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Environmental Assessment
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GEOTHERMAL LEASING FOR EIGHT PARCELS
ENVIRONMENTAL ASSESSMENT

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CHAPTER 1. PURPOSE AND NEED

1.1. Introduction

This environmental assessment (EA) has been prepared to disclose and analyze the potential impacts of leasing eight parcels of public land for the exploration and development of geothermal resources. The parcels are located on U.S. Bureau of Land Management (BLM), U.S. Forest Service (USFS), and State of Utah lands in Beaver, Millard, and Juab Counties, Utah (see Figure 1.1).

This EA includes an analysis of potential effects that could result from the implementation of the Proposed Action or its alternative. The EA assists the BLM and USFS in project planning, ensuring compliance with the National Environmental Policy Act (NEPA) of 1969, and determining whether any significant effects could result from the analyzed actions. *Significance* is defined by Council on Environmental Quality (CEQ) regulations for implementing NEPA; its definition is found in 40 Code of Federal Regulations (CFR) 1508.27. An EA provides evidence for determining whether to prepare an environmental impact statement (EIS) or a finding of no significant impact (FONSI). A FONSI is a document that presents the reasons why implementation of the selected alternative would not result in significant environmental effects beyond those already addressed in the BLM's applicable records of decision (RODs) and resource management plans (RMPs or land use plans) and in the *Fishlake National Forest Land and Resource Management Plan* (Forest Plan; USFS 1986). If the decision maker determines that the project would result in non-mitigable significant effects based on the analysis in the EA, a notice of intent to prepare an EIS would be published in the *Federal Register* and an EIS would be prepared for the project.

1.2. Background

Geothermal resources are defined as

- all products of geothermal processes embracing indigenous steam, hot water, and hot brines;
- steam and other gases, hot water, and hot brines resulting from fluids artificially introduced into geothermal formations; and
- heat or other associated energy found in geothermal formations (as well as any byproduct derived from them) (30 United States Code [USC] 1001).

In October 2008, the BLM and the USFS completed a joint programmatic EIS (Geothermal PEIS) to analyze and expedite the leasing of BLM- and USFS-administered lands in 12 western states with a high potential for renewable geothermal resources (BLM 2008a). A ROD was issued for the Geothermal PEIS in December 2008 (Geothermal ROD; BLM 2008b). The decision 1) allocated BLM lands as either open or closed to consideration for geothermal leasing and identified USFS lands that are open or closed to leasing, 2) established a projected new level of potential geothermal development though existing planning level decisions (a reasonably foreseeable development scenario), and 3) adopted stipulations, best management practices (BMPs), and procedures for geothermal leasing and development (BLM 2008b). The Geothermal ROD actions were to be implemented as amendments for 114 BLM land use plans (no USFS land use plans were amended). The BLM makes decisions whether or not to issue geothermal leases in conformance with the amended land use plans on the basis of the analysis in the Geothermal PEIS.

The BLM land use plans that cover the eight lease parcels are the Cedar/Beaver/Garfield/Antimony ROD/RMP (CBGA land use plan; BLM 1986), the Warm Springs Resource Area RMP/ROD (Warm Springs land use plan; BLM 1987a), and the BLM's House Range Resource Area RMP/ROD (House Range land use plan; BLM 1987b). The Geothermal ROD amended only the CBGA land use plan but not the Warm Springs or House Range land use plans. Amendments to the Warm Springs and House Range land use plans were deferred in accordance with provisions of the National Defense Authorization Act, which indicate that the Secretary of the Interior may not proceed with the amendment of any land use plan adjacent to or near the Utah Test and Training Range (UTTR) and Dugway Proving Grounds, or beneath military operating areas, restricted areas, and airspace that make up the UTTR, until a study is submitted that evaluates the impact of any proposed changes on military training, testing, and operational readiness. To date, no Department of Defense impact study as required by the National Defense Authorization Act has been developed or submitted. As noted above, no USFS land use plans were amended as part of the Geothermal ROD (see Appendix A of the Geothermal ROD; BLM 2008b). Based on this information, the three parcels within the CBGA land use plan (lease parcels 1, 2, and 3) are covered for a leasing decision under the Geothermal PEIS and Geothermal ROD. However, the three parcels within the CBGA land use plan are analyzed in this EA with the five remaining parcels not covered under the Geothermal PEIS and Geothermal ROD because the leasing of all eight parcels is a connected action under the requirements of NEPA. Connected actions are "actions that are 'closely related' and 'should be discussed' in the same NEPA document" (BLM 2008c). Section 1.5 contains a discussion of relevant geothermal restrictions for parcels 4 through 8 found in the related land use plans.

This EA provides a programmatic NEPA analysis by focusing on the leasing of the eight parcels rather than the project-specific exploration and development of each parcel (details for the geothermal exploration and development of each parcel are unknown at this time). Broad impacts associated with the allocation of geothermal resources for leasing, along with the adoption of stipulations and BMPs, are analyzed.

In accordance with CEQ regulations (40 CFR 1508.28, 40 CFR 1502.20), this EA is tiered to the Geothermal PEIS and the Geothermal ROD. Tiering uses coverage of general matters in broader NEPA documents to inform subsequent narrower documents. It allows for analysis of a smaller range of alternatives and limits the analysis focus to issues not already addressed (BLM 2008c). Portions of this document incorporate information and analyses from the Geothermal PEIS and Geothermal ROD by reference in accordance with 40 CFR 1502.21.

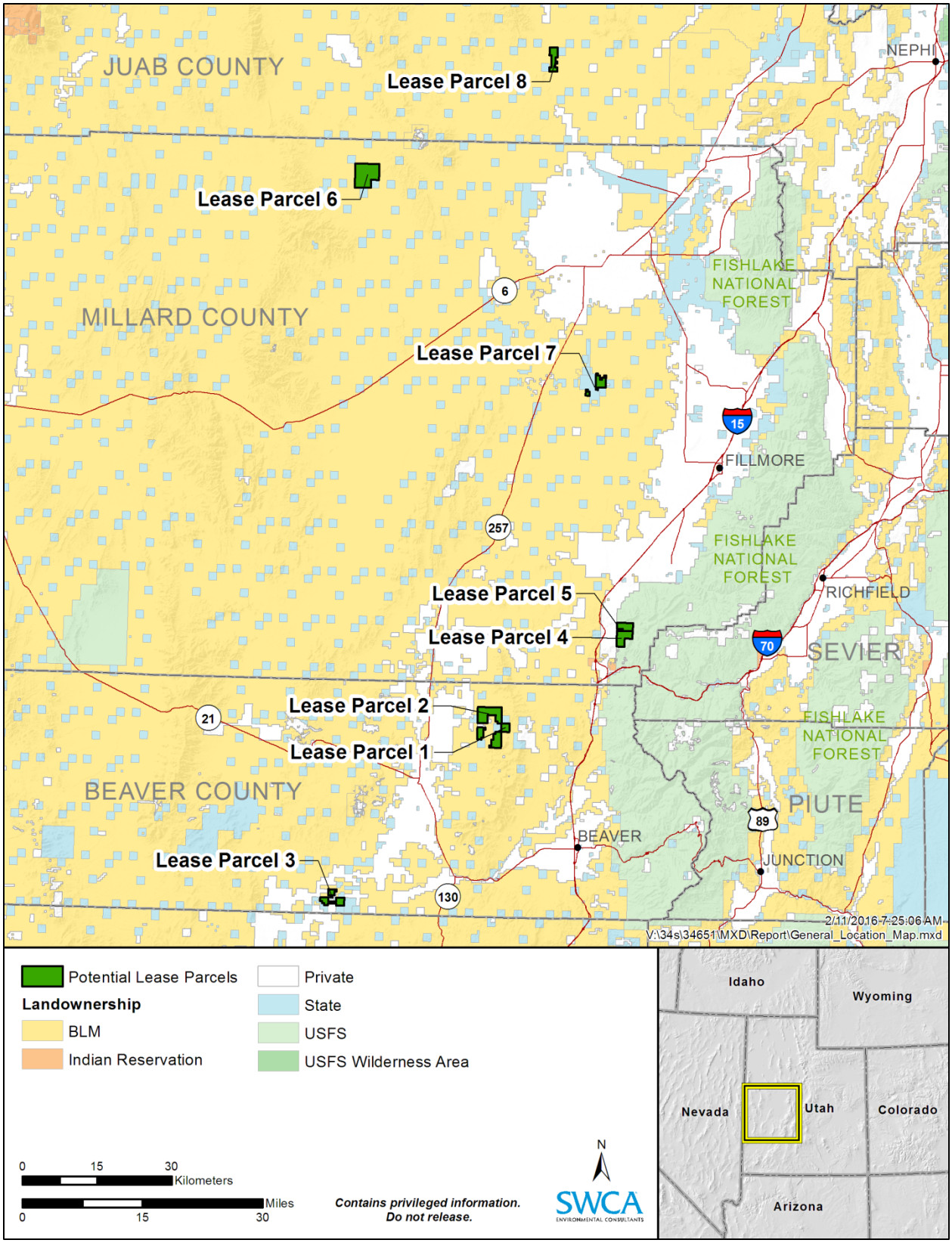

Figure 1.1. Lease parcel location map.

1.3. Purpose of and Need for the Action

In accordance with the Federal Land and Policy Management Act of 1976 (FLPMA) (43 USC 1701 et seq.) and the National Forest Management Act (NMFA) of 1976 (16 USC 1600 et seq.), public lands are to be managed for multiple use taking into account the long-term needs of future generations for renewable and non-renewable resources. BLM is authorized to issue leases for the development of geothermal resources on public lands through the Geothermal Steam Act of 1970 (30 USC 1001–1025) and Geothermal Resource Leasing regulations (43 CFR 3200). The purpose of this BLM action is to respond to geothermal leasing nominations to explore for and produce geothermal resources within eight potential lease parcels (18,817.80 acres) of BLM- and USFS-administered lands in Beaver, Millard, and Juab Counties, Utah.

The Proposed Action, if approved, would assist the BLM in addressing the management objectives in Title II, Section 211 of the Energy Policy Act of 2005, which establishes a goal for the Secretary of the Interior to approve 10,000 megawatts (MWs) of electricity from non-hydropower renewable energy projects located on public lands. The Proposed Action, if approved, would also further the purposes of the March 11, 2009, Secretarial Order 3285A1 that establishes the development of environmentally responsible renewable energy as a priority for the U.S. Department of the Interior.

The USFS is an agency of the U.S. Department of Agriculture. The Geothermal Steam Act requires that geothermal leasing on National Forest System lands be subject to the consent of and conditions prescribed by the Secretary of Agriculture. Section 225(a) of the Energy Policy Act of 2005 (Public Law 109-58) requires the coordination of geothermal leasing and permitting on public lands and National Forest System lands between the Secretary of the Interior and Secretary of Agriculture. In 2006, a memorandum of understanding (MOU) between the U.S. Department of the Interior and U.S. Department of Agriculture was completed implementing the requirements of Section 225 (BLM MOU WO300-2006-08/Forest Service Agreement No. 06-SU-11132428-051). The MOU establishes coordination policies and procedures for geothermal leasing and permitting between the BLM and USFS. In 2014, the BLM and the USFS initiated action to update the 2006 MOU. At this time, the updated MOU is undergoing Washington Office BLM and USFS final surnaming and signature. The USFS authority to consent to leasing has been delegated to the Forest Supervisor with jurisdiction over the lands involved. As such, the Fishlake National Forest Supervisor will decide whether or not to consent to leasing of the parcels on USFS lands and will provide that decision to the BLM's Utah State Office.

1.4. Decision to be Made

The BLM will decide whether to deny the geothermal lease nominations or to approve the lease of such lands in whole or in part with appropriate lease stipulations as determined necessary to protect important affected resources.

A decision to approve the geothermal lease nominations would not authorize surface disturbance from geothermal exploration or development activities. The BLM and USFS would conduct additional environmental analysis and make a new decision for each proposal that involves surface disturbance on a geothermal lease.

If the Proposed Action is approved, the BLM would offer the leases in a competitive sale. Once a lease is issued, the leaseholder would have the right to explore for and develop geothermal resources on the leased land for a term of 10 years, subject to renewal or extension.

1.5. Conformance with Land Use Plans

The Proposed Action affects areas managed by both the BLM and the USFS. Lease parcels 4 and 5 are considered split estate with the subsurface rights managed by the BLM and the surface rights managed by the USFS. The remaining six parcels are each managed by one federal entity as discussed in the following sections.

1.5.1. *CBGA Land Use Plan*

The BLM's Cedar City Field Office manages lands in eastern Beaver County based on decisions in the 1986 CBGA land use plan, as amended by the Geothermal ROD decisions. These lands include lease parcels 1, 2, and 3. The Proposed Action is consistent with the terms, conditions, and decisions in this plan. Specifically, it is consistent with Objective 1 described in the plan's minerals section, as follows:

> Provide maximum leasing opportunities for oil, gas, and geothermal exploration and development by using the least restrictive leasing categories necessary to adequately protect sensitive resources. (BLM 1986)

1.5.2. *Warm Springs and House Range Land Use Plans*

The BLM's Fillmore Field Office manages lands in the southern two-thirds of Millard County based on decisions in the 1987 Warm Springs land use plan, and lands in the northern portion of Millard County and all of Juab County based on decisions in the 1987 House Range land use plan. The Warm Springs land use plan covers lease parcel 7 and the subsurface mineral estate of lease parcels 4 and 5. The House Range land use plan covers lease parcels 6 and 8. Both land use plans emphasize the concept of multiple use management and the protection of unique and sensitive resources while allowing balanced and diverse resource uses. The Proposed Action is consistent with the terms, conditions, and decisions in both plans. It is consistent with the goals and objectives described in the minerals sections of both land use plans, as follows:

- Provide for the discovery, exploration, development, and use of minerals on public lands consistent with applicable laws and regulations. (BLM 1987a; 1987b)
- Require the least restrictive stipulations necessary to adequately protect other resources. (BLM 1987a; 1987b)

The Warm Springs land use plan lists the following planned actions and implementation measures for geothermal resources (BLM 1987a):

- Appropriate environmental protection stipulations will be attached to geothermal leases when issued.
- Appropriate environmental protection conditions of approval and stipulations will be applied to geothermal drilling permits and plans of operations at the time of approval.
- Energy and mineral activities on lands open for such activities will be administered on a case-by-case basis.

The Warm Springs land use plan notes the presence of favorable characteristics normally associated with geothermal resources in the planning area and indicates that there may be good potential for geothermal development. Lease parcels 4 and 5 are located in an area that is categorized as "lands prospectively valuable for geothermal resources" (BLM 1987a). These parcels are also in or near the Cove Fort-Sulphurdale known geothermal resource area (KGRA). Lease parcel 7 is adjacent to the Clear Lake Waterfowl Management Area, portions of which are in fluid mineral leasing categories 2 and 3. Category

2 leases are issued with standard lease terms plus appropriate special stipulations needed to protect resource values. Category 3 leases are issued with no right of surface occupancy and any recovery methods must not disturb the surface (BLM 1987a). Approximately half of lease parcel 7 is located on category 2 land, and a small portion is located on category 3 land.

The House Range land use plan notes that geothermal resource potential ranges from moderate to low in the planning area. It lists the following planned actions for geothermal resources (BLM 1987b):

- Over-the-counter leases will be offered on all areas with fluid mineral leasing categories 1, 2, and 3, except for KGRAs.
- All unleased areas in KGRAs will be offered by competitive sealed bids.

Lease parcel 8 is in an area categorized as "lands classified prospectively valuable for geothermal resources" (BLM 1987b). Both lease parcels 6 and 8 are in fluid mineral leasing category 1, which is open to leasing with standard lease terms (BLM 1987b).

1.5.3. *Forest Plan*

Mineral leases on USFS lands are issued by the U.S. Department of Interior. However, the USFS has the opportunity to perform environmental analysis, recommend actions, list stipulations, and propose requirements for rehabilitation. The USFS-administered portion of the project area is managed by the Fillmore Ranger District of the Fishlake National Forest.

The surface estate of lease parcels 4 and 5 is subject to the Forest Plan approved in 1986. Leasing decisions by the USFS and BLM must conform to the overall guidance in the Forest Plan. The Forest Plan recognizes the potential for geothermal resources in the Cove Fort-Sulphurdale area of the Fishlake National Forest.

The Proposed Action is consistent with the management direction contained in the Forest Plan (Chapter 4, pages IV-1 to IV-160) and associated amendments, as required by the NFMA of 1976 (16 USC 1600–1687). Directions related to geothermal operations and developments are given on pages IV-5 and IV-37 of the Forest Plan. Briefly, the Forest Plan allows for mineral exploration and development as consistent with the management of surface resources, and as protective of surface resources and environmental quality. It indicates that geothermal activities may be limited on slopes steeper than 40 percent, or where the erosion or geological hazard rating is high (USFS 1986). The Forest Plan also states that recommendations of consent to the BLM for issuance of leases and permits will include all current standard stipulations and any additional stipulations that may be necessary for additional protection of specific surface resources and uses. Stipulations for mineral activities, including geothermal leasing, are listed in Appendix H of the Forest Plan (USFS 1986). The 1986 Forest Plan was amended in 2014 for oil and gas leasing. The amendment provides guidance on leasing procedures and appropriate lease stipulations and lease notices for particular resource areas such as watershed resources, wildlife and plant species, and recreation (USFS 2014).

1.6. Relationships to Statutes, Regulations, and Other Plans

The BLM would issue leases for the exploration and development of geothermal resources on each parcel under the Geothermal Steam Act of 1970. This act states that geothermal leases convey the "exclusive right and privilege to drill for, extract, produce, remove, utilize, sell, and dispose of geothermal steam and associated geothermal resources" on the leased lands. To maintain this right, the lessee must "diligently explore the leased lands for geothermal resources until there is production in commercial quantities"

applicable to each of these leases. The lessee must pay annual rentals to the federal government, and has to expend increasing dollars until the production of geothermal resources in commercial quantities is achieved.

Energy production by geothermal resources on BLM land is regulated by 43 CFR 3000, 3200, and 3280. These regulations establish procedures for processing leases, right-of-way (ROW) agreements, geothermal unit agreements, and geothermal permits for activities relating to geothermal resource energy production. The Proposed Action is consistent with the Geothermal Steam Act of 1970 and with other federal laws and regulations, including the promotion of renewable energy under the Energy Policy Act of 2005 (42 USC 15801 et seq.). BLM's regulations have been updated to comply with this law.

The Proposed Action is consistent with local plans. According to the Beaver County zoning map and Zoning Ordinance of Beaver County, the project area is in the Multiple Use District (Beaver County 1993). Drilling for geothermal resources is a conditional use in this district and would require a conditional use permit. The *Millard County General Plan* supports the use and development of natural resources and associated industries and businesses in a responsible manner and in locations that contribute to the economic and social wellbeing of county residents. The general plan also contains objectives that support mineral development activities and the development and use of "green" renewable energy sources, including geothermal energy (Millard County 1998). The Juab County Land Use Code indicates that mineral development and processing are permitted uses in the outlying district. In addition, power plants, transmission lines, wells, and pipelines are permitted in the grazing, mining, recreation, and forestry district (Juab County 2014). The project area is in the outlying district. Geothermal resources are considered leasable minerals by the BLM but are undefined in the Juab County Land Use Code. Assuming geothermal development is considered mineral development, it would be a permitted use in Juab County.

The issuing of leases for geothermal development would be processed and evaluated under BLM statutory mandates and authority governing federal land leasing, and under other statutes, regulations, plans, programs, and policies of affiliated tribes; other federal agencies, and state and local governments to the extent practicable, including the following non-exhaustive list of statutes and regulations:

- 36 CFR 800 (Protection of Historic Properties)
- 43 CFR 3260 (Geothermal Drilling Operations - General)
- The American Indian Religious Freedom Act of 1978, as amended (42 USC 1996)
- The Archaeological Resources Protection Act of 1979, as amended (16 USC 470aa et seq.)
- The Clean Water Act of 1977, as amended (33 USC 1251 et seq.)
- The Endangered Species Act of 1973 (ESA), as amended (16 USC 1531 et seq.)
- Executive Order 13175 of November 6, 2000 (Consultation and Coordination With Indian Tribal Governments)
- Executive Order 13186 of January 10, 2001 (Responsibilities of Federal Agencies To Protect Migratory Birds)
- FLPMA of 1976, as amended (43 USC 1701 et seq.)
- NFMA of 1976 (16 USC 1600 et seq.)
- NEPA (43 USC 4321 et seq.)
- Title 54 USC 300101 et seq. National Park Service and Related Programs (formerly known as the National Historic Preservation Act (NHPA) of 1966)

- The Native American Graves Protection and Repatriation Act of 1990, as amended (25 USC 3001 et seq.) and 43 CFR 10 (Native American Graves Protection and Repatriation Regulations)
- U.S. Fish and Wildlife Service (USFWS) Bald and Golden Eagle Protection Act, as amended (16 USC 668 et seq.)
- BLM Manual 6840, Special Status Species Management (BLM 2008d)
- *Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbances* (Romin and Muck 2002)
- *Best Management Practices for Raptors and Their Associated Habitat in Utah*, August 2006 (BLM 2006)
- Applicable Utah Drinking Water rules (Utah Administrative Code [UAC] R309)
- Applicable Utah Water Quality rules (UAC R317), including Ground Water Quality Protection rule (UAC R317-6)

1.7. Identification of Issues

1.7.1. *Scoping Process*

The BLM's Cedar City and Fillmore Field Offices began the issue identification process by conducting internal scoping with interdisciplinary (ID) teams of BLM resource specialists for the appropriate parcels within their jurisdiction. In a February 12, 2014 letter, the BLM Utah State Office requested that the USFS review the two parcels in the Fishlake National Forest (lease parcels 4 and 5) to provide consent for leasing and to identify any lease stipulations or notices necessary to protect surface resources. The USFS also conducted internal scoping. In addition, a public notice requesting comment on the leasing of geothermal resources on the USFS parcels was published in *The Richfield Reaper* on October 8, 2014. No public comments have been received to date. A complete list of consultation is provided in Chapter 5 (Consultation and Coordination).

1.7.2. *Issues*

Appendix A of this EA (ID Team Checklists) contains the Cedar City and Fillmore Field Offices' and the USFS checklists of all resources and issues considered, including some of the common supplemental authorities that provide procedural or substantive responsibilities relevant to identifying issues for analysis in the NEPA process. As a result of the information and documentation contained in Appendix C, resources or issues that are identified in the checklists as not impacted by the Proposed Action or not present at the project area are not discussed further in this EA. The elimination of non-relevant resources is consistent with 40 CFR 1500.4. However, the following resources or issues were identified as potentially impacted on certain lease parcels in the ID Team checklists:

- **Cultural resources and Native American religious concerns (all lease parcels):** How would geothermal exploration, development, and operation activities following a lease sale of the eight parcels affect cultural resources and Native American religious concerns? For example, project-related surface disturbance could affect cultural resources determined eligible for the National Register of Historic Places (NRHP), other culturally important locations, or cultural resources that are especially valuable to Native Americans.

- **Wildlife (excluding special status species) (all lease parcels):** How would geothermal exploration, development, and operation activities following a lease sale of the eight parcels affect wildlife? For example, human activity and surface disturbance could cause direct mortality to individuals, impede daily activities, displace individuals from normal habitat, or disrupt normal breeding behavior and breeding success. Portions of the project area are in crucial and/or substantial habitat for mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), Rocky Mountain elk (*Cervus elaphus nelsoni*), and black bear (*Ursus americanus*).
- **Recreation (lease parcels 4, 5, and 8):** How would geothermal exploration, development, and operation activities following a lease sale of the parcels affect recreation? For example, exploration and development could result in limitations on hunters in popular hunting areas.
- **Soils (all lease parcels):** How would geothermal exploration, development, and operation activities following a lease sale of the parcels affect soils? For example, exploration and development could result in direct impacts to soils, including erosion (especially on steep slopes or in sensitive soils), soil compaction, and loss of topsoil and its productivity.
- **Special status animal species (all lease parcels):** How would geothermal exploration, development, and operation activities following a lease sale of the eight parcels affect special status species? For example, the project area may provide habitat for BLM sensitive species. Human activity and surface disturbance could cause direct mortality to individuals, impede daily activities, displace individuals from normal habitat, or disrupt behavior.
- **Migratory birds (all lease parcels):** How would geothermal exploration, development, and operation activities following a lease sale of the eight parcels affect migratory birds? For example, human activity and surface disturbance could cause direct mortality to migratory birds and impede daily activities, displace individuals from normal habitat, or disrupt normal breeding behavior and reduce breeding success.
- **Water resources (all lease parcels):** How would geothermal exploration, development, and operation activities following a lease sale of the parcels affect surface water, groundwater, water quality, and hydrology? For example, there could be a drawdown of the geothermal reservoir or other aquifers to provide water for drilling, construction, and operations. Geothermal exploration, development, and operations can also result in impacts to water resources such as springs, including changes in water quality and flow.
- **Wetlands, riparian zones, and floodplains (all lease parcels):** How would geothermal exploration, development, and operation activities following a lease sale of the parcels affect wetlands, riparian zones, and floodplains? For example, intermittent streams are located on all of the parcels and wetlands are located on parcel 7. Surface disturbing activities can result in negative impacts to streams and wetlands, such as the introduction of sediment.
- **Inventoried roadless areas (IRAs) (lease parcels 4, 5):** How would geothermal exploration, development, and operation activities following a lease sale of the parcels affect designated IRAs? For example, would roadless area characteristics be changed by the drilling, construction, and operation of geothermal facilities?

CHAPTER 2. DESCRIPTION OF ALTERNATIVES

2.1. Introduction

This EA analyzes the potential effects of implementing the Proposed Action and the No Action Alternative. The No Action Alternative is considered and analyzed to provide a baseline against which to compare the impacts of the Proposed Action. No other alternatives were brought forward for detailed analysis.

2.2. Proposed Action

2.2.1. *Geothermal Lease Parcel Details*

The Utah State Director of the BLM proposes to lease the eight parcels described in Table 2.1 for geothermal resources. Leasing is expected to occur in October 2016.

Table 2.1. Eight Geothermal Lease Parcel Nominations

Parcel Number	Serial Number	BLM Field Office	Surface Management Agency	County	Title Record Acreage
1	UTU-086142	Cedar City	BLM	Beaver	2,841.4
2	UTU-086143	Cedar City	BLM	Beaver	3,160.0
3	UTU-090200	Cedar City	BLM	Beaver	1,760.8
4	UTU-086295	Fillmore	USFS (Fishlake National Forest)	Millard	1,865.0
5	UTU-086298	Fillmore	USFS (Fishlake National Forest)	Millard	1,180.2
6	UTU-090483	Fillmore	BLM	Millard	5,120.0
7	UTU-090273	Fillmore	BLM, State of Utah*	Millard	1,366.2
8	UTU-090271	Fillmore	BLM	Juab	1,533.6

Notes: Subsequent acreages used in the EA are derived or calculated from available GIS data; small discrepancies may exist between the title record acreage and total acres reported.

*48.2 acres (derived from GIS data) or 3.5% of the title record acreage of lease parcel 7 are administered by the Utah Division of Wildlife Resources.

Figure 1.1 shows the location of each parcel. Legal descriptions of the geothermal lease parcel nominations can be found in Appendix B. The eight lease parcels cover an area of 18,817.8 acres and encompass BLM, USFS, and State of Utah–managed lands that are open to fluid mineral leasing. The parcels would be offered for lease through a competitive sale. If not leased at the end of the competitive sale process, the parcels would then be available for noncompetitive leasing.

Geothermal resource exploration and production on the parcels would be conducted through leases with the BLM, would be subject to terms and stipulations presented in the Geothermal ROD and this EA, and would comply with all applicable federal and state laws. Subsequent proposals for exploration and/or development on specific parcels would be examined for conformance with the appropriate land use plan and must be analyzed as required by NEPA prior to implementation.

2.2.2. Lease Stipulations and Best Management Practices

This EA incorporates by reference the lease stipulations and BMPs from the Geothermal ROD (Section 2.3, pages 2-4 through 2-9, and Appendix B). The incorporated section includes no surface occupancy (NSO), timing limitations (TL), and controlled surface use (CSU) lease stipulations to protect resources, including IRAs. The lease stipulations would apply to any potential future geothermal exploration and development on the eight parcels as a result of lease sales.

The BMPs incorporated from Appendix B of the Geothermal ROD, are "applied on a site-specific basis to avoid, minimize, reduce, rectify, or compensate for adverse environmental or social impacts" (BLM 2008b). They may be voluntarily included in the permit application by the lessee or incorporated in the use authorization by the BLM as conditions of approval. The Geothermal ROD includes BMPs for information collection and monitoring; planning, location, and design; construction; operations; reclamation; and specific resources. For the purposes of this EA, the lease stipulations and BMPs are considered design features of the Proposed Action, and it is assumed that all relevant lease stipulations and BMPs would be implemented for each lease parcel.

Specific lease stipulations and conditions described in the Warm Springs and House Range land use plans and in the Forest Plan may apply to the parcels under the jurisdiction of each plan, at the discretion of the BLM or USFS.

2.2.3. Reasonably Foreseeable Development Scenario

The reasonably foreseeable development (RFD) scenario used in this EA is based on the RFD scenario presented in the Geothermal ROD and serves as a basis for analyzing environmental impacts resulting from future leasing and development of the eight geothermal lease parcel nominations listed above. The RFD in the Geothermal ROD was largely based on the *Clean and Diversified Energy Initiative. Geothermal Task Force Report* prepared for the Western Governors' Association (Western Governors' Association 2006). The BLM reviewed the RFD in the Geothermal ROD and more current information on geothermal development potential in the State of Utah (Berry et al. 2009) and concluded that the RFD remains valid and applicable for use in this EA analysis regarding anticipated RFD extents. The BLM's review of the RFD's validity determined that neither geothermal exploration, development, and production technology and processes nor Utah geothermal resource estimates have changed since 2008.

A variety of factors influencing the demand for geothermal resources (e.g., economic, social, and political) are beyond government control. 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. Because of these unknowns, the RFD scenario is a best professional estimate of what may occur if the eight parcels are leased. It is not intended to be a maximum development scenario. It allows for a general evaluation of the types of impacts that may occur but cannot accurately predict the magnitude and extent of project impacts, due in part to uncertainty about timing, location, the distribution of geothermal resources, and the types of development. If future development eventually exceeds RFD predictions, the BLM and USFS would re-assess the resource impacts under the context of the analysis provided in the Geothermal PEIS, this EA, and relevant land use plans, and then determine if additional analysis is warranted.

A typical geothermal power project within the physiographic Basin and Range Province of Utah and Nevada encompasses a single power plant and associated geothermal well field (facilities). A geothermal electrical generation project usually requires several geothermal leases and often the use of adjacent private or state lands. For the purposes of this EA, the BLM assumes that one 50-megawatt (MW) power

plant and associated facilities could be developed on each potential lease parcel. Rather than assess potential project impacts across multiple adjacent leases or lands, allocating development to a single potential lease parcel allows for the evaluation of a maximum surface disturbance scenario. BLM anticipates moderate to high temperature geothermal resources as the most likely to be discovered in these parcels. Moderate temperature geothermal resources range from 194 to 302 degrees Fahrenheit; high temperature geothermal resources have temperatures greater than 302 degrees Fahrenheit (BLM 2008a). Historically, the development of this type of geothermal resource involves a total of six to eight wells (three to four successful production wells and two to three successful injection wells) with one binary power plant. The power plants are designed based on actual flow rates and temperatures determined during the exploratory phase, and typically range from 20 to 50 MW gross electrical generation capacity with an average power plant size of 30 MW gross generation.

2.2.4. *Typical Phases of Geothermal Development*

This EA incorporates by reference the description of typical geothermal development phases from the Geothermal PEIS (Section 2.5.1, pages 2-40 through 2-48 and Section 2.5.2, pages 2-51 through 2-52). These sections of the Geothermal PEIS describe the activities and surface disturbance associated with the four sequential geothermal development phases: exploration, drilling, utilization, and reclamation and abandonment. The four geothermal development phases are briefly summarized in Figure 2-1.

