

CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

This chapter describes the potential direct/indirect/residual/cumulative impacts to resources that may result from the Proposed Action or No Action Alternative, as well as identifies the potential mitigation measures and monitoring needs associated with the specific resources. Impacts are assessed in terms of their duration, intensity (or magnitude), and context (local, regional, or national effects). Direct impacts and indirect impacts based on a reasonably foreseeable development scenario would be analyzed for the Proposed Action as well as the No Action Alternative. If the additional ten wells are productive, it is reasonably foreseeable that Vulcan Power would take the next step of developing one or more power plants at Salt Wells. The extent of the development is unclear; however a general impact analysis of increased disturbance to the area is analyzed. Subsequent NEPA analysis would determine the actual impacts from development of a power plant at Salt Wells.

The Proposed Action would be required to implement standard lease stipulations and road and construction site practices from the State of Nevada Handbook of Best Management Practices (BMPs). In addition to BMPs, mitigation measures designed to avoid or reduce impacts are provided, as needed.

4.1 PROPOSED ACTION

The proposed action consists of constructing and maintaining ten well pads and drilling and testing ten exploratory wells at these pads to determine whether there are sufficient geothermal resources for power production at the Vulcan Salt Wells leases.

4.A AIR QUALITY

Direct Impacts

The construction phase would involve both fugitive dust and diesel emissions that would have temporary impacts on air quality. Fugitive dust emissions would be realized through ground-disturbing activities and transportation along unpaved roads used to access the project area from US Highway 50. Fugitive dust emissions would be negligible compared to levels of particulate matter suspended in the air during and after dust storms in the region. Diesel emissions would result from construction equipment and any diesel-fueled vehicles used to access the project site.

The proposed project would be required to implement standard lease stipulations and road and construction site practices from the State of Nevada Handbook of Best Management Practices. The Bureau of Air Pollution Control issued a Surface Air Disturbance (SAD)

permit for the project area, and Vulcan will implement the dust control plan outlined in the permit to reduce fugitive dust, including watering of disturbed areas, graveling of roadways, and limiting vehicle speeds to 10-15 miles per hour. These measures would reduce fugitive dust emissions during construction.

Well testing emissions could include venting of small amounts of hydrogen sulfide from the wells, slight heating of the local atmosphere, and diesel emissions from on-site vehicles and maintenance equipment. Well testing in the lease area would not increase fugitive dust from the playas. Temporarily flowing each cased well would not significantly drawdown any shallow groundwater aquifer or dewater the isolated portions of Eight Mile Flat that contain ephemeral meadows, springs, and seeps. These resources are recharged locally by groundwater primarily composed of geothermal fluids (Coolbaugh et. al. 2006).

Indirect Impacts Based on a Reasonably Foreseeable Development Scenario

Future actions based on the reasonable development scenario could result in indirect impacts to air quality. Construction of one or more geothermal power plants could result in temporary fugitive dust emissions from ground disturbing activities, construction vehicle exhaust emissions, diesel generator and power tool use, and worker vehicle emissions. Implementing BMPs and the dust control plan in the SAD permit would reduce fugitive dust emissions during construction; additional measures to reduce fugitive dust could be included as a requirement of development plans and subsequent environmental review.

If exploratory drilling confirms the presence of a high-temperature resource and a flash plant is built, operational emissions could include possible venting of limited amounts hydrogen sulfide, carbon dioxide, and other gases from the cooling towers; localized fogging around the wells; and slight heating of the local atmosphere. If exploration finds lower-temperature resources and Vulcan proposes a binary plant, the geothermal fluids and gases would be injected back into the reservoir and the only emissions would be accidental releases of gases or hydrocarbon working fluids and fugitives during operation and maintenance. It is unknown whether geothermal production will drawdown shallower groundwater aquifers, dewater areas of the playas fed by any aquifers, or result in increased fugitive dust from the playas at Salt Wells. The required BLM review and environmental reviews prior to utilization of geothermal resources would consider any necessary mitigation for increases in indirect impacts. Subsequent NEPA analysis would determine the actual impact to air quality.

4.B CULTURAL RESOURCES

Section 106 of the NHPA states that an undertaking would have an adverse effect on a historic property (i.e., NRHP-eligible resource), if that undertaking were to alter or diminish characteristics of the property that qualify it for inclusion in the NRHP. This includes Native American TCPs in that they possess traditional cultural significance. Per 36CFR60.4, properties eligible for the NRHP possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

- A. Are associated with events that have made a significant contribution to the broad patterns of our history; or
- B. Are associated with the lives of persons significant in our past; or
- C. Embody the distinctive characteristics of a type, period, or method of construction, represent the work of a master, possess high artistic values, or

represent a significant and distinguishable entity whose components may lack individual distinction; or

D. Have yielded or may be likely to yield, information important in prehistory or history.

Any impacts on NRHP-eligible historic properties as a result of the project must be identified, discussed with the State Historic Preservation Office (SHPO) and interested parties, and mitigated to the extent possible under the NHPA in order to avoid a significant impact under NEPA.

The Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 (as amended) provides federal protection of Native American human remains, associated and unassociated funerary objects, sacred objects, and objects of cultural patrimony. The intentional removal or excavation of Native American cultural items from federal or tribal lands for purposes of discovery, study, or removal of such items is considered illegal under NAGPRA, unless under the following circumstances:

- The items are excavated or removed under an Archaeological Resources Protection Act of 1979 permit;
- The items are excavated or removed after consultation with or, in the case of tribal lands, consent of the appropriate Indian tribe; or

Proof of consultation or consent is shown.

American Indian Religious Freedom Act allows for Native Americans to express and exercise their traditional religions, “including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.” EO 13007 states that federal agencies would, to the extent practicable, “accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners” and “avoid adversely affecting the physical integrity of such sacred sites.” As such, any actions that would alter or diminish a Native American sacred site or traditional resource identified by consulted parties or limit access to or use of those resources would constitute an adverse impact on Native American resources.

Direct Impacts

Prehistoric and Historic Cultural Resources

Vulcan Power relocated drill sites and access roads to avoid significant impacts. Both the original proposed locations and new locations were intensively inventoried for the presence or absence of cultural resources (WCRM 2008). Several sites are located within the APEs of proposed drill sites and access roads. With the exception of one NRHP-ineligible multi-component site and the NRHP-eligible Wadsworth and Columbus Freight Road, all sites, regardless of NRHP eligibility, would be avoided during construction and operation.

Three isolated segments of the road Wadsworth and Columbus Freight Road were recorded in 2007 by MACTEC as a historic road segment, historic debris and small rock cairns. The site as a whole was determined eligible upon its recording by MACTEC, and MACTEC provided a treatment plan and interpretative article in 2007 prior to Vulcan’s blading and use of the section of the road. Due to the loss of integrity to the portion of the road within the

project area, WCRM recommends this segment to be a non-contributing element of the NRHP-eligible site.

In the unlikely case that unexpected cultural resources or human remains are uncovered during construction or operation of the geothermal drill pads or access roads, work would halt immediately within 100-ft of the cultural materials or features and left undisturbed. The BLM CCDO cultural resource specialists would be contacted to assess the significance of the finds in compliance with the implementing regulations of the NAGPRA (43CFR10). In the case of accidental discovery of human remains, the County Coroner would be contacted as well. Should they prove to be significant, appropriate mitigation plans and measures would be developed and submitted for approval by the BLM, the SHPO, and the Fallon Paiute-Shoshone Tribe or other identified direct lineal descendent.

Native American Resources

Cultural resources are considered Native American Resources (see previous section). Based on the ongoing consultation with the Fallon Paiute-Shoshone Tribe, prehistoric cultural resources identified during the Class III survey would be avoided. In the event of an inadvertent discovery, the tribe would be contacted. Consultation would be ongoing with the tribe until completion of the project, so no significant impacts on Native American Resources are expected.

Indirect Impacts Based on a Reasonably Foreseeable Development Scenario

Based on a reasonably foreseeable development scenario and the density of prehistoric and historic sites within the region, impacts on cultural resources could be significant. However, it is anticipated that all such impacts would be mitigated to minor impacts by conducting necessary surveys, recordation of sites, avoidance, public interpretation, and/or any other mitigations recommended by a contracted qualified archaeologist at the time.

