucocephalus*)
- Common loon (*Gavia immer*)
- American Peregrine falcon (*Falco peregrinus anatum*)
- Townsend's big-eared bat (*Corynorhinus townsendii*)
- California wolverine (*Gulo gulo*)
- Mountain Goat (*Oreamnos americanus*)
- Larch Mountain salamander (*Plethodon larselli*)
- Van Dyke's salamander (*Plethodon vandykei*)
- Harlequin Duck (*Histrionicus histrionicus*)

- Shiny tightcoil (*Pristiloma wascoense*)
- Broadwhorl tightcoil (*Pristiloma johnsoni*)
- Johnson's hairstreak (*Callophrys johnsoni*)
- Valley silverspot (*Speyeria Zerene Bremnerii*)

Bald Eagle

There are occurrences of bald eagles nesting within the Project Area near the shore of Baker Lake. During the winter season (November through March), bald eagles in the Pacific Northwest use a large foraging area that includes most rivers in the Puget Sound region, the Fraser River system in British Columbia, coastal areas in western Washington and British Columbia, and portions of interior British Columbia and Washington state (Watson and Pierce 2001). Wintering bald eagles frequently move between major rivers in western Washington, in response to fish runs and shifts in fish distribution due to flood or high water.

Common Loon

There are occurrences of this species on Baker Lake but there are no other large lakes in the Project Area that could provide habitat for common loon.

Peregrine Falcon

There are no known occurrences of this species and there are no cliffs in the Project Area that could provide nesting habitat for falcons.

Townsend's Big-Eared Bat

Townsend's big-eared bats typically require caves, abandoned mines, or abandoned wooden bridges or buildings for critical roosting habitat, particularly for maternity colonies and winter hibernacula. These features are not known to occur within or near the Project Area. Although the species is strongly associated with caves, abandoned mines, or abandoned wooden bridges or buildings for roosting habitat, they also may occasionally use hollow trees for temporary roost sites. They feed mostly in the air along forest edges, roads, and open habitats, but can forage in almost any habitat (Johnson and Cassidy 1997). No surveys were conducted within or near the Project Area.

California Wolverine

This species is found in a variety of habitats in the western United States. Wolverines are present on the MBRD. Wolverines typically are known to inhabit large, sparsely populated wild and undeveloped, or unroaded areas. They are susceptible to human disturbance, particularly near den sites. It appears that food abundance and availability, and avoidance of humans, human activities, and also possibly high temperatures in summer, influence wolverine habitat use more than plant association types or topography (Ruggiero et al. 1994).

In the Washington Cascades, wolverines occur in alpine areas down through forested zones to the lower edge of forests. Generally, they are most common in alpine and subalpine zones, but will sometimes descend into valleys, particularly in winter where large game may be available. In many areas, wolverines are believed to be dependent on ungulates as a major food source.

This species naturally occurs at low densities, with individuals ranging over large areas (Johnson and Cassidy 1997). Wolverines are known to use parts of the Project Area. There is adequate cover and habitat available within the Project Area for their dispersal.

Mountain Goat

Mountain goats are known to use parts of the Project Area. Goats are often found in areas with cliffs which provide security and escape cover from predators. Forest Plan management areas allocated for mountain goat habitat (MA-15) occur within the Project Area.

Larch Mountain Salamander

The larch mountain salamander is not known to occur on the MBRD. Currently, the northern extent of the range of this species is thought to be state Highway 2, approximately 53 miles south of the Project Area.

Van Dyke's Salamander

The Van Dyke's salamander is not known to occur on the Forest. Currently, the northern extent of the range of this species is thought to be state Highway 2, approximately 53 miles south of the Project Area.

Harlequin Duck

This species is suspected to use parts of the Project Area. Nests are built along stream edges in mature and large conifer forest or mixed forest stands within riparian zones of Class 1 through 3 streams. Maintenance of water quality and downed wood is important for caddis flies, a major food source. Downed wood also provides potential nesting and hiding sites within riparian areas.

Shiny Tightcoil Snail

There is potentially suitable habitat for this species in the immediate vicinity of the Project Area and is suspected to occur on the MBS (BLM and USFS 2011).

Broadwhorl Tightcoil Snail

There is potentially suitable habitat for this species in the immediate vicinity of the Project Area (BLM and USFS 2011). Typical site descriptions include abundant ground cover (salal, oxalis, sword fern, grasses), conifer or hardwood overstory, and moderate to deep litter. Despite surveys on the MBS since 1997, in apparently suitable habitat, the species has not been found.

Johnson's Hairstreak

There is suitable hairstreak habitat within the Project Area. This butterfly is characteristic of mature and old-growth forests with mistletoe, particularly on large mature western hemlock at low elevations and large true firs at higher elevations. In Washington, Johnson's hairstreak has been documented from the Olympic, MBS and Gifford Pinchot National Forests (BLM and USFS 2011).

Valley Silverspot

This subspecies is historically known from southwestern British Columbia south to west-central Oregon. In British Columbia, this butterfly occurs on Vancouver Island and Salt Spring Island, although recent searches of these islands found only a few surviving populations (BLM and USFS 2011). In Washington this species occurs on the San Juan Islands, along the Washington Coast Range, and in the Puget Trough (BLM and USFS 2011).

MBS Management Indicator Species (MIS)

Selected habitat types and the representative management indicator species from the LRMP are displayed in Table 23.

Table 23. Management Indicator Species found on the MBS

Species	Preferred Habitats	Reason For Selection as MIS	Habitat Present in Analysis Area	Species Present or Suspected in Analysis Area
Bald Eagle	Roost, nest habitat and forage areas near lakes, reservoirs, rivers with readily available food source (fish and carrion)	Threatened and Endangered Species Habitat	Yes	Yes
American Peregrine Falcon	Cliff habitat for nesting	Threatened and Endangered Species Habitat	No	No
Gray Wolf	Security habitat > 500 m from road and high use trails	Threatened and Endangered Species Habitat	Yes	No
Grizzly Bear	Core habitat > 500 m from road and high use trails	Threatened and Endangered Species Habitat	Yes	Yes
Mountain goat	Rocky slopes >40 degrees adjacent to forage and cover	Big-game Winter Range	Yes	Yes
Northern Spotted Owl	Mature, old-growth forests (nesting, roosting, foraging). Second-growth used for dispersal	Old-Growth Forest	Yes	Yes
American Marten	Mature, old-growth forest >40% fir and canopy closure >50%	Old-Growth and Mature Forest	Yes	Yes
Pileated Woodpecker	Mature, old-growth forest	Old-Growth and Mature Forest	Yes	Yes
Primary Cavity Excavators	Snags and downed logs in forested habitats	Snags and Downed Logs	Yes	Yes

The MBS Management Indicator Species Assessment (USDA 2011b) provides additional information and monitoring efforts on the population and habitat trends of MIS on the Forest and is incorporated by reference.

Survey and Manage Species

The Survey and Manage species list considered conforms to the 2001, 2002, and 2003 Annual Species Review (BLM 2003) changes except for Red tree vole and meets the provisions of the 2001 Record of Decision, and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines. Survey and Manage Species associated with the MBS as of the 2003 Annual Species Review are listed in Table 24.

The 2001 decision amended the Survey and Manage direction and reorganized Survey and Manage species into six species categories (Categories A-F) based on rarity and survey practicality (USFS and BLM 2001). Categories A and C require that site-specific, pre-disturbance surveys be conducted prior to signing NEPA decisions or decision documents for habitat-disturbing activities. Habitat-disturbing

activities are defined as those disturbances likely to have a significant negative impact on the species' habitat, its life cycle, microclimate, or life support requirements.

Table 24. Survey and Manage Vertebrates and Mollusk Species on MBS

Common Name	Scientific Name	Survey and Manage Category	Management Direction
Larch Mountain Salamander	<i>Plethodon larselli</i>	A	Manage All Known Sites, Project Level Surveys Prior to Habitat Disturbing Activities, Strategic Surveys
Van Dyke's Salamander	<i>Plethodon vandykei</i>	A	Manage All Known Sites, Project Level Surveys Prior to Habitat Disturbing Activities, Strategic Surveys
Puget Oregonian	<i>Cryptomastix devia</i>	A	Manage All Known Sites, Project Level Surveys Prior to Habitat Disturbing Activities, Strategic Surveys
Evening Fieldslug	<i>Deroceras hesperium</i>	B	Manage All Known Sites, Equivalent Effort Surveys, Strategic Surveys

A – Rare, Pre-disturbance surveys practical

B – Rare, Pre-disturbance surveys not practical

A detailed discussion of the life history, habitat, threats, conservation status, and project area information of the Larch Mountain and Van Dyke's salamander is in the R6 Forest Service Sensitive Species section.

Puget Oregonian

The Puget Oregonian snail is found from southern Vancouver Island, B.C. south through the Puget Trough and western Cascade Range in Washington to the Oregon side of the Columbia River Gorge. This species may be found in low to mid elevation mature or old-growth forest habitat (<460m/1500ft. elevation). Typically this snail's habitat consists of mature to late successional moist forest and riparian zones, springs, and seeps where canopy cover is generally high. Rocks and talus, which are cool and moist beneath, may also be used. The Puget Oregonian hides under logs, moss, leaf litter, and/or talus; often under, near, or on large (greater than 20 inches dbh) big-leaf maple (*Acer macrophyllum*) and vine maple (*Acer circinatum*). Despite surveys on the MBS since 1997, in apparently suitable habitat, the species has not been found.

Evening Fieldslug

Associated with wet meadows in forested habitats in a variety of low vegetation, litter, debris; rocks may be used. This mollusk is suspected to be within 30m (98 ft.) of perennial wetlands, springs, seeps, and riparian areas. There is potentially suitable habitat for this species in the Project Area. Occupied range for this species is from Hood River to the Klamath River basin, Oregon. Despite surveys on the MBS since 1997, in apparently suitable habitat, the species has not been found.

January 2001 Survey and Manage ROD, and Standards and Guidelines - Protection Buffer Species

These Protection Buffer species includes the white-headed woodpecker, black-backed woodpecker, pygmy nuthatch, and flammulated owl. These species are not known to occur on the MBS.

Bat Roost Sites – The NWFP Standards and Guidelines call for protection of caves, and abandoned mines, wooden bridges and buildings that may be used as roost sites by bats, specifically fringed myotis, silver-haired bat, long-eared myotis, long-legged myotis, pallid bat, and Townsend’s big-eared bat. Some of these roost site features are found within the Project Area.

Birds of Conservation Concern

The MBS is included in Bird Conservation Region Five (Northern Pacific Forests). Within this region, the MBS may provide significant habitat, based on range maps in NatureServe Explorer (Ridgely et al. 2003) and forest survey information, for five species listed by the USFWS as “Birds of Conservation Concern”. These species include black swift (*Cypseloides niger*), rufous hummingbird (*Selasphorus rufus*), olive-sided flycatcher (*Contopus cooperi*), bald eagle (*Haliaeetus leucocephalus*), and peregrine falcons (*Falco peregrinus*).

Migratory Birds, Landbird Conservation

In 2012, Partners in Flight released version 2 of *A Conservation Strategy for Landbirds in Coniferous Forests of Western Oregon and Washington* (Altman and Alexander 2012). The strategy identifies a select group of focal species and their associated habitat attributes that can be used to identify desired forest landscapes. Most of the focal species identified are found on the MBS. The strategy is intended to help facilitate land management planning for healthy populations of native landbirds. The document focuses on landscape-scale forest management, with emphasis on habitat structure. The conservation options recommended in the strategy are not relevant to the Proposed Action because the action does not involve modifying forest habitat structure or any other native habitat.

The Project Area is located in the area covered by the Oregon-Washington Partners in Flight Bird Conservation Plan for Westside Coniferous Forests. The vegetation throughout the Forest provides habitat for focal species. Various habitats are represented on the Forest and considered adequate for conservation of priority bird species. Suitable nesting and foraging habitat is likely adjacent or near the Project Area.