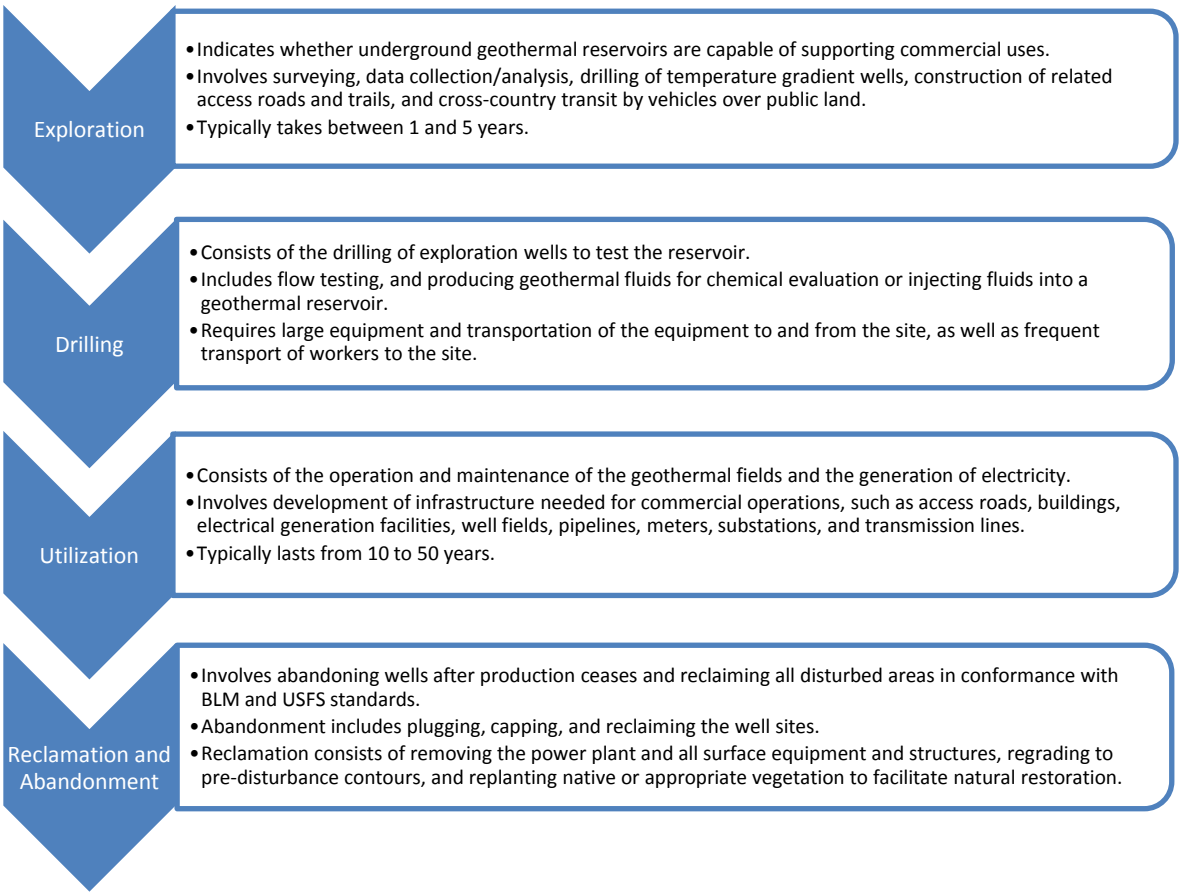

Figure 2.1. Four phases of geothermal development.

2.2.5. *Surface Disturbance Summary*

As described in Section 2.2.3, a typical geothermal electrical generation project requires several leases and often the use of adjacent private or state lands. For the purposes of this EA, the projected surface disturbance for a potential 50-MW power plant and associated facilities on each lease parcel is based on the estimates provided in the Geothermal PEIS (Chapter 2, Tables 2-8 and 2-9). This information is hereby incorporated by reference, including table assumptions. Total projected surface disturbance for the eight lease parcels is shown in Table 2.2.

Table 2.2. Estimated Surface Disturbance for a 50-MW Power Plant and Well Field Facilities

Activity and Component	Surface Disturbance Per Lease Parcel (acres)	Total Surface Disturbance for All Lease Parcels (acres)
Exploration		
Geophysical surveys, road construction, temperature gradient wells	2–7	16–56
Drilling Operations and Utilization		
Access roads	4–32	32–256
Well pads*	5–50	40–400
Pipelines	5–20	400–160
Power plant	25	200
Electrical transmission lines	24–240	192–1,920
Total	**65–374**	**520–2,992**

Notes: The BLM assumes that one 50-MW power plant and associated facilities would be developed on each potential lease parcel. Normally, a geothermal project requires several leases and the use of adjacent private or state lands.

A surface disturbance range is typically provided because the actual area of disturbance varies greatly depending on site conditions.

* Assumes eight well pads per 50-MW plant.

As shown in Table 2.1, total estimated surface disturbance per parcel ranges from 65 to 374 acres, which on the smallest parcel (lease parcel 5) comprises 5.5% to 31.8% of the entire parcel and on the largest parcel (lease parcel 6) comprises 1.3% to 7.3% of the entire parcel. In general, surface disturbance would cover less than one-third of each parcel. The maximum projected total surface disturbance on all eight parcels is estimated to be 2,992 acres or 15.9% of the 18,817.8-acre project area. The minimum projected total surface disturbance is estimated to be 520 acres or 2.8% of the 18,817.8-acre project area.

2.3. No Action Alternative

Under the No Action Alternative, the BLM and USFS would deny the geothermal leasing nominations for the eight parcels. Without leasing, exploration and development of geothermal resources would not occur on the parcels. The parcels would continue to be used primarily for open space, livestock grazing, wildlife habitat, roads, and undeveloped recreational uses.

The No Action Alternative could be chosen if activities under the Proposed Action would result in undue and unnecessary degradation of public lands. The Proposed Action could also be revised so that leasing and the resulting exploration and development could be completed without causing undue or unnecessary degradation.

2.4. Alternatives Considered but Eliminated from Further Analysis

For an EA where there are no unresolved conflicts concerning alternative uses of available resources, only the Proposed Action requires consideration (BLM 2008c). Other alternatives do not need to be analyzed. In this EA, no unresolved conflicts with respect to alternative uses have been identified, and only the Proposed Action and No Action Alternative are considered.

CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1. Introduction

The affected environment of the Proposed Action and No Action Alternative was considered and analyzed by BLM and USFS ID teams and documented in ID team checklists. The ID team checklists indicate which resources of concern are either not present in the project area or would not be impacted to a degree that requires detailed analysis. A summary of resources that were determined to be present in or near the lease parcels with potential for significant impact is presented in Table 3.1 below. The complete ID team checklists are included in Appendix A.

This chapter describes the existing environment and trends of the area that would be affected by the Proposed Action or the No Action Alternative, and discloses the potential impacts of the alternatives. The data used to describe the affected environment and to disclose environmental effects that could result from the Proposed Action or the No Action Alternative were collected from agency geospatial datasets. A level of uncertainty is associated with any dataset in terms of predicting outcomes, especially when natural systems are involved.

Table 3.1. ID Team Checklist Summary: Resources with Potential for Relevant Impact

Resource	Agency	Lease Parcels Potentially Impacted	Rationale
Cultural resources	Cedar City Field Office	1, 2, and 3	Recent cultural resource inventories in and within 1 mile of the lease parcels identified historic properties that may be adversely affected. Some parcels intersect the NRHP-listed Wild Horse Canyon obsidian quarry, the Negro Mag Wash quarry site, and the Roosevelt Hot Springs mining district. Also within 1 mile of lease parcel 3 is Thermo Hot Springs, which is a culturally important location to the Confederated Tribes of the Goshute Reservation and the Paiute Indian Tribe of Utah.
	Fillmore Field Office	6, 7, and 8	A recent cultural resource literature review indicates that cultural resources are known to exist within and around the lease parcels. The potential for locating cultural resources within the parcels is moderate to low, but analysis of the reasonably foreseeable impacts of leasing on both identified and unidentified cultural properties resulted in an adverse effect. Lease stipulations to protect cultural resources are recommended.
	USFS	4, 5	USFS has knowledge of cultural resource sites in the lease parcels.
Fish and wildlife, excluding special status species	Cedar City Field Office	1, 2, and 3	Lease parcels should be reviewed for the occurrence of Utah Division of Wildlife Resources (UDWR) mapped habitat for mule deer and pronghorn. Parcels 1 and 2 are both in crucial mule deer winter range, and all three parcels are in crucial yearlong pronghorn range. Parcel 1 is within substantial yearlong Rocky Mountain elk range. Parcels 1 and 2 are in mapped UDWR areas for upland game species.
	Fillmore Field Office	6 and 8	Crucial and/or substantial habitat occurs within or near parcels 6 and 8. Future construction, operations, maintenance, and decommissioning have the potential to directly and indirectly (temporarily or permanently) alter pronghorn habitat and species behaviors. Therefore, appropriate wildlife habitat and species surveys would be required.
	USFS	4 and 5	UDWR has identified crucial and/or substantial habitat for big game species in lease parcels 4 and 5. Future construction, operations, maintenance, and decommissioning have the potential to directly and indirectly (temporarily or permanently) alter mule deer and elk habitat, migration routes, species behaviors, and winter survival. Appropriate wildlife habitat and species surveys would be required. Additional measures such as off-site habitat improvement and crossing structures may be needed to mitigate negative effects.
Floodplains	USFS	4 and 5	Dog Valley Creek and other non-perennial streams are in the area; analyze to determine if stipulations and BMPs apply.
Hydrologic conditions (analyzed as part of Water Resources)	USFS	4 and 5	Dog Valley Creek and other non-perennial streams are in the area; analyze to determine if stipulations and BMPs apply.
Migratory birds	Cedar City Field Office	1, 2, and 3	The lease parcels provide habitat for a variety of migratory birds and raptors. Appropriate lease notices should be attached.
	Fillmore Field Office	6, 7, and 8	Migratory birds are known to occur in and near the parcels. Future construction, operations, maintenance, and decommissioning have the potential to directly and indirectly (temporarily or permanently) alter migratory bird habitat and species behaviors. Therefore, appropriate wildlife habitat and species surveys would be required on the three parcels.
	USFS	4 and 5	Migratory birds are known to occur in and near the parcels. Future construction, operations, maintenance, and decommissioning have the potential to directly and indirectly (temporarily or permanently) alter migratory bird habitat and species behaviors. Therefore, appropriate wildlife habitat and species surveys would be required for parcels 4 and 5.

Table 3.1. ID Team Checklist Summary: Resources with Potential for Relevant Impact

Resource	Agency	Lease Parcels Potentially Impacted	Rationale
Native American religious concerns	Cedar City Field Office	1, 2, and 3	Native American consultation is needed because of the types of cultural resources that would be impacted by this project. Also, this type of project is not covered under the existing MOU.
	Fillmore Field Office	6, 7, and 8	Consultation with Native American tribes must be completed for this project. The BLM Utah State Office will coordinate and complete all consultations.
Recreation	Fillmore Field Office	8	Sections 3 and 10 of parcel 8 are located in an area that limits travel to existing and/or designated roads and trails. The remaining lease parcels are located in open areas with no travel restrictions.
	USFS	4 and 5	Both parcels are in popular big game and shed antler hunting areas. Dispersed camping is permitted, and camps are prevalent during the fall hunting season. These lease parcels are adjacent to the Missouri Flat Cooperative Wildlife Management Unit, which receives increased use during hunting seasons. Forest roads FR108, FR883, and FR884 provide access to recreationists and fall within the lease parcels. FR108 provides access to an all-terrain vehicle (ATV) trail that is part of the Piute ATV trail network. To comply with the Forest Plan, access should be maintained to these routes for recreation purposes. Specific Forest Plan standards and guides relevant to recreation resources should be considered.
Soils	Cedar City Field Office	1, 2, and 3	Soils would be affected by physical disturbance through movement or removal and compaction. Changes to erosion patterns could occur; development on steep slopes would increase erosion and the risk of landslides.
	Fillmore Field Office	6, 7, and 8	Leasing the parcels would not directly affect soils. However, ground-disturbing activities necessary to develop geothermal resources could affect soils (e.g., permeability, infiltration rates, and productivity).
	USFS	4 and 5	Soils would be impacted by geothermal activities; the level of impact would determine the need for stipulations and BMPs.
Special status animal species	Cedar City Field Office	1, 2, and 3	There are no threatened, endangered, or candidate species identified within lease parcels 1, 2, or 3. Parcel 2 provides habitat for the kit fox (*Vulpes macrotis*), and parcel 3 has an identified ferruginous hawk (*Buteo regalis*) nest. A small portion of greater sage-grouse (*Centrocercus urophasianus*) winter habitat has been identified in parcel 3. Parcel 3 is currently located in the general habitat management area for greater sage grouse. This parcel is located more than 4 miles from a lek and would not be closed to leasing or subject to any seasonal buffers or restrictions.
	Fillmore Field Office	6, 7, and 8	There are no known threatened, endangered, or candidate wildlife species in or reasonably near the three lease parcels. Parcel 8 is south of the Sheeprocks sage-grouse management area and is not within suitable sage-grouse habitat; no further consideration is required. BLM special status species including golden eagle (*Aquila chrysaetos*), bald eagle (*Haliaeetus leucocephalus*), ferruginous hawk, shorebirds, bats, waterfowl, least chub (*Lotichthys phlegethontis*), and kit fox are known to occur in or near the parcels. Future construction, operations, maintenance, and decommissioning have the potential to directly and indirectly (temporarily or permanently) alter habitat and species behaviors. Therefore, appropriate wildlife habitat and species surveys for special status species would be required.
	USFS	4 and 5	There are no threatened, endangered, or candidate wildlife species known to occur in or reasonably near the lease parcels. Neither parcel is in nor near suitable sage-grouse habitat; no further consideration is required for this species. BLM special status species including golden eagle, bald eagle, ferruginous hawk, shorebirds, bats, waterfowl, and kit fox are known to occur in or near the proposed parcels. Future construction, operations, maintenance, and decommissioning have the potential to directly and indirectly (temporarily or permanently) alter habitat and species behaviors. Therefore, appropriate wildlife habitat and species surveys for special status species would be required on parcels 4 and 5.

Table 3.1. ID Team Checklist Summary: Resources with Potential for Relevant Impact

Resource	Agency	Lease Parcels Potentially Impacted	Rationale
Water resources/ quality (drinking/ surface/ground)	Cedar City Field Office	1, 2, and 3	Surface and groundwater could be affected by exploration, drilling, utilization, and reclamation.
	Fillmore Field Office	6, 7, and 8	The leasing activity itself has no consequence to water resources. However, it is estimated that approximately 10,000,000 gallons per day of geothermal waters would be used by each developed facility, and additional groundwater sources may be used for cooling. Impacts would vary greatly depending on the nature of the geothermal development, but could include the possible communication of waterbodies, discharges of geothermal or cooling water from operations, well drilling, spills or ruptures of pipes, discharges of condensates from cooling waters, and some erosion and runoff concerns. The condensation or spills of geothermal waters or even evaporation of separate groundwaters could result in the concentration of contaminants, including airborne deposition to soils that might be mobilized by runoff or percolation to shallow groundwater. Substantive geologic/hydrogeologic information would be needed, and groundwater modeling is likely. Lease stipulations would be necessary and BMPs are potentially needed depending on the nature of the actual geothermal operation. Ground and surface water monitoring is highly likely, and soil monitoring may be needed for airborne delivery of condensed/evaporated water contaminants. Parcel 7 is located near surface waters. Parcel 8 is located approximately 5 miles north of the popular and heavily used Baker Hot Springs. Private and public drinking water sources should be identified and evaluated in future proposed development activities. Existing water rights should be evaluated for potential impairment or interference through drawdown of water levels, increased temperature, or unacceptable pollutants and minerals from possible interaction with geothermal waters. Baseline sampling of certain surface waters, springs, and groundwater is anticipated before any on-the-ground action occurs.
	USFS	4	There is a groundwater protection zone within 0.75 mile south of lease parcel 4. Impacts to the groundwater protection zone should be analyzed to determine the need for stipulations and BMPs. Surface and groundwater water quality should not be degraded, as required by state water quality standards.
Wetlands/riparian zones	Fillmore Field Office	7	Wetlands and riparian zones are present in Parcel 7. Riparian zones have the potential to be impacted unless BMPs that contain the stipulations of the Utah Riparian Management Policy (BLM 2005) are implemented. These stipulations are that "No new surface disturbing activities would be allowed within 100 meters of riparian zones unless it can be shown that; A) There are no other alternatives or B) all long term impacts can be fully mitigated or the activity will benefit or enhance the riparian area."
	USFS	4 and 5	There are no official U.S. Geological Survey (USGS) mapped wetland areas, but springs and riparian zones along stream channels are within the lease parcels. Field review for small wetlands might be needed in the area to gauge the need for stipulations and BMPs.
Lands with wilderness characteristics	USFS	4 and 5	Lease parcels 4 and 5 contain portions of the Pyramids and Dog Valley IRAs. As specified in Section 2.2.2 of the EA, NSO lease stipulations may be implemented to protect resources such as IRAs. NSO for IRAs is consistent with the Forest Plan under special stipulations.

3.2. General Setting

The eight lease parcels are located in west-central Utah, with six parcels west of the Interstate 15 corridor and two parcels east of the corridor. In the overall region, the land typically slopes gently from east to west. The general setting of each lease parcel is described in Table 3.2.

Table 3.2. General Setting of Each Lease Parcel

Parcel Number	County Setting	Township, Range, Sections	Distance from Nearest Town (population greater than 500)	Elevation Range (feet)
1	Western slope of the Mineral Mountains at the northern end of the Escalante Desert, in the northeastern quarter of Beaver County	Township 27 South, Range 9 West, Sections 1 and 14 and portions of 4, 9, 11, and 15	8.9 miles from Milford	5,649–7,408
2	Western slope of the Mineral Mountains north of parcel 1, in the northeastern quarter of Beaver County	Township 26 South, Range 9 West, Sections 26–28 and 33 and portions of 34 and 35	10.2 miles from Milford	5,467–7,370
3	Escalante Valley, along the south border of central Beaver County	Township 30 South, Range 12 West, Sections 27 and portions of 21, 28, and 29	13.9 miles from Minersville	5,025–5,108
4	Straddles an old alluvial fan adjacent to Dog Valley and the western slopes of the Pahvant Range, in the southeast corner of Millard County	Township 25 South, Range 6 West, Sections 4, 5, and 8	20.3 miles from Elsinore	5,806–7,720
5	Immediately north of parcel 4 on the western slopes of the Pahvant Range, in the southeast corner of Millard County	Township 24 South, Range 6 West, Sections 33 and portions of 32	20.3 miles from Elsinore	5,897–6,811
6	Whirlwind Valley between the House Range/Swasey Mountains to the west and the Little Drum Mountains to the east, along the north border of central Millard County	Township 15 South, Range 12 West, Sections 22–27, 34, and 35	27.0 miles from Hinckley	5,060–5,360
7	Sevier Desert/Black Rock Desert, in the central portion of eastern Millard County	Township 19 South, Range 7 West, Sections 35 and portions of 26, 27, and 34 Township 20 South, Range 7 West, portions of Sections 3 and 4	13.5 miles from Hinckley	4,579–4,655
8	Sevier Desert/Black Rock Desert, in the southern border of central Juab County	Township 13 South, Range 8 West, Section 3 and portions of 10 and 15	24.1 miles from Delta	4,586–4,615

Utah is divided into three major physiographic provinces: the Basin and Range Province, the Colorado Plateau Province, and the Middle Rocky Mountains Province. Each province has characteristic landforms and geology. Two of the provinces overlap to form a fourth distinctive physiographic region called the Basin and Range-Colorado Plateau Transition Zone (Transition Zone), which contains structural and stratigraphic characteristics of both provinces. Six of the eight lease parcels are located in the Basin and Range Province; lease parcels 4 or 5 may be on the west edge of the Transition Zone (there is some disagreement on the boundaries of this zone). The Basin and Range Province is known for numerous north-south-oriented, fault-tilted mountain ranges separated by intervening, broad, sediment-filled basins (Blackett and Wakefield 2002). The higher temperature geothermal areas in Utah occur either in the Basin

and Range Province or within the Transition Zone, with a few exceptions. In central and western Utah, most thermal areas are located in valleys near the margins of mountain blocks and are likely controlled by active Basin and Range faults (Blackett and Wakefield 2002).

Beaver County's average high summer temperature is 78 degrees Fahrenheit and its average low winter temperature is 21 degrees Fahrenheit. The county receives an average of 12 inches of annual precipitation (Beaver County Travel Council 2014). Millard County has an average maximum temperature of 66 degrees Fahrenheit and an average low temperature of 38 degrees Fahrenheit. The county receives an average of 14 inches of precipitation annually (Millard County Travel 2016). Juab County receives an average of 13.5 inches of precipitation annually. The average July temperature in Juab County is 76.1 degrees Fahrenheit and the average January temperature is 29.2 degrees Fahrenheit (Juab Travel Council 2007).

3.3. Cultural Resources

The federal management agencies for all eight lease parcels have determined that leasing the parcels may have a potential impact on cultural resources. This section presents the affected environment and analyzes potential impacts to cultural resources on all eight parcels.

Cultural resources include archaeological resources, which are the material remains of past human activity. Archaeological resources can be either prehistoric or historic in age (i.e., dating to either before or after the time of Euro-American settlement). They include artifacts that are portable objects of human manufacture; features such as fire pits, houses, and other types of structures; rock art; and archaeological sites where any of the above may be found. Cultural resources also include other types of places that are important to the heritage of contemporary peoples (e.g., traditional cultural properties).

Cultural resources are protected primarily through Title 54 USC 300101 et seq. National Park Service and Related Programs (formerly known as the NHPA of 1966) and Title 54 USC 306108 (commonly known as Section 106 of the NHPA), the Archaeological and Historic Preservation Act of 1974, and the Archaeological Resources Protection Act of 1979. Section 106 of the NHPA requires federal agencies to consider the effects of their actions on cultural resources that are listed on or eligible for the NRHP. Such cultural resources are known as "historic properties." Criteria for NRHP eligibility are provided in 36 CFR 60.4. Section 101(d)(6)(A) of the NHPA allows properties of traditional religious and cultural importance to a tribe to be determined eligible for the NRHP.

3.3.1. *Affected Environment*

A cultural resources literature review for the eight proposed lease parcels was conducted in 2015 and 2016 to identify the extent of previous cultural resources investigations and the number, type, and density of known archaeological sites and other potential cultural resources in the proposed lease parcels (SWCA 2016a). During the literature review, file searches were performed at the Utah Division of State History, the BLM Cedar City Field Office, and the Fishlake National Forest office to identify cultural resources in the eight lease parcels and within 1 mile of these areas (the file search areas). With permission from the BLM Fillmore Field Office, a file search specifically for the literature review was not conducted at the BLM Fillmore Field Office because SWCA had previously obtained all of the Fillmore Field Office management area cultural resources records electronically between October 2014 and January 2015. Further, the Fillmore Field Office was aware of no new projects or sites relevant to the literature review (Whitman-Moore 2015). All cultural resource information was analyzed for the area of potential effects for each lease parcel, which is defined as the entire parcel being offered for the geothermal lease sale. General Land Office plat maps and several geographic information systems (GIS) layers were also

examined for potential cultural resources that may be present. These layers include the NRHP properties, Utah historic trails, Utah historic districts, Utah mining districts, historical topographic maps, and other historical aerial imagery. Results of the literature review are described in *Literature Review of Eight Proposed Bureau of Land Management Geothermal Lease Parcels (UTU-086142, UTU-086143, UTU-090200, UTU-086295, UTU-086298, UTU-090483, UTU-090273, and UTU-090271) in Beaver, Millard, and Juab Counties, Utah* (Literature Review Report; SWCA 2016a).

Table 3.3 provides a summary of previously conducted cultural resources inventories and recorded sites for all lease parcels, as described in the Literature Review Report. The table also presents the results of additional research performed as part of the literature review.

Table 3.3. Literature Review Report Summary

Parcel Number	Number of Previous Cultural Surveys Conducted in the File Search Area	Recorded Sites in the Lease Parcel	Status of Recorded Sites in the Lease Parcel	Utah Mining Districts and Geothermal Areas; Areas or Features of Tribal Concern; Potential Historic Features in the Lease Parcel
1	53* (of which 28 intersect the lease parcel)	16† (another 12 are within 200 feet of the lease parcel)	• One NRHP-listed site: Wild Horse Canyon/Bailey Ridge (Negro Mag) obsidian sources. • One NRHP-eligible site: prehistoric lithic scatter. • Four prehistoric open camps and/or chipping stations unevaluated for the NRHP. • 10 sites (seven prehistoric lithic or artifact scatters and three historic roads) not eligible for the NRHP.	• Roosevelt Hot Springs geothermal resource area. • No known areas or features of tribal concern. • Two potential historic features: Road from Milford to Roosevelt and one unnamed road. Additional miscellaneous features, including Wild Horse Canyon/Bailey Ridge (Negro Mag) obsidian sources and the Schoo Mine, are present.
2	43* (of which 17 intersect the lease parcel)	19† (another 5 are within 200 feet of the lease parcel)	• One NRHP-listed site: Wild Horse Canyon/Bailey Ridge (Negro Mag) obsidian sources. • Eight NRHP-eligible sites: all prehistoric lithic scatter sites. • One scatter site unevaluated for the NRHP. • Nine sites (four prehistoric lithic scatters, four historic artifact scatters, and one historic road) not eligible for the NRHP.	• Roosevelt Hot Springs geothermal resource area. • No known areas or features of tribal concern. • Seven potential historic features: Ranch Canyon to Antelope Springs Road, Hot Springs Road, and five unnamed roads. One additional miscellaneous feature (i.e., Wild Horse Canyon/Bailey Ridge [Negro Mag] obsidian sources) is present.
3	30 (of which 16 intersect the lease parcel)	7	• Six NRHP-eligible sites: four prehistoric sites consisting of two campsites, one artifact scatter, and one lithic scatter, and two historic sites consisting of roads. • One prehistoric lithic scatter site unevaluated for the NRHP.	• No mining districts. • One area or feature of tribal concern within the immediate vicinity: Thermo Hot Springs. • Nine potential historic features: Pioche and Salt Lake City Road via Minersville, the Pioche and Salt Lake City Wagon Road, two segments of the San Pedro, Los Angeles & Salt Lake Railroad, and five unnamed roads.
4	4 (of which 2 intersect the lease parcel)	0	• N/A	• Cove Fort-Sulphurdale geothermal resource area is immediately south of the parcel. • No known areas or features of tribal concern. • No potential historic features.
5	4 (of which 3 intersect the lease parcel)	1	• One NRHP-eligible prehistoric lithic scatter.	• No mining districts. • No known areas or features of tribal concern. • One potential historic feature: Dog Valley Canyon Road.
6	4 (of which 3 intersect the lease parcel)	2	• Two historic road sites not eligible for the NRHP.	• No mining districts. • No known areas or features of tribal concern. • Three potential historic features: Road to Swasey Spring/Joy, Utah and two unnamed roads.

Table 3.3. Literature Review Report Summary

Parcel Number	Number of Previous Cultural Surveys Conducted in the File Search Area	Recorded Sites in the Lease Parcel	Status of Recorded Sites in the Lease Parcel	Utah Mining Districts and Geothermal Areas; Areas or Features of Tribal Concern; Potential Historic Features in the Lease Parcel
7	15 (of which 5 intersect the lease parcel)	2 (a prehistoric lithic scatter is within 200 feet of the parcel)	• One NRHP-eligible prehistoric chipping station site. • One flaked stone artifact scatter not eligible for the NRHP.	• No mining districts. • No known areas or features of tribal concern. • Four potential historic features: three unnamed roads and one fence.
8	2 (both of which intersect the lease parcel)	0	• N/A	• No mining districts. • No known areas or features of tribal concern. • One potential historic feature: one unnamed road.

Source: SWCA (2016a).

Notes:

* A 2014 project (Blundell Geothermal Lease Area cultural resources inventory; Adams et al. 2014) surveyed the entirety of parcels 1 and 2.

† The original number of recorded sites in the lease parcel was higher. However, the number of sites has been reduced due to the combination of some sites under one site number and other factors.

In all, 46 different recorded sites were identified on all eight lease parcels. One of the recorded sites (Wild Horse Canyon/Bailey Ridge [Negro Mag] obsidian sources) is already listed on the NRHP. Seventeen of the recorded sites are eligible for the NRHP, six of the recorded sites are unevaluated for NRHP eligibility, and 22 of the recorded sites are not eligible for the NRHP.

The Literature Review Report notes that lease parcels 1 and 2 are contained within the Mineral Mountains High Priority Area. This area was identified as high priority in a previous Class I cultural resources inventory because of the nature and sensitivity of cultural resources in the region and specifically because of the presence of the Wild Horse Canyon/Bailey Ridge (Negro Mag) obsidian sources and lithic landscape. The designation asks that special attention be paid, and possibly additional protection and treatment measures enacted, in regard to the management of cultural resources before any federal undertaking or development (SWCA 2016a).

The Wild Horse Canyon/Bailey Ridge obsidian sources in lease parcels 1 and 2 are further described in *A Class III Cultural Resources Inventory of 5,979 Acres within the Blundell Geothermal Lease Area, Beaver County, Utah*, as follows:

> The [Wild Horse Canyon/Bailey Ridge] obsidian lithic raw material formation was volcanically deposited approximately 0.79 million years ago during a massive rhyolitic flow (Lipman et al. 1978). Obsidian within this formation is outcropping and/or eroding from several primary and secondarily deposited localities along the western flank of the Mineral Mountains. These sources of obsidian were frequently exploited by prehistoric groups and extensively utilized for the production of stone tools for at least the last 10,000 years. (Adams et al. 2014)

The Literature Review Report also notes that ethnographic studies have identified the landscape around lease parcel 3 as being culturally and ceremonially significant to Native American groups present historically in the region, and the viewshed is a critical component (SWCA 2016a).

In addition, the Literature Review Report indicates that lease parcels 4 and 5 are located approximately 5 and 7 miles north-northwest respectively "of a lithic landscape that extends north from near the line between Beaver and Millard Counties along the western edge of the Tushar Mountains, in an area of heavy alluvial and colluvial erosion. The lithic landscape is associated with both the Wild Horse Canyon obsidian source and known chert sources in the Tushar Mountains" (SWCA 2016a).

Additional cultural resources detail can be found in the Literature Review Report.

3.3.1.1. NATIVE AMERICAN RELIGIOUS CONCERNS AND CONSULTATION

Section 101(d)(6)(B) of the NHPA requires consultation with federally recognized Indian tribes that attach religious and cultural significance to historic properties, including archaeological sites. This consultation is ultimately the responsibility of the federal agency overseeing the undertaking. When federally recognized tribes speak of "government-to-government" consultation, they are often referring to consultation between a designated tribal representative and a designated representative of the federal government. The BLM and USFS must make a reasonable and good faith effort to identify such Indian tribes and invite them to be consulting parties. If such Indian tribes have not been invited by the agency to consult, the tribes may request in writing to be consulting parties and must be considered as such by the agency (Advisory Council of Historic Preservation [ACHP] 2012). See Chapter 5 of this EA for detail on the tribal consultation process.

NHPA Section 106 regulations state that the agency official shall acknowledge that Indian tribes possess special expertise in assessing the NRHP eligibility of historic properties, including archaeological sites, that may possess religious and cultural significance to them (36 CFR 800.4(c)(1)). Therefore, the agency should consult with Indian tribes to carry out identification efforts and to evaluate the NRHP eligibility of identified properties for proposed undertakings located off tribal lands. The agency should provide Indian tribes with the same information that is provided to the State Historic Preservation Office during consultation, including information on buildings and other standing structures that may be affected by the proposed undertaking. A federal agency should not assume to possess the expertise to determine what is of significance to a particular tribe unless it has been advised by that tribe (ACHP 2012).