Subsequent NEPA analysis would determine the actual impact to cultural resources.

4.C INVASIVE, NON-NATIVE SPECIES

Direct Impacts

Construction and operation of geothermal exploratory drilling sites, including well pads, the freshwater well, and roads, would result in long-term removal of vegetation, including invasive, nonnative species, in those areas. Long-term removal of vegetation from construction of drilling sites would occur initially on 33.7 acres. This would include vegetation removal on the ten 350-ft by 350-ft (28 acres) well pads and 3.7 miles of new roads approximately 14-ft wide (5.7 acres). Some additional vegetation may be removed during construction activities, such as staging and temporary storage, but the amount disturbed would be minimal. The total amount of vegetation to be removed (33.7 acres) for the proposed drilling would be small compared to the amount of similar surrounding vegetation on surrounding lands. Potential impacts to special status plant species are described in Section 4.E.

If initial well drilling finds a site unsuitable for geothermal resources, Vulcan would remove the wellhead and associated equipment and the site would be revegetated according to the revegetation plan. In this instance, removal of vegetation would be short-term. In areas of vegetation removal, potential infestation of invasive weed species such as cheat grass could occur. Vulcan would prevent the spread of invasive plant species by identifying populations in the field and avoiding driving in infested areas that could spread the plants. The proposed action would not affect existing salt cedar or tall whitetop populations and probably would

not be a factor in new invasions of these species. If, however, a productive geothermal resource is found, Vulcan would drill five production wells at the site with no additional potential for invasion of weed species or loss of habitat.

Staging areas if utilized would require vegetation clearing and potential grading. The invasive, nonnative species present have no special status listing, and do not provide valuable habitat. Also, where feasible, staging would occur on already disturbed areas, such as existing roads and off-highway vehicle trails.

Indirect Impacts Based on a Reasonably Foreseeable Development Scenario

Constructing and operating geothermal wells is assumed to be a precursor to development of a geothermal power plant. Although no such plant is proposed at this time, such construction would result in long-term removal of vegetation in the vicinity of the proposed geothermal wells, and that the affected vegetation community would be similar to that which would be affected by well construction. Overall impacts would be similar to, but possibly greater in extent, impacts from the construction of geothermal wells, and would be associated with construction and operation of the plant, pipelines, staging areas, and access roads.

Subsequent NEPA analysis would determine the actual impact to invasive, nonnative species.

4.D MIGRATORY BIRDS

Consequences to migratory birds generally result from impacts to individuals, populations, or from disturbance to migratory bird habitat. This section describes the environmental consequences to migratory birds. The majority of potential impacts to migratory birds are associated with habitat disturbance and vegetation removal. Removing vegetation in areas used by migratory birds results in a reduction of available habitat and also may cause habitat fragmentation. Habitat disturbance associated with construction activities would be temporary until vegetation becomes reestablished and would be small in relation to the surrounding habitat. The project area is within the Lahontan Valley Wetlands IBA. This IBA is approximately 430,379 acres. The proposed project would affect approximately 33.7 acres of habitat in the IBA or approximately 0.008 percent of the habitat. This impact to regional populations would be minimal.

Direct Impacts

Migratory birds listed in Table 3-4 have the potential to occur in the salt desert scrub and playas at the proposed pad locations and in the vegetated wetland habitat in the vicinity of the proposed drilling and testing.

As described in Section 4. C, 33.7 acres of vegetation would initially be removed in association with the proposed drill site and access roads. The amount of migratory bird habitat affected by the project actions would remain small compared to the amount of comparable habitat present on surrounding lands. Construction of the drill sites and new roads would add to habitat fragmentation in the project area. Migratory birds that could not tolerate fragmented habitat would be affected by these conditions.

Noise generated by construction activities could potentially affect migratory birds; these effects would be temporary and most likely migratory birds in the project area would habituate to the noise.

Due to the limited footprint of the proposed project, minimal impacts would occur to neotropical migratory birds associated with this project. Very little land would be disturbed, and as such, shrubs needed for nesting would remain virtually intact and prey species habitat would not be affected.

The majority of the project area is classified as salt desert scrub. The migratory species that infrequently use this habitat for breeding and foraging include the mourning dove, long-billed curlew, ferruginous hawk, Swainson's hawk, Costa's hummingbird, burrowing owl, short-eared owl, loggerhead shrike, Brewer's sparrow, sage sparrow, and willet. The golden eagle and the northern harrier may use salt desert scrub for foraging. Approximately 9,632 acres of the lease area is salt desert scrub habitat. The proposed project would affect 25.2 acres, approximately 0.3 percent, of the salt desert scrub habitat in the leases. The proposed habitat disturbance could potentially change breeding and foraging locations for individual birds in the area, but the loss of habitat would not affect migratory bird populations in the area.

The project area also includes 5,728 acres of playa habitat. Floyd (2007) found that the American avocet could occupy barren playas. Wilson's phalarope may forage in small pockets of dense vegetated wetlands fed by seeps and springs on the playa. The snowy plover may use the playa for foraging and nesting. The proposed project would affect 8.5 acres, approximately 0.1 percent, of the playa habitat at Star Flat and the edges of Eight Mile Flat. The proposed habitat disturbance could potentially change breeding and foraging locations for individual birds in the area, but the loss of habitat would not affect populations of these species.

No vegetated wetland habitat would be disturbed by the construction of the proposed well pads, but several small areas of wetlands associated with springs and seeps are 1,550 to 2,300 feet from well 15 on the western slopes of Eight Mile Flat. Temporary flow testing of the proposed exploratory wells would have little or no effect on the shallow groundwater aquifer and would not dewater the intermittent springs and seeps that are recharged primarily from precipitation and runoff. The well sites are also six miles south of the Stillwater National Wildlife Refuge and adjacent to or within four miles of Carson Lake and Pasture, which contain large areas of densely vegetated wetlands that may provide habitat to the canvasback, mallard, northern pintail, American avocet, long-billed curlew, northern harrier, Swainson's hawk, Ferruginous hawk, Wilson's phalarope, snowy plover, and willet. Occasionally fly over by these species may occur. The proposed exploratory drilling and testing would have little or no effect on individual birds flying over the area and would not impact the populations of these species.

Indirect Impacts Based on a Reasonably Foreseeable Development Scenario

If the proposed geothermal wells indicate evidence of significant geothermal activity, one or more geothermal power plants and related pipelines and electrical lines could be constructed in the vicinity of the wells to produce and deliver power. Although no such plant is proposed as part of this review, if it were constructed, impacts would be similar to those that would occur as a result of construction of the wells. However, since it is assumed that the geothermal power plants would cover an area larger than the sum of the well pads; indirect impacts would potentially be more extensive. Indirect impacts could include permanent loss of migratory bird habitat, habitat fragmentation, and noise impacts. Review of the proposed utilization plans would include performing preconstruction surveys for such habitat and could require avoiding loss of important habitat for migratory birds if it were found.

Potential indirect impacts could include changes to the isolated pockets 6.6 acres of vegetated wetlands associated with ephemeral seeps and springs on the western side of Eight Mile Flat. The impacts, if any, on this habitat would depend on the production and injection program at Salt Wells, determined using data obtained from the proposed exploration and testing. While substantial impacts to the seeps and springs are unlikely because they are primarily fed by precipitation and runoff (see the discussion of groundwater impacts), some changes to this habitat could occur. The potential changes in characteristics of up to 6.6 acres of fragmented vegetated wetlands is small compared to the 46,700 acres of contiguous habitat at Carson Lake and Pasture and the Stillwater National Wildlife Refuge. Review of the proposed development of the geothermal resources at Salt Wells would include preconstruction surveys of this area.

Subsequent NEPA analyses would determine the actual impacts of the utilization of geothermal resources to migratory birds.

4.E WASTES, HAZARDOUS OR SOLID

Direct Impacts

Exploratory drilling would involve some hazardous waste at the drill sites. These materials would include, but would not be limited to, the use of drilling additives and mud, diesel fuel, lubricants, solvents, oil, equipment/vehicle emissions, geothermal water, and laboratory materials. The transport, use, or disposal of hazardous materials could impact workers, the public, and the environment; however, training, experience, and knowledge of the drilling crews combined with the use of BMPs (e.g. secondary containment) would reduce the impact. Solid waste would be collected on-site and disposed of in accordance with BLM and Nevada regulations.

