Chapter 3

Affected Environment

3.0 Introduction and Geographic Setting

This chapter provides a description of those portions of the environment that could be affected by the alternatives selected for analysis. Particular emphasis is placed on how those alternatives could affect the unique resource values of the Truckhaven Geothermal Leasing Area. This chapter describes the affected environmental for the general impact assessment found in Chapter 4, Environmental Consequences, which focuses on the potential leasing of geothermal resources at Truckhaven.

Some resource values not found in the proposed action area are not discussed in this chapter unless it would provide context for the analysis in Chapter 4. The following resource disciplines are omitted entirely because they are not found in the Truckhaven Geothermal Leasing Area and are not relevant to the discussion: wild horses and burros, wildfire ecology and management, livestock grazing, wilderness, and caves.

For the purpose of preparing the analysis in Chapter 4 of this EIS, the baseline affected environment is defined as those conditions that exist at the time the BLM decides to approve, reject, or modify the noncompetitive lease applications for the 11 sections in the Truckhaven Geothermal Leasing Area.

3.0.1 Geographic Setting

The proposed action area's name is derived from the early 1980s, when several energy companies became interested in the local geothermal resources. One company, Phillips, called the area Truckhaven on its application for adjacent Federal minerals. It had drilled one well on private land, which was subsequently capped. Phillips called the area "Truckhaven," which was then used by BLM to designate it as a Federal unit and geologic prospect.

Imperial County extends over 4,482 square miles, bordering Mexico on the south, Riverside County on the north, San Diego County on the west, and the State of Arizona on the east. The terrain varies from 235 feet below sea level at the Salton Sea to 4,548 feet above sea level at Blue Angel Peak. Approximately 93 percent (4,175 square miles) of Imperial County is land and 7 percent (307 square miles – predominantly the Salton Sea) is water. The Colorado River forms the County's eastern boundary with the State of Arizona. Two notable geographic features are found in the county: the Salton Sea, at 235 feet below sea level, and the Algodones Dunes, one of the largest dune fields in the United States.

Geographically, the Truckhaven Geothermal Leasing Area is in Western Imperial County within the Colorado Desert, approximately 90 miles east of San Diego near the western shore of the Salton Sea. The Truckhaven Geothermal Leasing Area is southwest of Salton City, a town of approximately 950 people. State-owned lands intermingle with the

Federal land in the proposed action area, much of which is managed as the Ocotillo Wells State Vehicular Recreation Area (OWSVRA). Anza-Borrego Desert State Park (ABDSP), the largest park in the California Department of Parks and Recreation (CDPR) system, lies to the west. Most of the Truckhaven Geothermal Leasing Area is within the eastern portion of the OWSVRA. In addition, some surface and mineral lands within the Truckhaven area are under the jurisdiction of the California State Lands Commission. Some private land is also interspersed with State and Federal land at Truckhaven.

South of Truckhaven lies State Route (SR)-78. Imperial Valley, one of California's and the nation's most productive agricultural regions, is southeast of the proposed leasing area along the southern border of the Salton Sea. The Truckhaven Geothermal Leasing Area has relatively flat terrain, with the Chocolate and Superstition Ranges located to the southeast, and the Peninsular Range separating San Diego and Imperial Counties to the west.

3.1 Air Quality and Climate

3.1.1 Existing Conditions

Specific geographic areas are classified as either "attainment" or "nonattainment" areas for each pollutant, based on the comparison of measured data with Federal and State standards. Responsibility for attaining and maintaining ambient air quality standards in California is divided between the California Air Resources Board (CARB) and regional air pollution control districts. The CARB divides the state into air basins, based on topography and county boundaries. The Truckhaven Geothermal Leasing Area is in Imperial County, California, which is governed by the Imperial County Air Pollution Control District (ICAPCD) within in the Salton Sea Air Basin.

3.1.2 Definition of the Resource

In accordance with Federal Clean Air Act (CAA) requirements, the air quality in a given region or area is measured by the concentration of various pollutants in the atmosphere. The measurements of these "criteria pollutants" in ambient air are expressed in units of parts per million or micrograms per cubic meter ($\mu g/m^3$). The air quality in a region is a result of not only the types and quantities of atmospheric pollutants and pollutant sources in an area, but also surface topography and the prevailing meteorological conditions.