Other Species of Concern

Deer and Elk

The Nooksack Elk Herd provides recreational, aesthetic, spiritual, and subsistence values to residents of northwestern Washington. The herd is the smallest in Washington and has decreased in size over the past 15 years. The Project Area is located partially in the Nooksack herd’s range. Foraging habitat may not be a limiting factor to the herd at present, but the availability of forage in the project area in the future is a concern.

Deer occur throughout the area and both deer and elk use a combination of habitats comprised of cover and forage areas that are not too fragmented by road systems. Taber and Raedeke (1980) reported that winter mortality, legal harvest, and poaching were the primary causes of elk mortality. Poaching is the second leading cause of mortality to elk in Washington State (WDFW 2002b).

Forest Plan management areas allocated for deer and elk winter range (MA-14) occur in the Project Area. The MBS has a timing restriction for projects in winter range from December 1 to April 15. Project activity is restricted in elk calving areas from May 15 to July 1.

Reasonably Foreseeable Development Scenario

Future geothermal development could potentially affect wildlife resources.

Wildlife would be affected by the alteration, removal, reduction, or fragmentation of habitat and may be displaced during project activities. Construction activities could impact an area beyond the footprint of surface disturbance at drilling pads, facilities, roadways, transmission corridors and pipelines. Depending on species and individual animal tolerances to disturbance, effects from construction noise and human presence could cause individuals to avoid what is otherwise suitable habitat. Animal movement and habitat use patterns may be affected due to habitat fragmentation and disturbance from geothermal activities. Disturbances during sensitive time periods including the breeding season and during winter may also negatively impact wildlife. Geothermal development would have the greatest impact on wildlife if it were to affect high quality habitats such as riparian areas, wetlands, or wintering and breeding areas.

Lease stipulations would result in a lack of development in some areas, and would help to minimize and mitigate impacts from surface disturbance due to creation of roads, powerlines, pipelines, facilities, well pads, winter access, and vegetative changes. Stipulations were developed to avoid or minimize impacts to riparian areas and wetlands, winter range (big game), breeding areas (spotted owl and murrelets), and forest habitat for rare and uncommon species, and to protect wildlife during sensitive time periods (breeding/nesting seasons, winter).

Threatened and Endangered Species

Threatened and Endangered species are documented or suspected within the Project Area. Until site specific actions are proposed, it is unknown what occurrences may be impacted. Any future actions for geothermal development would be analyzed for site-specific effects on special status species at that time. Proposed future actions would follow stipulations and management requirements, and surveys for Threatened and Endangered species would be required to be consistent with the Forest Plan, as amended. In addition, protection and/or avoidance buffers to protect species would be recommended and implemented.

ESA Consultation

This proposed action does not establish a precedent or create any legal right that would allow ground-disturbing activities within any of the areas allocated for geothermal leasing. Following lease issuance, when an application to conduct activities involving surface disturbance is submitted that could affect a listed species or critical habitat at a particular location within one of these areas, it would be subject to full policy and legal review at the time it is filed. This includes review and coordination under the ESA.

Similarly, providing suitability information to facilitate the FS's subsequent consent decision to the BLM for leasing on NFS lands, to the extent this providing of information could be construed to be an action under the Endangered Species Act, is an administrative task that would not cause any impact, direct or indirect, as cognizable under the Endangered Species Act, to listed species or critical habitat.

Therefore, consultation with USFWS is not required based on determinations of no effect, as cognizable under the Endangered Species Act, from the proposed Mt. Baker Geothermal Consent to Lease project on all federally listed wildlife species or designated critical habitat.

Forest Service Sensitive Species

Forest Service Sensitive species are documented or are suspected within the Project Area. Until site specific actions are proposed, it is unknown what occurrences may be impacted. Any future actions for geothermal development would be analyzed for site-specific effects on special status species at that time. Proposed future actions would follow stipulations and management requirements, and surveys for Sensitive species would be required to be consistent with the Forest Plan, as amended. In addition, protection and/or avoidance buffers to protect species would be recommended and implemented.

There would be no impacts to Forest Service Sensitive species.

Management Indicator Species

MIS are documented or are suspected within the Project Area. Until site specific actions are proposed, it is unknown what occurrences may be impacted. Any future actions for geothermal development would be analyzed for site-specific effects on special status species at that time. Proposed future actions would follow stipulations and management requirements, and surveys for MIS would be required to be consistent with the Forest Plan, as amended. In addition, protection and/or avoidance buffers to protect species would be recommended and implemented.

Survey and Manage Species (S&M)

Survey and Manage species are suspected within the Project Area. Until site specific actions are proposed, it is unknown what occurrences may be impacted. Any future actions for geothermal development would be analyzed for site-specific effects on special status species at that time. Proposed future actions would follow stipulations and management requirements, and surveys for Survey and Manage species would be required to be consistent with the Forest Plan, as amended. In addition, protection and/or avoidance buffers to protect species would be recommended and implemented.

Migratory Landbirds

Migratory landbirds are documented or are suspected within the Project Area. Until site specific actions are proposed, it is unknown what occurrences may be impacted. Any future actions for geothermal development would be analyzed for site-specific effects on special status species at that time. Proposed future actions would follow stipulations and management requirements, and surveys for Migratory Landbirds would be required to be consistent with the Forest Plan, as amended. In addition, protection and/or avoidance buffers to protect species would be recommended and implemented.

Birds of Conservation Concern (BCC)

Birds of Conservation Concern are documented or are suspected within the Project Area. Until site specific actions are proposed, it is unknown what occurrences may be impacted. Any future actions for geothermal development would be analyzed for site-specific effects on special status species at that time. Proposed future actions would follow stipulations and management requirements. Surveys for Birds of Conservation Concern would be required to be consistent with the Forest Plan, as amended. In addition, protection and/or avoidance buffers to protect species would be recommended and implemented. Management actions, or lack thereof, for Survey and Manage species would also be determined and implemented at that time.

Other Local Species of Concern

Elk

Elk are documented within the Project Area. Until site specific actions are proposed, it is unknown what occurrences may be impacted. Any future actions for geothermal development would be analyzed for site-specific effects on elk at that time. Proposed future actions would follow stipulations and management requirements,

Forest Plan Consistency

All Alternatives would be consistent with the Forest Plan, as amended, for wildlife resources.

1990 Forest Plan, Raptor Nests

Stipulations included in the Resource Protection Measures section (pp. 24-29) of this analysis would ensure that raptor nests would be protected from human disturbance.

1990 Forest Plan, Unique Habitats

Stipulations in the Resource Protection Measures section (pp. 24-29) of this analysis would ensure that unique habitats would be carefully evaluated on the ground during the planning process to insure their protection and/or proper management.

1990 Forest Plan, Diversity

Stipulations in The Resource Protection Measures section (pp. 24-29) of this analysis would ensure there would be a mix and distribution of successional stages that would support maintaining or enhancing diversity

1990 Forest Plan, Management Area 14 – Deer and Elk Winter Range

The protection of important habitat and migration corridors stipulation in The Resource Protection Measures section (pp. 24-29) of this analysis would ensure that ungulates in winter range habitats would be exposed to minimal disturbance from project construction and long-term operations.

1990 Forest Plan, Management Area 15 – Mountain Goat Habitat

The protection of important habitat and migration corridors stipulation in The Resource Protection Measures section (pp. 24-29) of this analysis would ensure that goats in their habitats would be exposed to minimal disturbance from project construction and long-term operations.

1990 Forest Plan, Connectivity

The protection of important habitat and migration corridors stipulation in The Resource Protection Measures section (pp. 24-29) of this analysis would ensure that areas that serve as connecting habitat or corridors for indicator species native and desirable non-native animal species and communities are maintained.

1990 Forest Plan, Threatened and Endangered and Sensitive Species

All proposed management actions that have the potential to affect habitat of endangered, threatened, or sensitive species were evaluated to determine if any of those species are present. A Biological Evaluation was completed as described in Forest Service Manual 2670. Stipulations in The Resource Protection Measures section (pp. 24-29) of this analysis would ensure that habitat for sensitive animals would be managed to ensure that management activities do not contribute to these species becoming threatened or endangered.

1994 ROD, Late-Successional Reserves

The late successional reserve stipulation under the Controlled Surface Use and Timing Limitation Lease Stipulations of this analysis provides protection for late successional forests in the Project Area and to ensure that any subsequent geothermal development within LSRs would be conducted in such a manner as to be neutral or beneficial to the creation and maintenance of late successional habitat.

1994 ROD Riparian Reserves

The protection of riparian and wetland habitat stipulation in The Resource Protection Measures section (pp. 24-29) of this analysis provide protection for Riparian Reserves in the Project Area and would

maintain aquatic conditions and ACS objectives by preserving and enhancing connective corridors for wildlife that are dependent on late-successional forests.

2001 ROD, Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines

At this time there are no known or suspected Survey and Manage wildlife species in the Project Area. However, the stipulations covering species of concern would ensure surveys for Survey and Manage species would be conducted prior to habitat disturbance if a species becomes suspected.

Should a lessee submit a site-specific proposal for geothermal exploration or development Forest Plan consistency would be identified during the NEPA process. Terms and conditions as part of an exploration or development permit may include design features and/or mitigation measures to minimize adverse effects on wildlife resources.

Other Considerations

Irretrievable and Irreversible Commitment of Resources

Overview

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. The actions described in this document would not cause an irretrievable commitment of natural resources as no ground or vegetation disturbance activities are authorized from the leasing action itself.

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. No irreversible commitments of resources would result from the Proposed Action.

Reasonably Foreseeable Development

However, based upon the RFD, actions that may follow leasing could result in a variety of irreversible and irretrievable commitments of resources. The PEIS discloses the potential irreversible and irretrievable commitments of resources in depth (pp. 5-28 to 5-29) and is incorporated here by reference.

Forest Plan Consistency

Should a lessee submit a site-specific proposal for geothermal exploration or development Forest Plan consistency would be identified during the NEPA process. Terms and conditions as part of an exploration or development permit may include design features and/or mitigation measures to minimize any irretrievable or irreversible commitment of resources.

Potential Conflicts with Plans and Policies of Other Jurisdictions

Private individuals, groups, governmental agencies and federally-recognized Tribes have been contacted about this project. Several private individuals and Tribal representatives have been in contact with Forest personnel in regard to this project (see Tribal Consultation and Public Involvement Sections). There are no known conflicts between alternatives described in this document and the plans and policies of any other jurisdictions.

Chapter 4 Agencies and Persons Consulted

Federal, State, and Local Agencies:

This proposed action does not establish a precedent or create any legal right that would allow ground-disturbing activities within any of the areas allocated for geothermal leasing. Therefore, consultation with Federal, State and Local Agencies is not required at this time. Following lease issuance, if an application to conduct activities involving surface disturbance is submitted that could affect a listed species or critical habitat at a particular location within one of these areas, it would be subject to full policy and legal review at the time it is filed.

Tribes

Consultation with the following Tribes was initiated in a letter dated April 9, 2012 on the initial Consent to Lease project as described in the Background Section. Consultation was reinitiated with the same Tribes in a second letter dated October 23, 2014 describing the changes to the original Consent to Lease project and asking for information to be considered during project development.