Indirect Impacts

If a productive geothermal resource is discovered, additional deep exploration drilling would be implemented. Additional drilling would involve additional amounts of the same types of hazardous and solid waste.

Other indirect impacts involving hazardous materials would involve the routine transport, use, or disposal of hazardous waste. The hazardous materials associated with drilling are common and the packaging and transportation of the waste is routine.

Indirect Impacts Based on a Reasonably Foreseeable Development Scenario

Should the resource prove suitable, one or more geothermal power plants could be constructed. The potential power plant configuration has not been confirmed; however, construction, operation, and maintenance activities could affect general public safety in staging areas and at the geothermal power plant. The construction would involve the use of hazardous materials and production of additional solid waste. Hazardous materials could pose risks to the workers and affect public safety for any non-worker in the immediate vicinity of the activities.

Proper installation and operation of equipment, personal protective equipment, and worker training would reduce the risk to worker safety. Other precautions involve safe passage past construction sites, fencing around easily accessible and dangerous structures to prevent unauthorized access, and proper installation and operation of equipment to minimize impacts to public health and safety. The direct impacts of the wastes created during

construction and operation of a potential geothermal power plant to public health and safety would be low.

Subsequent NEPA analysis would determine the actual impact of hazardous and solid waste.

4.F WATER QUALITY (SURFACE/GROUND)

Direct Impacts

During construction, there would be a potential for releases of substances used in the construction process. The most likely substances to be released would be petroleum hydrocarbons, such as fuels and hydraulic fluid. Should a spill occur, it would be contained and cleaned up using standard procedures, such as excavating and disposing of contaminated soil. Although rainfall is low and storms are infrequent, there is potential for any spilled or exposed substances to be mobilized by runoff and to infiltrate to shallow groundwater. Under requirements of the Clean Water Act, any project involving disturbance of more than one acre of land must implement a Storm Water Pollution Prevention Program, which specifies that best management practices be undertaken to prevent pollution of surface water. Parallel requirements apply also to linear projects, such as road construction.

Water for drilling the wells and dust abatement would be trucked to the project area by the Truckee-Carson Irrigation District in Fallon under an existing agreement. Vulcan estimates that during pad construction and drilling, up to 28,700 gallons of water per day would be needed to supply water for the project. The water well in Section 14 will be shut in and abandoned. Vulcan does not propose any additional water wells at this time.

The temporary well flow testing of the exploration wells would have little or no effect on the shallow groundwater aquifer or affect surface waters. Temporary well flow testing of the exploration wells is not expected to have a significant effect on shallow groundwater aquifers or affect springs, seeps, or ephemeral meadows in the lease area. Vulcan will conduct a baseline evaluation program of these springs and seeps pursuant to conditions of approval that will provide a basis for future evaluation of interconnection between the operating wells and shallow groundwater aquifers and surface springs and seeps.

The construction of the drilling pads and access roads and the proposed drilling would not result in any discharges to the Carson Lake Irrigation Ditch or natural drainages, and short-term discharges of geothermal fluids during testing would adhere to BLM-approved conditions.

Indirect Impacts Based on a Reasonably Foreseeable Development Scenario

Future actions based on the reasonable development scenario could result in the following indirect impacts:

Surface Water:

During construction, ground-disturbing activities, such as road and foundation pad construction and utilities installation, could increase soil erosion. The result could be that more soil might be transported in surface runoff to, for example, perennial streams. In areas of higher than average erosion potential, BMPs to reduce sediment erosion and to prevent sediment from being transported to wetland areas would be implemented in compliance with nonpoint (storm water) pollution prevention requirements of the Clean Water Act. Similarly, petroleum product or other chemical spills that may occur during construction would be cleaned up, in compliance with state and local permit requirements.

During normal operations, geothermal plants require cooling and may use cooling towers, which produce wastewater. Cooling tower blowdown is water that is periodically discharged from the cooling system to replenish evaporative losses. The water in the cooling towers contains salts that become concentrated in the cooling system over time and must be periodically replaced. The cooling water may also contain metals or other constituents introduced from corroding pipes or from chemicals used to inhibit corrosion or microbial growth in the system. Cooling tower blowdown may be injected back into the ground or discharged to the surface. Discharging cooling water blowdown to the surface would need approval.

The specific nature of any impacts related to the generation of wastewater would not be known until the specific development proposal is submitted. Any potential impacts to surface or ground waters would be addressed through National Pollution Discharge Elimination System (NPDES) permit requirements issued by the State of Nevada Department of Environmental Protection. The NPDES permit would require testing to ensure that the water met the discharge requirements. Water would be held in a brine holding pond prior to discharge. The state could require that the water be discharged to a lined pond to prevent infiltration.

Additionally, future development and production would also involve a site-specific environmental analysis. The components of this analysis would be locating, characterizing, and quantifying surface water resources once a specific site for geothermal resources development is identified. The level of impact on surface water resources from geothermal resource development would be influenced by, for example, specific geothermal operation plans, new developments in the area, and site-specific surface water studies.

Groundwater. Geothermal resource development could affect groundwater resources from water consumption by evaporation and reinjection of water to replenish the geothermal reservoir. The magnitude of the effects would vary depending on groundwater conditions and availability within the basin and on the configuration of the geothermal plant. Water resource availability could be a limiting factor, affecting the expansion of geothermal resource development in a given area. The cost effectiveness of geothermal energy production tends to increase with the size and number of plants in a given geographic area.

Discharge of cooling tower blowdown or water from testing of geothermal production wells could affect shallow groundwater quality if the discharged water percolated to a shallow aquifer. As with surface water, the discharge of cooling tower blowdown water would be subject to a NPDES permit issued by the Nevada Department of Environmental Protection (NDEP). Therefore, the permit holder would be required to demonstrate that the discharge did not degrade groundwater quality.

The source of the makeup water would be either be condensed geothermal steam or groundwater from local production wells. Makeup water is used to replace or make up for the evaporative losses and blowdown in a water-cooled system. The quantity of cooling tower blowdown depends on the size and number of the power plants, the quality of the makeup water (lower quality water requires more frequent cycling), the nature of the additives to prevent mineral scale, and the number of times the water is cycled. The number of the power plants depends on a number of factors that cannot be predicted, including transmission capacity and the productivity of the geothermal resources at the sites. The impacts on groundwater resources depend on the number of plants and the quality of the groundwater.

Groundwater extraction and injection wells are installed and pumped to cycle geothermal fluids within the geothermal reservoir to remove heat energy. To be effective, it is desirable to create an efficient circulation system where the injected (cool) water is resident in the formation long enough to heat up to the maximum temperature without significantly altering subsurface pressures. This requires a highly permeable geothermal aquifer that is preferably isolated from any shallow cool water or potable water aquifer above it. High injection pressures can fracture rock, with resultant leakage of geothermal fluids. Typically these fluids are highly mineralized, so geothermal production systems could contaminate shallow freshwater aquifers and heat could be lost to the surface. Extracting geothermal fluids could result in drawdowns if connected to shallower groundwater aquifers, with the resulting potential to affect streams or springs that are in turn connected to the water table aquifer.

The shallow stratigraphy observed in recent drilling at Salt Wells shows a variety of fine grained and diagenetically altered rocks, which function as impermeable caps or aquatards above the geothermal reservoir. Clay intervals ranging in thickness from 25 to 200 feet and calcium carbonate cemented sandstones (80 to 200 feet thick) rest on top of a sequence of siliceous sinters (silicified tuffaceous rocks) that range in thickness from 80 to 200 feet. These impermeable units work in combination to confine the geothermal reservoir from quaternary (10,000-15,000 year old) sediments of the Sehoo Formation occupying Eight Mile Flat. Therefore, deep wells drilled for flash steam power plants are expected to have little to no interconnection to shallow groundwater aquifers. If production were from the moderate temperature upper geothermal zone, development would probably have a binary configuration with all of the geothermal fluids injected back into the reservoir, substantially reducing potential impacts to the hydrologic balance of the shallow aquifer and surface features. The proposed well testing program would evaluate the interconnection between the shallow and deeper geothermal reservoirs. Nevertheless, there is some potential for long-term production to result in local changes to the temperature, flow, or chemical characteristics of individual springs and seeps in the lease area.

