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Newberry Geothermal Consent to Lease Project

Bend/Ft. Rock Ranger District, Deschutes National Forest

Deschutes County, Oregon
Legal Location: Willamette Meridian
T21S, R12E, Sections 9, 20, 31;
T22S, R12E, Sections 14, 15;
T22S, R13E, Sections 2, 3, 9, 17-19, 30, 31

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Environmental Assessment

Newberry Geothermal Consent to Lease Project

T21S, R12E, Sections 9, 20, 31;

T22S, R12E, Sections 14, 15;

T22S, R13E, Sections 2, 3, 9, 17-19, 30, 31

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Table of Contents

Changes from 30-Day Comment Period EA to Final EA: 7

CHAPTER 1: Purpose and Need 10

Introduction 10

Background 10

Geothermal History 12

Proposed Action 13

Purpose and Need for Action 13

Management Direction 13

Other Law, Regulation, Policy 19

Past Exploration, Development and Monitoring Projects 21

Scoping and Public Involvement 22

Identification of the Issues 22

Project Record 23

Decision to Be Made 24

CHAPTER 2: Alternatives 25

Introduction 25

Alternatives Considered 25

Reasonably Foreseeable Development Activities 39

Resource Protection Measures 44

Lease Exceptions, Waivers, and Modifications 54

CHAPTER 3: Affected Environment and Environmental Consequences 56

Introduction 56

Scope of Analysis and Approach 56

Basis for Analysis 57

Changes from 30-Day Comment Period EA to Final EA: 57

Minerals and Geology 58

Wilderness, Inventoried Roadless Areas, Areas Meeting the Inventory Criteria for Potential Wilderness, and Other Undeveloped Lands 66

Recreation and Land Use 90

Soils 105

Scenic Resources 110

Wildlife: Threatened, Endangered and Sensitive Species (TES) 112

Wildlife: Management Indicator Species 133

Botany: Threatened, Endangered, and Sensitive Species 169

Botany: Invasive Plants 171
Cultural Resources 172
Tribal Interests and Traditional Cultural Resources 174
Fisheries and Water Resources 175
Transportation and Access 177
Air Quality 181
Noise 182
Socioeconomics and Environmental Justice 183
Other Disclosures 186
CHAPTER 4: Consultation and Coordination 190
Tribes 190
Other Agencies 190
Interdisciplinary Team 190
Literature Cited 191
APPENDICES 196
Appendix A: Standard Stipulations 196
Appendix B: 30-Day EA Comments 201
Appendix C: Parcel Lease History 226

List of Tables

Table 1: Summary of Deschutes National Forest LRMP Direction, Monument Legislation, and NNVM Comprehensive Management Plan 18
Table 2: Description of Alternative 2 (Proposed Action); Includes Parcels to be Leased, Legal Location (Willamette Meridian), Management Description, and Acres 25
Table 3: Description of Alternative 2 (Proposed Action); Includes Parcels to be Leased, Type of Lease, and Acres 26
Table 4: Summary Table of Typical Phases in Geothermal Development, Objectives, and Associated Activities 39
Table 5: Lease Stipulations and General Notices 48
Table 6: Acres of Inventoried Roadless Areas (IRA) within Consent to Lease Parcels 69
Table 7: Polygons Meeting FSH 1909.12, Chapter 71 Inventory Criteria for Potential Wilderness 78
Table 8: Acres Meeting the Inventory Criteria for Potential Wilderness within Consent to Lease Parcels 81
Table 9: Miles of National Forest System Trail, by Trail, Parcel and Special Stipulations 93
Table 10: Miles of National Forest System Trail, by Trail Type and Special Stipulation Type 99
Table 11: Lease Parcels Adjacent to the Newberry National Volcanic Monument (NNVM) Boundary with NNVM Management Zones and Lease Stipulations 101

Table 12: Acres of Land within Lease Nomination Areas by ROS Classification 102

Table 13: Projects that may Lead to Cumulative Effects with Reasonably Foreseeable Developments 104

Table 14: Acres of Steep Slope Classes in the Nominated Parcels 105

Table 15: Indirect Effects Analysis to Soil Resources 106

Table 16: USFWS Endangered, Threatened or Proposed Wildlife Species or Habitat Suspected on the DNF 113

Table 17: Oregon Spotted Frog Critical Habitat Primary Constituent Elements [1] 118

Table 18: Alternative Comparison 121

Table 19: USFS Pacific Northwest Region Sensitive Species documented or Suspected on the DNF 122

Table 20: Modeled White-headed Woodpecker Habitat for Subwatersheds in the Project Area 131

Table 21: Management Indicator Species for the Deschutes National Forest 133

Table 22: Modeled Northern Goshawk Habitat for Subwatersheds within the Project Area 135

Table 23: Modeled Cooper's Hawk Habitat in the Project Area by Subwatershed 137

Table 24: Modeled Sharp-shinned Hawk Habitat in the Project Area by Subwatershed 139

Table 25: Modeled Great Blue Heron Habitat in the Project Area by Subwatershed 141

Table 26: Predicted Osprey Habitat by Subwatershed 143

Table 27: Modeled Red-tailed Hawk Habitat for Subwatersheds in the Project Area 145

Table 28: Mule Deer Summer Hiding Cover and Open Road Density for Subwatershed in Project Area 147

Table 29: Modeled American Marten Habitat by Subwatershed in the Project Area 149

Table 30: Modeled Black-backed Woodpecker Habitat for Subwatershed in the Project Area 151

Table 31: Modeled Hairy Woodpecker Habitat for Subwatersheds in the Project Area 153

Table 32: Lewis' Woodpecker Nesting Habitat by Subwatershed on the DNF 154

Table 33: Acres of Northern Flicker Nesting Habitat by Subwatershed on the DNF 156

Table 34: Modeled Pileated Woodpecker Nesting Habitat by Subwatershed 158

Table 35: Modeled Three-toed Woodpecker Habitat by Subwatershed for the Project Area 159

Table 36: Williamson's Sapsucker Nesting Acres by Subwatershed 162

Table 37: Birds of Conservation Concern for BCR 9 – Great Basin 164

Table 38: Priority Habitat Features and Associated Focal Species for the East-Slope Cascade Strategy 165

Table 39: High Priority Shorebird Species/Populations 167

Table 40: Race/Ethnicity in Deschutes County, Oregon 184

List of Figures

Figure 1: Newberry Geothermal Consent to Lease Project Vicinity Map with Nominated Parcels 11
Figure 2: Deschutes National Forest Land and Resource Management Plan Management Areas (Including Newberry National Volcanic Monument) 16
Figure 3: Newberry Geothermal Consent to Lease Nominated Parcels 27
Figure 4: Newberry Geothermal Consent to Lease Parcel 1 28
Figure 5: Newberry Geothermal Consent to Lease Parcel 2 29
Figure 6: Newberry Geothermal Consent to Lease Parcel 3 30
Figure 7: Newberry Geothermal Consent to Lease Parcel 4 31
Figure 8: Newberry Geothermal Consent to Lease Parcel 5 32
Figure 9: Newberry Geothermal Consent to Lease Parcel 6 33
Figure 10: Newberry Geothermal Consent to Lease Parcel 7 34
Figure 11: Newberry Geothermal Consent to Lease Parcel 8 35
Figure 12: Newberry Geothermal Consent to Lease Parcel 9 36
Figure 13: Newberry Geothermal Consent to Lease Parcel 10 37
Figure 14: Newberry Geothermal Consent to Lease Parcel 11 38
Figure 15: Overview Map of Inventoried Roadless Areas and Geothermal Consent to Lease Parcels 68
Figure 16: Parcel 1 - Inventoried Roadless Area and No Surface Occupancy 71
Figure 17: Parcel 4 - Inventoried Roadless Area and No Surface Occupancy 72
Figure 18: Parcels 7, 8 and 9 - Inventoried Roadless Area and No Surface Occupancy 73
Figure 19: Overlap of Lava Cast Commercial Thin Unit with Parcel 1 75
Figure 20: Ogden Vegetation Management Units with Geothermal Consent to Lease Parcels 76
Figure 21: Polygons Meeting the Inventory Criteria for Potential Wilderness 79
Figure 22: Areas Meeting the Inventory Criteria for Potential Wilderness and the Geothermal Consent to Lease Parcels 80
Figure 23: Parcel 1 - Area Meeting Inventory Criteria for Potential Wilderness and No Surface Occupancy 83
Figure 24: Parcel 4 - Area Meeting Inventory Criteria for Potential Wilderness and No Surface Occupancy 84
Figure 25: Parcels 5 and 6 - Area Meeting Inventory Criteria for Potential Wilderness and No Surface Occupancy 85
Figure 26: Parcels 7, 8 and 9 - Area Meeting Inventory Criteria for Potential Wilderness and No Surface Occupancy 86
Figure 27: Recreation Opportunity Spectrum classifications for the Newberry Geothermal Consent to Lease project area 91
Figure 28: Areas Visible from Overlooks and Viewpoints 92

Figure 29: Summer Recreation Resources – Newberry Geothermal Consent to Lease Project Area . 95

Figure 30: Winter Recreation Resources – Newberry Geothermal Consent to Lease Project Area.... 96

Figure 31: Utility Corridor within the Area 97

Figure 32: Authorized and Proposed Geothermal Lease Parcels In the Area In Relation to the Newberry National Volcanic Monument and Motorized Transportation System..... 103

Figure 33: Steep Slopes in Nominated Geothermal Lease Areas 109

Figure 34: Parcel Number 1 – History 226

Figure 35: Parcel Number 2 – History 227

Figure 36: Parcel Number 3 – History 228

Figure 37: Parcel Number 4 – History 229

Figure 38: Parcel Number 5 – History 230

Figure 39: Parcel Number 6 – History 231

Figure 40: Parcel Number 7 – History 232

Figure 41: Parcel Number 8 – History 233

Figure 42: Parcel Number 9 – History 234

Figure 43: Parcel Number 10 – History 235

Reader's Guide

This Environmental Assessment (EA) contains information about a proposal to consent to the Bureau of Land Management (BLM) to provide 11 nominated parcels (6,174 acres) of land for lease, with stipulations, for potential exploration and development of geothermal energy.

The information in this EA is organized to facilitate consideration of the potential future environmental effects by the public, and by the Forest Supervisor of the Deschutes National Forest, who is responsible for deciding whether or not to select the Proposed Action alternative(Alternative 2) or the No Action alternative (Alternative 1).

Understanding the structure of this document is important to an overall understanding of the information required in an EA. The following provides an overview of the components of this document.

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

Chapter 1 – Purpose and Need: Chapter 1 describes the Purpose and Need for the proposal, and the Proposed Action. It includes Management Direction for the project, and the Decision Framework. Public Involvement and the Issues generated by public comments are explained here.

Chapter 2 – Alternatives: Chapter 2 includes a description of the alternatives, and discussions of the alternatives and actions considered but eliminated from detailed analysis. The focus of this chapter is Alternatives Considered in Detail, which includes the No Action and the Proposed Action as developed by the Forest Service that focused the analysis for this project. Mitigation measures to reduce potential resource impacts are documented in this chapter.

Chapter 3 – The Affected Environment and Environmental Consequences: Chapter 3 describes current physical, biological, and social and economic environments within the area of influence of the Proposed Action. This information provides the baseline for assessment of the potential impacts. In order to facilitate comparison of information provided, this chapter is organized and subdivided into resource areas/disciplines in a manner appropriate to the affected environment for this area.

Chapter 4 – List of Preparers and Coordination: Chapter 4 lists the individuals, Federal, State and local agencies and tribes that the Forest Service consulted during the development of this EA. It also discloses the distribution of the document including Federal Agencies, federally recognized tribes, State and local governments and organizations and individuals representing a wide range of views. The references and glossary are in the last part of this chapter.

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 Bend/Ft. Rock Ranger Station in Bend, Oregon.

Changes from 30-Day Comment Period EA to Final EA:

Following the 30-day comment period, this Final Environmental Assessment (EA):

- Provided additional discussion on seismicity events (EA, page 59) and North American Wolverine (EA, page 115), and provided analysis for the Pacific fisher (EA, page 118);
- Added Appendix B, 30-Day Comments (EA, page 201) and Appendix C, Parcel History (EA, page 226);
- Reasonably foreseeable developments (RFDs) are more distinct in effects section for each resource in Chapter 3. Emphasized no ground disturbing activities are associated with this EA.
- Basic editing made throughout the document;

Acronyms used in this Document:

ADA	Americans with Disabilities Act
BA	Biological Assessment
BCC	Birds of Conservation Concern
BE	Biological Evaluation
BI	Beneficial Impact
BLM	Bureau of Land Management
BMP	Best Management Practices
BO	Biological Opinion
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CMP	Comprehensive Management Plan
CSU	Controlled Surface Use
CWA	Clean Water Act
DEQ	Oregon Department of Environmental Quality
DNF	Deschutes National Forest
DOE	Department of Energy
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act of 1973
FLPMA	Federal Land Policy and Management Act
FS	Forest Service
FSH	Forest Service Handbook
FSM	Forest Service Manual
FSR	Forest Service Road
FZ	Flank Zone
GIS	Geographical Information Systems
IDT	Interdisciplinary Team
INFISH	Inland Native Fish Strategy
IRA	Inventoried Roadless Area
KGRA	Known Geothermal Resource Area
LRMP	Deschutes National Forest Land and Resource Management Plan
MA	Management Area
MIIH	May Impact Individuals or Habitat but Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species

MIS	Management Indicator Species
NE	No Effect
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NHPA	National Historic Preservation Act
NI	No Impact
NNVM	Newberry National Volcanic Monument
NSO	No Surface Occupancy
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
OGMA	Old Growth Management Area
PAG	Plant Association Group
PDC	Project Design Criteria
PEIS	Programmatic Environmental Impact Statement
PETS	Proposed, Endangered, Threatened, and Sensitive Species
PFA	Post Fledgling Area
PWA	Potential Wilderness Area
RHCA	Riparian Habitat Conservation Area
S&G	Standards and Guidelines
SOC	Species of Concern
TES	Threatened, Endangered, Sensitive
TL	Timing Limitations
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WUI	Wildland Urban Interface

CHAPTER 1: Purpose and Need

Introduction

The Deschutes National Forest (DNF) is responding to a request (March 6, 2008) from the Bureau of Land Management (BLM) to grant Consent to Lease of nominated parcels of land for geothermal mineral exploration and development. The DNF is the surface and subsurface management agency for the un-leased parcels. The State Director of the BLM has the authority to issue energy leases but needs the consent from the Forest Service (DNF Forest Supervisor) on National Forest System (NFS) lands. If consent is given, the BLM will manage any surface and subsurface geothermal activity of the leases.

This project evaluates the surface suitability of the nominated parcels for potential geothermal exploration and development, with stipulations. The Forest Service (FS) will determine if the lands should be leased, leased with stipulations, or withdrawn from further consideration for leasing and subsequent development. This project does not make the decision to grant leases or authorize any exploration or development activities. The project only authorizes the BLM to provide the nominated lands for competitive bid.

The Consent to Lease has no direct impacts on any resource. Impacts associated with any lease activity would be attributed to any geothermal exploration and subsequent development. For lands selected for leasing, the FS would identify any necessary stipulations that would be incorporated into any BLM lease that would guide subsequent surface and subsurface activities.

The project area (Figure 1, page 11) is located within the DNF, Bend-Ft. Rock Ranger District, Deschutes County, Oregon, approximately 25 air miles southeast of Bend, Oregon. The nominated parcels for lease are located outside the boundary of the Newberry National Volcanic Monument (NNVM), with some areas adjacent to the Monument. The potential lease areas range in elevation from approximately 5,100 to 6,800 feet and are largely covered by forest in various stages of regrowth from past timber harvest and accessed by several forest roads. Paulina Creek, eligible under the Wild and Scenic River Act, crosses through one of the parcels. There are no developed recreation areas within the parcels.

Background

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, which is responsible for conducting National Environmental Policy Act (NEPA) analysis for consenting to lease, for identifying appropriate lease stipulations under which the lease may be developed, and to ensure that doing so is consistent with the DNF Land and Resource Management Plan (LRMP) and complies with other regulation and policy. For a visual display of the geothermal leasing process, which includes both non-ground disturbing and ground disturbing environmental review, refer to Figure 2, page 12.

The BLM issues and administers geothermal leases on FS managed lands only after the FS has consented to leasing and has taken the actions necessary for the BLM to offer available lands for lease (USDI Geothermal Resource Leasing Regulations, 43 CFR 3201.10). The BLM can add additional terms, conditions or stipulations that it deems necessary and appropriate, and must make an independent decision whether to issue the lease after review of the decision and documentation presented by the FS, and any other relevant factors.

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 will 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 will be prepared with the BLM as lead and the FS as a cooperating agency.

Figure 1: Newberry Geothermal Consent to Lease Project Vicinity Map with Nominated Parcels

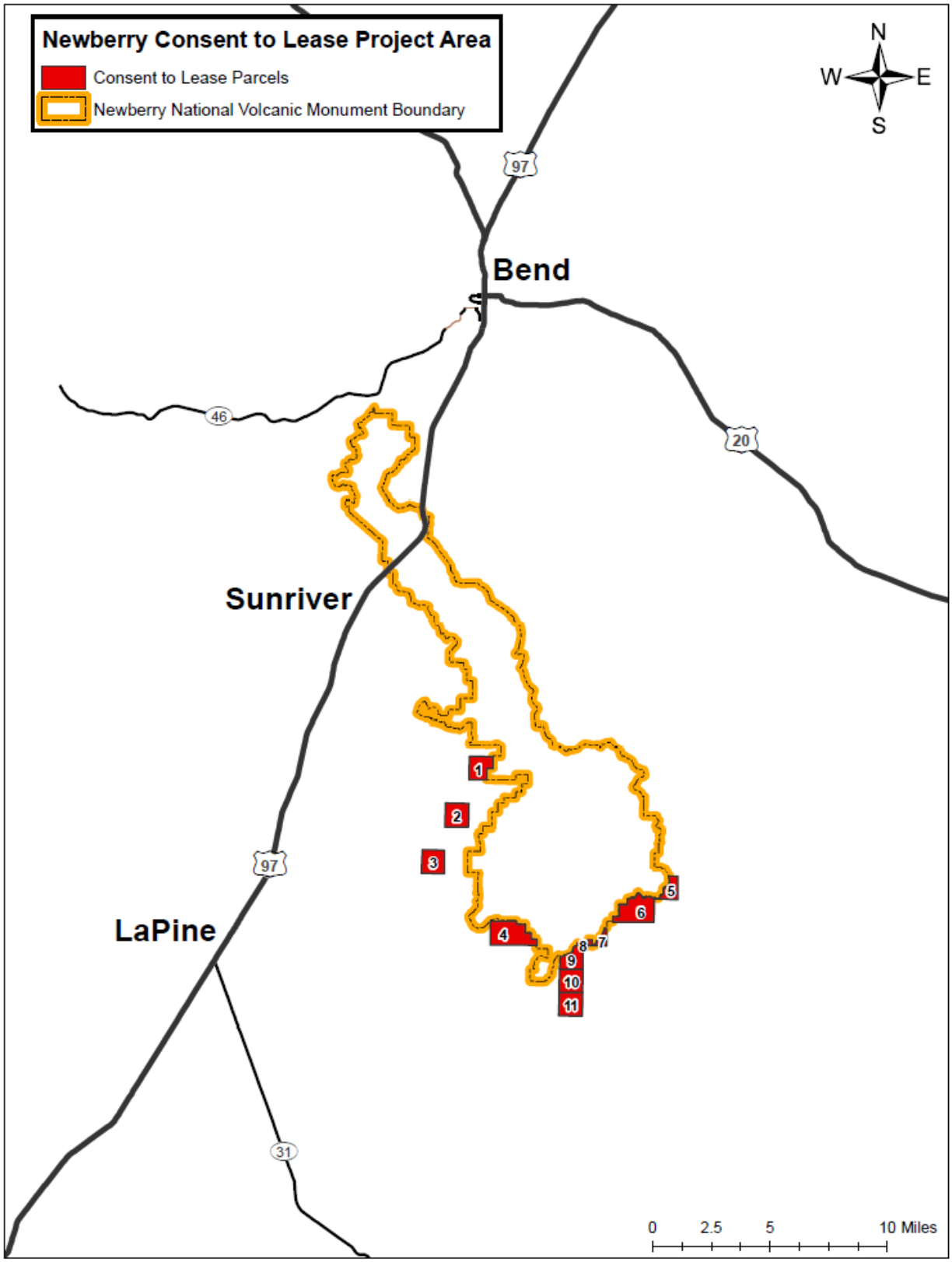

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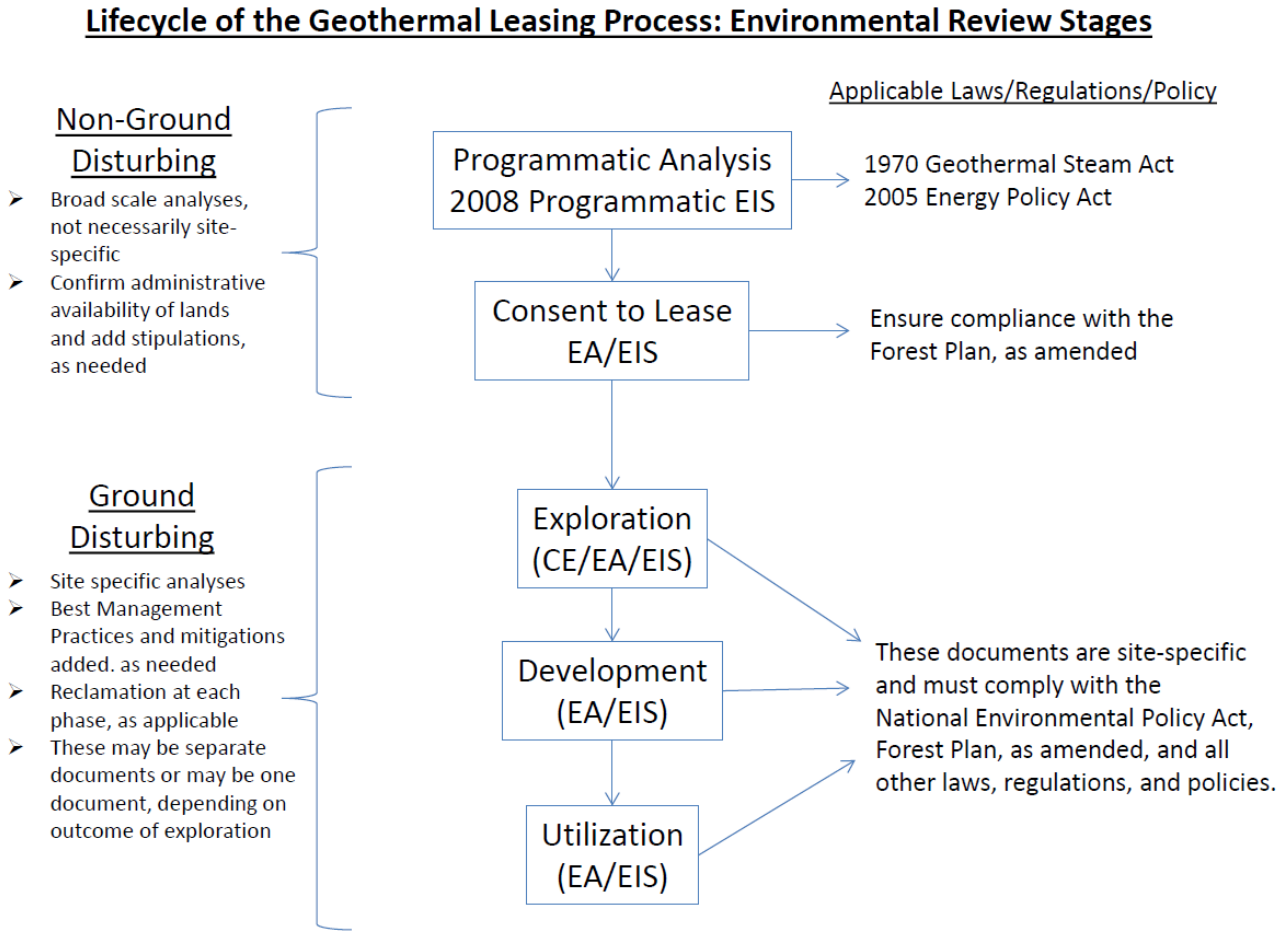
Figure 2: Lifecycle of the Geothermal Leasing Process: Environmental Review Stages



CE – categorical exclusion; EA – Environmental Assessment; EIS – Environmental Impact Statement

Geothermal History

Geothermal is heat generated and stored in the earth. A typical geothermal energy system functions by circulating water within zones of fractured hot rock deep underground. At high enough temperatures hot water and/or steam is brought to the surface to generate electricity. Once the heat is removed the water is recirculated back underground.

Geothermal resources have been used in the Newberry Caldera since the early 20th century. The East Lake Health Resort used geothermal waters from hot-springs in East Lake for hot baths from 1915 until the resort burned in 1923 (Garrett, 1991). Geothermal energy exploration began with the passage of the Geothermal Steam Act in 1970. In 1976, the US Geological Survey (USGS) designated the area around the Newberry Caldera as a Known Geothermal Resource Area (KGRA) (USDI 1980), which was determined to be one of the best geothermal energy prospects in the Pacific Northwest.

The first geothermal lease applications on the DNF were submitted in the late 1970s. The BLM began issuing mineral leases in the area following a Noncompetitive Geothermal Leasing EA analysis (DNF 1980). The USGS continued exploration and geologic mapping, culminating in the drilling of a 3,057 foot deep temperature gradient well in the center of Newberry Caldera near the Big Obsidian Flow in 1981. The well temperatures measured 509°F and produced steam for 20 hours during a test. During the last three decades, over two dozen exploratory wells have been drilled on the flanks of the caldera reaching depths from approximately 1,300 feet to 11,600 feet. One exploratory well drilled in 2008 to 10,060 feet recorded temperatures of almost 440°F at 6,500 feet to over 630°F at the bottom of the well (AltaRock, personal communication, 2012). No hydrothermal fluids or steam have yet been discovered on the flanks of Newberry Volcano. The question still remains whether Newberry can produce steam on its flanks in

quantities sufficient to economically generate electricity. There are currently 62 active geothermal leases on the flanks of Newberry Volcano outside of the Monument covering over 53,000 acres.

Concern regarding the geothermal exploration in the Newberry Volcano area in the 1980s led to the development of the NNVM. This area has long been recognized for its unique and spectacular landscape formed by volcanic activity and was considered for National Park status in 1904 and again recommended in 1920, 1940, and 1943. Newberry Caldera and some areas on its flanks were designated a National Natural Landmark in 1976. A year later, Newberry Caldera was again proposed as a National Park to specifically stop geothermal exploration. Due to the rise in geothermal exploration throughout the 1980s, a Consensus Committee was formed in 1987. The Consensus Committee was composed of representatives from conservation groups, geothermal industry, timber industry, recreation interests (such as skiers, snowmobilers, hunters, and fisherman), and various government agencies. The NNVM boundary and management guidelines were agreed to in 1989 by the Consensus Committee.

On November 5, 1990, NNVM Legislation became Public Law 101-522. By statute, the law withdraws all geothermal mineral rights from within the NNVM boundaries and gives the Secretary of Agriculture special and unusual authority over surface activities on geothermal compensation leases on the flanks outside of NNVM. The legislation also created several areas (Special Management Area, Transferal Area, Transferal Corridor, and Transferal Area Adjacent) within the NNVM boundary, not including the Caldera Zone, that have unique legal status related to mineral and geothermal uses. Guidance for the management of all of these lands is contained in the NNVM Comprehensive Management Plan (1994).

None of the proposed geothermal lease areas are within the NNVM. Seven parcels are adjacent to or near the NNVM boundary (Figure 3, page 16). The geothermal resource below the Special Management Area may only be accessed by directional drilling from outside the boundaries of the Special Management Area. Presently, active leases completely cover both Special Management and Transferal Areas.

Proposed Action

The proposed action is to consent to BLM to offer for sale new geothermal leases, with stipulations, on FS managed lands. Approximately 6,174 acres in 11 parcels (Table 2, page 25) have been nominated by the BLM for leasing. Lease stipulations would be attached in order to protect resources. Lease stipulations, described in detail in Chapter 2, could limit site surface occupancy or season of and/or specific location of use in the event of geothermal associated activities.

Purpose and Need for Action

The purpose of this project is, in response to a request by the BLM, for the Forest Service to consider as candidates for geothermal leasing presently unleased FS land near or adjacent to the NNVM boundary. The request is for these areas to be made available for potential exploration, and development and production of geothermal resources.

A Forest Service Consent to Lease is needed by the BLM, because the BLM is the federal agency with responsibility for managing subsurface mineral resources on federal lands, including FS managed lands (Geothermal Steam Act, 1970). This action requires determination of consistency with the goals and objectives outlined in the DNF LRMP (1990), as amended, in order to issue leases on FS lands.

Management Direction

Development of this EA follows implementing regulations of the National Forest Management Act (NFMA); Title 36, Code of Federal Regulations, Part 219 (36 CFR 219); Title 36, Code of Federal Regulations, Part 220 (36 CFR 220); Council on Environmental Quality, Title 40; CFR, Parts 1500-1508, National Environmental Policy Act (NEPA). This section describes applicable Forest Plan management direction as well as current laws, regulations, and executive orders.

Deschutes National Forest Land Resource Management Plan (LRMP, 1990)

The DNF LRMP (1990), as amended, guides all natural resource management activities and provides standards and guidelines for the DNF, including the potential for geothermal exploration and development. In accordance with the Federal Land Policy and Management Act (FLPMA) of 1976, as amended, for leased lands, BLM regulations require that activity on geothermal and other leases conform to the DNF LRMP. The LRMP provides statutory guidance for all Forest management activities.

Goals: The goals of the LRMP provide for the exploration, development, and utilization of energy resources within the Newberry Known Geothermal Resource Area (KGRA) where development of the geothermal resource is compatible with other resource values (LRMP p. 4-2).

Desired Future Condition: The LRMP desired future condition for energy resources predicts the potential importance of the geothermal resource and states, "Large areas of the Forest have become prime targets for the exploration and development of geothermal energy. If the supply of electricity in the western states slips from surplus to deficit, geothermal energy development will become increasingly attractive (LRMP p. 4-6)." Further anticipating geothermal exploration and development, the desired future condition also explains that "geothermal leases and permits have been issued in a timely way. Drill pads, pipelines, power plants, and electrical transmission lines, to the extent possible, are designed and located to minimize impacts on other resources, particularly visual quality." (LRMP p. 4-6)

LRMP Management Areas (MA): Geothermal operations are guided by which MA they are located in and the Standards and Guides (S&Gs) that apply to that particular MA. The proposed project falls within the following MAs (Figure 3, page 16); all allow for geothermal uses.

General Forest (MA-8): Within the General Forest MA, timber production is to be emphasized while providing forage production, visual quality, wildlife habitat, and recreational opportunities for public use and enjoyment. The objective is to continue to convert unmanaged stands to managed stands with the aim of having stands in a variety of age classes with all stands utilizing the site growth potential. This is achieved through stand treatments which include (but are not limited to) controlling stocking levels; maintaining satisfactory growth rates; protecting stands from insects, disease, and damage; controlling species composition; and regenerating stands that are no longer capable of optimum growth performance. (LRMP, page 4-117)

Scenic Views (MA-9): The project area contains retention and partial retention scenic views. The goal of scenic views management areas is to provide high quality scenery representing the natural character of central Oregon. The general theme and objectives of scenic views is for landscapes seen from selected travel routes and use areas are to be managed to maintain or enhance their appearance. To the casual observer, results of activities either will not be evident, or will be visually subordinate to the natural landscape. Timber harvest is permitted, but only to protect and improve the visual quality of the stands both now and in the future. For species other than ponderosa pine, the desired condition requires obtaining visual variety through either spatial distribution of age classes and species mixes, through density manipulation, or through a mixture of age classes within a stand. (LRMP, page 4-121)

Old Growth (MA-15): The old growth forest is to be managed to provide 1) large trees, 2) abundant standing and downed dead trees, and 3) vertical structure except in LP where a single canopy is common. The distribution and size of the OGMAs are based upon habitat requirements for pine martens in mixed conifer, goshawk in ponderosa pine, and three-toed woodpecker in the lodgepole pine. Vegetation can be manipulated to perpetuate or enhance old growth characteristics.

Paulina Creek Eligible Wild and Scenic River Corridor: Paulina Creek, from its source just downstream of Paulina Lake to where it leaves the project area at the Forest boundary (8 miles), is considered eligible to be a Wild and Scenic River because it is free-flowing and possesses two outstandingly-remarkable values (Hydrological/Geological and Scenic). Appendix D (p. D-7) of the Deschutes LRMP FEIS describes Paulina Creek in detail. The corridor includes all lands within ¼ mile of the banks of the river. It overlaps MA-15

(Old Growth) and MA-9 (Scenic Views), and includes all of the area designated as Riparian Habitat Conservation Area (RHCA). The lands within the corridor will be managed in accordance with Management Area 17 (Wild and Scenic Rivers) until further study is completed and the Forest Plan is amended.

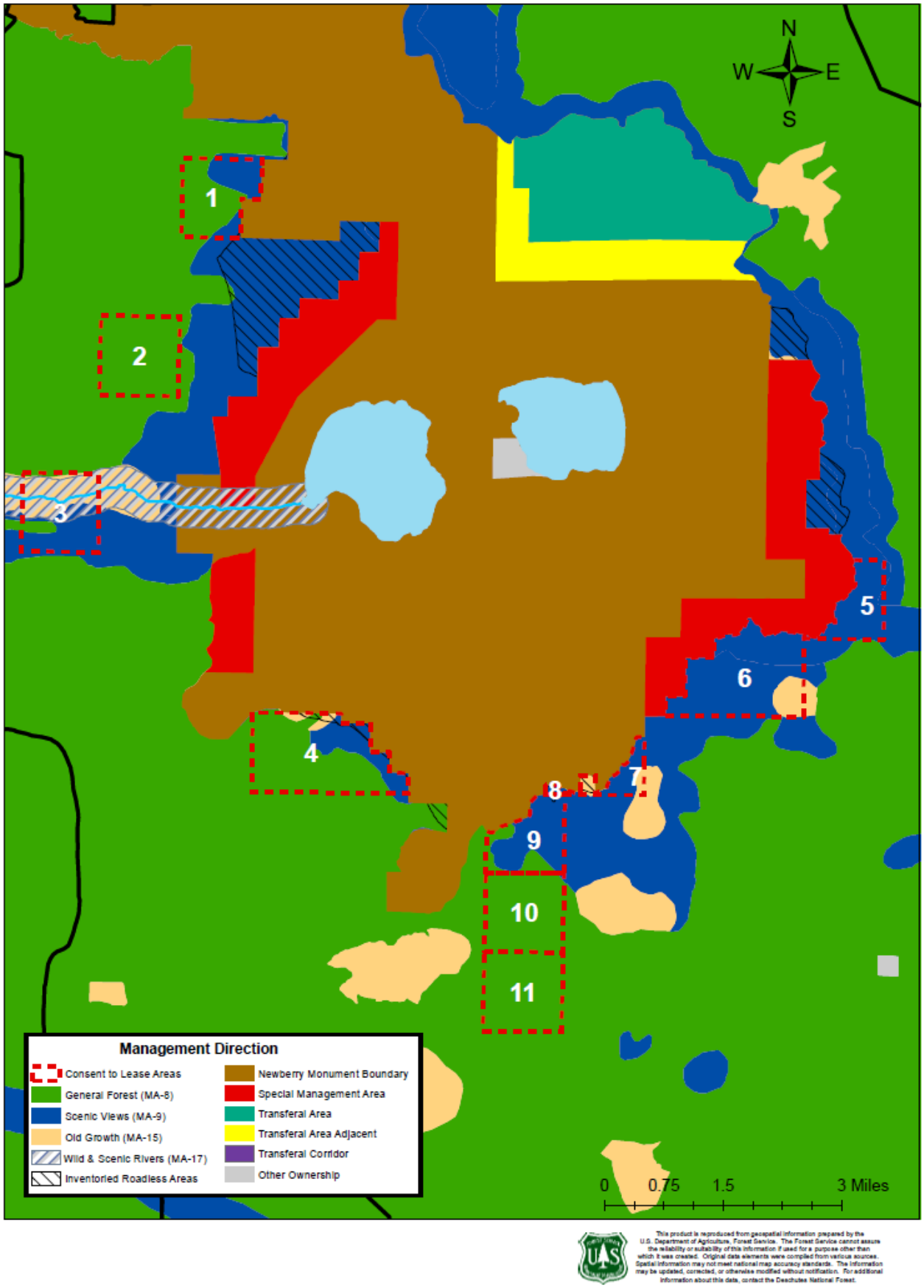
LRMP Standards and Guidelines (S&G's): These provide more detailed direction to help mitigate effects, minimize conflicts, and protect resource values. Forest-wide S&Gs provide overall Forest direction and affirm, among other things, that "the notices and stipulations in leases issued prior to implementation of this Plan take precedent over standards/guidelines developed in this Plan. These existing leases will continue and have prior rights. Proposals to explore develop, and produce electricity on all leases, past and future will be evaluated through the NEPA process. To the extent possible, consistent with existing lease rights, standards/guidelines will be followed." (LRMP p. 4-77). The S&Gs that address geothermal and mineral activities for each MA are:

- General Forest—M8-17. "Geothermal leases will be issued. Conditional Surface Use and Seasonal Restrictions Stipulations will be used to protect wildlife habitat and recreation areas that are included in the General Forest Area."
- Scenic Views—M9-83. "Mineral developments, utilities, and electronic sites may be located in these areas if the facilities and associated improvements are located, designed, and maintained to blend with the characteristic landscape. Visual quality objectives may not always be met when the viewer is within the special use site itself, due to the usual large scale of these facilities. However, when viewed from travel routes, recreation areas, and other sensitive viewer locations, Visual Quality Objectives should be met."
- Scenic Views—M9-84. "Trees may be removed within the Scenic Views Management Area where necessary to permit access to geothermal sites, mineral development, electronic sites, utilities, and other special use sites."
- Old Growth—M15-11. "Geothermal leases will be issued with No Surface Occupancy (NSO) stipulations."

The LRMP does direct that streams and rivers determined to be eligible in the National Wild and Scenic River System "are preserved until management planning is completed for each designated waterway." Paulina Creek is listed as eligible and is to be classified as a Recreational River. The "Wild and Scenic Rivers" (MA-17) S&Gs "serve as an interim management direction until formal river corridor management plans are completed" and LRMP is amended. (LRMP 4-149)

- Wild and Scenic River—S&G M17-5 for Recreational Rivers: "Geothermal: Leasing and development would be permitted with No Surface Occupancy. The situation will be reviewed as river management plans are developed."

Figure 3: Deschutes National Forest Land and Resource Management Plan Management Areas (Including Newberry National Volcanic Monument)



Inventoried Roadless Areas (2001)

The Department of Agriculture adopted the Roadless Area Conservation final rule to protect and conserve inventoried roadless areas on National Forest System lands. Direction "prohibits road construction, reconstruction, and all timber cutting within Inventoried Roadless Areas (IRA)."

- 36 CFR 294.12 prohibits road construction and road reconstruction in IRAs. There are exceptions as described in paragraph (b) of this section.
- 36 CFR 294.13 prohibits timber cutting, sale, or removal in IRAs. There are exceptions as described in paragraph (b) of this section.

Newberry National Volcanic Monument Act (Public Law 101-522), November 1990

In 1990, Congress designated over 50,000 acres to become the Newberry National Volcanic Monument (NNVM) through the NNVM Act (Monument Act). The Act creating the NNVM withdraws all geothermal mineral leases within the NNVM and also provides specific guidance related to activities outside the NNVM boundaries.

"Nothing in this Act shall be construed as authorizing or directing the establishment of protective perimeters or buffer zones around the Monument or Special Management Area for the purpose of precluding activities outside the Monument and Special Management Area boundary which would otherwise be permitted under applicable law….The fact that activities or uses outside the Monument and Special Management Area can be seen, heard, measured, or otherwise perceived from within the Monument and Special Management Area shall not, of themselves, limit, restrict, or preclude such activities or uses up to the boundary of the Monument and the Special Management Area" (Public Law 101-522, Section 8(a)).

Geothermal operations are guided by Section 4 of the Monument Legislation and vary by which area they are located in. Even though the project falls outside of the Monument boundaries, the two areas that could be affected by the geothermal leases, "Monument" and "Special Management Area" (Figure 3, page 16) are described below.

- Monument—Public Law 101-522 Sec 4 (a)(1). "Subject to valid existing rights, Federal lands within the Monument are hereby withdrawn from all forms of entry, appropriation, or disposal under the public land laws, from location, entry, or patent under the mining laws, and disposition under all mineral and geothermal leasing laws."
- Special Management Area—Public Law 101-522 Sec 4 (a)(5). "Subject to valid existing rights, Federal lands within the Special Management Area are hereby withdrawn from all forms of entry, appropriation, or disposal under the public land laws, from location, entry, or patent under the mining laws, and under all mineral leasing laws *except* the Geothermal Steam Act of 1970. Geothermal leases in this area shall contain stipulations that prohibit surface occupancy and shall require that the Special Management Area be entered only by directional drilling from outside the Special Management Area boundaries."

Newberry National Volcanic Monument Comprehensive Management Plan, August 1994

As mandated in the Monument Act, the Forest Service prepared a Comprehensive Management Plan (CMP) for the NNVM (August 1994). This plan established establishing programmatic management direction for FS lands within the newly created Monument and for the four specially designated areas (Special Management Area, Transferal Area Adjacent, Transferal Area, and Transferal Corridor) within the NNVM boundary that may be used for geothermal exploration and development under certain circumstances.

Consistent with the Monument Act, the CMP acknowledges there are valid geothermal leases within the Special Management Areas identified within the Monument Act. The CMP includes a goal to "Manage the surface of Newberry Special Management Area and of the Transferal Area Adjacent as part of the Monument, while allowing subsurface exploration for and development of geothermal resources" (CMP, page 7).

The Special Management Area is part of the Flanks Zone. The standard and guideline (S&G) that specifically addresses geothermal activity for this portion of the Monument is FZ-6. This S&G states "Subsurface geothermal exploration and development are permitted within these areas. No surface occupancy of any geothermal facilities is permitted." These areas have NSO stipulations.

Table 1: Summary of Deschutes National Forest LRMP Direction, Monument Legislation, and NNVM Comprehensive Management Plan

Management Area	Summary of Leasing	Guidance, Standards and Guides, and Stipulations
LRMP – Forest Wide Goals, Desired Future Condition, and Standards and Guidelines		
Forest Management Goals		Provide for exploration, development, and production of energy resources on the Forest while maintaining compatibility with other resource values.
Desired Future Condition - Energy		Geothermal leases and permits have been issued in a timely way. Drill pads, pipelines, power plants, and electrical transmission lines, to the extent possible, are designed and located to minimize impacts on other resources, particularly visual quality.
Energy Resources - Geothermal	Leasing with No Surface Occupancy Stipulation	EN-6: There will be no occupancy of the surface of the land in management areas listed below. This stipulation can only be modified or eliminated through a separate NEPA review. Old Growth (MA-15) Wild and Scenic Rivers (MA-17)
	Leasing with Conditional Surface Use Stipulation	EN-7: General Forest (MA-8) Use when necessary to protect wildlife habitat and recreation areas Scenic Views (MA-9)
LRMP Management Area Standards and Guidelines		
General Forest (MA-8)	Geothermal leases will be issued.	M8-17: Conditional surface use and seasonal restrictions stipulations will be used to protect wildlife habitat and recreation areas
Scenic Views (MA-9)		M9-83 … All improvements are located, designed, and maintained to blend with the characteristic landscape. … Visual Quality Objectives should be met. M9-84: Trees may be removed within the Scenic Views Management Area where necessary to permit access to geothermal sites, … .
Old Growth (MA-15)		M15-11: No Surface Occupancy
Wild & Scenic Rivers Recreational River (M17)	Geothermal leases will be issued; New transmission lines will not be permitted.	M17-5: Leasing and development would be permitted with No Surface Occupancy. The situation will be reviewed as river management plans are developed."
Monument Legislation and CMP		
Monument (Public Law 101-522 Sec 4 (a)(1))	No geothermal leases will be issued.	Withdrawn from all forms of geothermal leasing laws
Special Management Area (Public Law 101-522 Sec 4 (a)(5))	Geothermal leases will be issued.	No Surface Occupancy
Flanks Zone (FZ-6)		

Other Law, Regulation, Policy

Analysis and documentation has been done according to direction contained in the National Forest Management Act, the National Environmental Policy Act, the Council on Environmental Quality regulations, National Environmental Policy Act (NEPA) regulations, The Endangered Species Act, Magnuson-Stevens Fishery Conservation And Management Act of 2000, the National Historic Preservation Act, the Clean Air Act, and the Clean Water Act, and the Rescissions act, Public Law 104-19, Section 504.

The following is a brief explanation of each of these laws and their relation to the current project planning effort.

Final Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States (PEIS) (December 2008). This EA tiers to the PEIS, which facilitates "geothermal leasing of the federal mineral estate by allocating lands as open or closed to leasing, developing a reasonably foreseeable development scenario, and adopting stipulations, BMPs, and procedures for leasing." The lands under analysis for consent to lease are within those that are open to leasing as provided in the PEIS. The reasonably foreseeable development scenario is used in the effects analysis.

Federal Land Policy and Management Act (FLPMA) of 1976, as amended, (Public Law 94-579), October 2001: Among other things, FLPMA establishes public land policy; establishes guidelines for its administration; and provides for the management, protection, development, and enhancement of the public lands. FLPMA also establishes the BLM's multiple-use mandate to serve present and future generations and directs that on BLM leases the management plan in place be used for guidance.

National Forest Management Act (NFMA) of 1976, as amended (Public Law 94-588): NFMA requires that all National Forests develop Land and Resource Management Plans to guide allowable uses and activities on National Forest System Lands, and that all activities be consistent with those plans.

Final Environmental Impact Statement and Record of Decision for the Special Areas; Roadless Area Conservation, 2001: The Roadless Area Conservation (36 CFR 294.12 and 13) "prohibits road construction, reconstruction, and all timber cutting within Inventoried Roadless Areas (IRA)" and the direction provided by the Roadless Area Conservation will take precedence over the LRMP.

Programmatic Environmental Impact Statement (PEIS) and Record of Decision for Geothermal Leasing in the Western United States, December 2008: One of the goals of the Programmatic Environmental Impact Statement (PEIS) is to facilitate geothermal leasing decisions in the western United States. The PEIS was jointly prepared by BLM and Forest Service in cooperation with DOE, and includes a comprehensive list of stipulations, best management practices, and procedures to provide consistent guidance for geothermal exploration and development. This EA is consistent with the PEIS and incorporates by reference effects analyzed and addressed in the PEIS and Record of Decision.

National Energy Policy (May 2001) and Executive Order 13212 – Actions to Expedite Energy-Related Projects: The referenced Policy and Executive Order apply to energy-related projects and direct the federal agencies "to expedite projects that will increase the production, transmission, or conservation of energy", and "expedite their review of permits or take other action as necessary to accelerate the completion of such projects" (FR Vol. 66, No.99, Executive Order 13212 of May 18, 2001, Actions to Expedite Energy-Related Projects, Section 1 and 2, P. 28357).

Energy Policy Act of 2005 (Public Law 109-58): This Act applies to BLM and FS and directs the agencies to promote leasing and development of geothermal resources where appropriate on public lands.

Geothermal Steam Act of 1970 (Public Law 91-581): Under the terms of the Geothermal Steam Act and implementing regulations, BLM is required to respond to proposed geothermal plans, applications, and programs submitted by a lessee or the lessee's designated operator.

The American Antiquities Act of 1906: The American Antiquities makes it illegal to appropriate, excavate, injure, or destroy any historic, prehistoric ruin or monument, or any object of antiquity, situated on lands

owned by the Government of the United States, without permission of the Secretary of the Department of the Government having jurisdiction over the lands on which said antiquities are situated.

The National Historic Preservation Act of 1966, as amended: The National Historic Preservation Act requires Federal agencies to consult with American Indian Tribes, State and local groups before nonrenewable cultural resources, such as archaeological and historic structures, are damaged or destroyed. Section 106 of this Act requires Federal agencies to review the effects project proposals may have on the cultural resources in the Analysis Area.

The Endangered Species Act of 1973, as amended: The Endangered Species Act is to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such tests as may be appropriate to achieve the purpose of the treaties and conventions set forth in subsection (a) of this section." The Act also states "It is further declared to be the policy of Congress that all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act."

The National Environmental Policy Act (NEPA) of 1969, as amended: The National Environmental Policy Act is "To declare a national policy which will encourage productive and enjoyable harmony between man and his environment, to promote efforts which will prevent or eliminate damaged to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nations; and to establish a Council on Environmental Quality" (42 U.S.C. Sec. 4321). The law further states "it is the continuing policy of the Federal Government, in cooperation, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the present and future generations of "Americans". This law essentially pertains to public participation, environmental analysis, and documentation.

The Council on Environmental Quality (CEQ) promulgated the regulations for implementing NEPA (40 CFR parts 1500-1508) and 36 CFR 220.7 for environmental assessments in particular.. The CEQ has recently provided guidance on considering past actions in cumulative effects analysis (Memo to Heads of Federal Agencies, June 24, 2005) and mitigations and monitoring (Memo to Heads of Federal Agencies, January 14, 2011.

The Wild and Scenic Rivers Act of 1968: The purpose of the Wild and Scenic Rivers Act is to implement the declared policy of the United States to preserve certain rivers for the benefit and enjoyment of future generations and to prescribe mechanisms by which additional rivers may be added. A wild, scenic, or recreational river area eligible to be included in the system is a free-flowing stream with one or more Outstandingly Remarkable Values.

Migratory Bird E.O. 13186: On January 10, 2001, President Clinton signed an Executive Order (E.O. 13186) titled "Responsibilities of Federal Agencies to Protect Migratory Birds." This E.O. requires the *"environmental analysis of Federal actions, required by NEPA or other established environmental review processes, evaluates the effects of actions and agency plans on migratory birds, with emphasis on species of concern."*

Executive Order 13112 (invasive species): This 1999 order requires Federal agencies whose actions may affect the status of invasive species to identify those actions and within budgetary limits, "(i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species… (iii) monitor invasive species populations… (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded;…(vi) promote public education on invasive species… and (3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species… unless, pursuant to guidelines that it has prescribed, the agency had determined and made public… that the benefits of such actions clearly outweigh the potential harm caused

by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions."

The Clean Water Act, as amended in 1977 and 1982: The objective of the Clean Water Act (CWA) of 1972 is to restore and maintain the chemical, physical, and biological integrity of all waters. Under Section 319 of the 1987 CWA Amendments, States are required to determine those waters that will not meet the goals of the CWA, determine those non-point source activities that are contributing pollution, and develop a process on how to reduce such pollution to the "maximum extent practicable". Section 303(d) of the CWA requires that a list be developed of all impaired or threatened waters within each state. The Oregon Department of Environmental Quality (ODEQ) is responsible for compiling the 303(d) list, assessing data, and submitting the 303(d) list to the Environmental Protection Agency (EPA) for federal approval. Management direction for federal land management agencies regarding 303(d) listed waterbodies is that project activities should protect and not further degrade the parameters for which it is listed.

The following executive orders are associated with maintaining clean water:

- **Executive Order 11988:** requires agencies to avoid adverse impacts associated with the occupancy and modification of floodplains.
- **Executive Order 11990:** requires agencies to avoid adverse impacts associated with the destruction or modification of wetlands.
- **Executive Order 12088:** requires Federal compliance with pollution control standards (such as the Clean Water Act).

The Clean Air Act, as amended in 1990: The purposes of The Clean Air Act are "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population; to initiate and accelerate a national research and development program to achieve the prevention and control of air pollution; to provide technical and financial assistance to state and local governments in connection with the development and execution of their air pollution prevention and control programs; and to encourage and assist the development and operation of regional air pollution prevention and control programs."

Past Exploration, Development and Monitoring Projects

- **Newberry Geothermal Pilot Project FEIS and Record of Decision, 1994:** Outside of the NNVM boundary. In 1994 the DNF, Prineville District BLM, and Bonneville Power Administration analyzed potential effects of a proposed federal pilot project for geothermal exploration, development, and production of electrical energy on federal leases at Newberry, near the project area. The pilot project was approved by FS (as lead agency with BLM and Bonneville Power Administration as cooperating agencies) and several exploration wells were drilled, but the results were inconclusive and the project was suspended in 1996. An extensive and detailed environmental analysis was conducted for that project and some of the data may be relevant to the analysis of the proposed project; therefore, this NEPA document, and the three listed below, may be cited throughout this document where appropriate and are available at the Prineville District office.

- **Newberry Geothermal Exploration Project EA and Decision Record (DOI-BLM-OR-050-075) 2007:** Outside of the NNVM boundary. The 2007 EA and Decision Record issued by BLM are tiered to in this EA. The 2007 EA analyzed a Davenport Newberry exploration project that involves drilling deep geothermal exploration wells (10,000 feet deep or more) on three well pads each approximately 5 acres in size. All well pads were constructed and two wells have been drilled and continue to be monitored and evaluated.

- **Drilling, Testing, and Monitoring of up to 12 Temperature Gradient/Passive Seismic Geothermal Exploratory Wells (DOI-BLM-OR-P000-2010-003-EA) 2010:** Outside of the NNVM boundary. This 2010 EA and subsequent Decision Record issued by BLM and the Finding of No Significant Impacts issued by DOE are also incorporated by reference. This EA analyzed 12 sites for shallow small

diameter wells on ¼-acre well pad sites, to be used to collect geologic and seismic data to provide new information about the geology and potential geothermal resource in the area. Six wells have been drilled since 2011. Up to four of the 10 borehole MSA stations proposed for the EGS Project would be located at well sites previously analyzed and approved in this EA; therefore these NEPA documents may be cited and also incorporated by reference.

- **Newberry Volcano Enhanced Geothermal System (EGS) Demonstration Project (DOI-BLM-OR-P000-2011-0003-EA) 2012:** Outside of the NNVM boundary. This 2012 EA and subsequent Decision Record issued by BLM and the Finding of No Significant Impacts issued by DOE are also incorporated by reference. This EA analyzed and disclosed the environmental effects of developing and testing a geothermal reservoir created by using enhanced geothermal system (EGS) technologies as proposed by Davenport Newberry Holdings LLC and AltaRock Energy, Inc.

  As part of this project, two surface seismic stations and one strong motion sensor were placed within the Monument boundary in the Special Management Area. No drilling was connected with these surface monitors/sensors.

- **USGS Seismic Monitoring Stations (CE) 2011:** This categorical exclusion (CE) allowed for the installation of eight seismic monitoring stations in the Newberry Crater area. Two sites are within the Caldera Zone and one within the Flank Zone. These stations have been installed to provide timely warning to the public regarding volcanic activity.

Scoping and Public Involvement

In a letter dated March 6, 2008, BLM requested that the FS consent to allowing leases on 29 parcels, including the parcels displayed in Table 2, page 25. The Consent to Lease project was first listed in the Fall 2009 issue of the *Schedule of Projects for the Deschutes and Ochoco National Forests and Prineville District BLM*. The proposed action was presented to the public, Tribes and other agencies in a letter dated June 22, 2010.

Ten comments were received during the scoping period. Using the comments from the public, other agencies, and tribes, the interdisciplinary team determined a list of issues to address.

Following the letter of June 22, 2010, the Forest Service reduced the scope of this EA from 29 parcels (20,156 acres) to 11 parcels (6,174 acres). The original scoping included parcels under lease and due to expire by the end of 2012. The soon to expire leases were all extended by the BLM at the request of the lessees and are no longer a part of this analysis.

A meeting with the Klamath Tribes, specific to this project, was held at the Tribal offices on September 4, 2013 to discuss the consenting to lease of lands on the flanks of Newberry Caldera.

A 30-day public comment period for the EA was held from February 24, 2014 through March 26, 2014. Comments were received from seven respondents and are summarized in EA Appendix B, with Forest Service responses.

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 element. 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.

No key issues were identified that would provide a clear reason to develop other action alternatives other than to lease, with stipulations, or not to lease the nominated parcels.

Non-Key Issues

Non-key issues were 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 Council on Environmental Quality (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)…" A list of non-key issues and reasons regarding their categorization as non-key may be found below.

- The use of groundwater for the geothermal project and the effect to aquifers.

  The decision for this EA would be either grant or not grant the Consent to Lease. This EA does not propose or evaluate for any direct impacts on the land.

- Eliminate leases because they do not follow management direction.

  All geothermal mineral leasing would conform to all public laws, executive orders, and the Forest's management direction for General Forest, Scenic Views, Old Growth Management Areas, and Wild and Scenic Rivers.

- The EA does not address future action on the leases.

  In Chapter 2 of this EA, Typical Phases in Geothermal Development, page 40, describes potential geothermal projects on potential leased lands. This EA would only grant Consent to Lease of 11 parcels to the BLM. This project does not propose any geothermal activity that would have direct, indirect or cumulative impacts on the land.

- Protection of cave resources.

  All known cave resources are protected by the Federal Cave Resource Protection Act of 1988. The LRMP also addresses the importance of, public access to and management of caves for Townsend's Big-eared BatWL-64 – WL-71, pp. 61 and 62.

Project Record

This EA hereby incorporates by reference the Project Record (40 CFR 1502.21). The Project Record contains the complete Specialist Reports that may have been summarized in Chapter 3. The Project Record also contains other technical documentation used to support the analysis and conclusions in this EA. Chapter 3 provides a summary of or the complete Specialist Reports in adequate detail to support the decision rationale; appendices provide supporting documentation.

Incorporating these Specialist Reports and the Project Record help implement the Council on Environmental Quality (CEQ) Regulations provision that agencies should reduce NEPA paperwork (40 CFR 1500.4), that the document shall be "analytic rather than encyclopedic," and that the document "shall be kept concise and no longer than absolutely necessary" (40 CFR 1502.0). The objective is to furnish adequate site-specific information to demonstrate a reasoned consideration of the environmental impacts of the alternative and how these impacts can be mitigated, without repeating detailed analysis and background information available elsewhere. The Project Record is available for review at the Bend/Ft. Rock District Office, 63095 Deschutes Market Road, Bend, Oregon, Monday through Friday 7:45 a.m. to 4:30 p.m.

Decision to Be Made

The scope of the project and the decision to be made are limited to Consent to Lease with stipulations of Forest Service Managed Lands to the BLM. The project is limited to National Forest System land. This project and decision do not authorize geothermal with associated ground disturbing activities.

The Responsible Official for this proposal is the Forest Supervisor of the Deschutes National Forest. Based on response from the 30-day comment period, any changes made to the EA, and the disclosed analysis with mitigation, the Responsible Official will make a decision and document it in a Decision Notice (DN) and Finding of No Significant Impact (FONSI). The Responsible Official can decide to:

- Not grant consent to the BLM for geothermal leasing on the proposed parcels, or
- Grant consent to the BLM to offer none, some, or all of the proposed NFS parcels for geothermal leases, and
- Identify what stipulations would apply.

The decision regarding which alternative to choose will be determined by how the LRMP is met in each Alternative and the manner in which Alternative 2 responds to the issues.

CHAPTER 2: Alternatives

Introduction

This chapter describes Alternative 1 (No Action) and Alternative 2 (Proposed Action) that are considered for the Newberry Consent to Lease Project.

Alternatives Considered

Alternative 1 (No Action)

This alternative serves as a baseline for comparison of the effects of Alternative 2 (Proposed Action). Current management plans would continue to guide management. There would be no change in the level of ongoing management activities within the project area. If Alternative 1 (No Action) is decided upon, the decision would not consent to lease the nominated parcels.

Alternative 2 (Proposed Action) – Leasing with Stipulations

The FS would consent to the BLM to advertise and award leases. The BLM would advertise and issue the leases with identified stipulations. Parcels would first be offered at a competitive sale. If the parcels were not sold, the parcels would then be available for leasing non-competitively for two years. Table 2 provides information regarding each parcel, including the type of associated surface use.

Figure 4, page 27 through Figure 15, page 38 provide a visual display of each parcel, including the type of associated surface use that would occur with each parcel.

Table 2: Description of Alternative 2 (Proposed Action); Includes Parcels to be Leased, Legal Location (Willamette Meridian), Management Description, and Acres

Parcel Number	Legal Location	LRMP Management Areas (MA) Inventoried Roadless Area (IRA) Potential Wilderness Area (PWA)[1]	Parcel Acres
T21S R12E			
1	Section 9	MAs: Scenic Views, General Forest; IRA; PWA	561
2	Section 20	MA: General Forest	645
3	Section 31	MAs: Old Growth, Scenic Views, General Forest; Eligible Wild & Scenic River	614
T22S R12E			
4	Sections 14 and 15	MAs: Old Growth, Scenic Views, General Forest; IRA; PWA	1,050
T22S R13E			
5	Section 2	MA: Scenic Views	351
6	Sections 3, 9, and 10	MAs: Old Growth, Scenic Views NNVM Special Management Area; PWA	997
7	Section 17	MAs: Old Growth, Scenic Views IRA, PWA	176
8	Section 18	MA: Scenic Views; IRA; PWA	16
9	Section 19	MAs: Scenic Views, General Forest; IRA; PWA	492
10	Section 30	MAs: Scenic Views, General Forest	633
11	Section 31	MA: General Forest	639
Total Acres)			**6,174**

[1] Potential Wilderness Area: Areas meeting the criteria for potential wilderness.

Table 3: Description of Alternative 2 (Proposed Action); Includes Parcels to be Leased, Type of Lease, and Acres

Parcel	Acres			
		Stipulation		
	Standard Lease (SL)	Conditional Surface Use (CSU)	No Surface Occupancy (NSO)	Parcel Acres
1	205	210	146	561
2	640	3	2	645
3	0	0	614	614
4	301	169	580	1,050
5	0	247	104	351
6	0	0	997	997
7	0	123	53	176
8	0	6	10	16
9	78	384	30	491
10	622	11	0	633
11	592	0	47	639
Total Acres	**2,438**	**1,153**	**2,583**	**6,174**

Refer to page 45 for determinations of No Surface Occupancy (NSO) and Conditional Surface Use (CSU).