3.1.3 Applicable Regulations, Plans, and Policies

The CAA directs the U.S. Environmental Protection Agency (EPA) to develop, implement, and enforce strong environmental regulations to ensure clean and healthy ambient air quality. To protect public health and welfare, the EPA developed numerical concentration-based standards (National Ambient Air Quality Standards, or NAAQS) for pollutants determined to affect human health and the environment, known as criteria pollutants. NAAQS are currently established for six criteria pollutants: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), respirable particulate matter (PM) including particulates less than 10 microns in diameter (PM_{10}) and particulates equal to or less than 2.5 microns in diameter ($PM_{2.5}$), and lead. The State

of California, through the CARB, has established additional standards that are generally more restrictive than the NAAQS. **Table 3-1 presents** Federal and State standards**.**

Table 3-1 National and California Ambient Air Quality Standards

Pollutant	Averaging Time	NAAQS [a]		CAAQS [b]
		Primary Standard [c]	Secondary Standard [d]	Concentration [e]
Ozone (O_3)[f]	1-hour	0.12 ppm (235 µg/m^3)	Same as primary standard	0.09 ppm (180 µg/m^3)
	8-hour	0.08 ppm		0.070 ppm
Carbon monoxide (CO)	8-hour	9.0 ppm (10 µg/m^3)	None	9.0 ppm (10 µg/m^3)
	1-hour	35 ppm (40 µg/m^3)		20 ppm (23 µg/m^3)
Nitrogen dioxide (NO_2)	annual average	0.053 ppm (100 µg/m^3)	Same as primary standard	-
	1-hour	-		0.25 ppm (470 µg/m^3)
Sulfur dioxide (SO_2)	annual average	80 µg/m^3 (0.03 ppm)	-	-
	24-hour	365 µg/m^3 (0.14 ppm)	-	0.04 ppm (105 µg/m^3)
	3-hour	-	1300 µg/m^3 (0.5 ppm)	-
	1-hour	-	-	0.25 ppm (655 µg/m^3)
Suspended particulate matter (PM_{10})	24-hour	150 µg/m^3	Same as primary standard	50 µg/m^3
	annual arithmetic mean	50 µg/m^3		20 µg/m^3 [g]
Fine particulate matter ($PM_{2.5}$)[f]	24-hour	65 µg/m^3	Same as primary standard	-
	annual arithmetic mean	15 µg/m^3		12 µg/m^3 [g]
Lead [h]	30-day average	-	-	1.5 µg/m^3
	calendar quarter	1.5 µg/m^3	Same as primary standard	-
Hydrogen sulfide	1-hour	No Federal standards		0.03 ppm (42 µg/m^3)
Sulfates (SO_4)	24-hour			25 µg/m^3
Visibility reducing particles	8-hour (10 am to 6 pm Pacific Standard Time)			In sufficient amounts to produce an extinction coefficient of 0.23 per kilometer due to particles when the relative humidity is less than 70%
Vinyl chloride [h]	24 Hour			0.01 ppm (26 µg/m^3)

Sources: CARB 2006; EPA 2004.

Key: NAAQS = National Ambient Air Quality Standards; CAAQS = California Ambient Air Quality Standards; ppm=parts per million; µg/m^3=micrograms per cubic meter.

Notes:

[a] NAAQS (other than O_3, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year. The O_3 standard is attained when the fourth highest 8-hour concentration in a year, averaged over three years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when 99 percent of the daily concentrations, averaged over three years, are equal to or less than the standard. For $PM_{2.5}$, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard. Contact the EPA for further clarification and current Federal policies.

[b] CAAQS for O_3, CO (except Lake Tahoe), SO_2 (1- and 24-hour), NO_2, PM_{10}, and visibility reducing particles, are values that are not to be exceeded. All others are not to be equaled or exceeded.

[c] National primary standards are the levels of air quality necessary, with an adequate margin of safety, to protect the public health.

[d] National secondary standards are the levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects

Table 3-1 National and California Ambient Air Quality Standards

Pollutant	Averaging Time	NAAQS [a]		CAAQS [b]
		Primary Standard [c]	Secondary Standard [d]	Concentration [e]

of a pollutant.

[e] Concentration expressed first in units in which it was promulgated. In this table, ppm refers to ppm by volume or micromoles of pollutant per mole of gas.

[f] New Federal 8-hour ozone and fine particulate matter standards were promulgated by the EPA on July 19, 1997. The federal 1-hour O_3 standard continues to apply in areas that violated the standard. On April 15, 2004, the EPA issued attainment designations for the 8-hour standard and described plans for the phase-out of the 1-hour standard (EPA 2004).