The potential for these types of impacts is reduced through extensive aquifer testing, which is the basis for designing the geothermal plant and for locating, designing, and operating the extraction and injection wells to prevent leaks from the casing. Combined with the requirement to comply with state and federal regulations that protect water quality and with limitations imposed by water rights issued by the state engineer, the impacts on water quality and the potential for depleting water resources is expected to be minimized.

A potential for impacts on groundwater quality exists if the cooling water evaporation ponds recharge shallow groundwater. The discharge ponds would be monitored in accordance with a permit from the NDEP. Additionally, future development and production would involve a site-specific environmental analysis. Components of this analysis would be locating, characterizing, and quantifying groundwater resources once a specific site for geothermal resources development is identified. The level of impact on groundwater resources from geothermal resource development would be influenced by, for example, specific geothermal operation plans, new developments in the area, and site-specific groundwater studies.

Subsequent NEPA analysis would determine the actual impact to water resources.

4.G WETLANDS AND RIPARIAN ZONES

Direct Impacts

Temporary flow testing would have little or no effect in the lease area. Vulcan will conduct a baseline evaluation program of the springs and seeps pursuant to conditions of approval that will provide a basis for future evaluation of interconnection between operating wells and shallow groundwater aquifers and surface springs and seeps.

Indirect Impacts Based on a Reasonably Foreseeable Development Scenario

Construction and operating geothermal wells is assumed to be a precursor to development of a geothermal power plant. Although no such plant is proposed at this time, the geothermal plant would be situated to avoid sensitive resources, including ephemeral drainages and wetlands. Overall impacts would be similar to, but possibly greater in extent, impacts from the construction of geothermal wells, and would be associated with construction and operation of the plant, staging areas, and access roads.

It is not known whether geothermal production will affect shallow groundwater aquifers or dewater the springs, seeps, and associated wetland vegetation. Vulcan will conduct a baseline evaluation program of the springs and seeps pursuant to conditions of approval that will provide a basis for future evaluation of interconnection between the operating wells and shallow groundwater aquifers and surface springs and seeps.

Subsequent NEPA analysis would determine the actual impact to wetland and riparian zones.

4.H BLM SENSITIVE SPECIES

Direct Impacts

BLM sensitive species may occur in the project area based on areas of spring, playa, sand dune, and salt desert scrub habitat types. Impact to BLM sensitive species would depend on the alteration of their habitats and the sensitivity of the species.

Table 3-5 lists species identified by BLM as sensitive species and none of these 24 species have been recorded within the project area. Further, reconnaissance-level biological surveys conducted by Tetra Tech biologists in October 2006 and by an EMPS biologist in November 2006 did not document any sensitive plant or wildlife species. However, baseline surveys documented one burrowing owl on lands adjacent to the project area (WESTEC 1988), and a potential burrow was noted at one of the sites in 2006.

Of the species identified in Table 3-5, potential impacts to the ferruginous hawk, Western burrowing owl, Swainson's hawk, golden eagle, short-eared owl, snowy plover, loggerhead shrike, and long-billed curlew were discussed in Section 4-D above.

The proposed project would disturb up to 33.7 acres of land, consisting of approximately 25.2 acres of salt desert scrub habitat and approximately 8.5 acres of playa. Much of the land surrounding the proposed drilling sites is undisturbed and similar in habitat function. Burrowing owls most likely would occur within the 33.7 acres to be affected under the proposed action. However, there is suitable burrowing owl habitat throughout the project area and surrounding lands. Therefore, a preconstruction survey would occur at the sites to ensure that burrowing owls are not present. If burrowing owls are present within the construction footprint area, conservation measures and BMPs, closing burrows, and

relocating individual owls would be employed. Depending on the owls' proximity to the construction area, the birds would either be relocated to other suitable habitat nearby or left in place if construction activities are more than 260 ft from the burrow during non-breeding season (September 1 through January 31) or more than 250 ft during the breeding season (February 1 through August 31).

The majority of the project area is classified as salt desert scrub. The well sites are six miles south of the Stillwater National Wildlife Refuge and adjacent to or within four miles of Carson Lake and Pasture, which provide wetland habitat to the black tern and the Sand Hill crane. Occasionally fly over by these species may occur. The BLM sensitive species that use salt desert scrub habitat include the vesper sparrow, prairie falcon, and scented (Lahontan) beardtongue. Species that use this habitat for foraging include the Townsend's big-eared bat, spotted bat, small-footed myotis, fringed myotis, little brown myotis, California myotis, pallid bat, silver-haired bat, hoary bat, long-eared myotis, Western pipistelle, long-legged myotis, and Brazilian free-tailed bat. Sand dunes or deep sand within the salt desert scrub could be used as habitat for the Nevada oryctes and the Nevada sanddune beardtongue. Approximately 9,632 acres of the lease area is salt desert scrub habitat. The proposed project would affect 25.2 acres, approximately 0.3 percent, of the salt desert scrub habitat in the leases. The proposed habitat disturbance could potentially change breeding and foraging locations of individual birds in the area, but the loss of habitat would not affect populations. Vulcan does not anticipate any direct impacts from proposed project on flyover species or populations due to the lack of habitat onsite.

The project area includes ephemeral springs within the 5,728 acres of playa habitat. The Northern leopard frog may occur at these springs or in Carson Lake and Pasture to the west of the leases. The proposed project would affect 8.5 acres, approximately 0.1 percent, of playa habitat in the leases. The proposed habitat disturbance could potentially affect individuals, but the loss of habitat would not affect populations.

Indirect Impacts Based on a Reasonably Foreseeable Development Scenario

If the proposed geothermal wells indicate evidence of significant geothermal activity, it is assumed that one or more geothermal power plants would be constructed in the vicinity to process and deliver power. Although no such plant is proposed as part of this review, if it were constructed, impacts would be similar to those that would occur as a result of construction of the wells. However, since it is assumed that the geothermal power plants would cover an area larger than the sum of the well pads; impacts would potentially be more extensive. Review of the utilization plans would include performing preconstruction surveys for such habitat and could require avoiding loss of important habitat for BLM sensitive species if such habitat were found. If active burrowing owl burrows were detected and it was not possible to avoid them during construction, the same measures for relocating owls would be taken as described for impacts from geothermal well construction.

Subsequent NEPA analysis would determine the actual impact to BLM Sensitive Species.

4.I LAND USE

Direct Impacts

The proposed project would be within the Salt Wells geothermal leasing area and would be consistent with the conditions of the BLM lease. It would also be consistent with BLM leasing of geothermal resources on BOR lands. Although geothermal development in this area could be inconsistent with the designated uses for the surrounding lands as specified in the Churchill County Master Plan, almost no private land subject to these use designations is found around the lease area.

Sections 17, 20, 29, and 32 are on BOR land. Access roads are dedicated to the pad locations and are not expected to provide unauthorized access to Carson Lake and Pasture. Vulcan proposes to install gates during drilling and will consider relocating the fence to the Carson Lake and Pasture boundary if it plans to develop complete well fields in this area. Before the project commences, access to this area would be coordinated with BOR and their operation and maintenance contractor, the Truckee-Carson Irrigation District, and the Nevada Department of Wildlife.

Indirect Impacts Based on a Reasonably Foreseeable Development Scenario

Future actions based on the reasonable development scenario could result in indirect impacts. Although all lease areas may contain existing valid surface uses (such as easements, rights-of-way, and range improvements), it is assumed that these uses are largely nonexclusive, so compatible rights could be granted. Additionally, the BLM and any necessary environmental reviews that would take place prior to ground-disturbing activities would identify and provide mitigation measures for impacts on land use. Future actions would be subject to the BLM's standard lease stipulations.

Geothermal development in this area would not conflict with multiple use management objectives of the BLM and BOR, which have concurred that development of geothermal resources in this area would not conflict with its management objectives for withdrawn lands in the area. The western half of Sections 17, 20, 29, and 30 are in Carson Lake and Pastures area. Vulcan does not plan to propose surface facilities within this area. The federal government has retained the right to lease portions of land outside this area. Nevertheless, leasing the remaining land within these sections could result in development that is incompatible with adjacent sensitive land uses.