Figure 4: Newberry Geothermal Consent to Lease Nominated Parcels

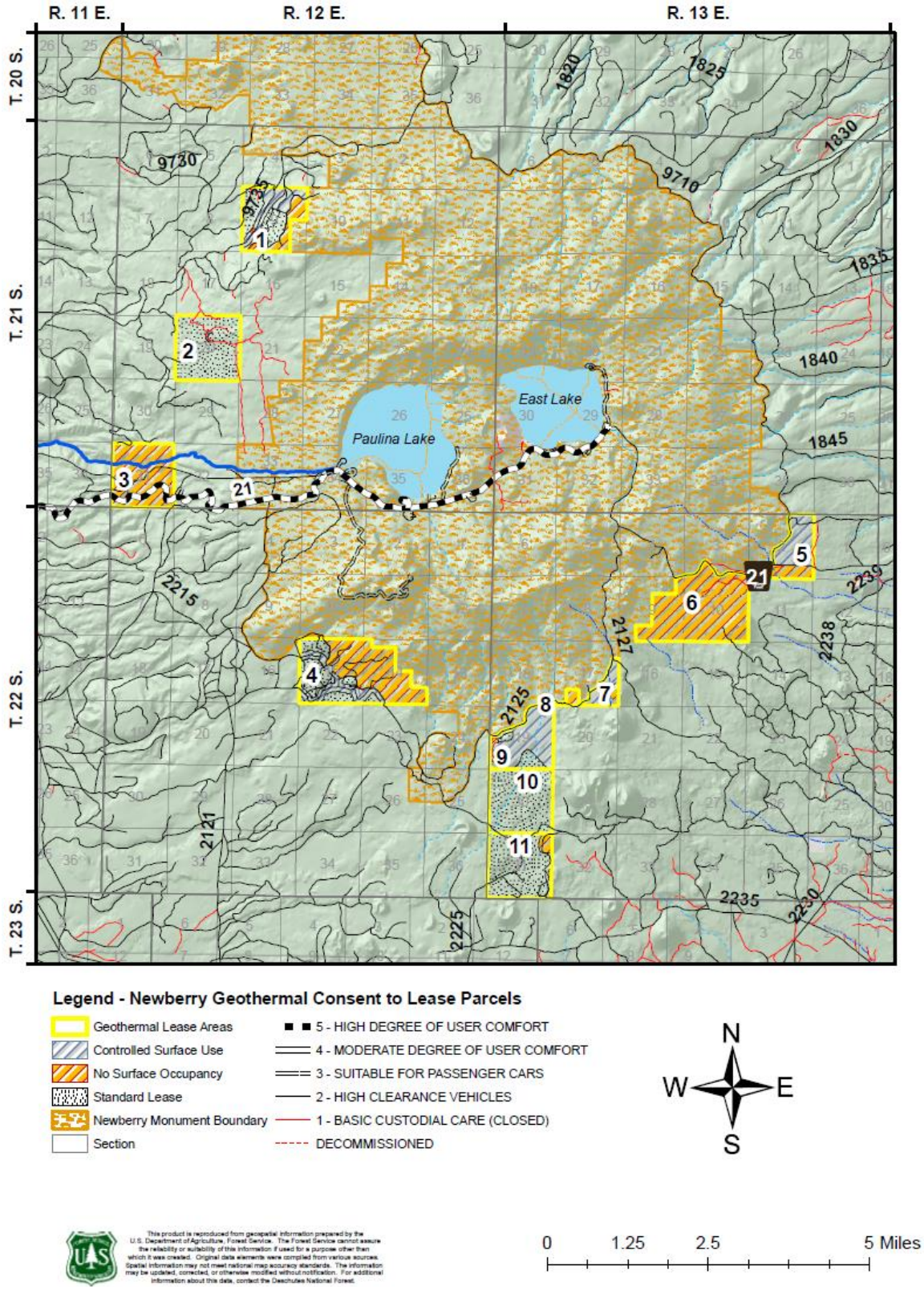


Figure 5: Newberry Geothermal Consent to Lease Parcel 1

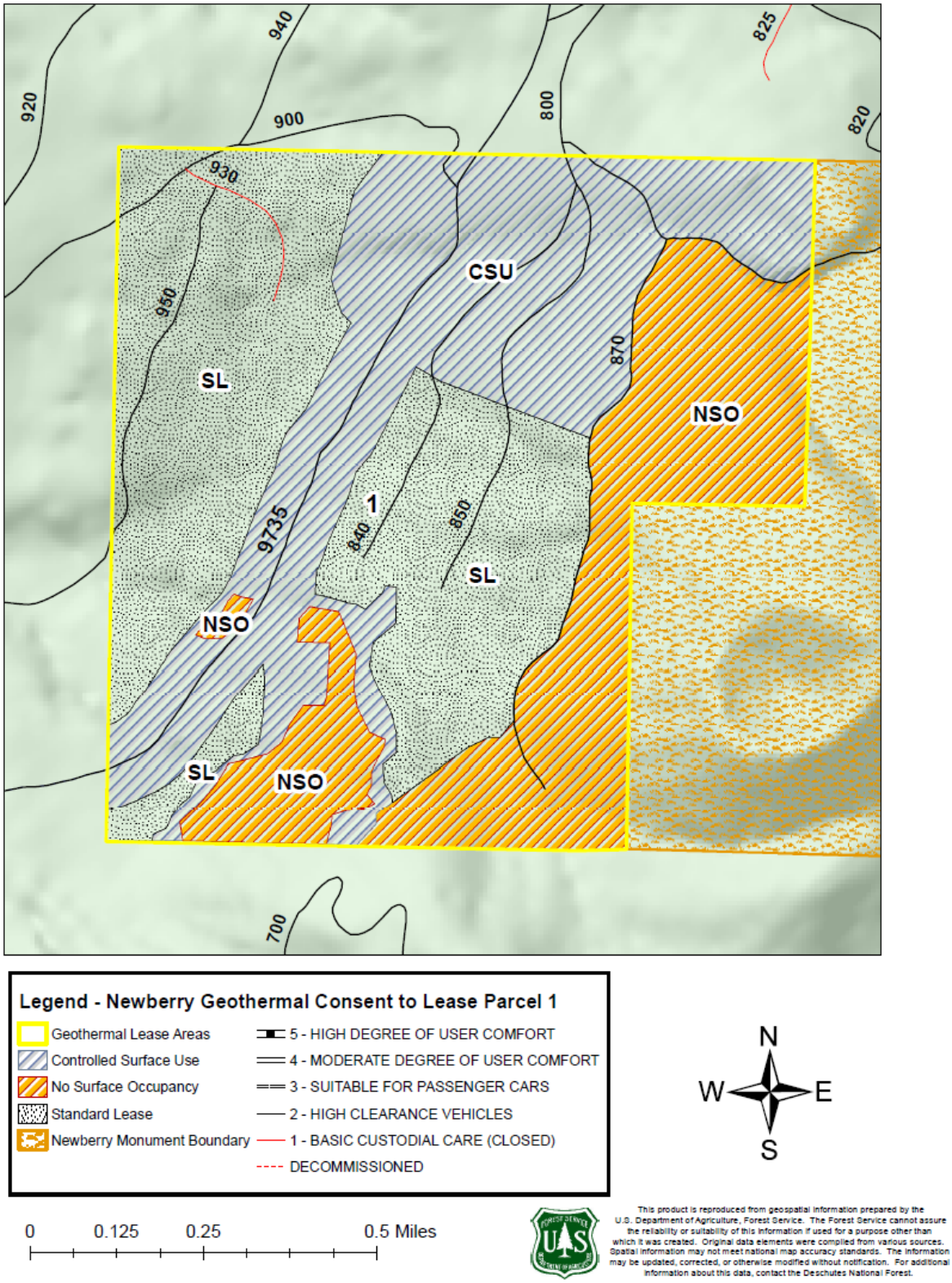


Figure 6: Newberry Geothermal Consent to Lease Parcel 2

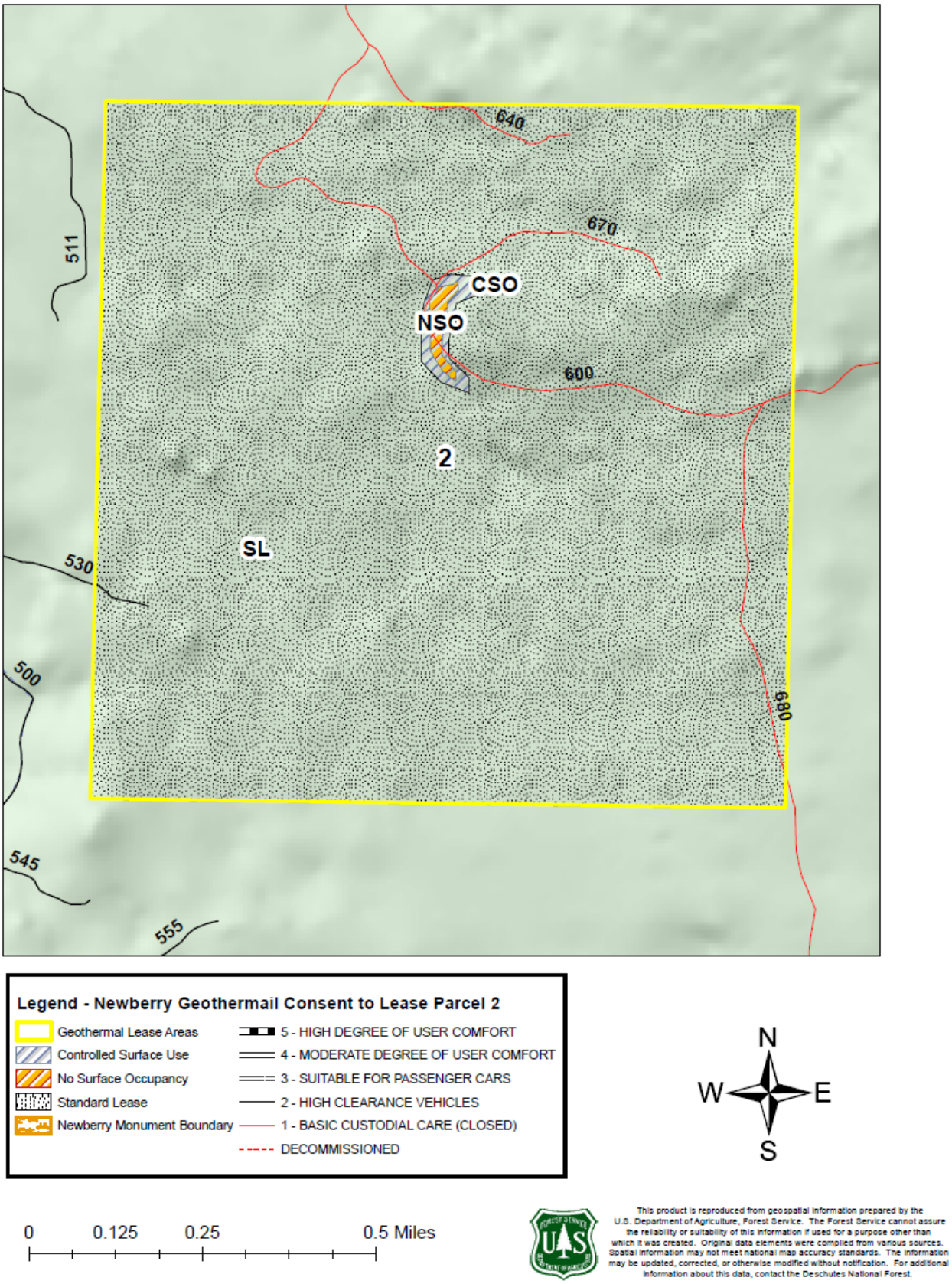


Figure 7: Newberry Geothermal Consent to Lease Parcel 3

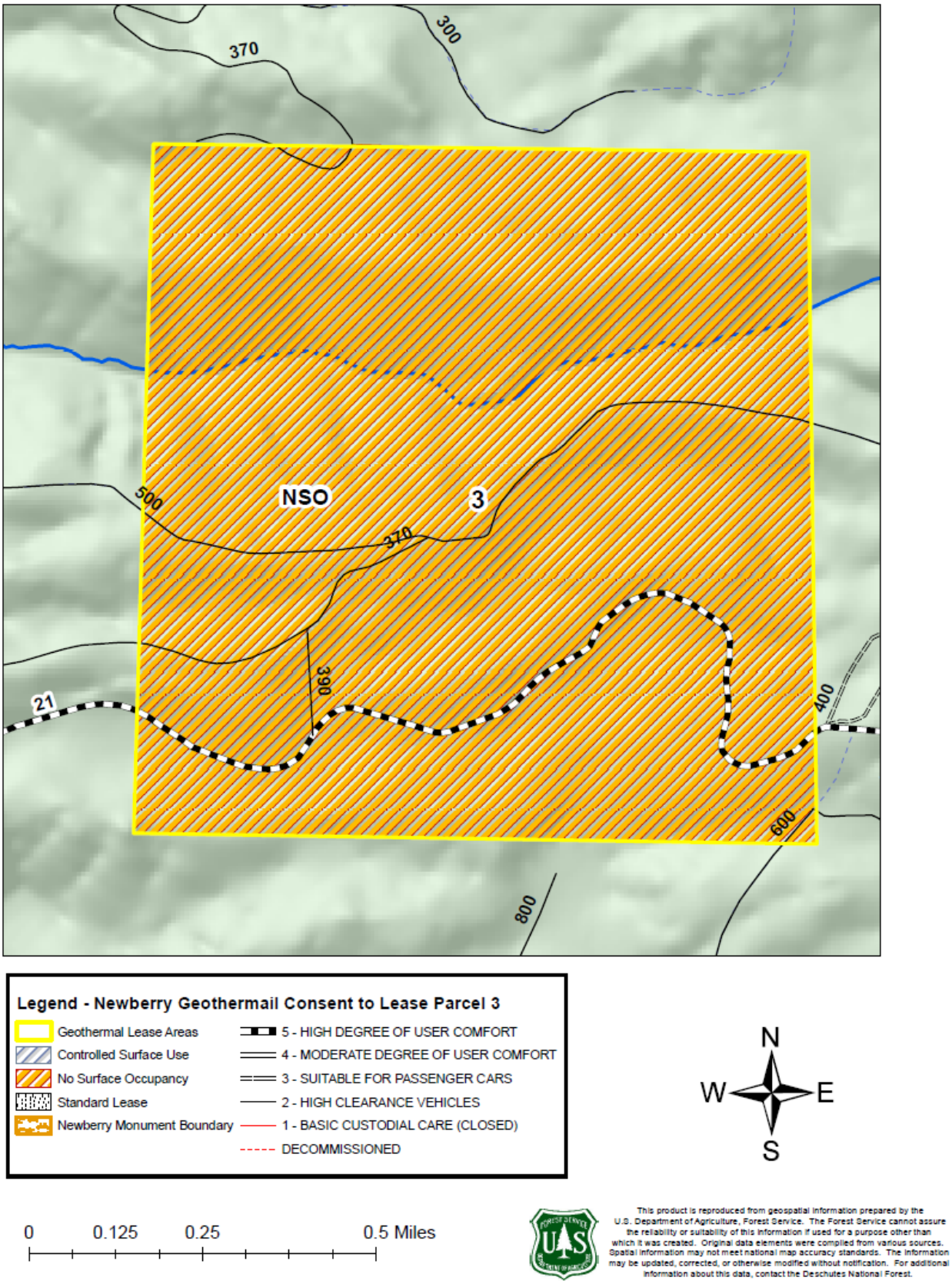


Figure 8: Newberry Geothermal Consent to Lease Parcel 4

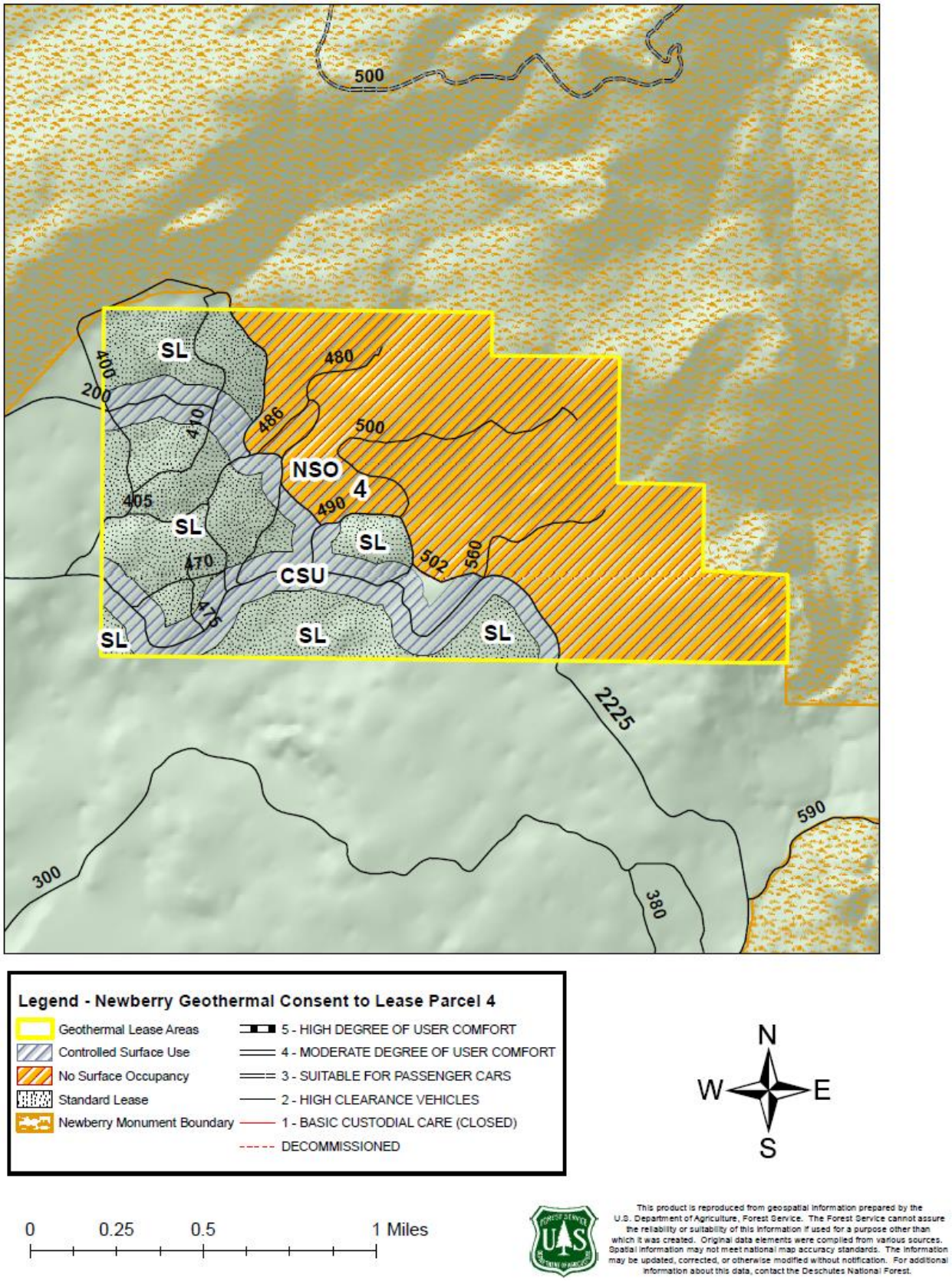


Figure 9: Newberry Geothermal Consent to Lease Parcel 5

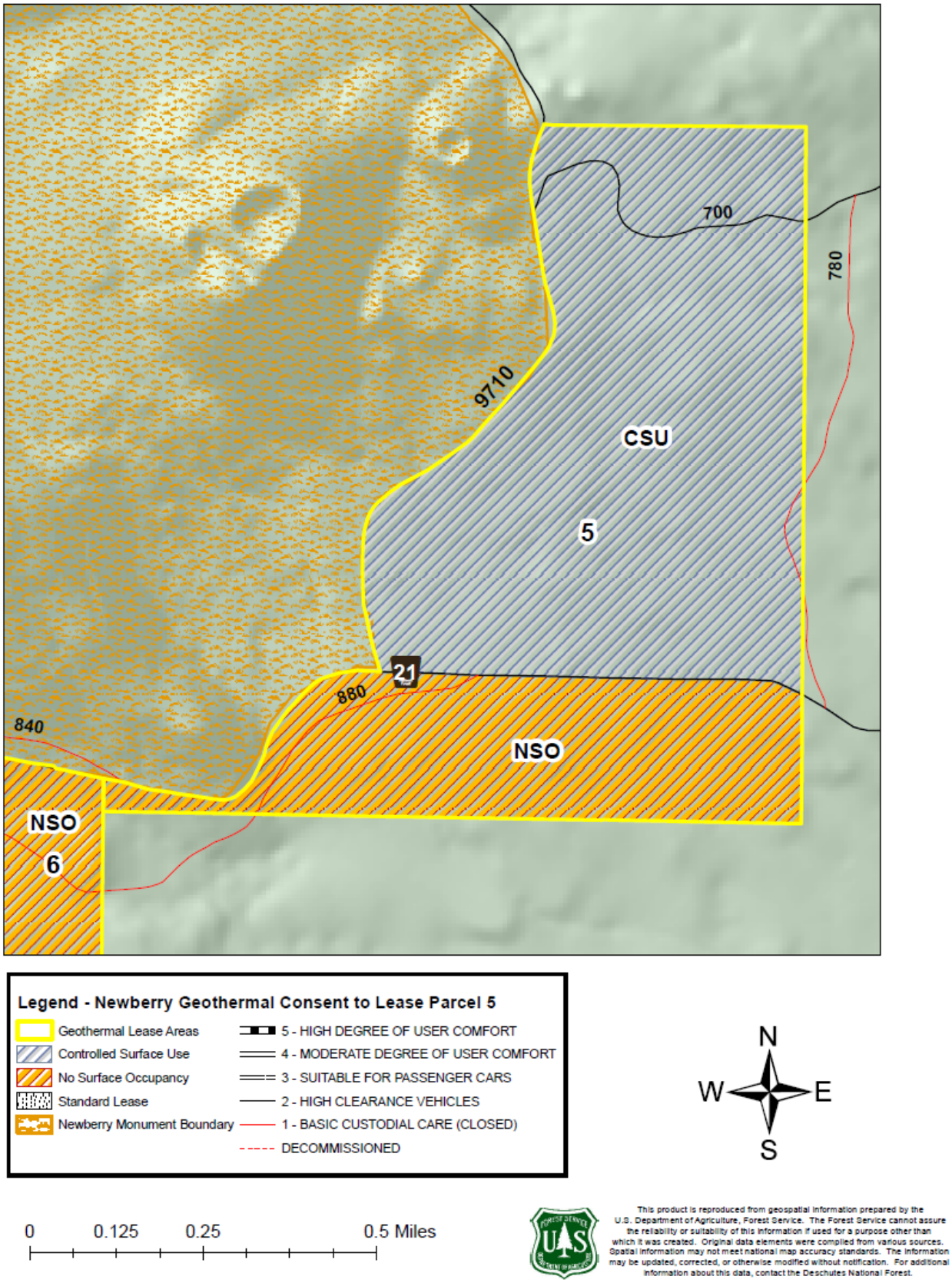


Figure 10: Newberry Geothermal Consent to Lease Parcel 6

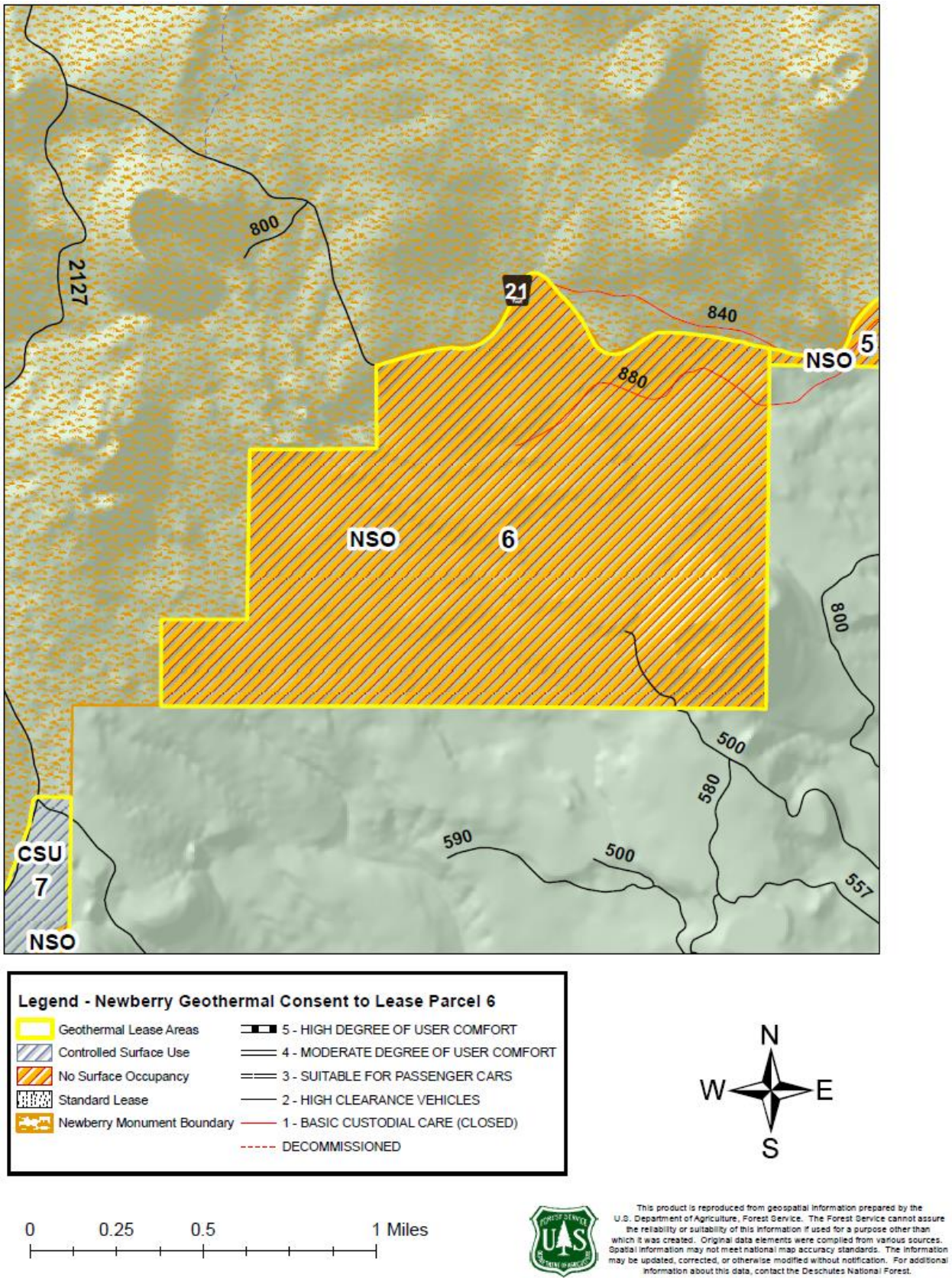


Figure 11: Newberry Geothermal Consent to Lease Parcel 7

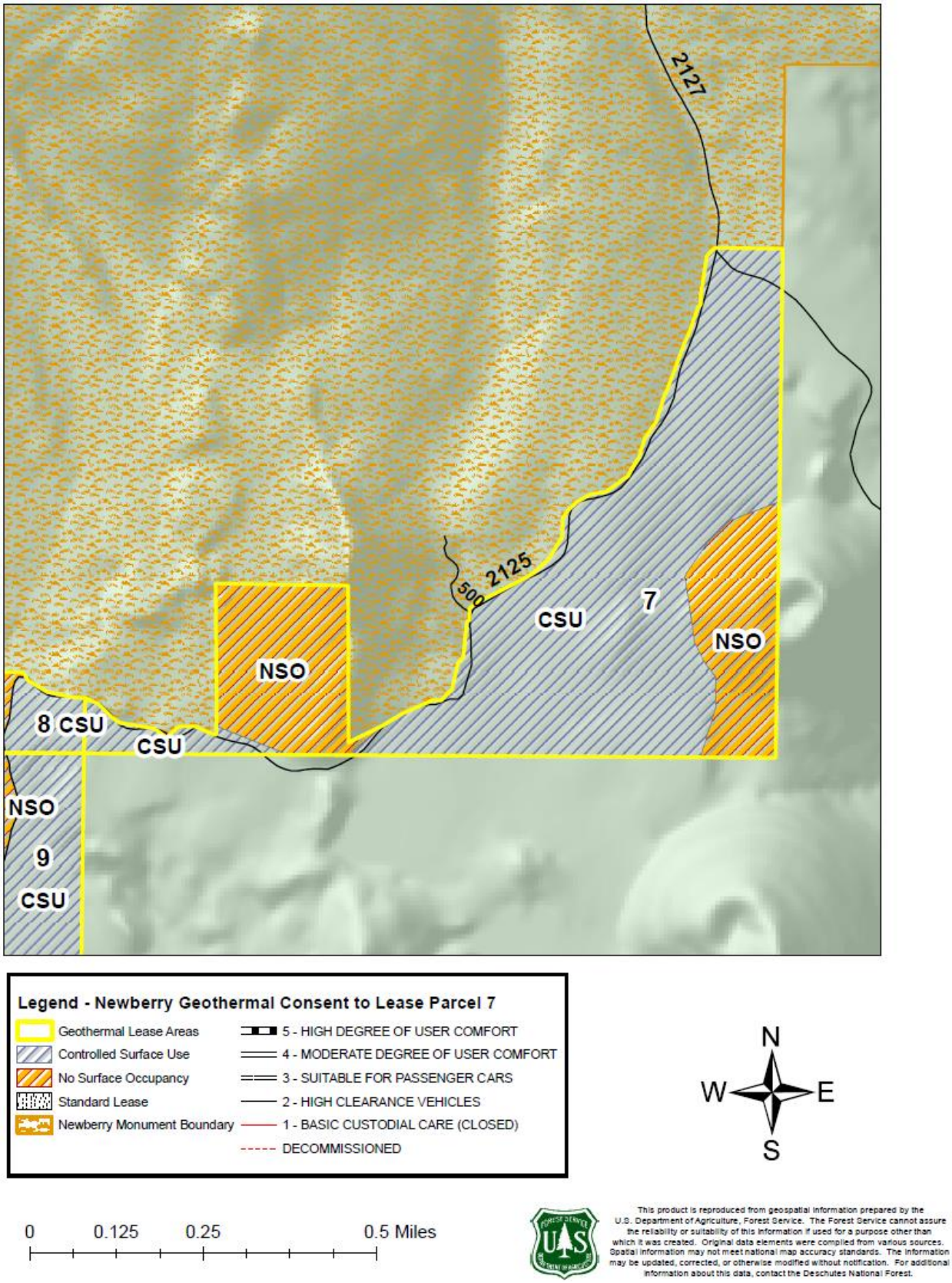


Figure 12: Newberry Geothermal Consent to Lease Parcel 8

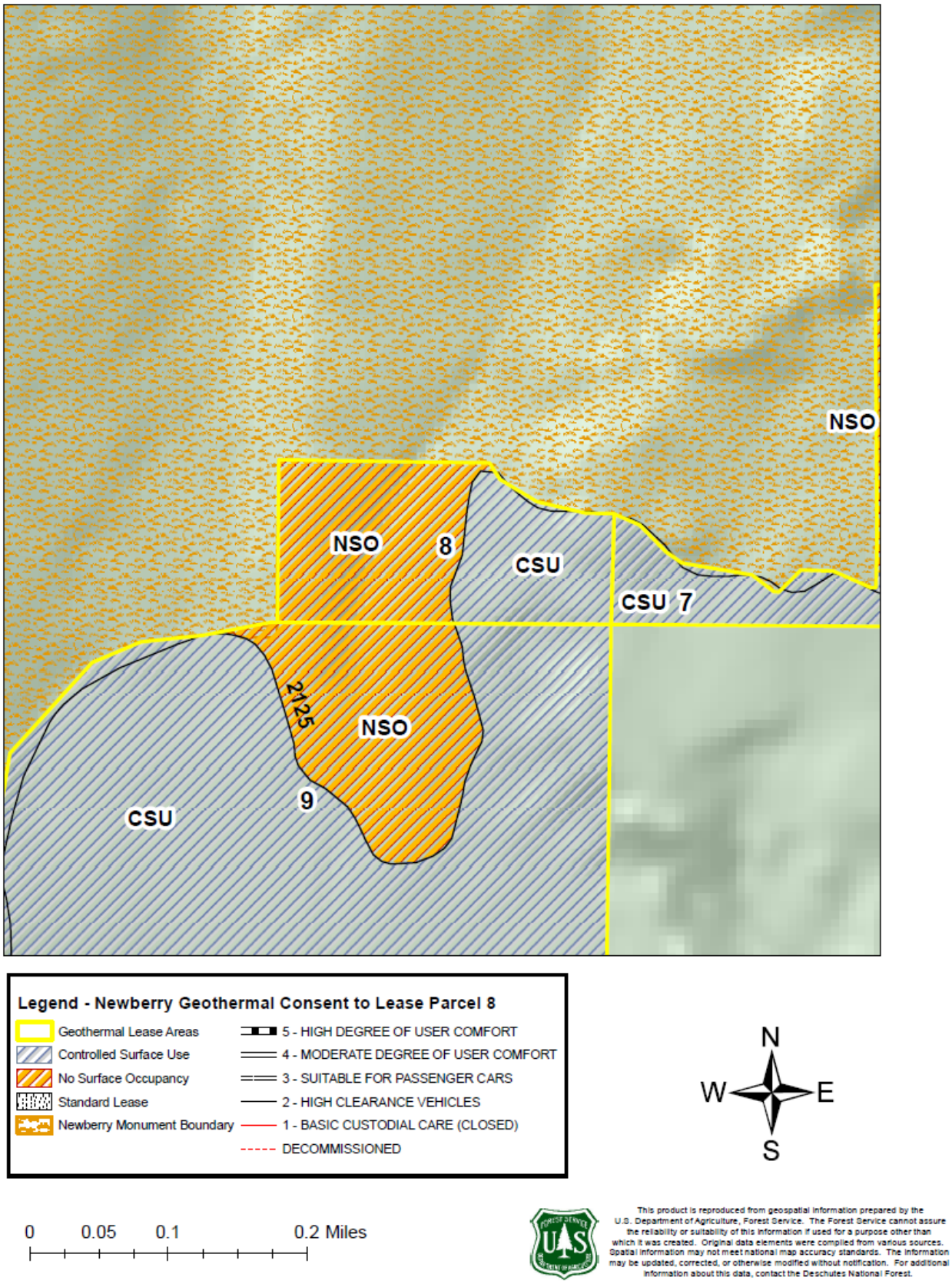


Figure 13: Newberry Geothermal Consent to Lease Parcel 9

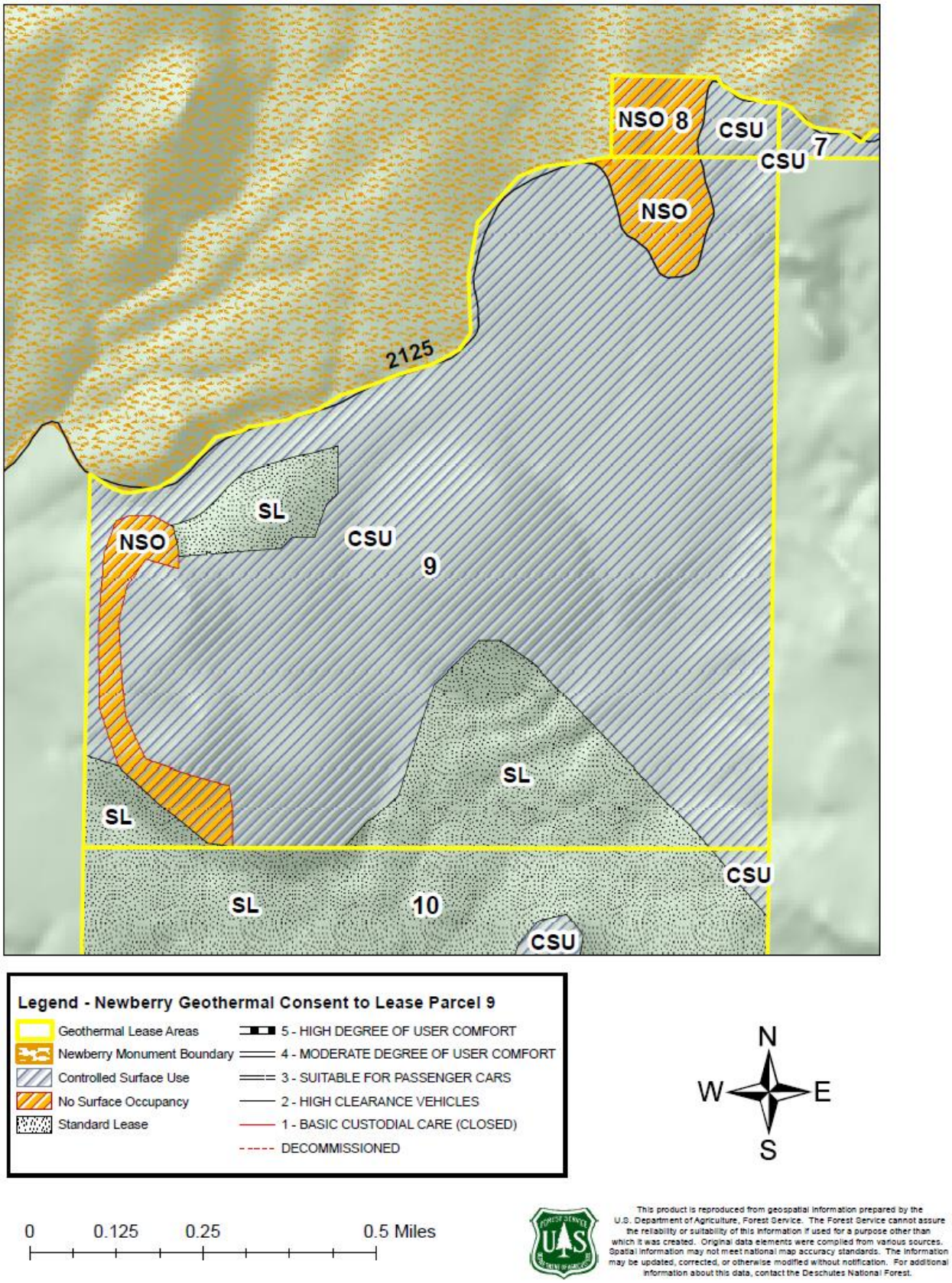


Figure 14: Newberry Geothermal Consent to Lease Parcel 10

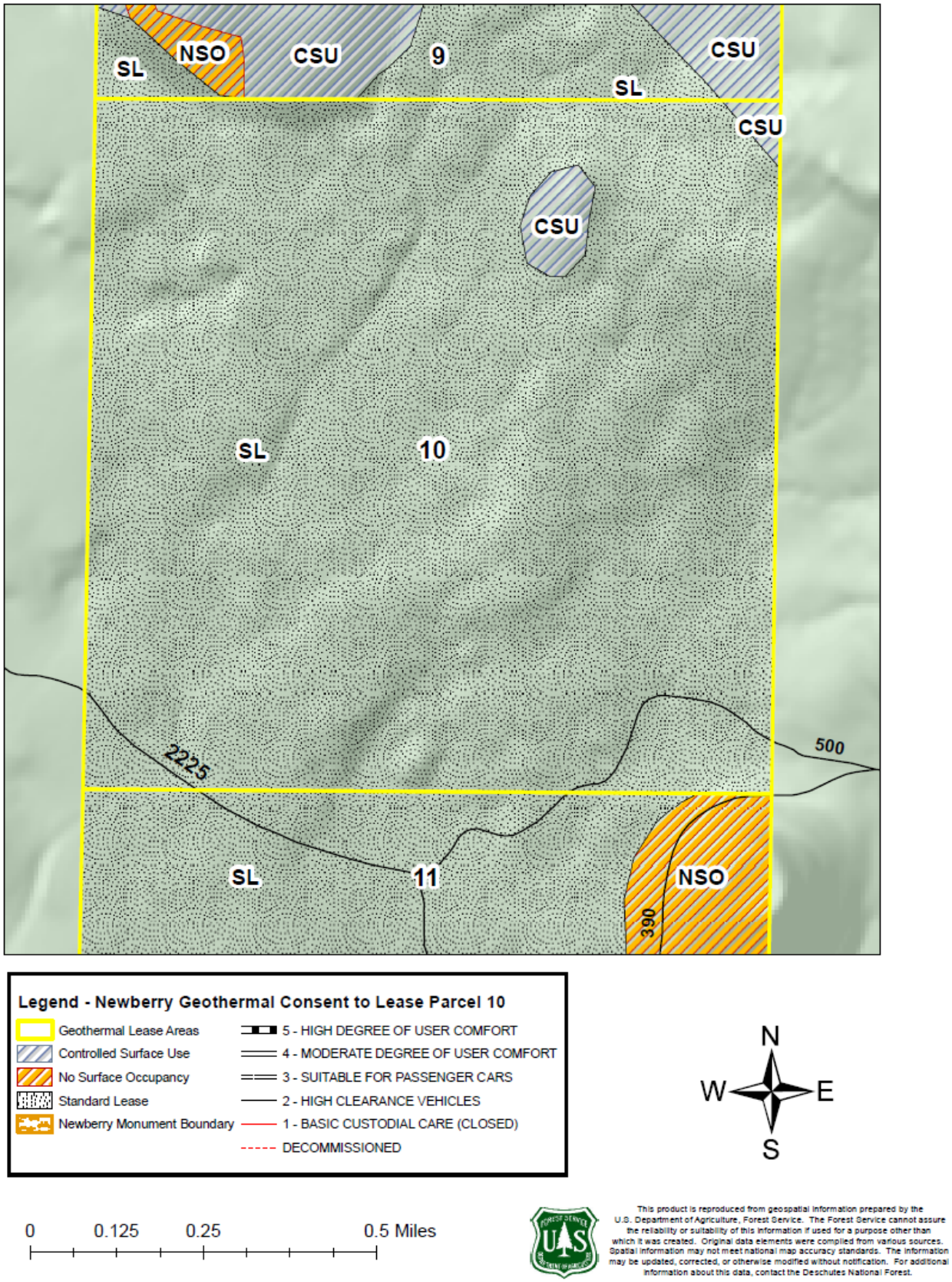
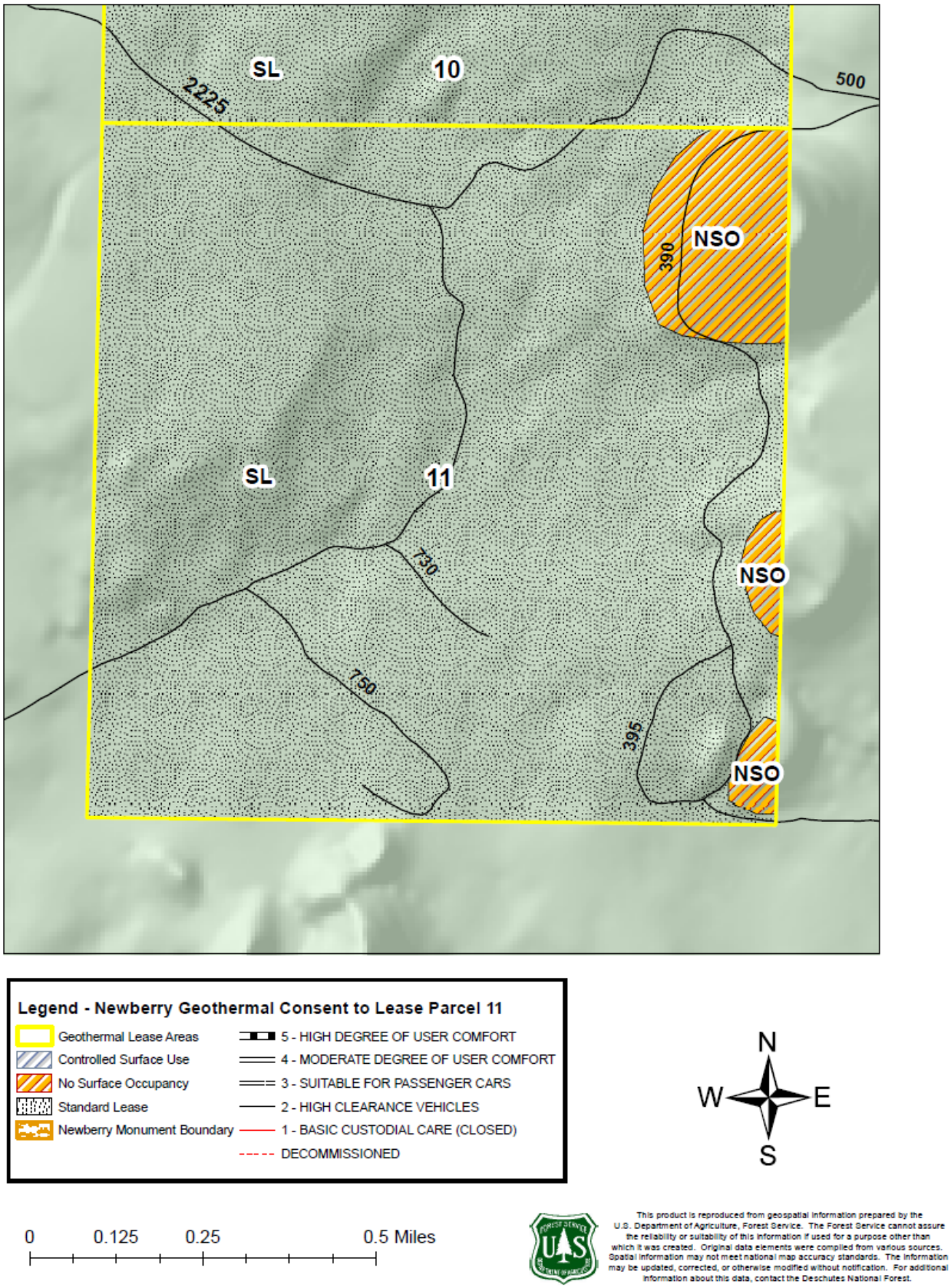


Figure 15: Newberry Geothermal Consent to Lease Parcel 11



Reasonably Foreseeable Development Activities

Consenting to Lease does not propose any ground disturbing activities. Therefore, there would not be any direct, indirect, or cumulative effects to the environment. The FS would only consent to allowing the BLM to advertise and lease, with stipulations, NFS lands for potential exploration and development of geothermal energy. Prior to any future exploration or development activities, site specific NEPA analysis must be completed.

The following reasonably foreseeable development (RFD) scenario (PEIS pp. 2-40 through 2-48) serves as a basis for a discussion of the potential environmental impacts resulting from the potential future leasing and development of Federal geothermal resources over the next 20 years. A variety of factors (e.g., economic, social, and political) are beyond the control of the Forest Service and will influence the demand for geothermal resources. Therefore, the RFD scenario (Table 4) is a best professional estimate of what may occur if NFS lands are leased. It is not intended to be a "maximum-development" scenario; however, it is biased towards the higher end of expected development and shows where the potential development might occur. If future development eventually exceeds RFD predictions, then the Forest Service will assess the impacts to the resources under the context of the analysis provided in the Programmatic Environmental Impact Statement (PEIS) or specific land use plans and determine if additional analysis is warranted.

The RFD was developed for the PEIS, and was based on a review of recent government and industry reports providing assessments of geothermal potential across the western US (Western Governors' Association 2006; DOE and BLM 2003; NREL 2006; BLM 2007a; Geothermal Energy Association 2007a) and the typical impacts associated with geothermal development (GeothermEx, 2007), PEIS pp. 2-34 through 2-35. Few quantitative evaluations have been conducted at this scale, and those that exist are considered largely speculative due to the wide array of variables around future geothermal development. These variables include the speculative estimation of unexplored geothermal resources, the development of geothermal technologies that may allow for extraction of resources currently unusable, the unknown nature of future energy markets, and the unknown future of regulatory and political climates. While some reports cite substantial barriers to geothermal development, current movements in energy markets as well as political and regulatory climates look favorable for an expansion of geothermal energy development to move forward.

Table 4: Summary Table of Typical Phases in Geothermal Development, Objectives, and Associated Activities

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, 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; or 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; wellfield equipment; power plant; 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

Typical Phases in Geothermal Development		Objectives	Activities
			contours; replant vegetation.

Typical Phases in Geothermal Development

This RFD for geothermal resources use involves four sequential phases: (1) exploration, (2) drilling, (3) utilization, and (4) reclamation and abandonment. The success or failure of each phase affects the implementation of subsequent phases, and, therefore, subsequent environmental impacts. Development of geothermal resources is unique to the industry, but many activities are similar in scope to other fluid minerals (e.g., oil and gas), such as surveying, drilling, site development (site clearing, well pads and roads), and reclamation and abandonment. The general assumptions outlined in the following four phases serve to establish RFD scenarios for analyzing future environmental impacts that may result from development following BLM issuance of leases for geothermal resources within the identified area of geothermal potential. It should be noted that the RFD scenario permits a general evaluation of the types of impacts that may occur but cannot accurately predict the magnitude and extent of these impacts. This is due in part to the uncertainty about the timing, location, distribution of the geothermal resources, and the likely types of development.

Phase One: Geothermal Resource Exploration

Before geothermal resources are developed, a geothermal resource developer explores for evidence of geothermal resources on leased or unleased land. Exploration includes ground disturbance but does not include the direct testing of geothermal resources or the production or utilization of geothermal resources. Exploration operations include, but are not limited to, geophysical operations, drilling temperature gradient wells, drilling holes used for explosive charges for seismic exploration, core drilling or any other drilling method, provided the well does not reach the geothermal resource. It also includes related construction of roads and trails, and cross-country transit by vehicles over public land. Exploration involves first surveying and then drilling temperature gradient wells. It generally takes between one and five years to complete exploration.

Surveying includes conducting or analyzing satellite imagery and aerial photography, volcanological studies, geologic and structural mapping, geochemical surveys, and geophysical surveys of leasable areas that could support geothermal resource development. The surveys consist of collecting electrical, magnetic, chemical, seismic, and rock data. For example, water samples from hot springs could be used to determine the subsurface characteristics of a particular area. Once the data are compiled, geologists and engineers examine the data and make inferences about where the higher temperature gradients may occur. High temperature gradients can indicate the location of potential underground geothermal reservoirs capable of supporting commercial uses.

Surveys may require creating access using four-wheel drive vehicles, or by helicopters or on foot to areas with no roads or very poor roads. Cutting of vegetation may be required in some areas to facilitate access. In some cases, gas collectors may be installed to measure soil gases. These collectors have partially buried sensors and may disturb small areas of less than three square feet (BLM2007b).

While not widely used for geothermal surveys, seismic surveys have the greatest survey impact on the local environment. These surveys typically involve setting up an array of geophones and creating a pulse or series of pulses of seismic energy. The pulse is created either by detonating a small charge below the ground surface (requires drilling a narrow “shot hole”) or by a vibroseis truck that is driven through the survey area. 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 (BLM 2007b).

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 (BLM 2007b).

The second step of the exploration phase is to drill temperature gradient wells on leased or unleased land. This process confirms a more precise location of high temperature gradients. Temperature gradient wells can be drilled using a truck-mounted rig and range from 200 feet to over 4,000 feet deep. The number of gradient wells also varies, depending on the geometry of the system being investigated and the anticipated size of power development. Geologists examine either rock fragments or long cores of rock that are brought up from deep within the well. Water samples are taken from any groundwater encountered during drilling. Also, temperatures are measured at depth. Both well temperatures and the results of rock sample analyses are used to determine if additional exploration is necessary to identify the presence and characteristics of an underground geothermal reservoir. After collecting the desired materials and data, the wells are completed with sealed, water-filled tubing from surface to bottom, often with cement around the tubing (BLM2007b).

Most temperature gradient wells are drilled with a small rotary rig (often truck-mounted) similar to that used for drilling water wells, or a diamond-coring rig, similar to that used for geologic sampling in mineral exploration and civic works projects. Neither rig of this size requires construction of a well pad or earth moving equipment unless the site is sharply graded. Support equipment is needed, including water trucks, tanks for mixing and holding drilling fluids, personnel and supply transport vehicles, and sometimes a backhoe for earthmoving activities is needed to prepare the drilling site. A temperature gradient drilling operation can be run by about three on-site personnel and others traveling to the site periodically with materials and supplies (BLM 2007b).

Temperature-gradient well drilling requires road access. Whenever possible, a driller would access the temperature gradient well site using existing roads. When existing roads are not available, new access roads may need to be constructed for the truck-mounted rig to reach the site; this could require one to six acres of disturbance.

Preparing the site for drilling could include leveling the surface and clearing away vegetation. Several temperature gradient wells are usually drilled to determine both the areal extent of the temperature anomaly and where the highest temperature gradient occurs. Each drill site could disturb approximately 0.10 acres, and the drill rig could be approximately 60 feet tall. During exploration, a driller is not permitted to produce any geothermal fluids out of or inject any geothermal fluids into the well. Additionally, a diesel generator may also be used at the site to power equipment. The well site itself involves excavation of a small cellar (typically less than three feet square and less than three feet deep) to allow the conductor casing to be set beneath the rig. Drilling may last for several weeks.

Temperature gradient wells are not intended to directly contact the geothermal reservoir, and therefore produce no geothermal fluids. In cases where a temperature gradient well does penetrate a geothermal zone, any release of geothermal fluids at the surface is likely to be minimal due to the small well diameters and the use of blow-out prevention equipment (BLM 2007b).

Drilling fluids may include drilling mud (bentonite clay, activated montmorillonite clay and crystalline silica-quartz), drilling mud additives (caustic soda, sodium bicarbonate, and anionic polyacrylamide liquid polymer), cement (Portland cement and calcium chloride), fuel (diesel), lubricants (usually petroleum-based) and coolants. The specific fluids and additives used depend on a variety of factors, including the geologic formations being penetrated and the depth of the well. Releases of drilling muds are not permitted; a sump and tanker truck are required to capture all fluids. The risk of spills of other

fluids is similar to that of any other project involving the use of vehicles and motorized equipment (BLM 2007b).

All surface disturbances would be reclaimed to the satisfaction of BLM and FS. If a temperature gradient well was unsuccessful, it would be abandoned, and the drill site would be reclaimed. Abandonment includes plugging, capping, and covering the wells. Reclamation includes removing all surface equipment and structures, re-grading the site to pre-disturbance contours, and replanting native or appropriate vegetation to facilitate natural restoration.

Phase Two: Drilling Operations

Once exploration has confirmed a viable prospect for commercial development and necessary leases have been secured, the drilling of exploration wells to test the reservoir can proceed. Drilling operations include flow testing, producing geothermal fluids for chemical evaluation or injecting fluids into a geothermal reservoir. This would also involve the construction of sumps or pits to hold excess geothermal fluids. It could involve development of minor infrastructure to conduct such operations.

Drilling is an intense activity that requires large equipment (e.g., drill rig) and typically takes place 24 hours a day. A drilling operation generally has from 10 to 15 people on-site at all times, with more people coming and going periodically with equipment and supplies. Getting the rig and ancillary equipment to the site may require 15 to 20 trips by full-sized tractor-trailers; with a similar amount for de-mobilizing the rig. There would be 10 to 40 daily trips for commuting and hauling in equipment (BLM 2007b).

If a reservoir is discovered, characteristics of the well and the reservoir are determined by flow testing the well. If the well and reservoir were sufficient for development, a wellhead, with valves and control equipment, would be installed on top of the well casing. Excess geothermal fluids are stored in temporary pits or sumps, generally lined with plastic (small sumps) or clay (large sumps). The water is left to evaporate and any precipitate is removed and properly disposed.

If no or minimal amounts of geothermal fluids are encountered but sufficient heat is discovered then development may involve Enhanced Geothermal Systems (EGS). EGS involves creating a reservoir by injecting water, under pressure, to induce shear slip on existing fractures. This is termed as "hydroshearing." Hydroshearing increases permeability of the geothermal reservoir and induces 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 a documented occurrence of an induced seismic event reaching a magnitude of 3.7 at Cooper Basin, Australia (AltaRock Energy 2008). Until seismicity, stratigraphy and tensile strength of the rock at depth is determined through exploration in the lease area it would be very speculative to determine the intensity or quantity of induced seismicity events associated with geothermal development.

Phase Three: Utilization and Production

Utilization and production is the next phase after a viable reservoir is determined and includes the infrastructure needed for commercial operations, including access roads, construction of facilities, building electrical generation facilities, drilling and developing well fields, and installing pipelines, meters, substations, and transmission lines. The utilization phase could last from 10 to 50 years and involves the operation and maintenance of the geothermal field(s) and generation of electricity. The type of utilization that occurs is based on the size and temperature of the geothermal reservoir. Geothermal resources can be classified as low temperature (less than 90°C, or 194°F), moderate temperature (90°C to 150°C, or 194 to 302°F), and high temperature (greater than 150°C, or 302°F). Only the highest temperature resources are generally used for generating electrical power; however, with emerging technologies and in colder climates such as Alaska, even the lower temperature resources are proving viable for electrical generation.

High temperature reservoirs are suitable for the commercial production of electricity. Three types of power plants that harness geothermal resources are dry steam plants, flash steam plants, and binary-cycle plants. Occasionally a hybrid between flashed steam and binary system is also used.

- Dry steam power plants use the steam from the geothermal reservoir as it comes from the wells and route it directly through turbine/generator units to produce electricity.
- Flash steam power plants use water at temperatures greater than 182°C (360°F). Water is pumped under high pressure to the generation equipment at the surface, the pressure is suddenly reduced, allowing some of the hot water to convert, or "flash," into steam, and the steam is used to power the turbine/generator units to produce electricity.
- Binary-cycle power plants use water from the geothermal reservoir to heat another "working fluid." The working fluid is vaporized and used to turn the turbine/generator units. The geothermal water and the working fluid never come in contact with each other. Binary-cycle power plants can operate with lower water temperature 74°C to 182° C (165°F to 360°F) and produce few air emissions. It should be noted that these systems are closed loop systems; 100 percent of the geothermal fluids are re-injected back into the reservoir.

Development of the lease would involve the following construction and operations:

Access roads: New access roads to accommodate the larger equipment associated with the development phase could be constructed. In general, a plant can require 1/2 mile to nine miles of roads in order to access the site, well pads, and power plant. Depending on the type and use-intensity of the road, the areas of surface disturbance is about 30-feet wide for an 18-20 foot wide road surface, including cut and fill slopes and ditches.

Drill site development: Multiple wells may be drilled per lease. Production-size wells can be over two miles (10,560 feet) deep. The number of wells is dependent upon the geothermal reservoir characteristics and the planned power generation capacity. For example, a 50MW (net) power plant could require up to 25 production wells and 10 injection wells. It is common that multiple wells would be installed on a well pad. The size of the well pad is dependent upon site conditions and on the number of wells for the pad, but they are typically about one to five acres, including minor cut and fill. In order to drill these deep holes, a large drilling rig or derrick would be erected. Various temporary support facilities may be located on-site, including generators, mud tanks, cement tanks, trailers for the drillers and mud loggers, housing trailers, and storage sheds. As appropriate, facilities can be painted to blend in with the surrounding environment. Drilling operations typically occur 24 hour a day.

Wellfield equipment: A geothermal power plant is typically supported by pipeline systems in the plant's vicinity. The pipeline systems include a gathering system for produced geothermal fluids, and an injection system for the reinjection of geothermal fluids after heat extraction takes place at the plant. Pipelines are usually 24 to 36 inches in diameter, but can be as small as 8 inches depending on the type of pipeline. Pipelines transporting hot fluids or steam to the plant are covered with insulation, whereas injection pipelines are generally not. Where feasible, they would parallel the access roads and existing roads to the destination of the geothermal resource's steam or water. Pipelines are typically constructed on supports above ground, resulting in little if any impact to the surrounding area once construction is complete and the corridor has been revegetated. The pipelines typically have a few feet of clearance underneath them, allowing small animals to easily cross their path. The pipelines are typically painted to blend in with the surrounding environment. In general, plants have about 1½ to seven miles of pipes with a corridor width of about 25 feet.

Power plant: A 50 MW plant would utilize a site area of up to 20 to 25 acres to accommodate all the needed equipment, including the power plant itself, space for pipelines geothermal fluids and reinjection, a switch yard, space for moving and storing equipment, and buildings needed for various

purposes (power plant control, fire control, maintenance shop, etc.). The power plant itself would occupy an estimated 25 percent of this area for a water-cooled plant, or about 50 percent for an air-cooled plant. Where topography permits, the power plant could be situated so as to be less visible from nearby roads, trails, scenic vistas or scenic highways. The site of the plant requires reasonable air circulation to allow for efficient operation of the plant's condensers. A smaller, 20 MW plant would typically require approximately five to ten acres for the entire complex.

Electric transmission lines: Transmission lines may range in length from 5 miles to 50 miles with a corridor width of approximately 40 feet. Wooden poles most likely support them, and about 5 acres could be disturbed per mile of transmission line.

Reclamation: When a production well is successful, a wellhead with valves and control equipment is installed on top of the well casing. If a production well is unsuccessful, the production well would be plugged and capped, and the site would be reclaimed.

The number of personnel required during construction varies significantly, but at any one point there may be a few hundred laborers and professionals on-site with attendant vehicle traffic. The number of people required for routine operation of a power plant is typically three per shift; however, additional personnel (as many as 12 total, depending on plant size) may be on site during the day for maintenance and management (BLM 2007b). Activities associated with operation and maintenance and energy production would involve managing waste generated by daily activities, managing geothermal water, landscaping, and the maneuvering of construction and maintenance equipment and vehicles associated with these activities.

Phase Four: Reclamation and Abandonment

This phase involves abandoning the well after production ceases and reclaiming all disturbed areas in conformance with BLM and FS standards. Abandonment includes plugging, capping, and reclaiming the well site. Reclamation includes removing the power plant and all surface equipment and structures, re-grading the site and access roads to pre-disturbance contours, and replanting native or appropriate vegetation to facilitate natural restoration.

Resource Protection Measures

Alternative 2 would meet direction of relevant laws and policies and standards and guidelines of the various management plans. The sources of these measures include but are not limited to: the Deschutes National Forest LRMP and the NNVM Comprehensive Management Plan – the goals, objectives, or standards and guidelines of each plan; Best Management Practices; conservation strategies; invasive plant prevention practices; and previous projects where the practice has been shown to be effective.

Resource protection measures include lease stipulations and best management practices that will reduce or eliminate unwanted effects and ensure that potential geothermal activities comply with standards and guidelines and other direction.

Lease Stipulations

This section provides the list of constraints that would be applied by the BLM to any new leases for lands that are available for geothermal leasing. Lease stipulations, derived from PEIS pp. 2-16 through 2-20, are major or moderate constraints applied to a new geothermal lease. 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 unacceptable 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.

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 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. An NSO stipulation is applied to parcels in this EA that are:

- Areas identified as Inventoried Roadless Area (IRA) or areas meeting the inventory criteria for potential wilderness.
- 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 avoid jeopardy.
- Within the boundary of properties designated or eligible for the National Register of Historic Places, including National Landmark 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.
- Water bodies, riparian areas, wetlands, playas, and 100-year floodplains.
- Segments of rivers determined to be potentially eligible 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.
- Designated important viewsheds, including (1) public lands designated as VRM Class I and (2) NFS lands with a Scenery Management System integrity level of Very High.
- Slopes in excess of 40 percent and/or soils with high erosion potential.
- Within the boundaries of the Newberry Special Management Area—Public Law 101-522 Sec 4 (a)(5).
- Deschutes National Forest LRMP Old Growth Management Areas (MA-15).

Controlled Surface Use (CSU) and Timing Limitations (TL) 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 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.

- 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. 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 CSUs would be applied by the authorizing officer as appropriate for the specific area and site conditions.

- ***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.
- ***Protection of visual resources.*** This stipulation would be applied to NFS lands with a Scenery Management System integrity level of High; and other sensitive viewsheds, such as within the visual setting of National Scenic and Historic Trails or near residential areas.
- ***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.
- ***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.
- ***Protection of erodible soils and soils on slopes 30-40 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 important habitat, such as migration/Old Growth Management Area corridors***. This stipulation would be applied to protect the continuity of those areas that serve as corridors and habitat that are important for wildlife movement.

Lease Stipulations and General Notices

Stipulations are management requirements or actions common to most projects that provide resource protection to ensure activities are consistent with the Deschutes Forest Plan Standards and Guidelines. Design features would be in place unless directed otherwise or waived by Forest Service personnel. These would be applicable to each leased parcel if exploration is planned and development if it is planned following exploration.

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 the Forest Service would decline to issue the lease.

- The Forest Service 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[2].

- 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.

Endangered Species Act

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."

Sensitive Species

Agency designated sensitive species 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.

Cultural Resources

The lead Federal Agency will ensure that National Historic Preservation Act Section 106 review will occur prior to any ground disturbing activities proposed for the leased areas. The Section 106 review will be carried out in accordance with 36 CFR 800 and will require consultation with interested parties, to include Native American Tribes and the Oregon State Historic Preservation Office. All Section 106 documentation will be reviewed by the USFS, Deschutes National Forest. Concurrence for Section 106 findings and project effects must be provided to the Lead Agency and the Oregon State Historic Preservation Office, by the Deschutes National Forest prior to project approval.

Inventoried Roadless Area (IRA) and Areas Meeting the Inventory Criteria for Potential Wilderness (PWA)

In order to maintain the characteristics of the IRAs and for areas meeting the inventory criteria for potential wilderness, No Surface Occupancy (NSO) will be applied. A non-discretionary restriction would be placed on any leases within NFS inventoried roadless areas, specifically prohibiting new road construction or reconstruction in designated roadless areas and in areas meeting the inventory criteria for potential wilderness. If future legislation or regulation changes the roadless area designation, the restriction would be revised along with any appropriate environmental review.

[2] The NNVM is not part of the National Park System (Department of Interior) and is administered by the U.S. Forest Service (Department of Agriculture).

Table 5: Lease Stipulations and General Notices

Descriptions of Stipulations for Nominated Parcels
Botany: Do not conduct project-related ground or habitat disturbing activities within the perimeter of whitebark pine subpopulations documented within this parcel.
Old Growth Management Area (M-15): In order to protect old growth management area, the lessee shall not occupy or use the surface of those parts shown as NSO unless this stipulation is modified or eliminated. Waivers, exceptions, or modifications of this stipulation will require evaluation through the NEPA process.
Areas Meeting the Inventory Criteria for Potential Wilderness (PWA): In order to protect areas meeting the inventory criteria for potential wilderness, the lessee shall not occupy or use the surface of those parts shown as NSO unless this stipulation is modified or eliminated. Waivers, exceptions, or modifications of this stipulation will require evaluation through the NEPA process.
Recreation - National Forest System Trails: In order to protect snowmobile winter trails, the lessee shall not occupy or use the surface of those parts adjacent to segments of winter trails, including a corridor of 300 feet on either side of the trail shown as CSU for activities such as power plants, transmission lines, pipe lines, etc. unless the lessee can demonstrate by appropriate plan of operation to the satisfaction of the authorized representative of the Forest Service that this area will not be adversely affected by the proposed activities. Waivers, exceptions, or modifications of this stipulation will require evaluation through the NEPA process.
Recreation –National Recreation Trail - Peter Skene Ogden Trail: In order to protect the National Recreation Trail, the lessee shall not occupy or use the surface of those parts adjacent to segments of trail, including a corridor of ¼-mile on either side of the trail shown as CSU for activities such as power plants, transmission lines, pipe lines, etc. unless the lessee can demonstrate by appropriate plan of operation to the satisfaction of the authorized representative of the Forest Service that this area will not be adversely affected by the proposed activities. Waivers, exceptions, or modifications of this stipulation will require evaluation through the NEPA process.
Recreation – Snowmobile Winter Trails: In order to protect snowmobile winter trails, the lessee shall not snow-plow roads on designated snowmobile trails and shall not use wheeled vehicles on designated snowmobile trails from December 1 to March 31 unless this stipulation is modified or eliminated. Waivers, exceptions, or modifications of this stipulation will require evaluation through the NEPA process.
Recreation – Wild and Scenic River (Eligible) - Paulina Creek: In order to protect areas eligible for Wild and Scenic River designation, the lessee shall not occupy or use the surface of those parts of a corridor of 0.25 miles from the high water mark on either side of the bank shown as NSO unless this stipulation is modified or eliminated. Waivers, exceptions, or modifications of this stipulation will require evaluation through the NEPA process.
Scenic Views: In order to protect areas with high visual sensitivities, the lessee shall not occupy or use the surface of those parts shown as controlled surface use (CSU) for activities such as power plants, transmission lines, pipe lines, etc. unless the lessee can demonstrate by appropriate plan of operation to the satisfaction of the authorized representative of the Forest Service that this area will not be adversely affected by the proposed activities. Waivers, exceptions, or modifications of this stipulation will require evaluation through the NEPA process
Soils (slopes greater than 40%): In order to protect slopes in excess of 40 percent, the lessee shall not occupy or use the surface of those parts shown as NSO unless this stipulation is modified or eliminated. Waivers, exceptions, or modifications of this stipulation will require additional evaluation through the NEPA process.
Soils (slopes 30-40%): In order to protect slopes in excess of 30 percent, the lessee shall not occupy or use the surface of those parts shown as CSU for activities such as power plants, transmission lines, pipe lines, etc. unless the lessee can demonstrate by appropriate plan of operation to the satisfaction of the authorized representative of the Forest Service that this area will not be adversely affected by the proposed activities.
Wildlife Timing Limits (Great Blue Heron): In order to protect [Great Blue Heron] nesting trees and rookeries, the lessee shall not occupy or use the surface from **March 1 to August 31** using a ¼-mile radius buffer around

Descriptions of Stipulations for Nominated Parcels
designated trees (WL-35) identified from surveys conducted by qualified individuals. This stipulation does not apply to operation and maintenance of production facilities. Waivers, exceptions, or modifications of this stipulation will require evaluation through the NEPA process. ***Wildlife Timing Limits (Osprey):*** In order to protect documented Osprey nesting trees in the NE ¼ of the SW ¼ in Section 15, the lessee shall not occupy or use the surface from **April 1 - August 31** using a ¼-mile (1-mile for the use of explosives) radius buffer around designated trees (WL-35) identified from surveys conducted by qualified individuals. This stipulation does not apply to operation and maintenance of production facilities. Waivers, exceptions, or modifications of this stipulation will require evaluation through the NEPA process ***Wildlife Timing Limits (Red-Tailed Hawk)*:** In order to protect documented Red-tailed Hawk nesting trees in the SW ¼ of the NE ¼ in Section 15, the lessee shall not occupy or use the surface from **March 1 - August 31** using a ¼-mile (1-mile for the use of explosives) radius buffer around designated trees (WL-35) identified from surveys conducted by qualified individuals. This stipulation does not apply to operation and maintenance of production facilities. Waivers, exceptions, or modifications of this stipulation will require evaluation through the NEPA process
Parcel 1: T21S, R12E, Section 9
1. ***Potential Wilderness Area and Inventoried Roadless Area (PWA and IRA)*** 2. ***Recreation - National Forest System Trails*** 3. ***Recreation – Snowmobile Winter Trails*** 4. ***Scenic Views*** 5. ***Soils (slopes greater than 40%)*** 6. ***Soils (slopes 30-40%)***
Parcel 2: T21S, R12E, Section 20
7. ***Soils (slopes greater than 40%)*** 8. ***Soils (slopes 30-40%)***
Parcel 3: T21S, R12E, Section 3 (All of Parcel 3 is determined to have NSO)
9. ***Old Growth Management Area (M-15)*** 10. ***Recreation – Wild and Scenic River (Eligible) - Paulina Creek*** 11. ***Recreation –National Recreation Trail - Peter Skene Ogden Trail*** 12. ***Recreation - National Forest System Trails*** 13. ***Recreation – Snowmobile Winter Trails*** 14. ***Scenic Views*** 15. ***Soils (slopes greater than 40%)*** 16. ***Soils (slopes 30-40%)*** 17. ***Wildlife – Great Blue Heron***
Parcel 4: T22S, R12E, Sections 14 and 15
18. ***Potential Wilderness Area and Inventoried Roadless Area (PWA and IRA)*** 19. ***Recreation - National Forest System Trails*** 20. ***Recreation – Snowmobile Winter Trails*** 21. ***Scenic Views*** 22. ***Wildlife Timing Limits (Osprey)*** ***Wildlife Timing Limits (Red-Tailed Hawk)***
Parcel 5: T22S, R13E, Section 2
23. ***Botany*** 24. ***Potential Wilderness Area (PWA)***

Descriptions of Stipulations for Nominated Parcels
25. ***Recreation - National Forest System Trails*** 26. ***Recreation – Snowmobile Winter Trails*** 27. ***Scenic Views***
Parcel 6: T22S, R13E, Sections 3, 9, and 10
28. ***Old Growth Management Area (M-15)*** 29. ***Potential Wilderness Area (PWA)*** 30. ***Recreation - National Forest System Trails*** 31. ***Recreation – Snowmobile Winter Trails*** 32. ***Scenic Views*** 33. ***Soils (slopes greater than 40%)*** 34. ***Soils (slopes 30-40%)***
Parcel 7: T22S, R13E, Section 17
35. ***Old Growth Management Area (M-15)*** 36. ***Potential Wilderness Area and Inventoried Roadless Area (PWA and IRA)*** 37. ***Recreation - National Forest System*** 38. ***Recreation – Snowmobile Winter Trails*** 39. ***Scenic Views*** 40. ***Soils (slopes greater than 40%)*** 41. ***Soils (slopes 30-40%)***
Parcel 8: T22S, R13E, Section 18
42. ***Potential Wilderness Area and Inventoried Roadless Area (PWA and IRA)*** 43. ***Recreation - National Forest System Trails*** 44. ***Recreation – Snowmobile Winter Trails*** 45. ***Scenic Views***
Parcel 9: T22S, R13E, Section 19
46. ***Potential Wilderness Area and Inventoried Roadless Area (PWA and IRA)*** 47. ***Recreation - National Forest System Trails*** 48. ***Recreation – Snowmobile Winter Trails*** 49. ***Scenic Views*** 50. ***Soils (slopes greater than 40%)*** 51. ***Soils (slopes 30-40%)***
Parcel 10: T22S, R13E, Section 30
52. ***Scenic Views*** 53. ***Soils (slopes greater than 40%)*** 54. ***Soils (slopes 30-40%)***
Parcel 11: T22S, R13E, Section 31
55. ***Scenic Views*** 56. ***Soils (slopes greater than 40%)*** 57. ***Soils (slopes 30-40%)***
General Notices – All Parcel
58. ***Scenic Views:*** Visual Impact Assessments need to be conducted within Scenic Views Management Areas within any parcel that has roads, trails, buttes, or viewpoints that may have views to or from

Descriptions of Stipulations for Nominated Parcels	
	these recreation access points or facilities. The District Landscape Architect will work with the visual consultant in order to establish viewpoints for the assessment. If any access roads, trailheads, trails, or viewpoints through immediate foreground areas are planned for development, then Scenic Views Management Area standards and guidelines must be met.
59.	***Wildlife – Raptors:*** -Raptor surveys or field checks should be completed as applicable by a qualified wildlife personnel; it may include the following species: peregrine falcon, golden eagle, bald eagle, osprey, northern goshawk, red-tailed hawk, Cooper's hawk, and sharp-shinned hawk. As per the LRMP, active raptor nest sites should be protected from disturbing activities within ¼ mile (1 mile for the use of explosives) of the nest by restricting site disturbing operations using the following: • Red-tailed HawkMarch1 to August 31 (WL-3) • Northern Goshawk: March 1 to August 31 (WL-11) • Osprey: April 1 to August 31 (WL-3) • Cooper's Hawk: April 15 to August 31 (WL-19) • Sharp-shinned Hawks: April 15 to August 31 (WL-28) • Bald Eagle: January 1 – August 31 • Golden Eagle: February 1 to July 31 • Great gray owl: March 1st – June 30th • Great blue heron: March 1st – August 31st Disturbing activities can include, but are not limited to heavy equipment use, tree removal, drilling, site clearing, construction, or frequent vehicle traffic. Locating new roads within raptor nest site stands will be avoided (WL-10) Active raptor nest sites will be protected by maintaining the forested character within a 300 feet radius around the nest tree (WL-2).
60.	***Wildlife – Caves:*** -All parcels will be surveyed for the presence of caves and if discovered coordination with the Bend/Ft. Rock Supervisory Wildlife Biologist will be necessary to determine appropriate buffers (M-39).
61.	***Wildlife – TES:*** If presence of a federally listed Endangered, Threatened or Proposed wildlife species is documented coordination with the Bend/Ft. Rock Supervisory Wildlife Biologist will be necessary to determine appropriate action.
62.	***Wildlife – Trash:*** On-site trash will be stored in a manner to reduce potential conflicts with black bears (M-40).
63.	***Cultural:*** The lead Federal Agency will ensure that National Historic Preservation Act Section 106 review will occur prior to any ground disturbing activities proposed for the leased areas. The Section 106 review will be carried out in accordance with 36 CFR 800 and will require consultation with interested parties, to include Native American Tribes and the Oregon State Historic Preservation Office. All Section 106 documentation will be reviewed by the USFS, Deschutes National Forest. Concurrence for Section 106 findings and project effects must be provided to the Lead Agency and the Oregon State Historic Preservation Office, by the Deschutes National Forest prior to project approval.
64.	***Cultural:*** If future geothermal exploration, development, or other activities are proposed within the leased areas then these activities have the potential to affect Tribal Interests and Traditional Cultural Resources and would be subject to the National Historic Preservation Act Section 106 review. Consultation with the Forest Service, the Oregon State Historical Preservation Officer,

Descriptions of Stipulations for Nominated Parcels	
	Native American Tribes, and other interested parties would occur according to 36 CFR 800 and other applicable laws and regulations. In addition, additional Traditional Cultural Property studies, or ethnographic work may be required in order to identify affected resources.
65.	***Botany:*** • Assure that project-related vehicles, heavy equipment and other materials are weed-free before accessing the new lease sites along USFS roads in the Newberry geothermal development area. This will entail assurance, by whatever cleaning methods are necessary, that all incoming vehicles and heavy equipment are free of soil, seed, vegetative matter or other debris that could bear seeds. • Include Bend/Ft. Rock Ranger District botanist in discussion of desirability and specific nature of revegetation efforts at sites disturbed by development activities. • Using the current USFS R6 Regional Forester's TES plant list, conducts sensitive plant surveys within lease sites before conducting ground or habitat disturbing, project-related activities. Notify Bend/Ft. Rock Ranger District botanist of detection of any new sensitive species sites. Three USFS R6 sensitive plant species – Crater Lake grapefern (*Botrychium pumicola*), green-tinged paintbrush (*Castilleja chlorotica*) and whitebark pine (*Pinus albicaulis*) – are known to occur either within or closely adjacent to the collective perimeter of the proposed lease sites.
66.	***Recreation – Dispersed recreation use:*** Take necessary actions to maintain public safety. This may include, but isn't limited to: signing and area closures.
67.	***Transportation:*** Road use permits authorize use of NFS roads, NFS road segments, and associated transportation facilities for purposes of commercial hauling or as an exception to traffic rules and use restrictions. Road use permits may authorize use of a road that is otherwise closed to access non-federal property; road use that is otherwise restricted by a road use order or a regulation; or motor vehicle use on NFS roads that are not designated for that use on a motor vehicle use map
68.	***Transportation:*** Maintenance costs should be shared with non-Federal commercial haulers or users when the estimated amount to be borne by the user will be at least $100 for the users' anticipated use.
69.	***Transportation:*** Cost will be recovered for road reconstruction and maintenance from commercial user commensurate with their use. (a) Reconstruction Required to Accommodate Use. The standard road use permit, requires the holder to perform any road reconstruction necessary to accommodate the holder's use under the permit or to deposit funds sufficient to cover the cost of the reconstruction before the holder's use commences. (b) Commensurate Share. Requires the holder to perform maintenance or deposit funds sufficient to cover the cost of maintenance made necessary by the holder's use under the permit.
70.	***Transportation:*** Use otherwise prohibited by traffic rules issue a road use permit to authorize an act or omission that would otherwise be in violation of a traffic rule in effect on a road. To protect the safety of road users and the public investment in roads and bridges, issue a road use permit to authorize the use of oversized vehicles and off-highway haul when they are not authorized by an agreement or easement.
71.	***Transportation:*** Compliance with environmental laws, propose road use permits to authorize use of a road when public use is normally restricted by regulation; a designation for motor vehicle use; a gate, barrier, or road use order; or seasonal snow accumulation are subject to environmental analysis and disclosure of effects as required by the National Environmental Policy Act (NEPA), in accordance with and subject to compliance with the Endangered Species Act (ESA) in addition to other applicable environmental law and policy.
72.	***Transportation:*** Designation of NFS roads for motor vehicle use does not preclude or obviate the

Descriptions of Stipulations for Nominated Parcels
need for issuance of road use permits to manage certain types of uses to protect public safety and the public investment in roads. Examples include: (1) Road use permits issued to authorize use of motor vehicles exceeding size and weight restrictions imposed under State traffic law; and (2) Road use permits issued to require cost recovery from commercial haulers. Road use permits issued for use of NFS roads designated for motor vehicle use (other than when public use is restricted by a designation for motor vehicle use by time of year) are not subject to NEPA or ESA analysis because these roads are available for public use. Road use permits include conditions on road use, terms requiring compliance with road operation and maintenance criteria, and provisions addressing protection and management of NFS lands.
73. ***Transportation:*** Revocation and Suspension. a. Grounds:. A road use permit may be revoked or suspended for: (1) Noncompliance with federal, State, or local law; (2) Noncompliance with the terms of the permit; or (3) Abandonment or other failure of the holder to exercise the privileges granted. b. Notice and Opportunity to Comply: Except for immediate suspension pursuant to paragraph 5c, the responsible official must give the permit holder written notice of the grounds for suspension or revocation and a reasonable opportunity to correct any noncompliance prior to revocation or suspension. c. Immediate Suspension: The responsible official may immediately suspend a road use permit in whole or in part when the responsible official deems it necessary to protect public health, safety, or the environment. d. Lack of Administrative Appeal: Revocation or suspension of a road use permit is not subject to administrative appeal.
74. ***Transportation:*** A road use permit terminates when by its terms a fixed or agreed upon condition, event, or time occurs without any action by the responsible official, such as expiration of the permit by its terms on a specified date or with the consent of the holder. Termination of a road use permit is not subject to administrative appeal.