The Cedar City and Fillmore Field Offices have determined that leasing parcels 1, 2, 3, 6, 7, and 8 may have a potential impact on Native American religious concerns. Native American consultation is needed because of the types of cultural resources that would be impacted by the Proposed Action. Tribal consultation for the Proposed Action is being conducted by the BLM Utah State Office. A number of tribes are being consulted to obtain specific tribal concerns and information about the locations of areas of particular importance to tribes. The following tribes are being contacted:

- Paiute Indian Tribe of Utah
- Kaibab Band of Paiute Indians
- Kanosh Band of Paiute Indians
- Confederated Tribes of the Goshute Reservation
- Skull Valley Band of Goshute Indians
- Ute Indian Tribe
- Hopi Tribe
- Navajo Nation
- Pueblo of Jemez

3.3.2. *Environmental Consequences*

The analysis area for impacts to cultural resources is the entire area of each individual lease parcel. This is the area of potential effects for each lease parcel for purposes of review under Section 106 of the NHPA.

3.3.2.1. PROPOSED ACTION

Geothermal exploration, development, and operation activities following a lease sale of the eight parcels could affect cultural resources. As described in the Geothermal PEIS (BLM 2008a) (Section 4.14.3), common impacts on cultural resources from the four phases of geothermal development would likely consist of the following:

- Exploration: The development of new roads/routes for surveying or exploratory wells could lead to increased disturbances of cultural resources or the landscape of cultural resources, and also increased illegal collecting or vandalism. The drilling of wells could directly and permanently impact any cultural resources that are present.
- Drilling: Ground disturbance would directly impact any cultural resources or historic landscapes of cultural resources that are present. Impacts would be permanent and long term.
- Utilization: Ground disturbance from a power plant, transmission line towers, and pipelines would directly and permanently impact any cultural resources or historic landscapes of cultural resources that are present.

- Reclamation and abandonment: Impacts on cultural resources from previous phases would remain, and additional impacts could occur if reclamation and abandonment activities extend beyond previously disturbed areas. Unless the changes from previous phases are removed and preexisting conditions are reestablished, all impacts on cultural resources would continue.

In summary, actions that cause surface and subsurface physical disturbance could result in the damage, destruction, or inadvertent discovery of cultural resources. Any damage or destruction of cultural resources would be long term. The magnitude and extent of the impacts would depend on the current state of the cultural resources and their eligibility for the NRHP. Indirect impacts would include the loss of research potential and interpretation possibilities.

Table 3.4 contains a summary of cultural resource recommendations from the Literature Review Report.

Table 3.4. Recommendations from the Literature Review Report

Parcel Number	Potential for Encountering Significant Cultural Sites		Percentage of Parcel Previously Surveyed (acres)	Additional Survey Recommended	Recommended Stipulations
	Prehistoric	Historic			
1	Moderate	Low	100% (2,836)	No	No surface occupancy within NRHP-listed 42BE52 (Wild Horse Canyon/Bailey Ridge obsidian sources) No surface occupancy within other known historic properties or unevaluated cultural resources Assessment of potential visual effects on historic properties, and specifically to NRHP-listed 42BE52, within the lease parcel prior to subsequent geothermal development Native American consultation
2	Moderate	Low	100% (3,151)	No	No surface occupancy related to geothermal development within NRHP-listed 42BE52 (Wild Horse Canyon/Bailey Ridge obsidian sources) No surface occupancy within other known historic properties or unevaluated cultural resources Assessment of potential visual effects on historic properties, and specifically to NRHP-listed 42BE52, within the lease parcel prior to subsequent geothermal development Native American consultation
3	Moderate to high	Moderate to high	5.0% (87.92)	Yes	Class III survey prior to site-specific development No surface occupancy within known historic properties or unevaluated cultural resources Assessment of potential visual effects on historic properties within the lease parcel as well as on the Thermo Hot Springs cultural landscape prior to subsequent geothermal development Native American consultation
4	Moderate	Low to moderate	3.8% (69.32)	Yes	Class III survey prior to site-specific development No surface occupancy within known historic properties or unevaluated cultural resources Assessment of potential visual effects on historic properties within the lease parcel prior to subsequent geothermal development Native American consultation

Table 3.4. Recommendations from the Literature Review Report

Parcel Number	Potential for Encountering Significant Cultural Sites		Percentage of Parcel Previously Surveyed (acres)	Additional Survey Recommended	Recommended Stipulations
	Prehistoric	Historic			
5	Moderate	Low to moderate	4.2% (49.76)	Yes	Class III survey prior to site-specific development No surface occupancy within known historic properties or unevaluated cultural resources Assessment of potential visual effects on historic properties within the lease parcel prior to subsequent geothermal development Native American consultation
6	Moderate	Low to moderate	1.8% (90.09)	Yes	Class III survey prior to site-specific development No surface occupancy within known historic properties or unevaluated cultural resources Assessment of potential visual effects on historic properties within the lease parcel prior to subsequent geothermal development Native American consultation
7	Moderate to High	Low to Moderate	3.6% (49.62)	Yes	Class III survey prior to site-specific development No surface occupancy within known historic properties or unevaluated cultural resources Assessment of potential visual effects on historic properties within the lease parcel prior to subsequent geothermal development Native American consultation
8	Low to Moderate	Low to moderate	0.05% (0.72)	Yes	Class III survey prior to site-specific development No surface occupancy within known historic properties or unevaluated cultural resources Assessment of potential visual effects on historic properties within the lease parcel prior to subsequent geothermal development Native American consultation

Source: SWCA (2016a).

There is variable previous survey coverage in each of the eight lease parcels, which is reflected in the number and density of known sites in each parcel. Only lease parcels 1 and 2 have been completely surveyed; less than 6% of each of the remaining six parcels has been surveyed. Lease parcel 8 has the lowest survey coverage. Overall, the eight lease parcels have moderate potential to contain significant prehistoric sites. The overall potential for significant historic sites is low to moderate on all parcels, with the exception of parcel 3 where it is moderate to high.

Overall, the anticipated surface disturbance associated with proposed geothermal development in each of the eight lease parcels is low (ranging from 65 to 374 acres). Based on the moderate potential for prehistoric sites and the low to moderate potential for significant historic sites across most of the parcels and the limited size of the potential development in relation to the overall size of the parcels, the Literature Review Report recommended that potential lessees could proceed with geothermal exploration and development in each lease parcel, after site-specific reviews, "without adversely affecting properties eligible for the NRHP" (SWCA 2016a). The Literature Review Report states that "none of these parcels should be excluded from nomination to the eight-parcel geothermal lease sale" and recommends a finding of no adverse effect for each of the eight lease parcels, assuming that the stipulations in Table 3.4 are met (SWCA 2016a).

Impacts to cultural resources would be minimized through the implementation of lease stipulations and BMPs.

3.3.2.1.1. Native American Religious Concerns and Consultation

Potential impacts to Native American religious concerns could result if tribal interests or traditional cultural resources are located on lands disturbed by the four phases of geothermal development. Impacts could occur from vandalism, unauthorized collection of ancestral sites, alteration of cultural landscapes, noise, loss of tribal treaty rights, and interference with traditional religious or cultural practices such as resource gathering, use of sacred sites, or hunting. In addition, the qualities essential to areas considered sacred could be permanently lost. Impacts on setting, important viewsheds, and cultural landscapes can extend far beyond the project area. The context and intensity of impacts would depend on the resources that are present and whether the resources can be avoided. Impacts may be minimized or avoided through consultations, environmental review, and lease stipulations and BMPs (BLM 2008a).

Native American consultation is ongoing and would continue if the Proposed Action is approved and subsequent applications for geothermal exploration and development are received for the lease parcels.

3.3.2.1.2. Lease Stipulations and Best Management Practices

The BLM would apply the appropriate lease stipulations and BMPs from the Geothermal ROD (Section 2.3 and Appendix B) to the Proposed Action to protect cultural resources on the eight lease parcels. Section 2.3.4 of the Geothermal ROD contains a specific stipulation for cultural resources, which states that the lease may be found to contain cultural resources and that the BLM would not approve any ground-disturbing activities that may affect such resources until it completes its obligations under applicable requirements of NHPA. The stipulation also notes that the BLM may require modification to exploration or development proposals to protect cultural resources, or disapprove any activity likely to result in adverse effects (BLM 2008b). This stipulation would be added to each lease parcel. The Geothermal ROD also specifies management procedures for Native American consultation (BLM 2008b) (Section 2.4).

Specific BMPs for cultural resources can be found in the Geothermal ROD (Appendix B, Sections B.1.2 and B.4.1). These include following procedures established by the ACHP for compliance with Section 106 of the NHPA, conducting pedestrian inventories of unsurveyed areas, evaluating sites for NRHP eligibility, preparing treatment plans for avoidance of impacts or mitigation of effects, avoiding impacts through project design, and preparing a cultural resources management plan in areas with high potential to contain cultural material (BLM 2008b).

If the Proposed Action is approved and subsequent applications for geothermal exploration and development are received for the lease parcels, additional cultural resource investigations would be required on lease parcels 3–8. Because of the limited survey coverage on these parcels, no geothermal development would be approved until a Class III inventory has been completed and information from Native American tribes received and addressed. After completion of the Class III inventory, lease stipulations and BMPs as described above and in the Geothermal ROD would be applied as appropriate to each lease parcel. Impacts to cultural resources would be minimized through the implementation of the stipulations and BMPs.

3.3.2.2. NO ACTION ALTERNATIVE

Under the No Action Alternative, the BLM and USFS would not lease the eight parcels for geothermal resources. Without leasing, exploration and development of geothermal resources would not occur on the parcels. The parcels would continue to be used primarily for open space, livestock grazing, wildlife habitat, roads, and undeveloped recreational uses. Existing cultural resources sites on the parcels would not be adversely affected by geothermal development, and mitigation would not be required.

3.4. Wildlife

The federal management agencies for seven of the eight lease parcels have determined that leasing the parcels may have a potential impact on wildlife. Lease parcel 7 was not specifically identified by the Fillmore Field Office as potentially impacted for wildlife; however, it is included in the analysis because of its location near the Clear Lake Waterfowl Management Area. This section presents the affected environment and analyze potential impacts to wildlife on all eight parcels.

3.4.1. *Affected Environment*

SWCA performed a biological resource inventory of the project area in September 2015 *Biological Resources Inventory of Eight Proposed Bureau of Land Management Geothermal Lease Parcels (UTU-086142, UTU-086143, UTU-090200, UTU-086295, UTU-086298, UTU-090483, UTU-090273, and UTU-090271) in Beaver, Millard, and Juab Counties, Utah* [Resource Inventory Report; SWCA 2016b(). The biological resource inventory consisted of a desktop analysis of biological resources to determine which biological resources have the potential to occur in or near the proposed lease parcels, and whether on-the-ground surveys would be needed. It included a review of available geospatial data for game bird habitat and big game habitat in each lease parcel.

3.4.1.1. LAND COVER TYPES

Land cover types or ecological systems are defined as recurring groups of biological communities found in similar physical environments and influenced by similar ecological processes, such as fire or flooding (USGS National Gap Analysis Program 2005). The identification of land cover types provides information about available wildlife habitat. Southwest Regional Gap Analysis Project (SWReGAP) data recognize 21 land cover types in the eight parcels. The most prevalent land cover types in each parcel are summarized in Table 3.5. Detailed descriptions of each land cover type are provided in the Resource Inventory Report (SWCA 2016b).

Table 3.5. Prevalent Land Cover Types in Each Parcel

Parcel Number	Most Prevalent Land Cover Types	Percentage of Parcel (acres)
1	Colorado Plateau Pinyon-Juniper Woodland	72.5% (2,055.8)
	Inter-Mountain Basins Big Sagebrush Shrubland	19.8% (560.6)
2	Colorado Plateau Pinyon-Juniper Woodland	61.9% (1,950.5)
	Inter-Mountain Basins Big Sagebrush Shrubland	19.5% (615.1)
	Great Basin Xeric Mixed Sagebrush Shrubland	11.4% (360.6)
3	Inter-Mountain Basins Mixed Salt Desert Scrub	32.9% (583.8)
	Inter-Mountain Basins Greasewood Flat	22.7% (402.3)
	Inter-Mountain Basins Big Sagebrush Shrubland	21.2% (376.9)
	Inter-Mountain Basins Semi-Desert Shrub Steppe	13.3% (236.5)
4	Colorado Plateau Pinyon-Juniper Woodland	72.8% (1,344.5)
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	16.1% (298.2)
5	Colorado Plateau Pinyon-Juniper Woodland	70.0% (824.1)
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	17.5% (205.8)

Table 3.5. Prevalent Land Cover Types in Each Parcel

Parcel Number	Most Prevalent Land Cover Types	Percentage of Parcel (acres)
6	Inter-Mountain Basins Semi-Desert Shrub Steppe	64.3% (3,290.3)
	Inter-Mountain Basins Mixed Salt Desert Scrub	27.0% (1,380.6)
7	Inter-Mountain Basins Playa	56.8% (783.4)
	Inter-Mountain Basins Volcanic Rock and Cinder Land	13.2% (182.3)
8	Inter-Mountain Basins Greasewood Flat	66.8% (1,024.7)
	Inter-Mountain Basins Mixed Salt Desert Scrub	18.5% (283.6)

Source: SWCA (2016b).

3.4.1.2. GENERAL WILDLIFE

Parcels 1, 2, 4, 5, and 6 contain foothill and mountain slope areas. In these areas, vegetation provides habitat for a variety of wildlife species, such as the golden eagle *(Aquila chrysaetos*), red-tailed hawk (*Buteo jamaicensis*), Cooper's hawk (*Accipiter cooperii*), sharp-shinned hawk (*Accipiter striatus*), ferruginous hawk (*Buteo regalis*), scrub jay (*Aphelocoma californica*), pinyon jay (*Gymnorhinus cyanocephalus*), juniper titmouse (*Baeolophus ridgwayi*), gray flycatcher (*Empidonax wrightii*), ash-throated flycatcher (*Myiarchus cinerascens*), olive-sided flycatcher (*Contopus cooperi*), green-tailed towhee (*Pipilo chlorurus*), mountain bluebird (*Sialia currucoides*), black-capped chickadee (*Poecile atricapillus*), wild turkey (*Meleagris gallopavo*), blue (dusky) grouse (*Dendragapus obscurus*), small mammals, black bear (*Ursus americanus*), elk (*Cervus canadensis nelsoni*), and mule deer (*Odocoileus hemionus*) (SWCA 2016b).

Vegetation types (sagebrush basins and slopes, *Atriplex*-dominated basins, salt desert grasslands and shrublands) in the alluvial slopes and valley bottoms of parcels 1, 2, 3, 6, 7, and 8 provide habitat for a variety of wildlife species, including red-tailed hawk, golden eagle (foraging), American kestrel (*Falco sparverius*), horned lark (*Eremophila alpestris*), western meadowlark (*Sturnella neglecta*), loggerhead shrike (*Lanius ludovicianus*), Brewer's sparrow (*Spizella breweri*), sagebrush sparrow (*Artemisiospiza nevadensis*), sage thrasher (*Oreoscoptes montanus*), lark sparrow (*Chondestes grammacus*), black-throated sparrow (*Amphispiza bilineata*), cottontail rabbit (*Sylvilagus* spp.), black-tailed jackrabbit (*Lepus californicus*), skunk (*Spilogale* spp.), coyote (*Canis latrans*), American badger (*Taxidea taxus*), mule deer, pronghorn antelope (*Antilocapra americana*), elk, small mammals, and multiple reptile species (SWCA 2016b).

Parcels 1 and 7 contain riparian, wetland, and open water areas that provide habitat for a wide range of wildlife species, including migratory birds and waterfowl, mule deer, pronghorn antelope, elk, amphibians, reptiles, fish, small mammals, and skunk. Riparian and wetland habitats are critical for many bird species because they provide foraging and nesting habitat and cover during migration. Migratory birds are discussed further in Section 3.8. Lease parcel 7 is adjacent to both Clear Lake and the Clear Lake Waterfowl Management Area. The Clear Lake Waterfowl Management Area is a 6,190-acre area consisting of wetlands that provide migratory bird habitat. Generally, mid-April and late September coincide with the peak of the annual spring and fall migrations. Primary waterfowl species include northern pintail (*Anas acuta*), redhead (*Aythya americana*), mallard (*Anas platyrhynchos*), green-winged teal (*Anas crecca*), and American wigeon (*Anas americana*). Noteworthy shorebird species include American avocet (*Recurvirostra americana*) and black-necked stilt (*Himantopus mexicanus*) (National Audubon Society 2013).

3.4.1.3. GAME SPECIES

Based on UDWR geospatial data, all lease parcels contain crucial and/or substantial habitat for mule deer, elk, pronghorn antelope, and black bear, with the exception of lease parcel 7. Background on these big games species is provided in the following paragraphs.

Mule deer are found in almost all of Utah, although they are less abundant in desert areas. Currently, 54% of the state is considered mule deer habitat. The deer population in Utah has grown at an average rate of 1.6% over the past 20 years; the population estimate was 79% of the long-term management objective of 425,400 deer in 2013 (UDWR 2014). Mule deer eat a variety of plants, including browse, forbs, and grasses. They are especially reliant on shrubs for forage during critical winter months. Their habitat is usually characterized by areas of thick brush or trees interspersed with small openings. Mule deer habitat is classified into three main categories (winter, summer, and transitional) based on the season of use. The size and condition of mule deer populations are primarily determined by the quantity and quality of these habitats (UDWR 2014). Loss and degradation of habitat are thought to be the key reasons for mule deer population declines in western North America over the last few decades. In many parts of Utah, crucial mule deer habitat is continuously being lost or severely fragmented because of human population expansion, development, and natural events (crucial mule deer habitat is defined as habitat essential to the life history requirements of mule deer). Other factors such as predation and disease are intensified with a reduction in habitat quality (UDWR 2014).

Although there are six recognized subspecies of elk in North America, all of the elk in Utah are of the Rocky Mountain elk subspecies. On 27 of the 38 management units in Utah, elk populations were at or above population objectives in 2014 (UDWR 2015). Elk are generalists and have a varied diet consisting of grasses, forbs, and shrubs. In Utah, elk live in a variety of habitat types including all of the state's mountains and some of the low deserts. They prefer to spend summers at high elevations in aspen conifer forests and winters in mid- to low-elevation habitats with mountain shrub and sagebrush communities. Elk are closely tied to aspen habitats in Utah, which provide both forage and cover during summer and calving locations in spring. Habitat quality is a major factor in determining elk herd size and is important for healthy and productive elk herds. Crucial elk habitat is being lost, fragmented, or changed in many parts of Utah because of human expansion, development, and fire suppression (UDWR 2015).

Black bear habitat is present in much of the forested areas of Utah. In central Utah, bears use low-elevation mountain brush habitats during summer and higher-elevation aspen and conifer habitats during spring and fall. High-quality black bear habitat in Utah consists of large interconnected blocks of land exhibiting high interspersions of aspen, mountain brush, and coniferous plant communities with a healthy herbaceous and shrub component (UDWR 2011). Bears in central and southeastern Utah have been found to prefer mesic, north-slope conifer patches as resting areas year-round. The species is often found near a water source. Utah's black bear population appears to have increased since 1990, but may have recently stabilized (UDWR 2011). The black bear is omnivorous and eats a variety of foods (typically grasses and forbs in spring, more fruits in summer, and a mixture of soft mast [fruits] and hard mast [nuts] in fall), which allows for seasonal diet changes based on availability. In Utah, black bear research has found that vegetative matter is the most important diet item, followed by mast, insects, and animal matter. Bears in central and southeastern Utah forage on grasses and forbs in aspen, aspen-conifer, and mountain brush, in addition to riparian zones and low-elevation timbered canyon bottoms (UDWR 2011).

The pronghorn antelope is native only to North America and is well known for its speed (it can attain speeds of approximately 45 miles per hour) (UDWR 2009). In Utah, nearly all populations occur in shrub steppe habitat. This habitat is characterized by large expanses of open, low, rolling or flat terrain. Pronghorn are browsers that consume shrubs such as sagebrush, as well as grasses and forbs. The abundance of free water sources is important to the viability of pronghorn populations. By 1900,

pronghorn numbers throughout the United States had declined by more than 99% because of fencing, habitat loss, and unregulated hunting. Although most historical habitats are currently occupied, individual herds are much smaller, and many are isolated. Beginning in 1945, transplants of pronghorn in Utah have resulted in a wider distribution across most of Utah's suitable desert habitats. The statewide pronghorn population is currently estimated at 12,000 to 14,000 animals (UDWR 2009). Currently, habitat degradation and loss (resulting in a lack of succulent forbs and grasses on spring and summer ranges) are major concerns for pronghorn antelope in Utah, as are fencing, livestock, disease, and energy development (UDWR 2009).

Table 3.6 lists the acreages of UDWR crucial and substantial habitats for big game species in each lease parcel. Maps of big game habitat are provided in the Resource Inventory Report.

Table 3.6. UDWR Designated Big Game Habitat Per Parcel

UDWR Big Game Habitat Designation	Acres of Habitat Per Parcel (percentage of parcel)							
	Parcel 1	Parcel 2	Parcel 3	Parcel 4	Parcel 5	Parcel 6	Parcel 7	Parcel 8
Black bear, crucial (year-long)	450 (15.9%)	–	–	–	–	–	–	–
Black bear, substantial (year-long)	1,536 (54.2%)	1,032 (32.7%)	–	1,451 (78.6%)	1,080 (91.8%)	–	–	–
Elk, substantial (year-long)	254 (9.0%)	–	–	–	–	–	–	–
Elk, substantial (winter)	–	–	–	1,847 (100.0%)	1,177 (100.0%)	–	–	–
Mule deer, crucial (winter)	2,255 (79.5%)	1,966 (62.4%)	–	1,484 (80.3%)	752 (63.9%)	–	–	–
Mule deer, substantial (winter)	–	–	–	363 (19.7%)	106 (9.0%)	–	–	–
Mule deer, substantial (summer)	–	–	–	–	319 (27.1%)	–	–	–
Pronghorn antelope, crucial (year-long)	719 (25.3%)	1,980 (62.8%)	1,774 (100.0%)	–	–	5,109 (99.8%)	–	1,534 (100.0%)

Source: SWCA (2016b).

Several of the lease parcels have game bird habitat. Lease parcels 1 and 2 also have band-tailed pigeon and blue grouse (*Dendragapus obscurus*) habitat; lease parcels 4 and 5 contain band-tailed pigeon, blue grouse, and wild turkey habitat; and lease parcel 7 contains habitat for California quail (*Callipepla californica*) and ring-necked pheasant (SWCA 2016b).

3.4.2. *Environmental Consequences*

The analysis area for general wildlife consists of the Hydrologic Unit Code (HUC) 10 watersheds that surround each lease parcel:

- Lease parcel 1: Cove Creek and The Big Wash-Beaver River watersheds (387,042 acres)
- Lease parcel 2: Cove Creek watershed (201,041 acres)
- Lease parcel 3: Fisher's Wash and Long Lick Canyon-Big Wash watersheds (388,077 acres)
- Lease parcel 4 and 5: Pahvant Valley watershed (94,597 acres)

- Lease parcel 6: Dry Lake Creek-Fish Springs Wash and Swasey Wash watersheds (345,493 acres)
- Lease parcel 7: Clear Lake watershed (154,295 acres)
- Lease parcel 8: Hog Back Reservoir-Old River Bed watershed (147,248 acres)

This analysis area was chosen because the watersheds represent a defined continuous area linked by common watercourses on which wildlife depend.

3.4.2.1. PROPOSED ACTION

Geothermal exploration, development, and operation activities following a lease sale of the eight parcels could affect wildlife. The impact of geothermal development on wildlife depends on the type and amount of wildlife and wildlife habitat at the site, as well as the amount of area that would be disturbed and the nature and location of the disturbance. The Geothermal PEIS (BLM 2008a) (Section 4.10.3), common impacts on wildlife resources from the four phases of geothermal development consist of the following:

- Exploration: The primary impacts from exploration activities would be habitat removal, the potential for direct injury and mortality from vehicles, noise, and effects from introduced invasive species. These impacts are usually short term, with the exception of the introduction of invasive species.
- Drilling: Clearing and grading activities could result in direct injury or death of individuals not mobile enough to avoid construction operations, wildlife that use burrows, or wildlife that are defending nest sites. Individuals that move into adjacent habitats may experience increased competition for resources. Sump pits can present toxicity or entrapment hazards to wildlife.
- Utilization: Construction of a geothermal project and its associated facilities could impact wildlife through long-term loss, reduction, alteration, and fragmentation of habitat. Wildlife and wildlife habitat adjacent to disturbed areas could also be affected. Other impacts could include a reduction in habitat quality from the establishment of invasive species and noise, disturbance from regular grass mowing and brush cutting, increased potential for fires, and the prevention or disruption of the movements of terrestrial wildlife, particularly during migration.
- Reclamation and abandonment: Vehicle traffic and structure removal would cause noise and may damage wildlife habitat. There could be an increased potential for runoff and erosion during land disturbance as buildings and associated structures are removed. Reclamation of native vegetation would provide habitat for wildlife.

Impacts on general wildlife species encountered in the analysis area would typically consist of 65 to 374 acres of habitat loss per lease parcel, depending on the amount of development. Surface disturbance could result in the direct loss of habitat elements such as groundcover and trees, which could cause a decrease in available forage and cover for certain species (e.g., birds) and an increase in predation on small mammal species. Effects on wildlife from human activity and noise during construction and operations would consist of auditory and visual disturbances to individual wildlife present in or near the project area, which could cause stress to individual animals (noise from drill rigs and construction activities can disturb wildlife in adjacent habitats up to 2,500 feet away [BLM 2008a]). Some individuals would likely leave the immediate area, resulting in a temporary spatial redistribution of individuals or habitat-use patterns. Construction activity and noise would be a direct, short-term impact that would disappear at the completion of each project. However, some human activity and noise associated with geothermal plant operations would be present consistently and in the long term in each lease parcel. Vehicle use associated with geothermal construction and operations would result in an increased risk of vehicle-animal collisions on project access roads and could cause stress, injury, or mortality to individual animals. Trapping hazards for wildlife could be present if geothermal development includes the construction of reserve pits at well pads to contain drilling fluids or the construction of pipeline relief ponds.

General wildlife species' population viability (rabbit, skunk, etc.) is unlikely to be affected because of the relatively small percentage of surface disturbance in the analysis area (ranging from 0.1% to 0.4% depending on the parcel) and the ability of individuals to move into adjacent habitat as needed to avoid the disturbance.

Impacts to game species would be the same as those described for common wildlife above, along with the more specific impacts discussed in the following paragraphs. Some or all of the potential geothermal development and construction on the eight lease parcels, except for lease parcel 7, could occur in crucial and/or substantial habitat for mule deer, elk, pronghorn antelope, and black bear. At this time, it cannot be determined how much of the habitat would be impacted on each parcel. Project activities would create approximately 65 to 374 acres of surface disturbance (depending on the amount of development) in each analysis area. In addition, if access roads and pipeline gathering systems are developed, they could impede deer movement and create new habitat fragmentation.

Human activity and noise would cause some individual game species to leave the immediate area, resulting in a temporary spatial redistribution of individuals or habitat-use patterns. Added stress would occur from physiological excitement as a result of the noise and human activity and could result in a change in food intake due to disruptions and extra exertion and movement to escape disruptions. Added stress could also result in the depletion of energy stores in individual animals at the expense of growth and reproduction, and could limit an animal's ability to respond to adverse conditions such as bad weather or hunting. In addition, overall habitat changes could cause individuals to select suboptimal habitat. Wildlife impacts would be minimized through the application of lease stipulations and BMPs.

3.4.2.1.1. Lease Stipulations and Best Management Practices

The BLM would apply the appropriate lease stipulations and BMPs from the Geothermal ROD (Section 2.3 and Appendix B) to the Proposed Action to protect wildlife on the eight lease parcels, including game species. TLs and CSU lease stipulations could be used to protect important wildlife habitat and the continuity of migration corridors. For example, these stipulations could protect big game movements and migration corridors by preventing or limiting geothermal development or operations in certain habitats during key time periods, minimizing impacts from human activity and habitat fragmentation. Specific BMPs for wildlife are found in the Geothermal ROD (BLM 2008b) (Appendix B, Sections B.1.4, B.2.10, B.3.1, B.3.3, B.4.2., B.4.4, B.4.6, B.6.1, and B.6.2). BMPs include identifying important habitat and biota in the project vicinity and designing the project to avoid, minimize, or mitigate potential impacts; preparing habitat restoration plans to avoid, minimize, or mitigate potential impacts to vulnerable wildlife; establishing speed limits to ensure safe traffic flow and reduce wildlife collisions and disturbance; ensuring adequate wildlife passage with aboveground pipelines; excluding wildlife from ponds, tanks, and impoundments containing hazardous liquids; installing escape ramps in pits, ponds, or tanks with clean water; avoiding wildlife harassment and disturbance; and reestablishing wildlife habitat or forage production during reclamation. These stipulations and BMPs would be used to address the potential impacts described in Section 3.4.2.1, including noise and human activity, vehicles, trapping hazards, and habitat loss and fragmentation.

If the Proposed Action is approved and subsequent applications for geothermal exploration and development are received for the lease parcels, appropriate wildlife habitat and species surveys would likely be required on each parcel (see Resources Inventory Report for details; SWCA 2016b). In addition, lease stipulations and BMPs as described above and in the Geothermal ROD would be applied as appropriate to each lease parcel. Impacts to wildlife, including game species, would be minimized through the implementation of the stipulations and BMPs. Additional measures such as off-site habitat improvement may also be implemented.

To protect mule deer and elk crucial winter habitat, UDWR may restrict surface disturbance and development activities from December 1 through April 30 or may limit construction during winter months on some lease parcels (see the Resource Inventory Report for details; SWCA 2016b).

3.4.2.2. NO ACTION ALTERNATIVE

Under the No Action Alternative, the BLM and USFS would not lease the eight parcels for geothermal resources. Without leasing, exploration and development of geothermal resources would not occur on the parcels. The parcels would continue to be used primarily for open space, livestock grazing, wildlife habitat, roads, and undeveloped recreational uses. Effects to wildlife resources from these land uses would continue similar to current conditions. No wildlife or wildlife habitat would be affected by construction or development activities for geothermal facilities.

3.5. Recreation

The Fillmore Field Office and USFS have determined that the exploration and development of geothermal resources on leasing parcels 4, 5, and 8 may have a potential impact on recreation. This section presents the affected environment and analyzes potential impacts to recreation on these three parcels only.

3.5.1. *Affected Environment*

3.5.1.1. LEASE PARCELS 4 AND 5

Lease parcels 4 and 5 are located on the western edge of the Fishlake National Forest, in the Fillmore Ranger District. This ranger district is one of four districts in the Fishlake National Forest and encompasses the northwest portion of the forest. The Pahvant Range dominates the east side of the Fillmore Ranger District, with the Canyon Mountains to the east of Interstate 15. Recreational uses in this district include off-highway vehicle (OHV) riding, camping, hiking, picnicking, hunting, fishing, and sight-seeing (USFS 2016). There are four primary recreational sites in the ranger district: Adelaide Recreation Site (camping, river/stream fishing, day hiking, nature viewing, OHV trail riding), Maple Grove Recreation Site (camping), Maple Hollow Recreation Site (camping, day hiking, OHV trail riding), and Oak Creek Recreation Site (camping, day hiking, OHV trail riding) (USFS 2016).