Although geothermal development in this area could be inconsistent with the designated uses for the surrounding lands as specified in the Churchill County Master Plan, almost no private land subject to these use designations is found around the lease area.

Subsequent NEPA analysis would determine the actual impact to land use.

4.J PUBLIC HEALTH AND SAFETY

Direct Impacts

Public health and safety issues from geothermal exploration generally include use of hazardous materials, wildfires, worker safety, and the safety of occasional visitors or members of the public.

Exploratory drilling would involve some hazardous materials at the drill sites. These materials would include, but would not be limited to, the use of drilling additives and mud,

diesel fuel, lubricants, solvents, oil, equipment/vehicle emissions, geothermal water, and laboratory materials. The transport, use, or disposal of hazardous materials could impact workers, the public, and the environment; however, training, experience, and knowledge of the drilling crews combined with the use of BMPs (e.g. secondary containment) would reduce the impact.

Exploratory drilling activities (equipment sparks, welding, worker smoking) would increase the potential for a fire in the project area. While the Great Basin is known for its year-round dry climate and occurrence of wildfires from July through September, the project area is populated by sparse vegetation and has minimal fire history. Properly implemented standard operating procedures would minimize the risk of fire.

Drilling activities involve the use of heavy equipment and dangerous materials. These activities and materials pose risks to the workers. Proper installation and operation of equipment, personal protective equipment, and worker training would reduce the risk to worker safety.

Indirect Impacts

If a productive geothermal resource is discovered, additional deep exploration drilling would be implemented. Additional drilling would involve additional activities of the same nature, additional amounts of the same types of materials and use of the same types of equipment. The risks to public health and safety would be the same.

Other indirect impacts involving hazardous materials would involve the routine transport, use, or disposal of hazardous materials. The hazardous materials associated with drilling are common and the packaging and transportation of the materials is routine.

Indirect Impacts Based on a Reasonably Foreseeable Development Scenario

Should the resource prove suitable, one or more geothermal power plants could be constructed. The potential power plant has not been fully designed; however, construction, operation, and maintenance activities could affect general public safety in staging areas and at the geothermal power plant. The construction would involve the use of heavy equipment and dangerous materials. These activities and materials pose risks to the workers and could affect public safety for any non-worker in the immediate vicinity of the activities.

Proper installation and operation of equipment, personal protective equipment, and worker training would reduce the risk to worker safety. Other precautions involving, for example, safe passage past construction sites, fencing around easily accessible and dangerous structures to prevent unauthorized access, and proper installation and operation of equipment to prevent electrical shock or fire would minimize impacts to public health and safety. The direct impacts of the construction and operation of a potential geothermal power plant to public health and safety would be low.

Subsequent NEPA analysis would determine the actual impact to public health and safety.

4.K RANGE RESOURCES

Direct Impacts

The project area spans 15,354 acres of BLM and BOR land; including 3,422 acres of the Rock Springs Grazing Allotment, 1,846 acres of the Bass Flat Grazing Allotment, and 161 acres of the Salt Wells Grazing Allotment. Five of the proposed well sites fall within the Rock Springs Allotment (see Table 4- 1).

Impacts on grazing resources would be minimal. The entire lease area would not be developed. After initial construction, the only area that would be unusable for grazing cattle would be the roadway (approximately 2.7 acres) and the well sites (approximately 14 acres).

Loss of grazing would be short-term during construction as revegetation would open up most disturbed areas to grazing. Post construction, approximately 16.7 acres of the Rock Springs Grazing Allotment would be permanently unavailable for grazing because roads would have no vegetation and well sites would be compacted. This would result in a total loss of less than one AUM.

Temporary well flow testing would have little or no effect on the shallow groundwater aquifer nor would testing affect the ephemeral springs on the playas that livestock may use as a water supply.

Table 4-1 Grazing Allotment Impacts

| Allotment Name | Total Area of Grazing Allotment (Acres) | Approximate Acres within Lease Area Available for Grazing | Approximate Allotment Acres within Lease Area Lost to Grazing | Approximate AUMs within Lease Area | Approximate AUMs within Lease Area Affected |
|----------------|---|---|---|------------------------------------|---|
| Bass Flat | 46,789 | 1,846 | 0 | 62.8 | 0 |
| Rock Springs | 28,394 | 3,422 | 16.7 | 64.3 | 0.3 |
| Salt Wells | 58,611 | 161 | 0 | 4.5 | 0 |
| Total | | | | | 0.3 |

Indirect Impacts Based on a Reasonably Foreseeable Development Scenario

If one or more power plants were to be developed, a greater area of land would be disturbed for construction and operation of the plant. As a result, a greater amount of grazing would be temporarily lost during construction and permanently lost during operations than under the Proposed Action.

Geothermal production is not expected to drawdown the shallow groundwater aquifers or dewater the playas or ephemeral springs and associated wetland areas which are primarily fed by precipitation and runoff (see the discussion of indirect impacts to groundwater resources). Production, however, could result in local changes to the temperature, flow, or chemical characteristics of individual springs and seeps in the lease area that contribute water for range resources.

Subsequent NEPA analysis would determine the actual impact to range resources.

4.1 RECREATION/SPECIAL DESIGNATIONS

Direct Impacts

Impacts to dispersed recreational users could result from increased traffic on local roads, increased noise levels, decreased air quality, and decreased visual quality within the viewshed during construction and operation. Also, both construction and operational noise and visual disturbances may decrease the local presence of avian and mammalian wildlife, potentially decreasing wildlife viewing opportunities.

Most of the impacts would occur during the construction phase of the project and would be temporary. Given the small area that would be affected compared to the surrounding areas available for dispersed recreational uses, impacts would be limited.

Vulcan Power would not restrict public access to the main north-south road or to Simpson Pass east-west routes. Road closures would be necessary in the event of an off-highway vehicle race. Vulcan Power would comply with road closures and resume activities when roads reopened.

Indirect Impacts Based on a Reasonably Foreseeable Development Scenario

Future actions based on the reasonable development scenario could result in indirect impacts. Development, production, and closeout initiated under a lease agreement should not contribute to any of the geothermal areas, a significant number of new residents who could increase the use of existing recreational facilities; therefore, there is a low potential risk of impacts from increasing the use of existing recreational facilities.

Implementing the Proposed Action could result in the eventual development of energy resources in the lease areas and in areas of dispersed recreational resources. Development in all areas would reduce the amount of natural landscape as well as the amount of areas available for recreationists seeking solitude; however, the lease areas are only a small portion of the surrounding landscapes. The creation of new roads would increase opportunities for people to access public lands and create trails and routes that currently do not exist and would be considered a beneficial impact. The creation of new trails on otherwise undeveloped, unspoiled natural areas would also be considered an adverse impact.

Subsequent NEPA analysis would determine the actual impact to recreation and special designations.

4.M SOCIOECONOMICS

Direct Impacts

No residents, minority or low-income populations, or businesses would be displaced, and no property would be acquired as a direct result of construction and operation of the proposed exploratory wells.

Constructing the well pads and drilling the wells could have a beneficial effect on the surrounding economy by employing construction workers for installing access roads and well pads, and operating the drill rigs. Construction would employ approximately six workers for six to eight weeks; drilling the exploration wells would employ six workers for approximately 45 days at each well.

Most of the workers would not be local, although some locals may obtain employment in road and pipeline construction. The increase in employment of personnel involved in well construction would be temporary, over the duration of the construction. Expenditures for equipment, materials, fuel, lodging, food, and other needs would stimulate the local economy over the duration of exploration (Whittome 2006). Additional workers would likely be employed for road construction and drilling water wells (if approved).

The nearest tribal lands are the Walker River Indian Reservation, which is about 9.9 miles south of the project area, and the Fallon Indian Reservation, which is approximately 10.7 miles north of the project area. Any potential physical effects of constructing and operating the proposed facility would be unlikely to affect these populations.