- Lummi Indian Business Council,
- Nooksack Indian Tribal Council
- Samish Tribe
- Swinomish Tribal Community
- Upper Skagit Tribal Council
- Sauk-Suiattle Tribal Council
- Tulalip Tribes

Interdisciplinary Team

Name	Position	Role
Jennifer Eberlien	Forest Supervisor	Responsible Official
Erin Uloth	District Ranger	Line Officer/Climate Change
Todd Griffin	Geologist/Acting Forest Environmental Coordinator	Geology/Program Manager
Eric Ozog	Realty Specialist	ID Team Leader
Jeremy Gilman	Fish Biologist	Fisheries/Hydrology
Shauna Hee	Botanist	Botany/Reviewer
Jesse Plumage	Wildlife Biologist	Wildlife
Carl Burdick	Archaeologist	Heritage Resources
Jan Hollenbeck	Archaeologist	Heritage Resources Review
Ann Dunphy	Landscape Architect	Visual Resources
Stella Torres	Recreation Specialist	Recreation
Carol Gladsjo	Public Service Manager	Recreation Review/Visual Resources

Name	Position	Role
Theresa Mathis	Wildlife Biologist/NEPA Coordinator	Assistant Team Leader /Air Quality/Environmental Justice
Dave Keenum	GIS Specialist	GIS
MJ Crandall	Trails Supervisor	Inventoried Roadless/Wild and Scenic River/Soils

Appendix A - References

- 36 CFR VIII § 800 et seq. Protection of Historic Properties. Parks, Forests, and Public Property, Advisory Council on Historic Preservation. National Park Service, Department of the Interior. *Code of Federal Regulations* online at www.access.gpo.gov/nara/cfr/cfr-table-search.html#page1
- 36 CFR § 218 et seq. Project-Level Predictive Administrative Review Process. Parks, Forests, and Public Property. *Code of Federal Regulations* online at <http://www.ecfr.gov/cgi-bin/searchECFR>.
- 36 CFR § 220 et seq. National Environmental Policy Act (NEPA) Compliance. Parks, Forests, and Public Property. *Code of Federal Regulations* online at www.ecfr.gov/cgi-bin/searchECFR.
- 36 CFR § 294 et seq. Special Areas. Parks, Forests, and Public Property. *Code of Federal Regulations* online at www.ecfr.gov/cgi-bin/searchECFR.
- 40 CFR § 1500 et seq. NEPA and Agency Planning. Protection of the Environment. Council on Environmental Quality. *Code of Federal Regulations* online at www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title40/40tab_02.tpl
- 43 CFR § 3201 et seq. Geothermal Resource Leasing. *Code of Federal Regulations* online at www.ecfr.gov/cgi-bin/searchECFR.
- 16 U.S.C. §§ 1600 et seq. National Forest Management Act of 1976. <http://www.fs.fed.us/emc/nfma/includes/NFMA1976.pdf>
- 30 U.S.C. 2 § 21 et seq. Mineral Lands and Mining, also known as the Mining Law of 1872, as amended. *United States Code* online accessed via the Internet at www.gpoaccess.gov/uscode/browse.html.
- 30 U.S.C. 23 § 1001 et seq. Geothermal Steam Act Amendments of 2005, as amended. *United States Code* online accessed via the Internet at www.gpoaccess.gov/uscode/browse.html.
- 42 U.S.C. 149 § 15801 et seq. National Energy Policy Act of 2005. *United States Code* online accessed via the Internet at www.gpoaccess.gov/uscode/browse.html.
- 42 U.S.C. 55 § 4321 et seq. The National Environmental Policy Act of 1969 (NEPA). *United States Code* online accessed via the Internet at www.gpoaccess.gov/uscode/browse.html.
- 43 U.S.C. 35 § 1701 et seq. The Federal Land Policy and Management Act of 1976 (FLPMA). *United States Code* online accessed via the Internet at www.gpoaccess.gov/uscode/browse.html.
- 59 FR 32, 1994. Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. *Federal Register*. Presidential Documents. W. J. Clinton. February 16. pp. 7629–7631.
- 75 FR 66496, 2009. Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act. *Federal Register*. Environmental Protection Agency. December pp. 66496-66546.
- Altman, B. and J.D. Alexander. 2012. Habitat Conservation for Landbirds in Coniferous Forests of Western Oregon and Washington. Version 2. Oregon-Washington Partners in Flight and American Bird Conservancy and Klamath Bird Observatory.

- Ames, Kenneth M., and Herbert D. G. Maschner. 1999. *Peoples of the Northwest Coast: Their Archaeology and Prehistory*. Thames and Hudson, London. p. 64.
- Bloomquist, R.G. 1985. Evaluation and ranking of geothermal resources for electrical generation or electrical offset in Idaho, Montana, Oregon and Washington. Technical Report, Washington State Energy Office, Olympia, WA.
- Blukis Onat, A. R., L. Bennett and J. Hollenbeck. 1980. Cultural Resource Overview and Sample Survey of the Skagit Wild and Scenic River. Study area on the Mt. Baker-Snoqualmie National Forest, Washington State. 3 Volumes. Institute of Cooperative Research (ICR), Seattle, WA 98102. On file at Mt. Baker-Snoqualmie National Forest, Everett, WA.
- Blukis Onat, A. R. and J. Hollenbeck. 1981. Inventory of Native American Religious Use, Practices, Localities, and resources: Study Area on the Mt. Baker-Snoqualmie National Forest Washington State. Supplementary Volume Site Data and Maps. Institute of Cooperative Research, Seattle, Washington, April 1981. On file at Mt. Baker-Snoqualmie National Forest, Everett, WA.
- Brown, E.R. 1985. tech. ed. Management of wildlife and fish habitats in forests of western Oregon and Washington. Portland, Oregon: USDA Forest Service, Pacific Northwest Region, 2 v. pp. 332.
- Bureau of Indian Affairs (BIA). 1980. Usual and Accustomed Fishing Places of Certain Western Washington Treaty Tribes Adjudicated in United States v. Washington No. 9213 as of January 1, 1977. Prepared by the Bureau of Indian Affairs United States Department of the Interior, Revised July 1978. Updated in 1980. On file at Mt. Baker-Snoqualmie National Forest, Everett, WA.
- Bureau of Land Management (BLM). 2005. Instruction Memorandum No. 2005-003. Cultural Resources and Tribal Consultation for Fluid Minerals Leasing. Available online at <http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction.html>. Accessed 11-14-2014.
- _____. 2014. Public Mining Claim Reports. <http://www.blm.gov/lr2000/>. Accessed online 11-10-14.
- Chadwick, D.H. 1983. A beast the Color of Winter: The Mt. Goat Observed. Bisson Books Edition 2002. Originally published by San Francisco Sierra Club Books.
- Collins, J. M. 1974. Valley of the Spirits, The Upper Skagit Indians of Western Washington. University of Seattle Press. Seattle, WA.
- Cornell. 2012. Cornell University Sustainable Design -- Geothermal Group. 2012 Geothermal Technologies Student Competition.
- Courtney S.P., J.A. Blakesley, R.E. Bigley, M.L. Cody, J.P. Dumbacher, R.C. Fleischer, A.B. Franklin, R.J. Gutiérrez, J.M. Marzluff and L. Sztukowski. 2004. Scientific Evaluation of the Status of the northern spotted owl. Portland, Oregon: Sustainable Ecosystems Institute (SEI).
- Douglas, G.W., G.B. Straley, D.V. Meidinger, and J. Pojar (eds.). 1998a. Illustrated Flora of British Columbia. Victoria, British Columbia: British Columbia Ministry of Environment, Lands and Parks and Ministry of Forests. Vol 1-8.
- Franklin, J.F. and C.T. Dyrness. 1973. Natural Vegetation of Oregon and Washington. Oregon State University Press, Corvallis, Oregon.
- Geology of the North Cascades, A Mountain Mosaic, Tabor & Haugerud, The Mountaineers Books, 1999.

- Hearne, Carol and Jan L. Hollenbeck. 1996. Cultural Resource Inventory Strategy, Mt. Baker-Snoqualmie National Forest. Mt. Baker-Snoqualmie National Forest.
- Henderson, J. A., R. D. Leshner, D. H. Peter, and D. C. Shaw. 1992. Field Guide to the Forested Plant Associations of the Mt. Baker-Snoqualmie National Forest. Technical Paper R6-Ecol-TP-028-91. USDA Forest Service, Pacific Northwest Region. Portland, OR.
- Holland, A. 1980. Switchbacks, the Mountaineers, Seattle, Washington. p.156.
- Hollenbeck, Jan L. 1987. *A Cultural Resource Overview: Prehistory, Ethnography and History: Mount Baker- Snoqualmie National Forest*. U.S. Dept. of Agriculture, Forest Service, Pacific Northwest Region, Portland, Oregon.
- Induced Seismicity Report, Engineered Geothermal System Demonstration Project, Roger Greensfelder, et al., AltaRock Energy Inc., 2008.
- Interagency Grizzly Bear Committee. 2001.
- Intergovernmental Panel on Climate Change (IPCC). 2012. Glossary of Terms used in the IPCC Fourth Assessment Report. Website accessed 4/24/12 at:
http://www.ipcc.ch/publications_and_data/publications_and_data_glossary.shtml
- Johnson, R. E., and K. M. Cassidy. 1997. Mammals of Washington state: location data and modeled distributions. Washington State GAP Analysis, Volume 3. Washington Cooperative Fish and Wildlife Research Unit, Seattle, Washington, USA.
- Johnson, D. H., T. A. O'Neil. 2001. Wildlife-habitat relationships in Oregon and Washington. Corvallis, OR: Oregon State University Press. pp. 722.
- Littell, J.S. (ed.), M.M. Elsner, L.W. Binder, and A.K. Snover. 2009. The Washington Climate Change Impacts Assessment, Evaluating Washington's Future in a Changing Climate. Executive Summary (Final Draft), A Report by the Climate Impacts Group, University of Washington. February 2009.
- McLellan, B.N.; Hovey F.W. 2001. Habitats selected by grizzly bears in multiple use landscapes. *Journal of Wildlife Management*. Vol. 65(1) pp. 92–99.
- McLellan, B.N.; Shackelton D.M. 1988. Grizzly bears and resource extraction industries: effects of roads on behavior, habitat use and demography. *Journal of Applied Ecology* Vol. 25 pp. 451–160.
- Mote, P.W. and E.P. Salathé Jr. 2010. Future Climate in the Pacific Northwest. *Climate Change*. DOI 10.1007/s10584-010-9848-z. Access on April 17, 2015. Available online at:
http://www.atmos.washington.edu/~salathe/papers/published/Mote_Salathe_2010.pdf.
- Mote, P., L. Brekke, P.B. Duffy, and E. Maurer. 2011. Guidelines for Constructing Climate Scenarios. *EOS* 92:31 pps. 257-264.
- National Wetlands Inventory (NWI). 2014. Accessed on April 23, 2014. Available online at:
<http://www.fws.gov/wetlands/index.html>.
- Nelson, C. M. 1990. Prehistory of the Puget Sound Region. In *Northwest Coast*, edited by Wayne Suttles, pp. 481-484. *Handbook of North American Indians*, Vol. 7, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