USFS data indicate that both lease parcels are in popular big game and shed antler hunting areas. Dispersed camping is permitted in this district, and such camps are prevalent during the fall hunting season. Both lease parcels are adjacent to the west part of the Missouri Flat Cooperative Wildlife Management Unit (CWMU), which is 21,535 acres in size. The CWMU program provides incentives to landowners to manage private lands to protect and sustain wildlife habitat and benefit wildlife, and to provide the public access to private and public land for hunting big game or turkey. Each CWMU has a written management plan that acts as a contract between the landowner and UDWR and includes species management objectives and hunting information. The Missouri Flats CWMU offers hunting permits annually for buck deer (early November), bull elk (late September), and cow elk (early December) and receives increased use during these hunting seasons. Hunting activities are managed in Utah by the UDWR through hunting boundary units. Table 3.7 describes the hunt unit containing the lease parcels, the type of hunting allowed, and the total hunters afield in 2014. It also includes hunting information for the Missouri Flat CWMU.

Table 3.7. Hunt Unit Containing Parcels 4 and 5 and Number of Hunters Afield in 2014

Hunt Unit (Subunit)	Type of Hunt	Total Hunters Afield in 2014
Fillmore (Pahvant)	Buck deer	1,653*
	Bull elk	449*
	Cougar	13†
	Black bear	0ŧ
Missouri Flat CWMU	Buck deer	10*
	Bull elk	6*
	Cow elk	Not reported

* Data from Bernales et al. (2014).
† Data from Bernales and McFarlane (2014a).
ŧ Data from Bernales and McFarlane (2014b).

All of lease parcel 4 is considered either crucial or substantial winter habitat for mule deer. The entire lease parcel 5 is considered substantial summer habitat or crucial or substantial winter habitat for mule deer. The entire area of both lease parcels is considered substantial winter habitat for elk. Both lease parcels contain some year-long substantial habitat for black bear.

Forest roads FR108, FR883, and FR884 provide access to recreationists and fall within lease parcels 4 and 5. FR108 provides access to an OHV trail that is part of the Piute ATV Trail, a more than 900-mile trail network in south-central Utah.

3.5.1.2. LEASE PARCEL 8

Lease parcel 8 is located along the southern border of central Juab County in the Sevier Desert/Black Rock Desert. Recreational uses in the portion of Juab County managed by the House Range land use plan include camping, hiking, off-road vehicle use, boating (e.g., Yuba Dam Reservoir), rock-hounding (e.g., Topaz Mountain), and sight-seeing. Little Sahara National Recreation Area, which has large sand dunes that are popular for camping and OHV use, is approximately 18 miles east of the parcel.

The Fillmore Field Office identified travel as the only recreational use concern for lease parcel 8. Sections 3 and 10 of lease parcel 8 are located in an area that limits travel to existing and/or designated roads and trails. The remaining portion of the lease parcel is located in open areas with no travel restrictions.

3.5.2. *Environmental Consequences*

The analysis area for impacts to recreation for lease parcels 4 and 5 is the Fillmore Hunt Unit's Pahvant subunit (543,164), plus the Missouri Flat CWMU (21,535 acres). The combined acreage totals 564,699. The hunt subunit and CWMU were chosen because they encompass the project area and all of the nearby environs, and because they are actively managed for a recreational use (hunting and wildlife management). The analysis area for impacts to recreation for lease parcel 8 is Juab County (3,412 square miles or 2,183,680 acres in size) (Utah Division of State History 2016). The county was chosen because similar recreational opportunities are provided throughout the area and it encompasses the parcel.

3.5.2.1. PROPOSED ACTION

Geothermal exploration, development, and operation activities following a lease sale of the eight parcels could affect recreation. The Geothermal PEIS (BLM 2008a) (Section 4.2.11) discusses the common impacts to recreation associated with the four phases of geothermal development:

- Exploration: Surveying and drilling activities may result in physical restrictions on recreation areas, displacing or limiting some recreational users. Recreation activities could resume at the end of exploration activities (completed in 1 to 5 years). Recreation users near the parcel could have a reduced quality experience due to noise, vibration, visual intrusions, and dust. New access roads could increase public access to previously inaccessible areas.
- Drilling: Impacts would be similar to those described for exploration, but they would be long term.
- Utilization: Impacts would be similar to those described for exploration, but they would be long term. The conversion of recreation lands to geothermal uses would displace recreation users and limit some activities. People that are camping, hiking, birding, and hunting would be most affected by activities that are part of the utilization phase. Short-term minor impacts to recreation resources may be experienced during standard operation and maintenance activities (e.g., movement of vehicles and infrastructure maintenance equipment, well service operations); such activities may also interfere with recreational traffic.
- Reclamation and abandonment: Increased traffic from reclamation and abandonment activities could affect public access for recreation. After reclamation and abandonment, disturbed lands would be reclaimed and recreation activities could resume, improving recreational opportunities.

3.5.2.1.1. Lease Parcels 4 and 5

Geothermal development and operations on the two lease parcels could remove up to 748 acres or 0.1% of the 564,699-acre analysis area from recreational use, including hunting. However, based on the numbers of hunters afield in 2014 in the analysis area (see Table 3.7) compared to the size of the analysis area, the development of a geothermal project on each parcel is not likely to be noticeable to hunters. The presence of construction vehicles, equipment, and workers would not likely deter recreation in areas that are unfenced but undergoing active geothermal development activities. Noise and human activity from geothermal operations could reduce the quality of the recreational experience for certain users (e.g., hunters) near the area where development or operations are occurring. For example, noise could affect the distribution or abundance of wildlife species available for hunting.

UDWR would continue to manage hunting activities under prescribed management objectives for the Fillmore (Pahvant) hunting unit. Hunting in the Missouri Flat CWMU would continue, and the number of big game permits issued would remain unchanged by the Proposed Action. With regard to hunting, surface disturbance to big game habitat would result in a loss of vegetation that may be used for forage and cover by big game species, which may impact the health of winter, summer, and year-long ranges. The loss of big game habitat from surface disturbance may result in individual animal mortality, depending on the number of animals using the range and the range's importance when compared to other, nearby crucial range. Rocky Mountain elk and mule deer would likely avoid portions of crucial ranges within the analysis area where noise and human presence are detected. Additional crucial habitat for these species is located beyond the lease parcels, which may allow for the redistribution of individuals or habitat-use patterns during geothermal development activities.

With regard to Forest Service roads, an increase in vehicular traffic could occur primarily during geothermal construction activities that may impact recreational access for visitors traveling to and from surrounding communities. Recreationists could experience increased traffic and delayed travel times. To comply with the Forest Plan, access should be maintained to these routes for recreation purposes. Specific Forest Plan standards and guides relevant to recreation resources should be considered.

3.5.2.1.2. Lease Parcel 8

Leasing for geothermal exploration and development would not change existing travel limitations on Sections 3 and 10 of lease parcel 8. Geothermal development and exploration activities would need to comply with existing travel limitations in these areas, unless exemptions were granted by the BLM Fillmore Field Office.

Recreation impacts to lease parcels 4, 5, and 8 would be minimized through the application of lease stipulations and BMPs.

3.5.2.1.3. Lease Stipulations and Best Management Practices

The BLM would apply the appropriate lease stipulations and BMPs from the Geothermal ROD (Section 2.3 and Appendix B) to the Proposed Action to protect recreation on the lease parcels. NSO lease stipulations can be used to protect developed recreation facilities, special-use permit recreation sites, and areas with heavy recreational use. TL and CSU lease stipulations can be applied to minimize the potential for impacts to recreational values (motorized and non-motorized) and the natural settings associated with recreational activity. For example, a TL lease stipulation could be used to limit construction activities during a particular hunting season, or a CSU stipulation could be used to limit geothermal development on portions of a parcel that have recreational value. Specific BMPs for recreation are found in the Geothermal ROD (BLM 2008b) (Appendix B, Section B.3.1). These consist of using signage to direct vehicles to alternative parking when construction obstructs recreational parking areas and avoiding construction activities during high recreational use periods. These stipulations and BMPs would be used to address the potential impacts described in Section 3.5.2.1, including loss of recreational use, noise and human activity, and traffic.

If the Proposed Action is approved and subsequent applications for geothermal exploration and development are received for the lease parcels, lease stipulations and BMPs as described above and in the Geothermal ROD would be applied as appropriate to each lease parcel. Impacts to recreation would be minimized through the implementation of the stipulations and BMPs.

3.5.2.2. NO ACTION ALTERNATIVE

Under the No Action Alternative, the BLM and USFS would not lease the eight parcels for geothermal resources. Without leasing, exploration and development of geothermal resources would not occur on the parcels. The parcels would continue to be used primarily for open space, livestock grazing, wildlife habitat, roads, and undeveloped recreational uses. Effects to recreation from these land uses would continue similar to current conditions. No recreational activities would be affected by construction or development activities for geothermal facilities.

3.6. Soils

The management agencies for all eight lease parcels have determined that leasing the parcels may have a potential impact on soils. This section presents the affected environment and analyzes potential impacts to soils on all eight parcels.

3.6.1. *Affected Environment*

Soils data from the State Soil Geographic Database (Natural Resources Conservation Service [NRCS] 2016a) were used to identify soil types in the lease parcels, as shown in Table 3.8.

Table 3.8. State Soil Geographic Database Soil Map Units in the Lease Parcels

Parcel Number	Soil Map Unit	Acres in Lease Parcel
1	Rock outcrop-May Day-Cowers-Bearskin	784.0
	Sheeprock-Hiko Peak-Decca	461.2
	Ushar-Snake Hollow-Sheeprock-Phage-Blue Star-Blackett	1,591.1
2	Rock outcrop-May Day-Cowers-Bearskin	785.3
	Sheeprock-Hiko Peak-Decca	283.3
	Ushar-Snake Hollow-Sheeprock-Phage-Blue Star-Blackett	2,082.5
3	Garbo-Deerlodge family-Biblesprings	154.1
	Uvada-Manselo-Antelope Springs	1,619.7
4	Reywat-Red Butte-Pharo family-Kanarra-Bowen-Amtoft family	780.9
	Ushar-Mosida-Etta	1,066.1
5	Reywat-Red Butte-Pharo family-Kanarra-Bowen-Amtoft family	830.9
	Ushar-Mosida-Etta	346.0
6	Sanpete family-Dera family	59.0
	Uvada family-Papoose family-Goshute family-Dera family	5,061.9
7	Sugarloaf-Nehar-Heist family-Goldrun family	609.0
	Toddler-Saltair-Playas	725.0
8	Skumpah-Saltair-Playas-Dynal	333.3
	Yuba-Uvada-Uffens-Playas-Abbott	1,200.3

Water or wind erosion of soil is influenced by climate, topography, soil properties, vegetative cover, and land use. Although erosion occurs naturally, rates of soil loss may be accelerated by human activities (BLM 2008a). Soil compaction occurs when moist or wet soil particles are pressed together, reducing pore size and the space between pores. This changes the soil structure and increases soil density. Denser soil can limit water infiltration, increase runoff and erosion, and limit plant growth or nutrient cycling (BLM 2008a). Compacted soil can be caused by wheeled traffic, large animals, vehicles, or people. Table 3.9 shows the acres of soil in each lease parcel that are moderately or highly susceptible to water or wind erosion, based on soil type.

Table 3.9. Water and Wind Erosion Susceptibility of Soils in the Lease Parcels

Parcel Number	Water Erosion Susceptibility Acres of Soil (percent of lease parcel)		Wind Erosion Susceptibility Acres of Soil (percent of lease parcel)	
	Moderate	High	Moderate	High
1	2,052.3 (72.4%)	–	1,591.1 (56.1%)	461.2 (16.3%)
2	2,365.8 (75.1%)	–	2,082.5 (66.1%)	283.3 (9.0%)
3	–	–	1,619.7 (91.3%)	–
4	–	780.9 (42.3%)	1,066.1 (57.7%)	–
5	–	830.9 (70.6%)	346.0 (29.4%)	–
6	–	–	–	–
7	–	–	–	609.0 (44.2%)
8	–	–	1,200.3 (78.3%)	–

As shown in Table 3.9, 72.4% of the soils in lease parcel 1 are moderately susceptible to water erosion and 72.4% are moderately or highly susceptible to wind erosion. Lease parcel 2 has soils with similar susceptibilities. In lease parcel 3, 91.3% of the soils are moderately susceptible to wind erosion. In lease parcels 4 and 5, 42.3% and 70.6% of the soils, respectively, are highly susceptible to water erosion; 57.7% and 29.4%, respectively, are moderately susceptible to wind erosion. The soils in lease parcel 6 have a low susceptibility to water and wind erosion. In lease parcel 7, 44.2% of the soils are highly susceptible to wind erosion. In lease parcel 8, 78.3% of the soils are moderately susceptible to wind erosion.

3.6.2. *Environmental Consequences*

The analysis area for soils-related issues consists of the HUC 10 watersheds that surround each lease parcel:

- Lease parcel 1: Cove Creek and the Big Wash-Beaver River watersheds (387,042 acres)
- Lease parcel 2: Cove Creek watershed (201,041 acres)
- Lease parcel 3: Fisher's Wash and Long Lick Canyon-Big Wash watersheds (388,077 acres)
- Lease parcel 4 and 5: Pahvant Valley watershed (94,597 acres)
- Lease parcel 6: Dry Lake Creek-Fish Springs Wash and Swasey Wash watersheds (345,493 acres)
- Lease parcel 7: Clear Lake watershed (154,295 acres)
- Lease parcel 8: Hog Back Reservoir-Old River Bed watershed (147,248 acres)

This area was chosen because the parcels fall within the watersheds and because watersheds provide clear topographic boundaries in which to analyze potential impacts to soils.

3.6.2.1. PROPOSED ACTION

Geothermal exploration, development, and operation activities following a lease sale of the eight parcels could affect soils. In general, impacts to soil resources would consist of physical disturbance through movement or removal, compaction, and changes to erosion patterns. Development on steep slopes would increase erosion and the risk of landslides.

The Geothermal PEIS discusses the common impacts to soil resources from the four phases of geothermal development (BLM 2008a) (Section 4.6.3):

- Exploration: Surveying activities, detonation of explosives, road development, and well drilling would cause physical disturbance to soils. Thumper trucks could cause surface compaction. Most impacts would be short term due to reclamation.
- Drilling: Disturbance to soils would occur from the development of access roads and well drilling. Impacts would be short term.
- Utilization: Surface disturbance from the development of access roads and the construction of the power plant, well field equipment, transmission lines, and support structures would impact soil in the long term through removal, compaction, and changes to erosion patterns. Soil impacts during operations would be minimal because the surface disturbance would primarily occur during construction.
- Reclamation and abandonment: All disturbed lands would be reclaimed; soil impacts would be minimized.

If geothermal development proceeds on the eight lease parcels, direct impacts to soils would occur that include changes in soil functions due to soil exposure from vegetation removal, mixing of soil horizons, potential loss of topsoil productivity, soil compaction, and increased susceptibility to wind and water erosion. The loosening of earthen material and the removal of soil and vegetation would contribute sediment and total dissolved solids (TDS) to the watershed. Most sediment eroded from lease parcels would be transported by surface runoff from precipitation. The potential for increased erosion and sedimentation would be greatest in the short term immediately after construction, when the disturbed soils are loose, and it would decline over time in areas where reclamation is implemented, and in other areas as natural stabilization occurs. Erosion impacts would be minimized through the use of lease stipulations and BMPs. Use of equipment for vegetation removal may compact soils, which would reduce soil infiltration rates, leading to increases in overland flow of water, erosion, and displacement of soil. Soil erosion is a concern in all of the lease parcels with the possible exception of lease parcel 6. This concern is due to the foothill and mountain slope areas of the lease parcels and the susceptibility of their soil types to water and wind erosion (see Table 3.9).

Impacts to soil resources would be minimized through the application of lease stipulations and BMPs.

3.6.2.1.1. Lease Stipulations and Best Management Practices

The BLM would apply the appropriate lease stipulations and BMPs from the Geothermal ROD (Section 2.3 and Appendix B) to the Proposed Action to protect soil resources on the lease parcels. NSO lease stipulations can be used on slopes in excess of 40 percent and/or soils with high erosion potential (BLM 2008b; Section 2.3.2). In addition, TL and CSO lease stipulations can be applied to protect erosive soils and soils on slopes greater than 30 percent to minimize the potential for adverse impacts to erosive soils in severe or very severe erosion classes (BLM 2008b; Section 2.3.3). For example, a CSU stipulation could be applied to areas of a lease parcel that are especially sensitive to erosion. Specific BMPs for soils are found in the Geothermal ROD (Appendix B, Sections B.1.1, B.1.3., B.2.2, B.2.5, B.3.2, B.6.1, B.6.2, and B.6.4). BMPs include an investigation of soil conditions prior to geothermal exploration and development, development of a stormwater management plan to prevent increased soil erosion, covering

fresh soil disturbances with mulch or scatter slash, segregating topsoil to spread on freshly disturbed areas, restricting road use during the wet season if road surfacing is inadequate to prevent soil displacement, conducting interim reclamation to maintain healthy topsoil and control erosion, incorporating erosion control procedures into interim and final reclamation, and avoiding excessive grades on roads, road embankments, ditches, and drainages in areas with erodible soils. These stipulations and BMPs would be used to minimize the potential impacts described in Section 3.6.2.1, including compaction, erosion, changes in soil function, and loss of topsoil productivity.

If the Proposed Action is approved and subsequent applications for geothermal exploration and development are received for the lease parcels, lease stipulations and BMPs as described above and in the Geothermal ROD would be applied as appropriate to each lease parcel. Impacts to soils would be minimized through the implementation of the stipulations and BMPs.

3.6.2.2. NO ACTION ALTERNATIVE

Under the No Action Alternative, the BLM and USFS would not lease the eight parcels for geothermal resources. Without leasing, exploration and development of geothermal resources would not occur on the parcels. The parcels would continue to be used primarily for open space, livestock grazing, wildlife habitat, roads, and undeveloped recreational uses. Effects to soils from these land uses would continue similar to current conditions. No soils would be affected by construction or development activities for geothermal facilities.

3.7. Special Status Animal Species

Special status species are species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category for this EA are federally listed and federally proposed species that are protected under the ESA, species considered as candidates for such listing by the USFWS, BLM sensitive species (Utah state-listed species and federal candidate species), and USFS sensitive species (identified by a regional forester; species for which population viability is a concern).

All three management agencies have determined that there are no federally listed threatened, endangered, or candidate wildlife species known to occur in or near the eight lease parcels. However, the agencies agree that leasing the eight parcels may have a potential impact on other types of special status animal species. This section presents the affected environment and analyzes potential impacts to other types of special status animal species on all of the parcels. It also includes some discussion of threatened, endangered, and candidate wildlife species based on information in the Resource Inventory Report.

3.7.1. *Affected Environment*

Tables 3.10 through 3.12 summarize results provided in the Resource Inventory Report (SWCA 2016b) and list special status wildlife species by county and potential habitat for these species in the lease parcels. The presence of potential habitat for these species was determined by comparing individual species habitat requirements to the SWReGAP land cover types predicted to occur in each parcel, surface geology (for parcels with available data), and elevation. Quadrangle-level Utah Natural Heritage Program (UNHP) occurrences of Utah's federally and state listed wildlife species were reviewed for each parcel. Records of occurrence are based on existing data in the UDWR's UNHP central database and should not be interpreted as a final statement regarding the occurrence of any species in or near the lease parcels. Species occurrences and the presence of potential habitat would be reviewed in more detail on a parcel-by-parcel basis as part of the environmental analysis that would occur when project-specific geothermal exploration and development moves forward. The tables include only those species with potential for occurrence in the parcels. Complete data can be found in the Resource Inventory Report (SWCA 2016b).

Table 3.10. Potential Habitat for Special Status Wildlife Species in Beaver County in Parcels 1 through 3

Species	Status	Potential Habitat Present		
		Parcel 1	Parcel 2	Parcel 3
Birds				
Burrowing owl (*Athene cunicularia*)	SPC	Y	Y	Y
Ferruginous hawk (*Buteo regalis*)	SPC	Y	Y	Y
Greater sage-grouse (*Centrocercus urophasianus*)	SPC	N	N	Y
Long-billed curlew (*Numenius americanus*)	SPC	Y	Y	Y
Short-eared owl (*Asio flammeus*)	SPC	Y	Y	Y
Mammals				
Big free-tailed bat (*Nyctinomops macrotis*)	SPC	Y	Y	N
Dark kangaroo mouse (*Microdipodops megacephalus*)	SPC	Y	Y	Y
Fringed myotis (*Myotis thysanodes*)	SPC	Y	Y	N
Kit fox (*Vulpes macrotis*)	SPC	Y	Y	Y
Pygmy rabbit (*Brachylagus idahoensis*)	SPC	Y	Y	Y
Spotted bat (*Euderma maculatum*)	SPC	Y	Y	N
Townsend's big-eared bat (*Corynorhinus townsendii*)	SPC	Y	Y	Y
Utah prairie-dog (*Cynomys parvidens*)	ESA-T	N	N	Y

Notes:
SPC: State wildlife species of concern.
ESA-T: Federally listed as threatened under the ESA.

The UNHP dataset for threatened, endangered, and sensitive species occurrences indicates that there are records of occurrence for burrowing owl, ferruginous hawk, kit fox, least chub, and long-billed curlew in the USGS 7.5-minute quadrangle intersected by parcels 1 and 2, and occurrences for burrowing owl, dark kangaroo mouse, ferruginous hawk, and greater sage-grouse in the quadrangle intersected by Parcel 3 (SWCA 2016b). A review of the USFWS Utah prairie-dog buffers indicates that parcel 3 falls within 5-mile and 10-mile survey buffers for this species. Low- and high-level intensity surveys for Utah prairie-dogs may be required by the USFWS in parcel 3, as outlined by the survey requirements in the *Utah Prairie-Dog Occupancy and Habitat Survey Protocol for Federal Section 7 Consultation* (USFWS 2014).

Table 3.11 lists special status wildlife species with the potential to occur in Parcels 4 through 7.

Table 3.11. Potential Habitat for Special Status Wildlife Species in Millard County in Parcels 4 through 7

Species	Status	Potential Habitat Present			
		Parcel 4	Parcel 5	Parcel 6	Parcel 7
Birds					
American white pelican (*Pelecanus erythrorhynchos*)	SPC	N	N	N	Y
Bald eagle (*Haliaeetus leucocephalus*)	SPC, USFS FLNF-sensitive	Y	Y	N	Y
Bobolink (*Dolichonyx oryzivorus*)	SPC, BLM FFO-sensitive	N	N	N	Y
Burrowing owl (*Athene cunicularia*)	SPC	Y	Y	Y	Y
Ferruginous hawk (*Buteo regalis*)	SPC	Y	Y	Y	Y
Golden eagle (*Aquila chrysaetos*)	BLM FFO-sensitive	Y	Y	Y	Y

Table 3.11. Potential Habitat for Special Status Wildlife Species in Millard County in Parcels 4 through 7

Species	Status	Potential Habitat Present			
		Parcel 4	Parcel 5	Parcel 6	Parcel 7
Grasshopper sparrow (*Ammodramus savannarum*)	SPC, BLM FFO-sensitive	Y	Y	Y	Y
Lewis's woodpecker (*Melanerpes lewis*)	SPC	Y	Y	N	N
Long-billed curlew (*Numenius americanus*)	SPC	N	N	Y	Y
Northern goshawk (*Accipiter gentilis*)	CS, USFS FLNF-sensitive	Y	Y	N	Y
Short-eared owl (*Asio flammeus*)	SPC	Y	Y	Y	Y
Snowy plover (*Charadrius nivosus*)	BLM-sensitive	N	N	N	Y
Mammals					
Big free-tailed bat (*Nyctinomops macrotis*)	SPC	Y	Y	Y	Y
Bighorn sheep (*Ovis canadensis*)	USFS FLNF-sensitive	Y	Y	N	N
Dark kangaroo mouse (*Microdipodops megacephalus*)	SPC	N	N	Y	Y
Fringed myotis (*Myotis thysanodes*)	SPC	Y	Y	Y	Y
Kit fox (*Vulpes macrotis*)	SPC	N	N	Y	Y
Pygmy rabbit (*Brachylagus idahoensis*)	SPC, USFS FLNF-sensitive	Y	N	Y	Y
Spotted bat (*Euderma maculatum*)	SPC, USFS FLNF-sensitive	Y	Y	Y	Y
Townsend's big-eared bat (*Corynorhinus townsendii*)	SPC, USFS FLNF-sensitive	Y	Y	Y	Y
Fish					
Least chub (*Iotichthys phlegethontis*)	CS	N	N	N	Y
Amphibians					
Columbia spotted frog (*Rana luteiventris*)	CS	N	N	N	Y
Western toad (*Bufo boreas*)	SPC	N	Y	N	Y
Mollusks					
Bifid duct pyrg (*Pyrgulopsis peculiaris*)	SPC	N	N	Y	Y
California floater (*Anodonta californiensis*)	SPC	N	N	N	Y

Notes:
SPC: State wildlife species of concern.
CS: Species receiving special management under a Conservation Agreement in order to preclude the need for federal listing.
BLM FFO-sensitive: BLM Fillmore Field Office sensitive species.
USFS FLNF-sensitive: USFS Fishlake National Forest Intermountain Region (R4) sensitive species.

UNHP indicates that there are records of occurrence for bald eagle, burrowing owl, and ferruginous hawk in the USGS 7.5-minute quadrangle map intersected by parcels 4 and 5, records of occurrence for kit fox and Townsend's big-eared bat in the quadrangles intersected by parcel 6, and records of occurrence for American white pelican, burrowing owl, dark kangaroo mouse, ferruginous hawk, kit fox, least chub, short-eared owl, and Townsend's big-eared bat in the quadrangles intersected by parcel 7 (SWCA 2016b).

Table 3.12 lists special status wildlife species with the potential to occur in parcel 8.

Table 3.12. Potential Habitat for Special Status Wildlife Species in Juab County in Parcel 8

Species	Status	Potential Habitat Present
		Parcel 8
Birds		
Bald eagle (*Haliaeetus leucocephalus*)	SPC, USFS FLNF-sensitive	Y
Burrowing owl (*Athene cunicularia*)	SPC	Y
Ferruginous hawk (*Buteo regalis*)	SPC	Y
Golden eagle (*Aquila chrysaetos*)	BLM FFO-sensitive	Y
Grasshopper sparrow (*Ammodramus savannarum*)	SPC	Y
Long-billed curlew (*Numenius americanus*)	SPC	Y
Short-eared owl (*Asio flammeus*)	SPC	Y
Mammals		
Dark kangaroo mouse (*Microdipodops megacephalus*)	SPC	Y
Kit fox (*Vulpes macrotis*)	SPC	Y

Notes:

SPC: State wildlife species of concern.

BLM FFO-sensitive: BLM Fillmore Field Office sensitive species.

USFS-FLNF-sensitive: USFS Fishlake National Forest sensitive species.

UNHP's dataset for threatened, endangered, and sensitive species occurrences by USGS 7.5-minute quadrangle indicates that there are no species occurrence data for the quadrangle intersected by parcel 8.

3.7.1.1. GREATER SAGE GROUSE

The BLM and USFS recently amended Utah land use plans to address threats to the greater sage-grouse (BLM 2015). A layered management approach was developed that applies the highest levels of protection to Sagebrush Focal Areas, which are landscapes with high breeding-population densities of sage-grouse, high-quality sagebrush habitat, and a large quantity of federal ownership or protected areas. These areas are proposed for locatable mineral withdrawal. The next level of protection is the designation of Priority Habitat Management Areas (PHMAs), which are defined as "BLM-administered lands identified as having the highest value to maintaining sustainable greater sage-grouse populations.... These areas include breeding, late brood-rearing, and winter concentration areas and migration or connectivity corridors" (BLM 2015). In PHMAs, surface energy and mineral development is limited. Development is capped with limits on the amount and density of allowed disturbance. To provide greater land use and management flexibility, General Habitat Management Areas (GHMAs) have also been established, which are defined as "BLM-administered lands where some special management will apply to sustain greater sage-grouse populations; areas of occupied seasonal or year-round habitat outside of PHMA" (BLM 2015). In GHMAs, mitigation and required design features are used to avoid, minimize, and mitigate the impacts of development. According to the Resource Inventory Report (SWCA 2016b), there is a PHMA approximately 6 miles southeast of parcel 1, 2 miles southeast of parcel 3, and 7 miles northeast of parcel 8. There are no designated PHMAs in Millard County. The eight proposed parcels are not located within SFAs or PHMAs. The Resource Inventory Report (SWCA 2016b) notes that the southeastern portion of lease parcel 3 (0.82 acre in size) is located in a GHMA.

The *Conservation Plan for Greater Sage-grouse in Utah* defines opportunity areas as "those portions of a Sage-grouse Management Area that currently do not contribute to the life cycle of sage-grouse but are areas where restoration or rehabilitation efforts can provide additional habitat when linked to existing sage-grouse populations" (UDWR 2013). There is opportunity area habitat for greater sage-grouse 1.5 miles south of parcel 1. There is also greater sage-grouse winter habitat 2 miles southeast of parcel 3, and 6 miles north of parcel 8. The eight proposed parcels are not located within UDWR opportunity area habitat or winter habitat.

Although the BLM has not adopted UDWR's *Conservation Plan for Greater Sage-grouse in Utah*, and does not recognize "opportunity area" habitat in their *Utah Greater Sage-Grouse Approved Resource Management Plan Amendment*, opportunity area habitat could be used for sage-grouse mitigation if lease parcel 3 is developed (Whitfield 2015). Greater sage-grouse surveys may be required in parcel 3 and for surface-disturbance activities and infrastructure relating to geothermal development within 3.1 miles of leks. The closest known lek to parcel 3 is the Minersville Lek located 7.8 miles to the east (SWCA 2016b). Maps of BLM-designated PHMAs/GHMAs and UDWR-designated habitat are available in the Resource Inventory Report (SWCA 2016b).

3.7.2. *Environmental Consequences*

The analysis area for special status species consists of the HUC 10 watersheds that surround each lease parcel:

- Lease parcel 1: Cove Creek and The Big Wash-Beaver River watersheds (387,042 acres)
- Lease parcel 2: Cove Creek watershed (201,041 acres)
- Lease parcel 3: Fisher's Wash and Long Lick Canyon-Big Wash watersheds (388,077 acres)
- Lease parcel 4 and 5: Pahvant Valley watershed (94,597 acres)
- Lease parcel 6: Dry Lake Creek-Fish Springs Wash and Swasey Wash watersheds (345,493 acres)
- Lease parcel 7: Clear Lake watershed (154,295 acres)
- Lease parcel 8: Hog Back Reservoir-Old River Bed watershed (147,248 acres)

This analysis area was chosen because the watersheds represent a defined continuous area linked by common watercourses on which special status species depend.

3.7.2.1. PROPOSED ACTION

Geothermal exploration, development, and operation activities following a lease sale of the eight parcels could affect special status species. The impact would depend on the type and amount of special status species and species habitat at the site, as well as the amount of area that would be disturbed and the nature and location of the disturbance. As described in the Geothermal PEIS, common impacts on special status species from the four phases of geothermal development would consist of habitat disturbance (including removal, reduction, or fragmentation of habitat), introduction of invasive vegetation, injury or mortality, erosion and runoff, fugitive dust, noise, exposure to contaminants (e.g., diesel fuel or geothermal working fluid), and interference with behavior activities (BLM 2008a) (Section 4.11.3). With special status species, impacts to small localized areas or impacts affecting only a few individuals can have overall adverse impacts to the species' population.

Effects on special status species would consist of those described in Section 3.4.2 of this EA for wildlife. Impacts on special status species encountered in the lease parcels would typically consist of 65 to 374 acres of habitat loss per lease parcel, depending on the amount of development. Specific impacts to specific species cannot be determined until site-specific surveys are completed and geothermal development details are known, after the parcels have been leased.

Impacts to special status species would be minimized through the application of lease stipulations and BMPs.