Construction and operation of the proposed wells could affect nearby recreational resources, which also could affect the economies of the areas in which the recreational resources are located if fewer visitors use the resources (and spend fewer dollars in the local economy). Revenues associated with recreational activity (such as bird watching, mountain biking, and hiking) could decline if these activities were reduced or eliminated. There are no recreation areas or areas of critical environmental concern within the project area; however, the Pony Express National Historic Trail is about 1.5 miles south of the southernmost drill site. Minor long-term effects could be expected from the alteration of the viewscape from the Pony Express Trail; however, a reduction in dispersed visitation would not be expected to result in adverse economic impacts, since the nearest economic center is the city of Fallon, which is approximately 13 miles from the project area.

Ranchers and shepherds rely on portions of the Salt Wells geothermal leasing area for grazing. The level of local economic impact of geothermal leasing activities on grazing would depend on the extent to which reducing the grazing areas would reduce the size or health of a permit holder's herds or require that a permit holder lease or purchase additional lands. As identified in Section 4.M, Range Resources, the Proposed Plant Site and access roads could cause a reduction of less than 1 AUM in the Rock Springs Grazing Allotment. These impacts would not affect the economic livelihood of ranchers and herders.

No long-term increases in population or growth would be induced through construction or operation of the wells, and demand for schools would not increase. Land values for private tracts of land bordering geothermal development areas could increase, based on the development potential and possible profitability exhibited on adjacent geothermal lands. Potential increased land values for adjacent private land could provide indirect revenue to Churchill County.

Overall, the potential risk for impacts on socioeconomic resources or environmental justice resulting from the proposed action would be very low.

Indirect Impacts Based on a Reasonably Foreseeable Development Scenario

If a power plant were to be developed, expenditures for equipment, materials, fuel, lodging, food, and other needs would stimulate the local economy over a longer duration of time than under the Proposed Action. Operation of one or more power plants would also bring greater revenue to the local economy. A greater area of land would be disturbed for plant construction and operation increasing the risk of impacts to recreational resources. The level of local economic impact of geothermal development activities on grazing would depend on the extent to which reducing the grazing areas would reduce the size or health of a permit holder's herds or require that a permit holder lease or purchase additional lands.

Subsequent NEPA analysis would determine the actual impact to socioeconomic resources.

4.N SOILS, GEOLOGY, AND MINERALS

Direct Impacts

Proposed Exploratory Wells

Each exploratory well's drilling area (350-ft x 350-ft) would involve 2.8 acres of disturbance. All ten exploratory wells would total 28 acres of disturbance. Approximately 3.4 miles of newly developed road would be constructed to access the proposed drill sites (Figure 2-1).

Each new access road would be approximately 14-ft wide for an area of disturbance of 5.7 acres.

Soils in the vicinity of the exploratory wells are either rocky or alkaline or have other limitations that make them unsuitable as farmland. There are no prime farmlands soils that would be impacted by the proposed action. The direct impacts of the proposed action to soils would be low.

Indirect Impacts

If a productive geothermal resource is discovered, additional production drilling would be conducted within the proposed 350-ft x 350-ft pads without requiring further disturbance of surrounding soils.

Combined with the 17.2 acres of disturbance for the existing pads, 4.4 acres for the existing access roads, and 8.5 acres for the upgraded main roads constructed in 2007, the total direct and indirect impacts to soils would be up to 64 acres of disturbance.

In much of the project area, the land is sparsely vegetated and surface soils are “armored” with a layer of pebbles and gravel called “desert pavement,” which has resulted from years of wind erosion winnowing the soils. The desert pavement stabilizes the surface soil, and when disturbed the soil becomes more vulnerable to erosion. The chemistry and properties of surface soils may be much different than the subsurface soils at shallow depth. With little rainfall, desert soils tend to develop and evolve over long periods so that scars from soil disturbance may remain for many years. These characteristics of desert soils can lead to slow recovery vegetation in disturbed areas. In general, soil disturbance can be minimized through the use of best management practices.

Seismicity. In general, ground shaking in a large earthquake, could damage drilling structures. Geothermal resources tend to occur in areas of geologically recent volcanic activity. Often these areas contain active faults, and often geothermal fluids circulate from deep to shallow depths because of fault-related fracturing. Also, some faults that may be distant from the geothermal area may produce earthquakes large enough to cause severe ground shaking in the project area. Although seismic hazards may exist at a site, the short time frame over which the activities would occur reduces the level of hazard to less than significant levels.

Mineral Resources. Geothermal areas are sometimes also areas of hydrothermal mineral deposition. Heated groundwater circulating through fractured rock dissolves metals from the rock and re-deposits them in the fractures, which over long periods can create significant ore deposits. The locations proposed for exploratory wells do not have known mineral resources.

Indirect Impacts Based on a Reasonably Foreseeable Development Scenario

Should deep exploratory drilling prove that the resource may be suitable; one or more geothermal power plants could be built. The disturbance associated with any future plants would depend on their size and design. While such a power plant has not been fully designed, the potential impacts would include the short-term construction of wells, pipelines, roads, power plants, and transmission lines. The amount of land disturbed could vary from ten to 20 acres.

Subsequent NEPA analysis would determine the actual impact to soils, geology and mineral resources.

4.0 VEGETATION

Direct Impacts

Construction and operation of geothermal exploratory drilling sites, including well pads, the freshwater well, and roads, would result in long-term removal of vegetation in those areas. The majority of vegetation within the project area is typical Great Basin greasewood--dominated vegetation communities, and is abundant in the surrounding areas. Long-term removal of vegetation from construction of drilling sites would occur initially on 33.7 acres. This would include vegetation removal on the ten 350-ft by 350-ft (28 acres) well pads and 3.7 miles of new roads approximately 14-ft wide (5.7 acres). Some additional vegetation may be removed during construction activities, such as staging and temporary storage, but the amount disturbed would be minimal. The total amount of vegetation to be initially removed (33.7 acres) for the proposed drilling would be small compared to the amount of similar surrounding vegetation on surrounding lands. Potential impacts to special status plant species are described in Section 4.E.

If initial well drilling finds a site unsuitable for geothermal resources, it is likely that removal of the wellhead and associated equipment would occur. In this instance, the well pad would be revegetated with native plant species, according to the revegetation plan. If, however, a productive geothermal resource is found, the site would be used for drilling up to five production wells with no additional potential for loss of habitat. The revegetation plan would be applied to the berms around the pads after completion of drilling, but the pads would be kept at their original size for well maintenance and future drilling.

There are approximately 6.6 acres of wetland vegetation associated with the intermittent springs and seeps on Eight Mile Flat. The extent of this vegetation fluctuates based on annual precipitation and runoff in the watersheds in the adjacent ranges. Temporary flow testing would have little or no effect on the shallow groundwater aquifers or the vegetation that depends on surface water manifestations, but exhibits some influence from geothermal groundwater. A well flow test of 2500 gpm for 46 hours, south of the Vulcan leases at Salt Wells, did not result in any drawdown (UNR 2008).

Staging areas if utilized would require vegetation clearing and potential grading. The vegetation present has no special status listing, and does not provide valuable habitat. Also, where feasible, staging would occur on already disturbed areas, such as existing roads and off-highway vehicle trails.

Indirect Impacts Based on a Reasonably Foreseeable Development Scenario

Constructing and operating geothermal wells is assumed to be a precursor to development of a geothermal power plant. Although no such plant is proposed at this time, it is assumed that such construction would result in long-term removal of vegetation in the construction area. It is further assumed that such a plant would be constructed in the vicinity of the proposed geothermal wells, and that the affected vegetation community would be similar to that which would be affected by well construction. Overall impacts would be similar to, but possibly greater in extent, impacts from the construction of geothermal wells, and would be associated with construction and operation of the plant, staging areas, and access roads.

Geothermal production is not expected to drawdown the shallow groundwater aquifers or dewater the playas or intermittent springs and associated wetland areas (see the discussion of indirect impacts to groundwater resources), but could result in local changes to the characteristics of individual springs and seeps in the lease area that contribute water for vegetation in these areas. Potential loss of approximately 6.6 acres wetland vegetation is

small compared to the 46,700 acres of similar habitat at Carson Lake and Pasture and the Stillwater National Wildlife Refuge.

Subsequent NEPA analysis would determine the actual impact to vegetation resources.