- NOAA 2012. National Oceanographic and Atmospheric Administration (NOAA), National Weather Service, Climate Prediction Center, Climate Glossary. Website accessed 4/24/12 at: www.cpc.ncep.noaa.gov/products/outreach/glossary.shtml#A.
- Nott, M. P. and N. Michel. 2005. Management Strategies for reversing declines in landbirds of conservation concern on military installations: Predictive modeling of landbird populations on military installations. The Institute for Bird Populations, Pt. Reyes Station, CA: A report to the Legacy Resources Management Office, Washington DC.
- Pacific Northwest Seismic Network. 2014. <http://pnsn.org/volcanoes/mount-baker>. Accessed online 11-12-2014.
- Pearson, R.R. and K.B. Livezey. 2007. Spotted owls, barred owls, and late-successional reserves. Lacey WA: U.S. Fish and Wildlife Service. Vol. 41-2. pp. 156-161.
- Peter, D. 1993. Subregional ecological assessment for the Mt. Baker-Snoqualmie National Forest, Draft document. Mountlake Terrace, WA: Mt. Baker-Snoqualmie National Forest.
- Public Law 90-542. 1968. Wild and Scenic Rivers Act. 82 Stat. October 2.
- Public Law 98-339, 1984. Washington State Wilderness Act of 1984. Ninety-eighth Congress. 98 Stat. 301. July 3.
- Ralph, C.J., G.L. Hunt, Jr., M.G. Raphael, and J. F. Piatt. Technical Editors. 1995. Ecology and Conservation of the Marbled Murrelet. General Technical Report PSW-GTR-152. USDA Forest Service, Pacific Southwest Research Station, Albany, CA. 420 p.
- Rice, C. 2008. Draft Status of Mountain Goats in Washington. Unpublished paper. Washington State Department of Fish and Wildlife. Mill Creek, Washington. pp. 8.
- Rice, C.G. and D. Gay. 2010. Effects of Mountain Goat Harvest on Historic and Contemporary Populations. *Northwestern Naturalist* 91:40-57.
- Richardson, A. 2000. National Register Nomination Form for "NUXWT'IQW'EM Middle Fork Nooksack River". On file at the Washington State Department of Archaeology and Historic Preservation, (DAHP).
- Ridgely, R.S., T.F. Allnutt, T. Brooks, D.K. McNicol, D.W. Mehlman, B.E. Young, and J.R. Zook. 2003. Digital Distribution Maps of the Birds of the Western Hemisphere, version 1.0. NatureServe, Arlington, Virginia, USA. [Web Page]. Data provided by NatureServe in collaboration with Robert Ridgely, James Zook, The Nature Conservancy - Migratory Bird Program, Conservation International - CABS, World Wildlife Fund - US, and Environment Canada - WILDSPACE. Located at: <http://www.natureserve.org/explorer/>.
- Ruggiero, L.F., K.B. Aubry, A.B. Carey, and M.H. Huff. (Technical Coordinators). 1991. Wildlife and vegetation of unmanaged Douglas-fir forests. General Technical report PNW-GTR-285. Portland, OR: Pacific Northwest Research Station. pp. 533.
- Ruggiero, L.F. and K.B. Aubry. 1994. The scientific basis for conserving forest carnivores. General Technical Report RM-GTR-254. Fort Collins, CO: Rocky Mountain Forest and Range Experimental Station.
- Ryals, A. 2002 and 2003. Personal communications, e.g. mountain goats, grizzly bear and game reserves.

- Sarychikhina, O., E. Glowacka, R. Mellors, F. S. Vidal. 2011. Land subsidence in the Cerro Prieto Geothermal Field, 1 Baja California, Mexico, from 1994 to 2005. An integrated analysis of DInSAR, leveling and geological data. *Journal of Volcanology and Geothermal*. Lawrence Livermore Laboratory.
- Steventon, J.D., G.D. Sutherland and P. Arcese. 2006. A population-viability-based risk assessment of Marbled Murrelet nesting habitat policy in British Columbia, Canada.
- Suttles, W. and B. Lane. 1990. Southern Coast Salish. In *Handbook of North American Indians*, Vol. 7 Northwest Coast (p.485-502). Smithsonian Institution, Washington.
- Taber, R.D. and K.J. Raedeke. 1980. Status Report: Roosevelt Elk of the Olympic National Forest. Unpub. Manuscript, University of Washington, Seattle.
- USA.com 2014. Air Quality. Washington. Online at www.usa.com/washington-state-air-quality.htm.
- U.S. Department of Agriculture. 1983. Land Use Policy. Departmental Regulation 9500-003. Land Use Policy. pp. 11.
- U.S. Department of Agriculture, Forest Service (USFS).1970. Mount Baker National Forest Soil Resource Inventory, Pacific Northwest Region. Prepared by Robert V. Snyder and John M. Wade, Soil Scientists. September 1970.
- _____. 1974. The Visual Management System *in* National Forest Landscape Management Volume 2. pp. 47.
- _____. 1972. Comprehensive Management Plan for the Pacific Crest National Scenic Trail.
- _____. 1985. Management of wildlife and fish habitats of western Oregon and Washington. Portland, OR: USDA Forest Service, Pacific Northwest Region.
- _____. 1990. Mt. Baker-Snoqualmie National Forest Land and Resource Management Plan. Seattle, WA.
- _____. 1994. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl. Portland, OR. (Commonly referred to as the Northwest Forest Plan).
- _____. 1995. Forest Wide Access and Travel Management Plan. Mountlake Terrace, WA. Mt. Baker-Snoqualmie National Forest.
- _____. 1995. Landscape Aesthetics: A Handbook for Scenery Management. Agriculture Handbook No. 701.
- _____. 1997a. Programmatic agreement among the United States Department of Agriculture, Forest Service, Pacific Northwest Region (Region 6), the Advisory Council on Historic Preservation, and the Washington State Historic Preservation Officer Regarding Cultural Resources Management on National Forest in the State of Washington. On file at Mt. Baker-Snoqualmie National Forest, Everett WA.
- _____. 1997b. Grizzly bear recovery–North Cascades ecosystem. File code 2600, dated August 12, 1997. Memo to the Regional Forester, Pacific Northwest Region, from the Forest Supervisors of the Okanogan, Wenatchee, and Mt. Baker-Snoqualmie National Forests. Mountlake Terrace, WA Mt. Baker-Snoqualmie National Forest.

- _____. 1997c. Visual Management System, Volumes 1 and 2.
- _____. 1998. Grizzly Bear Core Area Analysis Summary. Unpublished Draft. USDA, Forest Service. Mountlake Terrace, WA: Mt. Baker-Snoqualmie National Forest.
- _____. 2001. Forest-wide Late Successional Reserve Assessment. Mountlake Terrace, WA: Mt. Baker Snoqualmie National Forest. p. 26.
- _____. 2002a. Programmatic biological assessment for forest management on the Mt. Baker-Snoqualmie National Forest. Mountlake Terrace, WA: Mt. Baker-Snoqualmie National Forest.
- _____. 2002b. Baker River Watershed Analysis, Sedro Woolley, Washington. Mt. Baker Ranger District, Mt. Baker-Snoqualmie National Forest.
- _____. 2003. Mt. Baker-Snoqualmie National Forest Roads Analysis. Unpublished document and database. Mountlake, Terrace, WA: Mt. Baker-Snoqualmie National Forest.
- _____. 2005a. Treatment of Invasive Plants on the Mt. Baker-Snoqualmie National Forest, Environmental Assessment Decision Notice (. Mountlake Terrace, WA.
- _____. 2005b. Pacific Northwest Region Invasive Plant Program, Preventing and Managing Invasive Plants, Final Environmental Impact Statement Record of Decision. Portland, OR.
- _____. 2005c. Baker Lake and South Fork Nooksack River Access and Travel Management Environmental Assessment. Mt. Baker Snoqualmie National Forest, Pacific Northwest Region, Washington State. On file at Mt. Baker-Snoqualmie National Forest, Everett WA.
- _____. 2005d. Threatened, Endangered and Sensitive Plants and Animals *in* FS Manual 2600 Wildlife, Fish, and Sensitive Plant Habitat Management. Effective September 23, 2005. 22 pp.
- _____. 2006a. Middle Fork and South Fork Nooksack Watershed Analysis, Sedro Woolley, Washington. Mt. Baker Ranger District, Mt. Baker-Snoqualmie National Forest.
- _____. 2006b. North Fork Nooksack River Watershed Analysis, Sedro-Wooley, WA: Mt. Baker Ranger District, Mt. Baker-Snoqualmie National Forest.
- _____. 2006c. National Visitor Use Monitoring for Mt. Baker-Snoqualmie National Forest. Region 6.
- _____. 2006d. 1923 – Wilderness Evaluation. FS Manual, Effective January 31, 2006. pp 42-49.
- _____. 2009. Climate Change Considerations in Project Level NEPA Analysis. Website accessed 11/12/14 at http://www.fs.fed.us/emc/nepa/climate_change/includes/cc_nepa_guidance.pdf.
- _____. 2010. Mt. Baker-Snoqualmie Geothermal Leases Record of Decision. August 2010. 14 pp.
- _____. 2011a. Regional Forester's Sensitive Species List, December 2011. Pacific Northwest Region, Portland, OR.
- _____. 2011b. Mt. Baker-Snoqualmie National Forest Management Indicator Species Assessment. Everett, WA. Mt. Baker-Snoqualmie National Forest.
- USFS and U.S. Department of the Interior, Bureau of Land Management (BLM). 1994. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl. Portland, OR.

- _____. 2001. Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage Protection Buffer, and other Mitigation Measures Standards and Guidelines. Portland, OR.
- _____. 2003. BLM-Instruction Memorandum No. OR-2004-034. Implementation of 2003 Survey and Manage Annual Species Review. Available online at http://www.blm.gov/or/plans/surveyandmanage/files/02-asr_2003.pdf. Accessed 01-26-15.
- _____. 2008. Final Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States. Volume I: Programmatic Analysis. October 2008. 1792 pp.
- _____. 2008. Record of Decision and Resource Management Plan Amendments for Geothermal Leasing in the Western United States. Portland, OR. BLM-WO-G1-09-003-1800 FES-08-44.
- U.S. Department of Commerce (USDC). 2014. Census Bureau, County Business Patterns, Washington, D.C.
- U.S. Department of the Interior. Bureau of Land Management (BLM). 2004. Instruction Memorandum No. 2005-003. Cultural Resources and Tribal Consultation for Fluid Minerals Leasing. DOI, BLM, Washington Office. October 5. pp. 3.
- BLM and USFS. 2003. Draft version 3.0. Survey protocol for survey and manage terrestrial mollusk species. In: Northwest Forest Plan. Portland, OR and Vallejo, CA: Pacific Southwest and Pacific Northwest Regions.
- _____. 2011. Species Fact Sheet. Johnson's hairstreak. BLM Oregon/Washington and Region 6 Forest Service ISSSP. Portland, OR
- _____. 2011. Species Fact Sheet. Valley silverspot. BLM Oregon/Washington and Region 6 Forest Service ISSSP. Portland, OR
- _____. 2011. Species Fact Sheet. Broadwhorl tightcoil. BLM Oregon/Washington and Region 6 Forest Service ISSSP. Portland, OR
- _____. 2011. Species Fact Sheet. Shiny tightcoil. BLM Oregon/Washington and Region 6 Forest Service ISSSP. Portland, OR
- U.S. Department of the Interior, Geological Survey (USGS). 1994. Ground Water Atlas of the United States, Idaho, Oregon, Washington. Online version: http://pubs.usgs.gov/ha/ha730/ch_h/index.html
- _____. 1995. Potential Volcanic Hazards from Future Activity of Mount Baker, Washington, Cynthia A. Gardner, et al., USGS Open-File Report 95-498.
- _____. 2000. Mount Baker – Living with an Active Volcano. USGS Fact Sheet 059-00. May 2000. 4 pp.
- _____. 2004. Geological Provinces of the United States. Internet Web site: <http://geomaps.wr.usgs.gov/parks/province/pacifmt.html>. Accessed on April 16, 2008.
- _____. 2008. *The Challenges of Linking Carbon Emissions, Atmospheric Gas Concentrations, Global Warming, and Consequential Impacts*. Memorandum from Mark D. Myers, Director, US Geological Survey to Director, Fish and Wildlife Service. May 14, 2008.