3.7.2.2. LEASE STIPULATIONS AND BEST MANAGEMENT PRACTICES

The BLM would apply the appropriate lease stipulations and BMPs from the Geothermal ROD (Section 2.3 and Appendix B) to the Proposed Action to protect special status species on the eight lease parcels. The Geothermal ROD contains a specific stipulation for the ESA. The stipulation states that the lease area may contain threatened, endangered, or special status animals species or their habitats and also states that the BLM will not approve any ground-disturbing activities that may affect such species or habitats until it completes its obligations under applicable requirements of ESA. The stipulation also notes that the BLM may recommend modifications to exploration or development proposals to avoid contributing to a need to list such species or their habitats, or disapprove any activity likely to result in jeopardy to the continued existence of a threatened or endangered species or result in the destruction or adverse modification of critical habitat (BLM 2008b) (Section 2.3.4). The Geothermal ROD also indicates that a sensitive species lease stipulation (NSO, CSU, or TL) could be imposed for "those portions of high value/key/crucial species habitat where other existing measures are inadequate to meet agency management objectives" (BLM 2008b) (Section 2.3.4). For example, if high value kit fox habitat were identified on a lease parcel, a CSU stipulation could be applied to limit geothermal development in that habitat. NSO lease stipulations can be applied if critical habitat for listed species would be adversely modified. In addition, TL and CSU lease stipulations can be applied to protect important habitat and migration corridors. The specific BMPs for wildlife described in Section 3.4.2.1.1 of this EA would also apply to special status species. These stipulations and BMPs would be used to address the potential impacts described in Section 3.7.2.1, including habitat disturbance, loss, and fragmentation; noise and human activity; and vehicles. The Geothermal ROD also specifies management procedures for ESA consultation (BLM 2008b) (Section 2.4).

The BLM is required to 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 (BLM 2008b).

If the Proposed Action is approved and subsequent applications for geothermal exploration and development are received for the lease parcels, SWCA recommends pedestrian surveys for special status species on each parcel (see Resources Inventory Report for details; SWCA 2016b). Low-level intensity surveys for Utah prairie-dogs may be required by the USFWS in parcel 3. In addition, lease stipulations and BMPs as described above and in the Geothermal ROD would be applied as appropriate to each lease parcel. Impacts to special status species would be minimized through the implementation of the stipulations and BMPs. Additional measures such as off-site habitat improvement may also be implemented. Because lease parcel 3 contains greater sage-grouse GHMA, greater sage-grouse surveys may be required and lease stipulations and BMPs from the *Utah Greater Sage-Grouse Approved Resource Management Plan Amendment* (BLM 2015) may be applied.

3.7.2.3. NO ACTION ALTERNATIVE

Under the No Action Alternative, the BLM and USFS would not lease the eight parcels for geothermal resources. Without leasing, exploration and development of geothermal resources would not occur on the parcels. The parcels would continue to be used primarily for open space, livestock grazing, wildlife habitat, roads, and undeveloped recreational uses. Effects to special status species from these land uses would continue similar to current conditions. No special status species or special status species habitat would be affected by construction or development activities for geothermal facilities.

3.8. Migratory Birds

Migratory birds and raptors are protected under the Migratory Bird Treaty Act (MBTA) of 1918 (16 USC 703–712) and the Bald and Golden Eagle Protection Act (as amended in 1962). The MBTA prohibits taking or killing migratory birds and destroying their nests or eggs without a permit. The list of protected migratory birds includes raptors. Executive Order 13186 directs federal agencies taking actions that are likely to have a measurable adverse effect on migratory birds to undertake mitigation measures in support of the MBTA. In Utah, the *Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbances* (Romin and Muck 2002) provides practices and guidelines for consistent raptor management approaches across the state.

The federal management agencies for all eight lease parcels have determined that leasing the parcels may have a potential impact on migratory birds. This section presents the affected environment and analyzes potential impacts to migratory birds on all eight parcels.

During the resource inventory, SWCA reviewed *Birds of Conservation Concern* (USFWS 2008) and the *Utah Partners in Flight Avian Conservation Strategy* (Parrish et al. 2002) for non-game migratory bird species (SWCA 2016b). SWCA also reviewed the National Audubon Society Important Bird Areas (IBAs) in Utah (National Audubon Society 2013) and Intermountain West Joint Venture (IWJV) Bird Habitat Conservation Areas (IWJV 2005). The presence of potential habitat for migratory bird species was determined by comparing individual species habitat requirements to the SWReGAP land cover types predicted to occur in each parcel (SWCA 2016b).

3.8.1. *Affected Environment*

Migratory birds use a variety of habitat types found in the proposed lease parcels, including pinyon-juniper woodland, wooded riparian, sagebrush steppe, playa, grassland, and emergent marsh.

Migratory bird species of concern are identified in individual Bird Conservation Regions (BCRs) of the United States in *Birds of Conservation Concern 2008* (USFWS 2008). As identified in the Resource Inventory Report, lease parcels 1 through 3 and 6 through 8 are in BCR 9 (Great Basin) and lease parcels 4 and 5 are in BCR 16 (Southern Rockies/Colorado Plateau). During the resource inventory, SWCA reviewed the species lists for both regions and determined that there is potential for at least 17 of the 28 bird species from the BCR 9 list and at least 13 of the 27 species from the BCR 16 list to occur in the eight proposed lease parcels, primarily between April and September (SWCA 2016b). SWCA also reviewed the list of priority species identified in the *Utah Partners in Flight Avian Conservation Strategy* (Parrish et al. 2002) as part of the resource inventory. Of the 24 priority species listed, there is potential habitat for 23 in the proposed lease parcels.

SWCA also reviewed the National Audubon Society IBAs in Utah and IWJV Bird Habitat Conservation Areas (BHCAs) (SWCA 2016b). As explained in the Resource Inventory Report, IBAs are defined as "sites that support: 1) species of conservation concern; 2) range-restricted species; 3) species that are vulnerable because their populations are concentrated in one general habitat type or biome, and; 4) species, or groups of similar species, that are vulnerable because they occur at high densities due to their congregatory behavior" (SWCA 2016b). The IWJV *Coordinated Bird Conservation Plan* defines BHCAs as areas identified based on their "inherent value for priority birds and priority habitats" and states that "BHCAs are the best geographies where habitat conservation should take place in the next decade" (SWCA 2016b). Lease parcel 7 is located adjacent to the Clear Lake Waterfowl Management Area in Millard County, Utah, which is designated as an IBA. Parcel 7 is also located within the Delta BHCA.

The resource inventory also generated USFWS Information for Planning and Conservation (iPaC) database reports for each lease parcel. These reports include lists of migratory birds that could be impacted by a project. The iPaC reports indicated that there is potential habitat in or near each lease parcel for between 15 and 20 migratory bird species (SWCA 2016b).

As part of the resource inventory, SWCA also reviewed available geospatial data for raptor occurrences within 1 mile of each parcel. There are known nest occurrences for red-tailed hawk, ferruginous hawk, and burrowing owl (*Athene cunicularia*) within 1 mile of lease parcel 1; golden eagle, red-tailed hawk, and ferruginous hawk nest occurrences within 1 mile of lease parcel 2; ferruginous hawk nest occurrences within 1 mile of lease parcel 3; and red-tailed hawk and ferruginous hawk nest occurrences within 1 mile of lease parcel 7 (SWCA 2016b).

3.8.2. *Environmental Consequences*

The analysis area for migratory birds consists of the HUC 10 watersheds that surround each lease parcel:

- Lease parcel 1: Cove Creek and The Big Wash-Beaver River watersheds (387,042 acres)
- Lease parcel 2: Cove Creek watershed (201,041 acres)
- Lease parcel 3: Fisher's Wash and Long Lick Canyon-Big Wash watersheds (388,077 acres)
- Lease parcel 4 and 5: Pahvant Valley watershed (94,597 acres)
- Lease parcel 6: Dry Lake Creek-Fish Springs Wash and Swasey Wash watersheds (345,493 acres)
- Lease parcel 7: Clear Lake watershed (154,295 acres)
- Lease parcel 8: Hog Back Reservoir-Old River Bed watershed (147,248 acres)

This analysis area was chosen because the watersheds represent a defined continuous area linked by common watercourses on which migratory birds depend.

3.8.2.1. PROPOSED ACTION

Geothermal exploration, development, and operation activities following a lease sale of the eight parcels would affect migratory birds. Common impacts on migratory birds from the four phases of geothermal development would consist of those described for wildlife and special status species. More specifically, impacts on migratory birds could include a loss of habitat in each lease parcel from surface disturbance and vegetation removal. Habitat loss would likely range from 65 to 374 acres, depending on the extent of geothermal development on each parcel. Impacts could also include the displacement of individual birds, the abandonment of nests during breeding seasons because of human activity and noise, a temporary relocation of prey from the project area because of human activity and noise, and potential mortality from

vehicular collisions. Human activity and noise would be short term during construction activities, occurring sporadically, but would continue to occur after completion of geothermal development. Similar habitat for displaced prey or individual birds would be available in adjacent areas. Impacts to migratory birds would be minimized through the application of lease stipulations and BMPs.

3.8.2.1.1. Lease Stipulations and Best Management Practices

The BLM would apply the appropriate lease stipulations and BMPs from the Geothermal ROD (Section 2.3 and Appendix B) to the Proposed Action to protect migratory birds on the eight lease parcels. TL and CSU lease stipulations could be used to protect migratory birds and their breeding areas. For example, a TL stipulation could be applied to a lease parcel to limit construction near raptor nests during breeding season. Specific BMPs for wildlife described in Section 3.4.2.1.1 of this EA also apply to migratory birds, along with the Geothermal ROD BMP (Section B.4.4 of Appendix B) that requires enclosing or screening containers used to collect liquids to prevent access by migratory birds.

If the Proposed Action is approved and subsequent applications for geothermal exploration and development are received for the lease parcels, SWCA recommends pedestrian surveys for migratory birds on each parcel (see Resources Inventory Report for details; SWCA 2016b). Raptor nest surveys are required if ground-disturbing activities occur within the breeding and nesting period, March 1–August 31, for most raptor species. If active raptor nests are documented during field surveys, spatial and temporal buffers would be required as outlined in the USFWS *Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbances* (Romin and Muck 2002). Breeding bird nest surveys would also be required for nesting passerines if ground-disturbing activities occur during the breeding and nesting period, March 15 to August 15 (SWCA 2016b).

Pre-construction surveys for migratory birds and raptor nests would limit impacts from geothermal development. In addition, lease stipulations and BMPs as described above and in the Geothermal ROD would be applied as appropriate to each lease parcel. Impacts to migratory birds would be minimized through the implementation of the stipulations and BMPs.

3.8.2.2. NO ACTION ALTERNATIVE

Under the No Action Alternative, the BLM and USFS would not lease the eight parcels for geothermal resources. Without leasing, exploration and development of geothermal resources would not occur on the parcels. The parcels would continue to be used primarily for open space, livestock grazing, wildlife habitat, roads, and undeveloped recreational uses. Effects to migratory birds from these land uses would continue similar to current conditions. No migratory birds or bird habitat would be affected by construction or development activities for geothermal facilities.

3.9. Water Resources

The federal management agencies for all eight lease parcels have determined that leasing the parcels may have a potential impact on water resources. This section presents the affected environment and analyzes potential impacts to water resources on all eight parcels.

3.9.1. *Affected Environment*

3.9.1.1. SURFACE WATER

Watershed boundaries define the aerial extent of surface water drainage. According to the NRCS, a hydrologic unit is "a drainage area delineated to nest in a multi-level, hierarchical drainage system. Its boundaries are defined by hydrographic and topographic criteria that delineate an area of land upstream from a specific point on a river, stream or similar surface waters" (NRCS 2016b). HUCs include designations for the region, subregion, basin, subbasin, watershed, and subwatershed.

All eight lease parcels are in the Escalante Desert-Sevier Lake subregion and the Escalante Desert-Sevier Lake basin of the Great Basin Region. More specifically, lease parcels 1 and 2 are in the Beaver Bottoms-Upper Beaver subbasin, and in the Cove Creek and the Big Wash-Beaver River watersheds. Lease parcel 3 is in the Beaver Bottoms-Upper Beaver and Escalante Desert subbasins, and in the Fisher's Wash and Long Lick Canyon-Big Wash watersheds. Lease parcels 4, 5, and 7 are in the Lower Beaver subbasin. Within the subbasin, lease parcels 4 and 5 are in the Pahvant Valley watershed and lease parcel 7 is in the Clear Lake watershed. Lease parcels 6 and 8 are in the Lower Sevier subbasin. Within the subbasin, lease parcels 6 and 8 are in the Dry Lake Creek-Fish Springs wash and Swasey Wash watersheds and the Hog Back Reservoir-Old River Bed watershed, respectively.

Lease parcel 1 is on the western slope of the Mineral Mountains at the northern end of the Escalante Desert. It has numerous drainages and several intermittent streams that flow from the Mineral Mountains west toward the Beaver River. Several springs are present near the parcel in the Mineral Mountains. Lease parcel 2 is also on the western slope of the Mineral Mountains and has numerous drainages and several intermittent streams that flow from the Mineral Mountains toward the Beaver River. Lease parcel 3 is located in Escalante Valley and contains no major drainages. Thermo Hot Springs are immediately adjacent to the lease parcel 3.

In general, numerous drainages flow west from the Pahvant Range through lease parcel 4 toward Dog Valley. Major nearby drainages include Dog Valley Creek, to the north of the parcel; Thousand Dollar Gulch, which crosses the northeast corner of the parcel; and Cove Creek, which flows generally east to west south of the parcel. Dog Valley Creek is the primary drainage in lease parcel 5; numerous drainages flow downslope from the hilltops into Dog Valley Creek, which flows from Dog Valley Spring in the Pahvant Range toward Dog Valley. Both Thousand Dollar Gulch and Cove Creek flow south of this parcel.

Swasey Bottom lies at the northern end of lease parcel 6; Swasey Wash, which is fed by many ephemeral drainages from the House Range/Swasey Mountains and Little Drum Mountains, passes generally northwest to southeast through the parcel toward the Sevier Desert, eventually draining into Clear Creek approximately 22 miles to the southeast. Sevier Lake, a remnant of Lake Bonneville, is 28 miles to the south. Numerous springs are west of the lease parcel, in the House Range/Swasey Mountains.

Lease parcel 7 is adjacent to both Clear Lake and the Clear Lake Waterfowl Management Area; the Beaver River flows roughly north to south approximately 9 miles to the west; Sevier Lake, a remnant of Pleistocene Lake Bonneville, is 26 miles to the southwest. Parcel 7 contains large quantities of wetlands (further discussed in Section 3.10.1).

Lease parcel 8 is in a relatively flat area of the Sevier Desert/Black Rock Desert, 9.5 miles southeast of Keg Mountain, and 7 miles northeast of Crater Bench and the mudflats; Desert Mountain is 8.6 miles to the northeast. The Old River Bed flows north to south through the parcel; numerous ephemeral drainages flow into the parcel from Keg Mountain.

Table 3.13 presents USGS National Hydrography Dataset (NHD) waterbody and flowline data for the lease parcels.

Table 3.13. National Hydrography Dataset Waterbody and Flowline Data for Parcels 4 through 8

Parcel Number	Stream/River (feet)		Connector (feet)	Artificial Path (feet)	Canal/Ditch (feet)	Lake/Pond (acres)	
	Intermittent	Perennial				Intermittent	Perennial
1	25,711.5	–	4,718.1	–	–	–	–
2	59,494.5	–	1,706.7	–	–	–	–
3	12,905.1	–	10,709.4	–	–	0.7	–
4	25,773.8	–	897.4	–	–	–	–
5	34,124.2	494.3	–	–	–	–	–
6	117,417.2	–	2,972.6	194.6	–	0.4	–
7	11,916.5	68.4	85.9	972.0	3,914.9	2.2	11.4
8	8,571.1	–	17,228.9	–	–	–	–

Source: NRCS et al. (2015).

Note: Intermittent streams or lakes contain water for only part of the year, but typically more than just after rainstorms and at snowmelt. Perennial streams contain water throughout the year, except for infrequent periods of severe drought. A connector is a known, but nonspecific, connection between two nonadjacent network segments that have flow. An artificial path represents flow through a two-dimensional feature such as a lake.

Based on Table 3.13, all of the parcels contain intermittent streams and parcels 5 and 7 contain perennial streams. Parcel 7 contains a canal or ditch. Lease parcels 3, 6, and 7 have intermittent or perennial lakes/ponds. The surface estate of lease parcel 7 has an existing 40-acre Public Water Reserves Number 107 (PWR 107) withdrawal located in the SWSE of Section 26; it was recorded on December 10, 1986. The original "Interpretation" of this withdrawal dates back to April 17, 1916. This is a common federal reserved water right for public water holes and springs. The purpose of the PWR 107 was to reserve natural springs and water holes yielding amounts in excess of homesteading requirements. All waters from these sources in excess of the minimum amount necessary for these limited public watering purposes are available for appropriation through state water law. Surface water from this reserve may also support other resources of the Clear Lake Waterfowl Management Area to the immediate west. Existing water reserve withdrawal infrastructure on lease parcel 7 (located in SWSE of Section 26) includes a well head located at Mud Springs and an associated pond/reservoir with an estimated size of approximately 1 acre. Any proposed future geothermal exploration and development infrastructure and associated activity would need to avoid affecting this existing authorized surface water use/right.

3.9.1.2. GROUNDWATER

Each of the eight parcels proposed for geothermal leasing is associated with some type of geothermal resource or reservoir. Geothermal reservoirs are underground reservoirs or basins of hot water. (The reservoir must have fluid, heat, and permeability to be used for electricity generation.) Because of the programmatic nature of this EA, a discussion of the specific geothermal reservoirs associated with each parcel is not provided. Subsequent proposals for exploration and/or development on specific parcels would be subject to NEPA prior to implementation and would include analysis of the specific geothermal reservoir, in conjunction with the associated groundwater aquifer. This section of the EA provides a broad summary of the groundwater aquifers associated with each parcel.

The Great Basin contains a regional aquifer consisting of many individual basins, most of which are hydrologically linked. While some basins form multi-basin groundwater flow systems through the movement of water through permeable sedimentary deposits or consolidated rock, other basins are linked by rivers or surface-water drainages. Some basins are hydrologically isolated. All of the basins sit in structural depressions that have been filled either with alluvial deposits derived from the adjacent mountain ranges or lacustrine deposits derived from Quaternary lakes (Mason 1988). Regional ground-water flow is conceptualized as having two components: 1) a relatively shallow component that moves primarily from mountain ranges to basin fill beneath valley floors, which is superimposed on 2) a deeper component that moves primarily through carbonate rocks. Deeper groundwater flow mostly discharges at regional springs or in areas of evapotranspiration upgradient from terminal sinks such as the Great Salt Lake and the Railroad Valley (Prudic et al. 1993). At the regional scale, groundwater flow between hydrogeologic units of the Great Basin may occur where a hydraulic gradient is present, where the intervening mountains are composed of permeable rock that permits groundwater flow, and where substantial groundwater mounding from mountain-block recharge does not occur (Heilweil and Brooks 2011).

Lease parcels 1, 2, and 3 are in the Milford area, a north-trending groundwater basin bounded by the Mineral Mountains to the east and the San Francisco Mountains to the west. Lease parcels 1 and 2 are near the Roosevelt Hot Springs KGRA along the eastern margin of the Milford area at the base of the Mineral Mountains. Lease parcel 3 is located immediately adjacent to the Thermo Hot Springs KRGA. Unconsolidated materials underlying the Milford area contain the principal groundwater aquifer, which consists of three zones of high permeability separated by zones of low permeability. The zones are hydraulically connected, and the thickness of the aquifer reaches a maximum of approximately 840 feet about 21 miles south of Milford (Mower and Cordova 1974). Groundwater in the Milford area flows to the northwest through consolidated rocks in the northern San Francisco Mountains toward Sevier Lake (Mason 1988). The total amount of groundwater in storage is approximately 40 million acre-feet (Mower and Cordova 1974). The chemical quality of groundwater improves with depth to at least 250 feet; the median concentration of TDS in groundwater samples drawn from wells is 569 mg/l (Mower and Cordova 1974). The Milford area groundwater system is unconfined along the margins of the basin but becomes confined in the center of the southern half of the basin. In this area, the upper 200 to 300 feet of the saturated basin fill is under both unconfined and semiconfined conditions (Mason 1988).

Lease parcels 4 and 5 are located near the Cove Fort-Sulphurdale KGRA. In the Cove Fort area, the groundwater system provides all of the agricultural and culinary water supply and may be connected with groundwater in adjoining basins (Kirby 2012). The principal aquifer consists of basin-fill deposits and interbedded volcanics in lowland or valley areas, which are bounded by mountain ranges consisting of relatively impermeable tertiary volcanic and intrusive rocks and bedrock. High groundwater levels and impermeable geologic units along mountainous parts of the drainage basin prevent interbasin flow. Interbasin flow may occur elsewhere (Kirby 2012). Groundwater in the principal aquifer moves from areas of high elevation and recharge near the bases of the Mineral, Tushar, and San Francisco Mountains to areas of low elevation and discharge along the Beaver River and possibly in the Pahvant Valley. Along ephemeral portions of the Cove Creek channel, depth to groundwater is usually greater than 100 feet. Across much of the Beaver River valley, depth to groundwater is generally less than 50 feet (Kirby 2012). Groundwater quality is good in this area, with TDS values of less than 1,000 milligrams per liter (mg/L); it is lower in quality, with TDS levels greater than 2,000 mg/L, near Roosevelt Hot Springs and along the Beaver River. Available data indicate that much of the principal aquifer in the Cove Creek basin is unconfined (Kirby 2012).

Lease parcels 6, 7, and 8 are located in the Sevier Desert. The Sevier Desert covers an area of approximately 3,000 square miles, within a large basin in the eastern part of the Basin and Range Province (Mower and Feltis 1968). Extending from the mountain fronts into the basin, large alluvial fans meet with eolian and lacustrine deposits and with fluvial deposits of the Sevier River. These

unconsolidated deposits form a multi-aquifer artesian system that is over 1,000 feet thick. The artesian system extends from near the area of main recharge along the east side of the basin to Sevier Lake (Mower and Feltis 1968). Groundwater in the Sevier Desert occurs in consolidated rocks and unconsolidated basin fill (Holmes 1984). The principal aquifers of the Sevier Desert are in the unconsolidated basin fill. The thickness of the basin fill ranges from 1,300 feet to possibly 2,140 feet. The groundwater reservoirs in most of the Sevier Desert consist of shallow and deep artesian aquifers with a confining bed between them, and a water-table aquifer. The amount of recoverable groundwater storage in the unconsolidated basin fill is approximately 200 million acre-feet (Holmes 1984). The chemical quality of the groundwater ranges widely throughout the basin (e.g., lower quality groundwater [higher concentrations of dissolved minerals] has been detected near Leamington, whereas Delta has the highest water quality) (Mower and Feltis 1968). The concentrations of dissolved constituents in the groundwater of the shallow artesian aquifer are increasing in the Leamington and Lynndyl area. Water quality also usually deteriorates with depth (Mower and Feltis 1968).

A groundwater protection zone is located less than 1 mile south of lease parcel 4. Groundwater protection zones are management areas delineated around groundwater drinking sources to protect them from contamination. Parcel 8 is located approximately 5 miles north of the popular and heavily used Baker Hot Springs.

3.9.2. *Environmental Consequences*

The analysis area for water resources consists of the HUC 10 watersheds that surround each lease parcel:

- Lease parcel 1: Cove Creek and The Big Wash-Beaver River watersheds (387,042 acres)
- Lease parcel 2: Cove Creek watershed (201,041 acres)
- Lease parcel 3: Fisher's Wash and Long Lick Canyon-Big Wash watersheds (388,077 acres)
- Lease parcel 4 and 5: Pahvant Valley watershed (94,597 acres)
- Lease parcel 6: Dry Lake Creek-Fish Springs Wash and Swasey Wash watersheds (345,493 acres)
- Lease parcel 7: Clear Lake watershed (154,295 acres)
- Lease parcel 8: Hog Back Reservoir-Old River Bed watershed (147,248 acres)

This analysis area was chosen because the watersheds represent hydrologic system boundaries for each lease parcel.

3.9.2.1. PROPOSED ACTION

Geothermal exploration, development, and operation activities following a lease sale of the eight parcels would affect water resources. As described in the Geothermal PEIS, common impacts on water resources from the four phases of geothermal development would consist of the following (BLM 2008a) (Section 4.7.3):

- Exploration: Survey activities have little to no impact on surface water and groundwater. Exploratory drilling involves some ground disturbance, which could lead to an increase in soil erosion. Eroded soil can be transported in surface runoff to streams and other surface waters.
- Drilling: Within the geothermal field, geothermal fluids can be under high pressure. Drilling can create pathways for geothermal fluids to move into groundwater at shallow depths or commingle between aquifers of differing quality, impacting shallow groundwater quality if mixing occurs

and possibly altering the natural circulation of geothermal fluids. The degree of impact depends on aquifer characteristics and local conditions. Release of geothermal fluids during well testing can cause temporary impacts on surface waters if not contained, including thermal changes and changes in water quality. Accidental spills of geothermal waters may also occur. Extraction of geothermal fluids could result in drawdown in connected shallower groundwater aquifers, with the resulting potential to affect streams or springs connected to the water table aquifer. The Geothermal PEIS states that "there is a medium risk for moderate to high impacts on groundwater supplies from the use of groundwater for geothermal activities" (BLM 2008a).

- Utilization: Ground disturbance can lead to an increase in soil erosion, which can be transported in surface runoff to surface streams and other waters. Geothermal resource use could affect groundwater through the consumption of water by evaporation and the need to reinject water to replenish the geothermal reservoir. Effects would depend on groundwater conditions and availability within the basin, and the type of groundwater plan. Geothermal plants produce wastewater from cooling tower blowdown, which could affect shallow groundwater quality. This discharge would be subject to a National Pollution Discharge Prevention System permit and would likely be released to a lined pond to prevent infiltration. Based on this, the potential for water quality impacts on surface water from operational discharges is expected to be minor or mitigable (BLM 2008a). Air-cooled systems would have fewer impacts than systems with cooling water. Small amounts of geothermal fluids can be accidentally released into the surface environment from venting steam or through breakdowns, which would have minor impacts on surface water in the immediate area. Hot springs can be part of sensitive ecosystems, recreation areas, or traditional cultural properties. Geothermal resources that are developed are usually at greater depths than shallow groundwater associated with hot springs; however, withdrawing shallow groundwater or surface water for cooling water could affect nearby hot springs.
- Reclamation and abandonment: Improper abandonment of wells could allow geothermal fluids to migrate to other aquifers, affecting both the geothermal resource and other groundwater quality. Proper well abandonment would reduce the risk of these impacts.

Each of the parcels has surface waters that could be impacted by geothermal activities as described above. Effects to surface waters would occur in areas downgradient of the developed area on each parcel. Vegetation removal and soil disturbance and compaction during geothermal development could increase stormwater runoff, which could discharge sediment to surface waters. Surface water contamination could also occur from geothermal fluids. Geothermal fluids can contain a variety of dissolved compounds, including silica, sulfates, carbonates, metals, and halides (BLM 2008a). Mixing of geothermal fluids with surface water (or groundwater) could degrade the water and potentially damage aquatic ecosystems and contaminate drinking water supplies.

Groundwater beneath the parcels could be impacted as described above for the four phases of geothermal development. There is also potential for groundwater depletion due to water use for construction and facility operation, flow testing, and energy production. Surface features such as springs and existing water rights could be impacted by groundwater impairment or drawdown.

Site-specific impacts on water resources (including the identification and evaluation of private and public drinking water sources, existing water rights, and springs) would be addressed as part of the environmental analysis for subsequent proposals for exploration and/or development on specific parcels. Impacts to water resources would be minimized through the application of lease stipulations and BMPs.

3.9.2.1.1. Lease Stipulations and Best Management Practices

The BLM would apply the appropriate lease stipulations and BMPs from the Geothermal ROD (Section 2.3 and Appendix B) to the Proposed Action to protect water resources on the lease parcels. NSO lease stipulations could be used to protect waterbodies, riparian zone, wetlands, playas, and 100-year floodplains in a parcel (BLM 2008b; Section 2.3.2). The Geothermal ROD specifies lease stipulations for the protection of geothermal features, including the following:

> 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. (BLM 008b)

Specific BMPs for water resources are described in the Geothermal ROD (Section B.1.3 of Appendix B). These include complying with all state and federal surface and groundwater rules and regulations, developing a stormwater management plan to prevent off-site migration of contaminated stormwater or increased soil erosion, obtaining a clear understanding of the local hydrogeology (including areas for groundwater discharge and recharge and their potential relationships with surface waterbodies), avoiding the creation of hydrologic conduits between discrete aquifers, cementing all well casings from the casing shoe to the surface, and conducting periodic testing and monitoring through observation wells to assure maximum protection of water resources. The Geothermal ROD (Section B.2.2) also has several BMPs relating to water resources, including designing roads so that changes to surface water runoff are minimized and no new erosion is created, locating access roads to minimize stream crossings, and constructing stream crossings so that they do not decrease channel stability or increase water velocity. Other BMPs in the Geothermal ROD (Appendix B) include siting facilities away from water features, riprapping culvert outlets to dissipate water energy and reduce erosion, and regularly cleaning and maintaining catch basins, ditches, and culverts. Erosion features should be incorporated during reclamation so that water naturally infiltrates into the soil. Interim reclamation (or pre-interim reclamation) should include stormwater management actions to ensure disturbed areas are quickly stabilized to control surface water flow and to prevent erosion and siltation. These stipulations and BMPs would be used to address the potential impacts described in Section 3.9.2.1, including erosion, contamination of groundwater from geothermal fluids, and migration of geothermal fluids to other aquifers.

The existing water development facilities on lease parcel 7 would be avoided by stipulation during any geothermal exploration, development, or operation activities.

If the Proposed Action is approved and subsequent applications for geothermal exploration and development are received for the lease parcels, additional water resource investigations (and possibly groundwater modeling) would be required on the lease parcels. In addition, lease stipulations and BMPs as described above and in the Geothermal ROD would be applied as appropriate to each lease parcel. Impacts to water resources would be minimized through the implementation of the stipulations and BMPs.

3.9.2.2. NO ACTION ALTERNATIVE

Under the No Action Alternative, the BLM and USFS would not lease the eight parcels for geothermal resources. Without leasing, exploration and development of geothermal resources would not occur on the parcels. The parcels would continue to be used primarily for open space, livestock grazing, wildlife habitat, roads, and undeveloped recreational uses. Effects to water resources from these land uses would continue similar to current conditions. No water resources would be affected by construction or development activities for geothermal facilities.

3.10. Wetlands, Riparian Zones, and Floodplains

The federal management agencies for four of the eight lease parcels have determined that leasing the parcels may have a potential impact on wetlands, riparian zones, and floodplains. Lease parcels 1, 2, and 3 were not specifically identified by the Cedar City Field Office as being potentially impacted for wetlands, riparian zones, and floodplains; however, these parcels are included in the analysis because they contain mapped wetlands and intermittent streams. Lease parcel 6 was not specifically identified by the Fillmore Field Office as being potentially impacted for wetlands, riparian zones, and floodplains; however, it is also included in the analysis because it contains mapped wetlands, intermittent streams, and lakes/ponds. This section presents the affected environment and analyzes potential impacts to wetlands, riparian zones, and floodplains on all eight parcels.

3.10.1. *Affected Environment*

Wetlands are areas where water covers the soil, or is present either at or near the soil surface all year or for varying periods of time during the year, including the growing season (EPA 2015). National Wetland Inventory (NWI)–mapped wetland areas have been identified in lease parcels 1, 2, 3, 6, 7, and 8, as shown in Table 3.14. No NWI-mapped wetland areas were identified in lease parcels 4 and 5.