4.P VISUAL RESOURCES

Direct Impacts

Sensitive receptors in the Salt Wells area include hikers, off-highway vehicle users, equestrians, visitors to the Pony Express Trail, and people traveling on Highway 50. Construction and operation activities would be visible in the project area. However, these activities would be temporary, resulting in short-term impacts on the visual quality of the landscape. Also, it is assumed there would be no bright spot-lights to illuminate site activities at night. Therefore, there would be no impact on nighttime light.

Once operations ceased, Vulcan would cap the wells and reclaim the sites. The remaining structure would represent a noticeable human-made object in an area with few human-made structures. This would constitute a long-term impact on the visual quality of the landscape. Due to the size of the capped well, it would not be highly visible.

Indirect Impacts Based on a Reasonably Foreseeable Development Scenario

Future actions based on the reasonable development scenario could result in indirect impacts. Future development and production could involve new structures, roads, and operations. These would be near areas where expansive vistas are available, where recreation takes place, or where minimal nearby development exists. Potential risk exists for impacts on scenic vistas, the visual character of a site, and nighttime lighting. Future development and production would involve a site-specific environmental analysis. Geothermal resource developers would be required to comply with general lease stipulations in order to address the potential impacts on visual resources.

Subsequent NEPA analysis would determine the actual impact to visual resources.

4.Q WILDLIFE RESOURCES

Consequences to wildlife resources generally result from impacts to individuals, populations, or from disturbance to wildlife habitat. This section describes the environmental consequences to wildlife resources. The majority of potential impacts to wildlife are associated with habitat disturbance and vegetation removal. Removing vegetation in areas used by wildlife results in a reduction of available habitat and may cause habitat fragmentation. Habitat disturbance associated with construction activities would be temporary until vegetation becomes reestablished and would be small in relation to the surrounding habitat.

Direct Impacts

As described in Section 4.P, Vulcan would initially remove 33.7 acres of vegetation in association with the proposed drill sites and access roads. The amount of wildlife habitat affected by project actions would remain small compared to the amount of comparable habitat present on surrounding lands. Construction of the drill sites and new roads would add to habitat fragmentation in the project area. These conditions would affect wildlife species that could not tolerate fragmented habitat.

Construction activities, such as grading, digging, and the use of heavy vehicles, could result in direct adverse impacts through killing some wildlife. Larger and more mobile wildlife species, such as kit fox and coyote, along with various bird species would most likely be able to avoid construction equipment. Smaller, less mobile species and burrowing species may not be able to avoid equipment.

Noise generated by construction activities could potentially affect wildlife; these effects would be temporary and most likely wildlife in the project area would habituate to the noise.

Temporary flow testing would have little or no effect on intermittent seeps and springs nor would it affect wildlife species that depend on these water resources.

Potential impacts to special status wildlife species are described in Section 4.E.

Indirect Impacts Based on a Reasonably Foreseeable Development Scenario

If the proposed geothermal wells indicate evidence of significant geothermal activity, it is assumed that one or more geothermal power plants would be constructed in the vicinity to process and deliver power. Although no such plant is proposed as part of this review, if it were constructed, impacts would be similar to those that would occur as a result of construction of the wells. However, since it is assumed that the geothermal power plants would cover an area larger than the sum of the well pads; impacts would potentially be more extensive. Impacts would include permanent loss of general wildlife habitat, habitat fragmentation from road construction and use, and noise impacts. Loss of sensitive species habitat would be avoided by performing preconstruction surveys for such habitat and avoiding such habitat if it were found.

Geothermal production is not expected to drawdown the intermittent springs and associated wetland areas (see the discussion of indirect impacts to groundwater resources), but could result in changes to the characteristics of individual springs and seeps in the lease area and could alter the habitat for wildlife in these areas. Potential changes to 6.6-acres of fragmented wetland vegetation is small compared to the 46,700 acres of contiguous habitat in Carson Lake and Pasture and Stillwater National Wildlife Refuge.

Subsequent NEPA analysis would determine the actual impact to wildlife resources.

4.2 NO ACTION ALTERNATIVE

The No Action Alternative would not meet the need for the proposed action.

Implementation of the No Action Alternative would result in the lands not being open to additional geothermal exploratory drilling.

Although environmental impacts would not occur under the No Action Alternative, implementation of this alternative would not be consistent with the land use plan or the issuance of geothermal leases in the project area. This is also inconsistent with the Federal Energy Policy to promote the development of environmentally attractive energy resources.

Ongoing and reasonable foreseeable actions that would affect the human environment in the project areas include the exploration of the original ten wells and development of one or more geothermal power plants. The environmental impacts of these activities would include, but not limited to: groundwater and other resources dependent on groundwater; air quality; wastes, hazardous or solid; land use; and visual resources.

4.3 CUMULATIVE IMPACTS

Council on Environmental Quality regulations state that the cumulative impact analysis should include the anticipated impacts on the environment resulting from “the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over time” (40 CFR 1508.7).

Impacts of the proposed action and alternatives presented in this EA are assessed for cumulative impacts along with other actions conducted in the region. Unless otherwise specified, the ROI for each resource in the cumulative analysis is the same as the ROI defined in Chapter 3.

Current or reasonably foreseeable actions that have been identified are described below.

CCFO 2007 Geothermal Drilling EA. On February 6, 2007, the FONSI and Decision Record (DR) for the Vulcan Salt Wells Geothermal Drilling EA were signed by the Carson City Field Office (CCFO) Manager. As part of this Decision, Vulcan could now construct ten well pads and perform exploratory drilling at these locations in the project area encompassing 15,354 acres of BLM and BOR land. Vulcan Power is now seeking to perform additional exploratory drilling at ten new well pad locations. Vulcan plans to submit an a Plan of Utilization for future power plant development at the Salt Wells leases.

CCFO 2006 Geothermal Leasing EA. On July 17, 2006, the FONSI and Decision Record (DR) for the CCFO Geothermal Leasing EA were signed by the Carson City Field Office Manager. As part of this Decision, 11 leases encompassing 17,450 acres were issued in the Salt Wells Leasing area (including Vulcan Power’s leases). To date, no other entities have applied for drilling permits, but the lease conveys upon the lessee the right to drill and future exploration is expected.

Salt Wells Geothermal Binary Power Plant and other geothermal energy development. AMP Resources, LLC is constructing a geothermal binary power plant in the area of Salt Wells adjacent to the project area. In addition, seven other geothermal power plants are operating within the CCFO management area, four of them on private land in the Steamboat Springs Area. Although no detailed proposals have been developed, geothermal development is being considered on private, tribal, and US Navy land throughout the CCFO management area.

Naval Air Station Fallon Integrated National Resources Management Plan. Naval Air Station Fallon is updating its integrated national resources management plan. The purpose of the plan is to ensure consistency with the use of Naval Air Station Fallon to support the preparedness of the Armed Forces, while providing for the conservation and rehabilitation of natural resources on Naval Air Station Fallon-administered lands, the sustainable multipurpose use of the resources, including hunting, fishing, trapping, and non-consumptive uses, and public access to Naval Air Station Fallon-administered lands within safety and military security requirements. The overall goal of the integrated national resources management plan is to develop a program that preserves and enhances ecosystem integrity and sustains both biological diversity and continued availability of those resources for military readiness and sustainability and other human uses.

Borgna Oil and Gas Drilling Project. An oil and gas operator proposes to re-enter and deepen an existing well to a depth of 5000 ft. The existing well was drilled in 1990 to a depth of 2800-ft. This new proposed drill project would re-disturb the 1990 reclaimed area. Drill pad construction and a short segment of new road are proposed. The well site layout involves an

area of 250 ft by 300 ft, 1.7 acres and includes the reserve pit, maneuvering/turnaround area, mud tanks, pipe ramp and racks, fuel tank, 2 mud pumps, chemical toilet, generator, water tank, 2 worker/supervisor trailers, and drill rig. Access is via Highway 50, approximately 12 miles east of Fallon and via existing two-track road.

Air Quality

The proposed action would not result in significant regional air quality concerns. Other actions occurring on public lands, in combination with the proposed action, release low levels of air emissions, dispersed over large and sparsely populated areas. The resulting pollutant concentrations tend to be low, with limited fluctuations in air quality. The proposed action would not substantially increase pollutant emissions in Nevada; therefore, no cumulative impacts are expected.