[g] On June 5, 2003, the California Office of Administrative Law approved the amendments to the regulations for the State ambient air quality standards for particulate matter and sulfates. Those amendments established a new annual average standard for $PM_{2.5}$ of 12 $\mu g/m^3$ and reduced the level of the annual average standard for PM_{10} to 20 $\mu g/m^3$. The approved amendments were filed with the Secretary of State on June 5, 2003. The regulations became effective on July 5, 2003.

[h] The CARB has identified lead and vinyl chloride as "toxic air contaminants with no threshold level of exposure for adverse health effects determined." These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

Federal standards for 8-hour O_3 and $PM_{2.5}$ became effective on July 18, 1997, and were subsequently challenged and litigated. The U.S. Supreme Court affirmed the standards, and policies and systems to implement these new standards are being developed. On April 15, 2004, the EPA issued a final ruling for the 8-hour O_3 designations and controls (EPA 2004). The EPA designated Imperial County as a serious nonattainment area for PM_{10}, unclassified for $PM_{2.5}$, and marginal nonattainment for O_3 (CARB 1998). An attainment area is defined as a geographical area identified to have air quality as good as or better than the NAAQS/CAAQS. An area may be an attainment area for one pollutant and a nonattainment area for others.

Section 176 of the 1990 CAA Amendments requires the EPA to promulgate rules to ensure Federal actions conform to the appropriate State Implementation Plan (SIP). These rules, known together as the General Conformity Rule (40 CFR 51.850-.860 and 40 CFR 93.150-.160), require any Federal agency responsible for an action in a nonattainment area to determine that the action conforms to the applicable SIP or is exempt from the General Conformity Rule requirements. This means federally supported or funded activities will not: (1) cause or contribute to any new air quality standard violation; (2) increase the frequency or severity of any existing standard violation; or (3) delay the timely attainment of any standard, interim emission reduction, or other milestone.

Actions would conform to a SIP and be exempt from a conformity determination if an applicability analysis shows the total direct and indirect emissions from the project construction and operation activities would be less than specified emission rate thresholds, known as *de minimis* limits, and that emissions would be less than 10 percent of the area's emission budget.

3.1.4 Existing Air Quality

The Truckhaven area is in Imperial County and the Salton Sea Air Basin. The Salton Sea Air Basin encompasses all of Imperial County and a portion of central Riverside County.

The Truckhaven area is located wholly within Imperial County; therefore, the regulations and standards applicable in Imperial County are appropriate for this assessment.

Ambient air quality for the Salton Sea Air Basin is measured at several monitoring locations within Imperial County. The monitoring sites include:

- Brawley-Main Street (PM)
- Brawley-220 Main Street (PM)
- Calexico-East (PM and ozone)
- Calexico-Ethel Street (PM and ozone)
- Calexico-Grant Street (ozone)
- El Centro-9th Street (PM and ozone)
- Niland-English Road (ozone)
- Westmorland-West 1st Street (ozone)

Although some decreasing trends have been noted at these sites, data indicate air quality issues are still a concern in Imperial County. Particulate levels frequently exceed the state 24-hour PM_{10} standard of 50 μg/m³. These monitoring locations also consistently exceed the state annual standard of 20 μg/m³ and exceed both of the national PM_{10} standards: the 24-hour standard of 150 μg/m³ and the annual standard of 50 $\mu g/m^3$. The highest 24-hour average PM_{10} concentrations occurred at the Calexico monitoring sites, near the large city of Mexicali in Mexico (SDG&E 2006).

Wind-generated dust can produce very high episodic PM_{10} concentrations. Frequent high concentrations on windy days can also result in high annual average concentrations. In 2004, $PM_{2.5}$ levels exceeded the Federal 24-hour $PM_{2.5}$ standard. It has been estimated that approximately 72 percent of the $PM_{2.5}$ in Calexico is from combustion sources (SDG&E 2006).

Except for the Calexico-Ethel Street and Westmorland sites, days exceeding the ozone standards have had a declining trend since 1992 (SDG&E 2006).

In Imperial County, the ICAPCD is the agency responsible for protecting the public health and welfare through the administration of Federal and State air quality laws and policies. Included in the ICAPCD's tasks are monitoring air pollution, preparing the Imperial County portion of the SIP, and promulgating District rules and regulations. The SIP includes strategies and tactics used to attain and maintain acceptable air quality in the County; these strategies are called the Regional Air Quality Strategies. The rules and regulations include procedures and requirements to control pollutant emissions and prevent significant adverse impacts.