Best Management Practices

In addition to lease stipulations, during any subsequent exploration, drilling, utilization, or reclamation and abandonment of geothermal resources, the Forest Service would require project-specific mitigation measures to permits. The agency's first priority is to mitigate impacts on-site. When the agency determines that impacts cannot be mitigated to an acceptable level onsite, it may be necessary to deny the permit, ask the applicant to modify the proposal, or mitigate remaining impacts off-site. Best Management Practices are state-of-the-art mitigation 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 USFS. Conditions of approval are not lease stipulations, but they are site-specific and enforceable requirements to minimize, mitigate, or prevent impacts to resource values from an intended operation. Conditions of approval can limit or amend the specific actions proposed by the operator.

Monitoring

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 mitigation 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 light of continually changing circumstances and new information, the FS develops and applies lease stipulation exception, waiver, and modification criteria. An exception, waiver, or modification may not be approved unless, (1) the authorized officer determines that the factors leading to the stipulation's inclusion in the lease have changed sufficiently to make the protection provided by the stipulation no longer justified; or (2) the proposed operations would not cause unacceptable impacts. (43 CFR 3101.1-4).

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

An exception, waiver, or modification may be approved if the record shows that circumstances or relative resource values have changed or that the lessee can demonstrate that operations can be conducted without causing unacceptable impacts and that less restrictive requirements would meet resource management objectives.

The authorized officer may require the operator to submit a written request for an exception, waiver, or modification and information demonstrating that (1) the factors leading to the inclusion of the stipulation in the lease have changed sufficiently to make the protection provided by the lease stipulation no longer justified or (2) that the proposed operation would not cause unacceptable impacts. Requests from the operator should contain, at a minimum, a plan including related on-site or off-site mitigation efforts, to adequately protect affected resources; data collection and monitoring efforts; and timeframes for initiation and completion of construction, drilling, and completion operations. The operator's request may be included in a permit application (e.g., application for permit to drill), Sundry Notice, or letter. The FS may also initiate the process.

During the review process, coordination with other state or Federal agencies would be undertaken, as appropriate, and documented. For example, it may be appropriate to coordinate the review of wildlife exceptions, waivers, and modifications with the local office of the State wildlife agency. Staff review and recommendations would be documented along with any necessary mitigation and provided to the authorized officer for approval or disapproval. The applicant would then be provided with a written notification of the decision. Public notification (30-day public review) is generally not required for exceptions because an exception is seldom a substantial modification or waiver of a lease term or stipulation (43 CFR 3101.1-4), particularly if the exception criteria is outlined in the lease or the land use plan. Public review is not required for waivers or modifications that the authorized officer determines are not substantial and do not substantially waive or modify the terms of the lease. "Substantial" in this case would include the exception, waiver, or modification having a "substantial" effect on the environment that was not previously considered. However, the applicable land use plan may contain additional notification requirements. The public notice, if required, should include identification of the modified lease terms and a description of the affected lands or a map.

When Public Notice is appropriate, the following procedures may apply:

- Approval of an exception, waiver, or modification with the permit approval: A notice describing the modified lease terms, when required, may be posted for 30 days in the BLM office; posted on the BLM website; posted in a local paper as a legal notice or incorporated into a newspaper article; or the notice may be included as part of the NEPA document's public review, if the NEPA document is offered for review.
- Approval after the permit has been approved: Public notice, if required, may take the form of a 30-day posting on the BLM website, a legal notice or article in the newspaper, or a notice and associated public review conducted as part of the public review of a NEPA document.
- Approval after drilling has commenced: Unless specified in the land use plan, it is unlikely public notification would be necessary.

The BLM must analyze and document how the exception, waiver, or modification is in conformance with the land use plan and identify the plan decision (including goals, objectives, or desired outcomes) supported by the proposed exception, waiver, or modification. If existing NEPA analysis does not support the exception, waiver, or modification, the BLM must conduct the appropriate environmental review and NEPA analysis. If the proposed exception, waiver or modification is not in conformance with the land use plan or that document does not disclose the conditions under which such proposed change would be allowed, the BLM must either amend the plan or deny the exception, waiver, or modification.

It may be necessary to add, delete, or modify lease stipulations in the land use plan as a result of pre-lease issuance parcel reviews, statewide lease stipulation consistency reviews, plan amendments, changed circumstances on the ground, or changed resource protection priorities. This is accomplished and documented either through the plan maintenance process (for minor changes consistent with an approved land use plan) or the plan amendment process (for changes resulting in modification of terms, conditions, or decisions in an approved land use plan).

CHAPTER 3: Affected Environment and Environmental Consequences

Introduction

This section of the environmental assessment considers the environmental consequences of implementation of Alternatives 1 and 2. The following discussion of effects follows CEQ guidance for scope (40 CFR 1508.25(c)) by categorizing the effects as direct, indirect, and cumulative. The focus is on cause and consequences. For this analysis, in general, direct and indirect effects have been discussed in the context that most readers are accustomed to: those consequences which are caused by the action and either occur at the same time and place, or are later in time or farther removed in distance but are still reasonably foreseeable (40 CFR 1508.8). Cumulative effects are discussed where there is an effect to the environment which results from the incremental effect of the action when added to other past, present, or reasonably foreseeable future actions (40 CFR 1508.7). Consideration of past actions is per 36 CFR 220.

Measures to mitigate or reduce adverse effects caused by the implementation of any of the actions proposed are addressed in Chapter 2, Resource Protection Measures, page 26. Effective mitigation avoids, minimizes, rectifies, reduces, or compensates for potential effects of actions. After mitigation is applied, any unavoidable adverse effect to each resource area is addressed in the section titled "Other Disclosures" in this chapter of the EA. The temporal and spatial scale of the analysis is variable depending upon the resource concern being evaluated, particularly for cumulative effects. The landscape within the Consent to Lease parcels is the focus of this EA, but adjacent lands are considered in portions of this analysis process.

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

Scope of Analysis and Approach

This Consent to Lease analysis tiers to the Final Programmatic Environmental Impact Statement (PEIS) for Geothermal Leasing in the Western United States (2008). Included are stipulations and BMPs (PEIS pp. 2-16 through 2-21) and describes the Reasonably Foreseeable Development Scenario for the parcels (PEIS pp. 2-40 through 2-48). Also included are Mitigation Measures, developed by Forest resource specialists, which will help to minimize any potential negative effects that could result from exploration and development activities. This project also tiers to the Final EIS of the Deschutes National Forest LRMP (1990) for the associated standards and guidelines for Energy Resources pp. 4-77 through 4-79; General Forest (MA8) and Minerals p. 4-119; and Scenic Views (MA9) and Minerals and Special Uses p. 4-130. This Consent to Lease analysis examines the 11 nominated parcels, including the existing environmental setting, the potential impacts to the human and natural environment that leasing would have, and potential impacts from future exploration and development should they occur following leasing.

Basis for Analysis

Specialist Reports

- The interdisciplinary team (IDT) includes Forest specialists for appropriate resource disciplines. Addressed are the affected environment and the environmental consequences of consenting to lease nominated parcels. No surface occupancy (NSO) assumes there would be no ground disturbing effects from geothermal leasing activities without an exception, waiver, or modification.
- Also discussed are potential effects that are not based on site specificity, but on the assumption that geothermal development (Table 4, page 39) could occur sometime in the future.
- It is assumed that because there are no activities associated with consenting to lease of the nominated parcels that there would be no direct or indirect effect to the environment. Therefore, there would be no cumulative effects in either time or space, regarding the various resources. Consenting to lease is for the purpose of allowing the BLM to offer for lease those nominated parcels that have previously been described. Table 4, page 39, provides a description of the foreseeable phases in geothermal development, but, there is not a means of assuming when any potential activity would occur. If a lessee applies for a permit to implement one or more of the following phases, at that time, site specific analysis would occur. This would include analyzing for the direct, indirect, and cumulative effects for each resource and would be covered in additional NEPA analysis.

Role of Science

Science information improves the ability to estimate consequences and risks of decision alternatives. The effects of each alternative are predicted based on science literature and the professional experience of the IDT. The conclusions of the specialists are based on the best available science and current understanding. Relevant and available scientific information is incorporated by reference and a complete bibliography is included at the end of the EA. Referenced material is a consideration of the best available science.

Changes from 30-Day Comment Period EA to Final EA:

Comments during the 30-day comment period were useful in determining what areas of analysis were confusing or not complete. The opportunity to improve Chapter 3 of this Final Environmental Assessment (EA) has been through editing, resource enhancement and organization. These changes, in particular, include :

- Provided additional discussion on seismicity events (EA, page 59);
- Provided additional discussion on North American Wolverine (EA, page 115);
- Provided analysis for the Pacific fisher (EA, page 118);
- Reasonably foreseeable developments (RFDs) discussions are more distinct in the effects section in Chapter 3. Even though RFDs do not provide effects for this project, they provide some context for potential future geothermal activity, if it is proposed. If a proposal is brought forward in the future, further NEPA will be needed for each level of development, which will be based on site specificity.

Minerals and Geology

Geology

The project area is located on the flanks of Newberry Volcano in central Oregon. Newberry Volcano is one of the largest Quaternary volcanoes in the Cascade Arc. Its massive broad shield-shaped form was built by repeated eruptions over the last 400,000 years and has continued nearly to the present (1,300 years ago) with continued activity in the future highly probable.

Newberry Volcano is located 40 miles east of the crest of the Cascade Range, the west edge of the High Lava Plains Provence, northern extent of the Basin and Range Provence. It is likely, due to the faulting by the High Lava Plains and Basin and Range, the conduit for the magma was formed by the subduction of the Juan de Fuca oceanic plate, beneath the North American continental plate off the coast of Oregon, to form the back arc volcano. It is well known in the scientific community because of its long and varied history of bi-model volcanism, and its wide range of rock types from basalt to rhyolite.

At the summit of Newberry Volcano is a caldera that is four miles by three miles that formed 75,000 years ago by a major explosive eruption and collapse event. This was the most recent of at least three caldera-forming eruptions that spread silicic pyroclastic flows and ash across large areas of the volcano's east and west flanks. The summit caldera has been the location of ten eruptive periods during the last 12,000 years, last being the Big Obsidian Flow 1,300 years ago. The caldera was filled with precipitation (rain and snow melt) to form one large lake. About 10,000 years ago, the eruptions of Central Pumice Cone and Interlake Obsidian flow divided the lake into two smaller lakes, Paulina and East Lake.

The north and south flanks are distinctly different than the east and west flanks. In contrast, the north and south flanks of the volcano are covered by hundreds of cinder cones and their associated lava flows resulting from relatively gentle mafic eruptions. The most recent flank eruption is from the Northwest Rift Zone 7,000 years ago.

Another important eruption that affects Newberry is the violent eruption of Mount Mazama 7,700 years ago which formed Crater Lake 70 miles to the south. The ash from that eruption mantles all Newberry Volcano at varying depths.

Within the caldera there are three areas with surface indications of the volcanic heat below the surface. At Paulina Lake, small hot springs occur along the shoreline in the northeast corner of the lake. The water well at the north end of Little Crater Campground produced hot water before it was abandoned. At East Lake, small hot springs occur along the shoreline west of Hot Springs Boat Ramp. These springs supplied hot water to the East Lake Health Resort from 1915 to 1941 when it burned down. The water well in the Hot Springs Campground also produced hot water until it was abandoned. At Lost Lake, a small fumarole exists near the Big Obsidian Flow and one is located on the northeast side of Paulina Lake.

Geologic Resources and Hazards

Geologic Special Interest Areas

There are no existing or proposed Geologic Special Interest Areas in the project area.

Cave Resources

Caves are protected under the Federal Cave Resources Protection Act of 1988. There are no known caves (including lava tube caves) in the proposed project area. If any caves are found during exploration activities, they are to be reported to the Forest Service.

Groundwater Resources

Newberry Volcano is composed of Quaternary lava flows, lava domes, volcanic vents, pyroclastic deposits, volcaniclastic sediments. The surfaces of the young volcanic deposits are commonly fractured and brecciated making them extremely permeable. The regional groundwater system is recharged by precipitation (rainfall and snow melt) rapidly percolating through these rocks. Precipitation is the primary means of recharge and there is a strong correlation between recharge and elevation. The depth to the top of the regional aquifer varies based upon elevation; however, it generally ranges from 100 to over 500 feet below the ground surface. Recharge to the groundwater system on Newberry Volcano may approach 224,000 acre-feet/year (73 billion gallons/year).

Most of the Groundwater on Newberry generally flows down slope into the Upper Deschutes Basin with a small part flowing into the Fort Rock Basin. However, the divide between the Deschutes Basin and Fort Rock Basin is poorly defined and interbasin flow is likely. Estimates of the flow from the Fort Rock to the Deschutes Basin probably exceeds 10,000 acre-feet/year.

The John Day Formation, which underlies the regional (Newberry and Deschutes Formations) aquifer, includes low permeability stratigraphic units that inhibit the horizontal and vertical flow of regional groundwater. The depth to the top of the John Day aquiclude varies based upon elevation; however, it generally ranges from 1000 to 1100 feet below the ground surface.

The groundwater system within the caldera appears to be structurally-controlled by faulting associated with a series of ring-fractures from caldera collapse. These structures represent groundwater flow boundaries that impede the vertical and/or horizontal flow of groundwater from the caldera. Groundwater flow from the caldera to regional aquifer systems does occur however, and the U.S. Geological Survey has estimated the volume at 2,500 to 6,500 acre-feet/year.

The Paulina Lake and East Lake (caldera lakes) recharge by precipitation of about 31,900 acre-feet/year. East Lake does not have a surface water outlet and Paulina Lake discharges through an outlet structure to Paulina Creek. For irrigation purposes, the level of Paulina Lake and outflow volume to Paulina Creek have been controlled and managed since the early 1900s. Lake levels fluctuate seasonally dependent upon precipitation; however, the elevation of East Lake is generally 40 to 50 feet higher than Paulina Lake. The resulting hydraulic gradient from East Lake toward Paulina Lake and the relative stability of Paulina Lake and nearby groundwater levels relative to East Lake levels during below normal precipitation years, indicates appreciable groundwater flow from East Lake into Paulina Lake. This flow has been estimated at 2.3 cubic feet-per-second (cfs) through the permeable pumice and ash deposits separating the lakes.

Paulina Creek begins at the southwest shore of Paulina Lake at an elevation of 6,330 feet and flows west over 13 miles to the confluence with the Little Deschutes River at an elevation of 4,180 feet. The flow of Paulina Creek is controlled by a concrete spillway that has been in-place since the early 1900s. Paulina Creek loses approximately 6.1 cfs to groundwater. Below RM 5.2 Paulina Creek does not appear to lose flow to groundwater and may receive some minor recharge as the stream intersects groundwater levels of the near-surface, local aquifer. Paulina Creek is considered eligible to the Wild and Scenic Rivers System, and there is a No Surface Occupancy stipulation for a quarter mile on either side of the stream.

Seismicity Hazards

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 they occurred depending on 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. The central Oregon region is characterized by a moderate level of tectonic and volcanic activity with a number of active faults and a low to moderate level of historical seismicity. The regional tectonics of Newberry Volcano is influenced both by extensional faulting of the Basin and Range and from Cascades faulting and volcanism. Three principal fault zones that show Quaternary and Holocene displacements and probably intersect beneath the caldera are: the Northwest Rift zone, the Southeast Newberry fault zone, and the Southwest Newberry fault zone (USGS, 2010). On the northeast side of Newberry, the Brothers fault zone offsets Miocene and Pliocene volcanics but does not appear to offset Quaternary lava flows.

Based on the instrumental record, no earthquakes greater than magnitude (M) 3.0 were located within 6.2 miles of Newberry Volcano. The closest M 3.0 or larger earthquake to Newberry was an event estimated at M 3.0 in 1943 about 35 km north of Newberry Volcano. The earliest seismograph station coverage in central Oregon began in 1980. Due to the lack of extensive seismographic coverage, the historical record is probably only complete in the Newberry area for events of M 3.0 since 1980. Prior to seismic instruments, no earthquakes greater than M 5.0 were detected within 62 miles of Newberry Volcano between 1891 and 1961. There have only been six M 3.0 or greater earthquakes within 100 km of the Newberry Volcano since 1980. Four of these events were in 1999 consisting of a minor swarm of earthquakes during April and May of that year. They were located about 98 km southeast of the Newberry Volcano. The largest event in the swarm was M 4.3 earthquake on April 28, 1999, which was felt at Christmas Valley and Paisley, Oregon. Two other events were felt in Christmas Valley, M 3.1 on April 27and M 3.3 earthquake the following day.

In 2011, the U.S. Geological Survey (USGS) installed eight new permanent seismometers and Global Positioning Systems (GPS) around Newberry for monitoring of the volcano. The USGS seismologists will now be able monitor the volcano for more subtle earthquakes and ground surface deformation more accurately. To emphasize the sensitivity of the new network, the seismometers recorded ice cracking on the surface of Paulina Lake.

From October to December 2012, AltaRock Energy, Inc., as part of the Newberry Volcano Engineered Geothermal System (EGS) Demonstration Project, injected water under pressure and successfully hydro-sheared an underground reservoir of small fractures on the northwest flank of Newberry Volcano. For the EGS project AltaRock installed 14 highly sensitive seismometers – 8 subsurface and 6 surface, and a strong motion sensor.

During hydro-shearing, more than 200 seismic events M -2 and greater were produced. Twenty eight of the events were M 1 or greater. Of the 200+ events, no events were reported to be felt by humans, even at the location of the injection site.

On the last day of water injection of the AltaRock project (December 7, 2012), the largest event was recorded, Magnitude 2.39, by seismometers that surrounded the project site. The strong motion sensor, located at the Visitor Center in the Newberry National Volcanic Monument, did not record the earthquake. The earthquake was not felt at the project site and was not reported by anyone in La Pine, the closest town to the project. Soon after the earthquake on Dec 7, 2012 the well was shut-in, or closed, and no more water was injected. A Induced Seismicity Mitigation Plan was in place for the project. The protocol for a greater than Magnitude 2 is to not increase water flow and monitor for 24 hours. AltaRock exceeded the protocol by stopping water flow and closing the well. On the Modified Mercalli Intensity Scale at epicenter, a Magnitude 1.0 – 3.0 earthquake is “not felt except by a very few under especially favorable conditions.” There was no cause for an emergency. An earthquake larger than M5 or 6 would probably be required to create ground cracking or displacement visible at surface. Worldwide there are estimated 1.3 million micro earthquakes between Magnitude 2.0 – 2.9 per year.

On Davenport Pad 16, Well 46-16 was drilled to 11,600 feet depth in 2008. The well collapsed and bridged at approximately 5,000 feet before a flow test could be performed. Currently, Well 46-16 is shut in, or closed, until repairs can be made. The BLM and DOGAMI can be contacted for more information regarding this well. The Forest Service is not authorized to inspect wells deeper than 2,500 feet.

Volcanic Hazards

The proposed new lease areas are within the Volcano Hazard Zone boundaries mapped by the USGS. The USGS considers Newberry Volcano to be a "very high threat" volcano because of its close proximity to population centers in the area and recent volcanic activity. Interferometric synthetic aperture radar (InSAR) data as well as the network of eight seismometers and GPS stations installed by the USGS in 2011 to monitor Newberry Volcano for any volcanic unrest that would accompany future replenishment of the Newberry magma system.

Landside Hazards

No landslides were mapped in the proposed lease areas according to the Statewide Landslide Information Database for Oregon (SLIDO) as of February 11, 2013.

Paleontological Resources

All the pending lease applications are in geologic units that would be expected to have a relatively low potential for containing vertebrate fossils or scientifically significant invertebrate or plant fossils; therefore, paleontological resources are not analyzed in detail. Paleontological mitigative procedures outline in the PEIS would be followed for all ground-distributing activities. All protective measures outlined in the Record of Decision of the PEIS (Appendix B, B.4.1) would be applied.

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: Under the No Action Alternative, the FS would not consent to the leasing of the nominated lands; therefore BLM would deny the pending lease applications. There would be no effects to the geologic setting and hazards past 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.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: The Proposed Action would not result in any direct effects to the overall geologic setting or put people and structures at risk from geologic hazards in the lease nomination area. No ground-disturbing activities are authorized from the leasing action itself. However, anticipated actions following leasing could have impacts to the geologic setting and hazards for the purposes of geothermal development, thus this analysis will disclose the potential effects to the surface based upon the RFD, and assess the need for stipulations to protect surface resources.

Effects from exploration activities related to mapping, surveying and some geophysical operations are not expected to affect land stability issues in the lease nomination 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 No Surface Occupancy (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.

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 risk to a facility's safety and/or cause maintenance issues. Prior to construction of any facilities or infrastructure (Roads and Transmission lines), geotechnical investigations should 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 event. As long as operations are placed and designed with the above considerations, effects from geologic instability are expected to be minor.

Minerals and Energy Resources

Minerals are divided into three categories: locatable minerals (under the 1872 Mining Law), leasable (under the 1917, 1920, and 1947) mineral leasing acts and the Geothermal Steam Act of 1970), and saleable materials (Materials Act of 1947).

Locatable Minerals

The General Mining Law of 1872, as amended, opened the public lands of the United States to mineral acquisition by the location and maintenance of mining claims. Mineral deposits subject to acquisition in this manner are generally referred to as "locatable minerals." Locatable minerals include metallic minerals (i.e., gold, silver, etc.), nonmetallic minerals (i.e., certain limestones and gypsum, heavy minerals in placer form, and gemstones) and certain uncommon variety minerals.

Starting in 1873, the United States Department of the Interior (DOI) began defining locatable minerals as those minerals that are recognized as a mineral by the standard experts, are not subject to disposal under some other law, and make the land more valuable for mining purposes than for agriculture. Minerals normally locatable on lands acquired (purchased or received) under the Acquired Lands Act of 1947 by the United States or found on American Indian reservations are subject to lease only.

There are no known commercial deposits of gold or other precious metals, strategic metals or other base metals within any of the proposed lease parcels. No part of Newberry Volcano is considered to have potential for locatable minerals. No claims presently exist in any of the proposed lease parcels but areas under geothermal lease remain open to locatable entry if metals are discovered in the future. Small scale prospecting could be occurring within the boundaries of the nominated lands without the knowledge of the Forest Service. Prospectors are not required to inform the Forest Service of their mining activities if their actions are not creating a significant disturbance to surface resources.

Leasable Minerals

Since 1920, the Federal Government has leased fuels and certain other minerals. Minerals that are subject to lease include geothermal resources and oil and gas.

There are no oil and gas leases anywhere on the Deschutes National Forest. There are currently 60 authorized geothermal leases (52,981 acres) on the flanks of Newberry Volcano. The land within the Monument is withdrawn from all forms of location, entry, and disposition under all geothermal leasing laws. Leases extending within the Special Management Area of NNVM Act are held with a No Surface Occupancy stipulation and may only be entered by directional drilling outside the Special Management Area boundaries.

In 1976, the US Geological Survey (USGS) designated the area around the Newberry Caldera as a Known Geothermal Resource Area (KGRA) and was determined to be one of the best geothermal energy prospects in the Pacific Northwest. The USGS continued exploration and geologic mapping, culminating

in the drilling of a 3,057 feet deep temperature gradient well in the center of Newberry Caldera near the Big Obsidian Flow in 1981. The well temperatures measured 509°F and produced steam for 20 hours during a test. During the last three decades, over two dozen exploratory wells have been drilled on the flanks of the caldera reaching depths from approximately 1,300 feet to 11,600 feet. In 1994, the Newberry Geothermal Pilot Project FEIS was signed which proposed a 33-megawatt power plant, access roads, exploration and production wells, a power transmission line, and a switchyard. CalEnergy drilled four boreholes – two of them deep production wells – and found only hot rock without steam or hot water. They subsequently abandoned the project. In 2008, Davenport Power drilled two deep exploratory wells (55-29 and 46-16) drilled to 10,060 and 11,600 feet, respectively. Well 55-29 recorded temperatures of almost 440°F at 6,500 feet to over 630°F at the bottom of the well. However, at the time of this report no hydrothermal fluids or steam have been discovered on the flanks of Newberry Volcano. In 2012, AltaRock injected cold water under pressure and successfully hydrosheared Well 55-29. AltaRock plans to backflow this well in 2014 to test the created geothermal reservoir.

Saleable Minerals

Saleable Minerals include such material as cinders, sand and gravel, crushed stone, dimension stone, rip rap, clay, specialty material and borrow. Use of salable minerals requires either a sales contract or a free-use permit. Uncommon varieties of salable-type minerals may be locatable if the deposits meet certain tests. Federal certified mineral examiners determine uncommon variety on a case-by-case basis. Saleable Minerals are sold at the discretion of the District Ranger.

The Deschutes National Forest has a very active sales program (primarily cinders) from several large sources. Many pit and quarries on the forest are used for forest projects. There is one saleable mineral site that has been identified in a lease area. The Fishhook Cinder Pit (T. 21 S., R. 12 E., Section 9) is an inactive pit. Currently there is insufficient rock available to support future development for project support.

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: The FS would not consent to the leasing of the nominated lands; therefore, the BLM would deny the pending lease applications. There would be no impacts on minerals, other than 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.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: The 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 lease area. No ground-disturbing activities are authorized from the leasing action itself. If leasing does occur, actions following leasing could impact minerals for the purposes of geothermal development.

The Proposed Action would have a direct effect on leasable minerals, in that the lease holder will have exclusive rights to the geothermal resource. The proposed action would not result in any direct effect to all other minerals resources (locatable and saleable), known or undiscovered, in the lease nomination area

Exploration activities would provide beneficial effects to mineral resources, as more data and information would be available. As there is no locatable mining activity in the lease area, effects are expected to be minor for locatable minerals. The lease would not grant rights to the lessee for extraction of mineral materials (sand and gravel, crushed aggregate) in the lease area. Mineral materials

can only be acquired by permit and is at the discretion of the district ranger. The need for mineral material resources should be minor at the exploration stage and have little to no impact.

Small scale prospectors, who may be operating in the analysis area, without the knowledge of the Forest Service, could be affected. These operators generally would only be using Forest Service roads for ingress/egress and would not be hauling a substantial amount of equipment; therefore, geothermal exploration activities would not have a discernible effect on small scale prospecting.

Drilling and utilization activities would provide beneficial effects to the mineral resources, as additional data and information would be available. There may be an increasing demand for mineral materials (sand & gravel and crushed rock) in support of construction and maintenance of roads, drill pads, and facilities. This increase in demand on the limited sources in the area may either deplete the current resources or increase the surface disturbance at these current quarries by expanding the quarry boundaries. Mineral material use is at the discretion of the Forest Service; therefore impacts may be mitigated by requiring the lessee to use commercial (private) sources.

Cumulative Effects

Geologic Setting and Hazards

Cumulative impacts on the geologic setting from geothermal exploration, drilling and utilization would be expected to be minor. The proposed alternatives include stipulations to mitigate impacts from future drilling and earthmoving activities. Any impacts from development that might occur would be minimal and largely limited to the project site.

Minerals

An increase in development of geothermal resources would have a cumulative impact of contributing to the domestic energy supplies of the United States and of possibly reducing the demand for nonrenewable energy, such as oil, gas, and coal. According to the RFD, there is the potential to triple the megawatts produced with geothermal resources. Geothermal development could cumulatively result in competition for water rights and energy developments at the local and regional level.

Leasing of each parcel would be to one lessee. An adjacent lease could have a different lessee. Though unlikely, it is possible that two separate lessees could be operating in adjacent lease blocks at the same time, with respect to exploration activities. Although exploration activities could occur on adjacent leases at the same time, it is unlikely that all leased areas could support more than the 50 MW as outlined in the RFD scenario.

There may be cumulative effects with respect to exploration activities but none anticipated from the development of facilities. The construction of new access roads, improvements to existing roads and bridges, and installation of wells and facilities would involve cut and fill operations. If large amounts of fill material would be necessary, increased demands of on-forest supplies of sand, gravel, and crushed rock may occur. If multiple construction projects were developed within a single area, local supplies of required fill material, particularly gravel or crushed rock, could be reduced to the point of impacting the needs of roadways and other construction projects. Local changes in topography could be caused by construction of roads, well pads, pipelines, and power plants.

Forest Plan Consistency

All Alternatives would be consistent with the Deschutes National Forest Land Resource Management Plan standard and guidelines for the Minerals and Geology resource (USDA 1990).

Wilderness, Inventoried Roadless Areas, Areas Meeting the Inventory Criteria for Potential Wilderness, and Other Undeveloped Lands

Introduction

This section discloses the affected environment and environmental consequences of the Geothermal Consent to Lease project for wilderness areas, Inventories Roadless Areas (IRAs), areas meeting the inventory criteria for potential wilderness areas (PWAs), and other unroaded or undeveloped lands.[3] The full report is located in the District files and is available on request and is incorporated by reference.

The area for this analysis is approximately 166,215 acre Consent to Lease inventory analysis area for areas meeting the inventory criteria for potential wilderness. The zone of influence for the Consent to Lease project was an area surrounding the Newberry Crater and extended at least 2 miles beyond each lease parcel and 5 miles beyond the Inventoried Roadless Area boundaries. This was done to include the Inventoried Roadless Areas (South and North Paulina Peaks) and any adjacent or larger areas meeting the inventory criteria for potential wilderness areas in the vicinity of the Consent to Lease parcels.

The vast majority of the inventory area, especially with lands less than 30 percent slope, has been managed in the past with the exception of the Inventoried Roadless Areas. This includes substantial areas of harvested lands that were clearcut in the past with an extensive road system in the area to provide access for timber management. While many of the roads in the inventory area have been closed, the road beds remain evident on the landscape as no re-contouring or other actions have taken place to remove the evidence of roads from the landscape.

Wilderness

Affected Environment

The Three Sisters Wilderness is the nearest wilderness to the Geothermal Consent to Lease project, located approximately 35 miles to the west.

Environmental Consequences

Alternative 1 (No Action) and Alternative 2 (Proposed Action)

Direct and Indirect Effects: There are no designated wilderness areas within, nor directly adjacent to the Consent to Lease project inventory area. The Consent to Lease project activities would have no effect on the wilderness character, including solitude, on any wilderness because of the distance to the nearest wilderness. No activities would occur adjacent or within any designated wilderness.

Inventoried Roadless Areas

Affected Environment

Inventoried Roadless Areas (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 Forest Service, 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. Most IRA boundaries are nearly identical

[3] The term 'other undeveloped lands' is presented and used in this document to provide a consideration for lands that do not contain roads and evidence of timber harvest or other tree cutting.

to those identified by the LRMP and the FEIS, Appendix C; however some localized, minor differences in boundaries may exist.

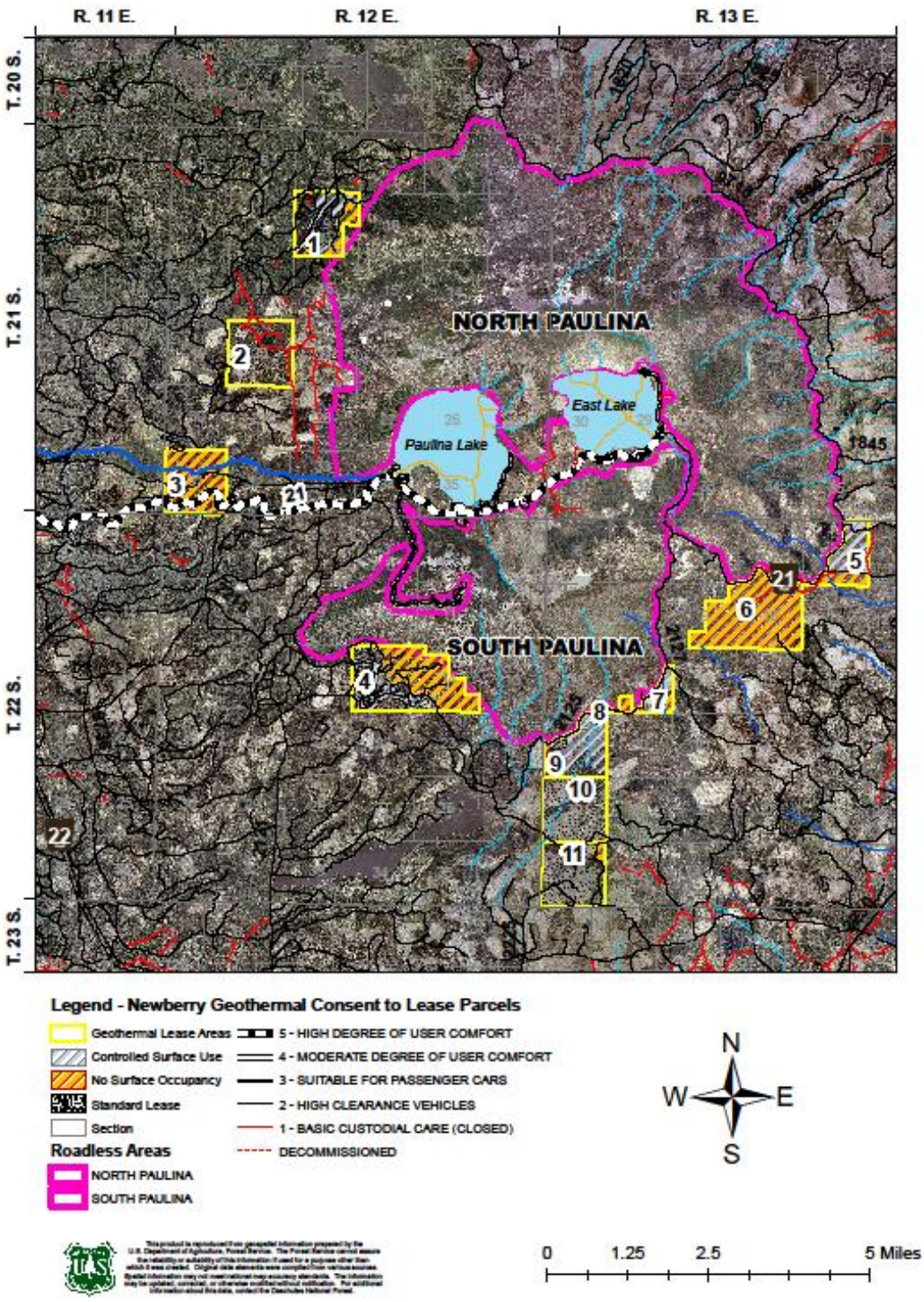
Seven of the nominated parcels of the Consent to Lease project are directly adjacent to the North and South Paulina Peak IRAs located within and on the flanks of the Newberry Caldera. South Paulina Peak IRA is approximately 9,082 acres and North Paulina Peak IRA is approximately 19,677 acres. See Figure 16, page 68, for locations of the Inventoried Roadless Areas and their relationship to the Consent to Lease parcels.

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.

This report discloses impacts to a number of resources sensitive to cutting trees and the construction of new forest roads or from our system of existing roads. Impacts to resources for habitat for threatened, endangered, proposed, candidate and sensitive species can be found in the respective biological evaluations for the project for fish, botany and wildlife and will not be discussed further. Impacts to diversity of plant and animal species are also covered under other botany and wildlife reports associated with management indicator species and biological evaluations. The impacts of the project on classes of dispersed recreation and landscapes of high scenic quality can be found in the recreation and scenic resources report. The impacts of the project on cultural properties and sacred sites can be found in the cultural resources report. The Consent to lease project area is not a source of public drinking water and will not be discussed further.

Figure 16: Overview Map of Inventoried Roadless Areas and Geothermal Consent to Lease Parcels



Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: There would be no direct/indirect effects to the Inventoried Roadless Areas with the No Action alternative. The leases would not be sold with a no-consent decision and conditions within the lease areas would remain the same. The affected environment would remain unchanged, except by natural processes. Biological and ecosystem functions would continue to function within and adjacent to the inventoried roadless areas. Any other vegetation management would continue when authorized through other NEPA decisions.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Small portions of parcels 1, 4, 7, 8 and 9 are within the North or South Paulina Peak Inventoried Roadless Areas. A total of 93 acres of Inventoried Roadless Areas are within the geothermal Consent to Lease parcels. The stipulations in Chapter 2 of the EA do not allow surface occupancy in certain portions of certain parcels to preserve the status of the inventoried roadless areas. The project has been designed to not allow any surface occupancy in the areas of the parcels that are within the IRAs (**Error! Reference source not found.**). The various constraints that determine NSO can be found on page 453.

Table 6: Acres of Inventoried Roadless Areas (IRA) within Consent to Lease Parcels

Parcel	Acres	Acres of IRA within Parcel	Acres of No Surface Occupancy (NSO) within Parcel	Acres of IRA outside of NSO within Parcel
1	560	2	146	0
2	645	0	2	0
3	614	0	614	0
4	1,050	56	580	0
5	352	0	104	0
6	997	0	997	0
7	176	25	53	0
8	16	8	10	0
9	492	3	30	0
10	633	0	0	0
11	639	0	47	0
Total	**6,172**	**93**	**2,582**	**0**

The Consent to lease project does not authorize any ground disturbing actions to take place; only authorizes which stipulations to be included with the each lease parcel when the lease is offered for bid by the BLM. There would be no surface occupancy (NSO) in the area of each parcel which has IRA, as displayed in Table 6. With no surface occupancy there would be no tree cutting or road building within these areas. Therefore, there would be no direct or indirect effects to the IRAs from the Consent to Lease project because it does not authorize any ground disturbing activities.

Additional NEPA would be needed to actually authorize any ground disturbing actions if the lease is sold and assigned by the BLM to a purchaser.

Reasonable development scenarios (RFD) were analyzed to address potential effects that could take place if exploration or development occurred in the Consent to Lease parcels outside of the no surface occupancy areas after the leases have been sold and assigned and further NEPA conducted. Again, this project does not authorize any ground disturbance and further NEPA would need to be undertaken to authorize any ground disturbance. Under reasonable development scenarios, no surface activities

would take place within the IRAs portion of the parcels because the lease would include no surface occupancy stipulations. Therefore there would be no direct effects under RFD scenarios of exploration or development because no ground disturbing actions would take place within the IRAs within the parcels.

Indirect effects to the IRA from the Consent to Lease project under potential RFD scenarios and subsequent operations which could potentially include towers, small clearings for pad development and new roads may be visible from the IRA by someone recreating with in the IRA. Additionally, noise associated with geothermal lease activities may also be heard by someone recreating within the IRA close to the activity causing the noise. Noise would be associated with the construction of the pads and a minor amount from drilling and facility operations. Smoke and dust from clearing activities may also be visible for short periods of time if slash burning and if construction was occurring.

Figure 17, page 71, Figure 18, page 72, and Figure 19, page 73, show the individual parcels with the area of No Surface Occupancy and the IRAs. Please note that the name of the IRA, North or South Paulina, indicates which side of the pink line is the IRA.

Other geothermal leases are active within the project area. Activities are associated with small pad clearing for testing and well drilling, small segments of road development, exploration drilling and restoration of pads where drilling and investigations have been completed. Because the Geothermal Consent to Lease project does not authorize any ground disturbance and therefore no direct or indirect effects would be associated with the project, there would be no cumulative effects with any other project. Further NEPA would be completed before any ground disturbance would occur.

Under RFD scenarios, actions that could take place on the Consent to Lease parcels would not overlap with any other geothermal activity because actions occur on individual leases. Other leases that are in operation are in the exploration and testing phase and are limited to small clearings with well drilling or monitoring wells. If further exploration and other activities occurred during the same time on existing leases as exploration and other activities on the Consent to Lease parcels, there could be cumulative indirect effects of smoke, dust and noise associated with mechanical activities, burning of slash and heavy equipment operations. This would likely be of short duration of one day to several weeks and because acreages would be small (1-5 acres of disturbance), there would not be large amounts of dust, smoke or noise produced, even cumulatively.

Other vegetation management projects in the area that overlap the Consent to Lease project include the Lava Cast Project that was signed on January 31, 2007. There is one unit in the Lava Cast project NEPA document that would overlap with Parcel 1 of the Consent to Lease project. No part of the Lava Cast unit within Parcel 1 is within the IRA therefore there would be no direct cumulative effect to the IRA from the Geothermal Consent to Lease project combined with the Lava Cast project because no ground disturbing activities would take place within the IRA for either project, even under RFD scenarios for the Consent to Lease project.

Figure 17: Parcel 1 - Inventoried Roadless Area and No Surface Occupancy

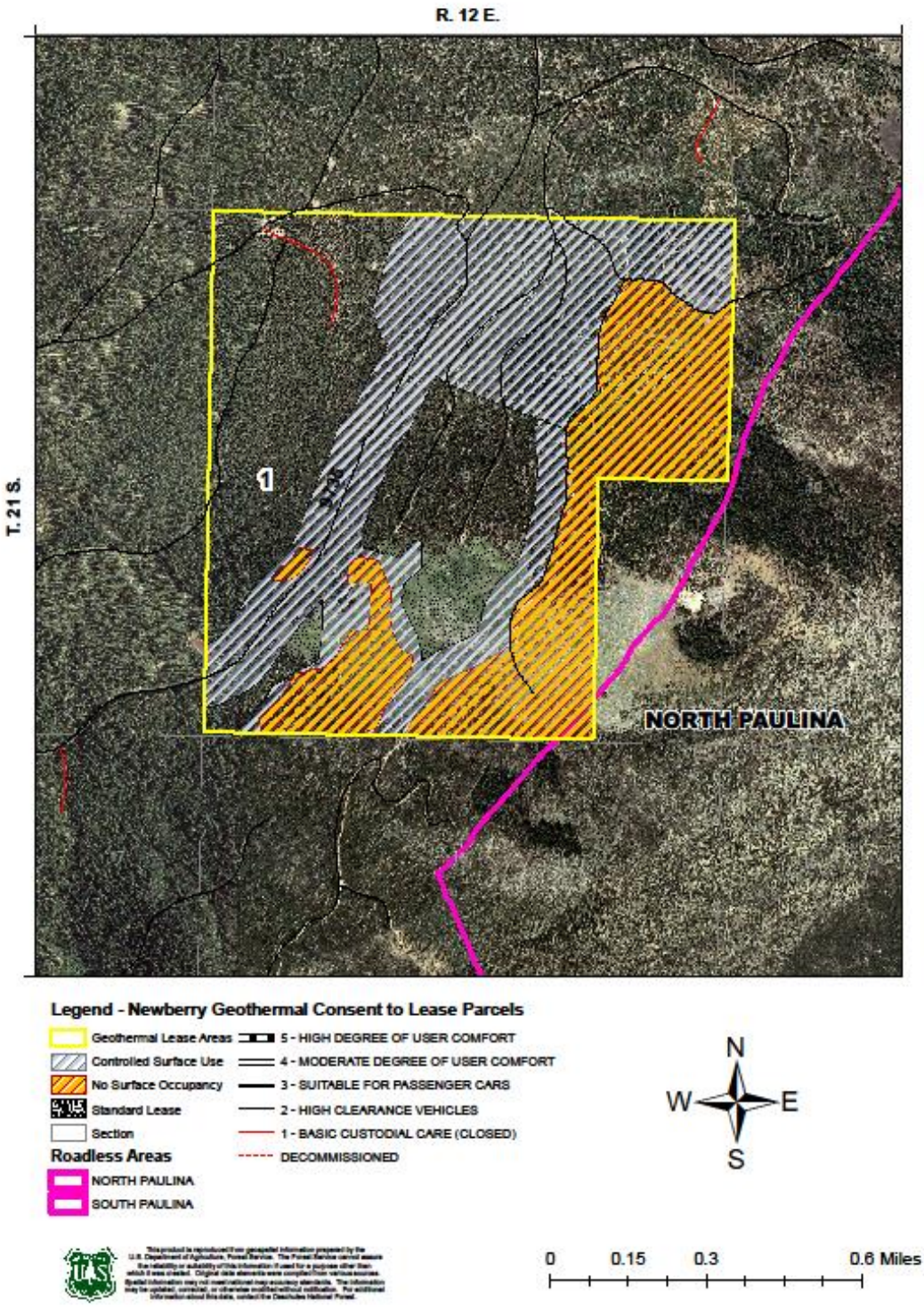


Figure 18: Parcel 4 - Inventoried Roadless Area and No Surface Occupancy

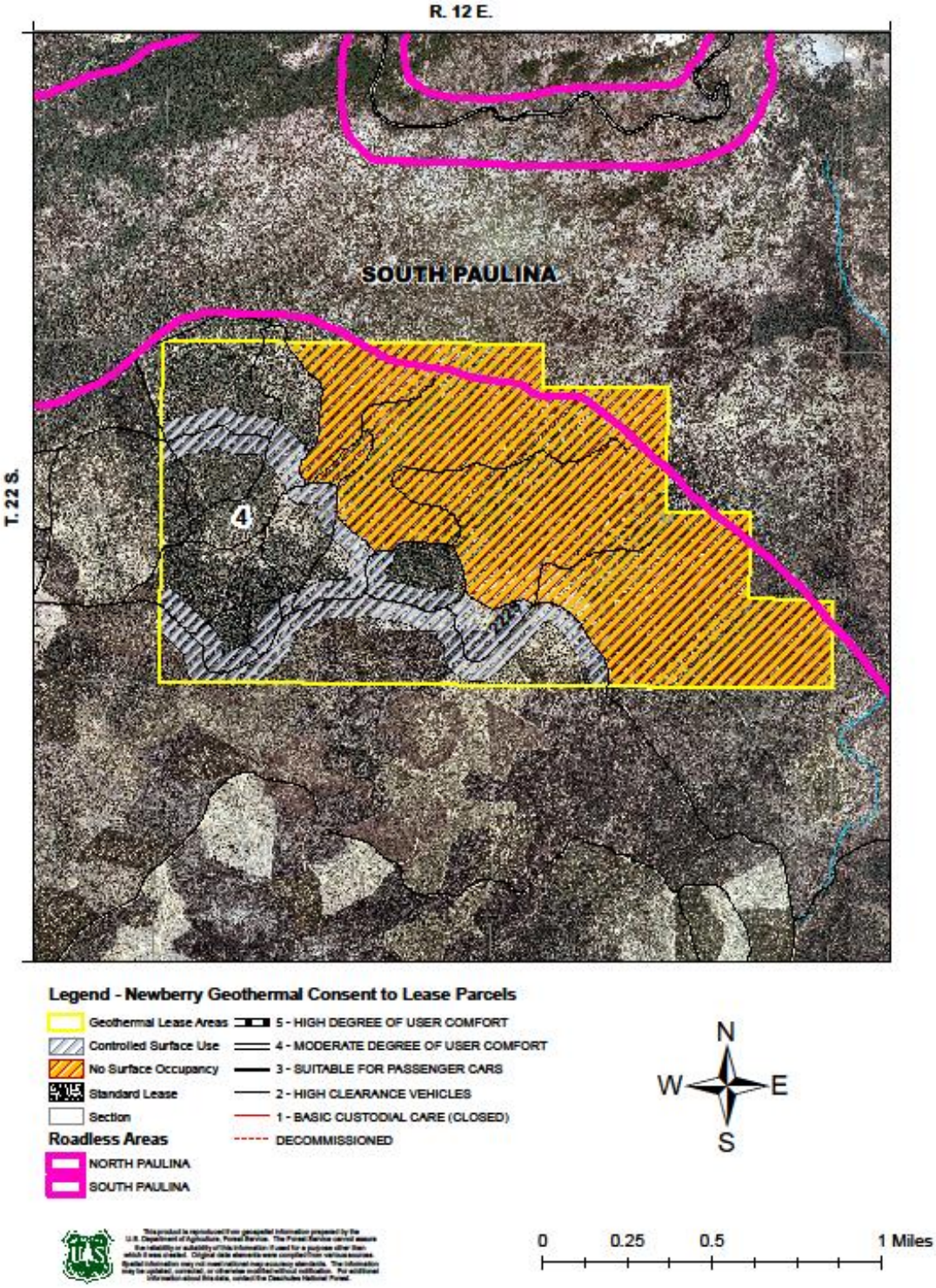
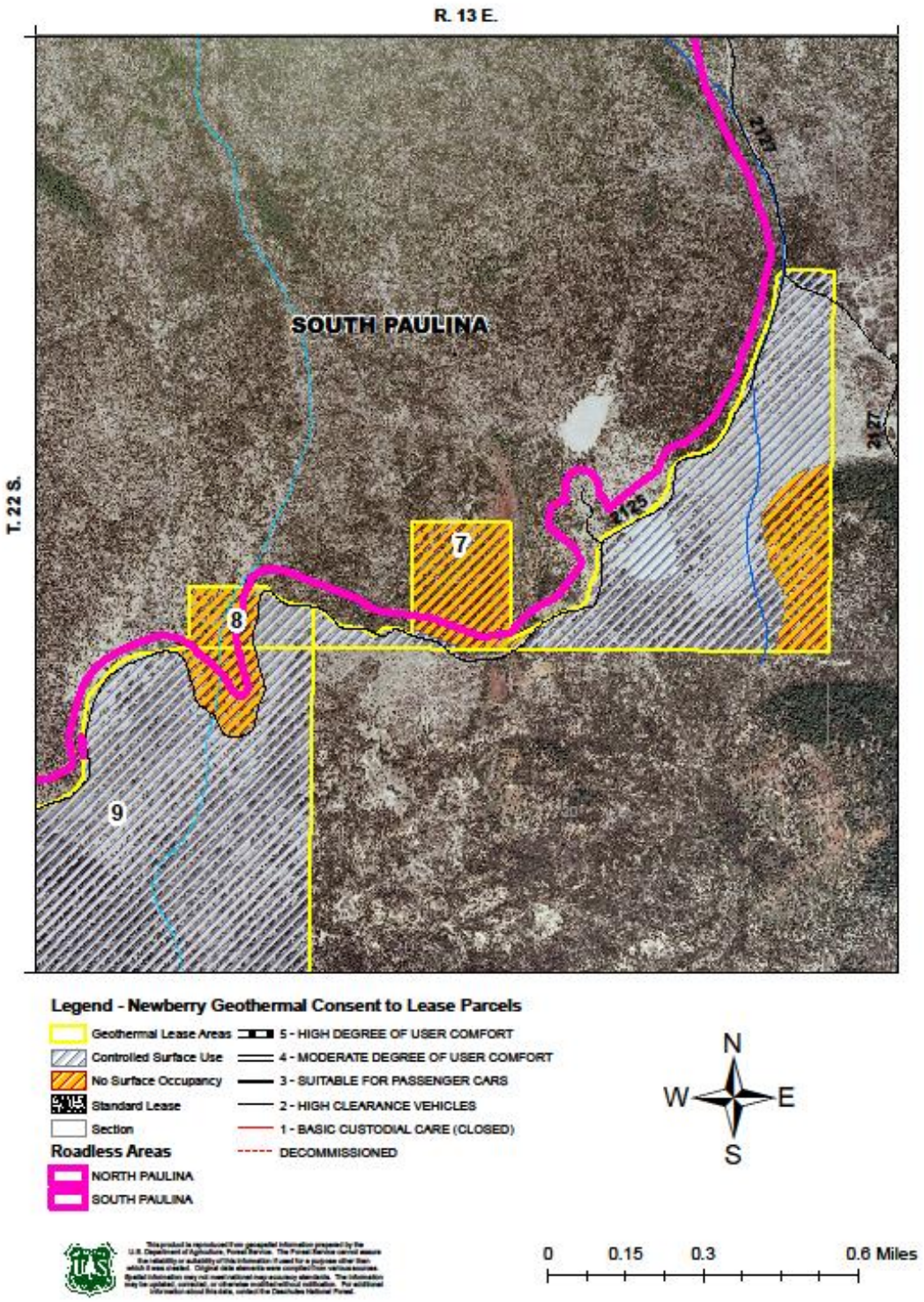


Figure 19: Parcels 7, 8 and 9 - Inventoried Roadless Area and No Surface Occupancy



The Lava Cast unit within parcel 1 is a commercial thinning unit and subsequent post sale activities where tree removal would occur. Impacts of implementing actions authorized with the Lava Cast project would be an indirect effect to people recreating in the IRA. The harvesting of the units has been completed along with precommercial thinning of small trees but post-harvest activities such as slash disposal and fuel reduction have not been completed. These activities include machine mowing of shrubs, piling of slash, pile burning and underburning. These activities would produce noise and dust from the heavy equipment associated with mowing and piling of slash during the short duration of about 1 to 3 weeks while the activities were being accomplished. The pile and under burning would produce smoke of very short durations of 1 to several days, normally in the spring for underburning or in the fall for pile burning.

Since the Consent to Lease project does not authorize any ground disturbing activities, there would be no cumulative effects overlapping with the Lava Cast unit.

Under RFD scenarios, there would potentially be cumulative indirect effects from both the geothermal Consent to Lease project and operations associated with implementing the activities from the Lava Cast unit that use heavy equipment that would result in noise and dust and with slash disposal that would result in smoke. This overlap of impacts would likely be a very short duration of one day to several weeks and would be affecting a small area within the parcel therefore not creating a significant amount of noise, dust or smoke that could be seen from the IRAs. There would be small plumes of smoke from pile burning lasting a few weeks potentially; associated with both projects. A larger plume of smoke lasting one to two days would be associated with underburning of the Lava Cast unit which may overlap with some pile burning associated with a reasonable development scenario for the geothermal project. See Figure 5 for a depiction of the overlap of the Lava Cast unit with Parcel 1.

Another vegetation management project that potentially could overlap with the Geothermal Consent to lease parcels under reasonable development scenarios is the Ogden Vegetation Management Project that was signed on September 9, 2012 and would be implemented in 2013 and beyond. Vegetation management units occur within Parcels 2 and 3 of the Consent to Lease project. These two parcels do not contain any IRA. Therefore, there are no Ogden Vegetation Management projects that overlap with the Consent to Lease project within the IRAs. Because no overlap exists, there will be no direct cumulative effects even under RFD scenarios. Vegetation management and Consent to Lease operations under reasonable development scenarios could result in indirect effects of smoke, dust and noise that could be visible by people recreating in the IRAs. The impacts would be of short duration of as described in the Lava Cast section above. Refer to Figure 21, page 76 for a depiction of the Geothermal Consent to Lease Parcel overlap with Ogden Vegetation Management project.

Figure 20: Overlap of Lava Cast Commercial Thin Unit with Parcel 1

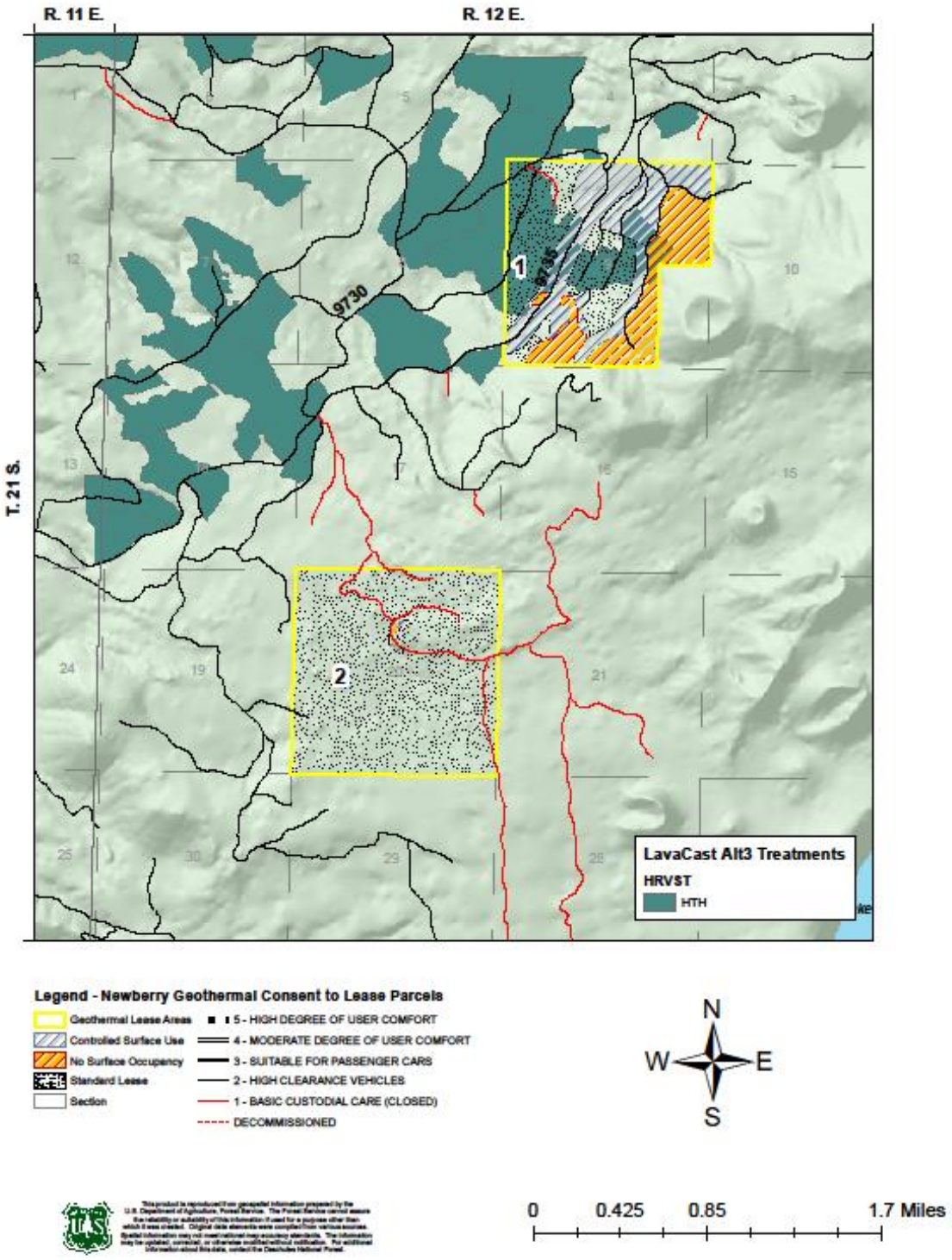
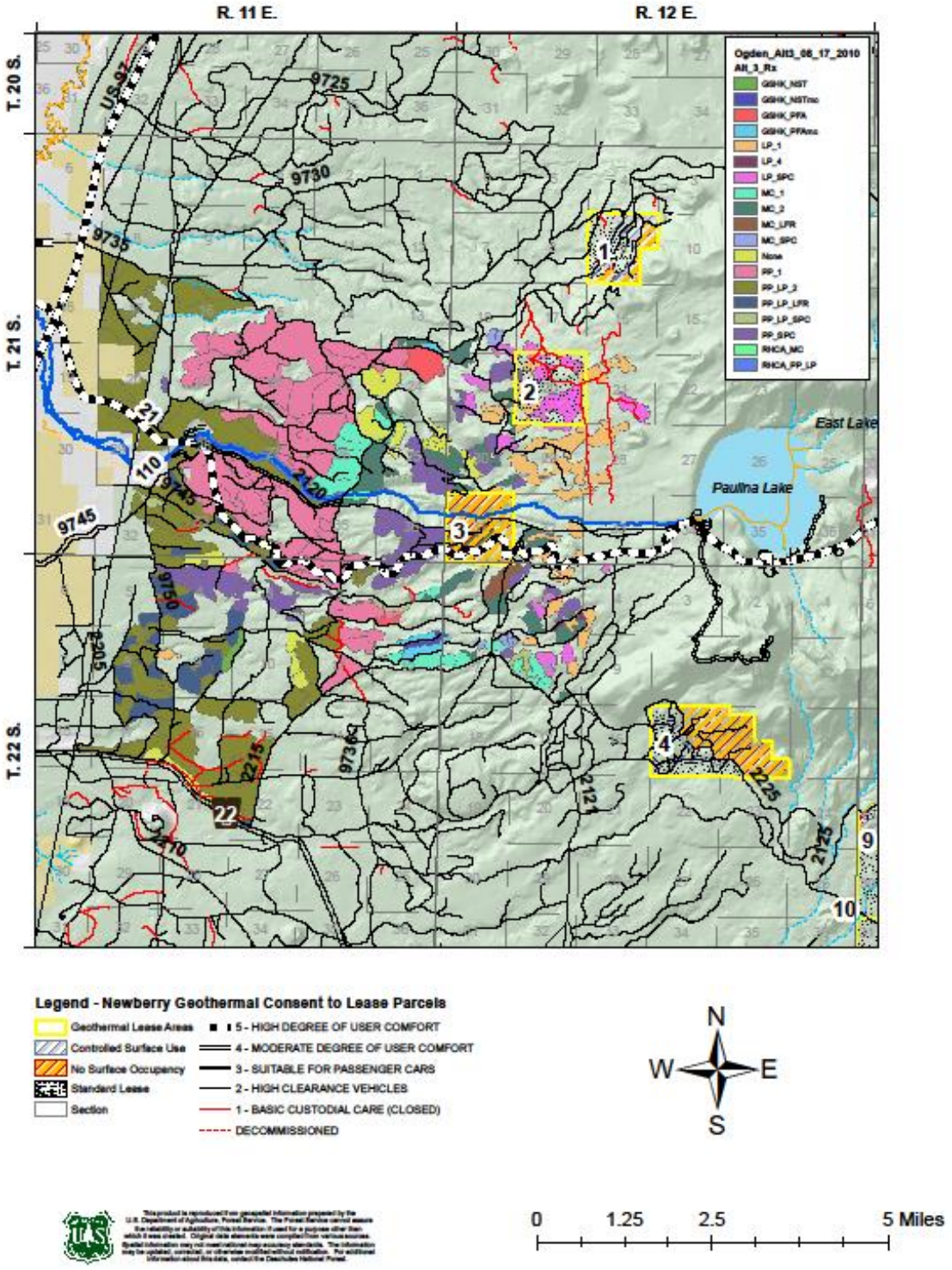


Figure 21: Ogden Vegetation Management Units with Geothermal Consent to Lease Parcels



Areas Meeting the Inventory Criteria for Potential Wilderness

Affected Environment

Areas meeting the inventory criteria for potential wilderness were identified using the inventory procedures found in Forest Service Handbook (FSH) 1909.12, Chapter 71. The inventory is conducted by the Forest Service with the purpose of identifying areas meeting the criteria for potential wilderness in the National Forest System. The analysis is documented in a specialist's report (Ferguson, 2013) and is incorporated by reference.

Areas meeting the inventory criteria for potential wilderness are not a land designation decision, they do not imply or impart any particular level of management direction or protection, they are not an evaluation of potential wilderness (Chapter 72), and lastly they are not preliminary administrative recommendations for wilderness designation (Chapter 73). The inventory of areas meeting the potential wilderness criteria does not change the administrative boundary of any IRA.

Typically, areas meeting the inventory criteria substantially overlap and/or are contiguous with IRAs.

Methodology

The Geothermal Consent to Lease project area and an adjacent two miles were inventoried utilizing the criteria in FSH 1909.12, Chapter 71. Areas are evaluated and are eligible for inclusion in the inventory if the area meets either criteria 1 and 3, or criteria 2 and 3 below:

1. Areas contain 5,000 acres or more.
2. Areas contain less than 5,000 acres, but can meet one or more of the following:
   a. Areas can be preserved due to physical terrain and natural conditions.
   b. Areas are self-contained ecosystems, such as an island, that can be effectively managed as a separate unit of the National Wilderness Preservation System.
   c. Areas are contiguous to existing wilderness, primitive areas, Administration-endorsed wilderness, or potential wilderness in other Federal ownership, regardless of their size.
3. Areas do not contain forest roads (36 CFR 212.1) or other permanently authorized roads, except as permitted in areas east of the 100th meridian (see FSH 1909.12, section 71.12).

Additionally, the Handbook provides guidance when it is acceptable to include areas with past management actions. FSH 1909.12, section 71.11 (9) states that timber harvest areas where logging and prior road construction are not evident may be included in the inventory.

For the Geothermal Consent to Lease project inventory area of approximately 166,215 acres, information regarding past harvest and tree cutting operations and previous and existing road construction was reviewed from corporate databases to determine if areas were qualified to be included in the inventory using the criteria described above. Additionally, satellite imagery was utilized to determine if previously harvested areas and roads were present on the ground but not captured in the corporate databases. GIS analysis was utilized to identify areas with no previous tree cutting operations, including any roadside hazard tree removal or firewood cutting, and with no evidence of road building. The area of analysis included the North and South Paulina Peak IRAs and was extended to approximately two miles beyond the Geothermal Consent to Lease parcels to determine if larger areas meeting the inventory criteria were present adjacent to the project area.

Any polygons not containing evidence of past harvest or tree cutting operations or evidence of prior road construction were compared with the inventory criteria above and given a polygon number for ease of tracking the disposition of each polygon over one acre through the inventory process. Polygons

were also edited if a portion of the polygon created an isthmus or other shape that did not lend itself to being maintained as one polygon.

Satellite imagery from the National Agriculture Imagery Program (NAIP) were utilized and overlaid with harvest unit polygons to look for evidence of stumps and roads. Once all data was reviewed and updated into the GIS analysis, a final listing of all polygons one acre or larger was identified as not having any previous evidence of tree cutting or road construction totaling 72,349 acres. Each polygon was then compared against the criteria from the Handbook and determination was made if they met the inventory criteria (refer to specialist report, Appendix A).

The methodology and rationale used to inventory and identify areas as eligible for inclusion in the PWA inventory within the analysis area are located in Appendix A of the Wilderness, IRA, and Areas Meeting the Inventory report (Ferguson, 2013). Maps included in Appendix A show a visual progression of the inventory process and final results. The analysis resulted in five polygons meeting the inventory criteria for potential wilderness. The five polygons (300, 552, 661, 559, and 615) are displayed in Table 7 and Figure 22, page 79.

Table 7: Polygons Meeting FSH 1909.12, Chapter 71 Inventory Criteria for Potential Wilderness

Polygon ID	PWA acres	Parcel Number(s)	Parcel Acres
300	2,758	5, 6	913
615	10,273	4, 7, 8, 9	343
661	22,914	1	49
552	1,628	N/A	0
559	4,302	N/A	0
Total Acres	**41,876**	**N/A**	**1,305**

Inventory Results

The largest of the polygons (661 and 615) include the North and South Paulina Peak IRAs respectively (within NNVM) and any adjacent and contiguous unharvested and unroaded areas. The other larger polygons are separated from the IRAs by roads but are large unroaded or unharvested areas. Polygons 559 and 552 are not near any Geothermal Consent to Lease parcels and therefore they would not be affected by the project and are not discussed further. Polygons 300, 661 and 615 do include geothermal Consent to Lease parcels. See Table 7 for a depiction of the numbered polygons meeting the inventory criteria for potential wilderness area in the inventory area. See Figure 22, page 79, for a depiction of the areas meeting the inventory criteria for potential wilderness overlapping with the geothermal Consent to Lease parcels.