Cultural Resources

Cumulative impacts on cultural resources from the above projects could pose a risk of significant impacts regionally since it is unknown if any of the above would adversely affect historic properties. However, because the proposed action would not have a significant impact on NRHP-listed or -eligible historic properties, the proposed action would not contribute to the cumulative impact.

Given the absence of Native American resources within the project area, no cumulative impacts are expected.

Invasive, Nonnative Species

Invasive species may be removed during construction activities, such as staging, temporary storage, and pipeline maintenance. In areas where native vegetation is removed, short-term, potential infestation of invasive weed species such as cheat grass could occur. There would be very little long-term cumulative disturbance.

Migratory Birds

The cumulative projects within the region that have similar habitats as the proposed action include the Salt Wells Binary Power Plant, the Borgna Oil and Gas Project, the CCFO 2007 Geothermal Drilling EA, and the proposed project. Utilizing the soil series within the project area and extrapolating them to the project region, there are approximately 91,307 acres of salt desert scrub and 195,397 acres of playa (Soil Conservation Service, 1975).

Construction activities, such as grading, digging, and the use of heavy vehicles, could result in temporary displacement of migratory birds under the Proposed Action and other cumulative projects. Projects areas that are permanently maintained and kept clear of vegetation could permanently displace migratory birds. The cumulative projects within the region of the proposed project, identified as having approved and identifiable cumulative impacts, would affect approximately 104 acres of salt desert scrub and 8.5 acres of playa habitat. These cumulative impacts represent approximately 0.1 percent of the salt desert scrub and 0.004 percent of the playa habitat in the region. Substantial migratory bird habitat would still be available with approval of the project. These cumulative losses are not a significant loss of migratory bird habitat for individuals or populations.

Wastes, Hazardous or Solid

Impacts to workers, the public, and the environment could result from disturbance of preexisting hazardous materials within cumulative project areas, or through exposure to hazardous materials used in the construction, operation, and maintenance of the a project.

By adhering to proper regulations on hazardous material use and transportation, however, the risk for potential cumulative impacts from hazardous materials would be low.

The implementation of the Proposed Action and other cumulative geothermal developments could affect general public safety. By adhering to local regulations pertaining to public health and safety, and by following standard operating procedures, safety impacts would be minor.

Water Resources

Spills of fuels, hydraulic fluid, or other substances, while not likely, could occur during the construction phase of any cumulative project. A Storm Water Pollution Prevention Plan would be implemented for the construction phase of each cumulative project, and any accidental spills that occur would be cleaned up as required by the plan.

Individually, projects in the Salt Wells area tend to have minor impacts on water supply. Cumulative impacts, however, would have a greater impact on water supply. These impacts would depend on, for example, the timing of and scale of projects. Multiple large-scale projects occurring at the same time would have a greater impact on water supplies than sporadic projects.

Wetlands and Riparian Zones

Little or no impacts to wetlands would occur under the Proposed Action. Development of cumulative geothermal projects is not expected to result in substantial changes to the wetland vegetation on the western side of Eight Mile Flat, but additional analysis during project review would evaluate the potential to result in local changes in characteristics to these wetland areas.

BLM Sensitive Species

The cumulative projects that are within the region and have similar habitats as the proposed action include the Salt Wells Binary Power Plant, the Borgna Oil and Gas Project, the CCFO 2007 Geothermal Drilling EA, and the proposed project. Utilizing the soil series within the project area and extrapolating them to the project region, there are approximately 91,307 acres of salt desert scrub and 195,397 acres of playa (Soil Conservation Service, 1975).

BLM sensitive species habitat occurs in the project area. Therefore, there would be a potential for impacts to individual BLM sensitive species or their habitat.

BLM sensitive species maybe displaced under the Proposed Action and other cumulative projects temporarily during construction. Areas of the projects that are permanently maintained and kept clear of vegetation would permanently displace BLM sensitive species. The cumulative projects within the region of the proposed project, identified as having approved and identifiable cumulative impacts, would affect approximately 104 acres of salt desert scrub and 8.5 acres of playa habitat. These cumulative impacts represent approximately 0.1 percent of the salt desert scrub and 0.004 percent of the playa habitats in the region. Substantial habitat for BLM sensitive species would still be available with approval of the project. These cumulative losses are not a significant loss of BLM sensitive species habitat for individuals or populations. These proposed impacts would not require any of the BLM sensitive species to be listed as a threatened or endangered species.

Impacts to BLM sensitive species would be minor under the Proposed Action in conjunction with conservation measures. Development of cumulative geothermal projects would likely result in the similar impacts.

Land Use

The proposed project would not conflict with any land use designations under the Churchill County Master Plan. All identified cumulative projects, including the Proposed Action would comply with local land use regulations.

Public Health and Safety

Impacts to workers, the public, and the environment could result from disturbance of preexisting hazardous materials within cumulative project areas, or through exposure to hazardous materials used in the construction, operation, and maintenance of the a project. By adhering to proper regulations on hazardous material use and transportation, however, the risk for potential cumulative impacts from hazardous materials would be low.

The implementation of the Proposed Action and other cumulative geothermal developments could increase the potential for a fire and affect general public safety. By adhering to local regulations pertaining to public health and safety, following standard operating procedures, and implementing the Carson City District Wildland Fire Mitigation Plan, safety impacts would be minor.

Range Resources

Cumulative impacts on range resources from the project listed above are minor, as most of the projects involve relatively small acreages. The cumulative projects within the region of the proposed project, identified as having approved and identifiable cumulative impacts, would affect approximately 104 acres of salt desert scrub and 8.5 acres of playa habitat. These cumulative impacts represent approximately 0.1 percent of the salt desert scrub and 0.004 percent of the playa habitats in the region. Resources for livestock would still be available with approval of the project, and the cumulative losses are not significant.

Recreation/ Special Designations

Most of the indirect impacts to recreation from the proposed project involve possible access limitations to recreation areas; scaring away wildlife; and reducing overall recreational enjoyment through possible diminishment of recreation area/adjacent land visual quality and the creation of disagreeable odors (i.e. hydrogen sulfide odors). As the amount of industrial activities in the area increase, the impacts on recreation would increase.

Socioeconomics

The cumulative projects listed above would result in only minor impacts on socioeconomic resources. Employment and expenditures associated with the geothermal development of the Salt Wells Area (and other areas in the region) would benefit the local economy, increasing incomes and property values, and supporting more development of public services. The Proposed Action would not contribute in any measurable way to this minor beneficial cumulative impact.

Soils, Geology, and Mineral Resources

The cumulative direct and indirect effects of the Proposed Action on soils, seismicity, and exploration and production of mineral resources are expected to be generally minor provided that the exploratory drilling and the operation of the current and future geothermal facilities in the area are in compliance with building codes, and state and local permit requirements.

Vegetation

Vegetation may be removed during construction activities, such as staging, temporary storage, and pipeline maintenance. Temporarily disturbed areas would be revegetated with native plant species, in accordance with the revegetation plan. Areas of the projects that are permanently maintained would be kept clear of vegetation and invasive species. The cumulative projects within the region of the proposed project, identified as having approved and identifiable cumulative impacts, would affect approximately 104 acres of salt desert scrub and 8.5 acres of playa habitat. These cumulative impacts represent approximately 0.1 percent of the salt desert scrub and 0.004 percent of the playa habitats in the region. These cumulative losses are not a significant loss of vegetation.

Visual Resources

Potential geothermal development in the future would increase the number of highly visible human-made structures in areas currently devoid of any apparent human-made structures. This would substantially reduce the natural undeveloped landscape of the area. Cumulative impacts could be very noticeable because future structures would not blend with the surrounding natural landscape. Sensitive receptors in the area would be negatively affected by cumulative projects and Visual Resource Management Class III objectives may not be met. Minimizing cumulative impacts could involve collocating geothermal plants, pipelines, and transmission lines.

Wildlife Resources

Construction activities, such as grading, digging, and the use of heavy vehicles, could result in temporarily disturbing wildlife under the Proposed Action and other cumulative projects. Habitat would be lost under cumulative geothermal projects.

4.4 BASELINE EVALUATION

Vulcan will collect baseline data that will be retained for use on future proposals. No specific monitoring needs have been identified for this action.