3.1.5 Compliance with Air Quality Standards/Regional and Local Air Quality

If an area is redesignated from nonattainment to attainment, the CAA requires a revision to the SIP, called a maintenance plan, to demonstrate how the air quality standard will be maintained for at least 10 years.

Table 3-2 shows Imperial County's attainment status with regard to the CAAQS and NAAQS. As shown, Imperial County is in attainment with regard to CO, NO_2, SO_2, sulfates, and lead; and is currently classified as nonattainment with regard to 0_3 and PM.

Table 3-2 Imperial County Attainment Status

Standard	CAAQS Attainment Status	NAAQS Attainment Status
0_3 – 1-hour	"Moderate" Nonattainment	N/A
0_3 – 8-hour	N/A	Marginal Nonattainment
$PM_{2.5}$ – 24-hour	Unclassified	Unclassified
$PM_{2.5}$ – annual	Unclassified	Unclassified
PM_{10} – 24-hour	Nonattainment	Serious Nonattainment
PM_{10} – annual	Nonattainment	Serious Nonattainment
CO	Unclassified	Unclassified
NO_2	Attainment	Unclassified
SO_2	Attainment	Attainment
Sulfates	Attainment	N/A
Lead	Attainment	N/A
H_2S	Unclassified	N/A
Visibility reducing particles	Unclassified	N/A

Key: NA = not applicable.

The State and Local Air Monitoring Network Plan provides a wealth of information about ambient air quality air monitoring sites in California and the northern Baja California portion of Mexico. The CARB operates air monitoring stations throughout the State. Most of the local districts operate air monitoring stations within their jurisdictions. In some portions of the State, private contractors operate monitoring stations by permit. The National Park Service also operates a number of air monitoring stations in the National Parks and National Monuments throughout California. There are a few monitoring stations located in Tijuana, Mexicali, and Rosarito Playas (Mexico), operated by a contractor for the CARB.

The Salton Sea Air Basin regularly exceeds of the CAAQS 1-hour 0_3 standard (54 days with exceedences in 2005) and the NAAQS 8-hour 0_3 standard (43 days with exceedences in 2005).

With respect to particulate matter, the Salton Sea Air Basin experiences regularly exceeds the CAAQS PM_{10} 24-hour standard (160 days with exceedences in 2005). The Salton Sea Air Basin also experiences exceedences of the NAAQS PM_{10} 24-hour standard (8.5 days with exceedences in 2005). $PM_{2.5}$ data for the Salton Sea Air Basin is not yet available, but monitoring stations are being adapted to gather data for the $PM_{2.5}$ standard.

3.1.6 Climate

Imperial County climatic conditions are characterized by large warming of air masses. The coastal mountains prevent the intrusion of any cool, damp marine air, and the Imperial Valley experiences clear skies, very low humidity, extremely hot summers, mild winters, and little rainfall. The prevailing wind directions at Niland, approximately 25 miles southeast of the Truckhaven area, are from the southeast (38 percent frequency) and the west (14 percent frequency). The average wind speed is approximately 7.5 miles per hour (U.S. Bureau of Reclamation 2002).

Temperature and precipitation measured in nearby Brawley is shown in Table 3-3.

Table 3-3 Temperature and Precipitation in Brawley, California

Month	Average Max Temp (ºF)	Average Min Temp (ºF)	Average Precipitation (Inches)
January	69.5	39.3	0.38
February	73.6	43.3	0.39
March	79.2	47.8	0.26
April	86.3	53.3	0.08
May	94.3	60.0	0.03
June	103.1	66.8	0.01
July	107.7	75.2	0.05
August	106.6	76.0	0.33
September	102.5	69.7	0.29
October	91.7	58.5	0.24
November	78.8	46.1	0.16
December	70.1	39.6	0.44
Annual	**88.6**	**56.3**	**2.66**

Source: WRCC 2007a.

3.2 Noise

3.2.1 Existing Conditions

The proposed action is located in the undeveloped desert of western Imperial County, California.

3.2.2 Definition of the Resource

Noise is generally defined as unwanted or annoying sound that is typically associated with human activity and that interferes with or disrupts normal activities. Although exposure to high noise levels has been demonstrated to cause hearing loss, the principal human response to environmental noise is annoyance. The response of individuals to similar noise events is diverse and influenced by the type of noise, the perceived

importance of the noise and its appropriateness in the setting, the time of day and the type of activity during which the noise occurs, and the sensitivity of the individual. Therefore, the "A-weighted" noise scale, which weights the frequencies to which humans are sensitive, is used for measurements. Noise levels using A-weighted measurements are sometimes written as "dBA."