Polygons 109 (1,167 acres), 377 (1,789 acres), and 647 (1,248 acres) are larger areas without prior harvest or roads but were not included in the areas meeting the inventory criteria for potential wilderness. Polygon 377 is partially within Parcel 9 and impacts are discussed in the unroaded section of this report. Polygons 647 and 109 are not near any Consent to Lease parcels. These three polygons are not self-contained ecosystems but are areas totally surrounded by past harvest, including clearcutting, and roads. They cannot be effectively managed as a separate unit of the national wilderness preservation system because there is nothing that can separate them from the surrounding area such as a natural feature nor are the polygons in an island situation

Figure 22: Polygons Meeting the Inventory Criteria for Potential Wilderness

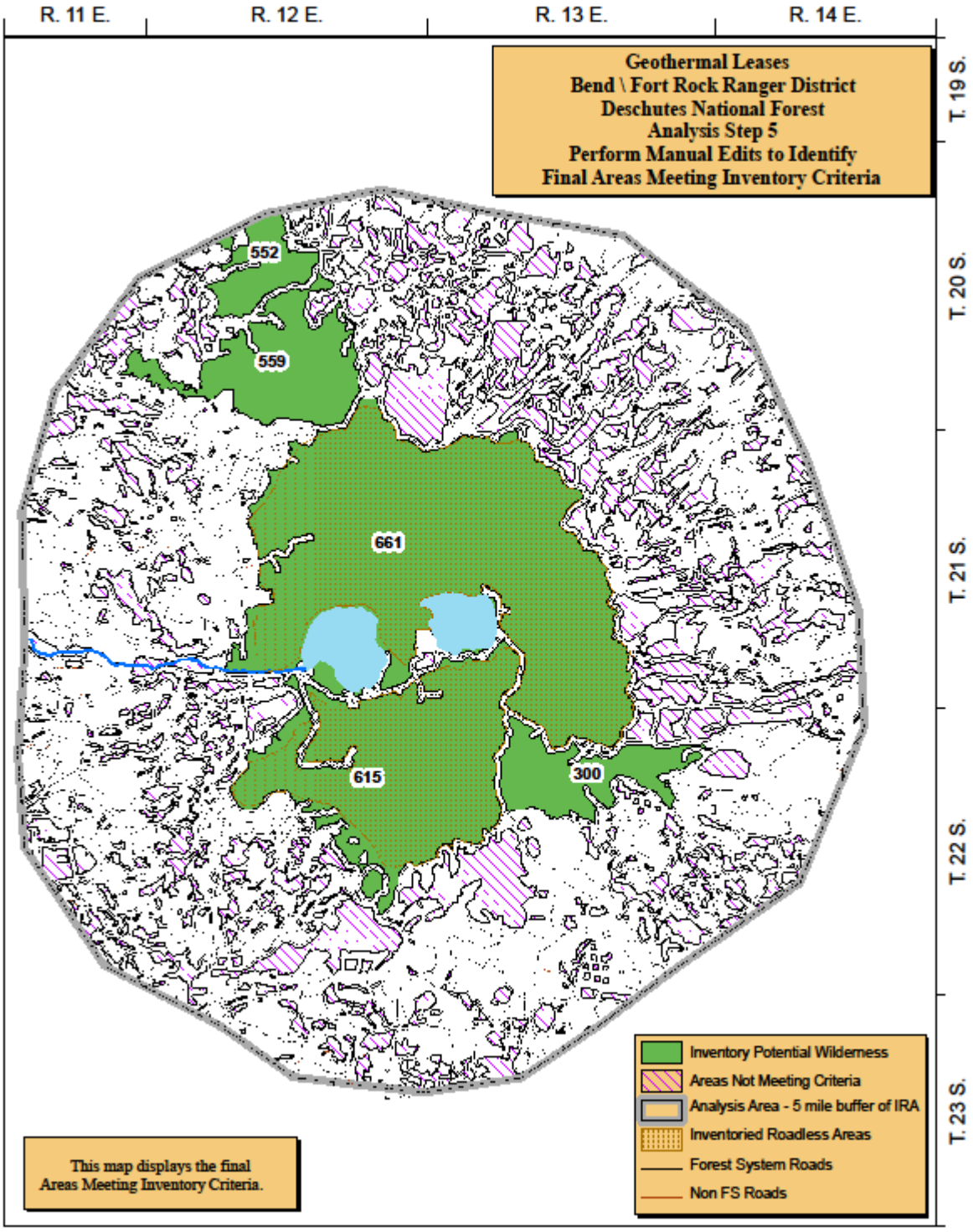
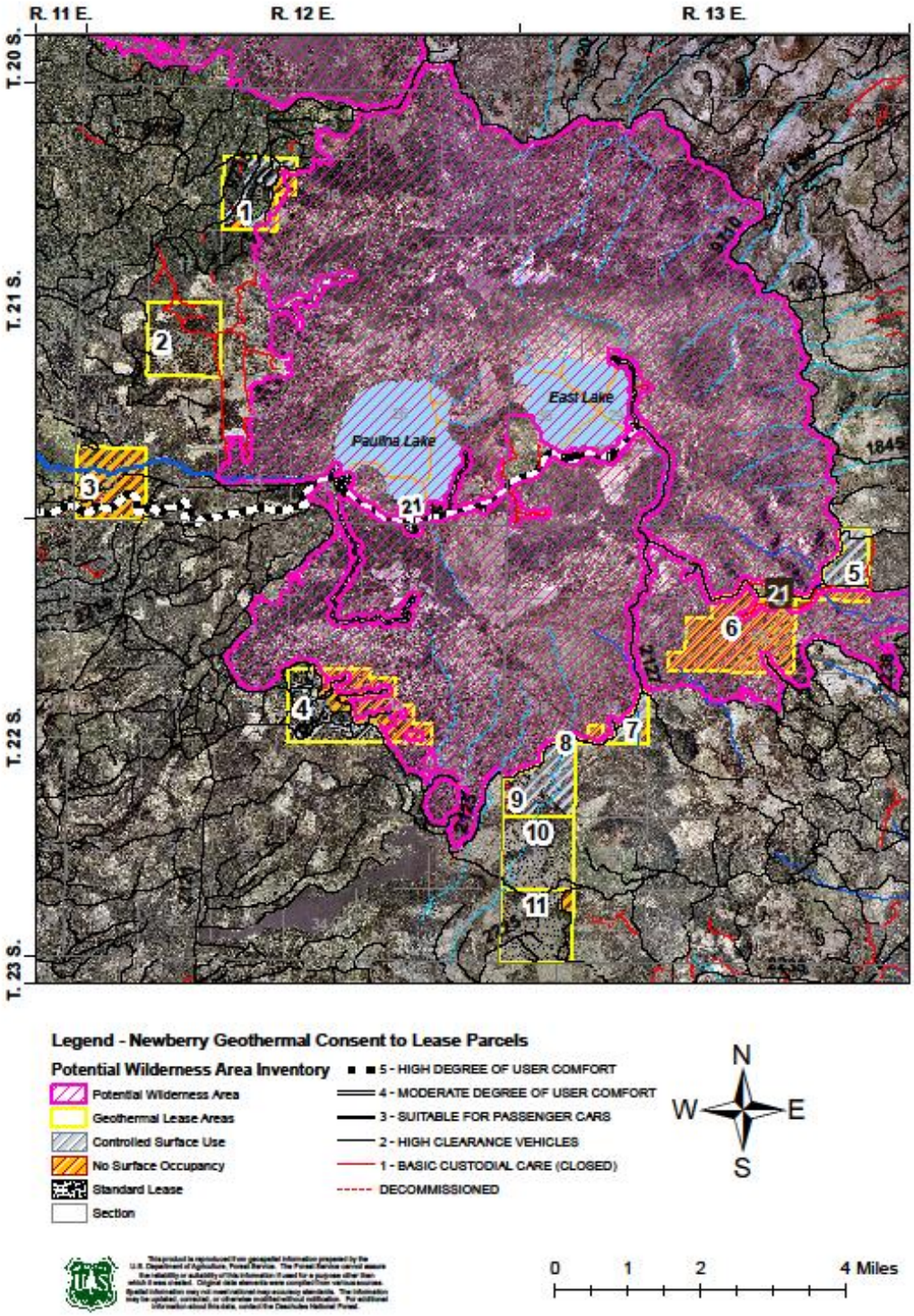


Figure 23: Areas Meeting the Inventory Criteria for Potential Wilderness and the Geothermal Consent to Lease Parcels



Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect: There would be no direct/indirect effects to the five polygons identified as eligible for inclusion in the potential wilderness inventory because no activities would occur with the implementation of the Geothermal Consent to Lease project. The leases would not be sold and conditions within the lease areas would remain the same. The affected environment would remain unchanged, except by natural processes and other actions authorized by other NEPA decisions. Biological and ecosystem functions would continue to function.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Parcels 1, 4, 5, 6, 7, 8 and 9 include areas that meet the inventory criteria for potential wilderness. A total of 1,306 acres of areas meeting the inventory criteria for potential wilderness are within the geothermal Consent to Lease parcels listed in Table 8. The stipulations in Chapter 2 of this EA do not allow surface occupancy in certain portions of certain parcels. The project has been designed to not allow any surface occupancy in the areas of the parcels that are within areas that meet the inventory criteria for potential wilderness (Refer to Table 8).

Table 8: Acres Meeting the Inventory Criteria for Potential Wilderness within Consent to Lease Parcels

Parcel	Acres	Acres Meeting Inventory Criteria within Parcel	No Surface Occupancy (NSO) Acres within Parcel	Acres Meeting Inventory Criteria outside of NSO within Parcel
1	560	49	146	0
2	645	0	2	0
3	614	0	614	0
4	1,050	312	580	0
5	352	60	104	0
6	997	853	997	0
7	176	25	53	0
8	16	5	10	0
9	492	1	30	0
10	633	0	0	0
11	639	0	47	0
Total	**6,172**	**1,306**	**2,582**	**0**

The Consent to lease project does not authorize any ground disturbing actions to take place; only sets the stipulations to be included with the lease when the lease is offered for bid by the BLM. The parcels include no surface occupancy stipulations for the areas meeting the inventory criteria for potential wilderness. Therefore there would be no direct effects to the areas meeting the inventory criteria for potential wilderness from the Consent to Lease project because no activities are authorized with the Consent to Lease project and the lease would include no surface occupancy stipulations.

Additional NEPA would be needed to actually authorize any actions once the lease is assigned by the BLM to a purchaser.

Reasonably Foreseeable Developments (RFDs) and Potential Cumulative Effects

RFD scenarios were also analyzed to address potential effects that could take place if exploration or development occurred. Under RFD scenarios, no surface activities would take place within the areas meeting the inventory criteria for potential wilderness of the parcel because the lease language would include no surface occupancy stipulations. Therefore there would be no direct effects, even under RFD

scenarios of exploration or development because no ground disturbing actions would take place within the areas meeting the inventory criteria within the parcels.

The inventory criteria for potential wilderness is applied at the polygon level therefore there would be no indirect impacts from any actions outside of an area meeting the inventory criteria. If tree cutting or road building occurred directly adjacent to an area meeting the inventory criteria, the area would still meet the inventory criteria because no tree cutting or road building would occur within the area.

Figure 24, page 83, Figure 25, page 84, Figure 26, page 85, and Figure 27, page 86, show the individual parcels with the No Surface Occupancy and the areas meeting the inventory criteria for potential wilderness. These figures all display that all areas that meet the inventory criteria for potential wilderness have stipulations that dictate no surface occupancy, therefore no ground disturbance will occur with the Consent to Lease project, even under reasonable development scenarios.

Cumulative Effects

Because there would be no direct or indirect effects to the areas meeting the inventory criteria for potential wilderness because no surface occupancy would be allowed, there would be no cumulative effects from any other project in the area. Since the inventory criteria is applied to the area of the polygon as described above then there would also be no indirect effects from any actions occurring directly adjacent to the area meeting the inventory criteria for potential wilderness because the area meeting the inventory criteria would remain unaffected by any adjacent activities.

Figure 24: Parcel 1 - Area Meeting Inventory Criteria for Potential Wilderness and No Surface Occupancy

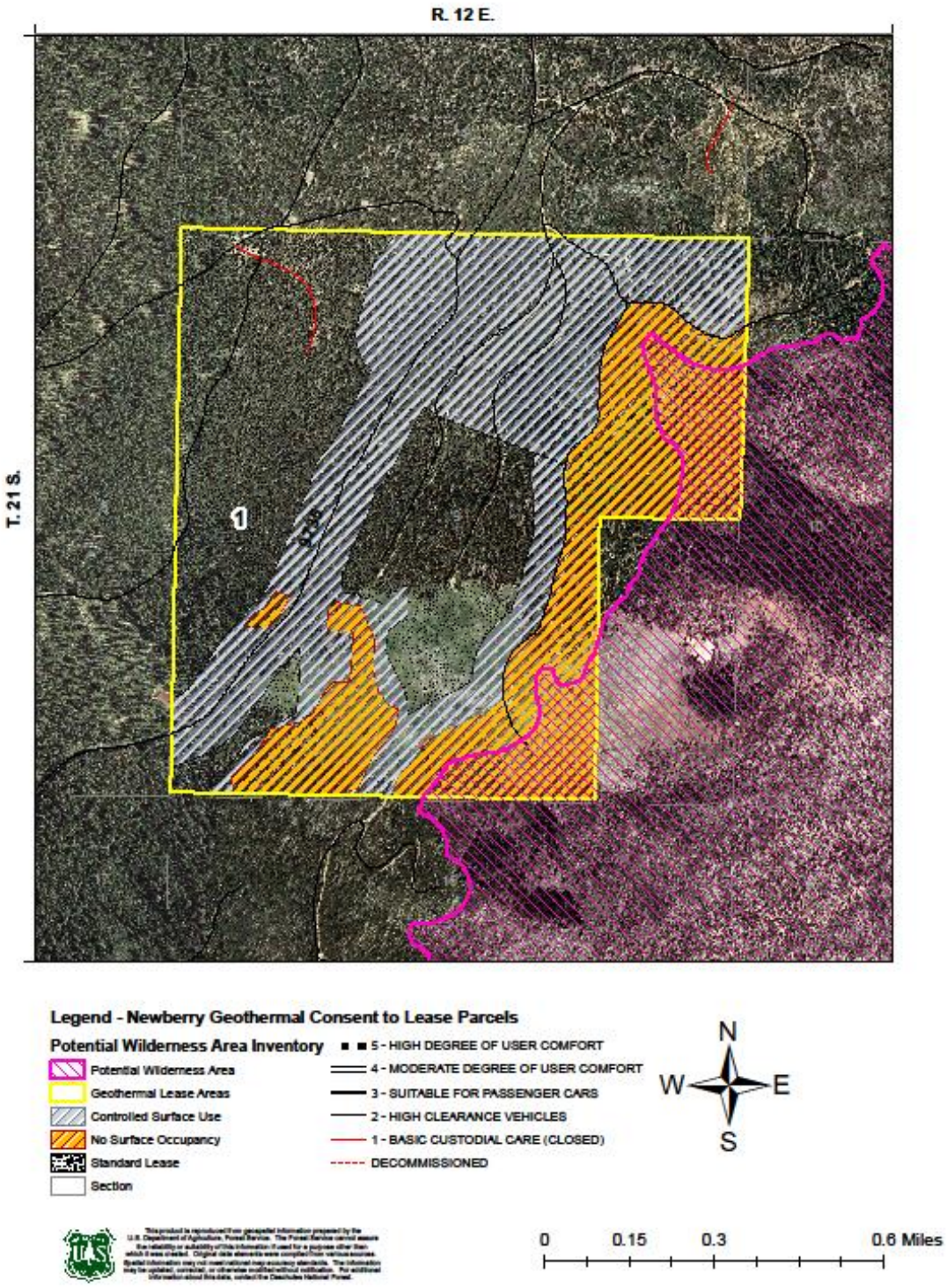


Figure 25: Parcel 4 - Area Meeting Inventory Criteria for Potential Wilderness and No Surface Occupancy

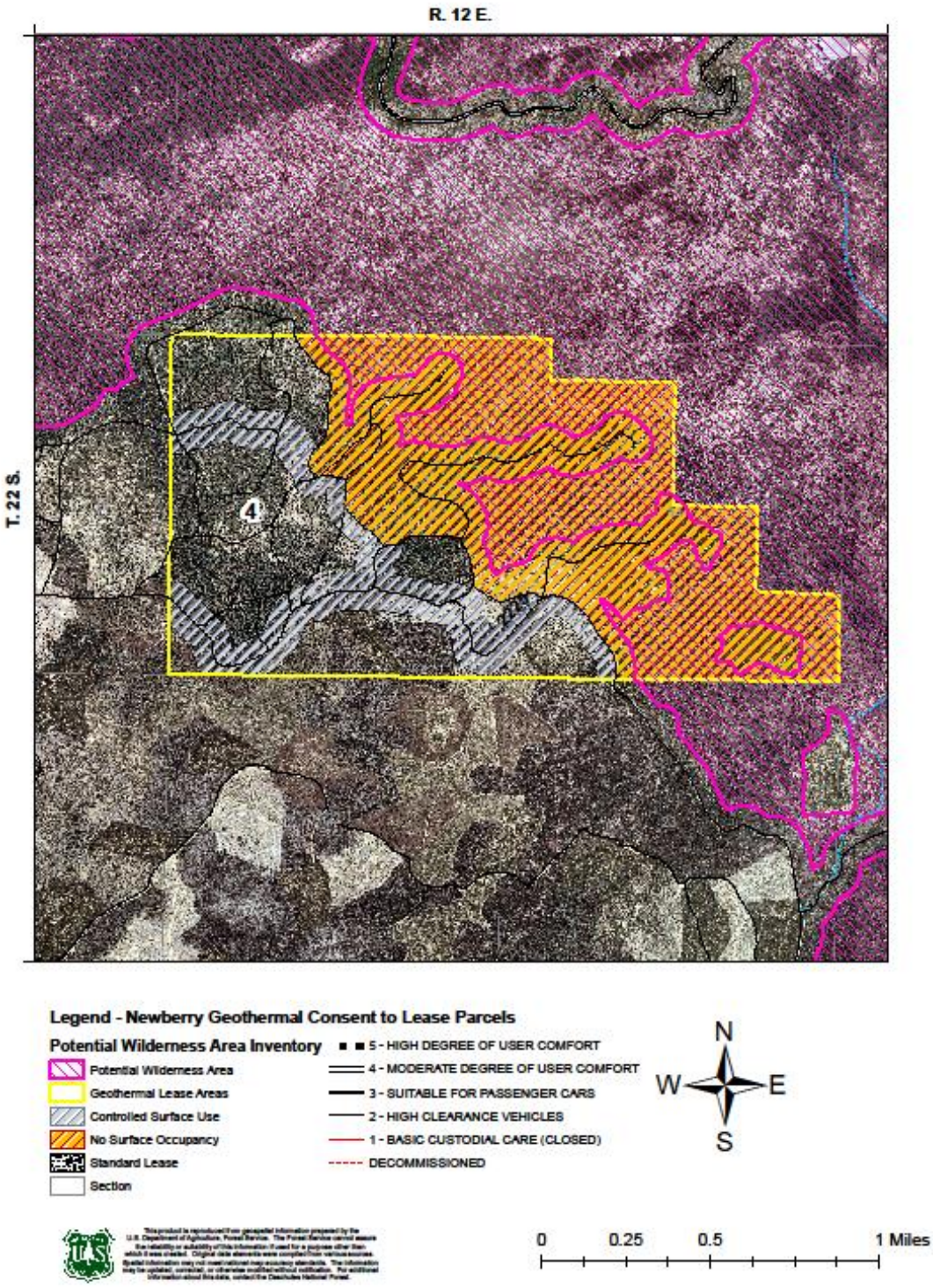


Figure 26: Parcels 5 and 6 - Area Meeting Inventory Criteria for Potential Wilderness and No Surface Occupancy

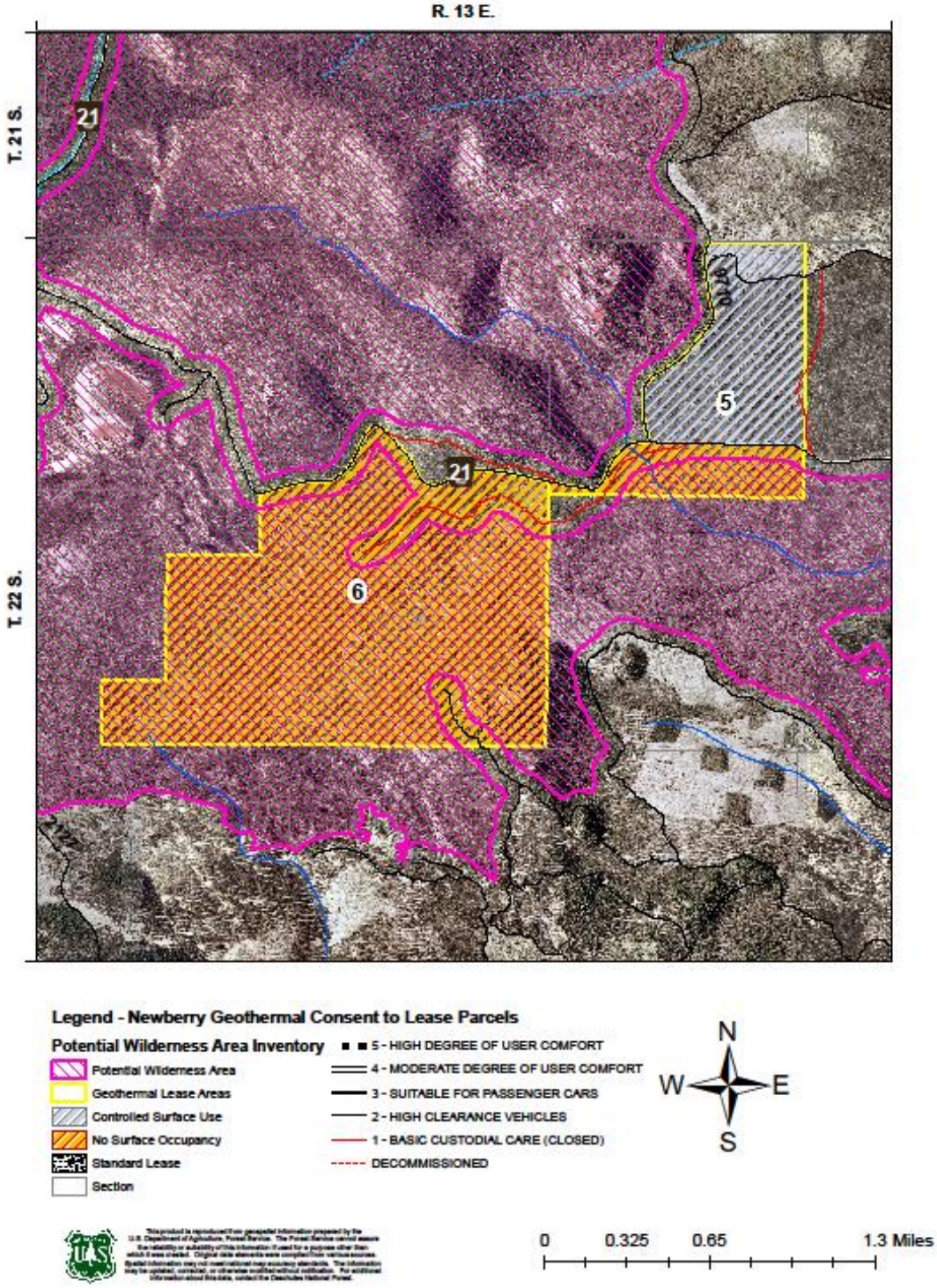
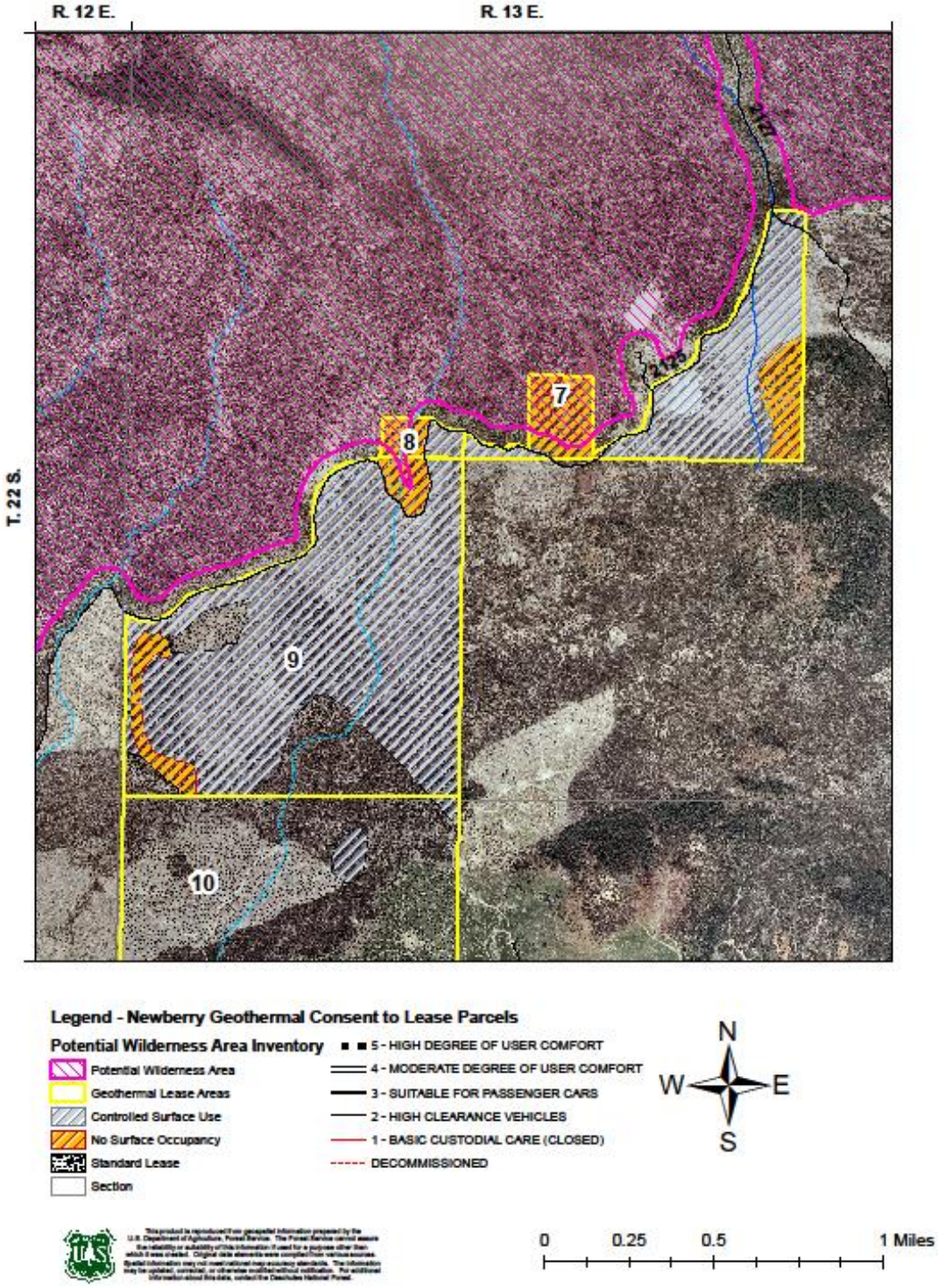


Figure 27: Parcels 7, 8 and 9 - Area Meeting Inventory Criteria for Potential Wilderness and No Surface Occupancy



Unroaded Areas or Undeveloped Lands

These areas of land have no history of harvest activity, do not contain forest roads[4], and are not designated as a wilderness area, inventoried roadless areas and do not meet the criteria for potential wilderness. Therefore they are smaller areas of unroaded or unharvested areas outside of the areas just described. These areas could have values and impacts associated with them as discussed under IRAs.

Background

Unroaded areas outside of IRAs and areas meeting the inventory criteria for potential wilderness and are found in smaller parcels of land in the inventory area. These areas are small unharvested areas surrounded by roads and past timber harvest. The areas within the parcels are no different than small patches of unharvested areas outside of the parcels and are not unique on the landscape. All of the parcels contain small acreages of areas that have not been previously harvested or roaded. However, none of these areas are considered large and are within a mosaic of vegetative conditions across the landscape as a result of past patch harvesting of timber.

As previously discussed, polygons 109 (1,167 acres), 377 (1,789 acres), and 647 (1,248 acres) are larger areas without prior harvest or roads but were not included in the areas meeting the inventory criteria for potential wilderness. Polygons 647 and 109 are not near any Consent to Lease parcels. Polygon 377 is partially within Parcel 9.

The largest area of unroaded and unharvested conditions is found in and around Parcel 9; however this area is totally surrounded by past clearcutting and is not unique on the landscape. Parcel 9 also contains conditional surface occupancy (CSU) stipulations that would regulate activities on this parcel and the majority of the unroaded portion of Parcel 9 is covered by the CSU stipulations (Refer to Figure 27, page 86 for a depiction of the surface stipulation area for Parcel 9).

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: No changes would occur to the areas identified as unroaded. Habitat conditions and undeveloped forested conditions would remain the same as the current condition. Biological and ecosystem functions would continue. The landscape would likely continue developing complex fuel loads. Cultural resources would remain the same and travelers along FS Road 21 would continue to view the flanks of Newberry Crater in the current condition.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: As already described in the IRA and areas meeting the inventory criteria for potential wilderness analysis sections, there would be no direct or indirect impacts to the smaller unroaded areas from the Consent to Lease project because the project does not authorize any ground disturbing activities.

Additional NEPA would be undertaken if exploration or development proposals were proposed after the leases were sold and assigned.

[4] Forest road – A road wholly or partly within or adjacent to and serving the National Forest System that the Forest Service determines is necessary for the protection, administration, and utilization of the National Forest System and the use and development of its resources. Road – A motor vehicle route over 50 inches wide, unless identified and managed as a trail (36CFR §212.1).

Under reasonable development scenarios, there may be direct impacts to these very small unroaded areas if the leases were sold and assigned and the purchaser proposed exploration or development activities. All parcels contain some amounts of existing roads and previous tree cutting activities outside of the areas meeting the inventory criteria for potential wilderness. All parcels but Parcel 10 have areas of no surface occupancy totaling 2,582 acres out of 6,172 acres of total lease acreage. In those parcels that have no stipulations prohibiting surface occupancy and there are areas of unroaded, however small, ground disturbance would result in direct effects to the unroaded portions of the parcels or directly outside of the parcel. Small patches of trees could be cut and removed for pad and road development to access areas for exploration or development. Potentially towers could get constructed, roads could be built and dust and noise would result from the construction of the geothermal pads and access roads to those pads. The duration and magnitude of these indirect effects would be limited to the actual construction and well drilling at the pad, likely taking about one month. Additional power lines and utility corridors that connect well heads with production sites and could be constructed resulting in more openings and more development within the leases and between leases. These impacts could be more long term as utility corridors are a more permanent structure. This could result in barriers to wildlife movement and fragment habitat for species associated with more interior forest conditions. Exploration activities in other leases have been occurring and have resulted in small clearings for well construction and have resulted in 1-5 acre clearings and it is assumed that this would be a reasonable development scenario with assumed ground disturbance acreages. Currently no electrical generating geothermal wells are operational at Newberry Caldera and therefore production geothermal development is speculative and would be contingent on additional NEPA analysis before any ground disturbing activities would occur, including exploration and electrical generating plants.

The Geothermal Consent to Lease project would result in no direct effects to the unroaded character of any portion of any of the leases because no ground disturbing actions are authorized. There would be no indirect effects from the Geothermal Consent to Lease project because no ground disturbing activities would occur with this decision.

Reasonably Foreseeable Development

Other geothermal leases are active within the project area. Activities are associated with small pad clearing for testing and well drilling, small segments of road development, exploration drilling and restoration of pads where drilling and investigations have been completed. Because the Geothermal Consent to Lease project does not authorize any ground disturbance and therefore no direct or indirect effects would be associated with the project, there would be no cumulative effects with any other project. Further NEPA would be completed before any ground disturbance would occur.

Under RFD scenarios, actions that could take place on the Consent to Lease parcels would not overlap with any other geothermal activity because actions occur on individual leases. Other leases that are in operation are in the exploration and testing phase and are limited to small clearings with well drilling or monitoring wells. If further exploration and other activities occurred during the same time on existing leases as exploration and other activities on the Consent to Lease parcels, there could be cumulative indirect effects of smoke, dust and noise associated with mechanical activities, burning of slash and heavy equipment operations. This would likely be of short duration of 1 day to several weeks and because acreages would be small (1-5 acres of disturbance), there would not be large amounts of dust, smoke or noise produced, even cumulatively.

Both Lava Cast and Ogden Vegetation Management Projects overlap with three of the Geothermal Consent to Lease parcels. A Lava Cast unit overlaps with Parcel 1 and Ogden Vegetation Management Units overlap with Parcels 2 and 3. However Parcel 3 is entirely no surface occupancy therefore any unroaded areas would remain unroaded under the geothermal Consent to Lease project therefore there

would be no cumulative effects with the Ogden project (Refer to Figure 20, page 75, and Figure 21, page 76. Since the Geothermal Consent to Lease project does not authorize any ground disturbing activities, there would be no direct or indirect cumulative effects with any of the vegetation management projects or other geothermal activities ongoing on the flanks of Newberry Crater.

Under RFD scenarios, contingent on additional NEPA, there could be indirect effects of smoke, noise and dust from construction activities that could overlap with timber harvest activities in the implementation of the Lava Cast and Ogden project in Parcels 1 and 2 as described previously in the IRA section. This would only occur if operations on both projects occurred at the exact time. As previously stated, exploration activities would be limited in duration to about 30 days and would only overlap in time for that duration with any timber sale activities that produce noise and dust.

Vegetation management occurring with the implementation of the Lava Cast and Ogden Vegetation Management project in parcels 1 and 2 would also result in changes to the habitat for wildlife species reliant on more unfragmented forested conditions. This is more fully discussed in the management indicator species analysis for wildlife and other resources.

Recreation and Land Use

Introduction

Recreation Resources

The public uses the project area primarily for snowmobiling, hiking, mountain biking, dispersed camping, big game hunting and driving for pleasure. Other activities include, but are not limited to OHV riding, caving, and wildlife viewing. The project area includes 1.4 miles of the Peter Skene Ogden (PSO) National Recreation Trail (NRT) and 14.5 miles of designated groomed snowmobile trails. Recreation special use permits in the area include an outfitter/guide operation, two resorts, concessionaire operated campgrounds and recreation residences. No developed recreation sites are located within the project area. Public use is relatively low, especially in comparison to the dramatic increase in the use of other areas of the Bend/Ft. Rock District. This is likely due to the lack of facilities and water bodies, location, and amount/variety of recreation opportunities available.

Land Uses

One utility corridor crosses through nominated lease parcel number three. The utilities serve both Forest Service and privately owned facilities.

Regulatory Framework

Land and Resource Management Plan

The LRMP provides standards and guides that affect recreation through trail management and energy resource management in the various management areas and Newberry Caldera Known Geothermal Resource Areas. The standards and guidelines related to the recreation experience and permitted activities within the project area inform how proposed management activities would be implemented and how the effects of those activities will be assessed within the Geothermal Consent to Lease project area. More specific discussion on the standards and guides is located at the beginning of the Recreation report in the project file.

Newberry National Volcanic Monument (NNVM) Comprehensive Management Plan

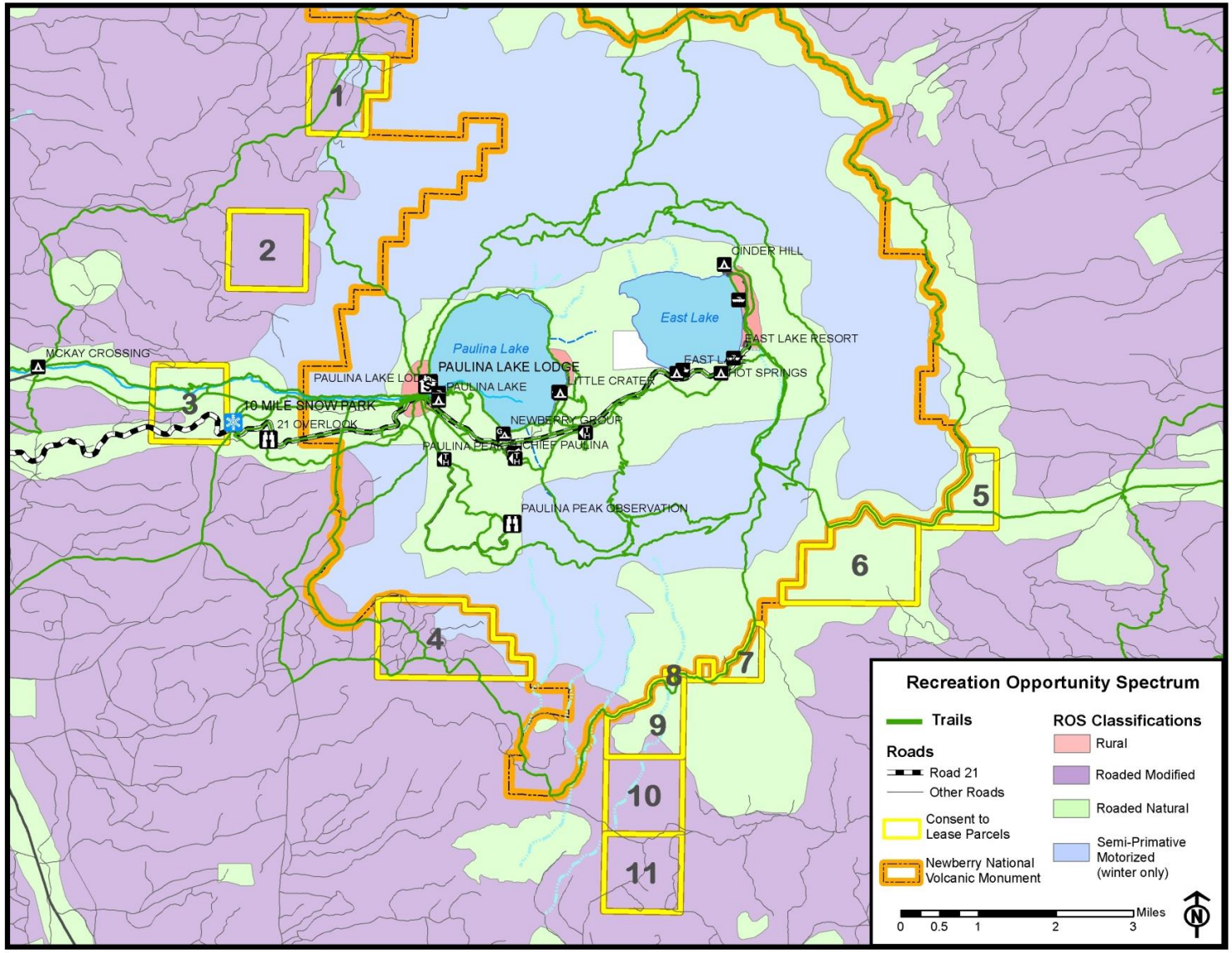
Proposed lease parcels 1, 4, 5, 6, 7, 8, and 9 are adjacent to the Monument boundary. The Flanks Zone surrounds the Newberry caldera and is undeveloped. The area is intended to provide opportunities for solitude and dispersed recreation in an unconfined setting, largely free of evidence of human disturbance. Standards and guidelines related to the recreation experience and permitted activities within the project area inform how proposed management activities would be implemented and how the effects of those activities will be assessed within the Geothermal Consent to Lease project area.

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 Forest Plan 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 three ROS classes identified for the lease area: Semi-primitive Motorized (winter only), Roaded Natural, and Roaded Modified (Figure 28, page 91).

Semi-primitive Motorized (winter only): Characterized by a predominately natural or natural appearing environment of moderate to large size. The area is managed in such a way that minimum, on-site controls and restrictions may be present, but subtle.

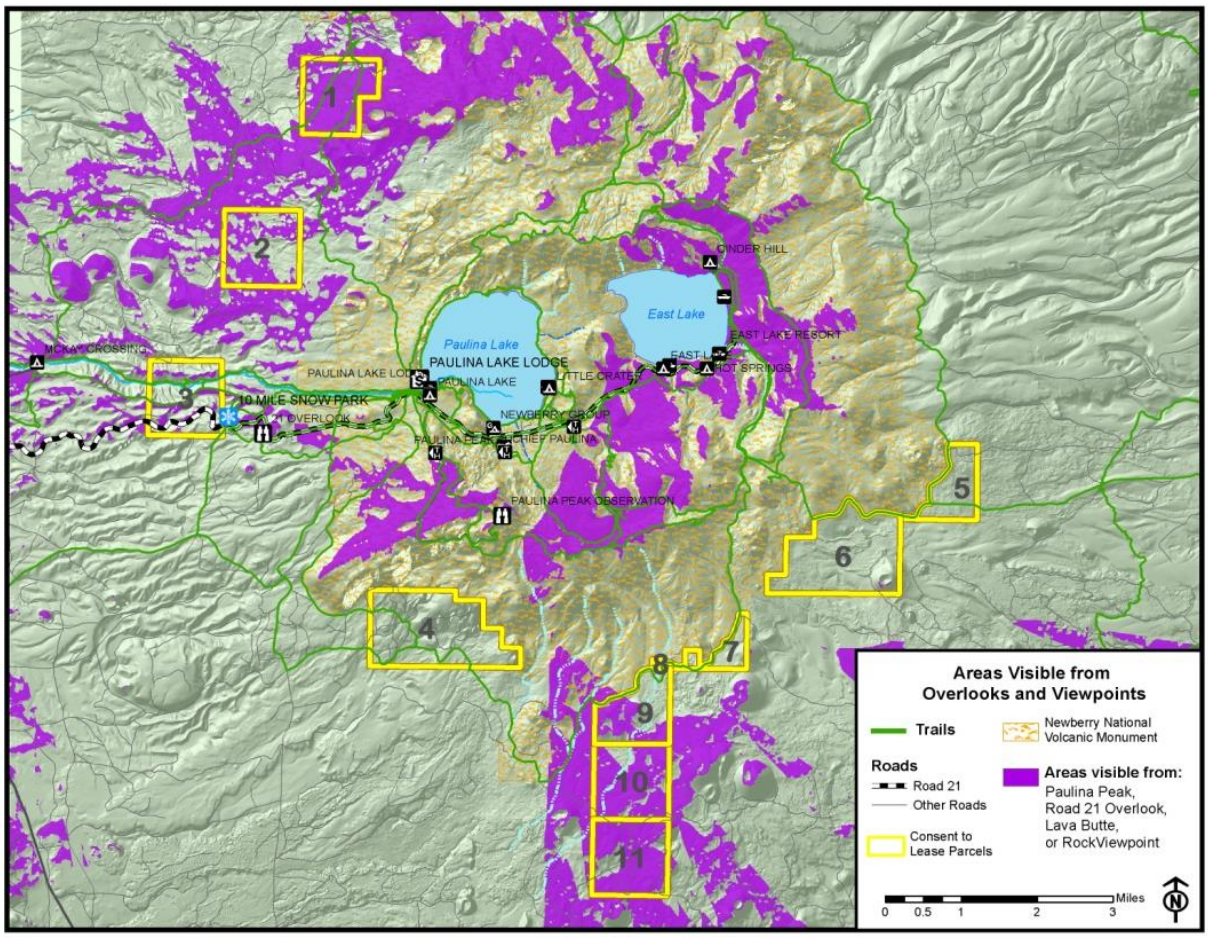
Figure 28: Recreation Opportunity Spectrum classifications for the Newberry Geothermal Consent to Lease project area



Roaded Natural: Characterized by predominately natural appearing environment with moderate evidence of the sights and sounds of humans. Such evidence usually harmonizes with the natural environment. Resource modification and utilization practices are evident, but harmonize with the natural environment.

Roaded Modified: Characterized by a setting that is heavily modified by human activity. Access is generally easy for highway vehicles. The setting is generally the result of intensive commodity production.

Figure 29: Areas Visible from Overlooks and Viewpoints



Analysis Methods

The analyses of environmental effects included in this report are based on the following assumptions:

A. Detailed descriptions of the proposed action and alternatives are included in Chapter 2 of the Newberry Geothermal Consent Lease Project Environmental Assessment and are not repeated in this report. Effects of the alternatives are based on those descriptions.

B. Recreation Resources: Damage and/or change to recreation infrastructure, trails and trailheads, public access, public safety, recreation use/experience and revenues generated by the recreational special uses (outfitter guides and events) and tourism are the attributes that may be affected by the proposed action and alternatives.

Recreation infrastructure:

- Damage and/or change to recreation infrastructure owned by the US Forest Service or privately owned and authorized under special use permit. This includes improvements such as buildings, signs and trails.

Trails and Trailheads:

- The physical recreational setting, and people's perception of the "natural" quality of their recreational experience.

Access:

- Type and scope of access affected
- Timing or season when recreational access may be affected

Safety:

- Effects to the public's safety during access and use of facilities and permitted areas.

Recreation Use and Experience:

- Effect on recreation use and experience in the affected area
- Effect on recreation use and experience in other areas (e.g. displacement)

Revenue:

- Effects on revenue including permitted special uses (outfitter/guides and events) and tourism
- Effects on revenue generated by permitted land uses.

C. Permitted Land Uses: Change to access, safety, and revenue generated by permitted land uses are the attributes that may be affected by the proposed action and alternatives.

D. Effects of the action alternatives are based on assumptions that the following general and special stipulations would be utilized (Table 5, beginning on page 47):

C. Permitted Land Uses: Change to access, safety, and revenue generated by permitted land uses are the attributes that may be affected by the proposed action and alternatives.

D. Effects of the action alternatives are based on assumptions that the following general and special stipulations would be utilized (Table 5, beginning on page 48):

Existing Condition

Winter and Summer National Forest System Trails

There are 1.5 miles of summer and 14.5 miles of winter snowmobile National Forest System Trails within the proposed lease areas (Table 9). Trails are characterized based on 'trail designed use', this is the use of a trail that requires the most demanding design, construction, and maintenance parameters. Other trail uses are permitted on all trails unless prohibited. For example, the PSO trail is designed for equestrian use; however, hiking is also permitted on the trail.

The PSO National Recreation Trail and the short PSO Bridge Tie are located within the Paulina Creek eligible Wild and Scenic River Area. Less than 1.5 miles lies within nominated parcel #3.

Table 9: Miles of National Forest System Trail, by Trail, Parcel and Special Stipulations

Trail Designed Use	Trail Name	Parcel#	Snowmobile Trail	Trail Miles
Snowmobile	Newberry #1	5	• Controlled Surface Use • Timing Limits	0.6
Snowmobile	Newberry #1	5	• No Surface Occupancy	1.1
Snowmobile	Newberry #1	6	• No Surface Occupancy	1.2

Trail Designed Use	Trail Name	Parcel#	Snowmobile Trail	Trail Miles
Snowmobile	Newberry #11	3	• No Surface Occupancy	1.1
Snowmobile	Newberry #120	3	• No Surface Occupancy	0.1
Snowmobile	Newberry #2	4	• Controlled Surface Use • Timing Limits	1.9
Snowmobile	Newberry #2	7	• Controlled Surface Use • Timing Limits	1.1
Snowmobile	Newberry #2	8	• Controlled Surface Use • Timing Limits	0.2
Snowmobile	Newberry #2	9	• Controlled Surface Use • Timing Limits	1.2
Snowmobile	Newberry #2	4	• No Surface Occupancy	0.4
Snowmobile	Newberry #2	8	• No Surface Occupancy	0.1
Snowmobile	Newberry #2	9	• No Surface Occupancy	0.4
Snowmobile	Newberry #64	1	• Controlled Surface Use • Timing Limits	1.0
Snowmobile	Newberry #64	1	• No Surface Occupancy	0.9
Snowmobile	Newberry #65	4	• Controlled Surface Use • Timing Limits	1.0
Snowmobile	Newberry #65	4	• No Surface Occupancy	0.4
Snowmobile	Newberry #80	1	• Controlled Surface Use • Timing Limits	1.1
Snowmobile	Newberry #80	5	• Controlled Surface Use • Timing Limits	0.7
Equestrian	PSO - NRT	3	• No Surface Occupancy	1.4
Equestrian	PSO Bridge Tie	3	• No Surface Occupancy	0.1
Total Trail Miles:				**16.0**

Land Uses

A utility corridor crosses thru parcel #3. Utilities include a Midstate Electric overhead transmission line and a Century Link buried phone line (Figure 32, page 97). These utilities serve FS and privately owned facilities.

NNVM Flank Zone

Parcels 1, 4, 5, 6, 7, 8 and 9 are adjacent to the Flank Zone management area of the NNVM. This zone is managed consistent with ROS classifications of semi-primitive non-motorized (summer) and semi-primitive motored (winter). Parcels 5 and 6 are adjacent to the Flanks Zone Newberry Special Management Area. Subsurface geothermal exploration and development are permitted within these areas; no surface occupancy (NSO) is permitted for any geothermal facility.

Viewpoints

Four primary viewpoints overlook the areas of the proposed leases: Paulina Peak, Road 21 Overlook, Lava Butte and Rock Viewpoint.

Special Use Permits

Recreation special use permits held in the area include the East Lake recreation residence tract, East Lake Resort, Paulina Resort and the Paulina Plunge outfitter/guide.

Figure 30: Summer Recreation Resources – Newberry Geothermal Consent to Lease Project Area

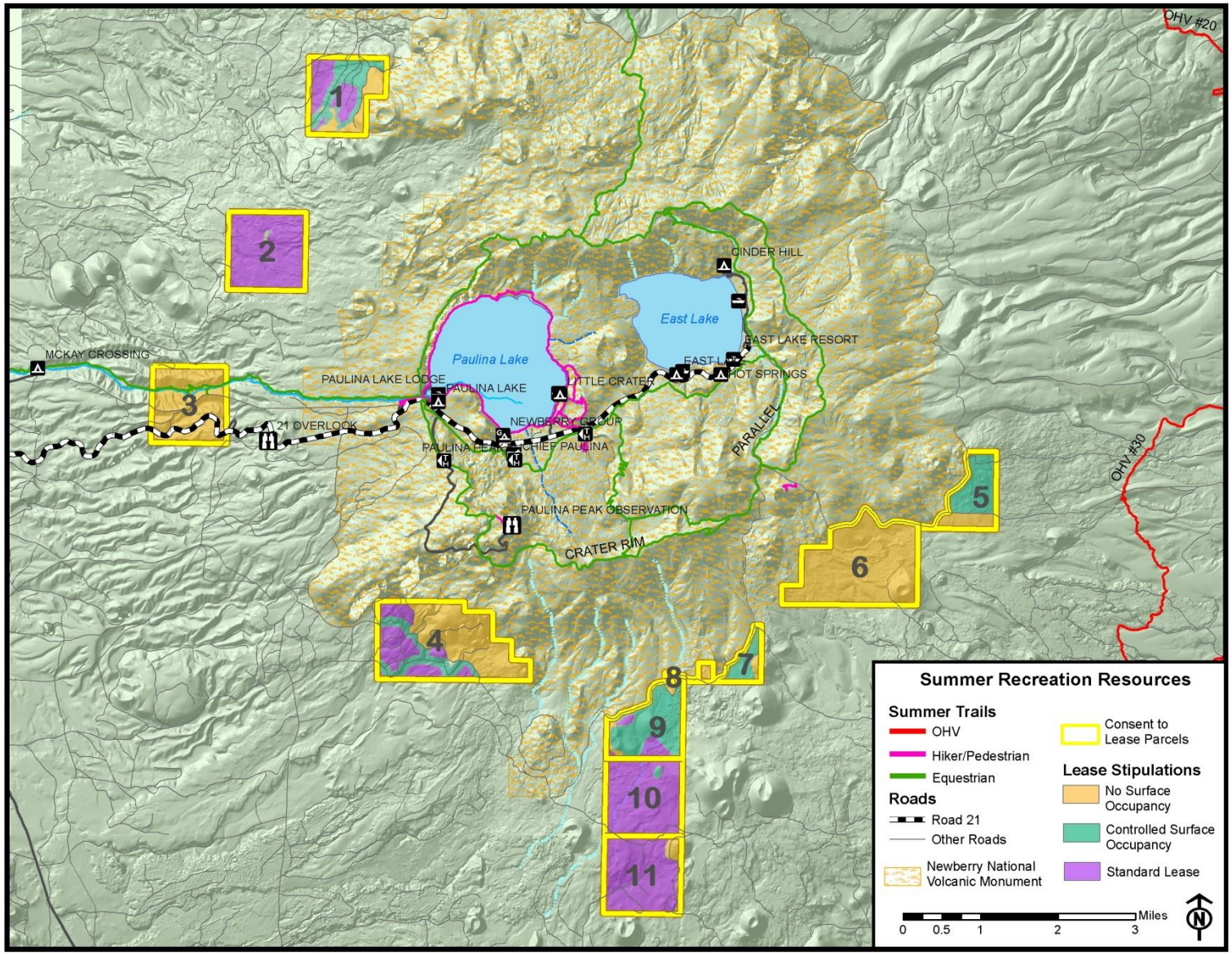


Figure 31: Winter Recreation Resources – Newberry Geothermal Consent to Lease Project Area

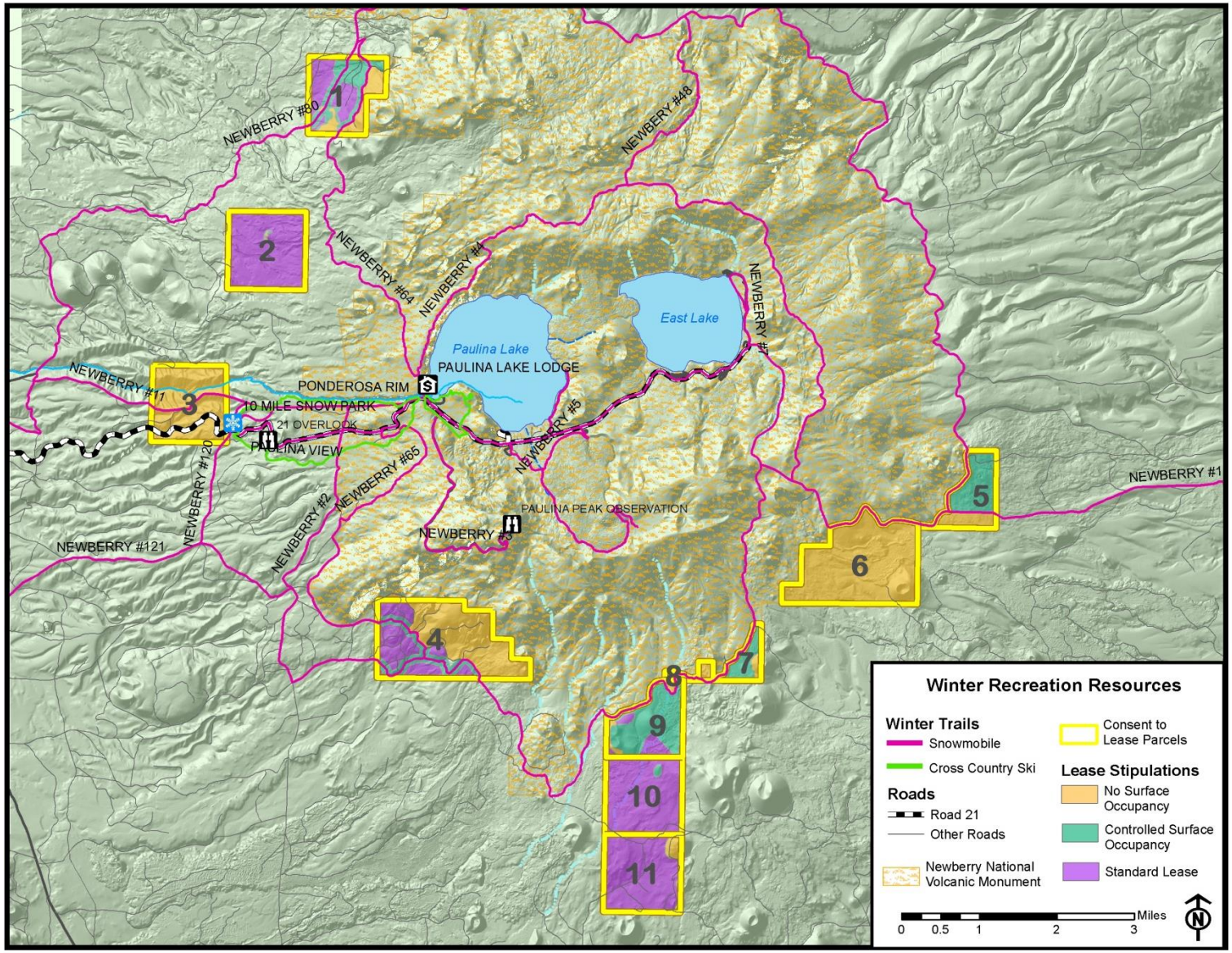
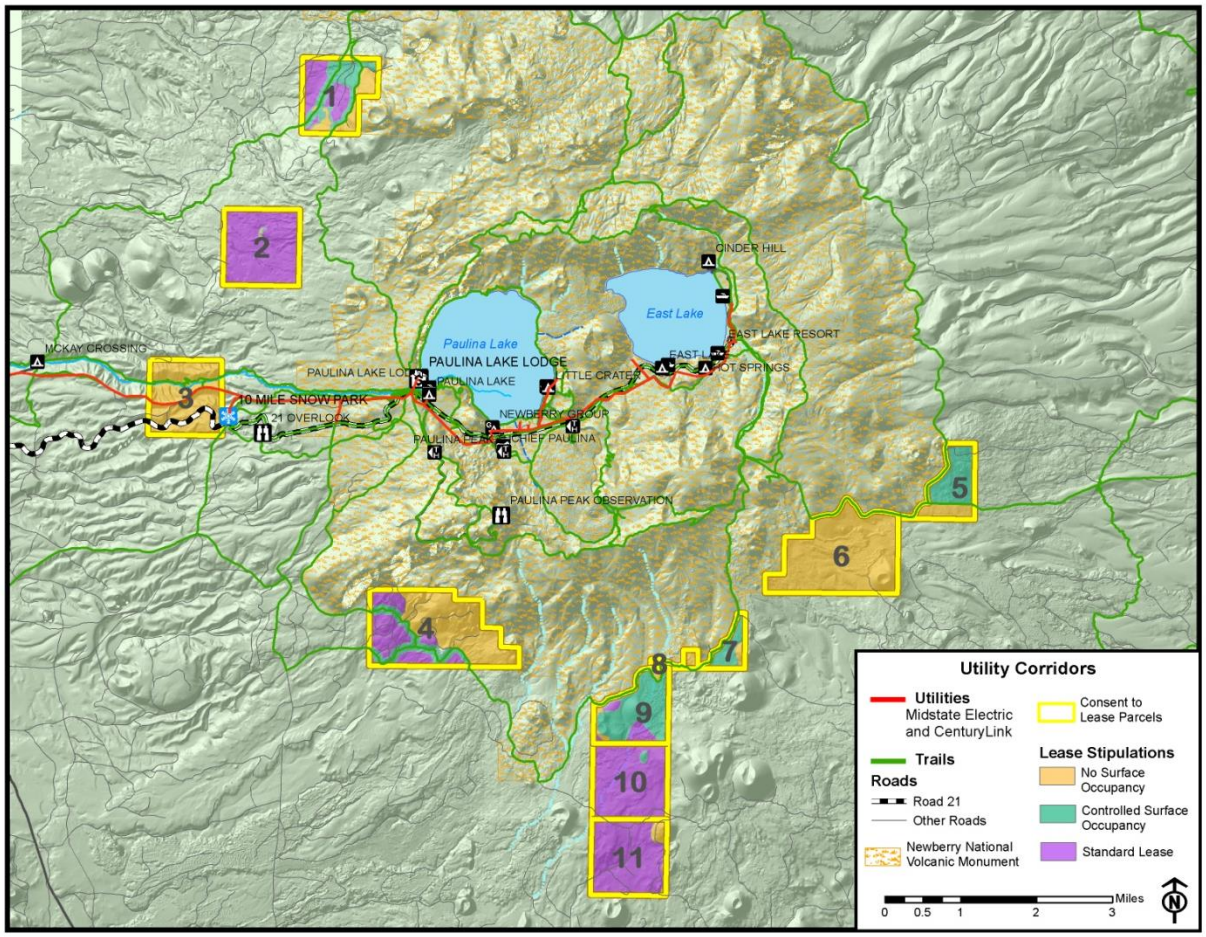


Figure 32: Utility Corridor within the Area



Environmental Consequences

Forest Plan Consistency

All Alternatives would be consistent with the Forest Plan standard and guidelines (USDA 1990), as amended. The Recreation Specialist Report (Tinderholdt, 2013), located in the Project Record and is incorporated by reference, lists all applicable Forest Plan Standards and Guidelines relevant to the Newberry Geothermal Project.

Alternative 1 (No Action)

Direct and Indirect: Under the No Action Alternative, the FS would not consent to the leasing of the nominated lands; therefore BLM would deny the pending lease applications. No exploration or development of geothermal resources would occur at this time, although the lands could be nominated in the future. There would be no direct, indirect or cumulative effects to recreation resources beyond what is already occurring.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: The Proposed Action would not result in any direct effects to the recreation resources because no ground-disturbing activities are authorized from the leasing action itself.

Reasonably Foreseeable Developments (RFDs) and Potential Cumulative Effects

Projects and authorizations affecting recreation have, are or will occur in the areas surrounding the Newberry Geothermal Lease project area. These include the Ogden Vegetation Management Project, existing geothermal lease authorizations, and the Travel Management Project (Table 4, page 39).

RFD actions (Table 4, page 39) following leasing could impact the recreation resource; stipulations, listed under Resource Protection Measures and beginning on page 44, would protect surface resources.

- **Winter and Summer National Forest System Trails**

General and special stipulations would reduce or eliminate damage and/or changes to the trail infrastructure (tread, prism, signs, bridges, drainage features and other constructed features) from RFDs.

With the NSO for all of parcel number three in place, trail infrastructure, including the PSO National Recreation Trail, would be protected. The lessee would not be able to occupy or use the surface of of any of parcel number three which includes those parts of a corridor of 0.25 miles from the high water mark on either side of the bank of Paulina Creek.

Two stipulations protect the winter snowmobile trail infrastructure. Less than six miles of trail are covered by the NSO stipulation (Table 10). The remaining 8.8 miles of snowmobile trail is protected under the CSU and Timing Limits stipulations. In order to protect these trails, the lessee shall not occupy or use the surface of those areas containing and adjacent to winter trails, including a corridor of 300 feet on either side of those areas identified as CSU for activities such as power plants, transmission lines, pipe lines, etc. unless the lessee can demonstrate by appropriate plan of operation to the authorized representative of the Forest Service that this area will not be adversely affected by the proposed activities.

A standard lease stipulation protects the groomed surface of snowmobile trails by not allowing roads on designated snowmobile trails to be snow-plowed and not allowing the use of wheeled vehicles on designated snowmobile trails from December 1 to March 31. Some actions may be restricted to roads

used as snowmobile trails outside of the timing limits. This could affect the ability to complete timely annual trail maintenance. These instances would be monitored by Forest Service trail staff to ensure that deferred trail maintenance is addressed before it becomes a public safety concern or leads to costly damage of trail infrastructure.

Table 10: Miles of National Forest System Trail, by Trail Type and Special Stipulation Type

Trail Designed Use	Stipulation Type	Miles
Snowmobile Trail	Controlled Surface Use (CSU) and Timing Limits	8.8
Snowmobile Trail	No Surface Occupancy (NSO)	5.7
Equestrian Trail – National Recreation Trail	No Surface Occupancy (NSO)	1.4
Equestrian Trail - other	No Surface Occupancy (NSO)	0.1
Total Trail Miles:		**16.0**

RFD activities such as road construction, construction of buildings, power lines and other infrastructure, and steam production may affect the recreational setting. The following is a description of the effects of the foreseeable actions that may affect the recreational setting as experienced from system trails throughout the area, the general area as used for dispersed recreation, and from the four developed viewpoints in the area.

Short-term Effects (0 to 3 years)

Some developments, including roads and access trails, would be needed for shorter terms for geothermal exploration or construction. These short term developments would be decommissioned and the areas rehabilitated to FS specifications as soon as practical after they are no longer needed.

Mid-term (3 to 10 years) and Long-term Effects

Mid- and long-term effects would be similar in type and scope; the difference would be in the duration. These mid to long term developments would be decommissioned and the areas rehabilitated to Forest Services specifications when the infrastructure is no longer needed for the operation or when the permit expires.

The recreational setting may be affected by roads and access trails, movement and operation of equipment including vehicles and heavy equipment, buildings including power plants and out buildings, transmission lines, and steam plumes.

Two-hundred thirty three miles of system trail are located within the area of the nominated and existing geothermal lease parcels (Figure 33, page 103), including 108 miles of summer hiking and equestrian trails and 125 miles of winter cross country ski and snowmobile trail. Short term damage to groomed snowmobile trails may occur during thinning operations. General and special stipulations vary among the proposed and existing lease parcels but, in general, would reduce or eliminate damage and/or changes to the trail infrastructure (tread, prism, signs, bridges, drainage features and other constructed features) that may occur from geothermal development activities.

- **Recreation Access**

Recreational access to trails and areas may be affected in order to maintain public safety and to protect lessee investments. Effects may include temporary and/or longer term road, trail or area closures. This change in access could affect recreational activities in the area including driving for pleasure, snowmobiling off-trail, dispersed camping, hunting, wildlife viewing, gathering forest products and other dispersed recreation activities.

- **Type and scope of access affected**

Overall, recreational access may be affected to maintain public safety and to protect lessee investments. Effects may include temporary and/or longer term road or area closures. This change in access may affect recreational activities in the area including driving for pleasure, snowmobiling off-trail, dispersed camping, hunting, wildlife viewing, gathering forest products and other dispersed recreation activities.

Access to winter snowmobile trails may be affected to maintain public safety. Effects may include disruption of services (e.g. outfitter and guide operations or the ability to maintain trails) or temporary closure of trails. Effects to access may occur when work is occurring directly adjacent to the trail, in areas surrounding the trail, and/or along roads that access the area. This change in access would primarily affect snowmobiling. Due to stipulations to protect the trail infrastructure and timing of operations, the effect would primarily occur during the summer maintenance season.

Access to the recreation residences, permitted resorts and campgrounds operated under a concessionaire would not be affected. Access to the Paulina Plunge in parcel #3 would not affect the outfitter/guide permittee.

Effects to recreation activities due to access disruptions may include: restriction of the recreation activity within the area, requirement to access the activity in the area via a different road or trail, requirement to participate in the same activity in the area at a different time, requirement to participate the same activity in another area, or the inability to participate in the desired activity during the access disruption.

In order to avoid the conversion of roads authorized for construction and use solely by the lessee into roads commonly used by the public, project design criteria would require the lessee to take the level of action necessary to restrict public access. This could be as simple as a sign or require a locked gate. Roads would also be fully decommissioned to Forest Service standard by the lessee when they are no longer needed for the operation or when the permit expires.

- **Timing or season when recreational access may be affected**

Under standard lease stipulations, restriction of public access would need to be proposed and accepted in a plan of operation for surface disturbing operations. Disruption to recreation access would be as limited as possible to maintain public safety, provide for safe and efficient operations and protect lease improvements. Access disruptions would vary depending on the activity. Disruptions could last from one day to greater than 20 years.

Access disruptions for thinning and fuel reduction activities would be short term during operations. The effects to access due to exiting geothermal exploration and development leases would be the same as those analyzed for the nominated leases. The addition of 6,174 acres authorized for geothermal exploration and development in the area is consistent with the uses already authorized and the cumulative effect would not result in a measurable difference for recreation access.

- **Land Use**

Parcel 3, which includes the utility corridor, would have a NSO stipulation, specifying that the lessee shall not occupy or use the surface of those areas surrounding FSR 21 in Parcel 3 except for casual use activities as defined by 43 CFR 3200.1. Modification or elimination of this stipulation would require evaluation through the NEPA process. There would be no cumulative effects from other activities.

- **Safety**

Under standard lease stipulations, restriction of public access would need to be proposed and accepted in a plan of operation for surface disturbing operations. This plan would address all known risks to public safety due to leased operations and the plan to mitigate those risks. Public safety mitigations that affect recreation access, experience or revenue would be as limited as possible may range from public information to area closures.

Increased operations across large areas may add cumulatively to the risk to public safety. For all current and potential future projects and geothermal authorizations, mitigations would be required to maintain public safety and provide for safe and efficient operations. These may range from public information to area closures.

- **Recreation Use and Experience**

The greatest effect to the recreation experience would be due to the appearance and use of roads, access trails, movement and operation of equipment including vehicles and heavy equipment, buildings including power plants and out buildings, transmission lines, and steam plumes. Noise may be a localized affect near areas of construction and power plant locations. These effects may affect the recreation experience of trail users, especially snowmobilers, and other visitors using the area for dispersed recreation. While this may alter the experience, these effects are not expected to displace recreationists from the area.

The seven parcels (1, 4, 5, 6, 7, 8 and 9) adjacent to the Flank Zone within NNVM would be able to be seen by visitors from certain locations within the Monument (Figure 3, page 16, and Table 11, page 18). The Flank Zone is intended to provide opportunities for solitude and dispersed recreation in an unconfined setting, largely free of evidence of human disturbance. The Zone is managed consistent with ROS classifications of semi-primitive non-motorized (summer) and semi-primitive motored (winter). The experience of recreating within an area largely free of the evidence of human disturbance would be maintained in areas adjacent to or within sight of areas with NSO. Development may occur in areas with CSU and Standard Lease stipulations. The sight and sounds of development may alter the experience for visitors within the Flank Zone; however, these effects are not expected to displace recreationists from the area.

Table 11: Lease Parcels Adjacent to the Newberry National Volcanic Monument (NNVM) Boundary with NNVM Management Zones and Lease Stipulations

Lease Parcel	Surface Designation within Parcel Adjacent to NNVM	NNVM Management Zone Adjacent to Nominated Parcel
1	• No Surface Occupancy • Controlled Surface Use	Flank Zone
4	• No Surface Occupancy • Standard Lease	Flank Zone
5	• No Surface Occupancy • Controlled Surface Use	Flank Zone, Special Management Area
6	• No Surface Occupancy (All)	Flank Zone, Special Management Area
7	• No Surface Occupancy • Controlled Surface Use	Flank Zone
8	• No Surface Occupancy • Controlled Surface Use	Flank Zone
9	• No Surface Occupancy • Controlled Surface Use	Flank Zone

Areas with ROS classifications of Roaded Natural and Semi-Primitive Motorized have either NSO or CSU stipulations (Table 12). The controls set in place by these stipulations would enable the Forest Service to maintain the expectations for the recreational settings in these areas or evaluate the need and effect of modifying the setting.

Table 12: Acres of Land within Lease Nomination Areas by ROS Classification

ROS Classification	Acres within Nomination Parcels	Acres by General and Special Stipulation	
		General and Special Stipulation Type	Acres
Roaded Modified	3,185	No Surface Occupancy	446
		Controlled Surface Use	300
		Standard Lease	2,439
Roaded Natural	2,476	No Surface Occupancy	1,739
		Controlled Surface Use	737
Semi-primitive Motorized (Winter Only)	514	No Surface Occupancy	399
		Controlled Surface Use	115

Over 52,000 acres of land in the area is currently authorized for geothermal exploration and development. The cumulative effect would not result in a measurable difference in the alteration of the recreation resource. The extent to which the experience is affected and the potential to displace recreationists from the area would depend on the extent of development within the area. There will be interpretive and educational value in telling the story of geothermal development and vegetation activities on public lands.

- **Revenue**

The RFDs connected to the leasing of these parcels would not have any foreseeable effects to Federal, State or commercial revenue derived from recreation in the area. The activities are not projected to affect business at the permitted resorts or occupancy at campgrounds operated under a concessionaire permit and therefore would not affect revenue. The Paulina Plunge outfitter/guide permittee revenue would not be expected to be affected. Visitation would not be affected at summer developed recreation sites and winter sno-parks where a Federal recreation-pass or State sno-park pass is required.

The addition of 6,174 acres authorized for geothermal exploration and development in the area is consistent with the uses already authorized and the cumulative effect would not result in a measurable difference in revenue.

Figure 33: Authorized and Proposed Geothermal Lease Parcels In the Area In Relation to the Newberry National Volcanic Monument and Motorized Transportation System

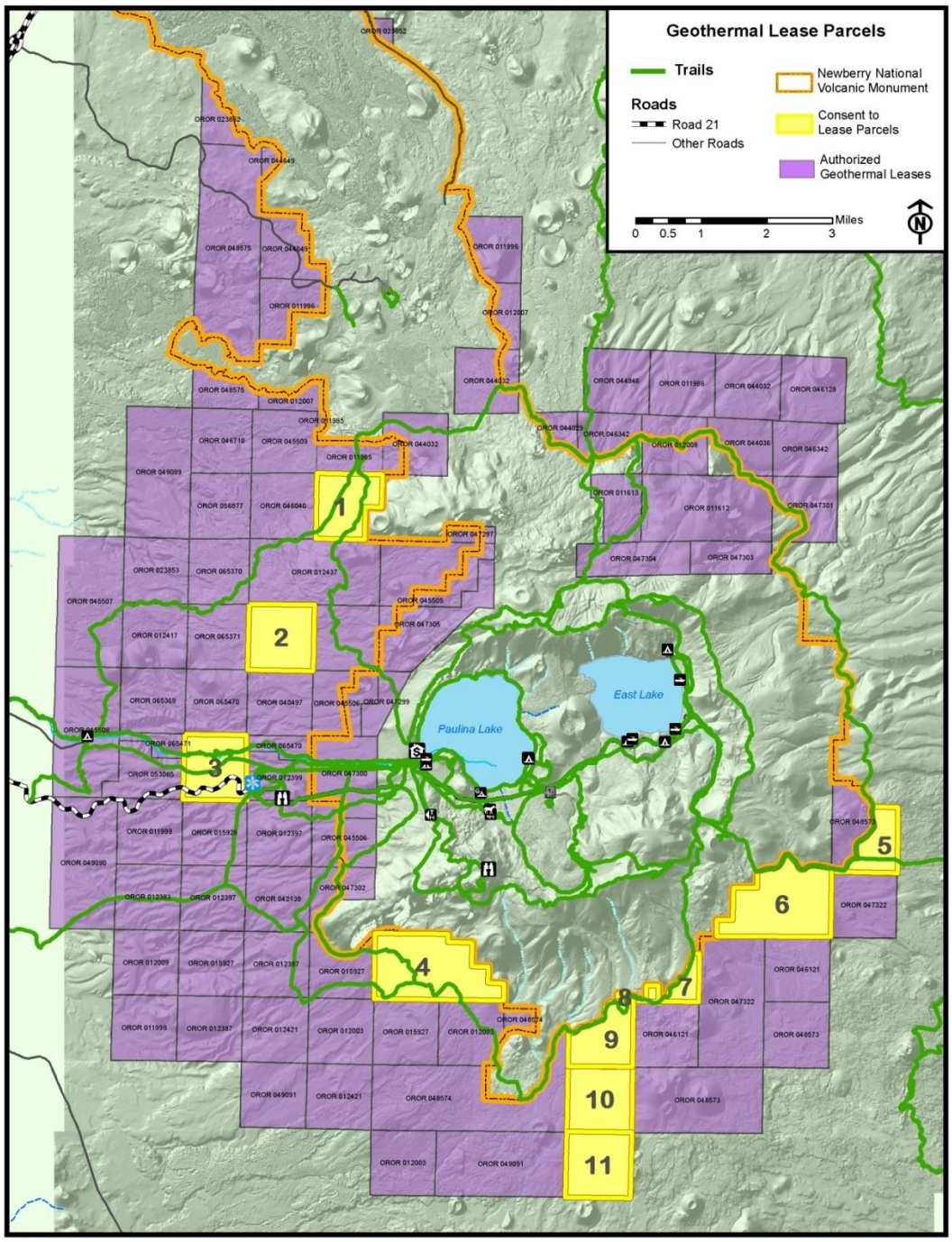


Table 13: Projects that may Lead to Cumulative Effects with Reasonably Foreseeable Developments

Project	Effect on Recreation Resources	Time Extent	Space Extent
Ogden Vegetation Management Project Record of Decision (September 2012); authorizes thinning and fuels reduction.	***Recreation infrastructure:*** No measurable effects. No RFDs would occur along the PSO National Recreation Trail or Paulina Creek. ***Scenery:*** Short term: visual effects of thinning operations (skid roads, slash, and piles) and fuels reduction operations (burned areas, scorched trees and piles). Mid to Long Term: improved forest conditions will enhance the recreation setting. ***Access*:** Access to snowmobile trails and for dispersed recreation use may be temporarily affected during operations. Disruptions would be for less than one year. Proposed thinning and fuels treatment would open up treated areas that could facilitate unauthorized motorized access and construction and/or expansion of dispersed campsites. Restoration and obliteration of unauthorized user-created roads and temporary roads for thinning operations would reduce undesignated OHV access, aligning with Travel Management goals. ***Safety*:** Public safety would be maintained through signs, temporary closures and other mitigation measures. ***Recreation Use and Experience*:** Temporary disturbances to access and scenery would have temporary effects to recreation use and experience and may lead to short term displacement. Long term improved condition of the forest environment would lead to improved recreation experience. ***Revenue*:** No measurable effects.	September 2012 -2022	Treatment units overlap proposed Newberry Geothermal Lease Parcels 2 and 3.
Existing Geothermal Lease Authorizations	The effects to recreation infrastructure, scenery, access, safety, recreation use and experience, and revenue would be similar to those disclosed for the proposed Newberry Geothermal Leases analyzed in Alternative 2	Present through the forseeable future	52,952 acres surrounding the proposed lease parcels.
Travel Management Project Record of Decision (August 2011) prohibits motorized travel outside designated routes (roads and trails)	***Recreation infrastructure:*** No measureable effect. ***Scenery:*** Reduction in user created trails, roads and sites will lead to improved scenic condition over time. ***Access*:** Motorized access limited to designated roads, trails and areas. Some dispersed campsites no longer accessible via motorized vehicle; visitor may walk into these sites. Game retrieval via motorized vehicle will be limited. ***Safety*:** Elimination of user created roads and trails reduced risk of getting lost or into accidents in remote areas not signed for emergency responders. ***Recreation Use and Experience*:** The recreation experience of exploring, camping and hunting the area via motorized vehicle in an unconfined manor will be eliminated. ***Revenue*:** No measurable effect.	August 2011 - through the forseeable future	Overlaps all proposed Newberry Geothermal Lease Parcels.