Table 3.14. National Wetland Inventory Mapped Wetland Areas in the Lease Parcels

Parcel Number	Type of Wetland	Acres of Mapped Wetlands
1	Riverine, intermittent, streambed, seasonally flooded (R4SBC)	7.2
2	Riverine, intermittent, streambed, seasonally flooded (R4SBC)	0.1
3	Palustrine, emergent, seasonally flooded, excavated (PEMCx)	0.4
	Palustrine, emergent, intermittently flooded (PEMJ)	0.3
6	Palustrine, unconsolidated shore, seasonally flooded, diked/impounded (PUSCh)	2.0
7	Lacustrine, littoral, unconsolidated shore, intermittently flooded (L2USJ)	121.6
	Palustrine, aquatic bed, semipermanently flooded, diked/impounded (PABFh)	9.8
	Palustrine, emergent, temporarily flooded, diked/impounded (PEMAh)	20.5
	Palustrine, emergent, temporarily flooded, excavated (PEMAx)	0.1
	Palustrine, emergent, saturated (PEMB)	0.9
	Palustrine, emergent, seasonally flooded (PEMC)	4.0
	Palustrine, emergent, seasonally flooded, diked/impounded (PEMCh)	61.3
	Palustrine, emergent, semipermanently flooded, diked/impounded (PEMFh)	9.7
	Palustrine, emergent, intermittently flooded (PEMJ)	46.4
8	Lacustrine, littoral, unconsolidated shore, intermittently flooded (L2USJ)	53.8

Note: Riverine wetlands are contained in natural or artificial channels periodically or continuously holding flowing water or that form a connecting link between two bodies of standing water. Palustrine wetlands include all nontidal wetlands dominated by trees, shrubs, emergents, mosses, or lichens. Emergent wetlands are characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens; this vegetation is present for most of the growing season in most years. Lacustrine wetlands are typically situated in a topographic depression or dammed river channel.

Lease parcel 7 and 8 contain the largest quantities of wetlands. Lease parcel 7 consists of two separate areas on the west side and east side of Clear Lake (Figure 3.1). It contains a total of 274.3 acres of NWI-mapped wetlands. The smaller western portion of the parcel contains primarily palustrine emergent wetlands, and the larger eastern portion of the parcel contains palustrine emergent wetlands, palustrine

aquatic bed wetlands, and lacustrine littoral wetlands. The lacustrine littoral wetlands are not necessarily open water, but are more often constantly wet mudflats (Thompson 2016). Lease parcel 8 contains a total of 53.8 acres of lacustrine littoral wetlands, as shown on Figure 3.2.

As shown in Table 3.13, all of the parcels contain intermittent streams, and parcels 5 and 7 contain perennial streams. Parcel 7 contains a canal or ditch. Lease parcels 3, 6, and 7 have intermittent or perennial lakes/ponds. These streams may support riparian zones. Riparian zones have unique soil and vegetation characteristics that are strongly influenced by the presence of water. They provide functions such as energy flow, nutrient cycling, and water cycling (NRCS 2016c).

The BLM conducted a riparian inventory that included a portion of the eastern part of parcel 7 in August 2005. The inventoried area was given a rating of proper functioning condition. The dominant vegetation was saltgrass (*Distichlis* spp.). Rushes (*Juncus* spp.) and seepweed (*Suaeda* spp.) were also present.

A floodplain is any land area susceptible to being inundated by floodwaters (Federal Emergency Management Agency 2016). No floodplain data was identified for any of the lease parcels.

3.10.2. *Environmental Consequences*

The analysis area for wetlands, riparian zones, and floodplains consists of the HUC 10 watersheds that surround each lease parcel:

- Lease parcel 1: Cove Creek and The Big Wash-Beaver River watersheds (387,042 acres)
- Lease parcel 2: Cove Creek watershed (201,041 acres)
- Lease parcel 3: Fisher's Wash and Long Lick Canyon-Big Wash watersheds (388,077 acres)
- Lease parcel 4 and 5: Pahvant Valley watershed (94,597 acres)
- Lease parcel 6: Dry Lake Creek-Fish Springs Wash and Swasey Wash watersheds (345,493 acres)
- Lease parcel 7: Clear Lake watershed (154,295 acres)
- Lease parcel 8: Hog Back Reservoir-Old River Bed watershed (147,248 acres)

This analysis area was chosen because the watersheds represent hydrologic system boundaries for each lease parcel.

3.10.2.1. PROPOSED ACTION

Geothermal exploration, development, and operation activities following a lease sale of the parcels could affect wetlands, riparian zones, and floodplains through ground disturbance. Ground disturbance could remove portions of the wetland, riparian zone, or floodplain; cause disruption to surface water flow or surface contours, which could affect water levels and drainage patterns; increase sedimentation; and remove or damage vegetation that is part of the local functioning unit. Geothermal development could also impact these areas through a release of geothermal fluids or other pollutants. In addition, changes to groundwater caused by geothermal development could impact surface waters that are key parts of wetlands or riparian zones, if there is connectivity.

Impacts to wetlands, riparian zones, and floodplains would be minimized through the application of lease stipulations and BMPs, particularly the use of NSO stipulations for floodplains and CSUs for riparian zones and wetlands.

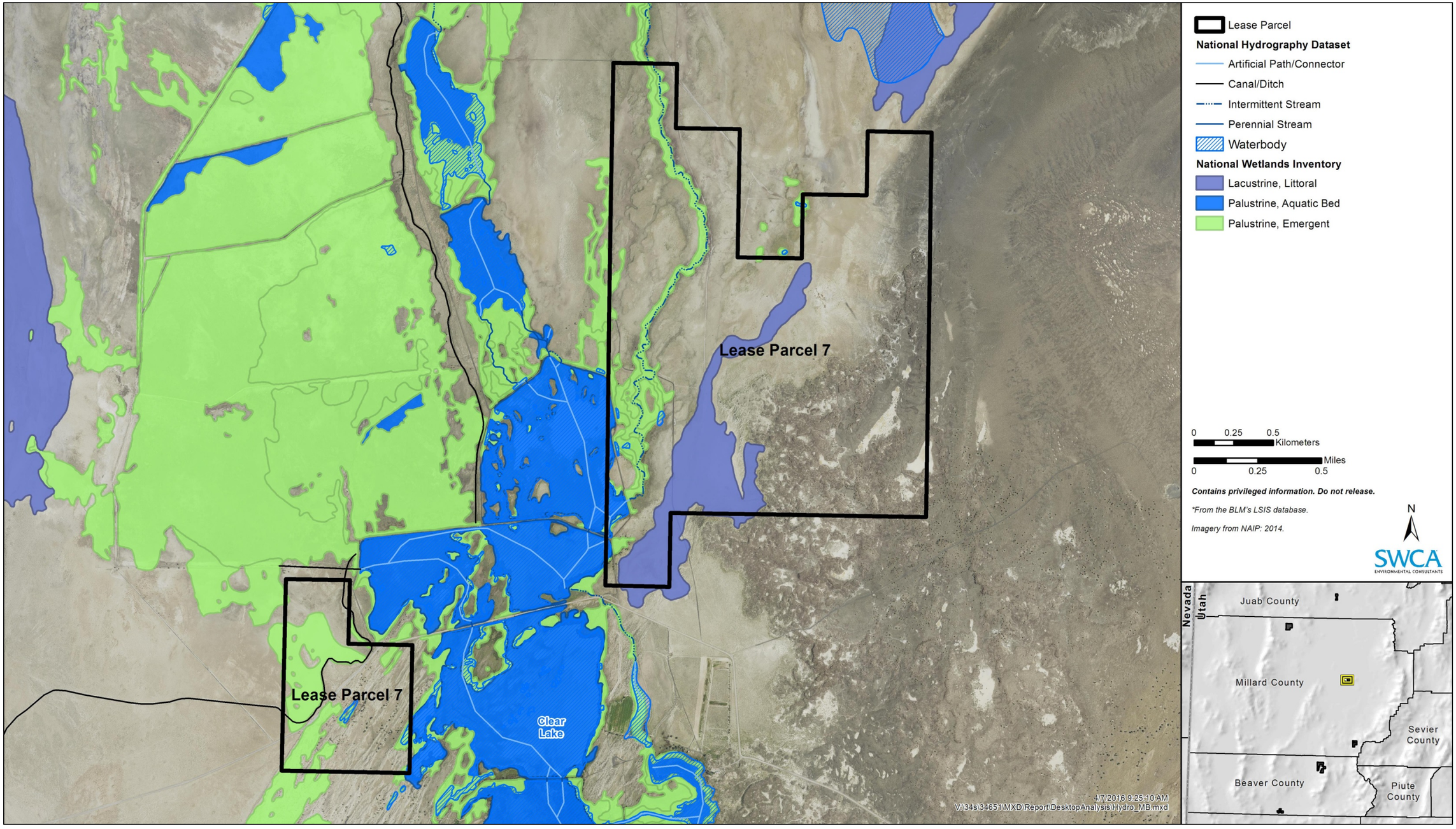

Figure 3.1. Wetlands and NHD data in lease parcel 7.

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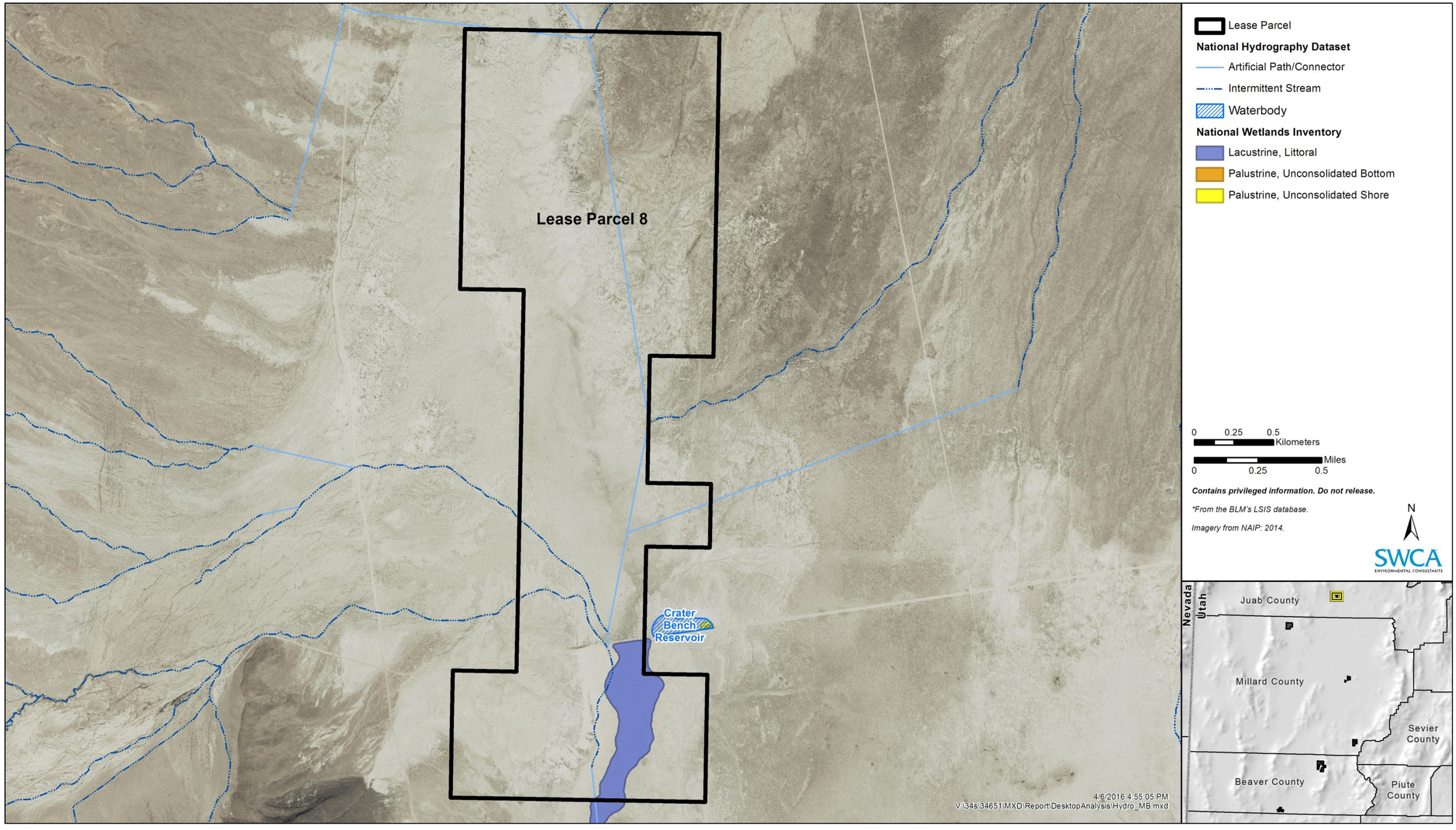

Figure 3.2. Wetlands and NHD data in lease parcel 8.

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3.10.2.1.1. Lease Stipulations and Best Management Practices

The BLM would apply the appropriate lease stipulations and BMPs from the Geothermal ROD (Section 2.3 and Appendix B) to the Proposed Action to protect wetlands, riparian zones, and floodplains on the lease parcels. Many of the stipulations and BMPs discussed in the water resources section also apply to wetlands, riparian zones, and floodplains. The Geothermal ROD indicates that NSO lease stipulations can be used to protect wetlands, riparian zones, and 100-year floodplains (BLM 2008b) (Section 2.3.2). The Geothermal ROD also specifies a CSU lease stipulation for the protection of riparian and wetland habitats:

> 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. (BLM 2008b; Section 2.3.3)

A specific BMP for wetlands and riparian zones is described in the Geothermal ROD (Section B.2.2 of Appendix B). It indicates that roads should be located away from drainage bottoms and wetlands (if practicable). These stipulations and BMPs would be used to address the potential impacts described in Section 3.10.2.1, including sedimentation and releases of geothermal fluids.

If the Proposed Action is approved and subsequent applications for geothermal exploration and development are received for the lease parcels, additional surveys for wetlands, riparian zones, and floodplains may be needed. Lease stipulations and BMPs as described above and in the Geothermal ROD would be applied as appropriate to each lease parcel. Impacts to wetlands, riparian zones, and floodplains would be minimized through project design and implementation of the stipulations and BMPs.

3.10.2.2. NO ACTION ALTERNATIVE

Under the No Action Alternative, the BLM and USFS would not lease the eight parcels for geothermal resources. Without leasing, exploration and development of geothermal resources would not occur on the parcels. The parcels would continue to be used primarily for open space, livestock grazing, wildlife habitat, roads, and undeveloped recreational uses. Effects to wetlands, riparian zones, and floodplains from these land uses would continue similar to current conditions. No wetlands, riparian zones, and floodplains would be affected by construction or development activities for geothermal facilities

3.11. Inventoried Roadless Areas

The USFS has determined that leasing parcels 4 and 5 may have a potential impact on IRAs. This section presents the affected environment and analyzes potential impacts to IRAs on these two parcels only.

3.11.1. *Affected Environment*

The management of roadless areas became a national focus in 1972 when the USFS initiated a review of such areas greater than 5,000 acres to determine their suitability for inclusion in the National Wilderness Preservation System. Additional reviews have been conducted through other assessments and the land and resource management planning process required by the NFMA of 1976 (USFS 2000). IRAs are expanses of land that have been identified by the USFS as being roadless and suitable for conservation. As outlined in 36 CFR Part 294, Supbart B, roadless area characteristics typically include the following:

- High-quality or undisturbed soil, water, and air
- Sources of public drinking water

- A diversity of plant and animal communities
- Habitat for threatened, proposed, candidate, and sensitive species, and habitat for species dependent on large, undisturbed areas of land
- Primitive, semi-primitive nonmotorized, and semi-primitive motorized classes of dispersed recreation
- Reference landscapes that serve as a barometer against which to measure the effects of development on other parts of the landscape
- Natural-appearing landscapes with high scenic quality
- Traditional cultural properties and sacred sites
- Other locally identified unique characteristics

Road construction, reconstruction, and timber harvest is prohibited in IRAs (with a few exceptions) to protect such characteristics.

Lease parcels 4 and 5 contain portions of the Dog Valley and Pyramids IRAs, as shown in Figure 3.3. Parcel 4 contains 1,133.9 acres of the Dog Valley IRA, and Parcel 5 contains 171.4 acres of the Dog Valley IRA and 558.7 acres of the Pyramids IRA.

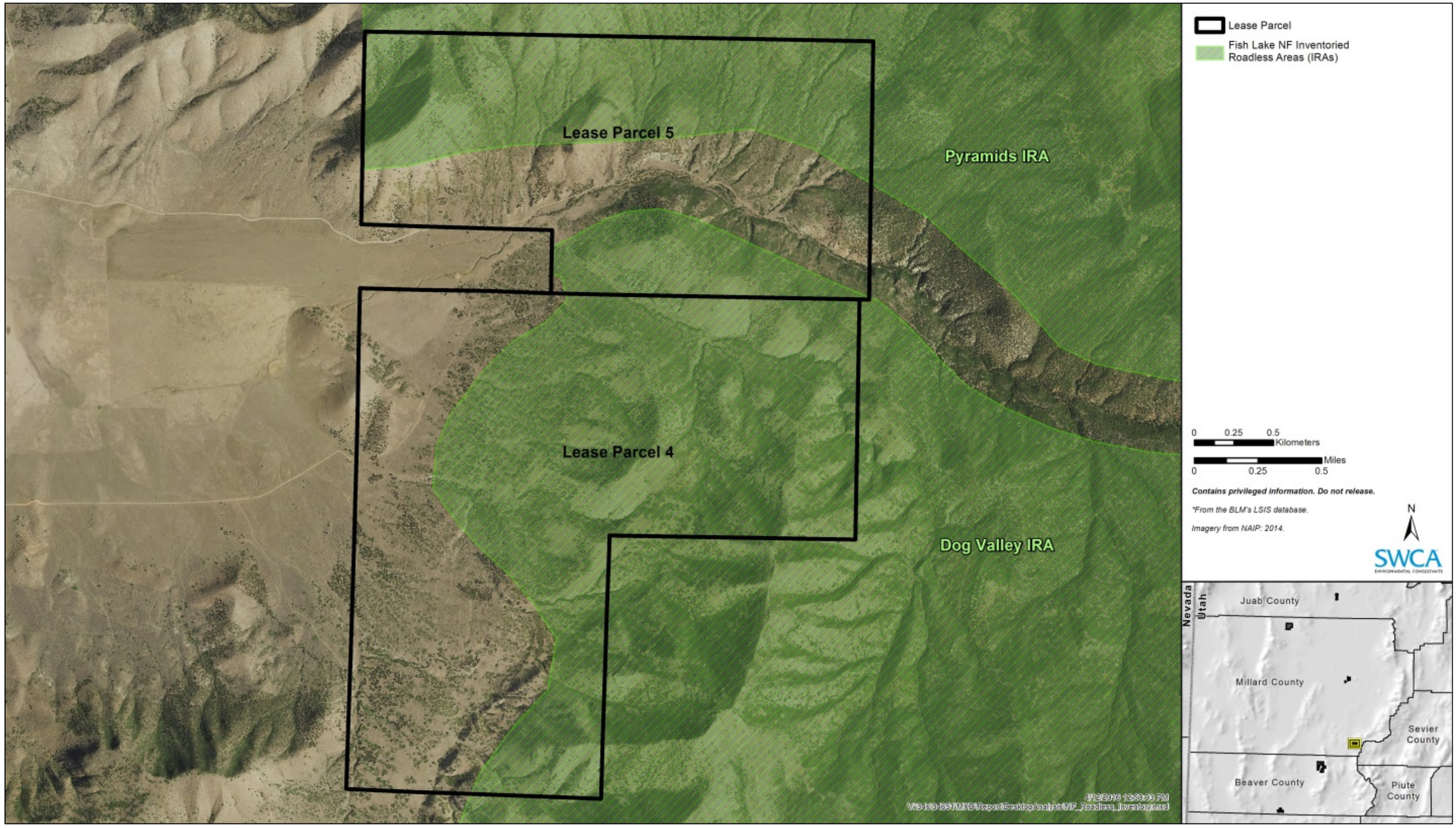

Figure 3.3. IRAs in lease parcels 4 and 5.

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3.11.2. *Environmental Consequences*

The analysis area for IRAs consists of the 398,056 total acres of IRAs in the Fillmore and Beaver Districts of the Fishlake National Forest. This analysis area was chosen because it provides clear topographical boundaries against which to measure impacts to IRAs.

3.11.2.1. PROPOSED ACTION

The 1,133.9 and 171.4 acres of the Dog Valley IRA in lease parcels 4 and 5, respectively, compose 0.3% of the IRAs in the 398,056-acre analysis area. The 558.7 acres of the Pyramids IRA in lease parcel 5 compose 0.1% of the IRAs in the analysis area. Together, both IRAs in lease parcels 4 and 5 (1,864 acres) compose 0.5% of all the IRAs in the Fillmore and Beaver Districts of the Fishlake National Forest.

The Geothermal PEIS (BLM 2008a; Section 4.2.7) discusses the common impacts to special designations such as IRAs associated with the four phases of geothermal development:

- Exploration: Administrative designations such as IRAs are not automatically withdrawn from geothermal development; however, activities that may affect the resources and values identified for protection under the designation would be precluded. If exploration were permitted, resources and values identified for protection under the designation (in this case, IRA) would be analyzed for potential impacts prior to any activity. Activities affecting such resources and values would be prohibited. Therefore, the effects of exploration on special designations are expected to be negligible.
- Drilling: Drilling operations are not expected to occur in special designations. Impacts would be similar to those described for exploration.
- Utilization: Because geothermal development is not expected to occur in special designations, utilization is not anticipated. Impacts would be similar to those described for exploration.
- Reclamation and abandonment: Because geothermal development is not expected to occur in special designations, reclamation and abandonment is not anticipated. Impacts would be similar to those described for exploration.

The Geothermal PEIS states that an IRA designation on USFS lands would not prohibit geothermal leasing; however, a nondiscretionary restriction would be placed on any leases within the designation. As a result, IRAs generally may not contain geothermal development because of restrictions on road construction and reconstruction (BLM 2008a) (Section 4.2.8). Because geothermal exploration, development, and operations would be prohibited in the IRAs on lease parcels 4 and 5, no direct impacts are expected. However, geothermal activities following a lease sale of the parcels 4 and 5 could indirectly affect the IRAs if they conflict with USFS management goals and objectives protecting IRAs, if they conflict with overall conservation goals for the area, or if they result in land uses that are incompatible with the existing IRAs.

3.11.2.1.1. Lease Stipulations and Best Management Practices

The BLM would apply the appropriate lease stipulations and BMPs from the Geothermal ROD (Section 2.3 and Appendix B) to the Proposed Action to protect the IRAs on lease parcels 4 and 5. The Geothermal ROD contains a specific roadless area lease stipulation:

> The BLM will issue a non-discretionary restriction on any leases within [National Forest System] inventoried roadless areas. Specifically, no new road construction or reconstruction would be allowed in designated roadless areas. (BLM 2008b)

NSO lease stipulations are consistent with the Forest Plan (Appendix H(a)) under special stipulations and would be used to protect the IRAs on lease parcels 4 and 5.

3.11.2.2. NO ACTION ALTERNATIVE

Under the No Action Alternative, the BLM and USFS would not lease the eight parcels for geothermal resources. Without leasing, exploration and development of geothermal resources would not occur on the parcels. The parcels would continue to be used primarily for open space, livestock grazing, wildlife habitat, roads, and undeveloped recreational uses. Effects to IRAs from these land uses would continue similar to current conditions. No IRAs would be affected by construction or development activities for geothermal facilities.

CHAPTER 4. CUMULATIVE IMPACTS ANALYSIS

4.1. Introduction

As defined in 40 CFR 1508.7 (CEQ regulations for implementing NEPA), a cumulative impact is an impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions (RFFAs), regardless of which agency (federal or non-federal) or person undertakes such actions. Cumulative impacts may result from individually minor but collectively significant actions occurring over a period of time.

4.2. Analysis Areas

The geographic extent of cumulative impacts may vary by the type of resource and resource issues and by the type of potential impact. Different cumulative impact analysis areas (CIAAs) have been developed for each resource and are listed in Table 4.1. A temporal boundary of 20 years was chosen for all resources because it is a reasonable timeframe within which to predict RFFAs, and because it is the time frame used in the Geothermal PEIS (BLM 2008a).

Table 4.1. Cumulative Impact Analysis Areas by Resource

Resource	Lease Parcels Potentially Impacted	CIAA	Rationale	Total CIAA Acreage
Cultural resources	All	All HUC 10 watersheds surrounding the lease parcels	Much of human cultural and behavioral variation is conditioned by the natural environment. Accordingly, archaeological, historical, and cultural sites within a defined natural habitat are often the product of a singular settlement system. This CIAA was chosen because it is a defined natural habitat for each lease parcel, and impacts to cultural resources in one part of that habitat can affect a broader understanding of the interrelationships between sites in the habitat area as a whole.	1,717,793
Wildlife	All	All HUC 10 watersheds surrounding the lease parcels	This CIAA was chosen because the watersheds represent a defined continuous area for each parcel that is linked by common watercourses on which wildlife depend.	1,717,793
Recreation	4, 5, and 8	Fillmore Hunt Unit (Pahvant subunit) and the Missouri Flat CWMU	This CIAA was chosen because it encompasses the project area and all of the nearby environs, and because it is actively managed for a recreational use (hunting).	564,699
Soils	All	All HUC 10 watersheds surrounding the lease parcels	This CIAA was chosen because the lease parcels fall within the watershed, and it provides clear topographical boundaries against which to measure cumulative impacts to soils.	1,717,793
Special status animal species	All	All HUC 10 watersheds surrounding the lease parcels	This CIAA was chosen because the watersheds represent a defined continuous area for each parcel that is linked by common watercourses on which special status species depend.	1,717,793
Migratory birds	All	All HUC 10 watersheds surrounding the lease parcels	This CIAA was chosen because the watersheds represent a defined continuous area for each parcel that is linked by common watercourses on which migratory birds depend.	1,717,793

Table 4.1. Cumulative Impact Analysis Areas by Resource

Resource	Lease Parcels Potentially Impacted	CIAA	Rationale	Total CIAA Acreage
Water resources	All	All HUC 10 watersheds surrounding the lease parcels	This CIAA was chosen because the watersheds represent hydrologic unit boundaries for each lease parcel.	1,717,793
Wetlands, riparian zones, and floodplains	All	All HUC 10 watersheds surrounding the lease parcels	This CIAA was chosen because the watersheds represent hydrologic unit boundaries for each lease parcel.	1,717,793
IRAs	4, 5	IRAs in the Fillmore and Beaver Districts of the Fishlake National Forest	This CIAA was chosen because it provides clear topographical boundaries against which to measure cumulative impacts to IRAs.	398,056

4.3. Past, Present, and Reasonably Foreseeable Future Actions

4.3.1. *Past and Present Actions Summary*

Development within the CIAAs includes roads, trails, geothermal facilities, the Sigurd to Red Butte power line and other transmission lines, agricultural fields, a wind farm, a mining and ballast quarry, and small towns. Other past and present actions in the CIAAs on BLM and USFS lands have included wildfires, grazing, range improvements associated with grazing, vegetation treatments, the implementation of greater sage-grouse management direction, and recreational uses (e.g., OHV use). Oil and gas leasing has occurred in some areas managed by the Fillmore Field office; however, no producing wells have been developed. Reasonably Foreseeable Future Actions Summary

RFFAs are decisions, funding, or formal proposals that are either existing or are highly probable, based on known opportunities or trends. Known RFFAs occurring in the CIAAs on USFS lands that may affect the leasing of geothermal resources consist of continued cattle grazing and associated management (which could include noxious weed treatment and the development of new range improvements such as fencing). Known RFFAs on BLM lands include continued grazing, range improvement projects, vegetation treatments, invasive species management, and potential oil and gas leasing; however, these are unlikely to interact with the leasing of geothermal resources because such interactions would be avoided through project design and mitigation (Ledbetter 2016). Two ROW applications may have minor interaction with the lease parcels: a road and fiber line ROW and the Bill Johnson Marble Mine Road ROW. Renewal of grazing permits is ongoing; new permits focus on meeting standards and guides for rangeland health for the sustainability of natural resources and ecological processes. In general, specific acreages and locations of RFFAs are not known at this time.

4.4. Cumulative Effects by Resource

Cumulative impacts organized by resource issue category are described below. A choice of No Action would not contribute incrementally to the impacts of past, present, and RFFAs because under the No Action Alternative, the BLM would not approve the leasing of the eight geothermal parcels, and no resulting geothermal development would occur. As a result, a No Action Alternative cumulative impacts analysis is not included below.

Because specific acreages and locations of RFFAs are not known at this time, the cumulative effects by resource section focus on past and present actions. Past and present actions in the CIAAs can be estimated by reviewing National Land Cover Database (NLCD) information. The NLCD presents characteristics of the land surface, including thematic classes such as forest, grassland/herbaceous, and developed. For this analysis, it is assumed that the following NLCD classes reflect past and present actions on the land (i.e., some type of development): all four developed classes (low intensity, medium intensity, high intensity, and open space), pasture/hay class, and cultivated crops class. The acreage of each of these classes in each CIAA has been totaled to estimate the amount of past and present actions in the CIAA. Table 4.2 provides a summary of the acres of cumulative disturbance in each resource CIAA with the implementation of the Proposed Action and resulting geothermal development. The estimate of cumulative disturbance in each CIAA is conservative because it assumes the maximum geothermal development disturbance per lease parcel (374 acres), and it does not include the implementation of lease stipulations and BMPs, which could limit overall disturbance. This table also assumes that all eight lease parcels are developed.

Table 4.2. Acres of Cumulative Disturbance in Each Resource CIAA

Resource	Lease Parcels Involved	Total CIAA Acreage or Size	Past and Present Developed Acreage in the CIAA*(percent of total CIAA acreage)	Maximum Geothermal Development Acreage (total for all lease parcels per resource)†	Acres of Total Cumulative Disturbance in the CIAA with Geothermal Development (percent of total CIAA acreage)	Percentage Increase to the Acres Disturbed by Past and Present Actions in the CIAA as a Result of Geothermal Development
Cultural, wildlife, soils, special status animal species, migratory birds, water resources, and wetlands, riparian zones, and floodplains	All	1,717,793	44,022 (2.6%)	2,992	47,014 (2.7%)	6.8%
Recreation	4, 5, and 8	564,699	4,172 (0.7%)	1,122	5,294 (0.9%)	26.9%‡
IRAs	4, 5	398,056	0	0	0	0

* Based on NLCD thematic classes (developed, pasture/hay, cultivated crops).

† Assumes 374 acres of development per lease parcel.

‡ This percentage is high because of the small amount of past and present development in the CIAA.

With the exception of recreation, the development of all eight lease parcels would constitute a less than 7% addition to past and present surface disturbance in the CIAAs. The CIAA for IRAs consists of the IRAs in the Fillmore and Beaver Districts of the Fishlake National Forest, in which development is generally prohibited. Therefore, there is no past or present developed acreage in this CIAA. No geothermal development would occur in the CIAA under the Proposed Action so there would be no direct incremental cumulative impact.

Although Table 4.2 groups certain resources together because they have been identified as being impacted by geothermal leasing and development on specific parcels and because they share CIAAs, the cumulative impacts to each type of resource may vary. The following sections provide a brief summary of cumulative impacts by resource. It should be noted that the issuing of geothermal leases for the eight parcels is not expected to have cumulative impacts. However, the geothermal exploration, development, and operation activities that would follow lease sales could have cumulative impacts. The cumulative impacts discussed below would be limited by lease stipulations, conditions of approval, and BMPs applied on a case-by-case basis.

4.4.1. *Cultural Resources*

Cultural resources tend to degrade over time from natural forces; however, many survive for hundreds or thousands of years. Past, present, and reasonably foreseeable activities causing surface and subsurface disturbance in the CIAA can disturb or damage cultural resources. Disturbances from geothermal development on the eight lease parcels could uncover or destroy cultural resources. Impacts would depend on the amount, placement, and type of surface disturbance, and could be beneficial (if the identification of new cultural resources during surface disturbance contributes cumulatively to an increase in the knowledge of cultural properties in the area) or adverse (if widespread disturbance activities cover a large portion of the landscape when viewed as a whole and lead to an increase in the potential for destruction or damage of cultural resources).