- U.S. Department of the Interior Fish and Wildlife Service (USFWS). 1993. Grizzly Bear Recovery Plan. Missoula, MT.
- _____. 1996. Final designation of critical habitat for the marbled murrelet. Final rule. May 26, 1996 Federal Register 61 FR 26255.
- _____. 1997a. Grizzly Bear recovery plan supplement: North Cascades ecosystem recovery plan. Missoula, MT: pp. 29.
- _____. 1997. Recovery Plan for the threatened marbled murrelet (*Brachyramphus marmoratus*) in Washington, Oregon, and California. Portland, Oregon: pp. 203.
- _____. 2002. Biological Opinion of the Effects of Mt. Baker–Snoqualmie National Forest Program of Activities for 2003–2007. FWS Reference Number 1–3-02-F-1583. Lacey, WA.
- _____. 2008. Revised designation of critical habitat for the northern spotted owl. Final rule. August 13, 2008, Federal Register 73 FR 47326.
- _____. 2011. Revised Recovery Plan for the Northern Spotted Owl (*Strix occidentalis caurina*). U.S. Fish and Wildlife Service, Portland, Oregon. xvi + 258 pp.
<http://www.fws.gov/arcata/es/birds/NSO/documents/USFWS2011RevisedRecoveryPlanNorthernSpottedOwl.pdf>
- _____. 2011. Revised critical habitat for the marbled murrelet. Final rule. October 5, 2011, Federal Register 76 FR 61599.
- _____. 2011. Report on Marbled Murrelet Recovery Implementation Team Meeting and Stakeholder Workshop.
- _____. 2012. Revised designation of critical habitat for the northern spotted owl. Proposed rule. May 8, 2012, Federal Register 77 FR 27010.
- _____. 2012. Marbled Murrelet Nesting Season and Analytical Framework for Section 7 Consultation in Washington. U. S. Fish and Wildlife Service Washington Fish and Wildlife Office, Lacey, Washington. June 20, 2012.
- _____. 2013. Biological Opinion and Letter of Concurrence, USDA Forest Service, USDI Bureau of Land Management and the Coquille Indian Tribe for Programmatic Aquatic Habitat Restoration Activities in Oregon and Washington That Affect ESA-listed Fish, Wildlife, and Plant Species and their Critical Habitats
- Waller, J.S. and C. Servheen. 2005. Effects of transportation infrastructure on grizzly bears in Northwestern Montana. *Journal of Wildlife Management*. 69:985-1000.
- Washington Department of Fish and Wildlife (WDFW). 1998. Washington Salmonid Stock Inventory, Bull Trout/Dolly Varden Appendix. Olympia, WA.
- _____. 2000. Washington State Salmonid Stock Inventory, Coastal Cutthroat Trout Appendix. Olympia, WA.
- _____. 2002a. Washington State Salmon and Steelhead Stock Inventory. Olympia, WA.
- _____. 2002b. North Cascade (Nooksack) Elk Herd *in* Washington State Elk Herd Plan.

-
- _____. 2004. Skagit River Bald Eagles Web site. Information on the Skagit River Bald Eagle Project. <http://wdfw.wa.gov/wlm/research/raptor/eagle/eagle.htm>
- _____. 2012. Memorandum of Understanding between the Washington State Department of Fish and Wildlife and the USDA Forest Service Pacific Northwest Region. MOU Number: NFS 12-MU-11062754-005.
- _____. 2014. Web site. Species of Concern List including species listed as State endangered, State threatened, State sensitive, or State candidate, as well as species listed or proposed for listing by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service <http://wdfw.wa.gov/wlm/diversty/soc/concern.html>List references as appropriate.
- _____. 2014. Wolf Conservation and Management 2014 Annual Report.
- Washington Forest Practices Board. 1997. Board Manual: Methodology for Conducting Watershed Analysis under Chapter 222-22 WAC. Version 4.0, Nov 1997. Washington Dept. of Natural Resources, Forest Practices Division, Olympia, WA. Single Volume. Available online at: http://www.dnr.wa.gov/ResearchScience/Topics/WatershedAnalysis/Pages/fp_watershed_analysis_manual.aspx
- Washington State Department of Health, Office of Drinking Water. Surface Water Protection Areas [vector digital data]. 2014. Olympia, Washington: Washington State Department of Health, Office of Drinking Water, 2009.
- Watson, J. and J. Pierce. 2001. Skagit River Bald Eagles: movements, origins and breeding population status. Washington State Department of Fish and Wildlife. Olympia, Washington: pp. 80.
- Wemple, B.C., J.A. Jones and G.E. Grant. 1996. "Channel network extension by logging roads in two basins, western Cascades, Oregon." *Water Resources Research* 32(6): 1195-1207
- Williams, R.W., R.M. Laramie and J.J. Ames. 1975. A Catalog of Washington Streams and Salmon Utilization. Puget Sound Region. Olympia, WA: Washington Department of Fisheries. Vol. 1.