Soils

Overview

Soil landtypes within the nominated lands are identified from the Deschutes National Forest Soil Resource Inventory for this analysis (USDA Forest Service 1976). There are no landtypes with unstable soils conducive to mass wasting or debris flows in these areas. However, soils within the 11 parcels nominated for geothermal leases are erodible, especially those associated with steep slopes when mineral soil is exposed by ground disturbance. As a result, steep slopes were queried from 10 meter Digital Elevation Model data in order to identify highly erodible soils within the proposed lease areas. All 11 parcels include slopes of 30 to 40% and >40%. Table 14 displays a summary of the slope data shown in Figure 34, page 109 for the proposed lease areas.

Table 14: Acres of Steep Slope Classes in the Nominated Parcels

HUC10 - Watershed	Lease Number	Total Acres	30-40% Slope Acres Moderately Erodible	>40% Slope Acres Highly Erodible	30-40% slope Percent	>40% Slope Percent
Lower Little Deschutes	1	560	79.0	63.0	14.0	11.0
Lower Little Deschutes	2	645	4.3	1.9	0.6	0.2
Lower Little Deschutes	3	614	38.1	11.3	6.0	1.2
Long Prairie	4	1,050	101.3	53.9	9.6	5.1
Pine Lake Devils Garden	5	352	0	0	0	0
Pine Lake Devils Garden	6	997	35.3	46.0	3.5	4.6
Long Prairie	7	175	5.2	13.6	2.9	7.7
Long Prairie	8	16	0.2	0	0.9	0
Long Prairie	9	492	38.0	19.8	7.7	4.0
Long Prairie	10	633	3.9	1.2	0.6	0.2
Long Prairie	11	639	13.0	17.7	2.0	2.8

The steep slopes identified within the parcels are primarily located on cinder buttes associated with the Newberry volcanic complex although some are also located on the dissected drainage of Paulina Creek or the edges of older lava flow landforms. The soil mantle that overlays these slopes is comprised primarily of coarse textured ash from Mt. Mazama and/or cindery material from local butte vents and is susceptible to erosion due to the detachability of the coarse particles. This susceptibility is elevated if ground disturbance removes vegetation and organic matter from the surface and exposes mineral soil directly to the forces of wind and water.

Ground disturbance associated with the construction and retention of infrastructure on steep slopes can raise the risk of soil erosion that would affect the long-term productivity of these sites. As a result, soils located on slopes exceeding 40% were determined to be highly erodible and recommended for No Surface Occupancy (NSO). Soils on slopes of 30-40% were determined to be moderately erodible and recommended for Controlled Surface Use (CSU). Restrictions for 30-40% slopes would be based on parcel/site specific erosional (slope) stability. The total area of highly and moderately erodible soils located on slopes exceeding 40% in the nominated lands is shown in Table 14.

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: Under the No Action Alternative, the FS would not consent to the leasing of the nominated lands; therefore BLM would deny the pending lease applications. There would be no effects to the soils resource as a result of this alternative. No exploration or development of geothermal resources would occur on the nominated lands at this time, although the lands could be nominated again in the future.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: The Proposed Action would not result in any direct effects to the soil resource within the areas nominated for lease. No ground-disturbing activities are authorized from the leasing action itself.

Reasonably Foreseeable Developments (RFDs) and Potential Cumulative Effects

Potential actions following leasing may have impacts to the soil resource for the purposes of geothermal development. The analysis of indirect effects discloses the potential effects to the soil resource based upon the proposed geothermal project phase and the stipulations identified to protect the soil resource.

Actions, potential indirect effects, and related management requirements and mitigation measures relating to geothermal development activities are described in the joint Draft Plan Environmental Impact Statement for Large Scale Geothermal Energy Development (USDA, USDI 2008). A summary of those relating to the soil resource by geothermal project phase are presented in Table 15.

Direct and Indirect Effects: The Proposed Action would not have any direct impact on soils; however, anticipated ground disturbance from the geothermal exploration and development activities likely to follow leasing would potentially result in impacts on erosion and soil productivity. Prior to construction of any facilities or infrastructure, geotechnical investigations would need to be conducted to ensure that any construction be situated on stable soils and that erosion prevention measures be implemented in accordance with permitting requirements.

Table 15: Indirect Effects Analysis to Soil Resources

Geothermal Project Phase	Action and Potential Indirect Effects	Impacts, Management Requirements, and Mitigation Measures
Exploration	Surveying activities cause soil disturbance at seismic survey pulse sites from detonation of explosives and “thumper” trucks. Area of disturbance at each site is small, but a large survey could include many sites. New roads needed to provide access to potential geothermal sites by survey equipment	Impacts would be short term. Following survey, all roads and routes reclaimed to BLM and FS standards.
Exploration	Drilling temperature gradient wells. Roads required for access. Several wells could be drilled per lease, with area of disturbance approx. 0.9 acres.	Impacts would be minor, last only duration of drilling and reclamation activities (several weeks). Drilling sites and access routes would be reclaimed to BLM and FS standards, minimizing long term soil impacts.
Drilling Operations	Access roads required to accommodate larger equipment would impact soil resources in	Impacts would be short term.

Geothermal Project Phase	Action and Potential Indirect Effects	Impacts, Management Requirements, and Mitigation Measures
	rights-of-way. Drill site development (well pad) would also impact soils.	
Utilization	Access roads required for larger equipment and to access power plant. Well field equipment includes pipelines with their own disturbance zone including pads for pipeline supports.	Impacts would be long term. Where feasible, pipelines would parallel access roads and existing roads, minimizing impacts. Pipelines are constructed on supports above ground, minimizing soil disturbance.
Utilization	Electrical transmission lines, including pads for powerline support structures and access and maintenance roads along powerline would cause soil disturbance.	Impacts would be long term where support structures and maintenance roads committed the soils resource to infrastructure.
Utilization	Operation of geothermal power plant.	Impacts on soil resources would be minimal. Initial areas used during construction would continue to be used sporadically. No additional impacts during this phase unless additional drill site required, then impacts same as exploration and drilling phases.
Reclamation and Abandonment	Abandoning wells after production ceases and reclaiming all disturbed areas.	Reclamation would occur in accordance with BLM and FS standards.

The following are additional indirect effects that may occur to soils:

- There is a small chance that seismic activity could increase if the proposed geothermal resource development includes high-pressure reinjection. Seismic activity could induce localized landslides on steep slopes and cause soils to slough and accumulate in valley bottoms or toe slopes.
- Actions taking place on slopes greater than 30% are more likely to result in surface erosion and soil displacement. These effects may also cause a loss of long term soil productivity on these sites.
- Accidental spills of fuels, solvents, geothermal working fluids or other hazardous materials can impact soils by killing soil microorganisms or altering unsaturated and saturated subsurface flows through soils. Hazardous materials that are not removed from or with contaminated soils may cause additional contamination as stormwater moves along the surface and infiltrates into the soil profile.
- Soils and all of their natural functions and values will be lost where they are buried or committed to road construction, pipeline or transmission line pad construction, power plant construction and any other activity which completely commits the soil resource to long term infrastructure. The burial or removal of the mineral “A” horizon and surface organic matter would alter the interaction of air and water with the soil and impair the ability of the site to support vegetation. This effect will persist for as long as the soils are covered or committed to infrastructure associated with geothermal exploration, drilling and utilization activities.

If RFDs would occur, activities would disturb soils and temporarily increase the potential for erosion. In the instances of intensively developed sites, such as buildings, parking lots, and access to geothermal

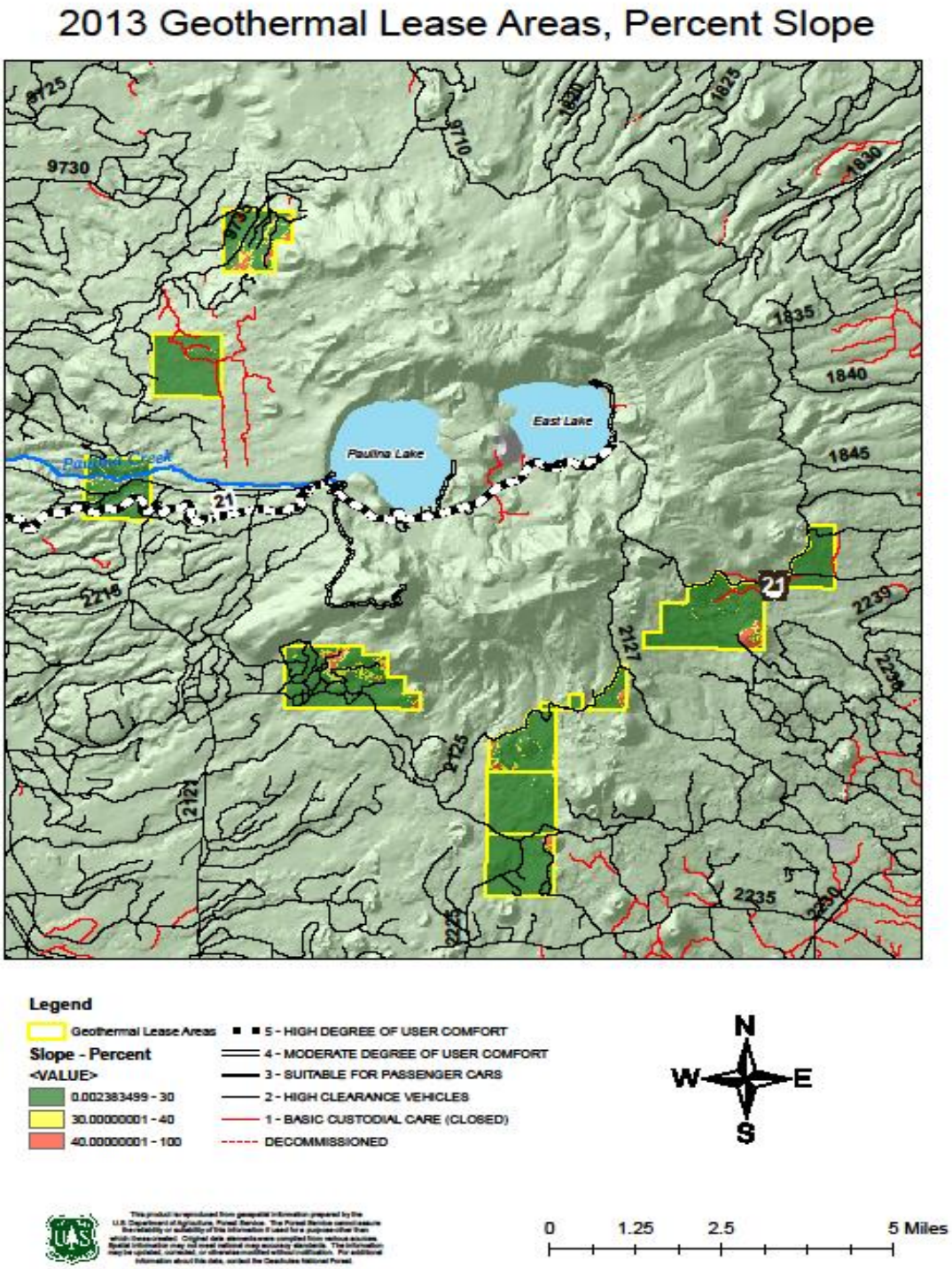
developments, soil quality standards and guidelines do not apply. This is because exploration and developments would not result in limited disturbance below specific thresholds. Soils dedicated to these land uses remove land from production and preclude other uses of the soil for as long as these facilities remain in use. The development and use of geothermal facilities is considered an irretrievable loss of soil productivity until their functions have been served and disturbed sites are returned back to a productive capacity.

Cumulative Effects: Depending on if, where, and when RFDs occur, the potential for adding cumulatively to other soils disturbances is possible. The removal of land from production of vegetation for an unknown period of time would add cumulatively with the Forest road system. Other incidental compaction associated with activities could conceivably add to compaction from any previous harvest or recreational development activities, such as trails, within the nominated parcels.

Forest Plan Consistency

All Alternatives would be consistent with the Deschutes National Forest Land Resource Management Plan standard and guidelines for the soil resource (USDA 1990).

Figure 34: Steep Slopes in Nominated Geothermal Lease Areas



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Scenic Resources

Introduction

Scenic Resources addresses compliance with management direction for Scenic Views Management Areas classified as High Scenic Integrity in the Scenery Management System (SMS) also known as Retention (VMS) and Medium Scenic Integrity (SMS) also known as Partial Retention (VMS) in areas both within and outside the boundaries of the NNVM.

Management Direction: Deschutes National Forest LRMP (1990)

Throughout the project area, nominated parcels that are located within the Scenic Views Management Area (MA-9) must meet these standards and guidelines as described in the LRMP. For more specific guidance, refer to the Scenic Resources Report, pages 1-4.

The goal, general theme and objectives are described in terms of desired future conditions for various settings (ponderosa pine, lodgepole pine, mixed conifer as well as foreground, middleground and background) and how these are to be met by specified activities or actions. The goal is to provide high quality scenery representing the natural character of Central Oregon. The general theme and objectives of Scenic Views is for landscapes seen from selected travel routes and use areas to be managed to maintain or enhance the appearance of the areas being viewed. To the casual observer, results of activities will either not be evident or will be visually subordinate to the natural landscape.

Scenery Management System Methodology

The methodology used for analyzing impacts to scenic resources is the Scenery Management System (SMS) which uses “Landscape Aesthetics: A Handbook for Scenery Management” (1996). This handbook replaces “Agriculture Handbook 462 – The Visual Management System (VQS)” (1974). 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 ideas of managing for ecosystems and is the current methodology used by the Forest Service 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, means having little or no deviation from the landscape character 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 Views – Foreground Management areas classified in SMS as High Scenic Integrity (VQS - Retention), visual changes will not be noticeable to the casual forest visitor. The casual forest visitor is the recreation-oriented person or motorist traveling through a portion of the forest who would relate to the visual environment based on the context of a landscape viewed, rather than focusing on an individual acre within a landscape. For the occasional pedestrian who wanders off a designated trail and views an individual acre where a management activity has recently taken place, visual changes will be noticeable, even in Scenic Views - Foreground Management Areas classified in SMS as High Scenic Integrity (VQS - Retention).

This current and more holistic system includes the human element as an integral part of the ecosystem and has been the methodology used in place of the previous outdated Visual Quality System (VQS) of 1974 which continues to be referenced in Forest Plans that have not yet been updated to reference the current SMS instead. To facilitate this change in methodology, both systems have been referenced by

applying SMS and including the VQS in parentheses such as High Scenic Integrity - SMS (Retention – VQS). The Forest Service implementing regulations currently establish a variety of Scenic Integrity Levels for Scenic Views – MA9 (LMRP page 4-121). These Standards and Guidelines include:

- High Scenic Integrity Level – SMS - Natural Appearing Landscape (Retention – VMS) - MA 9, SV-1 Foreground, SV-3 Middleground
- Moderate Scenic Integrity Level - SMS - Slightly Altered Landscape (Partial Retention – VMS) - MA 9, SV-2 Foreground, SV-4 Middleground
- Low Scenic Integrity Level – SMS - Altered Landscape (Modification – VMS or General Forest) - MA 8, GFO within Foreground as well as Middleground

The distance zones for Scenic Views Management Areas for an observer are as follows:

- Immediate Foreground 0 - 300 feet
- Foreground 0 - ½ mile
- Middleground ½ mile - 4 miles
- Background 4 miles – horizon

Existing Condition

Parcels 1, 4, 7, 8, and 9: The Scenic Views Management Area is Moderate Scenic Integrity – Middleground (SMS) and Partial Retention – Middleground (VMS).

Parcels 2, 10, and 11: These parcels are located within the General Forest Management Area.

Parcel 3: Forest Road 21, a major scenic travel corridor, and within view of or viewed from Paulina Creek, classified as eligible for Wild & Scenic River designation. The Scenic Views Management Area is High Scenic Integrity - Foreground (SMS) and Retention – Foreground (VMS).

Parcel 5: The Scenic Views Management Area is Moderate Scenic Integrity – Foreground (SMS) and Partial Retention – Foreground (VMS).

Parcel 6: The Scenic Views Management Area is Moderate Scenic Integrity – Foreground and Middleground (SMS) and Partial Retention – Foreground and Middleground (VMS).

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: There would be no changes to the scenic quality.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA will not have direct effects to the scenic resource because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: Changes to the 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, causing noise and dust. The current natural setting would change to a more industrial appearance on selected parcels in relatively localized areas.

Wildlife: Threatened, Endangered and Sensitive Species (TES)

Introduction

This report describes potential impacts to terrestrial wildlife associated with the implementation of the Geothermal Consent to Lease Project on the Bend/Ft. Rock Ranger District. This includes evaluating potential impacts to wildlife listed under the Endangered Species Act of 1973, as amended, USDA Forest Service Pacific Northwest Region Sensitive Species, Management Indicator Species, migratory birds and shorebirds.

Wildlife Species Analyzed

Potential impacts to wildlife species associated with this project are focused on five groups:

- USFWS Endangered, Threatened or Proposed terrestrial wildlife species and/or critical habitat
- USDA Forest Service Pacific Northwest Region Sensitive Species
- Management Indicator Species as identified in the Deschutes National Forest Land and Resource Management Plan (USDA FS 1990)
- Migratory birds listed as Birds of Conservation Concern (USFWS 2008) list for Bird Conservation Region 9-Great Basin and focal species in the Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington (Altman 2000)
- High priority shorebirds listed in the U.S. Shorebird Conservation Plan (2004)

Habitat Modeling

The Ochoco and Deschutes Viable Ecosystems Management Guide was developed to classify vegetation on a landscape basis. "The Viable Ecosystem model provides a process to apply ecosystem management concepts to project level planning. This system compares existing vegetation with site potential. The model focuses on relationships between combinations of vegetation structure and species composition, and habitat requirements for animals, insects, and plants. Viable Ecosystems is a useful tool for cumulative effects analysis of broad-scale changes in vegetation at a subwatershed to Forest-wide scale and subsequent changes in animal, insect, or plant communities."

Viable stratifies the environment along a gradient of size, structure, species composition, and relative tree density. The various classifications are then linked to wildlife habitat requirements. The 2004 satellite imagery layer was used to develop the Viable map. Data is mapped on a 25 meter pixel grid and assigned a value relating to size, structure, tree species, and tree density for the animal species. The resulting layer was then updated by removing stand replacement and mixed mortality fires and recent (within 5 years) forest management activities

Forest-wide assessment for MIS identified in the DNF LRMP was completed for the entire forest. Suitable habitat for each species was defined as areas that could potentially support reproduction, but also included habitat related to species specific direction in the DNF LRMP. An assessment was completed for each species based on the amount of potentially suitable habitat that occurs across the DNF, associated threats, and population trend data where it was available. The assessment used the best available science and guidance such as research found in books, scientific journals, and scientific websites. Habitat definitions were developed and suitable reproductive habitat models were generated for each MIS species.

The WildHab model is used to describe potential impacts to the viability of Management Indicator Species across the DNF. While a project may have localized impacts to MIS habitat at the project level this may not noticeably reduce the habitat available to the species when compared to the entire forest.

For this analysis the WildHab model was used to describe potential habitat within the lease parcel boundary. It overestimates potential habitat near parcels 5 and 6 because of boundary adjustments that occurred after the original estimation. Modeled habitat is not used to estimate disturbance acres because of the uncertainty associated with the RFD but does indicate potential habitat in the project area, including areas identified as NSO. Management Indicator Species without modeled habitat in any parcel were not carried forward to detailed analysis.

US Fish and Wildlife Service Endangered, Threatened, or Proposed Species or Critical Habitat

Wildlife species or their designated critical habitat listed as endangered, threatened or proposed by the USFWS under the Endangered Species Act of 1973, as amended with potential to occur on the Deschutes National Forest (Table 16).

Table 16: USFWS Endangered, Threatened or Proposed Wildlife Species or Habitat Suspected on the DNF

Species or Habitat	Habitat
Gray wolf	Wide ranging carnivore that uses a variety of habitats that support sufficient prey base.
Northern spotted owl	Multi-story forested stands of mixed conifer with high canopy closure and large diameter trees.
Northern spotted owl DCH	NRF and dispersal habitat within the range of the Northern Spotted Owl.
North American wolverine	Wide ranging carnivore found in high elevation alpine environments.
Oregon spotted frog	Highly aquatic amphibian associated with open water wetlands.
Oregon spotted frog PCH	Habitat for the Oregon spotted frog as described in USFWS (2013b)
Pacific fisher	Mixed conifer forest, complex forest structure

Gray wolf

The gray wolf has been listed as endangered since 1973 with the Western Great Lakes and Northern Rocky Mountain Distinct Population Segments currently delisted due to recovery. Gray wolves that occur in the western and central portions of Oregon are listed as Endangered, while wolves in the northeast portion of the state are not listed. The USFWS has proposed removing the gray wolf from the list of Endangered and Threatened wildlife which would include wolves in western and central Oregon (USFWS 2013c).

A single female wolf (Wolf B-45) from the Idaho experimental population dispersed into Oregon in 1999 (ODFW 2013). Since then the Oregon wolf population has become established with a minimum population estimate of 46 individuals with six packs at the end of 2012 (ODFW 2013). Gray wolf populations in Oregon are concentrated in the Blue Mountains northeast of Interstate 84. One gray wolf (OR-7) was documented on the DNF in 2011 as it was dispersing from the Imnaha pack. This individual moved through central Oregon and into northern California and returned to southern Oregon in March 2013. There have been no confirmed wolf observations on the DNF since OR-7.

Gray wolves use a variety forested habitats with interspersed river valleys and meadows for hunting. They prefer ungulate prey species such as pronghorn, deer and elk but will also take other mammals as available. Pack territories can exceed 400 mi^2 depending on the available habitat and prey resource. Key wolf habitat components include sufficient year-round prey availability, suitable denning and rendezvous locations, and sufficient area without human exposure (USFWS 1987). Den sites are often underground burrows, but can also include hollow logs, rock caves or other secure locations.

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: This alternative would have no direct or indirect effects to gray wolf. Any low probability of incidental use of the area would continue to be limited by the high degree of human recreation use and road density in the project area.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA would have no direct effects to gray wolf because the Forest Service is only consenting to allow the BLM to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: Since gray wolves are a forest generalist and are a wide-ranging species, implementation of potential future geothermal development should not affect gray wolf. The species is a very infrequent visitor to and movement through the area is expected only from dispersing individuals. The potential for a wolf to be in the area during any stage of development is very unlikely, given the amount of current road density and high recreational use. There are no records of an established pack on the Deschutes, nor is there a breeding population. Since there is not a breeding population, it has been determined there would be no effects to gray wolves on the Deschutes National Forest.

Effects Determination and Rationale from RFDs

Based on the lack of direct and indirect effects, the proposed action would have ***no effect*** to gray wolf.

- Unlike Northeastern Oregon, the Deschutes National Forest does not have a large elk population and has a declining deer population, and a much higher human population.
- Currently, there is no established breeding population.

Northern spotted owl

The northern spotted owl is currently listed as threatened by the USFWS under the Endangered Species Act of 1973, as amended (USFWS 1990). It was originally listed throughout its range, “due to loss and adverse modification of spotted owl habitat as a result of timber harvesting and exacerbated by catastrophic events such as fire, volcanic eruption, and wind storms” (USFWS 1990). Since the original listing action additional threats such as current habitat loss and competition from barred owls (*Strix varia*) have been identified (USFWS 2011).

This species is associated with structurally complex mature and old-growth forests. Suitable spotted owl habitat is categorized as nesting, roosting or foraging (NRF) or dispersal. Typical NRF habitat in the east Cascades is mature multi-storied stands of mixed conifer. Canopy cover is often 40% or higher with large diameter overstory trees (21 inch DBH or greater). Foraging habitat can have reduced canopy cover but nesting and roosting habitat also provides foraging habitat. Dispersal habitat is forested stands of all Plant Association Group (PAG) with a minimum 30% canopy closure and medium sized (11 inch DBH) trees.

The project area is 16 miles east of any known northern spotted owl territory and 15 miles east of established northern spotted owl range. The project area is not considered northern spotted owl habitat.

Environmental Consequences

Alternatives 1 and 2:

Direct and Indirect Effects: Alternative 1 and Alternative 2 would have no direct or indirect effects to northern spotted owl since this area is considered outside the range for this species and there is no ground disturbing activity associated with consenting to lease.

Reasonably Foreseeable Developments

Direct and Indirect Effects: Since the project area is substantially east of northern spotted owl habitat there is no potential for the species to occupy these parcels. Therefore, any future geothermal development would have no effect on northern spotted owl because no NRF or dispersal habitat would be affected by project activities and no individual owls are near the proposed parcels.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development would have ***no effect*** on northern spotted owl since the project area is outside this species range.

Northern spotted owl critical habitat

Critical habitat for the Northern spotted owl throughout the entire range was designated in 2008 (USFWS 2008). On December 4, 2012 the U.S. Fish and Wildlife Service revised the previous critical habitat for the Northern spotted owl across its range to better reflect the updated species recovery plan (USFWS 2011). This decision increased designated critical habitat on the DNF to 253,243 acres in 2013. Portions of Eastern Cascades Subunits 5-9 occur on the DNF. The project area is 15 miles east of mapped designated critical habitat.

Designated critical habitat is defined as the physical and biological features essential for conservation of the species. For the northern spotted owl this includes nesting, roosting, foraging, and dispersal habitat in an optimal spatial distribution to facilitate species persistence (USFWS 2012). Nesting and roosting habitat are described as multi-layered, multi-species forested stands with moderate to high canopy closure (60-80%) and large trees (30 inch DBH or more). There are often large snags and high levels of down wood but an open understory. A variety of forest stands can provide foraging or dispersal habitat but ponderosa pine stands are generally avoided as foraging habitat (USFWS 2012).

Environmental Consequences

Alternatives 1 and 2

Direct and Indirect Effects: Alternative 1 and Alternative 2 would not affect northern spotted owl designated critical habitat because the project area is substantially outside of the mapped habitat.

No ground disturbing activity is associated with consenting to lease and, therefore, there would be no change to the primary constituent elements of northern spotted owl critical habitat. The currently available habitat will remain unaffected by this activity.

Reasonably Foreseeable Developments

Direct and Indirect Effects: RFDs would have no effect on designated critical habitat for northern spotted owl. None of the proposed lease parcels occur in designated critical habitat l and none of the Primary Constituent Elements of critical habitat for this species will be altered.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development would have ***no effect*** on northern spotted owl since there is no designated northern spotted owl designated critical habitat.

North American wolverine

The North American wolverine was recently proposed for listing under the ESA as threatened (USFWS 2013c). The species was previously identified as a Candidate for listing under the ESA and on the USDA Forest Service Sensitive Species list. They are also a MIS as identified in the DNF LRMP.

Wolverines are wide-ranging carnivores found in alpine habitats (Aubrey et al. 2007). Home range size ranges from 60 miles^2 for females up to 540 miles^2 for males. They tend to occur at low density on a landscape and are often difficult to detect. Wolverine will consume most any available prey and carrion.

Wolverines have been documented in the Cascade Mountain Range with historic observations in central Oregon (1963-1973) but there are no confirmed individuals on the DNF since 1965. Current wolverine distribution extends into northern Washington but suitable habitat exists throughout the Cascades. The species has also recently been documented in northeast Oregon. There is potential habitat for wolverines in central Oregon but the species is not considered to regularly occur on the DNF.

Denning habitat on the DNF was modeled using north aspects above 5,500 feet in alpine dry, alpine meadow, glacier and rock PAG. Potential denning habitat on the DNF was estimated at 1,656 acres and concentrated at high elevation areas on the western portion of the district and Newberry Crater. Mapped denning habitat occurs in small disjunct patches with the largest concentration in the headwaters of Wychus Creek near Three Sisters. There is no mapped wolverine denning habitat in the Project Area.

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: Alternative 1 would have no direct or indirect effects to North American wolverine. Any low probability of incidental use of the area would continue to be limited by the high degree of human recreation use and road density in the project area.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Consenting to lease would have no direct or indirect effect to wolverine because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: Since there is no mapped wolverine denning habitat in the project area there should be no impact to wolverine from future geothermal development. This species has not been documented on the DNF for many years and the presence of individual wolverines is not expected.

Effects Determination and Rationale from RFDs

Implementation of any RFD would have ***no effect*** on northern American wolverine. While a wolverine's home range is quite extensive and would overlap the Geothermal Consent to Lease area, these areas do not provide the large cirque deep snow basins preferred by wolverines nor provides the large blocks of continuous habitat for solitude to establish a home range given the existing high recreational activities and road density in the project area. Wolverine denning habitat on the Deschutes National Forest was modeled from the Forest Plant Association Group (PAG) layer including the alpine dry, alpine meadow,

glacier and rock, north aspect of 0-22.5 degrees and 337.5-360 degrees, of which none of these features exist within the project area. For these reasons, wolverines are given a very low probability of incidental occurrence in the project area. Additionally, wolverines have a very broad movement and there is no local knowledge of wolverines residing within the greater Newberry Crater area.

Oregon Spotted Frog

On August 29, 2013 the U.S. Fish and Wildlife published a proposed rule to list the Oregon spotted frog as Threatened under the Endangered Species Act as amended (USFWS 2013a). Previously the species was identified as a candidate for listing but would now be classified as Proposed. Threats to this species were identified by sub-basin (4th Field watershed) with the Bend/Ft. Rock Ranger District being in the Upper Deschutes Sub-basin. Threats within the sub-basin are categorized based on the five listing factors. For Factor A (Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range) the threats are wetland loss, reed canarygrass, shrub encroachment, and hydrological changes (water management). Factor C (Disease or Predation) identified introduced warm and cold water fish and bullfrog. Factor E (Other Natural or Manmade Factors affecting its Continued Existence) identifies breeding locations being disconnected, cumulative effects of other changes and climate change (USFWS 2013a)

Historically the species ranged from British Columbia to northern California, but is now known from less than 50 sites in southwest British Columbia, south-central Washington and central Oregon (Cushman and Pearl 2007). Cushman and Pearl (2007) describe characteristics of Oregon spotted frogs and their current distribution combine to suggest a relatively high overall vulnerability of the species: 1) limited and highly fragmented distribution with extensive reductions from historic range, 2) strong association with emergent marshes and seasonally used microhabitats within wetland complexes, 3) limited ability to move long distances, particularly in non-aquatic environments, and 4) aspects of their behavior and life history are likely to result in high local mortality.

This species is highly aquatic and inhabits the margins of lakes, marshes, and pools in streams where there is an abundant growth of vegetation (USFWS 2013a). Cushman and Pearl (2007) describe spotted frog breeding habitat as moderate to large wetlands with extensive emergent marsh coverage that warms substantially during seasons when Oregon spotted frogs are active on the surface (February - May). Sites always include some permanent water juxtaposed to seasonally inundated habitat.

Cushman and Pearl (2007) identified the following factors as potential threats to Oregon spotted frog populations:

- Direct loss of marsh habitat, particularly through conversion to other land uses
- Alteration of hydrological regimes in extant marshes
- Interactions with non-native fish and American bullfrogs
- Vegetation changes such as succession and invasion by non-native species
- Livestock grazing, particularly in circumstances of high livestock density and duration, where Oregon spotted frog habitat is limited
- Degraded water quality
- Isolation from other Oregon spotted frog population

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: The no action alternative would have no direct or indirect effects to Oregon spotted frog since no activities would occur.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Consenting to lease would have no direct or indirect effects to Oregon spotted frog because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: The nearest Oregon spotted frog habitat is 8 miles to the west of Parcel 3 in the Little Deschutes River. The only water in the project area is the section of Paulina Creek that is in Parcel 3 which is NSO. There will be no modification of riparian habitat in the project. This species will not be affected by future geothermal development because the area does not currently provide habitat and there is no potential for downstream affects.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development would have ***no effect*** on the Oregon spotted frog because no habitat would be altered by project activities and no individuals would be near project activities.

Oregon Spotted Frog Proposed Critical Habitat

The USFWS proposed Critical Habitat for the Oregon spotted frog concurrently (USFWS 2013b) with the proposal to change the species status to Threatened. Critical habitat on the Bend/Ft. Rock Ranger District is in Unit 8 with the Project Area include in Subunit 8A (Upper Deschutes below Wickiup Dam).

Critical habitat is the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical or biological features essential to the conservation of the species and which may require special management considerations or protection. It also includes specific areas outside the geographical area occupied by the species at the time it listed that are essential for the conservation of the species (USFWS 2013b). Table 17 describes the Primary Constituent Elements of Oregon spotted frog habitat (USFWS 2013b).

Table 17: Oregon Spotted Frog Critical Habitat Primary Constituent Elements [1]

1	Ephemeral or permanent bodies of fresh water, including but not limited to natural or manmade ponds, springs, lakes, slow moving streams, or pools within or oxbows adjacent to streams, canals and ditches that have one or more of the following characteristics: • Inundated for a minimum of 4 months per year (B, R) • Inundated from October through March (O) • If ephemeral, areas are hydrologically connected by surface water flow to a permanent water body (B, R) • Shallow water areas less than or equal to 12 inches, or water of this depth over vegetation in deeper water (B, R) • Total surface area with less than 50% vegetative cover (N) • Gradual topographic gradient (less than 3% slope) from shallow water toward deeper, permanent water (B, R) • Herbaceous wetland vegetation or vegetation that can structurally mimic emergent wetland vegetation through manipulation (B, R) • Shallow water areas with high solar exposure or low (short) canopy cover (B, R) • Absence or low density of nonnative predators (B, R, N)
2	Aquatic Movement Corridors. Ephemeral or permanent bodies of fresh water that have one or more of the following characteristics: • Less than or equal to 3.1 linear miles from breeding areas

	• Impediment free
3	Refugia habitat. Nonbreeding, breeding, rearing or overwintering habitat or aquatic movement corridors with habitat characteristics that provide refugia from predators.

[1]- Non-breeding (N), Breeding (B), Rearing (R), and Overwintering habitat (O)

The nearest proposed critical habitat for Oregon spotted frog is seven miles west (Little Deschutes River) of Parcel 3 and the nearest known breeding site is nine miles west of the project area.

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: Alternative 1 would have no direct or indirect effects to Oregon spotted frog proposed critical habitat since no activities would occur.

Alternative 2 (Proposed Action

Direct and Indirect Effects: Consenting to lease would have no direct effects to Oregon spotted frog critical habitat because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: RFDs would not alter any of the primary constituent elements of Oregon spotted frog critical habitat since the nearest habitat is substantially outside of the project area. The only permanent water in the project area is along Paulina Creek in Parcel 3 which is NSO. No habitat modification is expected in the parcel so there will be no downstream impacts. This parcel is also nine miles away from the nearest known breeding site.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development would have ***no effect*** on proposed critical habitat for Oregon spotted frog because none of the described activities would alter primary constituent elements for the species.

Pacific Fisher

The Pacific fisher is listed as a candidate for Federal listing and also listed as a sensitive species for Region 6. The Pacific fisher primarily uses mature, closed-canopy coniferous forests with some deciduous component, frequently along riparian corridors (Csuti et al. 2001). Weir and Corbould (2010) found that fishers were limited by the openness of the stand; one reason being that escape cover (i.e. trees for climbing) are far apart making fishers further susceptible to terrestrial predators. In Ruggiero et al. (1994), it is suggested fishers prefer closed-canopy (greater than 60%), late-successional forests with large physical structures (live trees, snags, and logs), especially if associated with riparian areas. A 2004 Species Assessment by the US Fish and Wildlife Service documents key aspects of fisher habitat as those associated with late-successional forests (i.e. high canopy closure, large trees and snags, large logs, hardwoods, and multiple canopy layers). Distribution of fishers is limited by elevation and snow depth (Krohn et al. 1997 *in* US Fish and Wildlife Service Species Assessment). Fishers generally avoid areas of high human disturbance, primarily high road density or recreational developments.

Fishers are fairly large, weighing 3 to 13 pounds and 29 to 47 inches long. This may suggest a need of larger log sizes for dens than other animals with similar needs (i.e. marten). Aubry and Raley (2006) found in southwestern Oregon, fishers were found denning and resting at 4,000 feet elevation, more than 80% canopy closure, and more than 16 snags and 67 logs at least 20” dbh per acre; supporting the suggestion that this species utilizes large to very large structure. Denning and resting sites were also

observed in large live trees (mostly Douglas-fir) with mistletoe brooms, limb clumping, rodent nests, or some other deformity. They also found fishers were preying upon woodpeckers, jays, grouse, quail, squirrels, hare, porcupine, and skunks (most of these prey species can be found in the area). Fishers generally have large territories (a minimum of 10 square km or 2,500 acres).

Note: the following data and/or local information was utilized from the Ogden and Geothermal EGS EAs since they both overlap the Geothermal Consent to Lease EA planning area and are within the same vicinity or watershed (the Lower Little Deschutes River Watershed). Based on habitat descriptions in the literature and using the 2004 Satellite Imagery vegetation data, there are approximately 3,030 acres of potential habitat in the watershed (multi-storied stands; greater than 20" average stand dbh; and greater than 55% canopy closure). From the perspective of the snag and log component, the Ogden EA snag and log analysis indicated the area outside of Newberry Crater is at the lower tolerance level for snags but higher tolerance levels for logs. Even in the stands that meet the high quality habitat definitions, they would still probably serve as marginal fisher habitat, because of the high degree of recreation use, road, and trail densities. Since the Newberry Crater area has no scheduled timber harvest, these are areas where it may be more prudent to manage for high dead wood levels and where the largest patches of potential fisher habitat exists. The Newberry Crater area also provides 37% of the potential habitat within the Lower Little Deschutes watershed.

In summary, based on field reconnaissance, local knowledge of the area, and professional opinion, potential habitat or the higher quality conditions for Pacific fisher exist within the caldera itself, but even yet, this amount of habitat would marginally provide enough for a fisher home range. Habitat quality outside the caldera, including the Geothermal Consent to Lease area diminishes due to the lack of preferred habitat as described in the literature above. The dominate vegetation outside the caldera is lodgepole pine and ponderosa pine. Although there are some pockets of montane mixed conifer interspersed between areas, it would not provide the larger contiguous blocks of habitats preferred by fishers. While there is potential suitable habitat along Paulina Creek, it is unlikely fishers would inhabit this area to breed due to the high presence of recreation sites adjacent to the creek and high volume of human presence, such as the Paulina Plunge activities during the summer months. Rather, Paulina Creek would have more potential to be utilized for travel/movement into other less disturbed areas. While there are two historic records of fisher sightings several miles southwest of Paulina Lake, the reliability of these records are unknown. According to District and Forest records, there is also no established fisher breeding. Based on all of the conditions discussed, fishers are given a very low probability of occurrence within the Geothermal Consent to Lease project area.

Alternative 1 (No-Action)

Direct and Indirect Effects: Alternative 1 would have no direct or indirect effects to fishers or to potential habitat. Any low probability of incidental fisher use of the area would continue to be limited by the high degree of human recreation use and road density in the project area.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Consenting to lease would have no direct or indirect effects to Pacific fisher because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: Any RFDs have the probability to directly impact or reduce potential fisher habitat. These impacts could result in the removal of vegetation from proposed activities in preparation of new pads, drilling, temporary roads or new roads. However, based on experience of previously

working with geothermal companies, it is unlikely that a company would invest the time and money to remove heavily forested areas (preferred fisher habitat), or build new roads given the current road densities in the broad area. In addition, any potential impacts could be avoided through project design or stipulations to specifically place activities in previously disturbed areas.

Effects Determination and Rationale from RFDs

Based on the lack of direct and indirect effects and incorporation with project design criteria and stipulations, the proposed action would have ***no effect*** to Pacific fisher.

- They are given a very low probability of incidental occurrence in the project area since habitat is considered marginal, and the project is outside higher quality habitat in the caldera. In addition, the area currently receives a high volume of recreational activities and there is a high amount of road density surrounding the caldera area.
- Fishers have a relatively broad movement, and there is no local knowledge of fishers residing within or the greater Newberry Crater area.

Alternative Comparison

Tables 26 and 27 show effects determinations for species analyzed in detail for this project. Implementation of either alternative would have **no effect** to any U.S. Fish and Wildlife Service Endangered, Threatened or Proposed Species or Designated/Proposed Critical Habitat. None of the federally listed species or habitat on the DNF occurs within the project area.

Table 18: Alternative Comparison

Species	Alternative 1 (No-Action)	Alternative 2 (Proposed Action – lease only)	Reasonably Foreseeable Development (from geothermal)
Gray wolf	NE	NE	NE
Northern spotted owl	NE	NE	NE
Northern spotted owl Designated Critical Habitat	NE	NE	NE
North American Wolverine	NE	NE	NE
Oregon spotted frog	NE	NE	NE
Oregon spotted frog Proposed Critical Habitat	NE	NE	NE
Pacific fisher	NE	NE	NE

USDA Forest Service Pacific Northwest Region Sensitive Species

Potential impacts to species classified as sensitive by the USDA Forest Service are considered through biological evaluations (FSM 2670.32). The biological evaluation for the appropriate species for the project area discusses potential impacts to terrestrial wildlife species.

The USDA Forest Service Pacific Northwest Sensitive Species list was reviewed for species that may be present in the Project Area (Table 19). A review of species records, habitat requirements, and existing habitat components, it was determined the following sensitive animal species have habitat or are known to occur in the project area and will be included in this analysis: Townsend's big-eared bat, pallid bat, spotted bat, fringed myotis, Lewis' woodpecker, white-headed woodpecker. With the recent proposal for listing the Oregon spotted frog as Threatened this species was addressed under the Endangered, Threatened and Proposed Wildlife section of this report.

Table 19: USFS Pacific Northwest Region Sensitive Species documented or Suspected on the DNF

Common Name	Scientific Name	Habitat
Townsend's big-eared bat	*Corynorhinus townsendii*	Caves and manmade structures
Pallid bat	*Antrozus pallidus*	Caves
Spotted bat	*Euderma maculatum*	Sheer cliffs and caves
Fringed myotis	*Myotis thysanodes*	Caves, abandoned mines and large snags
Pacific fisher	*Martes pennati*	Mixed conifer with complex structure
Bald eagle	*Haliaeetus leucocephalus*	Mature trees/snags near lakes, rivers
American peregrine falcon	*Falco peregrinus anatum*	Cliffs and riparian areas
Lewis' woodpecker	*Melanerpes lewis*	Mature ponderosa pine or burned areas
White-headed woodpecker	*Picoides albolarvatus*	Large, open ponderosa pine
Bufflehead	*Bucephala albeola*	Lakes with snags
Harlequin duck	*Histrionicus histrionicus*	Rapid streams with large trees
Tule white-fronted goose	*Anser albifrons elgasi*	Marshes and wetlands
Horned grebe	*Podiceps auritus*	Lakes
Tricolored blackbird	*Agelaius tricolor*	Bulrush patches in marshes and lakes
Yellow rail	*Conturnicops noveboracensis*	Marshes
Northern waterthrush	*Parkesia noveboracensis*	Shrubby riparian areas with willow/alder
Greater sage-grouse	*Centrocercus urophasianus*	Sagebrush
Oregon spotted frog	*Rana pretiosa*	Streams/marshes with consistent water
Columbia spotted frog	*Rana luteiventris*	Streams and marshes
Crater lake tightcoil	*Pristiloma arcticum crateris*	Perennial wet riparian areas
Evening field slug	*Deroceras hesperium*	Perennial wet riparian areas
Silver-bordered fritillary	*Boloria selene*	Open riparian bogs and marshes
Johnson's hairstreak	*Callophrys johnsoni*	Mature conifer forest with mistletoe
Western bumblebee	*Bombus occidentalis*	Meadows

Townsend's big-eared bat

This is a non-migratory bat that uses caves, mines or abandoned buildings for larger roosts, such as maternity colonies or hibernacula. Solitary bats can use rock crevices, fissures, buildings, bridges and large trees as day or night roost sites. There are approximately 350 caves on the DNF and based on previous work, 10-15% of these caves could support maternity colonies or hibernacula. A radio-telemetry study of Townsend's big-eared bats suggested the species has low roost site fidelity during the post-emergence period as rugged lava flows provide day or night roosting habitat allowing flexibility in finding foraging areas (Dobkin 1992).

Townsend's bats are foraging habitat generalists due to successful foraging in a wide range of habitats where insects concentrate, including riparian areas/intermittent streams, wetlands, lakes, forest/shrub edges, ridges, and forest canopy (Burford and Lacki 1998, Clark et al. 1993, Seidman and Zabel 2001). They will also take prey directly from foliage or other substrates. Based on published estimates of the size of foraging areas used by Townsend's, a maternity colony may require up to 650 acres (260 ha); however, this number is for eastern populations, and area requirements may be lower in the West due to the generally smaller size of colonies. Conversely, water may be more limiting for western populations than for those in the eastern U.S. and foraging areas which often include drinking water sources may be greater.

Bats typically use four different roost types. Maternity roosts are often secure areas, e.g.-caves or buildings, with stable temperature and humidity where females gather for birth and caring of young. Hibernacula can be occupied by males and females and are often larger caves with stable temperature

and humidity to optimize hibernation efficiency. Quality hibernacula roosts should be secluded to minimize disturbance which can awaken bats and utilize limited fat reserves. Day roosts can include caves, rock crevices, bridges, buildings and large snags that are used by individuals for extended periods during daylight. Night roosts can be any structure that provides a resting place for bats between foraging activity at night. Maternity colonies and hibernacula are the most important roost types for bat populations because these are often larger concentrations of individuals and quality roost locations tend to be rare on the landscape.

The primary threat to this species is human disturbance at sensitive roost locations such as hibernacula or maternity colonies (Pierson et al. 1999). Other threats include loss of foraging and roosting habitat through vegetation management practices. Recreation activities can impact Townsend's big-eared bats if they increase human disturbance to sensitive roosts or remove potential roost trees.

White-nose syndrome is affecting many bat species in the eastern United States. The fungus (*Pseudogymnoascus destructans*) interrupts hibernating bats resulting in over-expenditure of fat reserves needed to hibernate. The fungus has been recorded in western Oklahoma and not in Oregon. The Townsend's big-eared bat has not been documented with white-nose syndrome and the extent of potential impacts to the species is uncertain.

There is limited habitat within the project area. The only known cave is the Red Hill Cave near, but not within Parcel 5. Water is not readily available in the project area which would limit bat occurrence without quality cave resources. No buildings are available that would provide roosting structures. The best available roosting habitat would be larger trees near Paulina Creek that would provide day or night roost opportunities for solitary bats.

Alternative 1 (No-Action)

Direct and Indirect Effects: There would be no impacts to Townsend's big-eared bats from implementing this alternative. Currently available cave habitat would still be present but not abundant in the project area. Activities along the section of Paulina Creek will not remove potential roost trees.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA will not have direct effects to the Townsend's big-eared bat because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: If RFDs occur, the primary impact to this species would be direct removal and modification of habitat from development activities (well pads, pipelines, powerlines, and roads). Well drilling is not expected to disturb bats roosting in caves because of the stipulations regarding pre-disturbance surveys and specific protection for the Red Hill Cave in Parcel 5. The best available habitat for day/night roosting Townsend's big-eared bats would be in Parcel 3 along Paulina Creek which is NSO so no removal of potential roosts is expected in this parcel.

The Red Hill Cave near Parcel 5 is outside of the lease boundary by 0.4 miles. The Red Hill Cave has been mapped and is approximately 60 feet long. Based on other cave locations this could provide roosting habitat for Townsend's big-eared bat but is likely inaccessible during winter due to snow levels. Potential drilling activities are not expected to impact this cave based on the cave dimensions and that drilling activities are expected to occur far away from the cave resource.

The first three phases of development have potential to remove day/night roosts for Townsend's big-eared bats. Development activities could remove larger trees depending on eventual locations of

facilities within the parcel. The highest quality roosting habitat is along Paulina Creek but there are individual larger trees throughout the project area that could provide infrequent roosting opportunities for this species. The probability that an individual bat is in a tree is remote but present.

The highest quality foraging habitat is in Parcel 3 which is NSO so this will remain available for Townsend's big-eared bat in the RFD. Since the species forages in a wide variety of habitats (Pierson et al. 1999) removal of forest areas will remove minor amounts of foraging habitat for the species.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development **may adversely impact individuals, but not likely to contribute a trend toward federal listing or loss of viability to the population or species**. There is potential that during development of well pads and ancillary facilities (pipeline, power lines, and roads) larger trees that provide potential day/night roosts for the species could be removed. There is also potential reduction of foraging habitat for the species.

Fringed myotis

Caves and abandoned mines are suitable maternity and hibernacula for fringed myotis as these sites maintain appropriate humidity and temperature conditions. Large trees, bridges and rock crevices can provide day and night roosts. Seasonal migration patterns for fringed myotis are poorly understood, but short-range migrations are likely based on the species wing shape (Keinath 2004). Of the four sensitive bat species on the regional list the fringed myotis is most likely to use large trees for day/night roosts and potentially larger rooststsites.

Foraging activity typically begins 30 minutes after sunset with suspension of foraging during the middle of the night. There is a brief foraging period prior to sunrise. Wetlands, riparian zones and areas with high insect concentrations provide quality foraging habitat. Fringed myotis are prey generalists that will consume a variety of insects (Keinath 2004)

The primary threat to fringed myotis is roost loss through abandoned mine closures and persistent roost disturbance from recreational caving. Other threats include loss of roosting habitat through timber management practices, prey reductions through the use of pesticides and white-nose syndrome. This species occurs outside of the range of where *Pseudogymnoascus destructans* has been documented. There are no fringed myotis observations in the Project Area. Potential habitat is similar to that described under the Townsend's big-eared bat, but this species is more likely to roost in large trees than Townsend's big-eared bat. Potential habitat in the Project Area is limited with only one known cave near any of the parcels.

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: There would be no impacts to fringed myotis from implementation of this alternative. The currently available habitat will remain for the species. Cave resources in the area will remain as potential roost locations.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA will not have direct effects to fringed myotis because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: If RFDs occur, the primary impacts to fringed myotis would be associated with the removal of large trees during development of well pads, pipelines, power lines, and roads. All phases have potential to disturb nearby roosting bats but this is most likely during Phase Two and Three when well pads are being developed and move into utilization phase.

The highest quality fringed myotis habitat is in Parcel 3 and 5. Parcel 3 is along Paulina Creek where there is a combination of large trees and foraging habitat that could support the species. This parcel is identified as NSO so there are no anticipated reductions in potential habitat. Wildlife stipulations described for all parcels require surveys for caves prior to development and specific stipulations on Parcel 5 protect the only known cave near the project area. These stipulations will protect the highest quality habitat for the species in the project area.

Foraging habitat is present in Parcel 3 which provides the combination of large trees and water that support abundant insect resources. Since this parcel is NSO the existing foraging habitat will remain as currently available to the species. Secondary foraging areas exist at forest edges and interior forested stands where they would be a slight reduction of foraging opportunities through forest removal during construction of well pads, power lines, pipelines and roads. Construction of features will create edge habitat and small openings for foraging opportunities but the prolonged human presence and noise associated with this development will reduce the quality.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development **may adversely impact individuals, but not likely to contribute a trend toward federal listing or loss of viability to the population or species.** This is because of potential impacts associated with tree removal during construction that potentially removes roosting habitat and possible disturbance to roosting individuals from persistent noise and human presence during well pad development and operation. Stipulations described for all parcels and specifically for Parcel 5 are intended to protect caves which are higher quality habitat for this species. Potential impacts are generally restricted to day/night roosting habitat. A slight reduction in foraging habitat is expected but the extent and location is impossible to estimate without specific site locations.

Pallid bat

The pallid bat occurs in western North America including central Oregon. Typical habitat includes lower elevation arid deserts or canyonlands and to a lesser extent coniferous forests (Hermanson and O'Shea 1983). They tend to form large maternity colonies and hibernacula that can reach hundreds of individuals. Day and night roosts can include rocky outcrops, caves, mines, trees and human structures (Hermanson and O'Shea 1983). The species can have large roost sites with entrances 4-5 meters above

ground level to deter predation. They are opportunistic feeders that consume a variety of insect prey including beetles, moths and scorpions.

There are no documented pallid bats on the DNF but there are observations east of the forest boundary. Potential habitat for this species is limited throughout the project area because the lack of rock outcrops and caves. This species does not regularly use trees for roosting habitat and prefers caves or rock outcrops. Trees would infrequently be used as day/night roosts but with a lack of rock outcrops or caves in the project area the predicted use of trees would be very infrequent. Similar to Townsend's big-eared bat the best habitat for the pallid bat is Parcel 3 which has permanent water and some rock outcrops associated with Paulina Creek. The entire parcel is identified as NSO so habitat modification on this parcel is not expected.

Pallid bats are sensitive to human disturbance and can be negatively affected by activities that increase frequency and duration of human presence at roosts. Recreational caving in the area can reduce effectiveness of potential roosts throughout the analysis area because of frequent human presence.

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: Implementation of this alternative would not directly impact pallid bats. All current habitats will remain available to the species.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA will not have direct effects to the pallid bat because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: If RFDs occur, activities could remove trees that provide day/night roosting opportunities during the first three stages of development. Development and operation of these leases could result in sustained human presence that could disturb roosting bats through equipment operation.

Parcels 3 and 5 provide the best potential roosting habitat for pallid bat. Parcel 3 is identified as NSO so there is no potential for tree removal or actions to remove large trees. Parcel 5 has a stipulation for protection of the Red Hill Cave which is the only known cave near a parcel. Cave surveys will be performed prior to lease development so if currently unidentified caves are discovered then appropriate protections can be developed.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development **may adversely impact individuals, but not likely to contribute a trend toward federal listing or loss of viability to the population or species**. Potential impacts are associated with removal of larger diameter trees that could provide day/night roosting opportunities. Foraging habitat would remain along Paulina Creek.

Spotted bat

The spotted bat is described as a solitary roosting species as there is little evidence of large concentrations at either maternity colonies or hibernacula (Luce and Keinath 2007). They are found throughout western North America including central Oregon (Rodhouse et al. 2005). Sheer cliffs in proximity to water are often identified as an important habitat feature for roosting but the species also

uses caves (Chambers et al. 2001). Maternity roosts in northern Arizona were remote areas that were difficult to access (Chambers et al. 2011). The solitary nature has made the species seem rare but recent work in central Oregon indicates that spotted bats are more widespread than previously thought but occur at low densities across a landscape in suitable habitat (Rodhouse et al. 2005). Foraging areas are often near of over water but can include open ponderosa pine or meadow areas (Luce and Keinath 2007).

Spotted bat have not been identified on the DNF but they are known to occur near the eastern forest boundary (Rodhouse et al. 2005). There is potential roosting and foraging habitat for the species in the analysis area however the area lacks the sheer cliffs and perennial water often associated with the species. This species is dependent on rock outcrops and caves for all roosting habitat. The only suitable habitat in the project area would be in Parcels 3 and 5. Parcel 3 is along Paulina Creek where there are rock outcrops near the creek and Parcel 5 is near Red Hill Cave which is the only known cave near the project area.

Threats to spotted bats include habitat loss through vegetation management or land conversion, especially actions that reduce available water sources and roost loss or modification. Roost loss or modification may be from actions such as recreational rock climbing, mining or reservoir impoundment (Luce and Keinath 2007).

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: There would be no impacts associated with this alternative. All currently suitable habitats will remain available.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA would not have direct effects to the spotted bat because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: No impacts are expected for this species. The only suitable habitat occurs in Parcels 3 and 5. Parcel 3 is proposed as NSO for the entire area and therefore no habitat will be disturbed. Parcel 5 has a stipulation on activities occurring near the Red Hill Cave which is outside of the parcel boundary. All parcels will be surveyed for the presence of caves prior to lease development so that if currently undiscovered caves are located appropriate protection measures can be placed on these caves.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development would have **no impact** on the spotted bat. The only suitable habitat in the project area is protected through NSO or specific stipulations for Parcel 5. In the event a previously undiscovered cave is located then appropriate protection measures qould be designed to protect that resource.

Lewis Woodpecker

This woodpecker is associated with mature ponderosa pine, riparian cottonwoods, and recently burned areas of any forest type (Able et al. 2004). Recent wildfires provide snags, perch sites and abundant insects to support nesting. The Lewis' woodpecker is considered a weak excavator and depends on large

snags in advanced decay or cavities created by stronger excavators. They are a DNF LRMP MIS as part of the woodpecker group and a focal species for ponderosa pine with patches of burned forest in the East Cascade Landbird Strategy (Altman 2000). It is apparently secure at both the global and national scales but is listed as imperiled for the state of Oregon (NatureServe 2010).

The Lewis' woodpecker is relatively tolerant of human disturbance at nest locations. Cooper et al (1998) indicate that disturbance beyond 15 meters from a nest resulted in little response from this species. Sustained disturbance from construction activities could disrupt nests at greater distances depending how long the activity lasts.

Threats to the Lewis' woodpecker include the loss of large snags, fire suppression, intensive grazing, timber harvest, salvage logging of burned ponderosa pine forests, loss of cottonwood trees, human development in breeding and wintering habitat, and human disturbance at nest sites (Tobalske 1997, Marshall et al. 2003, Abele et al. 2004, NatureServe 2010). In addition, minor threats may include use of pesticides or contaminants in orchards and agricultural settings and competition for nest cavities with European starlings (Tobalske 1997, Marshall et al. 2003, Abele et al. 2004, NatureServe 2010). The loss of breeding and wintering habitats in the form of burned pine forests, park-like ponderosa pine forests, riparian cottonwood stands and oak woodlands is thought to be the primary threat to the long-term persistence of populations (Abele et al 2004).

Lewis' woodpecker nesting habitat was mapped using the drier ponderosa pine forests in the early, mid and late seral stages. In addition, other PAG where ponderosa pine is the dominant species in the early and mid seral stages was mapped as habitat. Stand size had to be a minimum diameter of 15"dbh or greater and have open stand characteristics (based on the canopy cover level thresholds for each PAG) to be mapped as potential habitat. Older fires (greater than 5 years old) were added as habitat. Recent (since 2002) forest management activities that resulted in conditions other than described above were removed from mapped potential habitat. Acres of potential nesting habitat was then mapped by watershed and subwatershed.

Forest-wide Lewis' woodpecker habitat was estimated at 84,978 acres of potential Lewis' woodpecker nesting habitat on the forest. There are an estimated 24 acres of Lewis' woodpecker habitat in the project area mostly in Parcel 4 and approximately half of that is in portions of the parcel identified as NSO. There are portions of older large fires in Parcels 1, 3, 5 and 10 but these are not mapped as suitable habitat. All of these fires are 15-30 years old and the habitat value for this species is declining.

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: There are no anticipated impacts to Lewis' woodpecker from this alternative. Lewis' woodpecker habitat in the project area is very limited to isolated patches and older wildfires. All currently suitable habitats will continue to be available to Lewis' woodpecker.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA would not have direct effects to the Lewis' woodpecker because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: Potential Lewis' woodpecker habitat exists is in isolated patches primarily in Parcel 4. The RFD could remove minor amounts of Lewis' woodpecker habitat depending on the

eventual location of well pads, pipelines, power lines and roads in that parcel. Habitat would be impacted through removal of snags that could provide nesting and foraging opportunities for the species. Prolonged human presence at well pad sites could displace foraging or nesting birds if they occur at the time of development. The combined potential for impacts is low considering the predicted habitat is in isolated patches and approximately half of the modeled habitat is in areas identified as NSO.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development **may adversely impact individuals, but not likely to contribute a trend toward federal listing or loss of viability to the population or species.** This alternative has potential to remove larger diameter trees suitable for Lewis' woodpecker. Potential impacts would be expected to be infrequent as there is a small amount of habitat in the project area and approximately half of that is in NSO areas where snag removal is not expected to occur.

White-headed Woodpecker

This species is associated with old-growth ponderosa pine habitats and recently burned areas with reduced understory shrub component. The status for the white-headed woodpecker is apparently secure at the global and national levels (G4 and N4) and imperiled at the state level (S2).

White-headed woodpeckers may require dynamic landscapes with both burned and unburned habitat for the long-term persistence of populations (Hollenbeck et al. 2010). Wightman et al. (2010) found existing open-canopied ponderosa pine forests before a fire and a mosaic of burn severities within 1 kilometer of nests was found to characterize nest sites on the Fremont-Winema NF. They found the presence of larger, more decayed snags and fewer live trees near a snag after fire were important factors for nest selection, however this didn't influence nest survival. Open-canopied pine forests with mature, cone-producing trees within proximity of burns were also important in identifying white-headed woodpecker habitat as long as most of the landscape was not subjected to stand replacement burns (Wightman et al. 2010). A mosaic of burn severities across the landscape may improve white-headed woodpecker habitat by opening forest canopies in higher severity burned areas while retaining decayed snags created before wildfire and live cone-producing trees in unburned or low severity burned areas (Wightman et al. 2010).

White-headed woodpeckers may rely more on decay condition of snags than density (Wightman et al. 2010). Saab and Dudley (1998) found this species selected for the largest and most heavily decayed snags compared to other woodpeckers. However, snags created by fire have lower retention rates than trees killed more slowly by insects or disease and fire-killed snags may not reach levels of decay favored by white-headeds until 2-3 years post-fire (Wightman et al. 2010). Therefore, snags existing before fire, if retained, or those with more advanced decay seem to be critical components in post-fire landscapes, especially in the first few years after fire (Wightman et al. 2010).

Studies reviewed show the mean diameter of nest snags for this species ranges from 14.6 to 16.7 inch DBH (Saab and Dudley 1998, Saab et al. 2002). Nest success was equal for nests in both logged and unlogged burned areas (Saab and Dudley 1998). Wightman et al. (2010) found nest survival rates were higher in burned areas than nest success reported for unburned forests in central Oregon. Wightman et al. (2010) also found white-headed woodpeckers selected for nest snags ≥ 20 inch DBH from unburned or low severity burned areas that contained live trees.

Forests with live trees have more abundant and complex assemblages of predators than high severity burned areas (Wightman et al. 2010). The golden-mantled ground squirrel and yellow pine chipmunk are known nest predators. Golden-mantled ground squirrels are positively associated with down wood volume and yellow pine chipmunks are positively associated with shrub cover (Wightman et al. 2010).

Down wood and shrub cover are less in post-fire environments, thus nest placement in high severity burned areas may be a viable strategy to reduce nest predation as long as unburned or low severity burned areas are available within the landscape for foraging (Wightman et al. 2010). Nests in unburned forests may be more vulnerable than those in burned forests as these may also experience lower ambient temperatures which affect incubation behavior and reproductive effort (Hollenbeck et al. 2010).

Foraging habitat is usually found in association with nesting habitat. Kozma (2011) surmised because white-headed woodpeckers are primarily bark gleaners and feed on ponderosa pine seeds throughout the winter, large diameter and old-growth ponderosa pine may be more important to white-headed woodpeckers because these trees have a greater bark foraging area, higher insect abundance, and greater and more frequent cone production than smaller trees.

Habitat suitability model developed by Hollenbeck et al. (2010) found average maximum daily temperature and density of large trees (≥20 inch DBH) had a positive relationship with daily survival rates with temperature having the greatest effect. The positive relationship between temperature and nest survival may be related to increased activity of insects and subsequent foraging activities or within cavity microclimate. During the breeding season, white-headed woodpeckers rely on surface and bark insects. These insects likely become more available as the weather warms. Daily nest survival was also related to the density of large diameter trees surrounding the nest site (Hollenbeck et al. 2010). Larger diameter trees may allow for increased foraging opportunities and increased foraging efficiency as well as parental attentiveness (Hollenbeck et al. 2010). Large diameter pines may also provide greater numbers of cones and seeds which are important winter foods that may influence breeding condition and nest survival. In addition, higher densities of large trees may also reduce the impact of predators. Common predators include the yellow pine chipmunk and golden-mantled ground squirrel, both associated with live conifers. A high density of large trees may create a swamping effect if nest cavities are abundant compared to the surrounding forests (Hollenbeck et al. 2010).

Dixon (1995) found 42% of over 2,000 foraging observations were on branches, 23% on the upper trunk, 22% on the mid-trunk, and 13% on the lower trunk with an average foraging height of 62 feet on large diameter live ponderosa pine trees. Dixon (1995) also showed that white-headed woodpeckers gleaned 35%, fed on cones 31%, pecked 24%, and fed on sap 7% with males foraging slightly higher in trees and feeding on cones more than females.

White-headed woodpeckers do feed on tree sap (Dixon 1995, Kozma 2010) as well as insects and seeds. Kozma (2010) found white-headed woodpecker sap wells differed from those of red-naped and Williamson's sapsuckers based on size, arrangement, and white-headed's wells are only located on one side of the tree and not clustered together. All trees used were ponderosa pine and sap wells favored a southwest orientation (Kozma 2010). Sap trees were found to be shorter and smaller than non-used trees (Kozma 2010).

Habitat degradation is the primary threat to this species (Garrett et al. 1996, Frenzel 2000, and Nature Serve 2011). Loss of large diameter, old ponderosa pine from logging, planting of even-aged stands, fire suppression (which favors replacement of pines by firs), snag removal and forest fragmentation have contributed to local declines (Garrett et al. 1996). Fire suppression has altered fire regimes so that ponderosa pine forests are no longer maintained by natural fire and are being replaced by fir species in the understory as well as leading to increased shrub densities. Increased shrub densities may be a factor leading to increased mammalian nest predation and increased risk of avian predation on adults (Frenzel 2000). This species does persist in burned or cutover forests with residual snags and stumps and populations are more tolerant than those species associated with closed-canopy forest (Garrett et al. 1996).

Incidental disturbance at nest and roost sites occurs around recreation sites but this species is tolerant of human activity in the nest vicinity as long as activity does not involve the nest tree (Garrett et al. 1996). Birds become extremely agitated if the nest itself is disturbed and activity is not prolonged (Garrett et al. 1996).

White-headed woodpecker nesting habitat was mapped using ponderosa pine dominated forests which included all ponderosa pine PAG in all seral stages in addition to other PAG in the early and mid seral stages where ponderosa pine is dominant. Stand size had to be a minimum 10 inch DBH. The model estimates 198,330 acres of white-headed woodpecker nesting habitat on the DNF and there are 612 acres of modeled white-headed woodpecker habitat in the project area, which represents 0.3% of the available white-headed woodpecker habitat on the DNF. There are 103 acres of white-headed woodpecker habitat in Parcel 3 which is NSO. Some does occur in areas identified as NSO in parcels 3 and 4. There are no documented white-headed woodpecker observations within 0.5 miles of the project area.

Table 20 shows potential white-headed woodpecker reproductive habitat for the subwatershed with proposed parcels.

Table 20: Modeled White-headed Woodpecker Habitat for Subwatersheds in the Project Area

Watershed (10th Level)	Subwatershed (12th Level)	Acres
Lower Little Deschutes	Kawak Butte-Little Deschutes River	2,046
	Lower Paulina Creek	1,737
	Sugar Pine Butte-Little Deschutes River	8,265
	Upper Paulina Creek	35
Long Prairie	Finley Butte-Long Prairie	574
	Green Butte	1,461
	Paulina Peak South	1,291
	Surveyors Lava Flow	678
Pine Lake-Devils Garden	China Hat	847
	The Dome	6,775
Kotzman Basin	Potholes	871
Total Acres		**24,580**

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: There are no anticipated impacts to white-headed woodpecker from implementation of this alternative. All suitable habitats that are currently available will remain for the species. Snags will continue to be available at current levels. Fire suppression tactics are expected to remain the same as current direction. Fires are expected to remain small or medium sized with few large fires.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA would not have direct effects to the white-headed woodpecker because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: White-headed woodpecker habitat is present in most parcels proposed in this action but the largest concentrations are in parcels 1, 3 and 10. Habitat in Parcel 10 is associated

with the Topso Butte fire which is 15 years old and the overall habitat quality for this species associated with the fire will decline as standing material falls and regeneration of trees and shrubs continues. Parcel 3 is NSO and no RFDs would occur within this parcel.

If RFDs occur, the primary impact to white-headed woodpeckers would be from removal of snags and down wood that can support nesting or foraging opportunities for the species.

The quantity and extent of removal is expected to be far less than the 612 acres of potential habitat modeled for the species.

Construction of well pads, pipelines, power lines, and roads is not expected to alter large patches of potential habitat as the estimate disturbance is generally small patches associated with a well pad. The extent of snags that could be removed is completely dependent on the final facility site selection. Ongoing operation of these facilities would likely remove some snags that occur at the margin of developed sites and present a safety hazard. The actual extent of the potential impact is uncertain due to the uncertainty with and the type of development that would occur.

Conversion of suitable white-headed woodpecker habitat is expected to be long-term even if wells are not productive as suitable habitat can take many years to develop. This species is known to be tolerant of human near active nests, unless the nest itself is disturbed. However, persistent human and machine presence during construction would have the potential to displace nesting or forging individuals.

Increased roads are often cited as a source for snag reductions associated with increased access. The DNF regulates fuelwood collection and has certain areas open at a time. There are no fuelwood collection areas known in the project area. Any reduction of snags or down wood would be from unauthorized collection.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development **may adversely impact individuals, but not likely to contribute a trend toward federal listing or loss of viability to the population or species**. There is potential that the RFD could remove larger diameter snags and reduce currently available nesting or foraging opportunities. Prolonged human activity during development and production phases could disturb nesting or forging individuals.