4.4.2. *Wildlife, Special Status Animal Species, and Migratory Birds*

Past, present, and reasonably foreseeable activities in the CIAAs could adversely affect wildlife, special status animal, and migratory bird species and habitat through fragmentation, degradation, or destruction; disruption of seasonal patterns or migration routes; displacement of individual animals; an increase in collisions between wildlife and vehicles; and impacts to the health of individual animals through stress. The severity of the cumulative impacts would depend on factors such as the sensitivity of the species affected, seasonal intensity of use, type of project activity, and physical parameters (e.g., topography, forage, and cover availability). However, not all species would be harmed by the conversion of land to more developed uses.

Long-term changes to wildlife habitat and habitat loss can be estimated through quantities of surface disturbance. The maximum estimated surface disturbance for all eight lease parcels is 2,992 acres, which constitutes 0.2% of the CIAA. A cumulative effect could occur through the removal of small patches of habitat that add up to a larger total over time. Although the footprint of geothermal development is relatively small, if it is added to other developments with similar effects, cumulative habitat fragmentation can occur. In addition, the development of new access roads, pipelines, and transmission lines can also contribute to fragmentation and the introduction of invasive species.

Traffic, noise, and increased human activity on the lease parcels during geothermal construction activities would create a short-term cumulative impact on wildlife, special status species, and migratory birds in the CIAA. A long-term cumulative impact would also be created by the presence of human activity and noise associated with completed geothermal plants.

Generally, special status species would be more susceptible to impacts because of their association with specific habitat types, sensitivity to disturbance, declining population numbers, and ongoing habitat losses. Loss of habitat is a key factor contributing to the increase in federally listed special status species (BLM 2008a).

4.4.3. *Recreation*

Past, present, and reasonably foreseeable projects with land-disturbing activity in the recreation CIAA may cumulatively and incrementally affect recreation by removing land from recreational use, limiting access to recreational land, or impacting resources or aesthetics on which recreation depends (e.g., wildlife, scenic views, trails, and solitude).

The Geothermal PEIS notes that geothermal leasing and development require a relatively small footprint and that the land necessary is not completely occupied by the plant and associated facilities. Given the small footprint, geothermal development is generally compatible with some forms of recreation (BLM 2008a). However, the construction and presence of a geothermal facility would alter the recreation setting (local visual and auditory conditions) and would affect the recreation experience. This effect would be minimal given the relatively small area needed for development (BLM 2008a).

4.4.4. *Soils*

Any past, present, and reasonably foreseeable activities that remove native vegetation and topsoil from the soils CIAA may cumulatively and incrementally affect soil resources. Impacts in the CIAA would depend on the amount, placement, and type of surface disturbance; the type of soil; and soil characteristics. Specific impacts to soils include removal of vegetation, exposure of soil, mixing of soil horizons (layers), soil compaction, loss of productivity, and increased susceptibility to wind and water erosion.

Geothermal energy exploration and development would have minor cumulative impacts on soil compaction and erosion when combined with other projects and land uses such as livestock grazing in the soils CIAA (BLM 2008a). Geothermal development would disturb a maximum of 2,992 acres of soils, which constitute 0.2% of the CIAA.

4.4.5. *Water Resources and Associated Features such as Wetlands, Riparian Zones, and Floodplains*

Past, present, and reasonably foreseeable projects can affect surface water resources through increased surface and sediment runoff and changes to water chemistry from human activity–derived contaminants. Geothermal development on the lease parcels could add cumulatively to such impacts. Past and present disturbance likely has greater impacts affecting surface water resources than the current Proposed Action based on the total acreages of disturbance (i.e., 44,022 acres of past and present impacts in the water resources CIAA versus 2,992 acres from geothermal development on the eight lease parcels). Cumulative impacts to wetlands, riparian zones, and floodplains could also occur from increased surface and sediment runoff and water quality degradation. This could result in the loss of proper functioning condition for individual wetlands, riparian zones, and floodplains; numerous poorly functioning or non-functioning wetlands, riparian zones, or floodplains can add up to a large cumulative impact over time.

Drilling, well testing, construction, and geothermal production all require water consumption. New water consumption when combined with other water use projects (e.g., municipal wells and agriculture) would have a cumulative impact. Because energy facilities often concentrate in areas abundant in a particular energy resource, there is more potential to contribute to the cumulative depletion of groundwater and the lowering of water tables. Actual water consumption by energy facilities can be somewhat mitigated through water efficiency and water reuse (BLM 2008a). Typically, the state engineer assigns water rights and manages groundwater resources. Any added use of groundwater in areas where water demand is approaching the available supply would contribute to cumulative groundwater impacts and could affect water rights. In addition, cumulative impacts to water quality in the CIAA could occur, primarily where energy facilities are concentrated.

4.4.6. *Inventoried Roadless Areas*

Geothermal exploration, development, and operations would not occur in the IRAs on lease parcels 4 and 5; however, past and present projects and the Proposed Action may cumulatively affect IRAs if they conflict with USFS management goals and objectives protecting such lands, if they conflict with overall conservation goals for the area, or if they result in land uses that are incompatible with existing IRAs. In these cases, cumulative impacts to IRAs could be expected if multiple projects occur adjacent to or near the same IRAs.

The Geothermal PEIS states that, given its small footprint, geothermal development is generally compatible with many other land uses, including some forms of recreation and wildlife habitat conservation. In addition, "management of special designation areas is governed by site-specific management direction to protect the special resource values. This gives local authorized officers the information and discretion on how to manage leases to minimize local and cumulative impacts" (BLM 2008a).

CHAPTER 5. CONSULTATION AND COORDINATION

5.1. Introduction

This chapter provides information on the consultation and coordination that occurred during the NEPA process. The results of consultation efforts are described below in Section 5.2.

5.2. Persons, Groups, and Agencies Consulted

A scoping letter was mailed to the Fishlake National Forest's mailing list on February 12, 2014. A public notice requesting comment on the leasing of geothermal resources on the USFS parcels was published in *The Richfield Reaper* on October 8, 2014. A comment letter was received from the Hopi Tribe as noted in Table 5.1 (see Appendix C).The BLM Cedar City and Fillmore Field Offices conducted internal scoping on the Proposed Action and completed ID team checklists in consultation with USFS specialists in late 2015 and early 2016. The proposed project was posted to ePlanning (https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=renderDefaultPlanOrProjectSite&projectId=61539&dctmId=0b0003e880b5f04f) on May 11, 2016.

Table 5.1. Persons, Agencies, and Organizations Consulted

Name	Purpose and Authorities for Consultation and Coordination	Findings and Conclusions
Paiute Indian Tribe of Utah	Consultation as required by the American Indian Religious Freedom Act of 1978 (42 USC 1996) and Section 106 of the NHPA of 1966 (36 CFR 800)	Consultation is ongoing.
Kaibab Band of Paiute Indians	Consultation as required by the American Indian Religious Freedom Act of 1978 (42 USC 1996) and Section 106 of the NHPA of 1966 (36 CFR 800)	Consultation is ongoing.
Kanosh Band of Paiute Indians	Consultation as required by the American Indian Religious Freedom Act of 1978 (42 USC 1996) and Section 106 of the NHPA of 1966 (36 CFR 800)	Consultation is ongoing.
Confederated Tribes of the Goshute Reservation	Consultation as required by the American Indian Religious Freedom Act of 1978 (42 USC 1996) and Section 106 of the NHPA of 1966 (36 CFR 800)	Consultation is ongoing.
Skull Valley Band of Goshute Indians	Consultation as required by the American Indian Religious Freedom Act of 1978 (42 USC 1996) and Section 106 of the NHPA of 1966 (36 CFR 800)	Consultation is ongoing.
Ute Indian Tribe	Consultation as required by the American Indian Religious Freedom Act of 1978 (42 USC 1996) and Section 106 of the NHPA of 1966 (36 CFR 800)	Consultation is ongoing.
Hopi Tribe	Consultation as required by the American Indian Religious Freedom Act of 1978 (42 USC 1996) and Section 106 of the NHPA of 1966 (36 CFR 800)	The Hopi Tribe requested that the BLM and USFS provide them with copies of the cultural resources survey report for review and comment.
Navajo Nation	Consultation as required by the American Indian Religious Freedom Act of 1978 (42 USC 1996) and Section 106 of the NHPA of 1966 (36 CFR 800)	Consultation is ongoing.
Pueblo of Jemez	Consultation as required by the American Indian Religious Freedom Act of 1978 (42 USC 1996) and Section 106 of the NHPA of 1966 (36 CFR 800)	Consultation is ongoing.
Utah State Historic Preservation Office	Consultation for undertakings as required by 54 USC 302105	Consultation is ongoing.

5.3. List of Preparers

Tables 5-2, 5-3, and 5-4 identify BLM and USFS staff and consultants used in the preparation of the EA.

Table 5.2. BLM Staff Used in the Preparation of this Environmental Assessment

Name	Position	Role
Utah State Office		
Jim Gazewood	Renewable energy program coordinator	Project manager
Terry Snyder	Geologist	Contract officer's representative
Julie Carson	Planning coordinator	Planning and environmental specialist
Sheri Wysong	Leasing coordinator	Fluid and mineral leasing coordination
Al McKee	Petroleum engineer	Fluid minerals (geothermal program/lease operations)
Nate Thomas	Archaeologist	Cultural resources
Robin Naeve	Biologist	Wildlife
Cedar City Field Office		
Elizabeth Burghard	Field manager	Staff oversight and coordination
Dan Fletcher	Assistant field manager	Staff oversight and coordination
Gina Ginouves	Planning and environmental coordinator	Land use planning/NEPA
Ed Ginouves	Geologist	Minerals (geothermal), interdisciplinary team lead
Jamie Palmer	Archaeologist	Cultural resources
Sheri Whitfield	Wildlife biologist	Wildlife
Fillmore Field Office		
Mike Gates	Field manager	Staff oversight and coordination
Joelle McCarthy	Assistant field manager	Staff oversight and coordination
Cindy Ledbetter	Planning coordinator	Land use planning/NEPA
Stacy Whitman Moore	Archaeologist	Cultural resources
Jim Priest	Biologist	Wildlife

Table 5.3. USFS Staff Used in the Preparation of this Environmental Assessment

Name	Position	Role
Fishlake National Forest		
Rob Hamilton	Minerals program manager	USFS project manager
Sean Kelly	Wildlife biologist	Wildlife
Robert Leonard	Archaeologist	Cultural resources
Doug Robison	Natural resource specialist	Recreation
Adam Solt	Hydrologist	Water resources
Lance Sudweeks	Rangeland management specialist	Livestock grazing and rangeland management
David Tait	Botanist	Vegetation

Table 5.4. SWCA Environmental Consultants Staff Used in the Preparation of this Environmental Assessment

Name	Position	Role
Tom Hale	Project manager and NEPA oversight	Review of all sections
Gretchen Semerad	NEPA specialist	NEPA Writer
Audrey McCulley	Ecological specialist	Biological resources
Melanie Medeiros	Archaeologist	Cultural resources
Rob D'Andrea	Archaeologist	Cultural resources
Rachel Johnson	GIS specialist	All maps and GIS data

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ABBREVIATIONS

Advisory Council of Historic Preservation	ACHP
all-terrain vehicle	ATV
best management practice	BMP
Bird Conservation Region	BCR
Bird Habitat Conservation Area	BHCA
Bureau of Land Management	BLM
Cedar/Beaver/Garfield/Antimony ROD/RMP	CBGA land use plan
Code of Federal Regulations	CFR
controlled surface use	CSU
Cooperative Wildlife Management Unit	CWMU
Council on Environmental Quality	CEQ
cumulative impact analysis area	CIAA
Endangered Species Act	ESA
environmental assessment	EA
environmental impact statement	EIS
Federal Land and Policy Management Act of 1976	FLPMA
Fillmore Field Office	FFO
finding of no significant impact	FONSI
Fishlake National Forest	FLNF
General Habitat Management Area	GHMA
geographic information system	GIS
hydrologic unit code	HUC
Important Bird Area	IBA
Information for Planning and Conservation	iPaC
interdisciplinary	ID
Intermountain West Joint Venture	IWJV
inventoried roadless area	IRA
known geothermal resource area	KGRA
memorandum of understanding	MOU
Migratory Bird Treaty Act	MBTA
milligrams per liter	mg/L
megawatt	MW
National Environmental Policy Act	NEPA

National Forest Management Act	NFMA
National Historic Preservation Act	NHPA
National Hydrography Dataset	NHD
National Land Cover Database	NLCD
National Wetland Inventory	NWI
Natural Resources Conservation Service	NRCS
no surface occupancy	NSO
off-highway vehicle	OHV
Priority Habitat Management Area	PHMA
programmatic environmental impact statement	PEIS
Public Water Reserves	PWR
reasonably foreseeable development	RFD
reasonably foreseeable future action	RFFA
record of decision	ROD
resource management plan	RMP
right-of-way	ROW
Southwest Regional Gap Analysis Project	SWReGAP
species of concern	SPC
SWCA Environmental Consultants	SWCA
timing limitation	TL
total dissolved solid	TDS
United States Code	USC
U.S. Fish and Wildlife Service	USFWS
U.S. Forest Service	USFS
U.S. Geological Survey	USGS
Utah Administrative Code	UAC
Utah Division of Wildlife Resources	UDWR
Utah Natural Heritage Program	UNHP
Utah Test and Training Range	UTTR

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Appendix A.

ID Team Checklist

Note: The Section 508 amendment of the Rehabilitation Act of 1973 requires that the information in federal documents be accessible to individuals with disabilities. The Bureau of Land Management has made every effort to ensure that the information in the Geothermal Leasing for Eight Parcels - Environmental Assessment *is accessible. However, this appendix is not fully compliant with Section 508, and readers with disabilities are encouraged to contact James Gazewood at jgazewoo@blm.gov or (801) 539-4107 if they would like access to the information.*

INTERDISCIPLINARY TEAM ANALYSIS RECORD CHECKLIST

Project Title: 2016 Statewide Geothermal Lease Sale, CCFO Parcels

N**EPA Log Number**: DOI-BLM-UT-0000-2016-0002-EA

File/Serial Number: BLM UTU-86142 (Parcel 1), UTU-86143 (Parcel 2), UTU-90200 (Parcel 3)

Project Cat-Herder: Ed Ginouves, for CCFO Parcels 1, 2, 3

DETERMINATION OF STAFF: (Choose one of the following abbreviated options for the left column)

NP = not present in the area impacted by the proposed or alternative actions
NI = present, but not affected to a degree that detailed analysis is required
PI = present with potential for significant impact analyzed in detail in the EA; or identified in a DNA as requiring further analysis
NC = (DNAs only) actions and impacts not changed from those disclosed in the existing NEPA documents cited in Section C of the DNA form.

Determi-nation	Resource	Rationale for Determination*	Signature	Date
RESOURCES AND ISSUES CONSIDERED (INCLUDES SUPPLEMENTAL AUTHORITIES APPENDIX 1 H-1790-1)				
NI	Air Quality	Programmatic: Both Beaver and Iron Counties are in attainment of the National Ambient Air Quality Standards (NAAQS) for all pollutants. Currently, air quality in and surrounding the planning area meets State Department of Environmental Quality and the Division of Air Quality Standards. The proposed action would not exceed the level of activity projected in the Reasonably Foreseeable Development Scenario (RFDS). The RFDS for the programmatic analysis area is currently exploratory work only with projected activities of surface geophysics work, temperature gradient holes drilled from small truck-mounted rotary rigs and (possibly) a handful of deep exploratory wells to further assess promising areas. While there would be some differences between the alternatives, all actions analyzed in the EA would adhere to current air quality standards and emissions would be within established limits. The potential impacts of geothermal development on air quality were adequately analyzed in the RMP/EIS. Given the low level of drilling and other activity described in the RFDS, only minimal emissions are anticipated and effects to air quality are expected to be negligible. The following project activities and sources would produce emissions: Well pad and road construction: earth-moving equipment fugitive dust, earth-moving equipment exhaust, and mobile source tailpipe emissions on access roads; Drilling: mobile source tailpipe emissions, fugitive dust emissions on access roads, and drill rig engine exhaust; Completion: mobile source tailpipe emissions, fugitive dust emissions on access roads, well venting emissions, and well fracturing engine emissions; Well pad operation: separator heater emissions, flashing, working, and breathing emissions from condensate tanks, steam and hydrogen sulfide emissions; Gas processing: central dehydrator emissions, mobile source tailpipe emissions, and fugitive dust emissions on access roads; and Operation and maintenance: mobile source tailpipe emissions and fugitive	E. Ginouves	11/19/15

Determi-nation	Resource	Rationale for Determination*	Signature	Date
		dust emissions on access roads. The pollutant emitted in the greatest quantities during well development would be PM_{10} from earthmoving operations and travel upon unpaved roads. Mineral aerosols from dust are generated from wind erosion of surface soils and can result in an increase in inputs of K, Mg, Ca, N and P to the ecosystem (Neff et al. 2008). Impacts from ground disturbing activities would be localized and temporary in nature and would decrease significantly with distance from the immediate activity with overall PM_{10} emission spread out over a large area. It is likely steam, hydrogen sulfide and carbon dioxide would be released from exploratory drilling. These emissions would likely be small and considered de minimus from a permitting standpoint. Since the exploratory wells would likely be in relatively remote areas, it is likely these emissions would have no effect. The GOLD Book contains adequate enforceable mitigation measures to assure no adverse impacts on air quality would occur in the affected area. BLM will utilize BMPs and site specific mitigation measures, when appropriate, based on site specific conditions, to reduce emissions and mitigate impacts to air quality. Because the BLM does not know the specific locations or plans for any future leases, they do not have the ability at this time to determine the effects. The BLM's draft air resources guidance states that quantitative dispersion modeling is inappropriate in the absence of detailed emission data, especially source location information. Project specific analyses will consider use of quantitative air quality analysis methods (i.e., modeling), when appropriate as determined by BLM, in consultation with state, federal, and tribal entities. BLM will continue to work cooperatively with state, federal, and tribal entities in developing air quality assessment protocols to address regional air quality issues and with the Utah Airshed Group to manage emissions from wildland and prescribed fire activities. The BLM will also continue to exercise its land management authority and responsibility to analyze potential air quality impacts, to set levels-of-concern and desired-future-conditions, and to support air resources monitoring. Parcels 1, 2, & 3: This same type of exploratory activity (as described for the programmatic portion of the checklist / EA) would be expected on the three offered parcels in the 2016 lease sale. The RFDS for the 3 parcels proposed in the lease sale is exploratory work only with projected activities of surface geophysics work, temperature gradient holes drilled from small truck-mounted rotary rigs and (possibly) a handful of deep exploratory wells to further assess promising areas. Any discovery in the area of the Blundell plant or otherwise would likely be would be utilized as part of a "closed" system, so discharges from the wells themselves would be expected to be unsubstantial.		
NP	Areas of Critical Environmental Concern	None within the CCFO boundaries.	D. Jacobson	12/1/2015

Determi-nation	Resource	Rationale for Determination*	Signature	Date
NP	BLM Natural Areas	None within the CCFO boundaries.	D. Jacobson	12/1/2015
PI	Cultural Resources	Parcels 001 and 002: Recent cultural resource inventories in and within 1-mile of the lease parcels located numerous historic properties that may be adversely affected. These parcels intersect the NRHP-listed Wildhorse Canyon Obsidian Quarry, the Negro Mag Wash quarry site, and the Roosevelt Hot Springs Mining District. Also, the proposed Mineral Mountains ACEC is within 1 mile of Parcel 001. Parcel 003: Recent cultural resource inventories in and within 1-mile of the lease parcel located historic properties that may be adversely affected. Also within 1-mile of the lease parcel is the Thermo Hot Springs, which is a culturally significant location to the Confederated Tribes of the Goshute Reservation and the Paiute Indian Tribe of Utah.	Jamie Palmer	11/20/2015
NI	Greenhouse Gas Emissions			
NI	Environmental Justice	No minority or economically challenged populations would be disproportionately affected.	E. Ginouves	11/19/15
NP	Farmlands (Prime or Unique)	No prime or unique farmlands are present because they lack irrigation water.	E. Ginouves	11/19/15
PI	Fish and Wildlife Excluding USFW Designated Species	Parcels 001, 002, 003 needs to be reviewed for the occurrence of UDWR mapped habitat for mule deer and pronghorn. Parcels 001 and 002 are both in crucial mule deer winter range. Parcel 001, 002 and 003 are in crucial yearlong pronghorn range. Parcel 001 is within substantial yearlong Rocky Mountain elk range. Mapped UDWR upland game species: Parcel 001 and 002 – Band-tailed pigeon, blue grouse. A variety of raptors can be found throughout parcels 001, 002 and 003.	S. Whitfield	11/19/15
NP	Floodplains	It is likely that in most cases, the 200 meter rule could be applied under the No Action Alternative to provide for conformance with Executive Order 11988. However, selection of the Proposed Action, which allows for additional resource protective measures beyond the terms and stipulations described for the No Action alternative would assure compliance with EO 11988 for all parcels.	E. Ginouves	11/19/15
NI	Fuels/Fire Management	Fire and fuels management was not specifically addressed in existing NEPA documents. However, *application of standard* operating procedures (SOPs), and site specific mitigation and safety measures applied at the GDP stage would minimize the risk of inadvertent ignition. Therefore no impacts to fire management are expected. There are fuels projects planned for some of the area covered by this action. Mitigation would be required for any future disturbance in these areas.	M. Mendenhall	11/19/15
NI	Geology / Mineral Resources/Energy Production	The only existing minerals-related authorizations present on the parcels are as follows: unpatented mining claims (for perlite), occupying the southern half of section 1 of parcel 1 (UTU-86142) and a plan of operations for a perlite mining operation (UTU-80276) which occupies the extreme	E. Ginouves	11/18/15

Determi-nation	Resource	Rationale for Determination*	Signature	Date
		southwest corner of section 1 of parcel 1; a single unpatented mining claim for opaline silica in the SE of sec. 9 within parcel 2 (UTU-86143), and a single unpatented mining claim for an unknown mineral in the SE of section 27 on parcel 2. As one would expect, all three parcels are prospectively valuable for geothermal resources. Commercial development of found geothermal resources in ongoing adjacent to all three parcels. Most of parcels 1 and 2 and all of parcels three are also prospectively valuable for oil and gas resources. The only known solid mineral resource on the three parcels parcels is lapidary-grade opaline silica on portions of section 9 of parcel 1 (UTU-86142) and perlite on the southern portions of section 1 of the same parcel. Surficial deposits of common-variety mineral materials exist on portions of all three parcels. Given a reasonably foreseeable development scenario of exploration operations for all three parcels, there would be no impact on the existing locatable minerals authorizations. If a discovery of a commercially-viable geothermal resource be made on parcel 1, surface interference issues could arise from lease operations conflicting with existing or proposed surface mining operations for perlite on portions of parcels 1. Lease operations might be constrained or denied on portions of the SWSW sec. 1, T. 26 S., R. 9 W., on parcel 1 to avoid conflict with existing permitted perlite mining operations.		
NI	Hydrologic Conditions	See Water Resources.		
NI	Invasive, Non-native Species	The BLM coordinates with County and local governments to conduct an active program for control of invasive species. Standard operating procedures such as washing of vehicles and annual monitoring and spraying along with site specific mitigation applied as conditions of approval (COA) at the GDP stage would be sufficient to prevent the spread or introduction of Invasive, Non-native species.	E. Ginouves	11/19/15
NI	Lands/Access	Multiple Rights-of-way exist within the proposed lease boundaries. The holder of a geothermal lease would be subject to adhere to all valid and existing rights held by existing right-of-way holders. Rights-of-way in proposed operation areas would not be affected providing application *of standard* operating procedures (SOPs), and site specific mitigation are applied at the GDP stage. The ability to move operation up to 200 meters would ensure that communication sites, water projects, pipe lines & power lines etc. would be avoided, restored or replaced. The holder of a Geothermal lease would be subject to adhere to all valid and existing rights held by existing right-of-way holders.	M. Campeau	11/30/15

Determi-nation	Resource	Rationale for Determination*	Signature	Date
NI	Livestock Grazing	Given the low degree of anticipated exploration and development and application of standard operating procedures (SOPs), and site specific mitigation applied at the GDP stage as conditions of approval (COA), it is concluded that existing analysis is adequate and that livestock grazing operations would not be affected. Any range improvements such as fences and cattle guards that would be impacted would be replaced or restored and disturbed areas would be reclaimed utilizing a BLM approved seed mix.	11/19/15	11/19/15
PI	Migratory Birds	Parcels 001, 002, and 003 would provide habitat for a variety of migratory birds and raptors. Appropriate lease notices should be attached.	S. Whitfield	11/19/15
PI	Native American Religious Concerns	Native American consultation is needed because the types of cultural resources that will be impacted by this project. Also, this type of project is not covered the existing MOU.	Jamie Palmer	11/20/2015
NI	Paleontology	No paleontological resources are known to exist on the three parcels recommended for leasing. Parcels 1 and 2 (Mineral Mountain area) have a surface geology comprised of intermingled Quarternary Period sedimentary units (primarily alluvial-fan deposits, with some basin fill deposits), Quaternary Period lava flow units, and Tertiary Period intrusive units (granite, monzonite, and syenite) interleaved with Precambrian gneisses. These geologic units fall within Class 1 (very low) and Class 2 (low) of the Bureau's Potential Fossil Yield Classification System giving a low probability of impacting any significant paleontological resources. The surface geology of Parcel 3, UTU-90200 (Thermo area) consists primarily of Pleistocene-age, lacustrine deposits (sand and silt) laid down by ancestral Lake Bonneville, with lesser areas of Holocene-age fan and pediment deposits (sand, silt and minor cobbles) . Vertebrate fossils of Pleistocene-age mega-fauna have been found in the shoreline deposits of Lake Bonneville, the nearest being some 30 miles to the south in the Beryl Jct.-Newcastle area. Given the widespread nature of the fossil deposits that have be found to date, the geologic unit comprising parcel 3 is thought to fall within Class 2 (low) of the Bureau's Potential Fossil Yield Classification System giving a low probability of impacting any significant paleontological resources.	E. Ginouves	11/18/15
NI	Rangeland Health Standards	Water quality, vegetation, Threatened & Endangered Species habitat and other components of ecological conditions that are considered in Standards and Guidelines for Rangeland Health have been analyzed in the previous NEPA documents pertaining to the nominated parcels. Given the low degree of anticipated exploration and development in conjunction with the application of Standard *O*perating Procedures (SOPs), and site specific mitigation applied at the GDP stage as conditions of approval (COA), it is expected that there would be no impacts to the Standards and Guidelines for Rangeland Health.	E. Ginouves	11/19/15
NI	Recreation	Other than a minor amount of dispersed recreation, there are no existing recreation resources which would be affected	D. Jacobson	11/19/15

Determi-nation	Resource	Rationale for Determination*	Signature	Date
		as a result of this proposal.		
NI	Socio-economics	Minor increases in local service sector revenue could be expected from the temporary workforce involved in the exploration of the parcels if they are leased. . Lasting substantial impacts to the socioeconomics of the communities in the general project area could result from the discovery of a commercial viable geothermal resource on any of the parcels; however the quantification of those impacts would depend on the specifics of any discovery made and would have to be analyzed when a proposal to develop those resources was received.	E. Ginouves	11/18/15
PI	Soils	Impacts to soil resources would consist of physical disturbance through 20 movement or removal, compaction, and changes to erosion patterns. Development on steep slopes would 21 increase erosion and the risk of landslides.	E. Ginouves	11/19/15
NI	Threatened, Endangered, Candidate or Sensitive Plant Species	. No Special Status Plant species occur within parcel 001, 002 or 003.	S. Whitfield	11/19/15
PI	Threatened, Endangered, Candidate or Sensitive Animal Species	There are no threatened, endangered or candidate species identified within parcels 001, 002 or 003. Parcel 002 provides habitat for the kit fox. Parcel 003 has an identified ferruginous hawk nest. Parcel 003 has a small portion of greater sage-grouse winter habitat identified. The parcel 003 is currently located in GHMA (general habitat management area) for greater-sage grouse. This parcel is located more than 4 miles from a lek. This parcel would not be closed to leasing and would not be subject to any seasonal buffers or restrictions.	S. Whitfield	11/19/15
NP	Wastes (hazardous or solid)	Given the reasonably foreseeable development scenario of exploration on the parcels 1, 2, and 3, no solid or hazardous waste impacts could be expected.	E. Ginouves	11/18/15
PI	Water Resources/Quality (drinking/surface/ground)	Surface and groundwater could be affected by exploration, drilling, utilization and reclamation. See EA.	E. Ginouves	11/19/15
NP	Wetlands/Riparian Zones	There are no wetlands or riparian zones coincident or within 300 meters of parcels 1, 2 or 3.	E. Ginouves	11/19/2015
NP	Wild and Scenic Rivers	There are no designated or eligible segments of wild or scenic rivers in the Cedar City field office area	D. Jacobsen	11/19/2015
NI	Wilderness/WSA	No designated wilderness or wilderness study areas are within or adjacent to the project area.	D. Jacobsen	11/19/2015
NI	Woodland / Forestry	Given the low degree of anticipated exploration and development under the RFDS and application of standard operating procedures (SOP's) and site specific mitigation applied at the APD stage as conditions of approval (COA), it is concluded that woodland or forest resources would not be affected in a way not already analyzed in existing NEPA documents. In summary, the potential exists for removal of	E. Ginouves	11/19/15

Determi-nation	Resource	Rationale for Determination*	Signature	Date
		pinyon or juniper trees on potential access roads and drill pads, but the bottom line is that these resources would not be substantially affected.		
NI	Vegetation excluding USFW designated species	Due to the low degree of anticipated exploration and development it is not expected that impacts to vegetation would be limited. In addition, reclamation would occur in disturbed areas utilizing a BLM approved seed mix.	E. Ginouves	11/19/15
NI	Visual Resources	Portions of parcel 3 occupying sections 11 and 14 occur on VRM class II lands. **Class II Objective:** To retain the existing character of the landscape. The level of change to the characteristic landscape should be low.	E. Ginouves	11/19/15
NI	Wild Horses and Burros	None present within the project area.	C. Hunter	11/19/2015
NI	Lands with Wilderness characteristics	None present within the project area.	D. Jacobson	11/19/15

Reviewer Title	Signature	Date	Comments
NEPA / Environmental Coordinator			
Authorized Officer			

INTERDISCIPLINARY TEAM NEPA CHECKLIST

Project Title: 8 Parcel Geothermal Leasing Environmental Assessment
NEPA Log Number: DOI-BLM-UT-0000-2016-0002-EA
File/Serial Number:
Project Leader: Jim Gazewood

DETERMINATION OF STAFF: ***(Choose one of the following abbreviated options for the left column)***

NP = not present in the area impacted by the proposed or alternative actions
NI = present, but not affected to a degree that detailed analysis is required
PI = present with potential for relevant impact that need to be analyzed in detail in the EA
NC = (DNAs only) actions and impacts not changed from those disclosed in the existing NEPA documents cited in Section D of the DNA form.
The rationale column should include NI and NP discussions.

