4.3 WATER RESOURCES

Proposed Action

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.

During operation, it is possible for pipes or storage tanks to rupture and result in discharge of substances that would affect water quality. The potential for such releases would be reduced through proper maintenance and monitoring of project systems and components. Also, fluids, such as fuel and lubricants, would be stored in appropriate containers within containment berms to minimize the potential of an accidental release that could contaminate water.

Water for drilling the wells and dust abatement would be trucked to the project area either from an existing water well located in Fallon or from a new water well that would be drilled just south of proposed well 31-14 along the main entrance road. It is estimated that during drilling and construction, approximately 10,000 gallons of water per day would be needed to supply water for the project. If a new water well would be needed for the project, Vulcan Power would apply to the State Engineer for a "waiver to use water to explore for oil, gas or geothermal resources" under NAC 534.444 prior to field development. Water supplied from a new well would have a greater impact on groundwater supply in the ROI than water supplied from an existing well in Fallon.

Water drawn from the proposed water well could decrease the local groundwater aquifer on a short term basis during construction and drilling of the wells. The aquifer capacity and recharge rate would determine the amount of impact to the aquifer; however the county temporary use permit would specify the amount allowed to be accessed without permanently adversely affecting the aquifer.

Combined with the likely hydrologic separation of the geothermal aquifer from the shallow alluvial aquifer, it is unlikely that there would be any noticeable effects on flows in springs (which are recharged primarily from precipitation and runoff in the watersheds in the adjacent ranges).

The well pad in Section 33 is between two small arroyos. The drainages could be susceptible to flash floods. Depending on the quantity of water during flash flooding, the well pad could

redirect flash flood surface water flow, which could inundate areas not typically affected by flood waters. However, the likelihood of flash floods occurring in this area is expected to be low.

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 normal operations and when production wells are tested, geothermal plants produce wastewater from cooling tower blowdown. This is the spent water that is periodically discharged from the cooling system. Water in water-cooled systems periodically needs to be replenished due to evaporative losses. The original coolant water and the replenishment water contain salts that become concentrated in the cooling system over time, requiring that the coolant 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. Once a plant is operational, all excess fluids are injected back into the ground. Discharging cooling water blowdown to the surface would need approval.

The water used in cooling could be from local groundwater. 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 would be addressed through National Pollution Discharge Prevention System permit requirements.

Additives must be added to the coolant to prevent corrosion, and the coolant may contain some dissolved metals from the piping. Low-toxicity additives are available that could be used in the cooling towers to lower the potential for impacts from this source.

Any discharge of cooling tower blowdown would require a National Pollution Discharge Prevention System permit from the State of Nevada Department of Environmental Protection, which would require testing to ensure that the water met the discharge requirements. It is likely that the water would be discharged either to the ground or to an evaporation pond. The state could require that the water be discharged to a lined pond to prevent infiltration.

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 (stormwater) 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.

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.

Flooding. Some of the proposed lease areas are either within a delineated 100-year flood zone or may be in areas subject to periodic flooding where the flood hazard has not yet been determined. No surface occupancy would be allowed within 650 feet of a floodplain. Constructing permanent facilities in areas subject to flooding would not be permitted.

Groundwater. Geothermal resource development could affect groundwater resources because of water consumption by evaporation and the need to reinject 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 type of 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 National Pollution Discharge Prevention System permit issued by the Nevada Department of Environmental Protection. Therefore, the permit holder would be required to demonstrate that the discharge did not degrade groundwater quality.

The source of the makeup water would likely be 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 of the power plant, 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 size of the power plant(s) depends on a number of factors that cannot be predicted, including the demand for electricity and the productivity of the geothermal resources at the sites. The impacts on groundwater resources depend on the size of the plant(s) and the quality of the groundwater. Lack of sufficient quantities of groundwater could represent a constraint on geothermal production feasibility in some areas.

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 in connected shallower groundwater aquifers, with the resulting

potential to affect streams or springs that are in turn connected to the water table aquifer. 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. 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 Nevada Department of Environmental Protection.

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.

No Action Alternative

No impacts on water resources are expected from implementing the No Action Alternative.