Wildlife: Management Indicator Species

Introduction

The DNF LRMP (USDA 1990) identified wildlife species as management indicator species (MIS). These species were selected because they represent other species with similar habitat requirements. Management indicator species are used to assess the impacts of management activities for a wide range of wildlife species with similar habitat needs (FSM 2620.5).

Table 21: Management Indicator Species for the Deschutes National Forest

Species	Nature Serve Rank[1]	Habitat
Bald eagle	S4 Apparently secure	Large trees near lakes, rivers and estuaries.
Northern goshawk	S3 Vulnerable	Mature stands with high canopy closure/large trees.
Cooper's hawk	S4 Apparently secure	Stands with high canopy closures and tree density.
Sharp-shinned hawk	S4 Apparently secure	Stands with high canopy closures and tree density.
Great gray owl	S3 Vulnerable	Mature to old-growth stands near natural openings.
Great blue heron	S4 Apparently secure	Riparian edges near lakes, streams or marshes.
Golden eagle	S4 Apparently secure	Large open areas with cliffs or rock outcrops.
Red-tailed hawk	S5 Secure	Large snags and open country interspersed with forest.
Osprey	S4 Apparently secure	Large snags associated with fish bearing water bodies.
American marten	S3 Vulnerable	Mixed conifer or high elevation late-successional forests with abundant down woody material.
Elk	S5 Secure	Wide range of seasonal habitats.
Mule deer	S5 Secure	Wide range of seasonal habitats.
Snags/down wood		Snags and down woody material.
Waterfowl		
Common loon	SHB Possibly extirpated breeding S5N Secure non-breeding	Edges of remote freshwater ponds and lakes.
Pied-billed grebe	S5 Secure	Edges of lakes, ponds, slow rivers and marshes.
Horned grebe	S2B Imperiled breeding, S5N Secure non-breeding	Open water with emergent vegetation.
Red-necked grebe	S1B Critically imperiled breeding S4N Secure non-breeding	Lakes and ponds in forested areas.
Eared grebe	S4 Apparently secure	Open water with emergent vegetation.
Western grebe	S3B Vulnerable breeding S2S3N Imperiled/vulnerable nonbreeding	Open water marshes with emergent vegetation.
Canada goose	S5 Secure	Lakeshore, rivers and reservoirs especially with cattail
Wood duck	S4 Apparently secure	Cavity nester near perennial water bodies
Gadwall	S5 Secure	Clumps of grasses in meadows or tall grasslands
American widgeon	S5 Secure	Clumps of grasses in meadows or tall grasslands
Mallard	S5 Secure	Open water with emergent vegetation
Blue-winged teal	S4 Apparently secure	Marshes, lakes, ponds or slow moving streams
Cinnamon teal	S5 Secure	Shoreline vegetation

Species	Nature Serve Rank[1]	Habitat
Northern shoveler	S5 Secure	Grassy areas near freshwater
Northern pintail	S5 Secure	Open areas near water
Green-winged teal	S5 Secure	Freshwater marshes with emergent vegetation
Canvasback	S4 Apparently secure	Emergent vegetation
Redhead	S4 Apparently secure	Freshwater marshes with emergent vegetation
Ring-necked duck	S3 Vulnerable	Thick emergent vegetation near shorelines
Lesser scaup	S3B Vulnerable breeding S4N Secure non-breeding	Dry grassy areas near lakes at least 10 feet deep
Harlequin duck	S2B Imperiled breeding S3N Vulnerable non-breeding	Fast moving streams at higher elevations
Common goldeneye	S4 Apparently secure	Cavity nester
Barrow's goldeneye	S3B Vulnerable breeding S3N Vulnerable non-breeding	Cavity nester
Hooded merganser	S4 Apparently secure	Cavity nester
Common merganser	S4 Apparently secure	Cavity nester
Ruddy duck	S4 Apparently secure	Freshwater marshes and lakes with dense vegetation
Woodpeckers		
Williamson's sapsucker	S4B Apparently secure breeding S3N Vulnerable non-breeding	Mature conifer forests with open canopy.
Red-naped sapsucker	S4 Apparently secure	Riparian hardwood forest.
Lewis' woodpecker	S2S3 Imperiled/Vulnerable	Open mature ponderosa pine and recent burn areas.
Downy woodpecker	S4 Apparently secure	Riparian hardwood forest.
Hairy woodpecker	S4 Apparently secure	Mixed conifer and ponderosa pine forests.
Three-toed woodpecker	S3 Vulnerable	High elevation lodgepole pine forests.
Black-backed woodpecker	S3 Vulnerable	Lodgepole pine forests and burned areas.
White-headed woodpecker	S2S3 Imperiled/Vulnerable	Mature ponderosa pine
Northern flicker	S5 Secure	Variety of forest types
Pileated woodpecker	S4 Apparently secure	Mature to old-growth mixed conifer forest

Wildhab models were used to identify habitat in parcels included in the proposed action. Based on the model results the northern goshawk, Cooper's hawk, sharp-shinned hawk, great-blue heron, osprey, red-tailed hawk, American marten, mule deer, and several woodpecker species have potential habitat in the proposed leases. These species were carried to full analysis. Viability for each species was evaluated and based on the modeled habitat since the specific locations of project activities are not known.

Northern Goshawk

Goshawks tend to have larger home ranges that incorporate multiple spatial scales to meet their life requirements (Squires and Kennedy 2006). Three habitat areas are recognized as important for breeding goshawks. The nest area is composed of one or more forest stands or alternate nests. A post fledging area around the nest is used by adults and young from the time of fledging, when the young are

still dependent on the adults for food. A foraging area comprises the breeding pair's entire home range. Goshawk nest areas are unique in structure, with large trees, dense canopies, and high canopy closure. Nesting habitat encompasses approximately 200 acres surrounded by approximately 75 acres in stem exclusion or understory re-initiation with high canopy closure. The outlying 125 acre area should contain a mix of forest structure with significant areas of open canopy mixed with more closed forest. Numerous authors have described the size of the post fledging areas ranging from 296-593 acres. This area provides fledgling hiding cover and foraging opportunities as fledglings learn to hunt and may correspond to the area defended by the breeding pair. Foraging areas are typically 4,900-5,900 acres of forest mosaic that support a wide range of suitable prey and are usually more open than nesting areas. This area should contain large trees, snags, down logs, vegetative layering, and other structural elements important to prey species.

The following are identified potential threats to goshawk habitat and persistence:

- Timber harvest of mature and older stands that support nesting.
- Fire suppression may lead to increased susceptibility of stand-replacing fire and insect and disease outbreaks, which can result in the deterioration or loss of nesting habitat.
- Disturbance due to logging activities conducted near nests during the incubation and nestling periods can cause nest failure due to abandonment.
- High road densities may result in loss of snag and down wood habitat important to goshawk prey.

The DNF LRMP Standard WL-6 states: to provide 40 nesting pairs of goshawks be provided in mixed conifer, mountain hemlock, and ponderosa pine forests outside of Wilderness and the Oregon Cascades Recreation Area. Habitat for an additional 30 pairs in lodgepole pine forest if available, but may not be suitable due to extensive tree mortality from mountain pine beetle epidemic. Habitat modeling indicates that the DNF can support 77-108 nesting goshawk pairs.

Forest-wide northern goshawk nesting habitat was modeled using all PAG except juniper, mountain hemlock, and vegetation at higher elevations; dense stands and all seral stages were included. Minimum tree diameter was defined as 10" dbh except in lodgepole pine where the minimum diameter was set at 5" dbh. Lower diameter limits were used because the region-wide vegetation database quantifies average diameter of the majority of species even though the stand may have sufficient large trees within that meet the needs for nesting. This may over estimate nesting habitat in lodgepole stands.

There are 446,557 acres of potentially suitable goshawk habitat on the DNF and 2,470 acres of nesting habitat in the project area. Table 22 shows northern goshawk habitat by subwatersheds that include some portion of parcels proposed for leasing. The project area has 0.5% of the modeled northern goshawk habitat on the DNF. There are no known goshawk nests in the project area, but wildlife stipulations require surveys for northern goshawk to protect currently unidentified nests and to maintain DNF LRMP compliance.

Table 22: Modeled Northern Goshawk Habitat for Subwatersheds within the Project Area

Watershed (10th Level)	Subwatershed (12th Level)	Acres and Percent of Subwatershed
Lower Little Deschutes	Kawak Butte-Little Deschutes River	4,846 *(43%)*
	Lower Paulina Creek	6,770 *(39%)*
	Sugar Pine Butte-Little Deschutes River	9,136 *(32%)*
	Upper Paulina Creek	5,066 *(40%)*
Long Prairie	Finley Butte-Long Prairie	2,439 *(23%)*
	Green Butte	3,808 *(16%)*
	Paulina Peak South	6,427 *(41%)*

Watershed (10th Level)	Subwatershed (12th Level)	Acres and Percent of Subwatershed
	Surveyors Lava Flow	4,606 *(24%)*
Pine Lake-Devils Garden	China Hat	4,702 *(24%)*
	The Dome	9,430 *(28%)*
Kotzman Basin	Potholes	1,783 *(13%)*
Total Acres		***59,013***

Environmental Consequences

Alterative 1 (No-Action)

Direct and Indirect Effects: There are no anticipated impacts to northern goshawk under this alternative. All suitable habitats that are currently available to the species in the project area will remain.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA will not have direct effects to the northern goshawk because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: Potential impacts from the RFDs can be categorized into habitat removal/modification, roads, pipelines, power lines and human presence.

Northern goshawk habitat could be modified or converted under this Alternative due to timber harvest needed to create space for all the facilities described in the RFD. Considering the amount of northern goshawk habitat in the project area there is a wide range of potential impacts depending on the eventual development scenario. If a higher level of development as described in the RFD does occur it would still not impact the entire 2,470 acres of modeled habitat based on the described facilities. Approximately 39% of the entire project is open to Standard Leasing with the rest being CSU or NSO. If development reaches the production phase then habitat would be converted for the long-term since this phase could be 10-50 years as described in the RFD.

Increased traffic on roads can result in disturbance to nesting or foraging goshawks under the traffic estimations in the RFD. Heavy road traffic can create a road effect area which may be avoided by nesting or foraging goshawks.

Many raptors have been documented using power poles as perches and consequently electrocuted on older pole configurations without perch deterrents. The goshawk generally hunts in denser stands from a hidden perch and is not known to regularly use power poles. If these parcels produce to the point power lines are constructed then current raptor friendly designs should be used. These designs typically space wires far enough apart that the short-wingspan of a goshawk will not result in electrocution. There are no anticipated impacts to northern goshawks associated with power lines.

Wildlife stipulations requiring surveys for the presence of northern goshawk should identify any currently unknown nests if they occur and provide sufficient protections as outlined in the DNF LRMP. Nearby areas have been surveyed for northern goshawk as part of several timber management project without detections, but surveys specific to this project would promote nest protections since they would be current.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development would impact less than 0.5% of suitable habitat across the Forest; the overall direct, indirect and cumulative effects will result in a small negative trend of habitat (increase in disturbance). The loss of habitat will be insignificant at the scale of the Forest. The Geothermal Consent to Lease Project is consistent with the DNF LRMP, and thus continued viability of northern goshawk is expected. Potential impacts to northern goshawk are reduced through wildlife stipulations for surveys prior to implementation to identified previously unidentified nests.

Cooper's hawk

Cooper's hawk were selected as a terrestrial MIS for the DNF for providing stand diversity and retention of small blocks of 50–80 year old black bark pine stands and mixed conifer stands. Cooper's hawk nest sites varied from pure stands of ponderosa pine at lower elevations, to mixed stands of ponderosa pine and white fir at mid-elevations, to mixed and pure stands of white fir and lodgepole pine at high elevations. Stands of all age classes in each timber type were represented, however the most common type was mature ponderosa pine overstory with mixed understory of ponderosa pine and white fir. Nests were built in trees with high crown volume, utilizing mistletoe for nest structures.

Cooper's hawks play an important ecological role due to their predatory nature. In Oregon alone, Reynolds and Meslow (1984) documented 76 species in the diet of Cooper's hawks. American robins and Steller's jay (*Cyanocitta stelleri*) were the most common avian prey taken while chipmunks and brush rabbits (*Sylvilagu*s spp.) were the most common mammalian prey taken.

The DNF LRMP Forest-wide Standard WL-13 states nesting habitat for at least 60 pairs of Cooper's hawk will be provided in mixed conifer and ponderosa pine forests outside of Wilderness and the Oregon Cascades Recreation Area. Current estimates using the Wildhab Model suggest there is sufficient habitat for 48-166 nesting pairs of Cooper's hawks on the DNF. The range of this estimate is so wide because of the documented variability in home range size of the species.

Cooper's hawk nesting habitat was modeled using all PAG, except juniper, mountain hemlock and vegetation at higher elevations. All seral stages and dense stands with minimum structure of 10"dbh were used, except in lodgepole pine where the minimum diameter was 5" dbh. The maximum dbh used was 20". Hardwood stands where the canopy cover was greater than 50% was included in the model.

Based on this habitat modeling there are 275,340 acres of potential Cooper's hawk nesting habitat on the DNF. Table 23 shows the modeled Cooper's hawk habitat for all subwatersheds (12th Level) that have any amount of proposed lease parcel. There are 2,192 acres of modeled Cooper's hawk habitat in the project area, but the majority (59%) is in Parcel 6 which is identified as NSO. The project area has 0.8% of the modeled Cooper's hawk habitat on the DNF. There are no known Cooper's hawk nests in the project area. Wildlife stipulations require surveys for Cooper's hawk to prevent potential nest disturbance and maintain DNF LRMP compliance.

Table 23: Modeled Cooper's Hawk Habitat in the Project Area by Subwatershed

Watershed (10th Level)	Subwatershed (12th Level)	Acres and Percent of Subwatershed
Lower Little Deschutes	Kawak Butte-Little Deschutes River	3,750 *(33%)*
	Lower Paulina Creek	4,929 *(29%)*
	Sugar Pine Butte-Little Deschutes River	6,292 *(22%)*
	Upper Paulina Creek	4,693 *(37%)*
Long Prairie	Finley Butte-Long Prairie	1,790 *(18%)*
	Green Butte	2,697 *(11%)*
	Paulina Peak South	5,136 *(32%)*

Watershed (10th Level)	Subwatershed (12th Level)	Acres and Percent of Subwatershed
	Surveyors Lava Flow	4,000 *(20%)*
Pine Lake-Devils Garden	China Hat	4,007 *(21%)*
	The Dome	6,715 *(20%)*
Kotzman Basin	Potholes	1,485 *(11%)*
Total Acres		**45,491.46**

The primary threat to Cooper's hawk is habitat alteration and/or destruction which can reduce nest site and prey availability thereby limiting population growth.

Environmental Consequences

Alterative 1 (No-Action)

Direct and Indirect Effects: There are no anticipated impacts to Cooper's hawk from Alternative 1. All currently suitable habitats will remain available to the species in the near future.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA will not have direct effects to the Cooper's hawk because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: Potential impacts from the RFD can be categorized into habitat removal/modification, roads, pipelines, power lines and human presence.

Cooper's hawk reproductive habitat could be modified or converted under this Alternative due to timber harvest needed to create space for all the facilities described in the RFD. Habitats within areas identified as NSO are not expected to be modified or converted resulting from this action. This removes about 60% of the mapped Cooper's hawk habitat in the project area from disturbance. Considering the amount of habitat in the project area there is a wide range of potential impacts depending on the eventual development scenario. If a higher level of development as described in the RFD does occur it would still not impact the entire 2,192 acres of modeled habitat based on the described facilities. If development reaches the production phase then habitat would be converted for the long-term since this phase could be 10-50 years as described in the RFD.

Increased traffic on roads can result in disturbance to nesting or foraging Cooper's hawk under the traffic estimations in the RFD. Heavy road traffic can create a road effect area which may be avoided by nesting or foraging Cooper's hawk.

Many raptors have been documented using power poles as perches and consequently electrocuted on older pole configurations without perch deterrents. The Cooper's hawk typically hunts from concealed perch in a stand and is less likely to use an exposed perch such as a power pole. If these parcels continue to produce to the point power lines are constructed then current raptor friendly designs should be used. Current designs typically space wires far enough apart that the short-wingspan of a Cooper's hawk are unlikely to be electrocuted.

Wildlife stipulations requiring surveys for the presence of Cooper's hawk should identify any currently unknown nests if they occur and provide sufficient protections as outlined in the DNF LRMP. Nearby areas have been surveyed for northern goshawk as part of several timber management project without detections, but surveys specific to this project would promote nest protections since they would be current.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development would impact less than 0.8% of suitable habitat across the Forest; the overall direct, indirect and cumulative effects will result in a small negative trend of habitat. The loss of habitat will be insignificant at the scale of the Forest. The Geothermal Consent to Lease Project is consistent with the DNF LRMP, and thus continued viability of Cooper's hawk is expected. Potential impacts to Cooper's hawk are reduced through wildlife stipulations for surveys prior to implementation to identified previously unidentified nests.

Sharp-shinned hawk

Sharp-shinned hawk nest sites are characterized as dense, conifer stands, with dense over stories and sparse understories. Most nests were in young (25-50 years) even-aged conifer stands with single-layered canopies. The growth form of trees may be the most reliable parameter by which to characterize nest sites of sharp-shinned hawks. The vegetation at nest sites is usually in the early successional stages and extremely dense. Nest stands are dominated by trees 3-15 inch DBH and average 2,286 trees/ha. Tree species composition varies from pure stands of ponderosa pine at lower elevations, to mixed stands of ponderosa pine and white fir at mid-elevations, to mixed and pure stands of white fir and lodgepole pine at high elevations. The sharp-shinned hawk was selected as a terrestrial MIS for providing stand diversity and retention of small blocks of habitats within 40–60 year old ponderosa pine stands and mixed conifer stands with a dense canopy.

The DNF LRMP Forest Wide Standard WL-21 states nesting habitat for at least 60 pairs of sharp-shinned hawk will be provided in mixed conifer and ponderosa pine forests outside of Wilderness and the Oregon Cascades Recreation Area. WL-22 states the sharp-shinned hawk prefers nest groves that are even-aged stands of 40 to 60 year-old conifers with a dense canopy; nesting can occur in dense stands of second growth trees beneath an over-mature overstory.

Direct habitat loss can occur from urban development and timber harvest. Habitat loss can also occur indirectly as young forest stands mature and no longer provide suitable stand conditions for nesting. It should be noted though that impacts of timber harvest to sharp-shinned hawks will be unique from site to site depending on the structure of the forest at the time of harvest, the form and intensity of harvest, and the temporal perspective.

Forest-wide sharp-shinned hawk nesting habitat was modeled using white fir, grand fir, Douglas-fir lodgepole pine and ponderosa pine PAG. This included dense canopy with trees at a minimum 5" dbh, structure classes 3-5 with a 20" dbh maximum. The resulting layer was updated by removing stand replacement fire and recent management activities within the last 5 years. The acres of suitable habitat were calculated at the subwatershed level (Table 24).

Table 24: Modeled Sharp-shinned Hawk Habitat in the Project Area by Subwatershed

Watershed	Subwatershed	Acres and Percent of Subwatershed
Lower Little Deschutes	Kawak Butte-Little Deschutes River	5,326 *(48%)*
	Lower Paulina Creek	7,684 *(45%)*
	Sugar Pine Butte-Little Deschutes River	9,323 *(33%)*
	Upper Paulina Creek	4,798 *(38%)*
Long Prairie	Finley Butte-Long Prairie	3,299 *(33%)*
	Green Butte	6,319 *(27%)*
	Paulina Peak South	7,299 *(46%)*
	Surveyors Lava Flow	6,653 *(34%)*
Pine Lake-Devils Garden	China Hat	6,112 *(32%)*

Watershed	Subwatershed	Acres and Percent of Subwatershed
	The Dome	11,913 *(35%)*
Kotzman Basin	Potholes	1,970 *(15%)*
Total Acres		**70,692.14**

Sharp-shinned hawks play an important ecological role due to their predatory nature by preying on both birds and small mammals. Small birds, approximately 12 – 25 g, compromised greater than 95% of sharp-shinned hawk prey items in Oregon (Reynolds and Meslow 1984). The dominant prey items in this study were hummingbirds (*Trochilidae spp*.), flycatchers (*Tyrannidae spp.*), chickadees and titmice (*Paridae spp.*), nuthatches (*Sittidae spp.*), creepers (*Certhiidae spp.*), wrens (*Troglodytidae spp.*), warblers (*Parulinae spp.*), and finches (*Fringillidae spp.*).

There are an estimated 486,138 acres of potential sharp-shinned hawk nesting habitat on the DNF. The project area has 3,068 acres or 0.6% of the modeled sharp-shinned hawk habitat on the DNF. There are 2,208 acres of modeled habitat (72%) in lease parcel areas identified as NSO where no reduction of habitat is expected.

Environmental Consequences

Alterative 1 (No-Action)

Direct and Indirect Effects: There are no anticipated impacts to sharp-shinned hawk from Alternative 1. All currently suitable habitats will remain available to the species in the near future.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA will not have direct effects to the sharp-shinned hawk because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: Potential impacts from the RFDs can be categorized into habitat removal/modification, roads, pipelines, power lines and human presence.

Sharp-shinned hawk reproductive habitat could be modified or converted under this Alternative due to timber harvest needed to create space for all the facilities described in the RFD. Habitats within areas identified as NSO are not expected to be modified or converted resulting from this action. This removes about 70% of the mapped sharp-shinned hawk habitat in the project area from disturbance. Considering the amount of habitat in the project area there is a wide range of potential impacts depending on the eventual development scenario. If a higher level of development as described in the RFD does occur it would still not impact the entire 3,068 acres of modeled habitat based on the described facilities. If development reaches the production phase then habitat would be converted for the long-term since this phase could be 10-50 years as described in the RFD.

Increased traffic on roads can result in disturbance to nesting or foraging sharp-shinned hawks under the traffic estimations in the RFD. Heavy road traffic can create a road effect area which may be avoided by nesting or foraging sharp-shinned hawk.

Many raptors have been documented using power poles as perches and consequently electrocuted on older pole configurations without perch deterrents. Similar to the other accipiters the sharp-shinned hawk typically hunts from concealed perch in a stand and is less likely to use an exposed perch such as a power pole. If these parcels continue to produce to the point power lines are constructed then current

raptor friendly designs should be used. Current designs typically space wires far enough apart that the short-wingspan of a sharp-shinned hawk are unlikely to be electrocuted.

Wildlife stipulations requiring surveys for the presence of sharp-shinned hawk should identify any currently unknown nests if they occur and provide sufficient protections as outlined in the DNF LRMP. Surveys should reduce the potential for sharp-shinned hawk nests to be disturbed but this species can have very small nests that are difficult to detect so there is still some risk for unidentified nests to be disturbed. Nearby areas have been surveyed for accipiters as part of several timber management project without detections, but surveys specific to this project would promote nest protections since they would be current.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development would impact less than 0.6% of suitable habitat across the Forest; the overall direct, indirect and cumulative effects will result in a small negative trend of habitat (increase in disturbance). The loss of habitat will be insignificant at the scale of the Forest. The Geothermal Consent to Lease Project is consistent with the DNF LRMP, and thus continued viability of sharp-shinned hawk is expected. Potential impacts to sharp-shinned hawk are reduced through wildlife stipulations for surveys prior to implementation to identified previously unidentified nests.

Great Blue Heron

Great blue herons will nest in trees, bushes, on the ground and on artificial structures, usually near water. They prefer to nest in vegetation on islands or in swamps, probably to avoid ground predators. Nest locations in Oregon were determined primarily by proximity and availability of food but nest-site fidelity is weak.

Human activity can disturb nesting great blue herons but disturbance does not always lead to adverse impacts at the population level. Several studies have linked abandonment of great blue heron colonies to human activity, including housing and industrial development, highway construction, logging, vehicle traffic, and repeated human intrusions (Kelsall and Simpson 1979, Drapeau et al. 1984, Forbes et al. 1985b, Leonard 1985, Vennesland and Butler 2004).

Mapping of great blue heron habitat on the Deschutes National Forest focused on rookery habitat, including buffering all riparian and wet meadow habitats. Great blue heron nesting habitat was defined as forested areas within ½ mile of all water sources and ¼ mile from disturbance (e.g. recreation sites). All lakes, ponds, wet meadows, streams, and rivers were buffered ½ mile to develop a preliminary habitat layer. Campgrounds, boat ramps, subdivisions, trails and trailheads were buffered by ¼ mile and excluded where they overlap with habitat buffer.

There are 210,194 acres of modeled great-blue heron habitat on the DNF and the project area has 164 acres or 0.07% of the potential great blue heron habitat on the DNF. Great blue heron habitat exists in three of the subwatersheds with proposed parcels (Table 25). Modeled great-blue heron habitat only exists in Parcel 3 which is identified as NSO. A wildlife stipulation requiring surveys for great-blue heron in this parcel to identify and known rookeries and maintain DNF LRMP compliance (DNF LRMP Forest-Wide Standard WL-35)

Table 25: Modeled Great Blue Heron Habitat in the Project Area by Subwatershed

Watershed	Subwatershed	Acres
Lower Little Deschutes	Lower Paulina Creek	2,109
	Sugar Pine Butte-Little Deschutes River	39
	Upper Paulina Creek	926

Total Acres	3,074

Environmental Consequences

Alterative 1 (No-Action)

Direct and Indirect Effects: There are no anticipated impacts to great blue heron. All suitable habitats will continue to be available for great blue heron.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA will not have direct effects to the great blue heron because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: Since this species is dependent on area near permanent water the only potential habitat in the project area is adjacent to Paulina Creek. This is confirmed with habitat modeling which identifies 164 acres in Parcel 3 as great blue heron reproductive habitat. This parcel is identified as NSO so no direct removal of great blue heron habitat is expected. Wildlife stipulation to survey this parcel for the presence of great blue heron is intended to protect any undiscovered nests from any potential disturbance associated with development of this lease. Since great blue heron habitat is limited in the project area and there is no expected removal or modification of habitat no impacts are expected to this species.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development would not impact great blue heron individuals or habitat and therefore there will be no reduction in the viability of the species across the DNF. This project is in compliance with the DNF LRMP direction for great blue heron.

Osprey

Osprey were chosen as a terrestrial MIS in the Forest Plan due to its dependence on fish species and use of snags and trees surrounding large lakes. Key habitat components are large-diameter snags and dead-topped live or dead trees in or near clear, unobstructed fish-bearing large lakes and rivers.

Preferred nest sites are usually snags or dead topped trees near water, presumably to deter mammalian predation (Ewins 1997). Cliffs, rock pinnacles, and even bare ground on predator-free islands are also used. This species readily uses artificial structures including utility poles, pilings, windmills, microwave towers, chimneys, cell towers, buoys, and channel markers as nest sites (Marshall et al. 2003).

Several studies have demonstrated that human disturbance can cause nest site abandonment or reproductive failure (Lind 1976, Swenson 1979, Vana-Miller 1987, Ewins 1997). Ospreys are most sensitive to disturbance during incubation and the first 3-4 weeks after hatching (Van Daele and Van Daele 1982). Other osprey individuals who initiate nests near human activities appear to have a greater tolerance for disturbance (Ewins 1997).

The DNF LRMP established the Osprey Management Area (MA5) allocation of 8,100 acres, 4,400 of which were identified as not suitable for timber production. The goal of MA5 is to enhance the carrying capacity for osprey. Standards and guidelines (S&Gs M5-1 through M5-31) protect nesting and foraging areas by providing numerous suitable nest trees/snags on a continuing basis and spaced to minimize territorial competition and human disturbance during the nesting season. Specifically, M5-9 provided for the protection of all existing nest sites and associated perch trees; management of stands with a

relatively open overstory and fully-stocked understory; and provision of an average rate of 2 trees with dead or dying tops per acre (ponderosa pine favored). Single-aged stands in lodgepole pine forest are acceptable. Outside MA-5, active nest sites are to be protected by maintaining the forest character at least 300 feet in radius around the nest and maintaining an average of at least four dominant overstory trees per acre for nest and perch trees, with ponderosa pine favored (S&G WL-2). Active nest sites are to be protected from disturbing human activities 0.25 miles (0.40 km) (1 mile or 1.61 km for explosives) from the nest from April 1 to August 31 (WL-3 and M5-2).

There are 495,360 total acres of habitat forest-wide, however only 275,697 meet the LRMP direction for habitat nesting structure. Table 26 shows potential osprey nesting habitat by subwatersheds in the project area. The project area has 616 acres or 0.12% of potential osprey habitat on the DNF. The entire predicted osprey habitat is associated with Paulina Creek in Parcel 3 which is identified as NSO for the entire parcel. There is a historic osprey nest in Parcel 4 which has a wildlife stipulation to avoid disturbing activities within ¼ mile of the nest from April 1-August 31. This nest has not been documented as active since 1983 so surveys will be necessary to determine if the nest is still present.

Table 26: Predicted Osprey Habitat by Subwatershed

Watershed	Subwatershed	Acres
Lower Little Deschutes	Kawak Butte-Little Deschutes River	101
	Lower Paulina Creek	10,138
	Sugar Pine Butte-Little Deschutes River	1,429
	Upper Paulina Creek	8,171
Total Acres		**19,839**

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: There are no anticipated impacts from implementation of this alternative. All suitable osprey habitat will remain as currently available to the species.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA will not have direct effects to osprey because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: Osprey habitat in the project area is restricted to areas near water. The highest quality habitat is in Parcel 3 along Paulina Creek. This parcel is NSO so surface activities that would disturb nesting or foraging osprey or modify/remove habitat are not expected to occur in the higher quality habitat of the project area. While not modeled there is evidence of other areas (Parcel 4) in the project area that could support nesting osprey. Development activities that remove large diameter trees that could support an osprey nest would reduce potential habitat for the species. Human presence for prolonged periods during well pad development, pipeline installation, road construction and other activities described in the RFD could displace osprey that occur near these sites. Osprey are not expected to regularly occur in many of the parcels as the highest quality habitat is near East and Paulina Lake which is outside of the project area.

Surveys for osprey are required as a wildlife stipulation and if currently unidentified nests are discovered then appropriate buffers and road construction criteria are specified. This should prevent disturbance to nesting osprey.

Osprey regularly use artificial nesting structures such as power poles. Current design can reduce potential raptor conflicts but the large wingspan of the species makes it vulnerable to electrocution. It is impossible to identify where the potential exists without specific power line locations. Use of current raptor friendly power line construction and the relative scarcity of potential osprey habitat in the project area make the potential for this impact relatively low, but present. When subsequent NEPA is completed for power lines then site specific recommendations will need to be made to further reduce potential electrocutions.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development would impact less than 0.12% of suitable habitat on the DNF; the predicted impacts would result in a small negative trend of habitat. The modeled osprey habitat is not expected to be affected by this action since it is a NSO parcel, but there could be potential reduction in lesser quality habitat. The predicted loss of habitat will be insignificant at the scale of the Forest. The Geothermal Consent to Lease Project is consistent with the DNF LRMP, and thus continued viability of osprey is expected. Potential impacts to osprey are reduced through wildlife stipulations for surveys prior to implementation to identified previously unidentified nests and through timing limitations associated with a historic nest in Parcel 4. This nest has not been documented as active since 1969 so surveys will be necessary to determine if it still exists.

Red-tailed Hawk

The DNF LRMP identified red-tailed hawk as a terrestrial MIS for large trees in mixed structural habitat. Red-tailed hawks generally nest in the largest, tallest tree available that provides unobstructed views within their territory. They inhabit a variety of forested to open land ecosystems and elevations from alpine down to desert ecosystems.

Preferred habitats are open to semi-open coniferous, deciduous and mixed forests, forest edges, grasslands, parklands, rangelands, river bottomlands, and agricultural fields with scattered trees. Forest clearings, alpine meadows, estuaries, marshes, agricultural lands, clear cuts, sagebrush plains, and high elevation environments are also used, though less commonly. Nesting occurs in large mature trees, usually at a forest edge or near an opening in canopy.

Limiting factors in preferred habitat selection are availability of suitable perches and hunting grounds open enough to locate and catch ground prey. Perches can be any structure that provides unobstructed views can be natural or man-made. Perches are used for foraging, roosting, resting, mating, and defending territory.

The DNF estimated red-tailed hawk nesting habitat as all forest types with tree diameters 15 inches and greater in seral stages 5-7, with open canopy cover. Modeling also included dense canopy cover in ponderosa pine and mixed-conifer forest types.

The DNF LRMP does not list a target population level for red-tailed hawks. The LRMP determined the red-tailed hawk to be a non-game species of special interest and was chosen as a MIS for large trees in mixed structural habitat.

LRMP Standards and Guidelines (Forest Plan 4-52) for red-tailed hawks are:

- **WL-2**: Active nest sites will be protected by maintain the forested character of an area at least 300 feet in radius around the nest. While timber management may occur, maintain and average of at least four dominate overstory trees per acre suitable for nest and perch trees—with Ponderosa pine favored, where available.

- **WL-3**: Active nest sites should be protected from disturbing activities within ¼ mile (1 mile for the use of explosions) of the nest by restricting site disturbing operation during the period of March 1-August 31.
- **WL-4**: "Disturbing" activates will vary site specifically. An evaluation of potential disturbance will be made prior to planned activities, should a nest be encountered.
- **WL-5**: If the specified restriction period must be compromised, project activity at the end of the period (e.g. the last month or two) is least likely to cause nest abandonment. A nest site may be considered inactive for the year of nesting activity is not evident by May 15.

There in an estimated 192,492 acres of potential red-tailed hawk nesting habitat on the DNF and using Marshall et al. (2003) documented territory size there would be enough habitat for 478 nesting pairs on the Forest. Table 27 presents modeled red-tailed hawk reproductive habitat for subwatersheds with proposed lease parcels. There are 369 acres of potential red-tailed hawk nesting habitat in the project area or 0.19% of the forest wide habitat for this species. Parcels 1, 2, 4, 5 and 10 have potential reproductive habitat for red-tailed hawk in areas where surface occupancy could potentially occur.

Table 27: Modeled Red-tailed Hawk Habitat for Subwatersheds in the Project Area

Watershed	Subwatershed	Acres and Percent of Subwatershed
Lower Little Deschutes	Kawak Butte-Little Deschutes River	1,053 *(9%)*
	Lower Paulina Creek	1,086 *(6%)*
	Sugar Pine Butte-Little Deschutes River	2,627 *(9%)*
	Upper Paulina Creek	249 *(2%)*
Long Prairie	Finley Butte-Long Prairie	273 *(3%)*
	Green Butte	725 *(3%)*
	Paulina Peak South	513 *(3%)*
	Surveyors Lava Flow	444 *(2%)*
Pine Lake-Devils Garden	China Hat	745 *(4%)*
	The Dome	5,129 *(15%)*
Kotzman Basin	Potholes	409 *(3%)*
Total Acres		**13,252.41**

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: There are no anticipated impacts to red-tailed hawk under this alternative. All suitable habitats will remain available for the species.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA will not have direct effects to red-tailed hawk because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: The RFDs could remove or modify potential red-tailed hawk habitat. Construction activities associated with well pad development, pipeline installation and road location are activities that are likely to remove all trees from an area. The amount of potential habitat that would be disturbed is highly variable depending on the eventual development that occurs under the RFD. Early stage development (exploration) is more likely to occur and would result in less habitat disturbance. If development moves into the development and production phases then more habitat would be disturbed.

Prolonged human presence during the construction and operational phase could disturb nesting or foraging red-tailed hawks if they occur in the area. Roads and pipelines could remove some habitat and fragment existing stands. Increased fragmentation can present new disturbance to previously isolated nests.

Red-tailed hawks have been documented being electrocuted from power lines. Current designs can reduce but not eliminate potential for this species to be impacted from power lines. Without site specific locations of potential power lines the potential for red-tailed hawk electrocution is impossible. When these parcels are developed the subsequent NEPA process will have to evaluate the electrocution risk. Given the small isolated patches of habitat and the lack of recently active nests in the project area the potential for electrocution is expected to be low. Wildlife stipulations that require raptor surveys and specify nest protection measures should further reduce the potential of electrocution.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development would impact less than 0.19% of suitable habitat across the Forest; the combined effects would result in a small negative habitat trend. This predicted habitat loss will be insignificant at the scale of the Forest. The Geothermal Consent to Lease Project is consistent with the DNF LRMP, and thus continued viability of red-tailed hawk is expected. Potential impacts to red-tailed hawk are reduced through wildlife stipulations for surveys prior to implementation to identified previously unidentified nests.

Mule Deer

Mule deer were chosen as a terrestrial MIS identified in the DNF LRMP for its socio-economic importance to the hunting community within central Oregon. The ODFW established herd management objectives based on winter population and annual herd composition conducted by ODFW was used to set these objectives for the DNF LRMP (4-9). The DNF LRMP uses Management Area Seven (MA7) as mule deer winter range and everything else on the forest is considered summer range.

Mule deer populations may be migratory or non-migratory. Non-migratory deer can shift within their home ranges seasonally and share winter range with migratory deer. Migrating deer may move through the summer and winter ranges of other deer, which complicates interpretation of distribution and movement patterns.

Migratory mule deer exhibit high fidelity to summer and winter ranges. Deer tend to follow broad corridors during migration as influenced by topographic features, which become less distinct as the distance from winter range increases. Transition ranges often become important for weight gain during

migration. Winter range, corridors, and transition areas may be important to mule deer survival in severe winters, thus need to be evaluated for potential impact by development and other land use activities. Mule deer may experience resource competition from elk as their populations appear to be increasing in Oregon.

Human populations in central Oregon are increasing rapidly which can increase roads and infrastructure leading to fragmentation and reduced habitat quality for many species. Lower elevation deer and elk winter range areas closest to population centers are being converted into urban areas.

The ODFW began a study focusing on mule deer habitat selection between summer and winter range (East Slope Cascades Mule Deer Project). This work examines habitat selection between summer and winter range relating to various land uses, such as major highways, urban development, open road densities, OHV activity, vegetative treatments, and other human related alterations to the landscape. Results from data gathered from October 2005 to November 2010, showed the three primary factors for deer mortality which are poaching associated with open road densities, cougar predation, and deer mortality associated with traffic on Highways 97 and 31.

Wisdom et al. (2005) found mule deer showed little measurable response to off-road activities. Movement rates slightly increased during all off-road activities except during ATV use. Stankowich (2008) and Krausman et al. (2006) showed similar responses of mule deer. They found humans foot traffic have more impact than other stimuli (vehicles, noise, horseback) studied.

The project area primarily provides mule deer summer range with lesser amounts of transition range on the western side. There is no biological winter range in any of the parcels identified in Alternative 2. No big-game connectivity corridors are present in any of the parcels.

Mule deer hiding cover on the DNF is estimated at 716,598 and there are an estimated 4,493 acres of mule deer hiding cover in the project area. The project area has 0.62% of the modeled mule deer hiding cover on the DNF. All of the subwatersheds with proposed parcels are above 30% hiding cover and range from 33% to 64% hiding cover (Table 14). Most (63%) of subwatersheds with parcels identified in Alternative 2 are above the recommended 2.5 mi/mi^2 road density in the DNF LRMP Standard WL-53 (Table 28).

Table 28: Mule Deer Summer Hiding Cover and Open Road Density for Subwatershed in Project Area

Watershed (10th Level)	Subwatershed (12th Level)	Acres[1]		Open Roads (mi/mi^2)
Lower Little Deschutes	Kawak Butte-Little Deschutes River	5,890	*(53%)*	2.84
	Lower Paulina Creek	9,228	*(54%)*	3.31
	Sugar Pine Butte-Little Deschutes River	9,426	*(33%)*	3.15
	Upper Paulina Creek	8,155	*(64%)*	1.13
Long Prairie	Finley Butte-Long Prairie	6,229	*(62%)*	4.05
	Green Butte	12,064	*(51%)*	4.86
	Paulina Peak South	10,394	*(66%)*	3.74
	Surveyors Lava Flow	12,083	*(62%)*	2.24
Pine Lake-Devils Garden	China Hat	11,731	*(61%)*	2.43
	The Dome	16,262	*(48%)*	2.70
Kotzman Basin	Potholes	6,108	*(46%)*	1.45
Total Acres		**31.9**		

[1] – Parentheses indicate percentage of subwatershed that is sharp-shinned hawk habitat.

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: There are no anticipated impacts to mule deer from implementing this alternative. All suitable habitats will continue to be available for the species.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA will not have direct effects to mule deer because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: If RFDs occur, mule deer could be impacted through direct removal of hiding cover that provides security for the species. Hiding cover in all the subwatersheds is above LRMP standards and is widely distributed throughout the project area. Removal of hiding cover would reduce the ability of summering deer to avoid predators or humans.

The project area does not provide some of important mule deer habitat components, such as winter range and connectivity corridors. The proposed action is not expected to reduce this type of habitat.

Roads have been identified as an impact to mule deer through increased access that promotes legal and illegal harvest of mule deer. As development moves into the production phase and road density increases there is potential for increased illegal harvest of mule deer. Since many of the subwatershed are currently above LRMP guidance for road densities, whatever development that requires roads will have to consider the overall road densities.

Power lines and pipelines could reduce mule deer habitat through removal of hiding cover. The presence of these features is not known to impact mule deer.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development would impact less than 0.62% of suitable habitat across the Forest; the combined effects would result in a small negative habitat trend. This predicted habitat loss would be insignificant at the scale of the Forest. The Geothermal Consent to Lease Project is consistent with the DNF LRMP, and thus continued viability of mule deer is expected.

American marten

Martens are closely associated with forested habitats that have complex physical structure near the ground. Open areas, such as regeneration logging units, recent severely burned areas, and natural openings are avoided, especially during the winter. Forested riparian habitats are used higher than they are available, which indicates their importance as travel corridors.

Martens tend to be wide-ranging within their home range during the snow-free portions of the year, when they use a variety of habitats. They also are more active during summer than winter, but they do not hibernate. Summer rest sites may be in hollow trees, squirrel nests, mistletoe brooms, ground burrows, and stumps. During winter martens are highly associated with late-successional forest habitat within their home range. The DNF LRMP identifies the Old Growth Management Area (M15) as suitable for marten habitat (WL-62). All of the M15 in the project area is identified as NSO.

Much of their time during winter is spent resting or hunting beneath the snow in subnivean spaces created by physical structure close to the ground. This complex structure is more characteristic of older

forest structural stages than younger forests. These conditions are also more characteristic of moist and cold forest types where fire return intervals are greater, allowing time for dead wood to be recruited and accumulate. Large logs may be particularly important as winter resting structures.

Marten use a variety of structures for resting and denning sites. Resting and denning sites offer protection from predation and thermal stress; thus, availability of quality denning sites likely increases the rates of survival and fecundity in marten. Two types of dens are recognized in the literature: natal dens, in which parturition takes place, and maternal dens, which are occupied by the mother and young. A variety of structures are used for dens, with trees, logs, and rocks accounting for 70% of the reported den structures.

Motorized disturbance appeared to have no impact to martens based on a literature review by Claar et al. (1999). Zielinski et al. (2007) conducted a research study on snowmobile and OHV effects on martens and concluded OHVs had no effect. However, Claar et al. (1999) found from their literature review, studies suggesting marten were susceptible to overharvesting from trapping. Roads and motorized trails including snowmobile trails open for winter use could provide trapping access into marten habitats. Other research has indicated that home range sizes tended to be larger as the road density increased (Godbout and Ouellet, 2008).

Denning habitat was modeled using all PAG except juniper and ponderosa pine without the presence of lodgepole pine. Only dense stands were considered denning habitat expect in the lodgepole pine and dry cold white fir PAGs where open and dense were deemed suitable for denning. Those PAGs where lodgepole pine is an early seral species were also considered suitable denning habitat. Minimum average diameter of trees within the stand was defined as equal to or greater than 5 inches for lodgepole pine and equal to or greater than 15 inches for the other PAGs.

Modeling results indicate there are approximately 433,973 acres of potential marten denning habitat on the DNF. The 433,973 acres modeled as denning habitat used only green tree data. However, snags and down wood are important habitat components for marten denning and foraging habitat. Modeling also shows approximately 28,514 acres (7%) of the mapped denning habitat has up to 2.8 snags per acre (0-30% tolerance interval) capable of providing lower quality denning habitat. Only one percent of the mapped denning habitat has greater than 15.2 snags per acre equating to very high quality marten habitat. Marten habitat for subwatersheds with proposed parcels is presented in Table 29. There are an estimated 3,003 acres of marten habitat in the project area or 0.69% of the modeled habitat on the DNF. A substantial portion (48%) of the modeled marten habitat is in area identified as NSO.

Table 29: Modeled American Marten Habitat by Subwatershed in the Project Area

Watershed (10th Level)	Subwatershed (12th Level)	Acres
Lower Little Deschutes	Kawak Butte-Little Deschutes River	4,103
	Lower Paulina Creek	5,070
	Sugar Pine Butte-Little Deschutes River	5,114
	Upper Paulina Creek	6,999
Long Prairie	Finley Butte-Long Prairie	3,436
	Green Butte	9,013
	Paulina Peak South	6,568
	Surveyors Lava Flow	8,223
Pine Lake-Devils Garden	China Hat	9,186
	The Dome	8,455
Kotzman Basin	Potholes	7,789
Total Acres		**73,956**

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: Implementation of Alternative 1 is not expected to impact American marten. All suitable habitats will continue to be available for the species.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA will not have direct effects to American marten because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: There is substantial American marten habitat well distributed throughout the project area but the largest concentration of habitat is in Parcel 6 which is proposed as NSO so there is no anticipated loss of this higher quality habitat. Construction activities described in the RFD would convert marten habitat over the long-term if these parcels enter the production phase. Where marten habitat is converted during the exploration phase it will also be converted for the long-term because it will take many years to get the complex down wood structure. The extent of habitat that would be removed is dependent on the success of each phase. Even with some of the more extensive development scenario the amount of marten habitat expected to be disturbed will be well below the 3,003 acres of modeled marten habitat.

While this species is tolerant of human presence it is reasonable to expect that sustained human presence associated with construction activities would temporarily displace individuals in an area. This is partially because of increased noise levels during construction but there are likely to be reduced prey availability as human presence displaces some prey species.

Road construction can modify or reduce marten habitat through removal of larger diameter trees and complex down wood structure. Additional roads can result in lower snags and down wood near motorized routes through increased access. This can be an issue in areas where fuelwood collection is less regulated than on the DNF. The DNF identifies fuelwood collection areas and there are none known in the project area. Any reduction in complex woody features near recently constructed roads would be from unauthorized collection. Road traffic is not expected to displace marten as this species shows a moderate tolerance to motorized vehicles.

Pipelines and power lines may reduce habitat quality or reduce potential marten habitat through removal of larger tree structure and loss of snags and down logs assumed to be removed as part of construction and for safety.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development would impact less than 0.69% of suitable habitat on the DNF; the combined effects would result in a small negative habitat trend. This predicted habitat loss will be insignificant at the scale of the Forest. The Geothermal Consent to Lease Project is consistent with the DNF LRMP and thus continued viability of American marten is expected.

Woodpeckers

Woodpeckers were selected as a group MIS to represent all wildlife species which use cavities for nesting and denning.

Black-backed woodpecker

The black-backed woodpecker was chosen as a terrestrial MIS on the DNF to represent other species found in the mature and old-growth lodgepole pine forest type. It is assumed that if good habitat is provided for the black-backed woodpecker and their population is maintained at 70 - 1,020 pairs, then adequate habitat is also being provided for other species that share similar habitat requirements (USFS 1990). Threats include timber harvest, fire suppression, salvage of fire and bug-killed trees, and conversion of mature and old-growth forests to young stands with little decay.

Black-backed woodpeckers nest in both live and dead trees with little decay or recently dead trees (<5 years) (Bull et al. 1986, Goggans et al. 1989, and Nielson-Pincus et al. 2007, Bonnot et al. 2009). Mean tree height used for nesting by the black-backed woodpecker ranges from 33-70 feet (Bull et al. 1986, Goggans et al. 1989, and Nielson-Pincus et al. 2007) and cavities are located low to the ground (12 feet) (Goggans et al. 1989, Nielson-Pincus et al. 2007). This species also nests in smaller snags than most woodpeckers. Bull et al. (1986) found black-backs to select for trees less than 50 cm (19.6 inch DBH) while Goggans et al. (1989) found the mean nest tree diameter to be 11 inch DBH.

Black-backed woodpeckers forage in all forest types with lodgepole pine. Recently dead trees (<2 years) or live trees were used for foraging, preferring lodgepole pine. This species forages almost exclusively on larvae of bark beetles and wood borers. Prey is obtained from tree trunks primarily by scaling or flaking bark and excavating logs and the bases of large diameter trees. Black-backed woodpecker use declines 2-3 years after mortality when trees dry out and bark beetles decline.

This woodpecker has a strong association with prey abundance. The importance of increased food resources accounts for the ephemeral use of areas moving in a short time after disturbance with occupation for 3-5 years while bark beetles and wood borers are abundant. Abundance of wood borers was four times greater at occupied territories than available territories this species occupied territories with higher densities of mountain pine beetle infected trees than available territories.

Black-backed woodpecker nesting habitat was mapped using lodgepole pine dominated forests which include all lodgepole pine PAG in all seral stages in addition to other PAG in the early and mid seral stages where lodgepole pine is dominant. Recent fires (less than 5 years old) with stand replacement or mixed severity were also classified as habitat. There are no recent fires that would be stand replacement or mixed severity in parcels identified in Alternative 2.

Based on the habitat estimation there are 446,003 acres of potential black-backed woodpecker nesting habitat on the DNF. Table 30 presents the modeled black-backed woodpecker habitat by subwatershed in the project area. The project area has 4,456 acres of black-backed woodpecker habitat or 0.99% of the forest wide habitat. There is a minimum of 1,941 acres in areas identified as NSO so the amount of habitat with potential for disturbance is much lower. There is one documented black-backed woodpecker observation in Parcel 1 from 1997.

Table 30: Modeled Black-backed Woodpecker Habitat for Subwatershed in the Project Area

Watershed (10th Level)	Subwatershed (12th Level)	Acres
Lower Little Deschutes	Kawak Butte-Little Deschutes River	1,863
	Lower Paulina Creek	559
	Sugar Pine Butte-Little Deschutes River	8,103
	Upper Paulina Creek	67
Long Prairie	Finley Butte-Long Prairie	433
	Green Butte	1,086
	Paulina Peak South	1,261
	Surveyors Lava Flow	562

Pine Lake-Devils Garden	China Hat	497
	The Dome	4,501
Kotzman Basin	Potholes	8,702
Total Acres		**27,634**

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: There are no anticipated impacts to black-backed woodpecker from this alternative. Suitable habitats that are currently available for the species will remain. There are no large recent fires in any of the proposed parcels that are providing valuable habitat. Fire suppression tactics are expected to continue similar to current with most fires remaining small to medium sized.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA will not have direct effects to black-backed woodpeckers because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: If RFDs occur, the primary impact to black-backed woodpeckers would be from removal of snags and down wood that can support nesting or foraging opportunities for the species. This could occur where construction activities for well pads, pipelines, power lines and all features described in the RFD happens. The extent of snags that could be removed is completely dependent on the final facility site selection. Ongoing operation of these facilities would likely remove some snags that occur at the margin of developed sites and present a safety hazard. The actual extent of the potential impact is uncertain due to the uncertainty with this type of development. Even with the higher end development scenario black-backed woodpecker habitat will remain throughout the project area.

Increased roads are often cited as a source for snag reductions associated with increased access. The DNF regulates fuelwood collection and has certain areas open at a time. There are no fuelwood collection areas known in the project area. Any reduction of snags or down wood would be from unauthorized collection.

All portions of Old Growth Management Areas (M15) in the proposed parcels are identified as NSO so there is no expected reduction of this habitat for black-backed woodpecker.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development would impact less than 0.99% of suitable habitat on the DNF; the combined effects would result in a small negative habitat trend. This predicted habitat loss will be insignificant at the scale of the Forest. The Geothermal Consent to Lease Project is consistent with the DNF LRMP and thus continued viability of black-backed woodpecker is expected.

Hairy woodpecker

Hairy woodpeckers are found in mixed conifer and ponderosa pine forests and use deciduous stands during the breeding season. They have been observed nesting in relatively open stands with low basal area, low stem densities, and open canopies (39% canopy cover). Ponderosa pine is a preferred nest tree but they are known to nest in other species (lodgepole pine, western larch, Douglas-fir, and aspen) except grand fir. Most nests are in dead trees less than 5 years and preferred snags are 10-20 inch DBH.

Hairy woodpeckers use both live and dead trees for foraging which is primarily scaling (75%) but also excavated, pecked, and gleaned. They are abundant in recently post-fire burned areas. This species also had greater relative abundance in high severity areas than in moderate severity areas. The increase in hairy woodpecker relative abundance following fire may be due to an increase in bark and wood borer larvae. Abundance decreases with increasing burn age tapering off by years 4-7 as prey availability decreases.

Hairy woodpecker nesting habitat was mapped using mixed conifer, ponderosa pine, and lodgepole pine PAG in early, mid and late seral stages. In addition, stand size had to range from 11-20" dbh in mixed conifer and ponderosa pine and range from 5-20" dbh in lodgepole pine and have open stand characteristics to be mapped as potential habitat. Recent stand replacement fires less than 5 years old were added as habitat. Recent forest management activities that resulted in conditions other than described above were removed from mapped potential habitat.

There are an estimated 507,920 total acres of modeled hairy woodpecker nesting habitat across the DNF. From a watershed/subwatershed analysis stand point encompassing the Geothermal Consent to Lease planning area, Table 31 shows there are approximately 79,431 or 16% of the Forest-wide total acres of hairy woodpecker habitat. Specifically within the project area, there are 887 acres (0.17%) of the Forest-wide total acres of hairy woodpecker habitat. Of these 887 acres in the project area, 108 acres are in Parcel 3, which is NSO. There is one documented hairy woodpecker observation in Parcel 1 and it is from 1997.

Table 31: Modeled Hairy Woodpecker Habitat for Subwatersheds in the Project Area

Watershed	Subwatershed	Acres
Lower Little Deschutes	Kawak Butte-Little Deschutes River	5,946
	Lower Paulina Creek	7,942
	Sugar Pine Butte-Little Deschutes River	14,183
	Upper Paulina Creek	389
Long Prairie	Finley Butte-Long Prairie	2,886
	Green Butte	11,076
	Paulina Peak South	5,802
	Surveyors Lava Flow	4,717
Pine Lake-Devils Garden	China Hat	5,656
	The Dome	15,410
Kotzman Basin	Potholes	5,424
Total Acres		**79,431**

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: There are no anticipated impacts to hairy woodpecker from this alternative. Suitable habitats that are currently available for the species will remain. There are no large recent fires in any of the proposed parcels that are providing valuable habitat. Fire suppression tactics are expected to continue similar to current with most fires remaining small to medium sized.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA will not have direct effects to hairy woodpecker because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: If RFDs occur, the primary impacts to hairy woodpeckers would be from removal of snags and down wood that can support nesting or foraging opportunities for the species. This could occur where construction activities for well pads, pipelines, power lines and all features described in the RFD happens. The extent of snags that could be removed is completely dependent on the final facility site selection. Ongoing operation of these facilities would likely remove some snags that occur at the margin of developed sites and present a safety hazard. The actual extent of the potential impact is uncertain due to the uncertainty with this type of development.

Increased roads are often cited as a source for snag reductions associated with increased access. The DNF regulates fuelwood collection and has certain areas open at a time. There are no fuelwood collection areas known in the project area. Any reduction of snags or down wood would be from unauthorized collection.

Parcel 3 has 108 acres of modeled hairy woodpecker habitat. The entire parcel is NSO so no reduction of habitat is expected from leasing this parcel. Removal of this habitat from the calculation would reduce the project area hairy woodpecker habitat from 887 to 770 acres.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development would impact less than 0.17% of suitable habitat on the DNF; the combined effects would result in a small negative habitat trend. When the modeled habitat in Parcel 3 is removed from the calculation then this alterative would impact 0.15% of the suitable habitat on the DNF. This predicted habitat loss will be insignificant at the scale of the Forest. The Geothermal Consent to Lease Project is consistent with the DNF LRMP and thus continued viability of hairy woodpecker is expected.

Lewis' woodpecker

Biology and natural history of the Lewis' woodpecker was discussed previously and will not be repeated here.

There are 85,015 acres of modeled Lewis' woodpecker nesting habitat on the DNF. Table 32 shows modeled Lewis' woodpecker nesting habitat by subwatershed in the project area. The project area has 24 acres or 0.02% of the modeled Lewis' woodpecker habitat on the DNF. When areas not available for development (NSO, etc.) are removed there are 15.1 acres of Lewis' woodpecker habitat in the project area. There are no documented Lewis' woodpecker nests or observations of individuals in the project area.

Table 32: Lewis' Woodpecker Nesting Habitat by Subwatershed on the DNF

Watershed (10th Level)	Subwatershed (12th Level)	Acres
Lower Little Deschutes	Kawak Butte-Little Deschutes River	54
	Lower Paulina Creek	91
	Sugar Pine Butte-Little Deschutes River	289
Long Prairie	Finley Butte-Long Prairie	24
	Green Butte	53
	Paulina Peak South	37
	Surveyors Lava Flow	18
Pine Lake-Devils Garden	China Hat	114
	The Dome	2,778
Kotzman Basin	Potholes	43

Watershed (10th Level)	Subwatershed (12th Level)	Acres
Total Acres		3,501

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: There are no anticipated impacts to Lewis' woodpecker from this alternative. Suitable habitats that are currently available for the species will remain. There are no large recent fires in any of the proposed parcels that are providing valuable habitat. Fire suppression tactics are expected to continue similar to current with most fires remaining small to medium sized.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA will not have direct effects to Lewis' woodpeckers because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: If RFDs occur, the primary impacts to Lewis' woodpeckers would be from removal of snags and down wood that can support nesting or foraging opportunities for the species. This could occur where construction activities for well pads, pipelines, power lines and all features described in the RFD happen. The extent of snags that could be removed is completely dependent on the final facility site selection. While this type of disturbance is possible there is a high likelihood that potential habitat would be avoid considering the small amount in the project area and the fact that it occurs in disjunctive patches. Ongoing operation of these facilities would likely remove some snags that occur at the margin of developed sites and present a safety hazard. The actual extent of the potential impact is uncertain due to the uncertainty with this type of development.

This species can be tolerant of human activity that does not directly disturb the nest cavity, but the persistent presence of humans and equipment predicted to occur during all phases of RFD would likely displace individual Lewis' woodpecker.

Increased roads are often cited as a source for snag reductions associated with increased access. The DNF regulates fuelwood collection and has certain areas open at a time. There are no fuelwood collection areas known in the project area. Any reduction of snags or down wood would be from unauthorized collection.

There are 10.1 acres with no potential for surface occupancy which would reduce the amount of Lewis' woodpecker habitat that could potentially be disturbed to 15 acres.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development would impact less than 0.02% of suitable habitat on the DNF; the combined effects would result in a small negative habitat trend. This predicted habitat loss will be insignificant at the scale of the Forest. The Geothermal Consent to Lease Project is consistent with the DNF LRMP and thus continued viability of hairy woodpecker is expected.

Northern Flicker

The northern flicker nests in large diameter snags and live trees with moderate to heavy decay. The flicker frequently nests in ponderosa pine forest types, but will also nest in older juniper stands. Most studies have found flickers prefer to nest in open habitats characterized by low basal area, low canopy cover, large snags, and high herbaceous cover. Ponderosa pine stands provide nest sites adjacent to

grasslands where flickers forage.

The northern flicker forages almost exclusively on the ground during the summer specializing on ants and beetle larvae. Foraging locations are characterized by short vegetation and bare ground with tall vegetation being uncommon. Foraging methods shift to excavating dead and down woody material in the fall. Flickers also excavated, pecked, gleaned, and harvested seeds in live and dead trees, down woody material, and stumps.

Northern flicker nesting habitat was mapped using PAG from juniper, lodgepole pine, ponderosa pine, grand/white fir, and Douglas-fir in all seral stages. In addition, stand size had to be a minimum diameter of 10 inch DBH or greater in lodgepole pine and 15 inch DBH in all other PAGs and have open stand characteristics to be mapped as potential habitat.

There are approximately 219,576 acres of potential northern flicker nesting habitat on the Forest. Table 33 shows northern flicker nesting habitat by watershed and subwatershed in the project area. Within the parcels identified for potential leasing there are 786 acres or 0.35% of the modeled northern flicker nesting habitat on the DNF. Potential habitat occurs in all parcels except 7 and 8. There are no documented northern flicker nests or individuals within 0.5 miles of the project area, but this species tends to be quite common on the DNF so documentation may not have occurred.

Table 33: Acres of Northern Flicker Nesting Habitat by Subwatershed on the DNF

Watershed (10th Level)	Subwatershed (12th Level)	Acres
Lower Little Deschutes	Kawak Butte-Little Deschutes River	2,579
	Lower Paulina Creek	2,804
	Sugar Pine Butte-Little Deschutes River	8,543
	Upper Paulina Creek	229
Long Prairie	Finley Butte-Long Prairie	1,174
	Green Butte	3,401
	Paulina Peak South	1,757
	Surveyors Lava Flow	1,137
Pine Lake-Devils Garden	China Hat	2,469
	The Dome	7,409
Kotzman Basin	Potholes	2,759
Total Acres		**34,261**

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: There are no anticipated impacts to northern flicker from this alternative. Suitable habitats that are currently available for the species will remain.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA will not have direct effects to northern flicker because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: If RFDs occur, the primary impacts to northern flickers would be from removal of snags and down wood that can support nesting or foraging opportunities for the species. This could occur where construction activities for well pads, pipelines, power lines and all features described in the RFD are ultimately located. Ongoing operation of these facilities would likely remove

some snags that occur at the margin of developed sites and present a safety hazard. The actual extent of the potential impact is uncertain due to the uncertainty with this type of development.

Flickers can be tolerant of human activity that does not directly disturb the nest cavity, but the persistent presence of humans and equipment predicted to occur during all phases of RFD would likely displace individuals in the area.

Increased roads are often cited as a source for snag reductions associated with increased access. The DNF regulates fuelwood collection and has certain areas open at a time. There are no fuelwood collection areas known in the project area. Any reduction of snags or down wood would be from unauthorized collection.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development would impact less than 0.35% of suitable habitat on the DNF; the combined effects would result in a small negative habitat trend. This predicted habitat loss will be insignificant at the scale of the Forest. The Geothermal Consent to Lease Project is consistent with the DNF LRMP and thus continued viability of northern flicker is expected.

Pileated woodpecker

The pileated woodpecker was selected as part of the woodpecker group which was chosen as a terrestrial MIS to represent all wildlife species which use cavities for nesting or denning. It is considered a keystone habitat modifier in the Pacific Northwest (Aubry and Raley 2002). A keystone habitat modifier is a species whose activities substantially alter the physical structure of the environment influencing both available habitat for other species and various ecosystem processes (Aubry and Raley 2002). This species provides nesting and roosting habitat for secondary cavity users through the excavation of nest cavities and cavity starts, excavation of openings into roost cavities, and foraging excavations (Aubry and Raley 2002). Over 20 species of secondary cavity users in the Pacific Northwest have been documented nesting and roosting in old cavities or openings excavated by pileated woodpeckers (Aubry and Raley 2002).

Nest stands were found to have significantly more large diameter ($\geq$21” dbh) live trees and snags (Bull 1987, Madsen 1985). These nest stands were more frequently found in older forests although this species will use a variety of stand sizes if large snags and downed wood are available. Lundquist (1988) found 2 known nests, both located in old-growth while Bull (1987) found 44% of nests in mature stands, 21% in old-growth, and 24% in young stands with few large trees.

Pileated woodpecker nests have been reported as occurring in large diameter snags with little bark and limbs with broken tops that have been dead at least 10 years. Bull (1980 and 1987) and Bull et al. (1986) report this species selected for the largest dead trees available, generally $\geq$ 21 inch DBH. Ponderosa pine and western larch were favored nest tree species in northeastern Oregon while they avoided grand fir, Douglas fir, and lodgepole pine (Bull 1980, Madsen 1985, Bull et al. 1986, Bull 1987, and Nielsen-Pincus 2005). Lodgepole pines are avoided because they are too small to accommodate a pileated nest cavity. Pileated woodpecker cavities average 8 inches wide by 22 inches deep, therefore needing a large diameter tree to accommodate this large nest (Bull 1987). Grand fir and Douglas-fir are avoided because they retain their bark and limbs. Numerous limbs may hinder movement up or down the trunk and may enhance access by predators (Bull 1987). Grand fir commonly suffers heart rot resulting in hollow trees that may not be sound enough to accommodate a large nest. However, these may be fine to roost in (Nielsen-Pincus and Garton 2007). Ponderosa pine tends to decay primarily in the thick sapwood layer which is more suitable for pileated woodpeckers to nest in (Nielsen-Pincus and Garton 2007).

This species forages on logs, live trees, and snags (Bull 1980, Madsen 1985, Bull et al. 1986, Bull 1987, Raley and Aubry 2005). Feeding sites in dead down material were in logs with decay and the diameter, length, and tree species at these feeding sites differed from available down material (Bull 1980). Approximately 78% of logs fed on retained less than 25% bark, branches, and needles (Bull 1980). Smaller material lacks permanence, decays faster, and forces ants to move more frequently (Bull 1980). Raley and Aubry (2005) found similar results in a central Oregon study. They found pileated woodpeckers foraged extensively on downed structures with the average diameter and length with recent excavations ranged from 7.8-8.6 inch DBH and 16-29.5 feet long respectively. They also reported pileated woodpeckers selected for larger and longer logs and logs greater in diameter and length provide better habitat for wood-dwelling arthropods over a longer period than smaller logs (Raley and Aubry 2005). Raley and Aubry (2005) found beetle larvae and termites might be seasonally important in some regions. They also surmised the importance of downed wood as suitable substrate for ants varies by region, forest type, down woody material size, and season.

Habitat modeling estimates 178,480 acres of potential pileated woodpecker nesting habitat on the DNF. Table 34 shows the estimated pileated woodpecker habitat by subwatersheds included in the project area. The project area has 39 acres or 0.02% of the modeled pileated woodpecker habitat on the DNF. Modeled pileated woodpecker habitat occurs in Parcels 1, 3, and 4. There are no documented pileated woodpecker nests or individuals within 0.5 miles of the project area.

Table 34: Modeled Pileated Woodpecker Nesting Habitat by Subwatershed

Watershed (10th Level)	Subwatershed (12th Level)	Acres
Lower Little Deschutes	Kawak Butte-Little Deschutes River	137
	Lower Paulina Creek	42
	Sugar Pine Butte-Little Deschutes River	1,301
	Upper Paulina Creek	1,088
Long Prairie	Finley Butte-Long Prairie	37
	Green Butte	0
	Paulina Peak South	13
	Surveyors Lava Flow	28
Pine Lake-Devils Garden	China Hat	0
	The Dome	15
Kotzman Basin	Potholes	28
Total Acres		**2,689**

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: There are no anticipated impacts to pileated woodpecker from this alternative. Suitable habitats that are currently available for the species will remain.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA will not have direct effects to pileated woodpecker because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: If RFDs occur, the primary impacts to pileated woodpecker would be from removal of snags and down wood that can support nesting or foraging opportunities for the species. This would occur where construction activities for well pads, pipelines, power lines and all features

described in the RFD ultimately occur. This type of disturbance is possible but there is a high likelihood that potential habitat would be avoided considering the small amount in the project area and the fact that it occurs in disjunct patches. Ongoing operation of these facilities would likely remove some snags that occur at the margin of developed sites and present a safety hazard. The actual extent of the potential impact is uncertain due to the uncertainty with this type of development.

Persistent human presence and equipment operation is likely to displace individual pileated woodpeckers. Roads and power lines are not identified as potential threats to pileated woodpecker.

Increased roads are often cited as a source for snag reductions associated with increased access. The DNF regulates fuelwood collection and has certain areas open at a time. There are no fuelwood collection areas known in the project area. Any reduction of snags or down wood would be from unauthorized collection.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development would impact less than 0.02% of suitable habitat on the DNF; the combined effects would result in a small negative habitat trend. This predicted habitat loss will be insignificant at the scale of the Forest. The Geothermal Consent to Lease Project is consistent with the DNF LRMP and thus continued viability of pileated woodpecker is expected.

Three-toed woodpecker

The three-toed woodpecker has been identified as a bark beetle specialist found in high elevation forests near the Cascade crest. The species is highly associated with post-fire environments but is also found in unburned forests. Three-toed woodpeckers occupy areas between 4,500-5,600 feet elevation while the black-backed woodpecker tend to occupy lower elevations.

Source habitats were defined as late-seral subalpine and montane forests including old forests of lodgepole pine, grand-fir/white-fir, Engelmann spruce/subalpine fir, whitebark pine, and mountain hemlock. Three-toed woodpeckers prefer mature, unlogged conifer forests as well as conifer forests that have undergone some form of disturbance. This species uses higher elevation habitats of mature lodgepole pine stands or stands with a lodgepole component, although forest type may not be as important as the presence of bark beetles.

Three-toed woodpeckers forage in mixed conifer, mixed conifer dominated by lodgepole pine, grand fir forest types containing lodgepole pine, and lodgepole pine forest types. Three-toed woodpeckers primarily forage on dead trees (88-95% of the time) that are recently dead (<3 years). Three-toed woodpecker populations increase 3-5 years post-fire; common in burned areas 1-2 years after the fire but declining in years 3-4. This species generally establishes territories in moderately burned areas containing patches of live and dead trees and were less common in unburned forests in large, severely burned areas lacking live trees.

Three-toed woodpecker nesting habitat was mapped using lodgepole pine dominated forests which include all lodgepole pine PAGs in all seral stages in addition to other PAGs (i.e. mixed conifer and mtn. hemlock) in the early and mid seral stages where lodgepole pine is dominant. Stand size ranged from 5-15” dbh. Recent fires with stand replacement or mixed severity were also classified as habitat.

Table 35: Modeled Three-toed Woodpecker Habitat by Subwatershed for the Project Area

Watershed (10th Level)	Subwatershed (12th Level)	Acres
Lower Little Deschutes	Kawak Butte-Little Deschutes River	4,353
	Lower Paulina Creek	8,310
	Sugar Pine Butte-Little Deschutes River	6,266

	Upper Paulina Creek	5,573
Long Prairie	Finley Butte-Long Prairie	5,586
	Green Butte	9,475
	Paulina Peak South	6,308
	Surveyors Lava Flow	8,249
Pine Lake-Devils Garden	China Hat	9,627
	The Dome	8,315
Kotzman Basin	Potholes	8,702
Total Acres		**80,764**

Using these parameters there are approximately 367,499 acres of potential nesting habitat on the DNF. Table 35 shows the predicted three-toed woodpecker habitat by subwatershed. The project area has 4,348 acres of modeled three-toed woodpecker habitat or 1.19% of the modeled three-toed woodpecker habitat on the DNF. At least 43% of the modeled three-toed woodpecker habitat occurs in parcels identified as NSO so no reduction of habitat is expected in these. There are no documented three-toed woodpecker observations within 0.5 miles of the project area boundary.

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: There are no anticipated impacts to three-toed woodpecker from implementation of this alternative. All suitable habitats that are currently available will remain for the species.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA will not have direct effects to three-toed woodpecker because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: Impacts to three-toed woodpeckers under this alternative would be very similar to those described for black-backed woodpecker. The primary impact to three-toed woodpeckers would be from removal of snags and down wood that can support nesting or foraging opportunities for the species. This could occur where construction activities for well pads, pipelines, power lines and all features described in the RFD happens. Ongoing operation of these facilities would likely remove snags that occur at the margin of developed sites and present a safety hazard. The actual extent of the potential impact is uncertain due to the uncertainty with this type of development. Even with the higher end development scenario three-toed woodpecker habitat will remain throughout the project area.