RESOURCES AND ISSUES CONSIDERED:

Determi-nation	Resource	Rationale for Determination	Signature	Date
NI	Air Quality	Air quality in the project area is considered good to excellent and is currently meeting all National Ambient Air Quality Standards. Climatic conditions and an absence of major air pollution sources contribute to this condition. Visibility (regional haze) is good to excellent. Greenhouse gasses are mostly anthropogenic with carbon dioxide comprising the largest percentage of the gasses. There is a coal fired electrical generating power plant located over 50 miles from the project area. The plant meets air quality emission standards. It is over 70 miles to the closest Class I airshed	Rob Hamilton	1/29/2016
NP	Areas of Critical Environmental Concern	None present within the area impacted by the proposed project.	Rob Hamilton	1/29/2016
PI	Cultural Resources	Personal knowledge of sites	/s/ Robert W. Leonard	1/26/2016
NI	Greenhouse Gas Emissions	Refer to air quality section above. Offering the area for geothermal resource leasing in itself will not affect greenhouse gas presence. Development of geothermal resources for electrical energy production may have a minor short term increase in greenhouse gasses but will decrease the gasses in the long term.	Rob Hamilton	1/29/2016
NI	Environmental Justice	The proposed geothermal lease is within an area utilized by minority and low-income populations but leasing or development of the lease will have no effect on the associated environmental and human health	Rob Hamilton	1/29/2016
NP	Farmlands (Prime or Unique)	Prime or unique farmlands as designated in the Secretary of Agriculture's Memorandum Number 1827, Supplement 1 are not found on the Fishlake N.F. and therefore will not be impacted by the proposed geothermal lease	Rob Hamilton	1/29/2016
PI	Fish and Wildlife	UDWR has identified Crucial and/or substantial habitat for big game species within parcels Parcels 4 (UTU-086295) and 5 (UTU-086298). Future construction, operations, maintenance, and decommissioning has the potential to directly and indirectly (temporarily or permanently) alter mule deer and elk habitat, migration routes, species behaviors, and winter survival. Appropriate wildlife habitat and species surveys will be required. Additional measures	Sean Kelly	2/19/2016

Determi-nation	Resource	Rationale for Determination	Signature	Date
		such as off-site habitat improvement, crossing-structures and may be needed to mitigate negative effects.		
PI	Floodplains	Dog Valley Creek and other non-perennial streams are in the project area and geothermal activities need to analyze riparian to see if stipulations and BMPs apply.	/s/ Adam Solt	2/12/2016
NI	Fuels/Fire Management	Only light fuels exist within the project area. Leasing of geothermal resources within the area would not affect existing fuels. The project area is within the boundaries of an area impacted by wildfire. Leasing of geothermal resources within that area wouldn't exacerbate fire management provide standard fire prevention requirements were enforced.	/s/ Rob Hamilton	2/19/2016
NI	Geology / Mineral Resources/Energy Production	The proposed lease areas are known to contain geothermal resources. There is a potential for other fluid and solid mineral resources in the area. If the area were leased and geothermal resources developed, development of other mineral resources could still occur through coordination and compliance with current laws and regulation. Leasing and development of the parcels for production of electricity using geothermal resources would meet the "clean energy" requirements of the American Recovery and Reinvestment Act of 2009 and subsequent Presidential Orders and Initiatives.	Rob Hamilton	1/29/2016
PI	Hydrologic Conditions	Dog Valley Creek and other non-perennial streams are in the area. Geothermal activities need to be analyzed to determine if stipulations and BMPs apply.	/s/ Adam Solt	2/12/2016
NI	Invasive Species/Noxious Weeds	Scotch Thistle, Musk Thistle and Whitetop are in the area. Requiring BMPs identified in PEIS will prevent spread of these noxious weeds. Treatment of noxious weeds shall be the responsibility of the lease and applied to Forest Service standards	Lannce Sudweeks	1/28/2016 amended 2/24/2016
NI	Lands/Access	A determination of NI is made based on current levels of access continuing. If the development of UTU86295 and UTU86298 removes access to Forest Routes 108, 338, 883, and 884 then a more detailed analysis PI call should be applied as alternatives would need to be developed related to access. Range, recreation, and wildlife resource disciplines will need a continuation of access to the area. As mentioned in the recreation section, this area is popular with big game and shed antler hunters and it is adjacent to Missouri Flat CWMU which brings in more visitors to the area. The Fishlake Motorized Travel Plan EIS established route designations and any changes to the routes would require additional NEPA to amend the previous decision.	Doug Robison	2/12/2016
NI	Livestock Grazing	Area is part of the Grass Creek C&H Allotment. It is part of the spring range, currently understocked due to conversion of P/J to grassland after wildland fires.	Lannce Sudweeks	1/28/2016
PI	Migratory Birds	Migratory birds are known to occur within and near the proposed action. Future construction, operations, maintenance, and decommissioning has the potential to directly and indirectly (temporarily or permanently) alter migratory bird habitat and species behaviors. Therefore appropriate wildlife habitat and species surveys will be	Sean Kelly	2/19/2016

Determi-nation	Resource	Rationale for Determination	Signature	Date
		required Parcels 4 (UTU-086295) and 5 (UTU-086298).		
NI	Native American Religious Concerns	Scoping efforts should have established contact with the Native American Tribes and these efforts should have presented the opportunity for religious concern comments to be made. The district does not have any direct knowledge of Native American religious concerns. It is our recommendation that the EA should address and analyze concerns brought forward by the tribes during scoping of the proposal.	Doug Robison	2/12/2016
NP	Paleontology	The presence or absence of paleontological resources within the proposed lease area is unknown. However, leasing the geothermal resource would not cause any impact if the resource did exist. Development of geothermal resources will require surveys for, analysis of project effects upon and protection of paleontological resources.	Rob Hamilton	1/29/2016
NI	Rangeland Health Standards	Surface disturbance not expected to change the overall condition of the Range	Lannce Sudweeks	1/28/2016
PI	Recreation	UTU82698 and UTU86295 are in popular big game and shed antler hunting areas. Dispersed camping is permitted in the area and camps are prevalent during the fall hunting season. These leases are adjacent to the Missouri Flat CWMU which also receives an increase in use during hunting seasons. Forest roads FR108, FR883 and FR884 fall within the lease area which provides access to recreationists. Maintaining access to these routes for recreation purposes would be desired. FR108 provides access to a 50" ATV trail that is part of the Piaute ATV trail network. Applicable Forest Plan Standards and Guides relevant to the recreation resource include: • Provide recreation opportunities in accordance with the established recreation opportunity spectrum (ROS) classification for the management area (MA). These leases are in MA 6B and the ROS for 6B ranges from rural to semi primitive non-motorized. Specific to 6B Standards and Guidelines to consider include: • Provide roaded natural recreation opportunities within ½ mile of forest arterial, collector and local roads with better than primitive surfaces which are open to public travel. • Provide semi-primitive motorized recreation opportunities with a low to moderate incidence of contact with other groups and individuals within ½ mile of designated local roads with primitive surfaces and trails open to motorized recreation use. • Provide semi-primitive non-motorized recreation opportunities in all areas more than ½ mile away from roads and trails open to motorized recreation use. In summary: To maintain compliance with the Forest Plan access and use of these areas should continue.	Doug Robison	2/12/2016
NI	Socio-Economics	UTU86295 and UTU86298 are within management area 6B which is an emphasis area for livestock grazing. This is the	Doug Robison	2/12/2016

Determi-nation	Resource	Rationale for Determination	Signature	Date
		primary socio-economic factor that the proposal may impact. Removing lands from grazing and eliminating forage for livestock would impact the number of animals permitted on the range and the length of the use period.		
PI	Soils	Soils will be impacted by geothermal activities and the level of impact will be determined by the need for stipulations and BMPs.	/s/ Adam Solt	2/12/2016
NP	Special Status Plant Species	No known TES plants within the project area	/s/ David Tait	2/10/16
NP/PI	Special Status Animal Species	There are no known Federally listed threatened, endangered, or candidate wildlife species known to occur within or reasonably near the proposed parcels. Neither parcel is within or near suitable sage-grouse habitat and no further consideration is required for this species. BLM special status species, such as but not limited to: golden eagles, bald eagles, Ferruginous hawks, shorebirds, bats waterfowl and kit fox, are known to occur within or near the proposed parcels. Future construction, operations, maintenance, and decommissioning has the potential to directly and indirectly (temporarily or permanently) alter habitat and species behaviors. Therefore appropriate wildlife habitat and species surveys for special status species will be required on Parcels 4 (UTU-086295) and 5 (UTU-086298).	Sean Kelly	2/19/2016
NI	Wastes (hazardous or solid)	Leasing the geothermal resource would not produce any hazardous or solid wastes. If development of geothermal resources did occur, management of wastes would meet current laws, regulations, and stipulations identified in this process and analysis of effects of anticipated wastes would occur per NEPA before project authorization.	Rob Hamilton	1/29/2016
PI	Water Resources/Quality (drinking/surface/ground)	There is a Groundwater Protection Zone within 3/4 mile to the south of the Southern Lease Area so impacts to this Groundwater Protection Zone should be analyzed to determine impacts and needs for stipulations and BMPs. Surface and groundwater water quality will need to not have anti-degradation occur to it according to State Water Quality Standards.	/s/ Adam Solt	2/12/2016
PI	Wetlands/Riparian Zones	There are no official USGS mapped wetland areas, but springs, and riparian areas along stream channels are within the Lease areas. Field review for small wetlands might be needed in the area to gauge the need for stipulations and BMPS.	/s/ Adam Solt	2/12/2016
NP	Wild and Scenic Rivers	No Wild and Scenic Rivers present in UTU86298 and UTU86295 therefore the proposal will have no effect to the resource.	Doug Robison	2/12/2016
NP	Wilderness/WSA	No wilderness or Wilderness study areas exist on the Fishlake National Forest therefore no effect.	Doug Robison	2/12/2016
NP	Woodland / Forestry	Woodland/Forestry vegetation is not found on the two parcels which are located on National Forest System land associated with this project	Rob Hamilton	1/29/2016
NI	Vegetation	Currently dominated by native grasses, little shrub/forb component	Lannce Sudweeks	1/28/2016

Determi-nation	Resource	Rationale for Determination	Signature	Date
NI	Visual Resources	Applicable Forest Plan Standards and Guidelines related to visual resources are: • Choose facility and structure design, color of materials, location and orientation to meet the adopted visual quality objectives (VQO) for the management area UTU86298 and UTU86295 are completely within Management Area 6B which has the VQO of modification. Under the modification visual quality objective management activities may visually dominate the original characteristic landscape. Activities which are predominately introduction of facilities such as buildings, signs, roads, etc., should borrow naturally established form, line, color, and texture so completely and at such scale that it is visual characteristics are compatible with the natural surroundings. Specific direction, standards and guidelines for MA6B are: • Design and implement management activities to blend with the natural landscape. • When projects require soil disturbance, use irregular clearing edges and shapes to blend with the natural landscapes. If these plan standards and guidelines are followed the development would meet the VQO of modification for MA 6B	Doug Robison	2/12/2016
NP	Wild Horses and Burros	No wild horses on the Fillmore RD	Lannce Sudweeks	1/28/2016
PI	Lands with Wilderness Characteristics	Leases UTU86298 and UTU86295 contain portions of the Pyramids and Dog Valley Inventoried Roadless Areas (IRA). As specified in Lease Stipulations and Best Management Practices section of the EA, No Surface Occupancy lease stipulations may be implemented to protect resources including IRA. This recommendation is appropriate and consistent with the Fishlake Oil and Gas EIS which stipulates NSO for IRA. However, the requirement for NSO for IRA in the current forest plan applies only to Oil and Gas development. The existing Forest Plan direction does allow for line officers to implement special stipulations denying occupancy or surface disturbance of special areas (Appendix H(a) special stipulations 1. Fishlake LRMP p. H-1). It is reasonable to assume that line officers will issue a determination of NSO for IRA under the authorities of special stipulations contained in appendix H(a) of the Forest Plan to be consistent with the Oil and Gas analysis. In summary: No Surface Occupancy for Inventoried Roadless Areas is consistent with the Forest Plan under special stipulations.	Doug Robison	2/12/2016

FINAL REVIEW:

Reviewer Title	Signature	Date	Comments

Determi-nation	Resource	Rationale for Determination		Signature	Date
	Environmental Coordinator	/s/ Jenneka Knight	2/23/2016		
	Authorized Officer	/s/ Douglas Robison	2/24/16		

INTERDISCIPLINARY TEAM NEPA CHECKLIST

Project Title: 8 Parcel Geothermal Leasing Environmental Assessment

NEPA Log Number: DOI-BLM-UT-0000-2016-0002-EA

File/Serial Number:

Project Leader: Jim Gazewood

DETERMINATION OF STAFF: ***(Choose one of the following abbreviated options for the left column)***

NP = not present in the area impacted by the proposed or alternative actions
NI = present, but not affected to a degree that detailed analysis is required
PI = present with potential for relevant impact that need to be analyzed in detail in the EA
NC = (DNAs only) actions and impacts not changed from those disclosed in the existing NEPA documents cited in Section D of the DNA form.
The rationale column should include NI and NP discussions.

RESOURCES AND ISSUES CONSIDERED:

Determi-nation	Resource	Rationale for Determination	Signature	Date
NI	Air Quality	Construction activities will generate temporary and transitory emissions of regulated air pollutants (primarily particulate matter and engine combustion emissions), though these are unlikely to result in significant impacts due to existing laws and engine standards. Operation of the any constructed facilities such as power plants will have ongoing emissions of regulated air pollutants. In addition it is likely there will be some level of greenhouse gas emissions, though unknown whether that would exceed the 25,000 ton per year EPA reporting threshold. It is not possible at the leasing stage to accurately identify quantities and locations of emissions sources, both of which are needed to conduct adequate and representative air quality analysis. It is likely power plants will require permitting through the state regulatory agencies, and emissions controlled through that process to ensure no significant impacts are likely. This will need to be examined on project proposal; however at the leasing stage no further analysis is either warranted or reasonable.	/s/ Leonard Herr	2/11/16
NP	Areas of Critical Environmental Concern	There are no ACEC's located within the proposed leasing areas.	/s/ Teresa Frampton	2/11/2016
PI	Cultural Resources	A recent cultural resource literature review for Parcels UTU-090483, UTU-090273, and UTU-090271 indicate that cultural resources are known to exist within and surrounding the leasing parcels, and could be adversely affected by the project. The potential for locating cultural resources within the proposed lease parcels UTU-090483, UTU-090273, and UTU-090271is moderate to low. Analysis of the reasonably foreseeable impacts of leasing on both identified and unidentified cultural properties resulted in an Adverse Effect. This is based on the determination that reasonable development could occur on the proposed parcels with	/s/Stacey Whitman Moore	2/10/2016

Determi-nation	Resource	Rationale for Determination	Signature	Date
		impacts to eligible historic properties. A complete inventory of the proposed lease parcels has not occurred; therefore, the following stipulation should be added to any parcels offered for lease: *This lease may be found to contain historic properties and/or resources protected under the National Historic Preservation Act (NHPA), American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, E.O. 13007, or other statutes and executive orders. The BLM will not approve any ground disturbing activities that may affect such properties or resources until it completes its obligations under applicable requirements of the NHPA and other authorities. The BLM may require modification to exploration or development proposals to protect properties, or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized, or mitigated.*		
NI	Greenhouse Gas Emissions	Additional information about greenhouse gases (GHGs) and their effects on national and global climate conditions has emerged since the completion of the governing land use planning documents. However, determining GHG emissions, their relationship to global climatic patterns, and the resulting impacts is still an ongoing and developing scientific process. Without additional meteorological monitoring and modeling systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions; what is known is that increasing concentrations of GHGs are likely to accelerate the rate of climate change. While leasing the subject parcels, by itself, would not authorize any surface disturbing geothermal operations and, as a result, it would have no direct impacts on climate as a result of GHG emissions, there is an assumption, however, that leasing the parcels would lead to future exploration and/or development actions that would have effects on global climate through GHG emissions.	/s/ Cindy Ledbetter	2/11/2016
NI	Environmental Justice	As defined in EO 12898, minority, low income populations and disadvantaged groups may be present within the counties involved in this lease sale. However, all citizens can file an expression of interest or participate in the bidding process. Any stipulations and notices applied to the subject parcels do not place an undue burden on these groups. Leasing the parcels would not cause any disproportionately high and adverse effects on minority or low income populations.	/s/ Cindy Ledbetter	2/10/2016
NP	Farmlands (Prime or Unique)	A review of a Map of prime and unique farmlands obtained from the NRCS for the project area shows that there are no soils that qualify as prime and unique in the parcels to be leased.	/s/ Bill Thompson	2/9/2016
PI	Fish and Wildlife	Crucial and/or substantial habitat for big game species occurs within or near Parcels 6 (UTU-090483) and 8 (UTU-090271). Future construction, operations, maintenance, and decommissioning has the potential to directly and indirectly (temporarily or permanently) alter pronghorn habitat and species behaviors. Therefore appropriate wildlife habitat and species surveys will be required.	/s/ James Priest	2/9/2016

Determi-nation	Resource	Rationale for Determination	Signature	Date
NI	Floodplains	Lease stipulatoion for water bodies and riparian areas of 500 feet is anticipated to mitigate floodplain concerns. Of all, Parcel 7 located near the Clear Lake Wildlife Management area could use a confirmation look when actual geothermal operations are proposed if a lease is issued.	/s/ Tom Gibbons	2/22/16
NI	Fuels/Fire Management	The implementation of appropriate reclamation standards at the development stage would prevent an increase of hazardous fuels. Fuels and fire management would not be impacted by the lease process.	/s/ Erik Valdez	2/16/2016
NI	Geology / Mineral Resources/Energy Production	Conflicting interest are present in this Proposed Action for geothermal resources. There is an existing lease UTU-088139 which encompasses T.15 S., R.12 W., Section's: 22, 23, 24, 25, 26, 27, 34 & 35 (all). Lease operations might be constrained or denied on parcel # 6 (UTU-090483) to avoid conflict with existing lease. In addition there is a Public Water Reserve (withdrawn) in T.19 S., R.7 W., Sec; 26, lease # UTU-057023.The Geology of this area will not be impacted from this lease, however if construction and drilling from extraction of fluid minerals are in the foreseeable future the disturbance will have an impact and will have to be addressed.	/s/Cheryl LaRoque	2/11/2016
NI	Hydrologic Conditions	Hydrologic Condition is merged with 'Water Resources/Quality' below.	/s/ Tom Gibbons	2/22/16
NI	Invasive Species/Noxious Weeds	Issuing a lease presents no impacts to weeds, impacts would be evaluated upon a notice of intent.	R.B. Probert	2/17/2016
NI	Lands/Access	The proposed action would not impact any land use authorizations nor would it affect access to public land. The authorization would be issued subject to valid, existing rights-of-way, which includes county-maintained roads. Coordination would be made with Millard and Juab County Road Departments for the use of these roads. A separate right-of-way grant would be required for new and possibly existing roads that are outside the "leased" area.	/s/ Teresa Frampton	2/12/2016
NI	Livestock Grazing	The action of leasing these parcels would not affect livestock grazing. However, once drilling operations are begun, roads are constructed and facilities are installed then livestock grazing would be affected. Once ground disturbing activities are proposed then further analysis will need to be done to see how forage production, livestock access to water, existing range improvements could be affected and what mitigation may be needed to minimize impacts to livestock and Livestock grazing.	/s/ Bill Thompson	2/16/2016
PI	Migratory Birds	Migratory birds are known to occur within and near the proposed action. Future construction, operations, maintenance, and decommissioning has the potential to directly and indirectly (temporarily or permanently) alter migratory bird habitat and species behaviors. Therefore appropriate wildlife habitat and species surveys will be required Parcels 6 (UTU-090483), 7(UTU-090273), and 8 (UTU-090271).	/s/ James Priest	2/9/2016
PI	Native American Religious Concerns	Consultation with Native American tribes must be completed for this project. The BLM-Utah State Office will coordinate and complete all consultations.	/s/Stacey Whitman Moore	2/10/2016

Determi-nation	Resource	Rationale for Determination	Signature	Date
NP	Paleontology	There are no known paleontological resources within the parcel boundaries. If a lease is awarded, specific clearances would be conducted and incorporated into that NEPA process. Stipulations for any site activities will include the following: If paleontological resources are located, the AO will be contacted prior to any further work or disturbance.	/s/ Todd Leeds	2/9/2016
NI	Property Boundary Evaluation	Leasing parcels will have no effect on property boundaries. In accordance with WO IM 2011-122, cadastral survey reviews and verifies the legal land descriptions of the parcels prior to lease issuance.	/s/ Chad Kunz	2/10/2016
NI	Rangeland Health Standards	The act of leasing these parcels for Geothermal Resources would not affect rangeland health. However, ground disturbing activities that would be required to develop these resources could affect desired species (Rangeland Health Standard #3), the function of riparian areas (Rangeland Health Standard #2), permeability and infiltration rates which would affect soil productivity (Rangeland Health Standard #1). When soil disturbing activities are proposed then further analysis would need to be done to determine what the probable impacts would be and how to mitigate them.	/s/ Bill Thompson	2/16/2016
PI	Recreation	The proposed leasing site in sections 3 and 10 of UTU-090271, is located in an area which limits travel to existing and/or designated roads and trails. (Refer to Map 6 in the House Range Resource management Plan). The other proposed leasing sites are located in open areas with no travel restrictions.	/s/ Teresa Frampton	2/11/2016
NI	Socio-Economics	Minor increases in local service sector revenue could be expected from the temporary workforce involved in the exploration of the parcels if they are leased. Lasting substantial impacts to the socioeconomics of the communities in the general project area could result from the discovery of a commercial viable geothermal resource on any of the parcels; however the quantification of those impacts would depend on the specifics of any discovery made and would have to be analyzed when a proposal to develop those resources was received.	/s/ Cindy Ledbetter	2/10/2016
PI	Soils	The act of leasing these parcels for Geothermal Resources would not affect soils. However, ground disturbing activities that may be necessary to develop geothermal resources could affect the soils, permeability, infiltration rates and productivity.	/s/ Bill Thompson	4/26/2016
NP	Special Status Plant Species	There are no known federally-listed or other special status rare plant species within Parcels 6, 7, and 8 of this proposed geothermal lease sale.	/s/DWhitaker	2/9/16
PI	Special Status Animal Species	There are no known Federally listed threatened, endangered, or candidate wildlife species known to occur within or reasonably near the proposed parcels. Parcel 8 (UTU-090271) is south of the Sheeprocks sage-grouse management area and is not within suitable sage-grouse habitat. No further consideration required.	/s/ James Priest	2/9/2016

Determi-nation	Resource	Rationale for Determination	Signature	Date
		BLM special status species, such as but not limited to: golden eagles, bald eagles, Ferruginous hawks, shorebirds, bats waterfowl, least chub, and kit fox, are known to occur within or near the proposed parcels. Future construction, operations, maintenance, and decommissioning has the potential to directly and indirectly (temporarily or permanently) alter habitat and species behaviors. Therefore appropriate wildlife habitat and species surveys for special status species will be required on Parcels 6 (UTU-090483), 7 (UTU-090273), and 8 (UTU-090271).		
NP	Wastes (hazardous or solid)	Hazardous materials and solid wastes are not known to exist on the parcels identified. I Hazardous materials and solid wastes will be addressed in documentation pertaining directly to site activities at that time including spill prevention and material management.	/s/ Todd Leeds	2/9/2016
PI	Water Resources/Quality & Hydrologic Condition (drinking/surface/ground)	The leasing activity itself has no consequence to water resources. However, around 10,000,000 gallons per day (6,944 gpm) of geothermal waters is estimated to be used by each developed facility. Further, additional clean groundwater sources may need to be developed for cooling. The impacts may vary greatly depending on the nature of the geothermal infrastructure constructed and degree to which geothermal fluids might be exposed to the air any new water sources that may need to be developed for cooling waters. However, I do anticipate impacts from the geothermal exploration, drilling, utilization, and reclamation and abandonment at differing degrees, operation, and reclamation activities from the potential of communication of water bodies, discharges of geothermal or cooling water from operations, well drilling, or spills or ruptures of pipes, condensates from cooling waters that might affect water quality or groundwater, and some erosion and runoff concerns. Substantive geologic/hydrogeologic information will be needed and geochemistry of geothermal hot or steam waters needed, geochemistry of groundwater aquifers, and determination of hydraulic connection of geothermal and other groundwaters. The condensation or spills of geothermal waters or even evaporation of separate groundwaters might result in concentration of contaminants including airborne deposition to soils that might be mobilized by runoff or percolation to shallow groundwaters. Lease stipulations will be necessary and BMPs from Appendix D are anticipated to potentially be needed as mitigation depending on the nature of the actual geothermal operation. Ground and surface water monitoring is highly likely and possibly soil monitoring may be needed for airborne delivery of condensed/evaporated water contaminants. Regional geology/groundwater understanding is likely needed and groundwater modeling also likely. Parcel 7 is located near wetlands and surface waters. Parcel 8 is located about 5 miles north of the popularly, and heavily used Baker Hot Springs. Private and Public Drinking water sources will need to be identified and evaluated in future proposed development activities. And existing water rights will need to be evaluated for potential impairment or interference through drawdown of water levels, increased temperature or unacceptable pollutants and minerals from possible interaction with geothermal waters.	/s/ Tom Gibbons	2/22/16

Determi-nation	Resource	Rationale for Determination	Signature	Date
		Baseline sampling of certain surface waters, springs, and groundwater anticipated before any on the ground action occurs.		
PI	Wetlands/Riparian Zones	Wetlands and riparian are present in Parcel #7 – UTU-090273. Riparian areas have the potential to be impacted unless the best management practices which have incorporated into them the stipulations of the Utah Riparian Management Policy which states that "No new surface disturbing activities would be allowed within 100 meters of riparian areas unless it can be shown that; A) There are no other alternatives or B) all long term impacts can be fully mitigated or the activity will benefit or enhance the riparian area."	/s/ Cassie Mellon	2/12/2016
NP	Wild and Scenic Rivers	There are no wild and scenic rivers in the proposed lease area.	/s/ Teresa Frampton	2/12/2016
NP	Wilderness/WSA	There are no WSA's located within the project area.	/s/ Teresa Frampton	2/12/2016
NI	Woodland / Forestry	Woodland production areas are not present on or adjacent to the parcels. Impacts are not expected to occur as a result leasing or exploration. BMPs, SOPs and site specific mitigation would be applied at the APD stage as COAs.	/s/ Eric Reid	2/16/2016
NI	Vegetation	The act of leasing these parcels for Geothermal Resources would not affect vegetation. However, ground disturbing activities that may be required to develop geothermal resources would affect vegetation. When Ground disturbing activities are proposed then further analysis will be needed to show what the affect would be on desirable species, if weeds would replace existing vegetation, would some areas be devoid of vegetation and could soil be exposed to erosive forces from wind and water.	/s/ Bill Thompson	2/16/2016
NP	Visual Resources	All of the proposed leasing sites are located in areas managed as VRM Class IV under the current land use plan. Class IV directive, "To provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high." There would be no impacts to visuals by leasing the parcels.	/s/ Teresa Frampton	2/11/2016
NI	Wild Horses and Burros	The parcels do not intersect herd management boundaries. The proposed action of leasing would not have impacts to any wild horses in the area.	/s/ Eric Reid	2/16/2016
NP	Lands with Wilderness Characteristics	In March and April of 2016, the FFO wilderness team conducted wilderness inventories of the units potentially impacted with the proposed project area (leases). This included LWC units UT-050 -106, 107,132, 133,180, 182, and 185. Class B roads and existing ROWs cut units 106 and 182 into smaller sub-units which did not meet the size criteria. The rest of the units met the size and naturalness criteria, but did not meet the outstanding opportunities for solitude and/or primitive and unconfined recreation. It was determined by the FFO wilderness team and concurred by the West Desert District manager that wilderness characteristics are not present on any of the units within the proposed project area.	/s/ Teresa Frampton	4/7/2016

Determi-nation	Resource	Rationale for Determination	Signature	Date

FINAL REVIEW:

Reviewer Title	Signature	Date	Comments
Environmental Coordinator			
Authorized Officer			

Appendix B.

Legal Description of Parcels

APPENDICES

Appendix A - Listing of the Eight (8) Pending Geothermal Lease Sale Parcel Nominations to be Analyzed through the Contracted Environmental Analysis

BLM Field Office	Surface Management Agency	Parcel Number	Serial Number	Parcel Legal Land Description
Cedar City	BLM	1	**UTU-086142**	T. 27 S., R. 9 W., Salt Lake Meridian Sec. 1: All; Sec. 4: SW, N2SE, SWSE; Sec. 9: W2NE, W2, NWSE; Sec. 11: NE, NENW, S2NW, S2; Sec. 14: All; Sec. 15: E2E2, SWSE. 2,841.40 Acres Beaver County, Utah
		2	**UTU-086143**	T. 26 S., R. 9 W., Salt Lake Meridian Secs. 26, 27, 28 and 33: All; Sec. 34: W2W2; Sec. 35: E2, E2NW, NESW. 3,160.00 Acres Beaver County, Utah
		3	**UTU-090200**	T. 30 S., R. 12 W., Salt Lake Meridian Sec. 21: N2NE, SWNE, NW, N2SW, SESW, NWSE; Sec. 27: All; Sec. 28: N2S2; Sec. 29: N2, NESW, SE. 1,760.79 Acres Beaver County, Utah

BLM Field Office	Surface Management Agency	Parcel Number	Serial Number	Parcel Legal Land Description
Fillmore	USFS, Fishlake NF	4	**UTU-086295**	T. 25 S., R. 6 W., Salt Lake Meridian Sec. 4: All; Sec. 5: All; Sec. 8: All. 1,864.99 Acres Millard County, UT
	USFS, Fishlake NF	5	**UTU-086298**	T. 24 S., R. 6 W., Salt Lake Meridian Sec. 32: N2N2, N2S2, SESE; Sec. 32: Lots 1-4; Sec. 33: All. 1,180.20 Acres Millard County, UT
	BLM	6	**UTU-090483**	T. 15 S., R. 12 W., Salt Lake Meridian Secs. 22, 23, 24, 25, 26, 27, 34 and 35: All. 5,120.00 Acres Millard County, Utah
	BLM	7	**UTU-090273**	T. 19 S., R. 7 W., Salt Lake Meridian Sec. 26: W2SW, NESE, S2SE; Sec. 27: SENE, E2SE; Sec. 34: E2E2; Sec. 35: All; T. 20 S., R. 7 W., Salt Lake Meridian Sec. 3: Lot 1; Sec. 4: SWNE, SE. 1,366.15 Acres Millard County, Utah
	BLM	8	**UTU-090271**	T. 13 S., R., 8 W., Salt Lake Meridian Sec. 3: All; Sec. 10: N2NE, SWNE, E2W2, W2SE, SESE; Sec. 15: W2NE, E2NW, S2. 1,533.64 Acres Juab County, Utah

Appendix C.

Public Comments

THE HOPI TRIBE

Herman G. Honanie
CHAIRMAN

Alfred Lomahquahu Jr.
VICE-CHAIRMAN

October 16, 2014

Del Barnhurst, District Ranger
Fishlake National Forest, Fillmore Ranger District
390 S. Main
Fillmore, Utah 84631

Re: Dog Valley Geothermal Lease

Dear Ranger Barnhurst,

This letter is in response to your correspondence dated October 7, 2014, regarding the 3,045 acre Dog Valley Geothermal Leasein Millard County. The Hopi Tribe claims cultural affiliation to earlier identifiable cultural groups in Utah, including the Fremont prehistoric cultural group. The Hopi Cultural Preservation Office supports the identification and avoidance of our ancestral sites and Traditional Cultural Properties, and we consider the archaeological sites of our ancestors to be "footprints" and Traditional Cultural Properties. Therefore we appreciate the Forest's continuing solicitation of our input and your efforts to address our concerns.

The Hopi Cultural Preservation Office requests consultation on any proposal on the Forest with the potential to adversely affect prehistoric cultural resources. We understand if the Forest consents to the leasing with stipulations as proposed the BLM would offer the land at a competitive geothermal lease sale in 2015. Therefore, to enable us to determine if this proposal may affect cultural resources significant to the Hopi Tribe, please provide us with a copy of the cultural resources survey report for review and comment.

If you have any questions or need additional information, and please contact Terry Morgart at the Hopi Cultural Preservation Office at tmorgart@hopi.nsn.us or 928-734-3619. Thank you for your consideration.

Respectfully,

Leigh J. Kuwanwisiwma, Director
Hopi Cultural Preservation Office

xc: Rob Hamilton, Fishlake National Forest, 115 East 900 North, Richfield Utah 84701
Utah State Historic Preservation Office