In the United States, several noise metrics have been developed to describe noise levels depending on the character of the noise. Average noise levels over a period of minutes or hours are usually expressed as dB L_{eq}, the equivalent noise level. The period of time average may be specified; $L_{eq(3)}$ would be a 3-hour average. For continuous noise sources, such as roadways, noise levels are often averaged over a period of 24 hours and are normally weighted to account for greater human sensitivity to noise in the evening and nighttime hours. These 24-hour noise metrics are the community noise equivalent level and the day-night level.

3.2.3 Applicable Plans, Policies, and Regulations

The Noise Element of the Imperial County General Plan provides a program for incorporating noise issues into the land use and planning process, with a goal of minimizing adverse noise impacts to sensitive noise receptors. The Noise Element establishes goals, objectives, and procedures to protect the public from noise intrusion. The Noise Element for Imperial County is applicable to lands owned or zoned by the county. However, lands regulated by the State or Federal government, such as the OWSVRA, are preempted from local land use policy (Imperial County 2003). Approximately one-third of the Truckhaven area is privately owned land and is subject to the goals and objectives of the Noise Element of the Imperial County General Plan, which include:

- Goal 1: Provide an acceptable noise environment for existing and future residents in Imperial County.
- Objective 1.1: Adopt noise standards which protect sensitive noise receptors from adverse impact.
- Objective 1.2: Ensure that noise standards and policies are compatible with the standards and policies of other General Plan Elements and other County agencies.
- Objective 1.3: Control noise levels at the source where feasible.
- Objective 1.4: Coordinate with airport operators to ensure operations are in conformance with approved Airport Land Use Plans.
- Objective 1.5: Identify sensitive receptors with noise environments which are less than acceptable, and evaluate measures to improve the noise environment.

- Objective 1.6: Collect data for existing noise sources in the County to improve the data base and enhance the ability to evaluate proposed projects and land uses.

Proposed Action Area

The Truckhaven Geothermal Leasing Area is located in an area with primarily recreational land uses. The nearest noise-sensitive receptors to the proposed action area are single-family residences located in Salton City approximately 1 mile north of the northernmost BLM parcels.

3.2.4 Existing Noise Levels

The Truckhaven Geothermal Leasing Area is in a relatively remote desert region of the County. ABDSP lies 3 miles to the west of the Truckhaven area. A majority of the proposed action area, 83 percent, lies within the OWSVRA. Recreational activities occurring on OWSVRA include off-highway vehicle (OHV) use and camping.

In deserts where the natural sound pressure levels are very low, vehicular use on a route associated with recreational activities affect hearing in some vertebrates. Natural deserts do not exceed 66 dBA, and no desert animal creates sounds above 56 dBA. Mechanized sounds increase the decibels in the desert. A motorcycle ranges from 40 to 100 dBA. Within 300 feet, the peak noise levels created by a motorcycle exceed those of naturally occurring sounds (USDI BLM 2003a)

Ambient noise level measurements for OWSVRA and the Truckhaven Geothermal Leasing Area are not available. However, ambient noise levels in the proposed action area and vicinity generally are assumed to be low and typical of remote desert areas (i.e., 35 to 50 dBA), except as may be modified by noise-generating activities in the vicinity, including:

- Noise associated with occasional recreational and support activities, especially OHV uses of the Truckhaven Geothermal Leasing Area and immediate vicinity;

- Ambient vehicular traffic noise on SR-78 and SR-86 leading to the OWSVRA and to the Imperial County landfill, which is located within the Truckhaven area;

- Aircraft overflights associated with the Borrego Springs Airport, located west of the Truckhaven area;

- Occasional military aircraft overflights associated with flight corridors located southeast of the Truckhaven area;

- U.S. Border Patrol helicopter use of the proposed action area as a part of providing medical aid, and as a part of apprehending undocumented immigrants and smugglers; and

- Natural sources such as wind, rain, thunder, and wildlife.