Parcels 3 and 6 are identified as NSO so no removal or modification of potential three-toed woodpecker habitat is expected. When these acres are removed the project area has potential to impact 0.67% of the modeled three-toed woodpecker habitat on the DNF.

Increased roads are often cited as a source for snag reductions associated with increased access. The DNF regulates fuelwood collection and has certain areas open at a time. There are no fuelwood collection areas known in the project area. Any reduction of snags or down wood would be from unauthorized collection.

All portions of Old Growth Management Areas (M15) in the proposed parcels are identified as NSO so there is no expected reduction of this habitat for three-toed woodpecker.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development has potential to affect 1.19% of suitable habitat on the DNF; the combined effects would result in a small negative habitat trend. This is reduced to 0.67% when Parcels 3 and 6 are removed because they are NSO. This predicted habitat loss will be insignificant at the scale of the Forest. The Geothermal Consent to Lease Project is consistent with the DNF LRMP and thus continued viability of three-toed woodpecker is expected.

White-headed woodpecker

White-headed woodpecker biology and natural history was discussed previously (page 129) and will not be repeated here. The environmental consequences for lease only and RFDs are also the same and will not be discussed further.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development would affect 0.3% of suitable habitat on the DNF; the combined effects would result in a small negative habitat trend. This is reduced to 0.25% when Parcel 3 is removed because it is NSO. This predicted habitat loss will be insignificant at the scale of the Forest. The Geothermal Consent to Lease Project is consistent with the DNF LRMP and thus continued viability of white-headed woodpecker is expected.

Williamson's sapsucker

The Williamson's sapsucker is included with the woodpecker group which was chosen as an MIS for the DNF. This group was chosen to represent all wildlife species which use cavities for nesting and denning. The woodpeckers, as well as many of the secondary cavity nesters, consume forest insects thereby contributing a valuable suppression influence on destructive forest pests.

Williamson's sapsuckers occur in older forest interior ponderosa pine, aspen, cottonwood-willow. Forest stands that are single and multi-strata grand/white fir and interior Douglas-fir also provide habitat. In central Oregon, sapsucker densities were much greater in lightly harvested areas compared to intensively harvested stands; while nests were located in managed stands, they were generally found in denser patches of forest containing high snag densities.

Williamson's sapsuckers will use a variety of tree species including western larch, ponderosa pine, Douglas-fir, grand fir, and aspen for nesting (Madsen 1985, Bull et al. 1986, Nielsen-Pincus 2005, Hutto and Gallo 2006, Nielsen-Pincus and Garton 2007, and Gyug et al. 2009). Many studies have shown they use both live and dead trees about equally (Madsen 1985, Bull et al. 1986, Hutto and Gallo 2006, and Gyug et al. 2009). Live trees used by the Williamson's sapsucker for nesting usually contain advanced heartwood decay as they are weak excavators (Madsen 1985, Bull et al. 1986, Nielsen-Pincus and Garton 2007, and Gyug et al. 2009). One deciding factor to use live trees may be due to the sapwood thickness and decay condition of different tree species (Bull 1980). Cavity excavators drill through the sapwood and excavate cavities in the decayed heartrot, therefore tree species with a thin sapwood layer and decayed heartwood are used more frequently (Bull 1980). Western larch was found to be the preferred nest tree species in some areas and this species has a thin sapwood layer and is more resistant to decay than other conifers (Bull 1980, Gyug et al. 2009). When heartrot does impact the tree (making it suitable for nests), the solid sapwood may keep the tree standing much longer than other conifers (Gyug et al. 2009). Western larch may persist in a suitable state for cavity nesting longer than pines, Douglas-fir, or true firs which tend to become suitable after tree death and aren't available for nesting for long periods (Gyug et al. 2009). Where western larch isn't available, Williamson's sapsuckers prefer old, large trees. These trees may have more opportunity for fungi invasion and heartwood decay (Neilsen-Pincus and Garton 2007). This may suggest that the decay condition is more important than the tree species

(Neilsen-Pincus and Garton 2007). Williamson's sapsuckers demonstrated more ability to adapt to changes than other species in northeastern Oregon in a study that compared habitat use over two time periods (1970's and 2003/2004) (Nielsen-Pincus and Garton 2007). The preferred nest tree in the 1970's was ponderosa pine. However, in 2003/2004, Douglas-fir and grand fir were used more frequently. Nest trees were similar in height, diameter, and retained bark in both time periods. The shift in preferred tree species was due to high mortality levels and an increase in the number of dead trees resulting from spruce beetle and tussock moth outbreaks (Nielsen-Pincus and Garton 2007) demonstrating the adaptability of this species.

Although this species is highly adaptable and able to withstand considerable disturbance (Marshall et al. 2003), it is likely that the decay condition (i.e. heartwood decay), structural characteristics (such as tree diameter and height), and abundance of suitable nest trees are limiting factors influencing distribution and abundance in some areas of their range (Cooper and Manning 2004). Primary threats include forest management practices or activities that remove large snags and the impacts of fire suppression (Dobbs et al. 1997, Wisdom et al. 2000, Marshall et al. 2003, and Cooper and Manning 2004).

There is an estimated 243,364 total acres Williamson's sapsucker habitat on the DNF and Table 36 shows the estimated nesting acres for Williamson's sapsucker for subwatersheds in the project area. In general these watersheds do not provide large contiguous blocks of Williamson's sapsucker habitat. The project area has an estimated 487 acres or 0.20% of the modeled Williamson's sapsucker habitat on the DNF. There is one Williamson's sapsucker observation 0.3 miles west of Parcel 4 and the individual was observed in 1993.

Table 36: Williamson's Sapsucker Nesting Acres by Subwatershed

Watershed (10th Level)	Subwatershed (12th Level)	Acres
Lower Little Deschutes	Kawak Butte-Little Deschutes River	1,863
	Lower Paulina Creek	559
	Sugar Pine Butte-Little Deschutes River	8,103
	Upper Paulina Creek	67
Long Prairie	Finley Butte-Long Prairie	433
	Green Butte	1,086
	Paulina Peak South	1,261
	Surveyors Lava Flow	562
Pine Lake-Devils Garden	China Hat	497
	The Dome	4,501
Kotzman Basin	Potholes	794
Total Acres		**19,726**

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: There are no anticipated impacts to Williamson's sapsucker from implementation of this alternative. All suitable habitats that are currently available will remain for the species. Fire suppression tactics are expected to remain the same as current direction. Fires are expected to remain small or medium sized with few large fires.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA will not have direct effects to Williamson's sapsucker because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: If RFDs occur, the primary impacts to Williamson's sapsucker would be from removal of snags and down wood that can support nesting or foraging opportunities for the species. This would be focused in Parcels 1 and 10. Parcel 10 habitat is associated with the Topso Butte fire. This fire is over 15 years old and the habitat value for this species is beginning to decline. Snag removal could occur where construction activities for well pads, pipelines, power lines and all features described in the RFD happens. The extent of snags that could be removed is completely dependent on the final facility site selection. Ongoing operation of these facilities would likely remove some snags that occur at the margin of developed sites and present a safety hazard. The actual extent of the potential impact is uncertain due to the uncertainty with this type of development.

Increased roads are often cited as a source for snag reductions associated with increased access. The DNF regulates fuelwood collection and has certain areas open at a time. There are no fuelwood collection areas known in the project area. Any reduction of snags or down wood would be from unauthorized collection.

There are 58 acres of modeled Williamson's sapsucker habitat in Parcel 3 which is NSO. It is assumed that there will be no reduction of habitat for this species in that parcel. When those acres are removed from the calculation the project area has a potential to affect 0.17% of the modeled Williamson's sapsucker habitat on the DNF.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development has potential to affect 0.20% of suitable habitat on the DNF; the combined effects would result in a small negative habitat trend. This is reduced to 0.17% when Parcel 3 is removed because it is NSO. This predicted habitat loss will be insignificant at the scale of the Forest. The Geothermal Consent to Lease Project is consistent with the DNF LRMP and thus continued viability of Williamson's sapsucker is expected.

Waterfowl

Waterfowl are included as a group MIS. For this analysis waterfowl will be lumped together due to the limited water availability in the project area. The common characteristic for this group is the presence of perennial water such as lakes, rivers, streams and wetlands.

Environmental Consequences

Alternative 1 (No Action) and Alternative 2 (Proposed Action)

Direct and Indirect Effects: Implementation of either alternative would not modify waterfowl habitat. The only waterfowl habitat is 74 acres adjacent to Paulina Creek in Parcel 3. This parcel is identified as NSO so potential development is not expected to modify existing vegetation or hydrologic regimes that currently make the area suitable waterfowl habitat.

Effects Determination and Rationale

Since there are no effects to waterfowl under either alternative this project will not contribute to a negative trend in waterfowl viability on the DNF. This project is in compliance with DNF LRMP guidance for waterfowl (WL-39) which focuses on waterfowl production and artificial nesting structures.

Migratory Birds

Executive Order 13186 directs federal agencies to avoid or minimize the negative impact of their actions on migratory birds, and to take active steps to protect birds and their habitat (Federal Register 2001).

The USDA Forest Service and the U.S. Fish and Wildlife Service have a Memorandum of Understanding (FS Agreement #08-MU-1113-2400-264) with the purpose, "to strengthen migratory bird conservation by identifying and implementing strategies that promote conservation and avoid or minimize adverse impacts on migratory birds through enhanced collaboration between the Parties, in coordination with the State, Tribal and local governments."

Per this agreement the USDA Forest Service has agreed to evaluate the effects of agency actions on migratory birds, focusing first on species of management concern along with their priority habitats and key risk factors. This document addresses potential impacts to Birds of Conservation Concern in BCR 9-Great Basin and focal species as identified by Landbirds of the East-slope of the Cascades (Altman 2000).

Birds of Conservation Concern

The Birds of Conservation Concern 2008 (USFWS 2008) identifies species, subspecies, and populations of all migratory non-game birds that, without additional conservation actions, are likely to become candidates for listing under the ESA. The goal is to conserve avian diversity in North America and includes preventing or removing the need for additional ESA bird listings by implementing proactive management and conservations actions (USFWS 2008). Conservation concerns stem from population declines, naturally or human-caused small ranges or population sizes, threats to habitat, or other factors. This project is in Bird Conservation Region 9 – Great Basin (Table 37).

Table 37: Birds of Conservation Concern for BCR 9 – Great Basin

Species	Preferred Habitat
Yellow-billed loon	Winters along the Pacific Coast with transients found on inland bodies of water.
Greater sage-grouse (Columbia Basin DPS)	Sagebrush obligate, found east of Cascade crest. Requires large expanses of sagebrush with healthy native grasses and forbs.
Eared grebe	Shallow alkaline lakes and ponds where open water is intermixed with emergent vegetation.
Black Swift	Nests on ledges or shallow caves in steep roc faces and canyons. Usually near or behind waterfalls and sea caves. Forages over forests and open areas in montane habitats.
Calliope Hummingbird	Predominately montane open shrub sapling seral stages (8-15 years) at higher elevations and riparian areas.
Lewis' woodpecker	Ponderosa pine, cottonwood riparian area, or oak savannahs with open canopy, brushy understory and dead/down material. Also larger post-burn environments.
Williamson's sapsucker	East Cascades in middle to higher elevations of mature mixed conifer or deciduous forests. Snag dependent species.
White-headed woodpecker	Old-growth Ponderosa pine and open habitats where standing snags and scatter tall trees remain.
Willow Flycatcher	Riparian shrub dominated habitat, especially brushy/willow thickets.
Loggerhead Shrike	Grassland pasture with fences or sagebrush with scatter juniper woodlands. Requires perches for hunting and nesting.
Pinyon Jay	Pinyon-juniper woodland, sagebrush, and scrub oak habitats.
Sage Thrasher	Large patches of sagebrush/bitterbrush with shrub height usually 30-60cm high.
Virginia's Warbler	High elevation steep-sloped, xeric, pinyon-juniper or oak woodlands.
Green-tailed Towhee	Shrub-stands with high diversity interspersed with trees.
Brewer's Sparrow	Contiguous stands of big sagebrush, greasewood, and rabbitbrush.
Black-chinned Sparrow	Infrequently in ceanothus and oak hillsides of SW Oregon.
Sage Sparrow	Southeast and central Oregon in semi-open evenly spaced shrubs up to 6,800 feet.
Tricolored Blackbird	Hardstem bulrush, cattail, willows wetlands.
Black-rosy Finch	Bare rock outcrops, cliffs, and hanging snowfields above timberline.

Species	Preferred Habitat
Bald Eagle	Large water bodies and nearby forested areas.
Ferruginous Hawk	Sagebrush plains and bunchgrass prairie of the high desert and Blue Mountains.
Golden Eagle	Shrub-steppe, grassland, juniper, and open Ponderosa pine with open areas for hunting.
Peregrine Falcon	Wide range of habitat including cliffs, bridges, rock quarries.
Yellow Rail	Shallow flooded sedge meadows at 4,100-5,000 feet with vegetative cover near 50%.
Snowy Plover	Eastern Oregon summer resident breeding on alkali flats and salt ponds.
Long-billed Curlew	Open grassland east of Cascades.
Marbled Godwit	Migrant along the Pacific Coast preferring mudflats, sandy beaches, wet margins on large reservoirs.
Yellow-billed Cuckoo	No known breeding populations in Oregon. Large riparian forests, especially black cottonwood, Oregon ash and willow.
Flammulated Owl	Ponderosa pine forest and mixed conifer stands with a mean 67% canopy closure, open understory with dense patches of saplings or shrubs.

Landbirds of the East-slope of the Cascade Mountains

The conservation strategy for landbirds of the east-slope of the Cascade Mountains in Oregon and Washington (Altman 2000) identifies priority habitat features for focal species. Focal habitat includes ponderosa pine, mixed-conifer, lodgepole pine, whitebark pine, meadows, aspen, and subalpine fir (Table 38).

Table 38: Priority Habitat Features and Associated Focal Species for the East-Slope Cascade Strategy

Habitat	Habitat Feature	Central Oregon Focal Species
Ponderosa Pine	Large patches of old forest with large snags	**White-headed woodpecker**
	Large trees	**Pygmy nuthatch**
	Open understory with regenerating pines	**Chipping sparrow**
	Patches of burned old forest	**Lewis' woodpecker**
Mixed Conifer	Large trees	Brown creeper
	Large snags	**Williamson's sapsucker**
	Interspersion grassy openings and dense thickets	**Flammulated owl**
	Multi-layered/dense canopy	Hermit thrush
	Edges and openings created by wildfire	Olive-sided flycatcher
Lodgepole Pine	Old growth	**Black-backed woodpecker**
Whitebark Pine	Old growth	Clark's nutcracker
Meadows	Wet/dry	Sandhill Crane
Aspen	Large trees with regeneration	Red-naped sapsucker
Subalpine fir	Patchy presence	Blue Grouse

Using the above lists three migratory bird species will be carried forward for more detailed analysis. While the Project Area has mixed conifer habitat none would be affected by the proposed activities. Species associated with Ponderosa pine and lodgepole will be considered. Woodpecker species listed in these two forest cover types were previously analyzed and will not be repeated here. Flammulated owls will be addressed as a Bird of Conservation Concern (USFWS 2008) and the pygmy nuthatch and chipping sparrow will be addressed as focal species in the Landbirds of the East-slope of the Cascades (Altman 2000).

Flammulated Owl

Flammulated owls are a focal species of grassy openings and dense thickets within late-successional mixed conifer plant associations. Conservation issues for this species include: loss of mature and old-

growth trees and snags for nest and roost sites; loss of open understory because of invasion of exotics and fire intolerant species; requires small patches of dense thickets for roosting; creation of large areas of even-aged stands is detrimental; fuelwood collection reduces the densities of snags (Altman 2000).

Conservation Strategies

- Target conservation efforts near grassland or dry meadow openings
- Avoid insect control spraying near known nest areas or suitable habitat
- In restoration efforts, leave patches of dense sapling thickets to function as roost sites
- Retain large (12 inch DBH) snags during silvicultural practices
- Where snags with nesting cavities are a limiting factor and the habitat is otherwise suitable, create snags by fungal inoculation, topping, girdling, etc.
- Where dense roosting thickets are limited within potential or suitable habitat, avoid forest practices that remove brush from the understory
- Where grassy openings in potential or suitable habitat are being encroached on by shrubs and trees, initiate actions such as manual removal and prescribed fire to maintain openings
- Eliminate or restrict fuelwood cutting and application of pesticides in suitable or potential habitat

Pygmy Nuthatch

Pygmy nuthatches are cavity nesters and although they can utilize smaller and well-decayed ponderosa pine snags, pygmy nuthatches do compete with other cavity nesters such as the white-breasted nuthatch and white-headed woodpecker for ponderosa pine snags. It has been demonstrated that snags are limiting in the project area; and it is this aspect of their habitat needs that may be adversely impacted rather than the general habitat type of ponderosa pine.
The desired condition in ponderosa pine forest is a large tree, single layered canopy with an open, park-like understory dominated by herbaceous cover with scattered shrub cover and pine regeneration (Altman 2000).

Conservation Strategies

- Manage for large diameter trees through wider tree spacing and longer rotation periods.
- Eliminate or restrict fuelwood cutting in suitable or potential habitat.
- Retain all snags >10 inch DBH and all Ponderosa pine trees >17 inch DBH.

Chipping Sparrow

Chipping sparrows are a focal species of open Ponderosa pine stands with active regeneration. They nest relatively close to the ground in young pine trees (e.g. 4-8 feet tall). Their habitat is limited by the more even-aged, tall, and high density stand structure of the proposed treatment units.

Conservation strategies

- Evaluate historical plant communities and current landscape conditions when assessing where restoration activities should occur.
- Conduct understory removal and burning outside of the nesting season (April 15-July 15).
- Conduct thinning and/or overstory removal to provide suitable open conditions.

Environmental Consequences

Alternative 1 (No-Action)

Direct and Indirect Effects: There are no potential impacts to migratory birds from implementation of Alterative 1. All suitable habitats for the species will continue to be available in the project area.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This Consent to Lease EA will not have direct effects to birds of conservation concern because the Forest Service is only consenting to allow the BLM permission to lease National Forest Service lands for geothermal energy development.

Reasonably Foreseeable Developments

Direct and Indirect Effects: Implementation of this alternative has potential to remove some habitat for these species depending on final site locations of the proposed facilities. Construction of well pads, roads, power lines and continued human presence and equipment during construction could displace individuals in the immediate area.

When the conservation strategies for each species are reviewed the project would be consistent with these strategies. Site specific NEPA performed prior to lease development will need to address retention of larger diameter trees and snags, but without that specificity it is difficult to evaluate whether individual snags would be removed.

Effects Determination and Rationale from RFDs

Implementation of any future geothermal development would be consistent with conservation strategies identified in the East-slope of the Cascades for the flammulated owl, pygmy nuthatch, and chipping sparrow.

Priority Shorebirds

The U.S. Shorebird Conservation Plan identified U.S. and Canadian shorebird populations that are considered highly imperiled or of high concern (U.S. Shorebird Conservation Plan 2004). The 2004 list (Table 39) updated the initial list from 2001 and created a list of seven highly imperiled and 23 high priority shorebird populations. The list is grouped into global species and North American populations. Global species are those with their entire range restricted to the U.S. and Canada and North American populations are a concern in North America but the species does occur in other areas. Most of these species do not regularly occur on the DNF and when they do habitat is typically restricted to larger water bodies.

Table 39: High Priority Shorebird Species/Populations

Highly Imperiled	
Global Species	**North American Populations**
Piping Plover	Snowy Plover
Mountain Plover	Black-necked Stilt (Hawaiian population)
Long-billed Curlew	Red Knot (Canadian Arctic-Atlantic Coast Population)
Buff-breasted Sandpiper	
High Concern	
Global Species	**North American Populations**
American Golden-Plover	Wilson's Plover
Black Oystercatcher	American Oystercatcher
Solitary Sandpiper	Whimbrel

Upland Sandpiper	Bar-tailed Godwit
Bristle-thighed Curlew	Ruddy Turnstone
Hudsonian Godwit	Red Knot (Populations other than Canadian Arctic-Atlantic Coast Population)
Marbled Godwit	Sanderling
Black Turnstone	Dunlin (Alaska-East Asian and Alaska-Pacific Coast Populations)
Surfbird	
Western Sandpiper	
Rock Sandpiper	
Short-billed Dowitcher	
American Woodcock	
Wilson's Phalarope	

Based on the ecology and natural history of the species listed there is no habitat for high priority shorebirds in the project area and therefore either alternative would not impact this group of species.

Conclusion

This concludes the terrestrial wildlife specialist report for the Geothermal Consent to Lease Project. All determinations are made based on the project being implemented as described. If the project design changes then a revised report will be necessary.

Botany: Threatened, Endangered, and Sensitive Species

This report provides a description of existing conditions within the 11 nominated parcels proposed for lease within the Newberry geothermal development area. It also provides an assessment of potential botanical effects subsequent to leasing. Stipulations are proposed in an effort to minimize any adverse botanical effects that might follow Consent to Lease.

Setting

Elevations within the 11 parcels proposed for lease ranges from 5,080-6,800 feet. Within the 11 parcels collectively, the most abundant vegetation type is Lodgepole Pine Dry (3,635 acres = 59% of collective parcel area). Mixed Conifer Dry is also abundant within the parcels, with 2,428 acres accounting for 39% of the collectively parcel area. In order of abundance, but each representing less than 1% of the collective parcel area, other vegetation types within the parcels include Lodgepole Pine Wet, Ponderosa Pine Dry, Mixed Conifer Wet, Ponderosa Pine Wet, and Mountain Hemlock Dry. Non-forested pumice also accounts for less than 1% cover within the collective parcel area. Special habitats within the parcels are principally associated with the perennial Paulina Creek (Parcel #3) and mapped intermittent drainages in Parcels 9-11.

Management Direction

Direction for the conservation of threatened, endangered and sensitive (TES) plant species is found in the Forest Service Manual (FSM Sections 2670.5 and 2672.4), the Endangered Species Act of 1973 Subpart B; 402.12, Section 7, Consultation), and the Deschutes National Forest LRMP (4-60 and 4-61). The FSM states that habitats for all existing native and desired non-native plants, fish and wildlife should be managed, at minimum, to maintain viable populations for each species. The FSM and the LRMP each direct that habitat for sensitive plant and animal species be managed to ensure that these species not trend toward being listed as federal endangered and threatened species. Federal threatened, endangered, sensitive or strategic plant species currently documented or suspected to occur on Deschutes National Forest are listed in the Region 6 Regional Forester and OR/WA State Director Special Status Species List, December 1, 2011.

Existing Condition

There are no plant species within the vicinity of the proposed leases, either documented or suspected, with current threatened or endangered status. Thousands of acres of plant surveys are documented within the perimeter of the area bounded by the 11 parcels. These documented surveys, which were mostly conducted in the early to mid-1990s, were primarily conducted in what was regarded as high probability habitat for the sensitive plant species Crater Lake grapefern (*Botrychium pumicola*) and green-tinged paintbrush (*Castilleja chlorotica*). Relatively little of this surveyed area is included within the 11 parcels.

More recent surveys targeting the sensitive whitebark pine (*Pinus albicaulis*) have also been conducted in the vicinity of the 11 parcels. Specific sites at which whitebark pine was detected are currently mapped in Deschutes NF GIS. However, the boundaries of the areas actually surveyed for whitebark pine are not mapped. Occurrences of whitebark pine detected during these surveys, but not specific areas surveyed, are currently available in Deschutes NF GIS. In 2011, the US Fish and Wildlife Service (USF&WS, 2011) determined that whitebark pine warrants protection under the Endangered Species Act, and added it to the candidate species list with a priority of 2 (threats are of high magnitude and are imminent). It was noted, however, that a decision to list as Endangered or Threatened would be precluded for some time due to a backlog of listing assessments with a higher priority.

Crater Lake grapefern, green-tinged paintbrush and whitebark pine are well represented in the area bounded by the proposed leases, with 12, 20 and 79 documented sites respectively. With the exception of one site of whitebark pine in Parcel #5, no occurrences are documented within the 11 parcels.

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: The No Action alternative should have no impact on sensitive plant species present within the project area.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: The Proposed Action, consenting to lease, would not have any direct impact on sensitive plant species. Leasing in itself would not initiate any human disturbance to any leased parcel.

Reasonably Foreseeable Developments

Direct and Indirect Effects: Any potential geothermal exploration and development activities that could follow leasing could adversely affect any sensitive plant species existing within the specific nominated parcel areas, whether currently documented or not. Lease stipulations are included that would reduce potential negative impacts.

Sensitive species could be adversely affected by 1) disturbance of physical habitat including changes in exposure to sunlight, local soil temperatures, soil moisture, wind speeds, ambient humidity, 2) direct mortality or physical damage to plants, 3) exposure to contaminants and 4) introduction of invasive plant species.

Botany: Invasive Plants

Management Direction

Direction for the prevention and control of invasive plant species within the Newberry geothermal development area include the USDA/USFS Guide to Noxious Weed Prevention Practices (2001), the Deschutes National Forest LRMP (1990) as amended by the USFS Region 6 Invasive Plant Species Final Environmental Impact Statement Record of Decision (2005), the Deschutes and Ochoco National Forests Invasive Plant Prevention Practices (2006; direction letter signed 2007), and Invasive Plant Treatments Final Supplemental Environmental Impact Statement Vols. 1 and 2, Deschutes and Ochoco National Forests and Crooked River National Grassland (2012).

Existing Condition

Several invasive plant species are documented within the vicinity of the 11 parcels. A single site each of spotted knapweed (*Centaurea biebersteinii*) and St. Johnswort (*Hypericum perforatum*) is documented within Parcel #3. An additional site of spotted knapweed, as well as one of Dalmatian toadflax (*Linaria dalmatica*), are documented within 400 meters of the boundary of Parcel #3, while a site of bull thistle (*Cirsium vulgare*) is documented within 400 meters of Parcel #7. Additional sites of these species as well as of Canada thistle (*Cirsium arvense*) are documented within the perimeter of the area that includes the 11 parcels.

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: The No Action alternative would have no impact on invasive plant species. Ongoing rates of introduction and spread of invasive plant species would not be affected.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: The Proposed Action would not have any direct impact on invasive plant species. Leasing in itself would not initiate any human disturbance to any leased parcel.

Reasonably Foreseeable Developments

Direct and Indirect Effects: Potential geothermal exploration and development activities that could follow leasing have the potential to introduce or promote the spread of invasive plant species. Lease stipulations are included to reduce these potential negative impacts.

The presence of invasive plant species within the area of the proposed leases could be promoted by 1) introduction of weed propagules on vehicles and equipment entering the area of the leases for purposed of exploration and development, 2) spread of weeds within and among existing weed sites within the area of the leases and 3) creating new habitat for weeds through ground-disturbing activities.

Cultural Resources

Management Direction

Management direction for cultural resources is found in the Deschutes National Forest LRMP (1990), in the Forest Service Manual section 2360, in Federal Regulations 36CFR64 and 36CFR800 (amended December 2000), and in various federal laws including the National Historic Preservation Act (NHPA) of 1966 (as amended), the National Environmental Policy Act, and the National Forest Management Act. In addition, the 2004 Programmatic Agreement among the USDA Forest Service Region 6, the Advisory Council on Historic Preservation, and the Oregon State Historical Preservation Officer, guides the Forest Service in implementation of Section 106 of the NHPA.

The Forest Service is directed to consider the effects on cultural resources when proposing projects that fall within the Forest's jurisdiction. Further direction indicates that the Forest will determine what cultural resources are present on the forest, evaluate each resource for eligibility to the National Register of Historic Places (National Register), and protect or mitigate effects to resources that are eligible.

Relevant Forest Plan Standards and Guides include:

- CR-2 states that cultural resource properties located during inventory will be evaluated for eligibility to the National Register.
- CR-3 states that in concert with inventories and evaluations the Forest will develop thematic National Register nominations and management plans for various classes of cultural resources.
- CR-4 indicates that project level inventories or the intent to conduct such shall be documented through environmental analysis for the project.

Desired Condition

The desired condition is not clearly stated in the LRMP but can be derived from the implied goals of the Standards and Guides and the Monitoring Plan. It would be desirable to know the location and extent of all cultural resources, to have evaluated each one for eligibility to the National Register, and to have developed management plans for all eligible properties that would provide protection or mitigate effects that would occur to the resources.

Affected Environment

The project area lies outside of the NNVM. Pre-contact (defined as the time prior to Euro-American contact with Native Peoples) archaeological sites that have been recorded within this area date back several thousands of years and are typical of seasonal habitation and procurement of resources. Historically (and to the present day) this area was important to the timber industry in Central Oregon.

Previous archaeological surveys have been conducted within the proposed project area. Of the 11 proposed lease parcels, eight parcels (Parcels 1, 2, 3, 4, 7, 8, 9, and 11) have been surveyed, either partially or in their entirety, to determine the presence or absence of archaeological resources. Parcels numbered 5, 6, and 10 have had no previous archaeological survey. Previous surveys were completed in preparation for timber harvest projects, geothermal exploration, or recreation activities. A total of 2,187 acres or 35 percent of the proposed project acreage has been previously surveyed. These surveys resulted in the discovery and recordation of nine archeological sites. Eight of the sites are pre-contact in nature and are associated with stone tool manufacture or possible habitation sites. Of the eight sites, three have been determined eligible for listing on the National Register of Historic Places (NRHP). The

other five pre-contact sites have not been evaluated and are therefore treated as eligible to the NRHP. The remaining site, which is a historic logging camp, has been determined eligible to the NRHP.

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: Because consenting to lease would not occur, the No Action alternative would not have any direct or indirect effects on cultural resources.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: The Proposed Action, that would consent to lease the nominated parcels, would not result in any direct or indirect effects to cultural resources. Consenting, in itself, has no direct or indirect effects to cultural resources.

Reasonably Foreseeable Developments

If future geothermal exploration, development, or other activities are proposed within the leased areas then these activities have the potential to affect cultural resources and would therefore be subject to the National Historic Preservation Act Section 106 review. Consultation with the Forest Service, the Oregon State Historical Preservation Officer, Native American Tribes, and other interested parties would occur according to 36 CFR 800 and other applicable laws and regulations.

Tribal Interests and Traditional Cultural Resources

Introduction

Tribal interests include economic rights such as Indian trust assets, and resource uses and access guaranteed by treaty rights. Traditional cultural resources or properties include areas of cultural importance to contemporary communities, such as sacred sites or resource gathering areas. While most commonly considered in the context of Native Americans and Native Alaskans, there are traditional cultural resources associated with other ethnic or socially linked groups.

Consultation

Project letters were sent to the Confederated Tribes of the Warm Springs, the Burns Paiute Tribe, and the Klamath Tribes seeking their input. The consultation process is considered on-going.

The Deschutes National Forest is currently consulting with the Klamath Tribes who have identified a potential Traditional Cultural Property in the vicinity of the proposed project area. The Klamath Tribes have also identified other resources within the project vicinity that they feel are significant.

While some traditional cultural resources are known, some locations or resources may be privileged information that is restricted to specific practitioners or clans. For tribes, maintaining confidentiality and customs regarding traditional knowledge may take precedence over identifying and evaluating these resources, unless they are in imminent danger of damage or destruction.

Affected Environment

The proposed project area is not within any Reservation or Ceded Indian Lands although a number of Native American groups traversed through or exploited resources adjacent to or within the proposed project area. Historic and recent ethnographic information indicate that the area was frequented by Northern Paiute and the Klamath Tribes.

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: Because consenting to lease would not occur, the No Action alternative would not have any direct or indirect effects on cultural resources.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: The Proposed Action, that would consent to lease the nominated parcels, would not result in any direct or indirect effects to Tribal Interests and Traditional Cultural Resources. Consenting, in itself, has no direct or indirect effects to cultural resources.

Reasonably Foreseeable Developments

If future geothermal exploration, development, or other activities are proposed within the leased areas then these activities have the potential to affect Tribal Interests and Traditional Cultural Resources and would be subject to the National Historic Preservation Act Section 106 review. Consultation with the Forest Service, the Oregon State Historical Preservation Officer, Native American Tribes, and other interested parties would occur according to 36 CFR 800 and other applicable laws and regulations. In addition, additional Traditional Cultural Property studies, or ethnographic work may be required in order to identify affected resources.

Fisheries and Water Resources

Introduction

The project evaluates the suitability of parcels of land located on the Bend/Ft. Rock Ranger District for geothermal exploration and potential future development, with stipulations. The project does not make the decision to grant leases or authorize any exploration or development activities. The project only authorizes the BLM to conduct geothermal leases sales for nominated lands. One of the nominated parcels is located along Paulina Creek (Parcel #3). There would be no surface occupancy (NSO) within the 614 acre parcel. No other known water sources exist within the remaining 10 parcels.

Management Direction

Paulina Creek is within lands managed under the Inland Native Fish Strategy (INFISH), which amended the 1990 Deschutes National Forest LRMP (Forest Plan) in 1995. Management direction within INFISH requires Riparian Habitat Conservation Areas (RHCAs) to be delineated for watersheds. RHCAs are portions of watersheds where riparian-dependent resources receive primary emphasis, and management activities are subject to specific standards and guidelines. Paulina Creek is a fish bearing stream, therefore the RHCA width is 300 feet from either side of the stream. Parcel #3 includes approximately 73 acres of RHCA.

Management Area 17 (Wild and Scenic River)

Paulina Creek, from the outlet at Paulina Lake to the forest boundary 8.0 miles downstream, is eligible for inclusion into the national Wild and Scenic River system, classified as Recreational. To be eligible for inclusion in the Wild and Scenic Rivers system, a stream must be free-flowing and have one or more "Outstandingly Remarkable Value" (ORV). The stream and the ¼ corridor on both sides of the stream are to be managed in accordance with Management Area 17 of the Forest Plan (Wild and Scenic Rivers) to protect the ORVs and not to preclude Paulina Creek's inclusion into the Wild and Scenic River system until suitability can be determined. The identified ORVs for Paulina Creek are Hydrological/Geological and Scenic, but these ORVs only occur within the first 0.5 mile below Paulina Lake, an area upstream of Parcel #3. The Hydrological/Geological is an ORV because of an unusual example of a stream that drains an expended crater and the associated Paulina Creek falls. Scenic is an ORV because of the exceptional and unique Paulina Creek Falls and lower falls. Appendix D of the LRMP describes Paulina Creek in detail.

Water Resources

Parcel #3 includes one mile of Paulina Creek and includes lands on both sides of the stream. The stream is included on the 2010 Oregon Department of Environmental Quality list of water quality impaired streams (303(d) list) for the parameter of high water temperatures, year-round (non-spawning), in compliance with the Clean Water Act.

Paulina Creek originates at the outlet of Paulina Lake and flows westerly for approximately 8 miles. The stream enters private land beyond the forest boundary where water is utilized for irrigation purposes. There is no surface connection to the Little Deschutes River, but there may have been historically (ODFW, 1996) prior to agricultural development.

The stream is included on the 2010 303(d) list for the parameter of algae due to the presence of potentially toxic blue-green algae blooms in Paulina Lake. Only the first 1.65 miles below the lake are included.

Fish Populations and Habitat

Fisheries Populations

A review of the Region 6 Regional Foresters Special Status Species list determined that there are no known threatened, endangered, proposed, candidate, or sensitive fish species within Paulina Creek. There are no native fish populations within Paulina Creek and it is unknown if there ever were (ODFW, 1996). Native fish may have inhabited the lower reaches but were limited in upstream distribution due to the first set of impassable waterfalls at about river mile 7.0. Populations of introduced brown trout (*Salmo trutta*), which are out-migrants from Paulina Lake, inhabit the stream. Kokanee salmon, blue chub, three-spined sticklebacks, and rainbow trout also, at times, come downstream from the lake. There may also be a self-sustaining small population of eastern brook trout in Paulina Creek (ODFW, 1996).

Fisheries Habitat

Fisheries habitat is poor to fair, limited by low flows, high water temperatures, numerous migrational barriers, and a lack of quality pool habitat, instream large wood, and riparian vegetation. There is no surface connection to the Little Deschutes River. Water temperatures exceed the state water quality standard which is based on fisheries requirements.

Riparian Resources

Floodplains and wetlands within Parcel #3 are associated with Paulina Creek. Floodplains adjacent to the Paulina Creek are primarily narrow (<10 feet wide), transitioning quickly into upslope vegetation stands of ponderosa or lodgepole pine and bitterbrush. There are no other wetlands or floodplains within the parcel.

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: Because consenting to lease would not occur, the No Action alternative would not have any direct or indirect effects on fisheries or water resources.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This EA does not propose or evaluate for any direct impacts to resources. A stipulation for Parcel #3 is that there would be no surface occupancy for any potential future geothermal activities. The Consent to Lease project would not affect fisheries or water resources.

Reasonably Foreseeable Developments

If leasing occurs and RFDs are proposed, the no surface occupancy stipulation would prohibit exploration and subsequent potential development. With no surface occupancy, there would be no direct disturbance to the stream or adjacent land. Because of this, there would be no sediment entering the stream other than is presently occurring or changes to riparian vegetation.

There would be no effect to Fish and other vertebrate and invertebrate habitat, RHCA, or Wild and Scenic ORVs because no geothermal exploration or development within parcel #3 would occur. Parcel #3 is considered NSO, which does not allow exploration or development without waivers, exceptions, or modifications of this stipulation which would require further evaluation through the NEPA process.

Transportation and Access

Introduction

The Forest Service shall provide a forest transportation system that best achieves the desired conditions identified in the applicable land management plan. In managing the forest transportation system, responsible officials shall coordinate with other federal, state, county, and local public road authorities and tribal governments to:

- Integrate transportation information.
- Balance forest transportation facility investments and maintenance costs with current and future budgets to maintain the health of the land and water quality; provide for user safety; and provide public and administrative access.

All nominated parcels are accessed by open roads. County Road 21 is the primary public access to the NNVM recreational area within the caldera.

Management Direction

Existing roads on BFR, which access potential geothermal sites, will be held to the design standard for their appropriate use. All relevant roads affiliated with the consent to lease would be regulated in accordance Forest Service Manual 7701.2b subpart A; which establish the requirements for administration of the Forest transportation system, including roads. The National Forest Roads and Trail Act (FSM 7710, FSH 7709.55(Forest Service Handbook)) allow for imposition of requirements on road (FSM7730, FSH 7709.59) users for maintaining and reconstructing roads, including cooperative deposits for that work.

The NFS road system should be the minimum necessary to achieve Forest and LRMP objectives. The transportation system should provide access to NFS lands for both motorized and non-motorized uses in a manner that is socially, environmentally, and economically sustainable over the long term, enhances public enjoyment of NFS lands, and maintains other important values and uses.

Priority is to be given to maintaining and reconstructing the most heavily used roads to meet management objectives, to provide safe travel and to reduce adverse environmental impacts. Maintenance level 1 (closed) roads provide access for Forest Services administration of NFS lands and can be authorized for use via contract, permit or other written authorization issued under federal law or regulations.

All new proposed roads shall be identified and subjected to the appropriate level of environmental and travel analysis processes. When adding roads to the forest transportation system, carefully consider and document the road management objectives, environmental impacts, and social and economic benefits associated with the proposed additions. Decisions to add roads to the forest transportation system must be informed by travel analysis conducted at an appropriate scale, as well as appropriate site-specific environmental analysis and public involvement. Consider values affected by new NFS roads, including access to, utilization, protection, and administration of NFS lands; public health and safety; and valid existing rights. Consideration must be given to long-term road funding opportunities and obligations. In examining the environmental effects of new roads, consider:

a. Effects on associated ecosystems;

b. Introduction of invasive species;

c. Effects on threatened and endangered species and areas with significant biodiversity, cultural resources, fish and wildlife habitat, water quality, and visual quality;

d. Effects on recreation opportunities; and

e. Effects on access to NFS lands.

Objectives of Forest Transportation System

The objectives of managing the forest transportation system and motor vehicle use on NFS roads, on NFS trails, and in areas on NFS lands are:

- To provide sustainable access in a fiscally responsible manner to NFS lands for administration, protection, utilization, and enjoyment of NFS lands and resources consistent with the applicable land management plan.
- To manage the forest transportation system, including motor vehicle use on NFS roads and NFS trails and in areas on NFS lands, within the environmental capabilities of the land. Roads would be maintained at a level that would support vehicles associated with geothermal activities.
- To provide an appropriate range of recreation opportunities on NFS lands and to minimize conflicts among uses of NFS lands.
- To manage the forest transportation system to address user safety and convenience and efficiency of operations in an environmentally responsible manner and, where needed, to restore ecosystems along NFS roads and NFS trails designated for motor vehicle use within the limits of current and anticipated funding levels.
- To coordinate travel planning and analysis on NFS lands with federal, state, county, and other local governmental entities and tribal governments and to allow the public to participate in the designation of NFS roads, NFS trails, and areas on NFS lands for motor vehicle use.
- To designate those NFS roads, NFS trails, and areas on NFS lands that are open to motor vehicle use.
- To provide for regulation of use by over-snow vehicles on NFS roads, on NFS trails, and in areas on NFS lands.
- To make appropriate use of transit and intermodal transportation systems when they best meet the need for transportation to NFS destinations in a sustainable and environmentally acceptable manner.

Permitted Use of the Transportation System

- Road use permits authorize use of NFS roads, NFS road segments, and associated transportation facilities for purposes of commercial hauling or as an exception to traffic rules and use restrictions. Road use permits may authorize use of a road that is otherwise closed to access non-federal property; road use that is otherwise restricted by a road use order or a regulation; or motor vehicle use on NFS roads that are not designated for that use on a motor vehicle use map
- Maintenance costs should be shared with non-Federal commercial haulers or users when the estimated amount to be borne by the user will be at least $100 for the users' anticipated use.
- Cost will be recovered for road reconstruction and maintenance from commercial user commensurate with their use.

- (a) Reconstruction Required to Accommodate Use. The standard road use permit, requires the holder to perform any road reconstruction necessary to accommodate the holder's use under the permit or to deposit funds sufficient to cover the cost of the reconstruction before the holder's use commences.
- (b) Commensurate Share. Requires the holder to perform maintenance or deposit funds sufficient to cover the cost of maintenance made necessary by the holder's use under the permit.

- To protect the safety of road users and the public investment in roads and bridges, issue a Road-Use permit (RUP) to authorize the use.
- Designation of NFS roads for motor vehicle use does not preclude or obviate the need for issuance of road use permits to manage certain types of uses to protect public safety and the public investment in roads. Examples include:
  - (1) Road use permits issued to authorize use of motor vehicles exceeding size and weight restrictions imposed under State traffic law; and
  - (2) Road use permits issued to require cost recovery from commercial haulers.
- Road use permits issued for use of NFS roads designated for motor vehicle use (other than when public use is restricted by a designation for motor vehicle use by time of year) are not subject to NEPA or ESA analysis because these roads are available for public use.
- Road use permits include conditions on road use, terms requiring compliance with road operation and maintenance criteria, and provisions addressing protection and management of NFS lands.

Revocation and Suspension

- a. ***Grounds***. A road use permit may be revoked or suspended for:
  - (1) Noncompliance with federal, State, or local law;
  - (2) Noncompliance with the terms of the permit; or
  - (3) Abandonment or other failure of the holder to exercise the privileges granted.
- b. ***Notice and Opportunity to Comply***. Except for immediate suspension the responsible official must give the permit holder written notice of the grounds for suspension or revocation and a reasonable opportunity to correct any noncompliance prior to revocation or suspension.
- c. ***Immediate Suspension***. The responsible official may immediately suspend a road use permit in whole or in part when the responsible official deems it necessary to protect public health, safety, or the environment.
- d. ***Lack of Administrative Appeal***. Revocation or suspension of a road use permit is not subject to administrative appeal.
- A road use permit terminates when by its terms a fixed or agreed upon condition, event, or time occurs without any action by the responsible official, such as expiration of the permit by its terms on a specified date or with the consent of the holder. Termination of a road use permit is not subject to administrative appeal.

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: No Consent to Lease would occur. No effects would occur to the road transportation system as no potential geothermal exploratory and associated development activities would occur. Continuing management activities, recreation and newly-approved travel management decisions will continue to impact the Forest roads through normal wear and tear and deterioration.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This alternative would provide Consent to Lease of the nominated parcels for potential geothermal exploratory and associated development activities. Consenting to lease, in itself, would have no effect to the transportation system because no increase in traffic would occur as a result.

Reasonably Foreseeable Developments

In the event that exploratory drilling and subsequent development occurs, roads may need to be brushed, stabilized, or reconstructed for heavier vehicular traffic associated with the geothermal activities. Changes in the road character may result in increased public and lessee traffic, increased chance for collision with vehicles and/or wildlife, and increased maintenance costs. Additional road development associated with the various phases of geothermal development may create safety concerns. Safety concerns would be minimized through the use of BMPs, commercial road use permits, and proper engineering design if development is proposed.

Air Quality

Introduction

The nominated parcels for lease are located in Deschutes County and near the NNVM. The average air quality index in Bend, Oregon is rated as good (USA.com 2010), with levels below the National average and similar to the State average. Due to the remote location of the lease sites, air quality is generally considered to be good.

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: The No Action alternative would have no impact on air quality or atmospheric values. Air quality would continue to be affected by dust and smoke from either natural processes or as a result of human disturbance. Wildfire and other burning, such as prescribed burning on federally managed lands or burning on private lands, would produce smoke that can affect the air quality in the vicinity of the various parcels. Dust associated either with wind or from human activities can cause various levels of lowering of air quality, primarily in the immediate vicinity of the activity.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Consenting to Lease the nominated parcels for potential geothermal exploration and development would have no effect to air quality.

Reasonably Foreseeable Developments

If RFDs are proposed, initial exploration activities such as surveying and sampling would have minimal air quality impacts. Some 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 [PEIS p. 3-98]).

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.

Noise

Introduction

Current sources of noise in or from the nominated lease areas or outside areas are limited to wind, dispersed recreational use, traffic from roads, and wildlife, activities associated with Forest management, air traffic, and activities associated with motorized recreational use. Sensitive noise receptors are generally considered to be homes, hospitals, schools, and libraries, none of which are located within, adjacent to, or within hearing distance of the nominated parcels. One resort lies approximately 3-4 miles from the nearest parcel and is within and at the bottom of the Monument caldera.

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: Any noise associated with the nominated geothermal lease areas would be normal ambient noise.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Consenting to lease nominated parcels for geothermal activity would not change any ambient noise in the areas of the parcels.

Reasonably Foreseeable Developments

Potential geothermal exploration and development activities that would potentially follow leasing would likely change noise levels. The PEIS describes common impacts associated with geothermal activites on p. 4-149. No sensitive receptors have been identified within or immediately adjacent to the lease areas, so noise impacts would be expected to be minimal.

Socioeconomics and Environmental Justice

Introduction

The lease area occurs within Deschutes County, Oregon. The county was selected as the region of influence (ROI) for socioeconomic analysis as the impacts of leasing are likely to mostly occur within this area. Klamath and Lake Counties would likely experience some economic impact as well. A summary of the population, housing, employment, local school data and low-income and minority populations for Deschutes County is provided based primarily on data from US Census 2000 and 2010 population, demographic and housing information (US Census Bureau 2000, 2010).

Population (US Census Bureau 2000 and 2010)

- The 2010 estimate for the county population was 157,733, which is a 36.7 percent increase over 2000 census levels of 115,367.
- The 2012 population estimate was 162,277, a 2.9% increase over 2010.

Housing (US Census Bureau 2008)

- Approximately 68,602 housing units existed in 2005 (US Census Data, Go Bend, 2006) and 80,599 in 2011 (US Census Bureau, American Fact Finder, 2013).
- The homeownership rate in 2000 was 72.3 % (US Census Data, Go Bend, 2006), dropping to 66.9% for the period of 2007-2011 (US Census Bureau, American Fact Finder, 2013).
- Housing units in multi-unit structures was 12.1% in 2000 (US Census Data, Go Bend, 2006) increasing to 14.6% for the period of 2007-2011 (US Census Bureau, American Fact Finder, 2013).

Employment

- In 2000, the population of those over 16 years of age was 90,114; 61.9% (58,785) of the civilian labor force (90,114) were employed and 3.4% (3,031) were unemployed (US Census Bureau, American Fact Finder, 2013).
- The 2007-2011 estimates showed the population of those over 16 years of age was 124,927; 57.4% (71,762) of the civilian labor force (80,328) were employed and 6.9% (8,566) were unemployed (American Community Survey 2007-2011).

In the 2007-2011 American Community Survey (ACS), the industries employing the largest percentage of the population were:

- Education, health care and social assistance (19.0 percent);
- Arts, entertainment, recreation, accommodation and food services (12.9 percent) (US Census Bureau 2000).
- Retail trade (12.6 percent);
- Professional, scientific, management, and administrative and waste management services (11.1%); and
- Agriculture, forestry and mining (2.0 percent);

While forestry and ranching were historically the primary industries, recreational opportunities on the Deschutes National Forest have increased substantially over the past several years. Recreation has become increasingly important in the local economy (US Forest Service 1990).

Income

- The Median household income in 2000 was $53,071, an increase of 26.8% since 2000 an increase of 26.8% since 2000 (USA.com. Deschutes County Income and Careers. 2010)
- In 2000, 14.2 percent of the population surveyed was below the poverty level.
- The 2007-2011 estimates showed 11.4% of all persons below the poverty level.

Schools and Public Infrastructure

In 2012 approximately 23,000 students were enrolled in K-12 education in Deschutes County (USA.com 2013).

Environmental Justice

In Deschutes County, 92.2 percent of the population identified themselves as White of non-Hispanic descent. The largest minority population represented in the county is the Hispanic /Latino population, which makes up approximately 7.4 percent of the population (US Census Bureau 2010). Additional details for the racial and ethnic groups represented in the county are provided in Table 40.

Table 40: Race/Ethnicity in Deschutes County, Oregon

Race/Ethnicity in Deschutes County, Oregon			
Race/Ethnicity	**2000 Population and Percent**	**2010 Population and Percent**	**Change in Population and % from 2000-2010**
White persons not Hispanic	109,423 - (94.8)	145,374 – (92.2)	35,951 - (32.9)
American Indian/ Alaskan Native	956 - (0.8)	1,449 - (0.9)	493 - (51.6)
Asian	849 - (0.7)	1,476 - (0.9)	627 - (73.8)
Black/African American	222 - (0.2)	564 - (0.4)	346 - (155.9)
Native Hawaiian and other Pacific Islander	85 - (0.1)	210 - (0.1)	125 - (147.1)
Two or more races	2,258 - (2.0)	3,993 - (2.5)	1,735 - (76.8)
Some other race	1,574 - (1.4)	4,663 - (3.0)	3,089 - (196.2)
Total Population	**115,367 - (117,467)**	**157,733 - (159,654.6)**	**N/A**
Population by Hispanic or Latino Origin (of any race)			
Persons of Hispanic or Latino Origin	4,304 - (3.7)	11,718 - (7.4)	7,414 - (172.3)
Persons not of Hispanic or Latino Origin	111,063 - (96.3)	146,015 - (92.6)	34,952 - (31.5)
Total Hispanic or Latino Population	**115,367 - (100)**	**157,733 - (100)**	**N/A**

Source: US Census Bureau 2000.

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: The No Action alternative would have no impact on existing socioeconomics in Deschutes County. No impacts would occur to minority or low-income populations.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Consenting to lease parcels for potential geothermal exploration and development would not have any direct impact on socioeconomics or environmental justice.

Reasonably Foreseeable Developments

If leasing occurs, revenues would be accrued by the State and County governments through rents, royalties, and bonus bids. Of the geothermal revenues collected by the BLM and HNNR, 50 percent is returned to the State, 25 percent to the county, and 25 percent to the Federal Treasury.

If geothermal exploration and development occurs, activities would potentially have an impact such as a potential increase in jobs and decrease in unemployment due to construction, operations and maintenance jobs at newly developed geothermal plants.

Exploration activities are limited and would not result in any substantial long-term impacts to any resource and would not likely result in any long-term stimulus to the local economies.

Geothermal development would likely be more extensive with potential additions to employment opportunities and associated increases in income, population, housing – both home ownership and rental – and school populations. A positive stimulus to the local and State economies through tax revenues would occur.

A general discussion of the impacts of geothermal leasing for a 50-MW plant is provided in Section 4 of the PEIS under *Socioeconomics and Environmental Justice*. Similar impacts to those discussed in the PEIS are likely for this lease area. Due to the lack of residential areas in the vicinity of the lease area, there would be no disproportionate impacts on minority or low-income populations.

Other Disclosures

Civil Rights and Environmental Justice

Civil Rights legislation and Executive Order 12898 (Environmental Justice) direct an analysis of the proposed alternatives as they relate to specific subsets of the American population. The subsets of the general population include ethnic minorities, people with disabilities, elderly and low-income groups. Environmental Justice is defined as the pursuit of equal justice and protection under the law for all environmental statutes and regulations, without discrimination based on race, ethnicity, or socioeconomic status. The minority and low income populations groups living in counties surrounding the project area work in diverse occupations. Some minorities, low income residents, and Native Americans may rely on forest products or related forest activities for their livelihood. This is especially true for those individuals that most likely reside in the rural communities adjacent to National Forest Lands, such as La Pine, Crescent, and Gilchrist, Oregon.

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: Local economics would not change under this alternative. There would be no disproportionate effects to any ethnic minorities, people with disabilities, and low-income groups.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Consenting to Lease would have no effect to any groups or individuals as this project would only consent to lease and no implementation of any type would occur. There would be no known adverse effects that would be disproportionately high to any ethnic minorities, people with disabilities, and low-income groups in the areas of the nominated parcels.

If reasonably foreseen geothermal activities occur, opportunities for employment of minority and low income workers may arise through contract activities for various projects associated with geothermal development and associated activities, such as preparation of the site and road related work.

Within the social context presented, there is potential for workers from the outside the area to perform logging and post-harvest activities such as small tree thinning and hand piling. Pact activities on the Forest have provided work for a non-local workforce and local communities have worked effectively with and supported anticipated fluctuations in the workforce. The primary services needed by the workers would be food and shelter. Local businesses that can supply food (grocery stores and restaurants) and other services would capture most of the money being spent by the workers in the area. Since these businesses have supported similar workforces in the past, capitol expansion would probably not be required.

Human Health and Safety

Alternative 1 (No Action) and Alternative 2 (Proposed Action)

Direct and Indirect Effects: Consenting to Lease would have no effect on human health and safety.

Reasonably Foreseeable Developments

If future geothermal activities occur, danger trees would be removed from along Forest roads that access the geothermal parcels. Placing signs to notify the public of the project activity areas, in addition to notification of additional project-related traffic, would promote a safe environment for forest visitors during geothermal activities. Implementation activities would increase the potential for encounters on roadways between forest visitors and equipment associated with geothermal activity until

abandonment of developments. Safety measures such as informational signing and road maintenance activities, such as brushing roads for increased visibility, would be enforced.

All associated project activities carried out by Forest Service and Forest Service contract employees would comply with State and Federal Occupational Safety and Health Administration (OSHA standards. All Forest Service project operations would be consistent with Forest Service Handbook 6709.11 (Health and Safety Code).

Clean Air Act: Lists 189 hazardous air pollutants to be regulated. Some components of smoke, such as polycyclic aromic hydrocarbons (PAH) are known to be carcinogenic. Probably the most carcinogenic component is benzo-a-pyrene (BaP). Other components, such as aldehydes, are acute irritants. In 1994 and 1997[5], air toxins were assessed relative to the exposure of humans to smoke from prescribed and wildfires. The five toxins most commonly found in prescribed fire smoke were:

- *Particulate matter* - Particulates are the most prevalent air pollutant from fires, and are of the most concern to regulators. Research indicates a correlation between hospitalizations for respiratory problems and high concentrations of fine particulates (PM2.5, fine particles that are 2.5 microns in diameter or less). Particulates can carry carcinogens and other toxic compounds. Overexposure to particulates can cause irritation of mucous membranes, decreased lung capacity, and impaired lung function. Particulate matter is analyzed for each alternative in Chapter 3.3.2.
- *Acrolein* - An aldehyde with a piercing, choking odor. Exposure severely irritates the eyes and upper respiratory tract.
- *Formaldehyde* - Low-level exposure can cause irritation of the eyes, nose and throat. Long-term exposure is associated with nasal cancer.
- *Carbon Monoxide* - CO reduces the oxygen carrying capacity of the blood, a reversible effect. Low exposures can cause loss of time awareness, motor skills, and mental acuity. Also, exposure can lead to heart attack, especially for persons with heart disease. High exposures can lead to death due to lack of oxygen.
- *Benzene* - Benzene causes headache, dizziness, nausea and breathing difficulties, as well as being a potent carcinogen. Long-term exposure can cause anemia, liver and kidney damage, and cancer. The closest Designated Area to the analysis area is the city of Bend, Oregon; the communities of Sunriver, and La Pine are closer to the analysis area but are not as highly populated.

Hazardous Materials and Waste Management: Wastes produced by drilling would include drilling fluid and muds, geothermal fluids (and remaining sludge in sump pits after evaporation), used oil and filters, spilled fuel, drill cuttings, spent and unused solvents, scrap metal, solid waste, and garbage.

Drilling wastes include hydraulic fluids, pipe dope, used oils and oil filters, rigwash, spilled fuel, drill cuttings, drums and containers, spent and unused solvents, paint and paint washes, sandblast media, scrap metal, solid waste, and garbage. Wastes associated with drilling fluids include oil derivatives (e.g., such as polycyclic aromatic hydrocarbons [PAHs], spilled chemicals, suspended and dissolved solids, phenols, cadmium, chromium, copper, lead, mercury, nickel, and drilling mud additives, including potentially harmful contaminants such as chromate and barite). Adverse impacts could result if hazardous wastes are not properly handled and are released to the environment.

[5] Results of an April 1997 conference to review the results of health studies and develop a risk management plan for the protection of fire crews were published by Missoula Technology Development Center in Health Hazards of Smoke, Technical Report 9751-2836-MTDC.

Produced geothermal fluids would be routed to sumps or pits and left to evaporate. Remaining sludge then would be removed and transported to licensed off-site locations for disposal.

Irreversible and Irretrievable Commitments of Resources

- Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore.

  Direct and Indirect Effects: Alternative 2 is not expected to create any impacts that would cause irreversible damage to soil productivity.

- Irretrievable commitments are those that are lost for a period of time, such as resources lost.

  Direct and Indirect Effects:

  The Consent to Lease parcels of land would not have any effect to the irretrievable commitment of resources. No activity would occur through consent.

  The development and use of temporary roads and clearing of forest land for geothermal well sites and associated facilities would have a temporary loss of timber and soil productivity until their functions have been served and disturbed sites are returned back to a productive capacity. Assuming that one development per parcel occurs (could range from zero to more than one) in standard or controlled use areas and each development is 20-30 acres, approximately 180-270 acres and 1.8-2.7 mmbf of timber volume in General Forest would be lost for an indefinite period of time.

  Reclamation activities would restore the hydrologic function and productivity on detrimentally disturbed soils. There would be no irretrievable losses of soil productivity associated with these reclamation treatments.

Wetlands and Floodplains

Affected Environment

Floodplains: Executive Order 11988 provides direction to avoid adverse impacts associated with the occupancy and modification of floodplains. Floodplains are defined by this order as, ". . . the lowland and relatively flat areas adjoining inland and coastal waters, including flood prone areas of offshore islands, including at a minimum, that area subject to a one percent [100-year recurrence] or greater chance of flooding in any one year."

Wetlands: Executive Order 11990 is to avoid adverse impacts associated with destruction or modification of wetlands. Wetlands are defined by this order as, ". . . areas inundated by surface or ground water with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mud flats, and natural ponds."

Floodplains and wetlands within the project area are associated with Paulina Creek. Floodplains adjacent to the Paulina Creek are primarily narrow (<10 feet wide), transitioning quickly into upslope vegetation stands of ponderosa or lodgepole pine and bitterbrush. There are no other wetlands or floodplains within the project area.

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: There would be no direct effects to wetlands and floodplains. Stand replacing wildfire potential in floodplains and wetlands would increase and could result in short term effects to vegetation. Wildfires routinely enter wetlands and floodplains.

Effects Common to Alternative 1 (No Action) and Alternative 2 (Proposed Action)

Direct and Indirect Effects: There would be no direct or indirect effects. There would be no machinery operated in wetlands and floodplains. There would be no destruction, modification, or occupancy of wetlands and floodplains.

Prime Farmland, Rangeland, and Forestland

This project is consistent with the Secretary of Agriculture memorandum 1827 for the management of prime farmland. Prime farm land and rangelands are not within any Consent to Lease area. Prime Forest Land, as defined in the memorandum, is not applicable to lands within the National Forest System.

Energy Requirements of the Proposed Action

Alternative 1 (No Action) and Alternative 2 (Proposed Action)

Direct and Indirect Effects: No energy requirements would be needed with Consent to Lease because no activities would be occurring.

Reasonably Foreseeable Developments

If exploration and development occur at a later time, consumption of fossil fuels and human labor would be expended for the use of vehicles transporting workers associated with geothermal activities. Fossil fuel would not be a retrievable resource.

CHAPTER 4: Consultation and Coordination

Tribes

The Klamath Tribes, Chiloquin, OR
The Burns Paiute Tribe, Burns, OR
The Confederated Tribes of the Warm Springs, Warm Springs, OR

Other Agencies

The Bureau of Land Management, Prineville, OR

Oregon Department of Fish and Wildlife

Interdisciplinary Team

Bart Wills	Team Leader and Geology/Minerals
Gery Ferguson	Wilderness, Potential Wilderness, IRA
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Peter Sussmann	Soils
Robin K. Gyorgyfalvy	Visuals
Bill Munro	Wildlife
Ben Hernandez	Wildlife
Rick Dewey	Botany/Noxious Weeds
Penni Borghi	Cultural Resources
Tom Walker	Fisheries and Water Resources
Steve Bigby	Transportation System
Maureen Durrant	GIS
David Frantz	Writer/Editor/NEPA

Literature Cited

Abele, S.C., V.A. Saab, and E.O. Garton. (2004). Lewis's Woodpecker (*Melanerpes lewis*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/lewisswoodpecker.pdf

Altman, B. 2000. Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington. Oregon and Washington Partners in Flight. Corvallis, OR.

Aubry, K.B., K.S. McKelvey, J.P. Copeland. 2007. Distribution and Broadscale Habitat Relations of the Wolverine in the Contiguous United States. Journal of Wildlife Management. 71(7):2147-2158.

Beachly, Matthew W.; Hooft, Emilie E. E.; Toomey, Douglas R.; and Waite, Gregory P., 2012, Upper crustal structure of Newberry Volcano from P-wave tomography and finite difference waveform modeling, Journal of Geophysical Research, Vol. 117

Bryan, T. and E. D. Forsman. (1987). Distribution, abundance, and habitat of Great Gray Owls in south central Oregon. *The Murrelet*, 68, 45-49.

Bull, E. L. and M. G. Henjum. (1990) Ecology of the Great Gray Owl. General Technical Report PNW-GTR-265. Portland, Oregon: United States Department of Agriculture, Forest Service, Pacific Northwest Research Station. 39 p.

Claar, J. J., N. Anderson, D. Boyd, M. Cherry, B. Conard, R. Hompesch, S. Miller, G. Olson, H. Ihsle Pac, J. Waller, T. Wittinger, H. Youmans. 1999. Carnivores. Pages 7.1– 7.63 *in* Joslin, G. and H. Youmans, coordinators. Effects of recreation on Rocky Mountain wildlife: A Review for Montana. Committee on Effects of Recreation on Wildlife. Montana Chapter of the Wildlife Society. 307 pp.

Clark, Roger N., and George H. Stankey, 1979. Determining the acceptability of recreation impacts: An application of the Outdoor Recreation Opportunity Spectrum. In Proceedings of the Wildland Recreation Impacts Conference, October 27-29, 1978, Seattle, Wash. Ruth Ittner, Dale R. Potter, and James K. Agee, eds. USDA For. Serv. and Natl. Park Serv., Pac. Northwest Reg.

Cole, E.K., M.D. Pope and R.G. Anthony. 1997. Effects of Road Management on Movement and Survival of Roosevelt Elk. Journal of Wildlife Management. 61:1115-1126.

Cooper, J.M. and E.T. Manning. 2004. Williamson's Sapsucker. Accounts and Measures for Managing Identified Wildlife. Version 2004. Ministry of Water, Land and Air Protection, Victoria, BC. pp. 309-317.

Cushman, K. A. and C. A. Pearl. 2007. A Conservation Assessment for the Oregon Spotted Frog (*Rana pretiosa*). U.S. Department of Agriculture, Forest Service, Region 6 and U.S. Department of Interior Bureau of Land Management, Oregon and Washington: 46 pages.

Dixon, R. 1995. Ecology of white-headed woodpeckers in the central Oregon Cascades. MS Thesis. University of Idaho, Moscow, ID. 148 pp.

Dobbs, R.C., T.E. Martin, and C.J. Conway. 1997. Williamson's Sapsucker (Sphyrapicus thyroideus), The Birds of North America Online (A. Poole, ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/285

Dobkin, D.S., R.G. Gettinger and M.G. Gerdes. 1995. Springtime movements, roost use and foraging activity of Townsend's big-eared bat (*Plecotus townsendii*) in central Oregon. Great Basin Naturalist 55(4):315-321.

Dobkin, D.S. 1992. Radiotelemetry Study of Townsend's big-eared bats (*Plecotus townsendii*) on the Fort Rock Ranger District, Deschutes National Forest, Central Oregon.

Donnelly-Nolan, J.M., Stovall, W.K., Ramsey, D.W., Ewert, J.W., and Jensen, R.A., 2011, Newberry Volcano—central Oregon's sleeping giant: U.S. Geological Survey Fact Sheet 2011–3145, 6 p., available at http://pubs.usgs.gov/fs/2011/3145/.

Duncan, J.R. 1997. Great Gray Owls (*Strix nebulosa nebulosa*) and forest management in North America: a review and recommendations. J. Raptor Res. 31(2):160-166.

Ewins, J. 1997. Osprey (*Pandion haliaetus*) populations in forested areas of North America: changes, their causes, and management recommendations. Journal of Raptor Research 31(2): 138-150.

Forman, R.T. 2000. Estimate of the Area Affected Ecologically by the Road System in the United States. Conservation Biology 14(1):31-35.

Forman, R.T and D. Sperling. 2003. Road Ecology: Science and Solutions. Island Press. 481pp.

Gaines, W.L., P.H. Singleton, and R.C. Roger. 2003. Assessing the cumulative effects of linear recreation routes on wildlife habitats on the Okanogan and Wenatchee National Forests. Gen. Tech. Rep. PNW-

Garrett, S.G. 1991. Newberry National Volcanic Monument.: Pacific Northwest Books. Medford, OR. 123pp.

Go Bend. Central Oregon Real Estate. 2013. Deschutes County QuickFacts from the US Census Bureau.

GTR-586. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 79 pp.

Goggans, R., R.D. Dixon, and L.C. Seminara. 1989. Habitat use by three-toed and black-backed woodpeckers, Deschutes National Forest, Oregon. Oregon Department of Fish and Wildlife, Nongame Wildlife Program, Tech. Rep. #87-3-02. 43pp.

Hayward, G. D. and J. Verner, tech. eds. 1994. Flammulated, boreal, and Great Gray Owls in the United States: a technical conservation assessment. Gen. Tech. Rep. RM-253. Fort Collins, Colorado: United States Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experimental Station. 214 p. 3 maps.

Jensen, Robert A., 2000, Roadside Guide to the Geology of Newberry Volcano, CenOreGeoPub, Third Edition

Jensen, Robert A.; Donnelly-Nolan, Julie M.; and Mckay, Daniele, 2009, A Field Guide to Newberry Volcano, Oregon, The Geological Society of America, Field Guide 15

Keinath, D.A. Fringed Myotis (*Myotis thysanodes*): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/fringedmyotis.pdf

Keith, Terry E.C. and Bargar, Keith E., Petrology and Hydrothermal Mineralogy of U.S. Geological Survey Newberry 2 Drill Core From Newberry Caldera, Oregon, U.S. Geological Survey, Journal of Geophysical Research, Vol. 93, No. B9

Kozma, J. 2011. Composition of Forest Stands used by White-Headed Woodpeckers for Nesting in Washington. Western North American Naturalist 71(1):1-9.

Krausman, P.R., S.S. Rosenstock, J.W. Cain III. 2006. Developed waters for wildlife: Science, Perception, Values and Controversy. Wildlife Society Bulletin. 34(3):563-569.

Lind, G.S. 1976. Osprey production, nest site selection, and food habits on Deschutes National Forest, Oregon. Master of Science thesis. Oregon State University, Corvallis.

Lyon, L.J. 1979. Habitat effectiveness for elk as influenced by roads and cover. Journal of Forestry 79:658-660.

Marshall, D.B., M.G. Hunter, and A.L. Contreras, Eds. 2006. Birds of Oregon: A General Reference. Oregon State University Press, Corvallis, OR. 768 pp.

MacLeod, N.S., Sherrod, D.R., Chitwood, L.A., and Jensen, R.A., 1995, Geologic map of Newberry Volcano, Deschutes, Klamath, and Lake Counties, Oregon: U.S. Geological Survey Miscellaneous Investigations Series Map I–2455, 2 sheets, scale 1:62,500, pamphlet, 23 p.

MacLeod, Norman S. and Sherrod, David R., 1988, Geologic Evidence for a Magma Chamber Beneath Newberry Volcano, Oregon, U.S. Geological Survey, Journal of Geophysical Research, Vol. 93, No. B9

Mckay, Daniele; Donnelly-Nolan, Julie M.; Jensen, Robert A.; and Champion, Duane, 2009, The post-Mazama northwest rift zone eruption at Newberry Volcano, Oregon, The Geological Society of America, Field Guide 15

Mellen-McLean, Kim, Bruce G. Marcot, Janet L. Ohmann, Karen Waddell, Susan A. Livingston, Elizabeth A. Willhite, Bruce B. Hostetler, Catherine Ogden, and Tina Dreisbach. 2012. DecAID, the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon. Version 2.20. USDA Forest Service, Pacific Northwest Region and Pacific Northwest Research Station; USDI Fish and Wildlife Service, Oregon State Office; Portland, Oregon. http://www.fs.fed.us/r6/nr/wildlife/decaid/index.shtml

Nero, R. W. (1980). The Great Gray Owl – phantom of the northern forest. Smithsonian Inst. Press, Washington, D.C.

Orr, Elizabeth L. and Orr, William N.; 1999, Geology of Oregon, Kendall/Hunt Publishing Company, Fifth Edition

Pierson, E.D., M.C. Wackenhut, J.S. Altenbach, P.Bradley, P.Call, D. Genter, C.E. Harris, B.L. Keller, B. Lengus, L. Lewis, B. Luce, K.W. Navo, J.M. Perkins, S. Smith, and L. Welch. 1999. Species conservation assessment and strategy for Townsend's big-eared bat (*Corynorhinus townsendii townsendii and Corynorhinus townsendii pallescens*). Idaho Dept. Fish and Game, Boise, ID.

Riper, C., and J.W. van Wagtendonk. Home Range characteristics of great gray owls in Yosemite National Park. (in press). *in* Sears, C. L. 2006. Assessing distribution, habitat suitability, and site occupancy of great gray owls (Strix nebulosa) in California. Thesis, University of California, Davis, USA.

Rose, C.L, B.G. Marcot, T.K. Mellen, J.L. Ohmann, K.L. Waddell, D.L. Lindley, B. Schreiber. 2001. Decaying Wood in Pacific Northwest Forests: Concepts and Tools for Habitat Manipulation *in* Johnson, D.H. and T.A. O'Neil. 2001. Wildlife- Habitat Relationships in Oregon and Washington. Oregon State University Press, Corvallis, OR.