Appendix B – Allowed Occupancy Maps

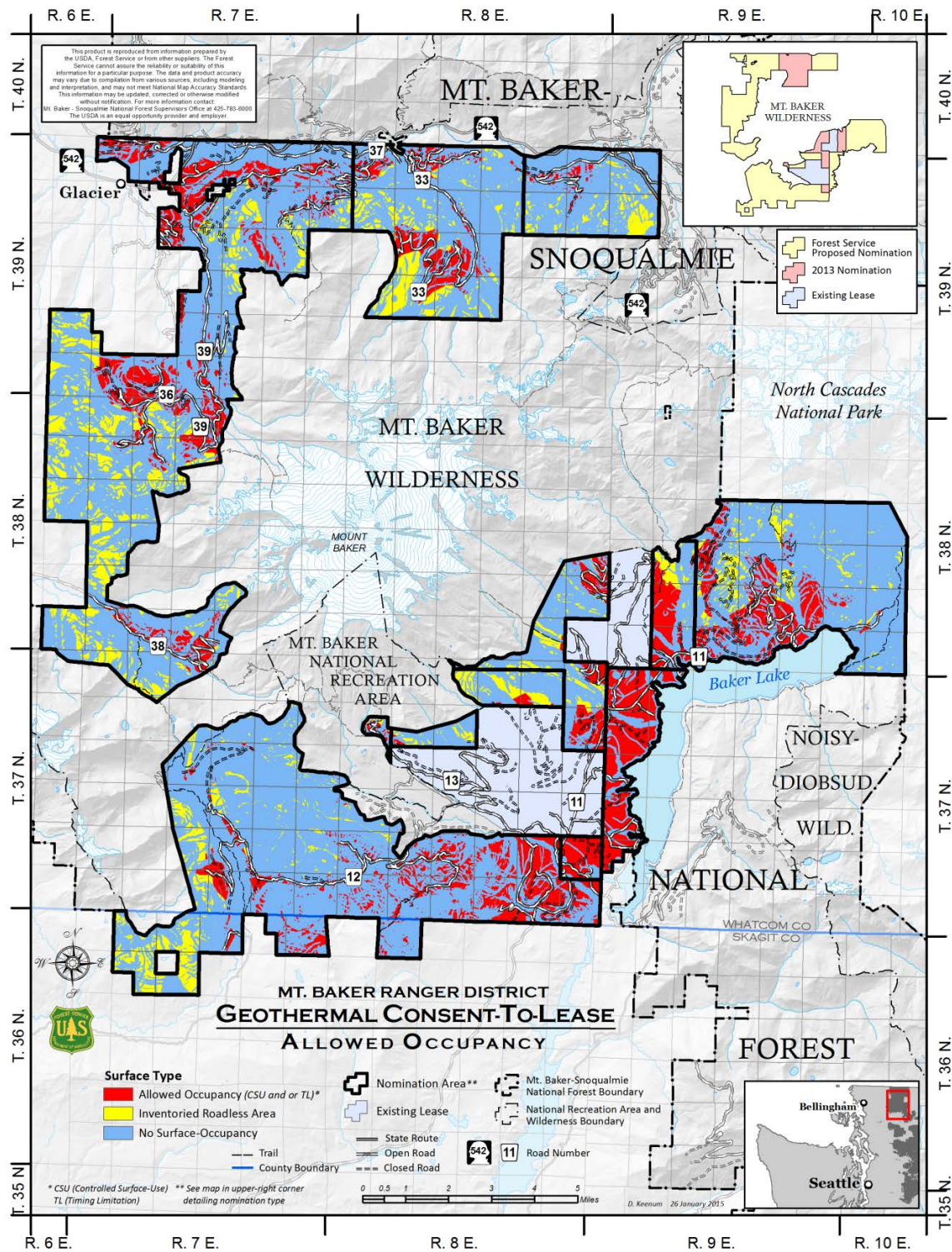


Figure 7. Allowed Occupancy – Project Area

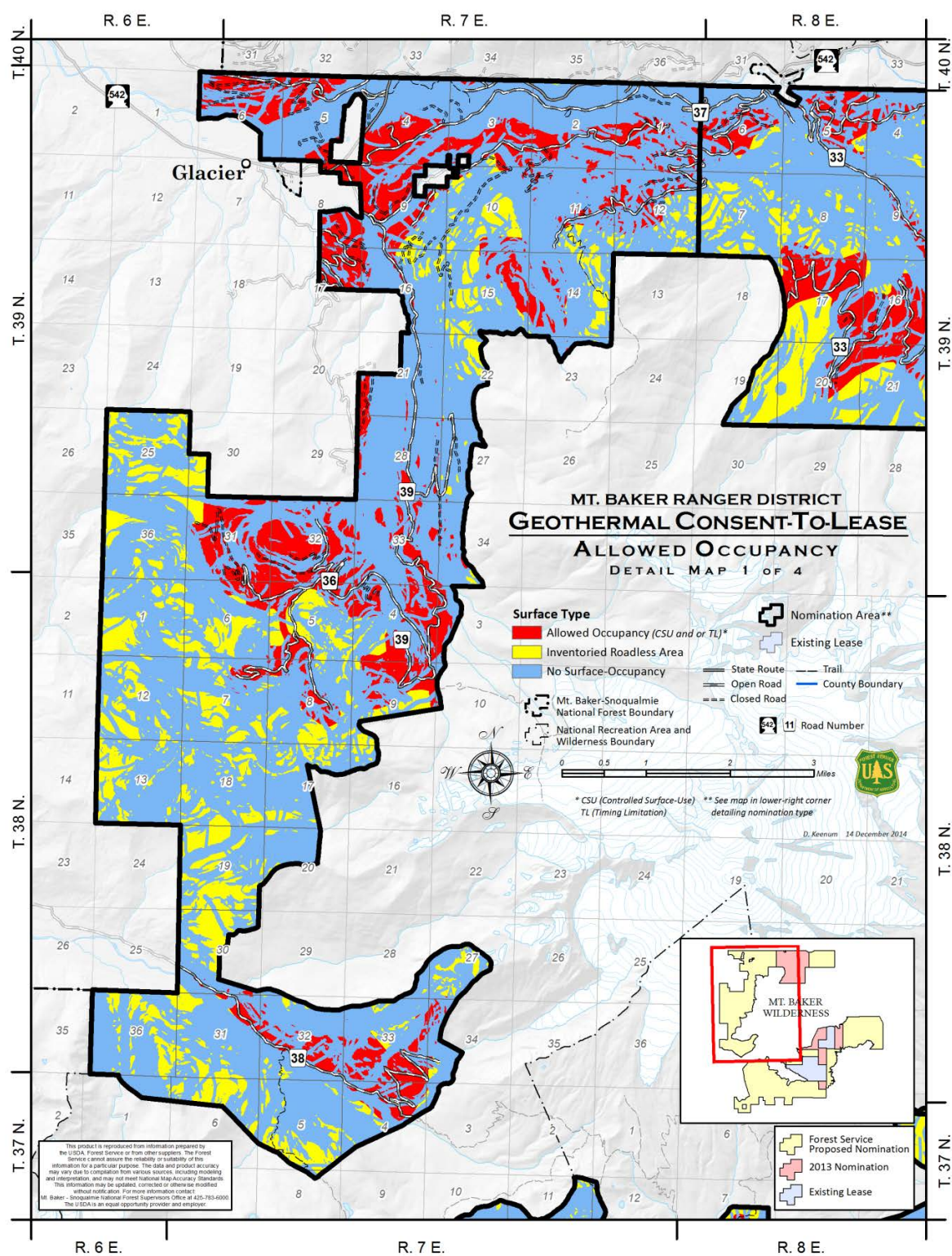


Figure 8. Allowed Occupancy - Project Area Northwest

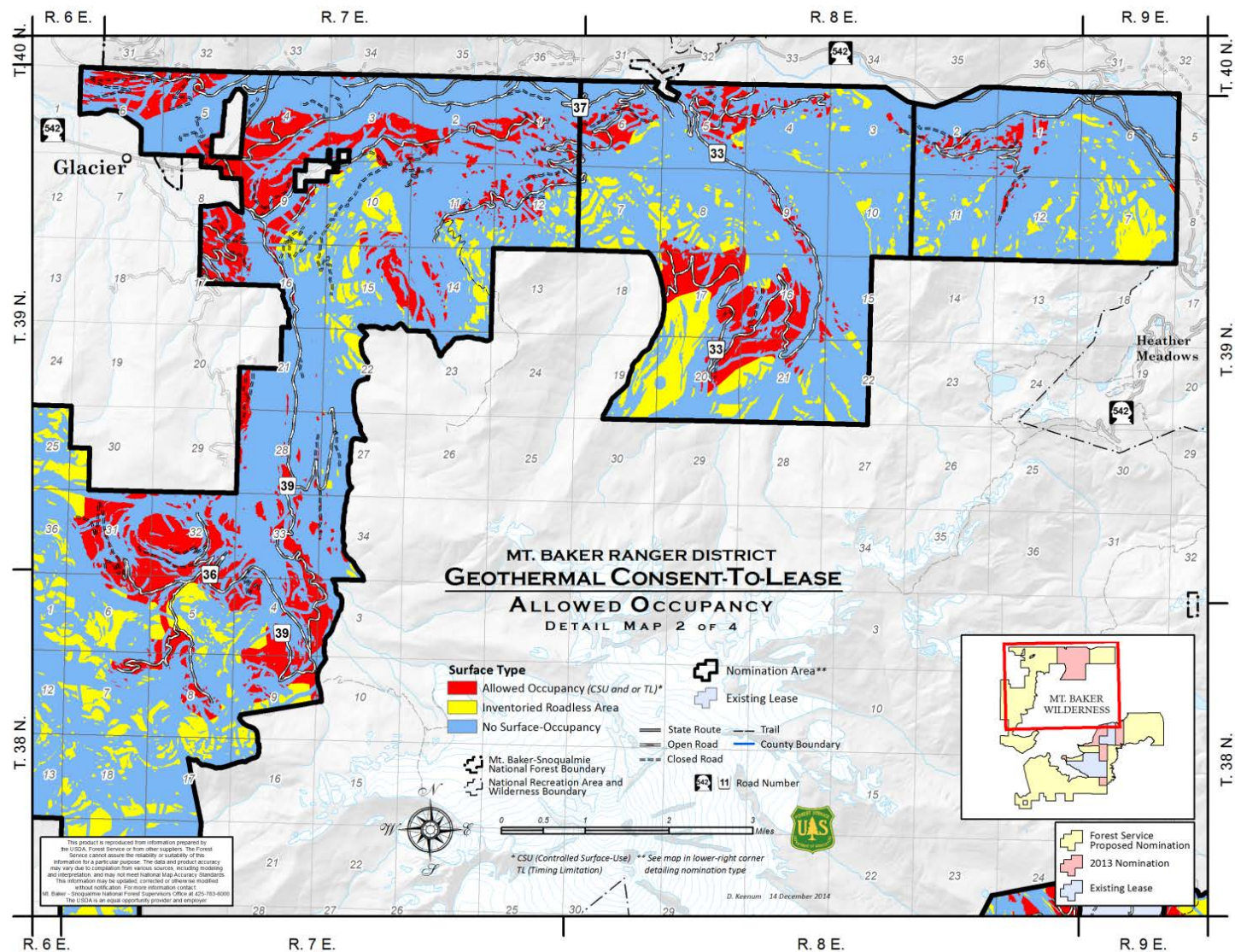


Figure 9. Allowed Occupancy - Project Area North

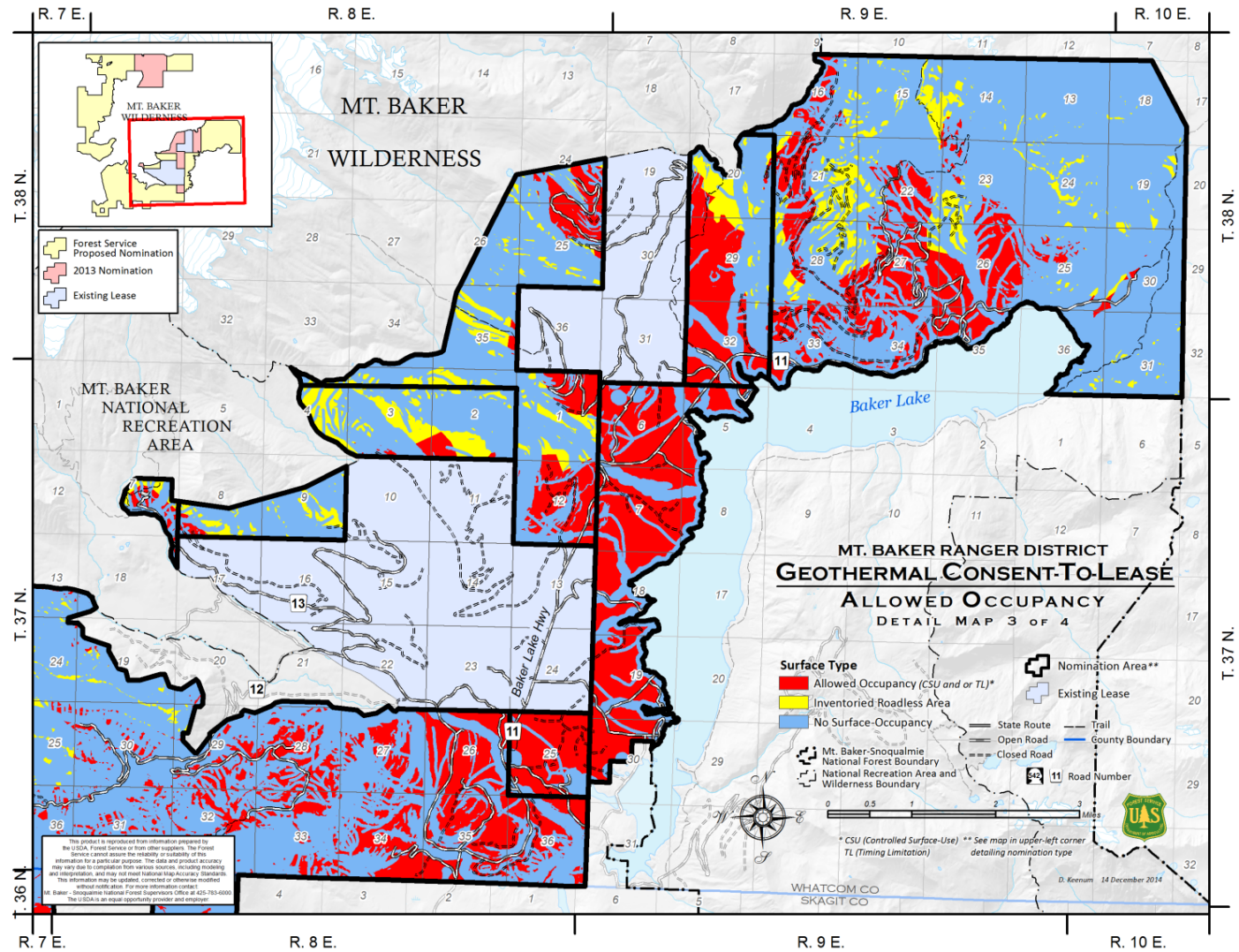


Figure 10. Allowed Occupancy - Project Area Southeast

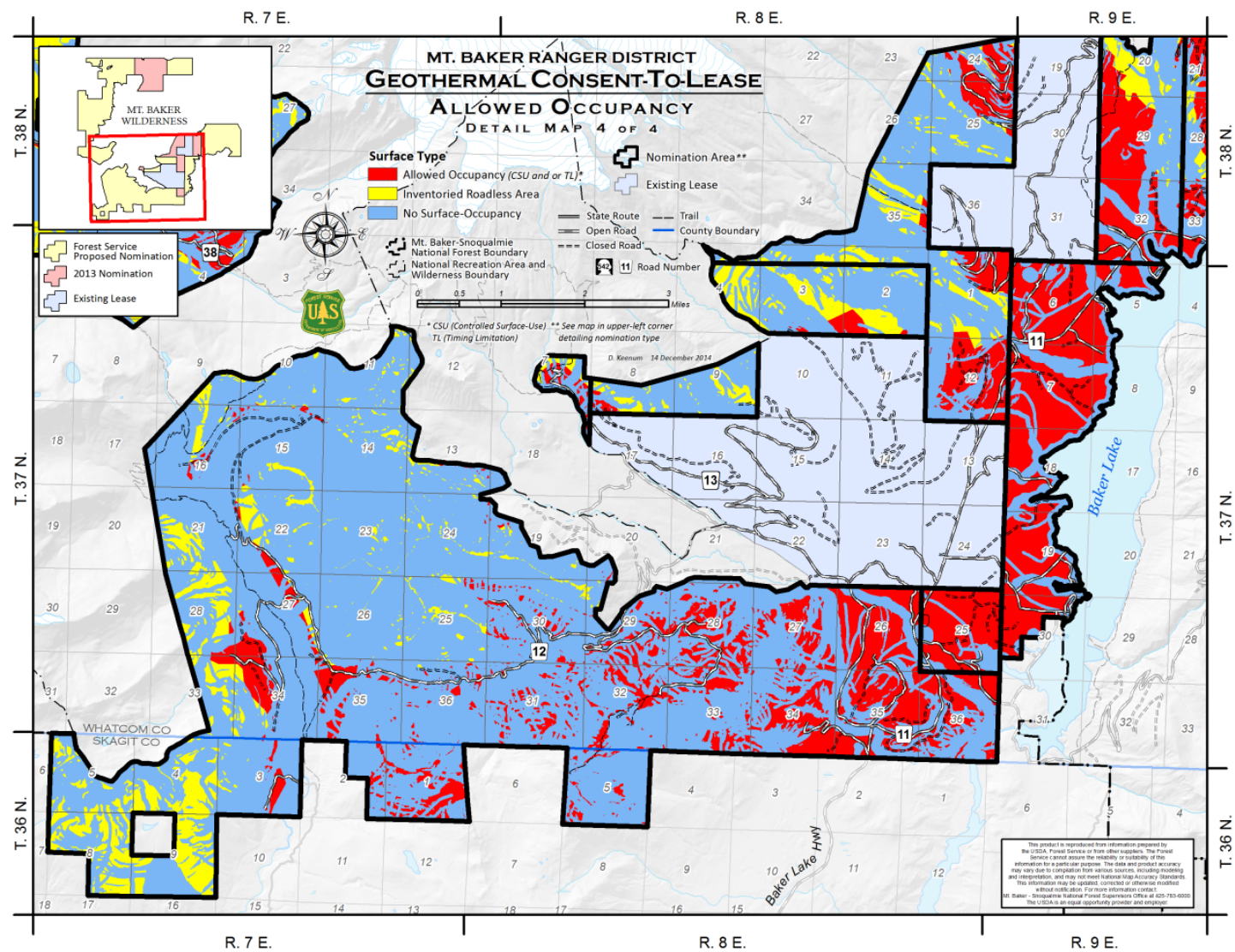


Figure 11. Allowed Occupancy - Project Area South

Appendix C - Stipulations

Geothermal Stipulations

Introduction

This appendix displays the stipulations applied to geothermal leases to be consistent with Mt. Baker-Snoqualmie Land and Resource Management Plan (LRMP) Standards and Guidelines, and a short explanation of the reasons for the stipulations.

All the following stipulations are consistent with and necessary to implement the land and resource management plan.

Heritage

No Surface Occupancy (NSO)

Stipulation

No surface occupancy or use is allowed within National Register eligible heritage sites.

Objective (Justification)

The objective is to protect National Register eligible heritage sites and immediate environment of the site. For justification refer to the LRMP, Archaeological and Historical Resources (pp. 4-98).

Application Methodology

Use this stipulation for National Register eligible heritage sites.

No Surface Occupancy (NSO)

Stipulation

Areas with important cultural and archaeological resources, such as traditional cultural properties and Native American sacred sites, as identified through consultation.

Objective (Justification)

The objective is to protect important cultural and archaeological resources, traditional cultural properties, and Native American sacred sites. For justification refer to the LRMP, American Indian/Cultural Use (pp. 4-97) and Archaeological and Historical Resources (pp. 4-98).

Application Methodology

Use this stipulation for traditional cultural properties, Native American sacred sites, and important cultural and archaeological resources identified through consultation and scoping.

Recommended Wild and Scenic Rivers

No Surface Occupancy (NSO)

Stipulation

Segment of rivers determined to be potentially eligible² (recommended) for Wild and Scenic Rivers (WSR) status by virtue of a WSR inventory.

² Where a river or river segment has been found to be "eligible" for inclusion in the WSR system, the BLM has the obligation to protect the lands along the eligible segment until a "suitability" determination has been made as part of the land use planning process. If the river or river segment is found to be "non-suitable," the lands along the river then would be available for other uses.

Objective (Justification)

Protect those characteristics that contribute to the eligibility of these rivers at their highest potential classification. For justification refer to the LRMP, Wild and Scenic Rivers (4-95).

Application Methodology

This stipulation includes a No Surface Occupancy corridor of 0.25 miles from the high water mark on either side of the bank on all river segments designated as management areas 5A, 5B, and 5C.

Recreation

No Surface Occupancy (NSO)

Stipulation

Developed recreational facilities, special-use permit recreation sites (e.g., ski resorts and camps), and areas with significant recreational use with which geothermal development is deemed incompatible; excluding direct use applications.

Objective (Justification)

The objective is to maintain the recreation opportunities and settings within developed recreation sites. For justification refer to the LRMP, Recreation (4-84).

Application Methodology

Use this stipulation in all developed recreation sites (MA-3A).

Stipulation

Primitive recreation areas in which geothermal development is deemed incompatible.

Objective (Justification)

The objective is to maintain an unmodified natural environment with a high probability of isolation, where evidence of human activities would be unnoticed by most users. For justification refer to the LRMP, Recreation (pp. 4-150).

Application Methodology

Use this stipulation in the Primitive Management Area 1A.

Controlled Surface Use (CSU)

Stipulation

Protection of recreational areas.

Objective (Justification)

This stipulation would be applied to minimize the potential for adverse impacts to recreational values, both motorized and non-motorized, and the natural settings associated with the recreational activity. For justification refer to the LRMP, Recreation (4-84).

Application Methodology

Use this stipulation in natural settings associated with recreational activities including roads, hiking trails, and semi-primitive non-motorized and semi-primitive motorized management areas (MAs-1B and 1C).

Timing Limitation (TL)

Stipulation

Protection of recreational areas by the closing of Forest Roads to wheeled access and snow parks during winter snow conditions.

Objective (Justification)

To maintain the recreation opportunities and settings within snow parks and along Forest roads for winter sports activities. For justification refer to the LRMP, Recreation (pp. 4-91).

Application Methodology

Use this stipulation for Salmon Ridge snow park, Sentinels Snow Park, and Forest Service roads (FSR) 12, 1230, 13, 31, 39, and 3070.

Scenery Management

No Surface Occupancy (NSO)

Stipulation

Designated important viewsheds with a Scenery Management System integrity level of Very High.

Objective (Justification)

The objective is to maintain the Scenic Management System (SMS) integrity level for areas identified as Very High (Preservation). For justification refer to the LRMP, Visual Resource Management (pp. 4-93) and the Scenery Management Handbook 701(USDA Forest Service 1996).

Application Methodology

Use this stipulation for areas designated as Management Area 1A, Primitive.

Controlled Surface Use (CSU)

Stipulation

Protection of visual resources.

Objective (Justification)

The objective is to maintain the Scenic Management System (SMS) integrity level for areas identified as high. For justification refer to the LRMP, Visual Resource Management (pp. 4-93) and the Scenery Management Handbook 701(USDA Forest Service 1996).

Application Methodology

Use this stipulation for areas designated as Management Area 1B (Semi-Primitive Nonmotorized), 1C (Semi-Primitive Motorized), 2A (Scenic Viewshed Foreground), 14 (Deer and Elk Winter Range, foreground), 23A (Other Municipal Watershed), and within foreground (1/4 mile) of Mt. Baker and Baker Lake Highways.

Sensitive Species Stipulation

For agency designated sensitive species (e.g., mountain goat), a lease stipulation (NSO, CSU, or TL) would be imposed for those portions of high value/key/crucial species habitat where other existing measures are inadequate to meet agency management objectives.

Soils

No Surface Occupancy (NSO)

Stipulation

Slopes in excess of 40 percent and soils with high erosion potential.

Objective (Justification)

The objective of this stipulation is to protect soil resources from loss of productivity, prevent erosion on steep slopes, soil mass movement, and resultant sedimentation. For justification refer to the LRMP, Soil Resources (pp. 4-117).

Application Methodology

Use this stipulation where slopes are greater than 40 percent and in areas designated Soil Class S-8.

Controlled Surface Use (CSU)

Stipulation

Protection of erosive soils and soils on slopes greater than 30 percent.

Objective (Justification)

The objective would be to minimize the potential for adverse impacts to erosive soils as defined as severe or very severe erosion class based on the Natural Resources Conservation Services (NRCS) mapping. For justification refer to the LRMP, Soil Resources (pp. 4-117).

Application Methodology

Use this stipulation on slopes greater than 30 percent and in areas classified as S-8 soils.

Water, Wetlands, Riparian Reserves, and Floodplains

No Surface Occupancy (NSO)

Stipulation

Water bodies, Riparian Reserves, wetlands, playas, and 100-year floodplains.

Objective (Justification)

This stipulation is to protect the biological and hydrologic features of Riparian Reserves, wetlands, and floodplains. For justification refer to the LRMP, Water Resources and Riparian Areas (pp. 4-118) and the Northwest Forest Plan, Standard and Guidelines (C1).

Application Methodology

Use this stipulation for all areas identified as Riparian Reserves, water bodies, wetlands, and 100-year floodplains.

Controlled Surface Use (CSU)

Stipulation

Protection of Riparian Reserves and wetland habitat.

Objective (Justification)

To protect the values and functions of Riparian Reserves and wetlands. For justification refer to the LRMP, Water Resources and Riparian Areas (pp. 4-118) and the Northwest Forest Plan, Standard and Guidelines (C1).

Application Methodology

This stipulation would be applied within 500 feet of Riparian Reserves or wetland vegetation.

Wildlife

No Surface Occupancy (NSO)

Stipulation

Designated or proposed critical habitat for listed species under the Endangered Species Act of 1973 (as amended) if it would adversely modify the habitat. For listed or proposed species without designated habitat, NSO would be implemented to the extent necessary to minimize or avoid adverse impacts.

Objective (Justification)

To minimize or avoid adverse impacts to critical habitats. For justification refer to the LRMP, Wildlife (pp. 4-124) and the Endangered Species Act of 1973 (as amended).

Application Methodology

Use this stipulation in designated or proposed critical habitat throughout the project area.

Controlled Surface Use (CSU)

Stipulation

Late Successional Reserve stipulation.

Objective (Justification)

To provide protection for late successional forests in the project area and to ensure that any subsequent geothermal development within Late Successional Reserves would be conducted in such a manner as to be neutral or beneficial to the creation and maintenance of late successional habitat. For justification refer to the LRMP, Wildlife (pp. 4-124) and the Northwest Forest Plan, Standard and Guidelines (C9).

Application Methodology

Use this stipulation in all lands designated as Late Successional Reserves (LSR), including management areas 1A LSR, 1B LSR, 1C LSR, 15 LSR, and 19 LSR.

Timing Limitation (TL)

Stipulation

Protection of important habitat and migration corridors.

Objective (Justification)

To protect the continuity of migration corridors and important habitat. For justification refer to the LRMP, Wildlife (pp. 4-124) and Management Area Prescriptions (pp. 4-156).

Application Methodology

Use this stipulation for the road segments in Table C1 below for the protection of deer, elk, and mountain goat in winter, spring, and summer ranges.

Table C1. Wildlife Timing Limitations

Road Name and Number	Closure Dates	Location
Loomis Nooksack, Forest Service Road (FSR) 12	11/01 to 07/01 (Deer/Elk winter and calving range)	From its junction with Road 1240 in the SW 1/4 Sec. 30, T37N, R8E to the end of the road in the SW 1/4

Road Name and Number	Closure Dates	Location
		Sec. 16, T37N, R7E.
Dillard Ridge, FSR 1303	Full Year (Mountain goat winter/spring range and elk summer range)	From M.P. 0.0 in the SW 1/4 Sec. 15, T37N, R8E to the end of the road in the NE 1/4 Sec. 9, T37N, R8E.
Beaver Pond, FSR 1200-100	Full Year (Sensitive wildlife habitat)	From M.P. 0.0 in the SW 1/4 Sec. 35, T37N, R8E to the end of the road in the SW 1/4 Sec. 26, T37N, R8E.
Wells Creek, FSR 33	11/01-07/01 (Mountain goat winter/spring range)	From M.P. 0.8 in the SW 1/4 Sec. 32, T40N, R8E to the end of the road in the NW 1/4 Sec. 17 T39N, R8E.
Spawning Beach Road	Full Year (Sensitive wildlife habitat)	From its junction with Road 1168 & 11 in the SW 1/4 Sec. 30, T38N, R10E to the end of the road in the NE 1/4 Sec. 36, T38N, R9E.
Middle Fork Nooksack, FSR 38	12/01-06/15 (Mountain goat and big game winter/spring range)	From M.P. 9.0 in the SW 1/4 Sec. 30, T38N, R7E to the end of the road in the NE 1/4, Sec. 4, T37N, R7E.
Sulphur Point, FSR 1102	Full Year (Deer/Elk range)	From M.P. .05 in the SW 1/4 Sec. 35, T37N, R8E to the end of the road in the NE 1/4 Sec. 34, T37N, R8E.
West Church, FSR 3120	12/25-04/15 (Deer/Elk winter range)	From M.P. .05 in the NW 1/4 Sec. 6, T39N, R7E to the end of the road in SE 1/4 Sec. 29, T40N, R7E.
South Boulder Creek, FSR 1123	10/1-5/20 (Deer/elk winter and transition range)	From M.P. .05 in the NW 1/4 Sec. 7, T37N, R9E to the end of the road in the SE 1/4 Sec. 7, T37N, R9E.
Rock Pit, FSR 1140	10/1-5/20 (Deer/elk winter and transition range)	From M.P. .05 in the SW 1/4 Sec. 32, T38N, R9E to the end of the road in Sec. 31, T38N, R9E.
Smith Basin, FSR 3940	12/1-6/15 (Mtn. Goat winter range)	From M.P. .05 in the SE 1/4 of Sec. 28, T39N, R7E to the end of road in the SE 1/4 of Sec. 28, T39N, R7E.

Other Lease Stipulations

Endangered Species Act Stipulation

In accordance with BLM Instruction Memorandum No. 2002-174, the BLM will apply the following stipulation on any leases where threatened, endangered, or other special status species or critical habitat is known or strongly suspected. Additionally, the BLM will provide a separate notification through a lease notice to prospective lessees identifying the particular special status species that are present on the lease parcel offered.