Rowland, M.M., M.J. Wisdom, B.K. Johnson, J.G. Kie. 2000. Elk Distribution and Modeling in Relation to Roads. Journal of Wildlife Management 64(3):672-684.

Rowland M. M., M. J. Wisdom, B. K. Johnson, and M. A. Penninger. 2005. Effects of road on elk; Implications for management in forested ecosystems. Pages 42-52 in Wisdom, M. J., technical editor, The Starkey Project: a synthesis of long-term studies of elk and mule deer. Reprinted from the 2004 Transactions of the North American Wildlife and Natural Resource Conference, Alliance Communications Group, Lawrence, Kansas, USA.

Sherrod, David R.; Mastin, Larry G.; Scott, William E.; and Schilling, Steven P., 1997, Volcanic Hazards at Newberry Volcano, Oregon, U.S. Department of Interior, U.S. Geological Survey, Open-File Report 97-513

Squires, J.R. and P. Kennedy. 2006. Northern goshawk ecology: an assessment of current knowledge and information needs for conservation and management. Studies in Avian Biology 31:8-62.

Stankowich, T. 2008. Ungulate flight responses to human disturbance: A review and meta-analysis. Biological Conservation 141:2159-2173.

Stroud, Peter L.; Wallace, R. Scott; Allard, Remi; and Bailey, Jim, 2011, Independent Hydrologist Review Report AltaRock Energy EGS Demonstration Project Newberry, Oregon, Kleinfelder, Portland, Oregon, Project No. 116075

Swenson, J.E. 1979. Factors affecting status and reproduction of ospreys in Yellowstone National Park. Journal of Wildlife Management 43(3): 595-601.

US Census Bureau, American Fact Finder. 2000. Profile of General Demographic Characteristics: 2000; Deschutes County, Oregon.

US Census Bureau, American Fact Finder. 2000. Profile of General Population and Housing Characteristics: 2010; Deschutes County, Oregon.

US Census Bureau, American Fact Finder. 2000. Profile of Selected Economic Characteristics: 2000; Deschutes County, Oregon.

US Census Bureau, American Fact Finder. 2000. Selected Economic Characteristics 2007-2011; Deschutes County, Oregon.

US Fish and Wildlife Service. 2011. Whitebark Pine. Posting by USF&WS, Mountain Prairie Region, at http://www.fws.gov/mountain-prairie/species/plants/whitebarkpine

US Fish and Wildlife Service. 2013a. Endangered and Threatened Wildlife and Plants; Threatened Status for Oregon Spotted Frog; Proposed Rule. Federal Register Volume 78, Number 168 Pages 55382-53623.

US Fish and Wildlife Service. 2013b. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Oregon Spotted Frog; Proposed Rule. Federal Register Volume 78, Number 168, pages 53539-53579.

US Fish and Wildlife Service. 2013c. Endangered and Threatened Wildlife and Plants; Removing the Gray Wolf (Canis lupus) From the List of Endangered and Threatened Wildlife and Maintaining Protections for the Mexican Wolf (Canis lupus baileyi) by Listing it as Endangered; Proposed Revision to the Nonessential Experimental Population of the Mexican Wolf; Proposed Rule. Federal Register Volume 78, Number 114, pages 35664-35719.

US Fish and Wildlife Service. 2013c. Endangered and Threatened Wildlife and Plants; Threatened Status for the Distinct Population Segment of the North American Wolverine Occurring in the Contiguous United States; Establishment of a Nonessential Experimental Population of the North American Wolverine in Colorado, Wyoming, and New Mexico; Proposed Rules. Federal Register. Volume 78 Number 23 Pages 7864-7890.

US Fish and Wildlife Service. 2012. Endangered and Threatened Wildlife and Plants; Designation of Revised Critical Habitat for the Northern Spotted Owl; Final Rule. Federal Register Volume 77 Number 233 Pages 71876-72068.

US Fish and Wildlife Service. 2008a. Birds of Conservation Concern. U.S. Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management. Arlington, VA. http://www.fws.gove/migratorybirds

US Fish and Wildlife Service. 2008b. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Northern Spotted Owl. Federal Register Volume 73, Number 157 Pages 47326-47522.

US Fish and Wildlife Service. 1987. Northern Rocky Mountain Wolf Recovery Plan. U.S. Fish and Wildlife Service, Denver, CO.

US Shorebird Conservation Plan. 2004. High Priority Shorebirds-2004 (Unpublished Report) U.S. Fish and Wildlife Service, Arlington, VA. Available: http://www.shorebirdplan.org/wp-content/uploads/2013/01/Priority-Shorebirds-Aug-04.pdf

USDA Forest Service. 1990. Deschutes National Forest Land and Resource Management Plan.

USDA Forest Service. 1994. Newberry National Volcanic Monument Comprehensive Management Plan. Pacific Northwest Region, Deschutes National Forest.

USDA Forest Service, 1996. Landscape Aesthetics, A Handbook for Scenery Management.

USDI Geologic Survey. 1980. Selected Administrative, Land, and Resource Data for Known Geothermal Resources Areas in Arizona, California, Idaho, Nevada, Oregon, and Washington. Page 24.

Vana-Miller, S.L. 1987. Habitat suitability index model: osprey. U.S. Fish and Wildlife Service Biological Report 82 (10.154). 46 pp.

Van Daele, L.J. and H.A. Van Daele. 1982. Factors affecting the productivity of ospreys nesting in west-central Idaho. Condor 84:292-299.

Whitfield, M.B., and M. Gaffney. 1997. Great Gray Owl (*Strix nebulosa*) Breeding Habitat Use Within Altered Forest Landscapes. Biology and Conservation of Owls of the Northern Hemisphere. USDA GTR-NC-190. p498-505

Wisdom, M.J., N.J. Norman, B.K. Johnson, E.O. Garton, J.W. Thomas. 2004. Spatial partitioning by mule deer and elk in relation to traffic. In Transactions of the 69th North American Wildlife and Natural Resources Conference: 509-530

Wisdom, M.J., R.S. Holthausen, B.C. Wales, C.D. Hargis, V.A. Saab, D.C. Lee, W.J. Hann, T.D. Rich, M.M. Rowland, W.J. Murphy, M.R. Eames. 2000. Source habitats for terrestrial vertebrates of focus in the interior Columbia basin: broad-scale trends and management implications. Gen. Tech. Rep. PNW-GTR-485. Portland, OR. USDA Forest Service, Pacific Northwest Research Station. 3 Vol.

Wong, Ivan; Pezzopane,,Silvio; Dober, Mark; and Terra, Fabia, 2010, Evaluations of Induced seismicity/Seismic Hazards and Risk for the Newberry Volcano EGS Demonstration, URS Corporation, Oakland, California

APPENDICES

Appendix A: Standard Stipulations

Serial No. _____

NOTICE FOR LANDS OF THE NATIONAL FOREST SYSTEM
UNDER JURISDICTION OF
DEPARTMENT OF AGRICULTURE

The permittee/lessee must comply with all the rules and regulations of the Secretary of Agriculture set forth at Title 36, Chapter II, of the Code of Federal Regulations governing the use and management of the National Forest System (NFS) when not inconsistent with the rights granted by the Secretary of Interior in the permit. The Secretary of Agriculture's rules and regulations must be complied with for (1) all use and occupancy of the NFS prior to approval of an exploration plan by the Secretary of the Interior, (2) uses of all existing improvements, such as forest development roads, within and outside the area permitted by the Secretary of the Interior, and (3) use and occupancy of the NFS not authorized by an exploration plan approved by the Secretary of the Interior.

All matters related to this stipulation are to be addressed

to: **District Ranger**

at:

Telephone:

who is the authorized representative of the Secretary of Agriculture.

NOTICE

CULTURAL AND PALEONTOLOGICAL RESOURCES - The FS is responsible for assuring that the leased lands are examined to determine of cultural resources are present and to specify mitigation measures. Prior to undertaking any surface-disturbing activities on the lands covered by this lease, the lessee or operator, unless notified to the contrary by the FS, shall:

1. Contact the FS to determine if a site specific cultural resource inventory is required. If a survey is required, then:

2. Engage the services of a cultural resource specialist acceptable to the FS to conduct a cultural resource inventory of the area of proposed surface disturbance. The operator may elect to inventory an area larger than the area of proposed disturbance to cover possible site relocation which may result from environmental or other considerations. An acceptable inventory

report is to be submitted to the FS for review and approval at the time a surface disturbing plan of operation is submitted.

3. Implement mitigation measures required by the FS and BLM to preserve or avoid destruction of cultural resource values. Mitigation may include relocation of proposed facilities, testing, salvage, and recordation or other protective measures. All costs of the inventory and mitigation will be borne by the lessee or operator, and all data and materials salvaged will remain under the jurisdiction of the U.S. Government as appropriate.

The lessee or operator shall immediately bring to the attention of the FS and BLM any cultural or paleontological resources or any other objects of scientific interest discovered as a result of surface operations under this lease, and shall leave such discoveries intact until directed to proceed by FS and BLM.

ENDANGERED OR THREATENED SPECIES - The FS is responsible for assuring that the leased land is examined prior to undertaking any surface-disturbing activities to determine effects upon any plant or animal species listed or proposed for listing as endangered or threatened, or their habitats. The findings of this examination may result in some restrictions to the operator's plans or even disallow use and occupancy that would be in violation of the Endangered Species Act of 1973 by detrimentally affecting endangered or threatened species or their habitats.

The lessee/operator may, unless notified by the FS that the examination is not necessary, conduct the examination on the leased lands at his discretion and cost. This examination must be done by or under the supervision of a qualified resource specialist approved by the FS. An acceptable report must be provided to the FS identifying the anticipated effects of a proposed action on endangered or threatened species or their habitats.

Serial No._____

NO SURFACE OCCUPANCY STIPULATION

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

For the purpose of:

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820.)

Serial No._____

TIMING LIMITATION STIPULATION

No surface use is allowed during the following time period(s). This stipulation does not apply to operation and maintenance of production facilities.

On the lands described below:

For the purpose of (reasons):

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820.)

Serial No._____

CONTROLLED SURFACE USE STIPULATION

Surface occupancy or use is subject to the following special operating constraints.

On the lands described below:

For the purpose of:

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820.)

Serial No._____

USDA - FOREST SERVICE

FLOODPLAIN AND WETLAND
LEASE NOTICE

The lessee is hereby notified that this lease contains the riparian ecosystem (Management Area , Forest Plan, pages). The lands affected include:

All activities within this area may be precluded or highly restricted in order to comply with Executive Order 11988 - Floodplain Management and Executive Order 11990 - Protection of Wetlands, in order to preserve and restore or enhance the natural and beneficial values served by floodplains and wetlands.

Management Area , the riparian ecosystem, will be managed by the Forest Service to protect from conflicting uses in order to provide healthy, self-perpetuating plant and water communities that will have optimum diversity and density of understory and overstory vegetation. Occupancy and use of lands within Management Area proposed in a Surface Use Plan of Operations will be considered in an environmental analysis done to identify the mitigation measures necessary to protect the riparian area. Measures such as road design, well pad size and location or directional drilling, will be made part of the permit authorizing the activity.

Appendix B: 30-Day EA Comments

Newberry Geothermal Consent to Lease Project

30-Day Public Comment Period, February 24, 2014 – March 26, 2014
Comments Received

1	Kristine Venier 60313 Cinder Butte Road Bend, OR 97702 February 28, 2014	5	Doug Heiken Oregon Wild PO Box 11648 Eugene, OR 97440 dh@oregonwild.com
2	Matt Skeels unadjusted@gmail.com March 6, 2014	6	Kelly B. McDonald 60886 Granite Drive Bend, OR 97702-9013
3	Stu Garrett, MD 21663 Paloma Drive Bend, OR 97701 March 20, 2014	7	Karen Coulter Blue Mountains Biodiversity Project League of Wilderness Defenders 27803 Williams Lane Fossil, OR 97830
4	Sheilajean Whitefield 141 SW 15th St., #11 Bend, OR 97702 March 22, 2014		

* No ground disturbing or resource impacting activities are being considered under this proposed action. The scope and scale of reasonably foreseeable development scenarios are described in Chapter 2, pages 38-44. Any proposal for specific geothermal exploration or development would require additional site-specific environmental analysis and public disclosure prior to being approved.

In the Team Response column of the following table, the above paragraph will be shortened to:

No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities.

Letter	Category	Comment	Team Response
4	Comment Period	I, also, believe that the comment period should be extended for another 30 days because the Email address, printed with the public notice on Feb. 24, 2014, was incorrect. ONLY those persons who wanted to read the Environmental Assessment (EA), and actually went to the Forest Service Offices to obtain a copy of the 196-page EA, are aware of the CORRECT Email address, as I found out by reading a letter that had been inserted into the EA. Despite THREE phone calls, prior to obtaining the EA, to different FS officials, NO ONE INFORMED ME THAT THE EMAIL ADDRESS WAS INCORRECT!	The timeframe for reviewing and commenting was not affected by the typo on the comment inbox address. A letter was sent to all those on the mailing list on March 5, 2014 stating that the address was incorrect. Any new interested potential commenters were also provided a copy of the letter of March 5. The correction letter was also placed on the Deschutes/Ochoco website.
7	Exploration and Development General Comments p. 13 (Direction – Extraction in Monument) p. 17 (comment/direction Directional drilling) p. 100 (Direction - Flank Zone) pp. 69, 103 (Future Analysis - Consenting to Lease) p. 64 (Future Analysis) Fill material	No directional drilling should be allowed under the Newberry National Volcanic Monument as underground drilling can still cause harm, such as earth subsidence, earthquakes, and even possible volcanic activity, or pollution of the water table with toxic geothermal fluids. These effects can cause changes to the unique geology and natural character of the Monument, degrading recreational values and wildlife habitat. A "No Surface Occupancy" stipulation can still allow visual scenic impacts from adjacent emission plumes, air pollution …. We are concerned … could cause significant degradation of Paulina Lake, Paulina Creek, East Lake, and unique, undisturbed habitat for wolverine and Pacific fisher in the Newberry caldera and adjacent roadless areas. We are concerned that triggered earthquakes or a volcanic eruption could harm or kill recreational visitors and workers in the area through landslides and falling rock The Environmental Assessment also fails to analyze the contribution to global catastrophic climate change of increased carbon dioxide emissions from the entire geothermal production process.	On page 71 of the NNVM Plan for Special Management Areas (as part of the Flank Zone), Standard and Guide FZ-6 states that "subsurface geothermal exploration and development are permitted. No surface occupancy of any geothermal facilities is permitted." *No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities.
5	National Energy Policy	Geothermal energy might be part of a viable future for renewable, non-fossil energy, however this requires that new non-fossil energy developments be coupled to direct reductions in fossil energy use. Current energy policy, or the lack thereof, results in significant adverse cumulative effects from the ecological footprint of new and expanded renewable energy development, plus the adverse effects	The FS is mandated by the Energy Policy Act to respond to this Consent to Lease by the BLM.

		from continuing unchecked use of fossil fuels. This proposal should be preceded by a sound national energy plan that addresses the serious threat of global climate change by requiring significant and immediate absolute reductions in greenhouse gas emissions. This issue is not outside the scope of this project - not as long as this project will contribute to the adverse cumulative effects described.	
3	Lease History	The lease history, the reason for lease abandonment, and pertinent details of reasons for leasing should be noted.	10 of the 11 parcels were previously leased and expired. Refer to EA Appendix C (page XX) for the lease history. No geothermal activities have occurred on any of the 11 parcels. For more information, please contact the Prineville BLM.
7	Leases and Exportation	p. 62 -When were these 60 leases authorized? p. 62 - Are these 60 leases for development or only exploration? p. 64 - Why does this EA fail to disclose that the geothermal energy potentially generated by this project would be exported to California or elsewhere while the impacts would remain local and are being externalized onto local communities? p. 69 – Future analysis – Hypocritical reasoning re: cumulative effects	The existing leases have been authorized over the past 32 years. In March 2014, the BLM approved a unit agreement which renewed the leases for 5 years, within the unit. Refer to EA Appendix C for the lease history. For more information, please contact the Prineville BLM. The leases are available for exploration and development, with stipulations. If development was to occur, and energy made available for use, various populations would potentially receive energy benefits. *No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities..
5	Development	Oregon Wild is concerned about haphazard development of geothermal energy resources around Newberry Crater National Monument. We have been asked to comment on a plethora of proposals over the course of the last 10 years. We are not sure how this effort is connected to existing geothermal testing and development proposals in the area. We would like to see a cohesive and integrated plan, and a comprehensive analysis of cumulative impacts.	It is unknown how many of the 11 parcels would be leased and, if so, by what entity. *No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities
7	Consenting to Lease	p. 57 – "Consent to lease" is effectively consent to cause environmental impacts through geothermal development.	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal

		…obviously there are indirect effects of this "Consent to lease" Project, or the FS would not be including analysis of …. Obviously there are cumulative effects in "time and space regarding the various resources" …	activities.
7	Bureau of Land Management (BLM)	p. 182 - … we request the past history of geothermal corporations proposing to operate in the NNVM area regarding human health impacts and safety record, emissions, hazardous waste left. p. 183 – What is the safety record and accountability of the geothermal corporations.	As the subsurface management agency, the Prineville BLM maintains these records and, accordingly, would be the proper agency to provide this information.
7	LRMP consistency	p. 97 – All applicable Forest Plan Standards and Guidelines relevant to the Newberry Geothermal Project should have been incorporated in this EA and evaluated for consistency for each issue (e.g. Recreation, Wildlife, etc.) within the EA for public disclosure of why these standards and guidelines are considered met and for informed decision-making. p. 101 – To be consistent with the Deschutes Forest Plan, the expectations for recreational settings within recreational management areas should be protected from geothermal leasing impacts, not changed or eliminated to prioritize inconsistent industrial geothermal lease.	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities. Applicable LRMP Standards and Guidelines (General Forest – M8-17; Scenic Views – M9-83 and M9-84; Old Growth – M15-11) would be applied with any geothermal activity proposal, including multiple-use within the nominated lease parcels. Also included are applicable guidelines from the NNVM Comprehensive Management Plan (1994).
7	Amending the LRMP p. 55	p. 55 – We are strongly opposed to the allowance for the BLM to amend the relevant land use plan (allow for its violation) just to push through an exception, waiver, or modification to a geothermal lease that is not in conformance with the land use plan. …	Any Forest Plan amendment would include involvement of and be approved by the Forest Service with public involvement..
7	EIS vs EA	… a full Environmental Impact Statement should be prepared for this consent to lease impacts disclosure to inform the public and decision-making. Further, the Consent to Lease Project covers 11 potential lease parcels over a common geographic area that would be approved and operational over roughly the same time frame, which should require an EIS for connected actions over the same geographic area and the same or similar time frame p. 64 –… should really require an EIS…	Any proposal for specific geothermal exploration or development would require additional site-specific environmental analysis and public disclosure prior to being approved. As there are no ground disturbing activities involved with this project and there is a Finding of No Significant Impact, an EA meets the NEPA requirements for this project.
4	EIS	The last Environmental Impact Statement (EIS), concerning geothermal exploration on the flanks of Newberry, was done in 1994! A lot has been learned about the actual, potential, &/or	In 1994, a power plant was proposed which required an EIS. No power plant was developed. The level of NEPA analysis is

		cumulative effects of fracking since then!	dependent on the scope of the project.
4	EIS	Since 1994, for each incremental stage, ONLY a myopic Environmental Assessment (EA) has been done with each one piggy-backed onto the last EIS. This practice escapes the INTENT of environmental laws.	Since 1994, three (3) geothermal EAs have been approved by the BLM for exploratory projects. (30-day EA, p. 21) The level of NEPA analysis is dependent on the scope of the project. Potential cumulative effects would be part of the analysis.
6	EIS	There hasn't been a EIS done since 1994 and a New EIS needs to be done now in 2014 20 years has gone by, doing these EA assessments and coupling them together does not get the job done.	See above comment answer. *No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities
3	EIS	As the FS, BLM, and power companies now (again) admit that their goal is the establishment of a 30-acre power plant on the volcano, within 5 years, an EIS SHOULD BE DONE BEFORE THE FS CONSENTS TO LEASE FURTHER PARCELS TO THE BLM FOR SALE TO THE POWER COMPANIES!!	See above comment answer. *No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities.
7	Range of alternatives	We also find that the EA includes an inadequate range of alternatives, giving the public no choice to consider further protective stipulations or some parcels being dropped from consideration. Instead, it's an "all or nothing" choice of no geothermal leasing or leasing only as the Forest Service now prefers to lease. While we appreciate the NSO stipulations and other mitigations selected by the Forest Service, we still see significant problems with the Consent to Lease proposal as outlined above, so we can only support no leasing at all (No Action) in choosing between the only two alternatives offered. p. 22 – Why one action alternative? Insufficient range of alternatives. Key issues. p. 23 – We challenge these assumptions (*re: why non-key issues*)	The consideration of alternatives includes not leasing (Alternative 1) and leasing with stipulations (Alternative 2). No key issues were identified following scoping. After thorough consideration of LRMP management areas, scenic, riparian, roadless, slopes, and areas meeting the criteria for PWA values, of the 6,174 acres proposed for consenting to lease, approximately 42% have a NSO stipulation, 19% have a CSU stipulation, and 39% would fall under standard lease. Further consideration of an alternative with no NSO or CSU stipulations could occur. The effects for consenting to lease for this third alternative would be the same as Alternative 2, as no ground disturbing or resource impacting activities are being considered with this EA.
7	BMPs, Standards and Guidelines, and	p. 53 – Best Management Practices that could be required for geothermal leasing should have been specified in the EA …	*No ground disturbing or resource impacting activities are being considered. Site-specific

	Monitoring	p. 53 – There should have been an analysis of the past effectiveness of BMPs proposed for use in geothermal lease parcels based on past monitoring of implementation and effectiveness of these BMPs. Please send us hard copies of all relevant BMP monitoring reports for BMPs proposed for use in geothermal consent to lease parcels. p. 107 – How would unreclaimable toxin-contaminated soil be brought into compliance with Forest Plan standards and guidelines? Monitoring should be done by the Forest Service and the BLM, not left up to the lessee.	analysis would occur with proposed geothermal activities. As stated on 30-day EA page 53, project specific mitigation measures would be required prior to granting a permit. Because at this time no lease has been granted and no activity has been proposed, there are no site or project specific BMPs that have been proposed. Federal agencies are also participants in monitoring. Independent third party monitoring would be included in future project NEPA analysis.
7	Comment waivers, exceptions, or modifications	We ask that the Forest Service eliminate all loopholes allowing for violation of protective lease stipulations for recreational trails, the Paulina Creek proposed Wild and Scenic River Corridor, scenic views, Old Growth Management Areas, Potential Wilderness Areas, slopes greater than 30% and 40%, Great Blue Heron, Osprey, and Red-tailed hawk, as described (along with loophole exemptions) on pages 48 & 49 of the EA.	No ground disturbing or resource impacting activities are being considered under this proposed action. Any waivers, exceptions, or modifications of stipulations (discussed on 30-day EA pp. 54 & 55) would require evaluation through the NEPA process and an amendment to the Forest Plan.
7	Chapter 2 (pp.25-55)	General Comments pp. 48 – 50 (stipulations, BMPs, Monitoring); p. 55 (exemptions, waivers, modifications)	
5	Stipulations	Oregon Wild supports the most stringent stipulations to minimize the footprint of geothermal development activities and protect soil, water, vegetation, wildlife habitat, unroaded areas >1,000 acres, scenic values, carbon storage, non-motorized recreation, etc.	Stipulations are addressed in the 30-day EA pages 44-53. All stipulations are consistent with the Forest Plan.
5	Stipulations	There are important resources in the project area that need to be carefully considered: old growth trees, mature forests, unroaded areas, biogenic carbon stores, Paulina Creek eligible wild & scenic river, recreation and visual resources, etc. Several of the proposed parcels appear to conflict with the compelling need to conserve these values.	All stipulations are consistent with the Forest Plan. All resources have been addressed with stipulations as needed. Old Growth Management Area and proposed Wild and Scenic River have a NSO stipulation.
7	Chapter 3 (pp. 56-184)	General Comment pp. 56 - These lease stipulations and BMPs are being discussed and decided now with regard to future impacts on the environment and	These are the protective measures that would occur with any proposal for exploration and development activities.

		humans.	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities
5	Effects	This consent-to-lease proposal appears to contemplate potentially significant geothermal development around Newberry Crater. This raises the prospect of potentially significant environmental effects on soil, water, wildlife, weeds, old growth trees, natural disturbance processes, OHVs, recreation, scenic values, carbon storage, fire hazard, recreation, etc... This proposal demands an EIS.	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities
5	Cumulative Effects	The EA fails to adequately discuss cumulative impacts in its many dimensions: fossil + non-fossil energy development, or multiple concurrent geothermal energy developments, or geothermal project plus other activities as they impact soil, water, wildlife, vegetation, old growth, roadless areas, fire hazard, etc.	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities.
7	Minerals and Geology (pp. 58-64)	p. 61 – What are the paleontological mitigative procedures and how would they ensure protection of the fossil record in the area? …	The Forest Service is mandated by law to protect paleontological resources (Paleontological Resources Preservation Act of 2009). However, for this project there are no ground disturbing activities. *No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities. Work would be halted and a District Ranger would be contacted to determine extent and importance of the area.
2	Pumice	It appears certain sections within the project area harbor pumice deposits which may be of tourist/scenic/commercial value and may be desirable to be avoided.	This EA only consents the BLM to lease for geothermal activities. This EA does not exclude other activities, for example, recreation, mining and prospecting, on the lease parcels.
7	Composition and toxicity of fluids.	The Environmental Assessment for the "Newberry Geothermal Consent to Lease Project" fails to adequately disclose the composition and toxicity of "excess geothermal fluids" (EA p.42) and "another working fluid" (EA p.43), and fails to analyze the environmental and human health impacts of any toxins in "waste	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities.

		generated" and "geothermal water." (EA p.44). p. 21 – Pollution of creek, lake, and/or drinking water. p. 69 – Effects of toxicity to other resources p. 177 – These are very significantly toxic pollutants; what pollutants and in what quantity	
1	Chemicals	I request they disclose any and all trade secret chemicals they are using that they claim are organic, but they won't tell us because they are a trade secret. If they have a patent pending then they should be able to inform the public of exactly what it is.	No chemicals use is proposed in this EA. Not within the scope of the Forest Service responsibility. BLM is the responsible agency for this information. *No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities
1	Plastic	I would also like to know how long it will take the plastic they are using dumping/pumping/hydroshearing whatever … to disintegrate?	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities
4	Waste	Similar to nuclear waste, NOBODY WANTS THIS WASTE in their neighborhood! Isn`t it bad enough that Oregonians have to deal with the Hanford and Fukashima waste-products?!	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities
5	Waste	All drilling waste and used drilling mud should be exported from the site. Ponds to store drilling waste and drilling mud should not be allowed on public land.	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities
5	Powerlines	New powerlines are a concern because this is a forested area. New powerlines will require clearing of vegetation and fragmentation and loss of forest habitat. Forest fires are a natural occurrence in this area and smoke can cause powerlines to arc and ignite new fires. The FS should require stipulations such as fully insulated powerlines in order to minimize this known hazard.	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities
3	Reclamation	On prior projects in the area there has been considerable delay in rehab of the drill sites and disturbed areas. This should be corrected.	The timing of reclamation would be considered on a project by project basis. *No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal

			activities
5	Reclamation	We strongly support full reclamation as a stipulation for all leases	The type of reclamation would be considered on a project by project basis. *No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities
6	Methane in drinking water	… and water faucets will be able to be lit on fire, where there are thick concentrations of methane homes will have to be evacuated because those homes are at risk of instantaneous explosion.	Comment – Outside scope
7	Reasonably Foreseeable Developments	p. 39 – Why is FS analyzing RFDs if consenting to lease does not cause indirect effects and trigger direct and cumulative effects. pp. 56, 60, 61, 81 – Geothermal activities and related seismic and volcanic potential	RDFs are being considered in order to apply appropriate stipulations on the lease parcels. *No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities.
3	NNVM Transferal Area	The North Paulina roadless area/Transferral Area should be respected for possible transfer into the Monument in later years. A no-degradation policy should be in place.	None of the 11 parcels are located within or adjacent to the Transferal Area. For those areas of the North and South Paulina IRAs that may overlap with parcels, there is an NSO stipulation.
7	IRA, PWA, OGMA (pp. 65-88)	All Inventoried Roadless Areas, Potential Wilderness areas, and Old Growth Management Areas should be excluded from lease parcels due to their qualification for NSO stipulation plus potential for directional drilling to cause surface subsidence, water table pollution, earthquakes, or other impacts that result in loss of habitat values for which these areas are designated. Drop the "polygon 377" area of never logged and unroaded land from lease parcel 9 to preserve the larger block (1,789 acres) of unlogged and unroaded land as wildlife habitat for species needing larger blocks of habitat with little human disturbance (such as Canada lynx, Pacific fisher, Wolverine, Gray wolf, American marten, and Rocky Mountain elk.) This area of the Deschutes National Forest has already been heavily logged and roaded and is subject to considerable human disturbance, so remaining roadless areas, potential wilderness areas, and undeveloped lands need to be fully protected from fragmentation and human disruption to preserve the viability of increasingly rare species requiring large blocks of habitat and little human disturbance.	The NSO stipulation is described in the 30-day EA, page 45 and applies to these areas. NSO covers a portion of parcels 1 and 4 through 7.- Direction has been given to do an evaluation for areas that may meet the inventory criteria for PWA using the criteria in FSH 1909.12, Chapter 71 and listed on 30-day EA page 76. These areas have been given a NSO stipulation. Parcel #9.contains a portion of polygon #377. Parcel#9 is not a self-contained ecosystem. *No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities.

		p. 49 – Areas that should be NSO. pp. 49, 50, 68, 77, 79 – Areas/acres that should be dropped from parcels. p. 77, 86 – Drop polygon #377 or designate as NSO. pp. 68, 81, 86, 88 – Effects – Directional drilling contamination, seismic event, volcanic eruption. p. 76 – Why areas are being evaluated to determine if they meet criteria for PWA unless they are being evaluated for potential wilderness? p. 66 – Lack of analysis (Pacific fisher, roadless, diversity of plants and animals) p. 69, 73, 81 – Inadequate analysis, indirect effects p. 87 – These long term (utility corridors etc.) and potentially irreparable impacts to wildlife could be avoided by NSO stipulations for all unlogged/unroaded areas. Leasing can lead to ground disturbing activities.	
4	OGMA, Scenic View, PWA	Only three of the eleven parcels in question, are not immediately adjacent to the NNVM boundary; those three parcels include Old Growth Forests &/or a Scenic River. In fact, 614 acres are designated as Scenic River, 2,837 acres are designated as Old Growth, 3,292 acres are designated as Potential Wilderness Areas, and 4,810 acres are designated as Scenic Views, many visible from high elevation points within the NNVM. This is not acceptable!	Parcel 3 has scenic views, the OGMA and Paulina Creek and has been stipulated as NSO. PWA has been stipulated as NSO. Scenic Views, where not NSO are considered CSU, limiting where any potential geothermal activity may occur.
7	Controlled Surface Use (CSU)	Controlled surface use being allowed on parcels adjacent to the Monument would allow the noise and sight of industrial activity to disrupt the unique character of the Monument and recreational values of solitude, peace, a natural setting, and a sense of wonder at geological features, bird watching, etc. So we ask that if any parcels adjacent to the Monument are approved (although we oppose their approval), that they have the stipulation of NSO p. 46 – Comment – Believe automatic NSO for all or most of CSUs. p.100 – Comment - Drop all CSU and replace with NSO stipulation.	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities.
7	Recreation (EA pp. 89-103)	p. 88 - …industrial degradation of recreational experience…	Parcel #3 is the only parcel directly associated

		p. 89 - …very misinformed analysis of recreational use in the project area. While field surveying in the Ogden sale… What about the facilities along the waterbodies of Paulina Creek and Paulina Lake? p. 93 – We support those parcels with semi-primitive trails being restricted by NSO stipulation… And this is considered "relatively low" public use? p. 97 – How much damage would be eliminated and how much only reduced? p. 100 – Actually the effects of industrial operation probably will displace recreationists and keep people away. Recreationists exposed to industrial sights and sounds are likely to leave and spread the word not to go to the NNVM. p. 101 – Value for what? For corporations making profits… p. 101 – …indefensible and inadequate analysis of effects to recreational revenue… This is inadequate cumulative effects analysis. p. 103 – Cumulative effects table and related comments.	with flowing water or a lake and has an NSO stipulation. No parcels are within the caldera. *No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities.
	Soils (EA pp. 104-108)	p. 61 – What happened to the NSO stipulation for slopes greater than 30? p. 104 – So what would the CSU stipulation restrictions be for slopes of 30-40%? p. 104 – slope – convert percent slope to degree slope. p. 106 – Comment – NSO stipulation should be given to slopes over 30% … p. 106 – The EA admits that ground water and surface runoff toxic contamination are possible… …there are no standards to protect soils from toxic contamination or from irretrievable loss of soil productivity, only from soil disturbance? p. 107 – …no analysis of the effects of cumulative impacts to soils…	30-40% = 17-22° There is no LRMP Standard and Guide that limits activity on slopes over 30%. Restrictions for 30-40% slopes would be based on parcel/site specific erosional (slope) stability. *No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities.

7	Scenic (EA pp. 109-110)	p. 110 – Effects – What would the effects be to changing the current natural setting …? What mitigation of these impacts …? Inadequate analysis.	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities.
7	Wildlife (EA pp. 111-164)	We are concerned by potential impacts to Sensitive-listed bat species, including Townsend's Big-eared bat, Fringed myotis, and Pallid bat. Maternity colonies and hibernacula roosting caves could be disrupted by increased human disturbance or geothermal drilling-induced seismic events, and crucial foraging areas and roost trees could be cleared for geothermal development. pp. 58, 119-121 – Caves and Bats Cut no trees over 21" dbh We ask the Forest Service to abide by Forest Plan standards and regional direction by requiring any corporations involved in geothermal leasing to not log live trees or snags over 21" dbh that are not OSHA hazard trees, in order to provide large trees and snags for roosting bats, White-headed woodpeckers, Lewis' woodpeckers, and Northern flickers. p. 120 – 21" dbh We are also concerned by the cumulative effects to Northern goshawk, other accipiter hawks, American marten, and Mule deer, all Management Indicator species, of geothermal development plus the numerous timber sales in the area, ATV use, and firewood cutting, eliminating useable habitat for these species by canopy or tree density reduction, snag and down wood reduction, and human disturbance. There is inadequate or no cumulative effects analysis in the EA for various impacts.	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities. 21" dbh limit is for timber sales. Other locations would be considered.
7	Wildlife Comments from 30-day EA	pp. 112, 117 – Pacific fisher – Should be listed in Table 16 and analyzed as Threatened-listed species…; Habitat near Paulina and East Lake & Crater; "No Effect" not justified. PP. 114, 115, 117 – Wolverine – Newberry Crater should be considered part of Geothermal Leasing project area; home range 60-540 square miles; inadequate and biased analysis; suspected to inhabit Newberry Crater; "No Effect" not justified. General comments and future analysis p. 113 – dispersing individuals and habitat of a listed species needs	Pacific fisher is presently a sensitive species and listed in Table 19. A discussion of the Pacific fisher is provided in the Final EA. Wolverine discussion is more complete in the Final EA. Stipulations in EA Chapter 2 address Wildlife and habitat (pp. 48, 49, 51). *No ground disturbing or resource impacting activities are being considered. Site-specific

		to be protected; geothermal development would be a lot more human disturbance. pp. 119-121 – Caves and Bats –How far do they forage; May be using project area for foraging even if roosting more distant; concerned activities could collapse caves; no justification for conclusion Alt 2 would not contribute to uplisting of species; stipulations to protect cave habitat (#60, page 51); how only a slight reduction of foraging habitat without quantifiable data? pp. 58, 120, 121, 122 (surveys for caves and bat species) 124, 133, 135, 149, 157 (surveys for other species); 135 (structural stage analysis); 136 (impacts from RFDs by acreage); 144 (analysis of loss of species habitat); 136, 146 (distance of avoidance effect from heavily trafficked roads?; analysis of acreage of disturbed habitat); p. 157 –Clearing of forest in general is a threat to woodpeckers as removal of existing and future snags and logs, not just the removal of snags and down logs; claiming consistency with the DNF LRMP has been not saving species from loss of viability, declining trends, and uplisting. p. 124 – Lewis WP – Parcel #4 use NSO stipulation if in area pp. 133, 135, 136 – Cooper's hawk (surveys?; cumulative effects; protecting nests; foraging habitat) pp. 135, 136 – Sharped Shinned Hawk (surveys?; cumulative effects) pp. 135, 136 – Goshawk (cumulative effects) pp. 145, 146 –Pine marten (overestimation of habitat and underestimation of effects; all of suitable marten habitat should have NSO stipulation or excluded; highly questionable re: habitat; increased access and mortality) p. 147 –Black-backed WP (inadequate analysis; overestimate of habitat by modeling; does not consider snags)	analysis would occur with proposed geothermal activities.

		p. 149 – Hairy WP (use of LP stands?; contradiction in numbers; saw in Ogden) p. 157 – Three-toed WP (inappropriate to switch scales of analysis to the Forest level to minimize effects to species in the project area)	
2	Caves	After review of the map and comparing it with known cave locations, special attention should be paid to the following caves, and areas within the project area. Also note, that any cave locations outlined below are not to be published(e.g. in The Bulletin as noted in the project) by the government as restricted by the FCRPA (datum WGS84):	Caves – stipulation #60: All parcels will be surveyed for the presence of caves and if discovered … determine appropriate buffers (LRMP, M-39).
3	Invasive plant species	There has been inadequate procedures for preventing weed invasion in the areas including washing of equipment, weed monitoring, and revegetating.	EA page 51, Stipulation #65
3	Botany	I want to be sure the areas proposed have been surveyed for sensitive plants, especially *Botrychium pumicola*.	EA page 51, Stipulation #65
4	TES plant and animal species	I also find it disturbing that the anticipated impacts upon threatened &/or endangered species are found acceptable because they are not deemed to "threaten the survival of the species"; this is not acceptable. The issue of noise pollution upon native bats is not addressed at all.	A discussion on TE species in the 11 parcels (EA pages 112-117) and sensitive species (pages 117–128) is provided with effects rationale. Further, site specific NEPA would occur with any proposal for exploration or development, with stipulations.
7	Botany (pp. 165-167)	All invasive exotic plant populations within or near lease parcels should be well buffered from any ground disturbance to prevent wind or animal-carried seed of these exotic plants from being introduced or dispersed into new areas. p. 44 – Any replanting should be with only <u>native</u> plants appropriate to the site. p. 52 – Drop all sensitive plant locations and their suitable habitat from any approved lease parcels or stipulate No Surface Occupancy for these areas (e.g. for Crater Lake grapefern, green-tinged paintbrush, and whitebark pine.) p. 165 – Sensitive plant surveys planned? p. 165 – Is there any suitable habitat for whitebark pine within the lease parcel areas? Why is this not discussed?	Stipulation #65, 30-day EA pp. 51, 52, addresses weeds, replanting and botany TES species. Surveys have occurred in the vicinity of the 11 parcels (EA p. 165). Site specific Surveys for sensitive plants would likely occur if geothermal activities were to be proposed in any of the 11 parcels. *No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities.
7	Cultural (pp. 168-170)	All indigenous people's cultural sites and cultural use areas for plant gathering, ceremonies, etc. should be excluded from any lease parcel	Stipulations #63 & #64, 30-day EA, page 51, address general cultural resources.

		acreage approved. Spiritual and cultural significance related to a sense of place and natural settings cannot be mitigated other than by disallowing industrial activities within sight, sound, or proximity of these areas. p. 51 – Drop any cultural sites or use areas from acreage in approved lease parcels p. 169 – Lease stipulations need to be analyzed. Need to be clear that surveys would be done for parcels 5, 6, & 10. Stipulations either be dropped from lease parcel or NSO.	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities.
5, 7	Fish and Water (PP. 171-172)	Parcel #3 straddling Paulina Creek should be dropped (there are just too many potential resource conflict) as well as all parcels encompassing inventoried roadless areas. No further degradation of 303(d)-listed streams is allowed for the parameters for which the stream is designated. Paulina Creek acreage and Riparian Habitat Conservation Area buffers should be excluded from parcel 3 lease acres if parcel 3 is approved for leasing (and p. 171). p. 171 – All of Paulina Creek should be protected on public lands in order to protect its outstanding values, its potential designation for inclusion into the Wild and Scenic River system, its high recreational use, and its scenic integrity. We ask that the parcel 3 lease not be approved for these reasons. p. 138 – Wildlife – Parcel 3 should be dropped from consent to lease …	Parcel 3 has an NSO stipulation. The NSO stipulation is described in the 30-day EA, page 45.
6	Restoration of ecosystem	How will the ecosystem ever be restored which include micro organisms in the aquifer plus wildlife on land and air eventually recover, have you ever walked through a forest and not heard a single animal they are all dead, because the ecosystem has been so terribly polluted nothing can survive, not marine life, not land animals, or birds of the sky.;	Resource Protection Measures / Stipulations are provided for resource protection (30-day EA pages 44-53. *No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities.
5	Road for Geothermal Exploration and Development	The EA suggests that 9 miles of new road may be required. Is that per drill site, per project, or all total? Recognizing that roads have serious adverse impacts, we urge that new roads be minimized. Development should focus near existing roads. Stipulations should	On EA page 43, access road discussion gives a range (.5-9 miles) per potential development, depending on intensity.

		also require effort to limit the impact of expanding OHV activity in developed areas. The impacts of associated roads and power transmission facilities also need to be carefully considered.	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities.
7	Transportations system (pp. 173-176)	p. 144 – Compensate for any new or "temporary" roads with road closure to adhere to FS Standards and Guides. p. 176 – How would transportation user conflicts be mitigated? How would recreational opportunities be protected? How would other resources be protected from increased traffic and traffic conflicts? How would the transportation system stay "within the environmental capabilities of the land"? This is a very inadequate analysis ….	Temporary and access roads would be decommissioned with site rehabilitation following geothermal activities. Roads would be maintained at a level to support vehicles associated with geothermal activities using the environmental analysis process. *No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities.
7	General Road Access	p. 52 – Why are geothermal lease holders given such carte blanche to violate public traffic and road restrictions despite clear threats to public safety or road condition p. 98 – … de facto privatization of public lands through restriction or elimination of public access for recreational, cultural, and spiritual activities. Just the exploration phase of geothermal development sealed off some major roads and sizable blocks of public lands to the public. p. 99 – Major road closures have lasted for at least since 2008 "to protect lessee investment" by closing off large areas of public land to the public. When will these closures be lifted and federal penalties for "trespassing" on public land be ended…	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities. The Multiple Use - Sustained Yield Act of 1960 authorizes and directs the Secretary of Agriculture to develop and administer the renewable resources of timber, range, water, recreation and wildlife on the national forests for multiple use and sustained yield of the products and services. Multiple use, including geothermal and mineral extraction, is direction for management of National Forests. Presently, the use of Forest Road 9735-600 not allowed by Special Area Closure (DES-2008-001). The closure was established for the protection of public health and safety. At this time there is no date to lift the closure notice because geothermal activities are seasonally on-going. The Forest Supervisor may lift the closure notice.

1, 6	Water testing	I request the testing of the water samples be collected and sent in by an independent 3rd party and Altarock/Davenport should not be allowed to collect or FILTER THE SAMPLES BEFORE THEY SEND THEM, as Altarock has done since the beginning of this project. I for one am not going to trust a FOR profit energy company that has everything to gain from providing test results that show what they want us to see (of course they show nothing, they filtered them before they sent them) they have been providing filtered samples and then say that they are independent tests. All testing should be videotaped showing the Independent 3rd party collecting and sending the samples. Are you aware that Altarock Energy are actually filtering the water samples before they are sent off to a Oregon State Laboratory to check for chemicals in the sample. How can they be trusted.	As a regulating agency responsible for the health and safety of the public, the Forest Service is very concerned about allegations that permittees or any other user of NFS lands and resources are intentionally violating the law or the terms of their permit. If proof exists of these allegations, and is presented, the Forest will take action. Otherwise, this comment is outside the scope of this analysis
6	Water testing - Trust	You really need to look at these two LLC companies and ask yourself can the Bend-Fort Rock Ranger District trust these companies, and if you can't you must deny their request to drill at parcels 1-11.	The FS is mandated by the Energy Policy Act to respond to this Consent to Lease by the BLM.
1,4,5	Water availability	The EA lacks an adequate discussion of water demands associated with geothermal development. Producing geothermal energy virtually always requires water, but there is a serious shortage of available water resources in the project area. The lack of water renders much of this project area unsuitable for energy development.	Consenting to lease only means the 11 parcels are available for lease. Water leasing is not regulated by the FS. *No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities
4	Aquifer discussion	Of utmost concern is the designation, in this EA, that “the use of groundwater for the geothermal project and the effect to acquifers” as a “NON-KEY ISSUE” ! (See page 23.) Due to this decision, only surface water potential disturbances are evaluated at all. Surely the State has tested the Central Oregon Regional acquifer (at ~ 2600 feet above sea level) PRIOR to and AFTER the drilling and fracking of wells (@ > 10,000 foot deep) into the flanks of the volcano, given the stated “groundwater flow, from the cauldera to the regional acquifer of 2,500 to 6,500 acre-feet/year”! (See page 59.) Local brewers and growers report that the regional acquifers` water has CHANGED from slightly acidic (~4 pH) to VERY alkaline (~ 8pH) RECENTLY! (This is not addressed in the EA.)	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities

6	Water contamination	Residents will not be able to use this water it will be no good for cooking, bathing, drinking, watering your lawn, …	General Comment *No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities
6	Water study	A water study for Central Oregon needs to be done, this study must be funded by the Oregon Water Resources Department, with actual devices collecting real time data, funding must be restored to the Oregon Water Resources Department so that a proper report can actually be prepared. A report prepared by AltaRock and DavenPort Newberry holds no water with me. I want see a report prepared with my tax payer dollars and is brutally honest. AltaRock and Davenport Newberry are also the folks that are tampering with the water samples before they are even sent off to the state for analysis.	Outside scope of this project. A water study was done by the USGS in 2002. http://or.water.usgs.gov/projs_dir/deschutes_gw/pubs.html
1,4	Toxic waste water	I also find it very disturbing that the disposal of the toxic wastewater created is not addressed other than to state that "disposal will be off-site."	If any of the 11 parcels is leased, it is unknown at this time if any geothermal activity would be proposed. Disposal of any geothermal waste, toxic or non-toxic, would need to be addressed in project specific NEPA analysis.
7	Air Quality (p. 177) Water Quality Noise (p. 178)	There is inadequate analysis in the EA of the full range of potential air quality and noise pollution impacts of reasonably foreseeable consequences of alternative 2 consent to lease resulting in geothermal drilling and development. Drilling could release emissions of mercury, which causes neurological impairment, and of hydrogen sulfide, which can cause respiratory impairment, and arsenic, a significant toxin. …could violate the Clean Air Act, given potential highly toxic emissions. "Emissions generated during any exploration and drilling phase would include ... the release of geothermal fluid vapors (especially hydrogen sulfide, carbon dioxide, mercury, arsenic, and boron, if present in the reservoir)." (EA p. 177) There is grossly inadequate analysis of potential human health and safety impacts… There should be worst case scenarios analyzed and full disclosure of such potential human health and safety impacts prior to public comment… (p. 21) …EA does not consider potential violations of the Clean Water act through geothermal fluid toxins from drilling reaching the ground	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities. Noise pollution is discussed in the 30-day EA on page 178. Noise would be analyzed for each step if those steps occur.

		water table. … The EA (really, an EIS) should analyze potential geothermal exploration and development-related pollution of the water table and "develop a process on how to reduce such pollution to the 'maximum extent practicable"' (Clean Water Act quote, EA p.21). … causing chemical pollution of creek, lake, and/or drinking water. p. 178 – Inadequate analysis of noise. Actually quiet and freedom from the sights and sounds of industrial development and cities are a major component… Simply not true that consenting to geothermal lease would not change the ambient noise level in the area… …evaluate now to as to attach any protective lease stipulations for noise… …why aren't noise pollution sources analyzed for…geothermal development as well?	
4	Literature	Please have your staff Google these topics for your review: 1) EPA links water contamination to oil and gas drilling in Pavillion, WY." 2) "USGS states Oklahoman earthquakes are almost certainly man-made." 3) "Communities attempt to &/or ban hydraulic fracturing."	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities.
7	Human health and safety	The Environmental Assessment has grossly inadequate, misleading, and down-played assessment of human health and safety impacts in that it doesn't even consider the potential impacts to humans, wildlife, and birds of highly toxic geothermal vapor components-such as hydrogen sulfide, mercury, and arsenic. There should be analysis of worst case scenarios for human health and wildlife exposure. There is no discussion of known geothermal accidents among workers that caused their deaths or permanent health disabilities. The scanty health and safety discussion also fails to analyze the actual potential health effects of geothermal production to local communities, such as increased cancers. p. 177 – Inadequate analysis of air quality impacts …	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities. In the event that a lessee would propose exploration and development activities, human health and safety would be further analyzed.

		Why no detailed analysis of health effects… These are significantly toxic pollutants. Which would include what pollutants … example of typical emissions. Why no discussion of triggers for state and local permits? p. 182 – Inadequate analysis of health effects. What about disproportionate health effects to local low income & native Americans likely to reside in rural communities adjacent to these NF lands… p. 183 – This is a grossly inadequate, misleading, and downplayed assessment of human health and safety … So why are there no waste case scenarios considered…? This health discussion also fails to analyze the potential health effects to local communities, …	
4	Comment Green Energy	Originally touted as "green", "renewable" energy, growing experience and scientific research is now divided on whether geothermal energy , WHEN IT REQUIRES DRILLING INTO THE EARTH, FRACTURING OF THE EARTHS` MANTLE, OR THE INTRODUCTION OF FLUIDS (NOT NATURALLY OCCURING IN THE QUANTITIES IN QUESTION), is truly either.	Comment The FS is mandated by the Energy Policy Act to respond to this Consent to Lease by the BLM.
4	Comment Fracking	The drillers exploring the flanks of our local volcano are anxious to distance themselves from the enormous NATIONWIDE controversy concerning FRACKING! Therefore, they have adopted a phrase that was previously ONLY used to describe the use of pressurized water to slice thin layers of cells to facilitate DNA sequencing: hydroshearing. Nonetheless, their process remains hydraulic fracturing, although they do not need to use chemicals to keep the fissures open; the type of rock involved keeps them open due to displacement. Some chemical compounds are used, but the company is not, by Oregon law, required to divulge what they are because they are "trade secrets". THIS is a problem when our regional aquifer could be at risk!	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities.
4	Reinjection of fluids	Heated amidst volcanic rocks containing a diverse array of toxic mineral compounds (i.e. cadmium, cesium, mercury, etc.), the IMPORTED water, injected into the fractures created or enlarged through water injected into wells under great pressure, becomes a	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities

		toxic soup of dangerous chemicals, substances, and gases.	
4	Reinjection of fluids	Earthquakes have been generated in traditionally NON-SEISMIC areas through the reinjection of the toxic wastewater, that is a byproduct of fracking, into deep wells at locations other than the production sites. Will these fluids be reinjected on other leased parcels on the flanks of Newberry, or ANYWHERE in the Central Oregon (aquifers`) region?	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities
4	Comment	Furthermore, the Newberry Volcano is deemed by the USGS to be a "very high threat" (for further eruptions). I find it, at least disingenuous, that this EA states that termination of the EGS (fracking) stimulation, in 2012, "coincided" with a > 2.o seismic event, rather than admitting that the safety protocols demanded that the process be terminated and EMERGENCY measures implemented when that event occurred!	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities. In regards to the seismic event in 2012. On the last day (Dec 7) of hydroshearing, AltaRock increased the volume of water injected into the well triggering a M2.39 earthquake. This seismic event did not record on the strong motion sensor that was placed in the NNVM Visitor Center in the caldera. Protocol for this event is not to increase flow further and monitor for other seismic events. AltaRock stopped injecting water and shut-in (closed) the well. No other seismic of greater than M2 were recorded. This earthquake was not felt on the surface and was not reported by the citizens of La Pine.
4, 6	Comment	The geologists just can`t say with any certainty if the Brothers (Newberry) Fault connects to the Yellowstone hotspot, or through the Sisters Fault, to the Blue Mountain Lineament. Nor are they certain that the Blue Mountain Lineament connects to the San Juan de Fuca slip zone, or the Olympia-Wallowa Lineament, but they suspect that they do! This is no time to be less than honest, or less than thorough!	The best available scientific knowledge would be applied to the analysis of any proposed exploration and development activities during any NEPA process.
6	Convection	Discussion regarding convection.	Comment to watch video
6	Convection	I know that even if the casing doesn't crack or break it doesn't matter the act of CONVECTION will still bring to the surface methane among other gases to the surface regardless of a cracked or broken casing. Whether or not it is in the regulation book that your office must follow is another matter, I do hope you have to protect the	EA pages 44-53, Resource Protection Measures.

		watershed and the scenic waterways.	
5	Fire	Building new infrastructure within a fire prone forest type does not make a lot of sense. It will create and perpetuate a need to suppress fire which is a natural and beneficial process within this ecosystem. The EA does not disclose the adverse effects of continued fire suppression around the new energy development sites and access road and powerlines.	Active wildfire suppression activities are immediately initiated in areas with developments and use by the public, including areas within and adjacent to NNVM.
6	Low Income	Here in the United Stated of America our government recognizes that the low income and disabled (I am in this group) have no where to go if our homes are damaged or destroyed. The U.S government has past legislation to protect these groups. I wish I could name the bureau plus the legislation that was passed and signed into law	Comment Outside scope of project.
6	Central Oregon caldera	The entire Central Oregon region is classified as a Caldera not just the Caldera's at Newberry but all of Central Oregon is a Caldera. The size of our Caldera is significantly smaller than Yellowstone National Park, The reason I bring this up is because Yellowstone National Park is exempt from any and all fracking or geothermal development. Central Oregon in it's entirety must be recognized as a caldera, and legislation must be passed to protect Central Oregon from development as well.	Comment Outside scope of project. Best available science would be reviewed.
6	Alternative 1 Support	I would tend to support the "No Action Alternative"(Alternative 1).	Support of Alternative 1
6	Earthquake	AltaRock and DavenPort Newberry. Brought in a machine back in I think 2010 that I think at the time was either 2 or 3 times more powerful than the one officially agreed upon to open one well sight, and they caused a 2.0 (somewhere in that range) earthquake at the sight., you can't trust AltaRock or DavenPort Newberry	Comment *No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities. In regards to the seismic event in 2012. On the last day (Dec 7) of hydroshearing, AltaRock increased the volume of water injected into the well triggering a M2.39 earthquake. This seismic event did not record on the strong motion sensor that was placed in the NNVM Visitor Center in the caldera. Protocol for this event is not to increase flow further and monitor for other seismic events. AltaRock stopped injecting water and shut-in (closed) the well. No other seismic of greater than M2 were recorded. This earthquake was not felt on the

			surface and was not reported by the citizens of La Pine.
6	Earthquakes	Something I am alarmed about is earthquakes, if my home is damaged where am I suppose to live, Exhibit One is a check from my bank (U.S. Bank) here in Bend, from Social Security Disability Insurance, I receive full Disability from Social Security and have received it for many years now. Where am I to live if my home is damaged or destroyed.	Comment Outside scope of project.
6	Earthquake	The South Sister it has a bulge growing on it's side and is about 4 miles from the surface it' volume of magma is calculated at 50,000,000 cubic yards between the size of Black Butte and Pilot Butte respectively, our volcanic eruptions in Central Oregon erupt all three types of magma Basaltic, Andesitic, Rhyolitic, plus Cinder Cones. The earthquake that took place to the south of Bend, Oregon in Klamath Falls which took place on September 20, 1993 at 03:28:55 and September 21, 1993 at 05:45:33 both were 6.0 magnitude in size. Landslides occurred and a man driving a car was killed by a boulder, another man died of a heart attack, 7.5 million dollars in damage was done to the City of Klamath Falls , damage to Tulelake California was done. It has been 21 years since this has happened 21 years is just a blink of a eye in geologic terms, just go Page 2 of 3 ask a geologist. A ten year period isn't enough time to make a decision on. Geothermal Development was going on at these times when the earthquakes occurred . It is hard for me to say this but I need to be blunt here, You folks should not shy away from being brutally honest with the consquences of a major earthquake in Central Oregon and the ramifications in the lives of every Central Oregonian that are hanging in the balance, based on your decision, you are actually and quite literally playing God here, geologist know we who live in Central Oregon are way overdue for a major eruption, and geothermal activity at Newberry will spur a earthquake eruption. You need to determine weather or not the lives of250,000 Central Oregonians is worth a couple of geothermal power companies also the energy development won't help Oregonians, it will be exported to California. Central Oregon gets the mess and California gets the energy, this doesn't sound like a benefit to Oregon.	Information *No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities
6	Damage	Altarock payed out 9.5 million dollars or more to the people in the town of Basel Switzerland back in 2006 through 2007, after their homes were damaged or destroyed. Altarock shut the project down	Information not correct *No ground disturbing or resource impacting

		after this. Altarock also shut down a project in California in 2009 after homes where damaged, in Anderson Springs. Jacques Felber said she thought one day her house would roll right down the hill side.	activities are being considered. Site-specific analysis would occur with proposed geothermal activities
7	**Approach of EA for this project**	There is a curious cognitive dissonance going on in the EA, whereby the Forest Service claims that: "Consenting to lease would not have direct, indirect, or cumulative effects to the environment" (EA p.39), and then goes on to consider many of the direct, indirect, and cumulative effects that the consent to lease decision could trigger by allowing for geothermal production-in the same EA. … "However, there may be potential effects from future geothermal development" and that: "The following reasonably foreseeable development (RFD) scenario serves as a basis for a discussion of the potential environmental impacts resulting from the potential future leasing and development of Federal geothermal reserves over the next 20 years." (EA p.39). ... there are indirect effects from consenting to lease public lands for geothermal development which have significant environmental consequences. Inclusion of "Reasonably Foreseeable Development Activities" in this EA implies that these impacts are reasonably foreseeable and need to be discussed within this EA. We agree, as otherwise the public and decision-makers are left in the dark about potential significant impacts of consenting to lease public lands for geothermal development. However the EA continues to have a schizophrenic approach to the question of later site-specific analysis negating the need for comprehensive environmental impact analysis in this EA (which should be an EIS.). While further site-specific analysis is promised in some parts of the EA to occur when the BLM actually initiates the leasing process for any "consented to lease" parcels (which we agree should be conducted then), on p. 39 of the EA the Forest Service implies that no such further site-specific analysis may be "warranted" unless "future development eventually exceeds RFD predictions" (although RFD impacts analysis is inadequate in the EA.) Specifically, the Forest Service says that: "If future development eventually exceeds RFD predictions, then the Forest Service will assess the impacts to the resources ... and determine if additional analysis is warranted." (EA p.39) This is truly frightening, that the current inadequate level of	*No ground disturbing or resource impacting activities are being considered. Site-specific analysis would occur with proposed geothermal activities. A general discussion of Reasonably Foreseeable Developments (RFDs) is presented to provide some basis for how geothermal activities would occur. It is not implied that geothermal activities would occur. It is unknown if by Consenting to Lease, the nominated parcels would be leased through competitive bid. If so, it is unknown if leasing would lead to exploration and development. If so, it is unknown how far in the future activities would occur, where they would occur in a parcel, and what type of technology would be used, including advancements in technology. For this reason, site specific analysis for exploration and development activities would occur at the time these activities would possibly be proposed. The majority of the existing and expired lease parcels have had no past geothermal activities take place.

		analysis given in the EA is all that decision-makers would use to decide whether to allow leasing of parcels to go forward, and the public would not have the opportunity to weigh in based on site-specific, more detailed information. This seems like a terrible case of "passing the buck" procedurally and never doing the detailed, site-specific analysis of potential environmental impacts required by NEPA to fully inform the public and decision making.	

Appendix C: Parcel Lease History

Figure 35: Parcel Number 1 – History

Run Date: 03/26/2014

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Geographic Report with Customer
Sorted by Serial Number

Run Time: 03:10 PM
Page 1 of 1

Admin State: OR

Geo State: OR

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 011987	321000	CLOSED	970	CASE CLOSED	11/13/2007		Total Acres =	560.000

WATERS GEO W — 0.00000 OVERRIDING ROYALTY
72 PINE COVE RD — FAIR HAVEN — 07704 — NJ

ORNI 4 LLC — 100.00000 LESSEE
6225 NEIL RD STE 300 — RENO — 895111153 — NV

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0210S	0120E	009	ALIQ			N2,SW,W2SE;

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 012765	320070	CLOSED	970	CASE CLOSED	08/08/2005	ENERGY POLICY ACT;	Total Acres =	44,628.210

BLM-OREGON STATE OFFICE — 100.00000 OFFICE OF RECORD
PO BOX 2965 — PORTLAND — 972082965 — OR

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0210S	0120E	009	ALIQ			ALL;

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Figure 36: Parcel Number 2 – History

Run Date: 03/26/2014

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Geographic Report with Customer
Sorted by Serial Number

Run Time: 03:09 PM
Page 1 of 1

Admin State: OR

Geo State: OR

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 011992	321000	CLOSED	970	CASE CLOSED	11/13/2007		Total Acres =	640.000

ORNI 4 LLC 100.00000 LESSEE
6225 NEIL RD STE 300 RENO 895111153 NV

WATERS GEO W 0.00000 OVERRIDING ROYALTY
72 PINE COVE RD FAIR HAVEN 07704 NJ

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0210S	0120E	020	ALIQ			ALL;

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 012765	320070	CLOSED	970	CASE CLOSED	08/08/2005	ENERGY POLICY ACT;	Total Acres =	44,628.210

BLM-OREGON STATE OFFICE 100.00000 OFFICE OF RECORD
PO BOX 2965 PORTLAND 972082965 OR

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0210S	0120E	020	ALIQ			ALL;

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Figure 37: Parcel Number 3 – History

Run Date: 03/26/2014

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Geographic Report with Customer
Sorted by Serial Number

Run Time: 03:07 PM
Page 1 of 1

Admin State: OR

Geo State: OR

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 011990	321000	CLOSED	970	CASE CLOSED	09/25/2000		Total Acres =	1,801.620

DELTA WESTERN CO 50.00000 LESSEE
PO BOX 551669 DALLAS 753551669 TX

MURER CHRISTIAN F 0.00000 OVERRIDING ROYALTY
1645 COURT PL #201 DENVER 80202 CO

CE EXPLORATION CO 50.00000 LESSEE
302 S 36TH STE 400 OMAHA 68131 NE

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0210S	0120E	031	ALIQ			E2W2,E2;
33	0210S	0120E	031	LOTS			1-4;

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 012765	320070	CLOSED	970	CASE CLOSED	08/08/2005	ENERGY POLICY ACT;	Total Acres =	44,628.210

BLM-OREGON STATE OFFICE 100.00000 OFFICE OF RECORD
PO BOX 2965 PORTLAND 972082965 OR

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0210S	0120E	031	ALIQ			E2,E2W2;
33	0210S	0120E	031	LOTS			1-4;

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Figure 38: Parcel Number 4 – History

Run Date: 03/26/2014

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Geographic Report with Customer
Sorted by Serial Number

Run Time: 02:46 PM
Page 1 of 2

Admin State: OR

Geo State: OR

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 011954	321000	CLOSED	970	CASE CLOSED	06/28/1974		Total Acres =	640.000

ALASKAN GEOTHERMAL 100.00000 APPLICANT
6100 CORPORATE DR HOUSTON 770363419 TX

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0220S	0120E	015	ALIQ			ALL;

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 011963	321000	CLOSED	970	CASE CLOSED	06/28/1974		Total Acres =	2,553.890

ALASKAN GEOTHERMAL 100.00000 APPLICANT
6100 CORPORATE DR HOUSTON 770363419 TX

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0220S	0120E	014	ALIQ			ALL;

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 012669	321000	CLOSED	970	CASE CLOSED	09/25/1997		Total Acres =	1,075.450

MURER CHRISTIAN F 100.00000 LESSEE
1645 COURT PL #201 DENVER 80202 CO

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0220S	0120E	014	FF		1	APPROX 410 AC OUT OF MON;
33	0220S	0120E	015	ALIQ			ALL;

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 012765	320070	CLOSED	970	CASE CLOSED	08/08/2005	ENERGY POLICY ACT;	Total Acres =	44,628.210

BLM-OREGON STATE OFFICE 100.00000 OFFICE OF RECORD
PO BOX 2965 PORTLAND 972082965 OR

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part

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Figure 39: Parcel Number 5 – History

Run Date: 03/26/2014

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Geographic Report with Customer
Sorted by Serial Number

Run Time: 03:44 PM
Page 1 of 2

Admin State: OR

Geo State: OR

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 011984	321000	CLOSED	970	CASE CLOSED	08/21/1975		Total Acres =	2,557.580

ROBERTS JAMES 100.00000 APPLICANT
1901 MONTY CT STOCKTON 95207 CA

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0220S	0130E	002	ALIQ			S2N2,S2;
33	0220S	0130E	002	LOTS			1-4;

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 015925	321000	CLOSED	970	CASE CLOSED	08/02/1976		Total Acres =	1,256.960

PHILLIPS PETRO - GEO 100.00000 APPLICANT
655 E 4500 SOUTH SALT LAKE CITY 84110 UT

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0220S	0130E	002	ALIQ			S2N2,S2;
33	0220S	0130E	002	LOTS			1-4;

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 016135	321000	CLOSED	970	CASE CLOSED	03/17/1997		Total Acres =	352.580

CALIFORNIA ENERGY CO 100.00000 LESSEE
302 S 36TH ST #400 OMAHA 68131 NE

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0220S	0130E	002	FF		1	APPROX 352.38A OUT OF MON

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 048573	321300	AUTHORIZED	282	REINSTATEMENT APPROVEC	03/25/1996		Total Acres =	2,335.000

DAVENPORT NEWBERRY HOLDINGS LLC 100.00000 LESSEE

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Figure 40: Parcel Number 6 – History

Run Date: 03/26/2014

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Geographic Report with Customer
Sorted by Serial Number

Run Time: 03:45 PM
Page 1 of 2

Admin State: OR

Geo State: OR

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 011615	321000	CLOSED	970	CASE CLOSED	08/02/1974		Total Acres =	2,553.890

SUN E & P CO 100.00000 APPLICANT
PO BOX 2880 DALLAS 752212880 TX

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0220S	0130E	003	ALIQ			ALL;
33	0220S	0130E	009	ALIQ			ALL;
33	0220S	0130E	010	ALIQ			ALL;

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 011963	321000	CLOSED	970	CASE CLOSED	06/28/1974		Total Acres =	2,553.890

ALASKAN GEOTHERMAL 100.00000 APPLICANT
6100 CORPORATE DR HOUSTON 770363419 TX

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0220S	0130E	003	ALIQ			S2N2,S2;
33	0220S	0130E	003	LOTS			1-4;

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 011973	321000	CLOSED	970	CASE CLOSED	06/28/1974		Total Acres =	1,920.000

ALASKAN GEOTHERMAL 100.00000 APPLICANT
6100 CORPORATE DR HOUSTON 770363419 TX

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0220S	0130E	010	ALIQ			ALL;

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 011984	321000	CLOSED	970	CASE CLOSED	08/21/1975		Total Acres =	2,557.580

ROBERTS JAMES 100.00000 APPLICANT

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Figure 41: Parcel Number 7 – History

Run Date: 03/26/2014

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Geographic Report with Customer
Sorted by Serial Number

Run Time: 03:48 PM
Page 1 of 1

Admin State: OR

Geo State: OR

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 011994	321000	CLOSED	970	CASE CLOSED	12/31/1997		Total Acres =	195.000

HAWTHORN OIL CO 100.00000 LESSEE
PO BOX 2693 CASPER 82602 WY

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0220S	0130E	017	FF		1	M&B OUTSIDE NEWBERRY MON;

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 047888	321000	CLOSED	970	CASE CLOSED	03/02/1992		Total Acres =	445.000

HAWTHORN OIL CO 0.00000 LESSEE
PO BOX 2693 CASPER 82602 WY

CE EXPLORATION CO 100.00000 ASSIGNEE
302 S 36TH STE 400 OMAHA 68131 NE

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0220S	0130E	017	M&B		1	INSIDE NEWBERRY MONUMENT;

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Figure 42: Parcel Number 8 – History

Run Date: 03/26/2014

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Geographic Report with Customer
Sorted by Serial Number

Run Time: 03:50 PM
Page 1 of 2

Admin State: OR

Geo State: OR

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 011962	321000	CLOSED	970	CASE CLOSED	06/26/1974		Total Acres =	1,915.450

ALASKAN GEOTHERMAL 100.00000 APPLICANT
6100 CORPORATE DR HOUSTON 770363419 TX

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0220S	0130E	018	ALIQ			E2W2,E2;
33	0220S	0130E	018	LOTS			1-4;

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 012669	321000	CLOSED	970	CASE CLOSED	09/25/1997		Total Acres =	1,075.450

MURER CHRISTIAN F 100.00000 LESSEE
1645 COURT PL #201 DENVER 80202 CO

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0220S	0130E	018	FF		1	APPROX 25.45AC OUT OF MON

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 012765	320070	CLOSED	970	CASE CLOSED	08/08/2005	ENERGY POLICY ACT;	Total Acres =	44,628.210

BLM-OREGON STATE OFFICE 100.00000 OFFICE OF RECORD
PO BOX 2965 PORTLAND 972082965 OR

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0220S	0130E	018	ALIQ			E2,E2W2;
33	0220S	0130E	018	LOTS			1-4;

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 012960	321000	CLOSED	970	CASE CLOSED	09/28/1983		Total Acres =	1,915.450

ALASKAN GEOTHERMAL 100.00000 APPLICANT

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Figure 43: Parcel Number 9 – History

Run Date: 03/26/2014

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Geographic Report with Customer
Sorted by Serial Number

Run Time: 03:52 PM
Page 1 of 1

Admin State: OR

Geo State: OR

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks
OROR 011915	321000	CLOSED	970	CASE CLOSED	01/27/1998	

Total Acres = 1,126.020

KRAMER TERRY ALLEN 100.00000 LESSEE
711 5TH AVE NEW YORK 10022 NY

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0220S	0130E	019	M&B		1	486.40 AC OUT OF MON;

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Figure 44: Parcel Number 10 – History

Run Date: 03/26/2014

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Geographic Report with Customer
Sorted by Serial Number

Run Time: 03:53 PM
Page 1 of 1

Admin State: OR

Geo State: OR

Serial Number	Casetype	Disposition	Actn Code	Actn Txt	Date	Action Remarks		
OROR 012433	321000	CLOSED	970	CASE CLOSED	02/08/1999		Total Acres =	637.320

NORTHWEST GEOTHERMAL 100.00000 LESSEE
300 ATLANTIC ST STE 301 STAMFORD 06901 CT

THE HINSDALE CORP 0.00000 OVERRIDING ROYALTY
7 COTTONWOOD CIRCLE ROLLING HILLS 90274 CA

MER	Township	Range	Section	Typ	Sur Nr	Suff	Aliquot Part
33	0220S	0130E	030	ALIQ			E2W2,E2;
33	0220S	0130E	030	LOTS			1-4;

NO WARRANTY IS MADE BY BLM FOR USE OF THE DATA
FOR PURPOSES NOT INTENDED BY BLM

Parcel Number 11 is a new parcel. No history exists regarding leasing.