“The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species. BLM may recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that will contribute to a need to list such a species or their habitat. BLM may require modifications to or disapprove proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of a designated or proposed critical habitat. BLM will not approve any ground-disturbing activity that may affect any such species or critical habitat

until it completes its obligations under applicable requirements of the Endangered Species Act as amended, 16 USC 1531 et seq., including completion of any required procedure for conference or consultation.”

Protection of Geothermal Features

Under the following situations, the BLM or FS would apply stipulations to protect the integrity of geothermal resource features, such as springs and geysers. If it is determined that geothermal operations are reasonably likely to result in a significant adverse effect to such a feature, then BLM would decline to issue the lease.

- The BLM or FS would include stipulations to protect any significant thermal features of a National Park System unit that could be adversely affected by geothermal development. These stipulations will be added, if necessary, when the lease or permit is issued, extended, renewed or modified (43 CFR 3201.10[b]).
- Any leases that contain thermal features (e.g., springs or surface expressions) would have a stipulation requiring monitoring of the thermal features during any exploration, development, and production of the lease to ensure that there are no impacts to water quality or quantity.

Cultural Resources Stipulation

In accordance with BLM Instruction Memorandum No. 2005-003, the BLM will apply the following stipulation to protect cultural resources:

“This lease may be found to contain historic properties and/or resources protected under the National Historic Preservation Act (NHPA), American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, E.O. 13007, or other statutes and executive orders. The BLM will not approve any ground disturbing activities that may affect any such properties or resources until it completes its obligations under applicable requirements of the NHPA and other authorities. The BLM may require modification to exploration or development proposals to protect such properties, or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized or mitigated.”

Roadless Area Stipulation

The FS manages approximately 42,700 acres of land in the project area that is designated as Inventoried Roadless Areas (IRAs). A non-discretionary CSU stipulation would be placed on any leases within NFS IRAs (overlapping portions of MA-1A, 1B, 1C, 14, 15, 19, 23A, and LSR). Pursuant to the Roadless Rule of 2001, no new road construction, reconstruction or timber removal would be allowed in designated IRAs. If future legislation or regulation changes the roadless area designation, the CSU would be revised, subject to site-specific environmental review, and design features or mitigation measures to protect IRA characteristics.

Glossary

Activity center: The core of an owl's territory and the focal point of protection measures. Most frequently located in or near the highest concentration of remaining suitable habitat.

Adverse Effect: 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. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.

Anadromous: Migrating from the sea to freshwater to spawn

Bear Management Unit (BMU): The area assessed for carrying capacity of a sow grizzly bear and cub.

Cascadia: Refer to Ames & Maschner 1999 page 64

Climate: Refers to average weather over a period of about 25-30 years.

Climate variability: Refers to deviations of the climate on all spatial and temporal scales beyond that of individual weather events. Variability can be due to natural processes or variations in human-induced causes.

Climate change: Refers to a non-random change in climate that is measured over several decades or longer. The change may be due to natural or human induced causes.

Concern species: Species whose populations are of concern to biologists on the Mt. Baker-Snoqualmie National Forest. This is an informal designation.

Consultation: The process of seeking, discussing, and considering the views of other participants, and, where feasible, seeking agreement with them regarding matters arising in the section 106 process. The Secretary's "Standards and Guidelines for Federal Agency Preservation Programs pursuant to the National Historic Preservation Act" provide further guidance on consultation.

Critical habitat: (Endangered Species Act) defined as an area occupied by a species listed as threatened or endangered within which are found physical or geographical features essential to the conservation of the species, or an area not currently occupied by the species, which is itself essential to the conservation of the species. As defined in the ESA "conservation" means any and all methods and procedures, and the use of those, needed to bring a species to recovery—the point at which the protections of the ESA are no longer needed.

Cultural resources: Refers to a much broader range of resources associated with human manipulation of the environment than the term Historic Property, and encompasses all the resources that are potentially eligible for listing in the National Register of Historic Places, that being: sites, buildings, structures, districts, and objects and includes properties of traditional religious and cultural importance to an Indian tribe and that could potentially meet the National Register criteria.

Developed recreation site: A constructed recreation facility with at least some facilities such as an established trailhead with bulletin board or campground with campsites, toilets, picnic tables, fire rings, and trash receptacles.

Dispersed camping: An undeveloped campsite with no facilities such as a road side campsite.

Effect: The alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register.

Endangered species: A native species found by the Secretary of the Interior to be threatened with extinction.

Essential Fish Habitat: Those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity

Extirpated: Eliminated from a local area.

Fragmentation: The degree to which the landscape is broken into distinct patch types.

Hibernacula: Sites where hibernation occurs.

Historic Property: Any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe and that meet the National Register criteria.

Human influence zone: Areas of human activity (recreation sites, roads, trails, buildings, mines, hydropower operations, etc.) buffered by one-third mile around trails and one-half mile around roads and other sites.

Hydrological Unit Code (HUC): The United States is divided and sub-divided into successively smaller hydrologic units which are classified into four levels: regions, sub-regions, accounting units, and cataloging units. The hydrologic units are arranged within each other, from the smallest (cataloging units) to the largest (regions). Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to eight digits based on the four levels of classification in the hydrologic unit system.

Invasive species: is one whose introduction does or is likely to cause economic or environmental harm or harm to human health (EO 13112). Herein the term “invasive species” only refers to invasive plant species. Those species that are listed in Categories A, B, and C of the 2014 Washington State Noxious Weed List are considered High Priority for treatment. Species that are not rated (NR) may also be considered if they pose a threat to the establishment of native species.

- Class A: Non-native species that are limited in distribution in Washington. State law requires that these weeds be eradicated.
- Class B: Non-native species that are either absent from or limited in distribution in some portions of the state but very abundant in other areas. The goals are to contain the plants where they are already widespread and prevent their spread into new areas.
- Class C: Non-native plants that are already widespread in Washington State. Counties can choose to enforce control, or they can educate residents about controlling these noxious weeds.

Large woody debris: Pieces of wood larger than 10 feet long and 6 inches in diameter.

Late-successional forest: Late-successional forests are those forest seral stages that include mature and old-growth age classes. (ROD USDA-USDI, Standards and Guidelines 1994, B-1)

Neotropical migrants: Birds that migrate from North America to regions south of the Tropic of Cancer (latitude 23 1/2 degrees north) to winter.

Omnivore: Animal that feeds on both plants and animals.

Plants: Herein refer to all vascular and non-vascular plants, lichens, and fungi. The term “plants” will be used colloquially to refer to the above mentioned species.

Propagule: Herein refers to any plant part or structure that can give rise to a new individual, such as rhizomes, corms, or seeds.

Rare: Herein refers to all plants of special status, including, but not limited to: Region 6 Sensitive plants and fungi species, Northwest Forest Plan Survey and Manage plants, lichens, and fungi species, and Region 6 Strategic Species.

Rendezvous sites: Temporary resting sites used for several days at a time by a wolf pack during summer months while the pups are developing.

Riparian zone: Those terrestrial areas where the vegetation complex and microclimate conditions are products of the combined presence and influence of perennial and/or intermittent water, associated high water tables, and soils that exhibit some wetness characteristics. Normally used to refer to the zone within which plants grow rooted in the water table of these rivers, streams, lakes, ponds, reservoirs, springs, marshes, seeps, bogs, and wet meadows.

Recreation Opportunity Spectrum (ROS): A conceptual framework for defining types of recreation opportunities, physical settings, and experiences a visitor can expect. There are several ROS classes applied on the Mt. Baker-Snoqualmie National Forest:

- Primitive – Area is characterized by an essentially unmodified natural environment of fairly large size, essentially free from evidence of human induced restrictions and controls, motorized use is not permitted.
- Semi-primitive Nonmotorized – Area is characterized by a predominately natural appearing environment of moderate to large size, minimum onsite controls and restrictions may be present, motorized use is not permitted.
- Semi-primitive Motorized – Area is characterized by a predominately natural appearing environment of moderate to large size, minimum onsite controls and restrictions may be present, motorized recreational use of roads with natural surface and trails suitable for motor bikes is permitted.
- Roaded Natural – Area is characterized by predominately natural appearing environment with moderate evidence of man, resource modification and utilization practices are evident, conventional motorized use is allowed.
- Rural – Area is characterized by a natural environment that has been substantially modified by development, resource modification and utilization may be used, a considerable number of facilities are designed for use by a large number of people, facilities for intensified motorized use and parking are available.

- **Roaded Modified** – Area is characterized by a predominately altered environment, allowing for noticeable to strong evidence of management activity.
- **Urban** – Area is characterized by a substantially urbanized environment, although the background may have natural appearing elements. Large numbers of users can be expected both on site and in nearby areas. Facilities for highly intensified motor use and parking are available with forms of mass transit often available to carry people throughout the site.

Riparian Reserves: Lands along streams and unstable and potentially unstable areas where special standards and guidelines direct land use. They are specified for five categories of streams or waterbodies in USDA FS and USDI BLM 1994.

Security habitat: Habitat defined as 0.25 mile from open road or outside of human influence zones for mountain goats, 0.3 mile for grizzly bear core and wolf security habitat.

Sensitive Species: (from <http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy>)–For Region 6 of the Forest Service, those plant and animal species identified by the Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density and habitat capability that would reduce a species’ existing distribution (FSM 2670.5).

Seral: Of or pertaining to the series of stages in the process of ecological succession.

Special Status: Herein refers to those species that are rare.

Survey and Manage species: Those plants or animals determined to be associated with/or an indicator of late-successional or old-growth forest within the range of the Northern spotted owl. The 2001 Northwest Forest Plan Record of Decision, implementing the 2003 species review, contains the species list used for this analysis.

Suitable habitat: Habitat in which an animal or plant can meet all or some of its life history requirements.

Threatened species: A native species likely to become endangered within the foreseeable future.

Undertaking: A project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license or approval.

Utilities: Industrial facilities authorized through special use permits issued by the Forest Service, including communication sites, signal relays, other electronic sites, hydroelectric project features, canals, penstocks, pipelines, and power transmission lines.

Visual Quality Objectives (VQO): An inventoried measure of acceptable levels of modification to the visual resource. Visual Quality Objectives were incorporated in the standards and guidelines in the approved Forest Plan (1990) and allow for different levels of human activity.

- **Preservation**--Allows ecological changes only.
- **Retention**--Human activities are not evident to the casual Forest visitor.
- **Partial Retention**--Human activity may be evident, but must remain subordinate to the characteristic landscape.

- **Modification**--Human activity may dominate the characteristic landscape but must at the same time follow naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in foreground or middleground.
- **Maximum Modification**--Human activity may dominate the characteristic landscape, but should appear as a natural occurrence when viewed as background.
- **Enhancement**--A short-term management alternative which is done with the express purpose of increasing positive visual variety where little variety now exists.

Viewsheds: Sometimes termed "Viewshed Corridor" or "Visual Corridor" and are the "seen" landscape visible to most Forest visitors from roads, trails, rivers and recreation areas. Most are corridors, one-quarter to two miles wide. Viewsheds viewed from primary travel routes and use areas are "Sensitivity Level 1." Viewsheds viewed from secondary travel routes and use areas are "Sensitivity Level 2."

Visual Condition: The visual appearance of a landscape described in terms of the degree of alteration of the natural appearing landscape. Descriptive degrees of alteration are:

- **Natural Appearing** - Area appears untouched by man; changes are not visually evident.
- **Slightly Altered** - Changes may be noticed by the average visitor but do not attract attention. Natural appearance dominates minor disturbances.
- **Moderately Altered** - Changes are easily noticed by the average visitor and may attract attention. Disturbances are apparent.
- **Heavily Altered** - Changes are strong and obvious to the average visitor. Changes dominate the landscape but may resemble natural patterns when viewed from a distance of 3 to 5 miles. Disturbances are major.