3.2.5 Off-highway Vehicle Noise Levels

OHV activities and vehicular traffic within the OWSVRA are the primary noise sources in the Truckhaven Geothermal Leasing Area. OHV noise levels are variable, with older vehicles producing higher noise levels than newer ones. California Vehicle Code Section 38370 requires that dBA levels (measured at 50 feet) for Green Sticker vehicles (vehicles registered as OHV in California) be below (1) 92 dbA for any such vehicle manufactured before January 1, 1973; (2) 88 dbA for any such vehicle manufactured on or after January 1, 1973, and before January 1, 1975; (3) 86 dbA for any such vehicle manufactured on or after January 1, 1975, and before January 1, 1986; and (4) 82 dbA for any such vehicle manufactured on or after January 1, 1986. Tests conducted at the Oregon Dunes National Recreation Area concluded that, even with mufflers, noise levels from all-terrain vehicles are found to be in the range of 81 to 111 dBA per unit at a distance of 20 inches (Scharf 1999). A noise level of 111 dBA at 20 inches is estimated to attenuate to a level of approximately 85 dBA at a distance of 50 feet. For purposes of this section, 92 dBA will be the average assumed noise level at 50 feet for OHV use within the OWSVRA.

The level of recreation al activities in or near the Truckhaven Geothermal Leasing Area (associated with the OWSVRA) varies throughout the year with little, if any, OHV use and noise during the summer months. Virtually all OHV usage in OWSVRA occurs from approximately mid-October to Easter, with an estimated 50 percent of OHV usage occurring on the following six holiday weekends: Halloween, Thanksgiving, New Year's, Martin Luther King Jr., President's Day, and Easter. During these high-use weekends, OHV-related noise levels can be relatively high within certain areas of the OWSVRA. The remaining 50 percent of annual OHV usage occurs primarily on other weekends throughout the October to May period. Therefore, background OHV noise levels in and around the Truckhaven Geothermal Leasing Area range from low during weekdays to moderate during moderate-use weekends and high during the six high-use weekends. According to the State, based on an annual visitation of 1.9 million people and an average of three occupants per vehicle, there would be approximately 633,000 vehicle trips to the recreation area (CDPR 2007) with the vast majority occurring between October and May.

3.2.6 Sensitive Receptors

Sensitive noise receptors are, in general, those areas of human habitation or substantial use where the intrusion of noise has the potential to adversely impact the occupancy, use, or enjoyment of the environment. These can include residences, schools, hospitals, parks, and places of business requiring low levels of noise. Since the BLM parcels under consideration for geothermal development are situated in a very remote area, there are no likely sensitive human receptors in or anywhere near the Truckhaven Geothermal Leasing Area. Hiking and flora/fauna observation activities that occur in the ABDSP would not be affected by construction or operation activities due to the several miles of distance separating the two locations.

The closest area of likely sensitive receptors would be within the town of Salton City, located approximately 1 mile north of the northernmost of the BLM geothermal parcels to the northeast of the Truckhaven Geothermal Leasing Area.

3.3 Topography, Geology, and Geologic Hazards

3.3.1 Topography

The Truckhaven area is over 40,320 acres. The area's topography consists mainly of gentle hills and washes. The slopes trend downward to the east, toward the Salton Sea. The elevation ranges from several hundred feet on some hilltops to approximately 235 feet below sea level at the surface of the Salton Sea. Of the 23 sections of BLM land in the Truckhaven area, approximately six sections of land, in the northeast portion of the area, are below sea level. The San Felipe Hills are located in the southern half of the proposed action area.

3.3.2 Geologic Setting

The Truckhaven area's landforms result from the underlying geology. The region is part of the Colorado Desert geomorphic province. Major features of the area include the Salton Trough, which includes the Salton Sea and the Imperial Valley. The Salton Trough was created by the pull-apart basin bordered by the San Andreas Transform System to the northeast and the San Jacinto Fault Zone to the southwest. The basin is an extension of the Gulf of California and is separated from the Gulf by the Colorado River Delta. Marine and freshwater sediment, several miles thick, have partially filled the trough. Surface sediments consist of Holocene clay and silt alluvium grading to sandy gravel near the mountains (CEPA 2006).

The current Salton Sea was formed in 1905 when flooding from the Colorado River broke through irrigation canals and created the lake. However, it overlies the same location of the Pleistocene age Lake Cahuilla. Many of the old shorelines are visible on the hill surrounding the Salton Sea. One prominent shoreline is found at an elevation of 44 feet above sea level. Carbon-14 dating has shown that Lake Cahuilla existed up until just a few hundred years ago (Busch 1995).

Figure 3-1 presents a soils map of the proposed action area. The surface deposits consist mainly of (from youngest to oldest) Holocene or recent surficial deposits including alluvium, Lake Cahuilla deposits, and sand dunes; Pleistocene Brawley Formation, a fine-grained sandstone and mudstone from the Colorado River; the Pliocene Borrego Formation, consisting of mudstone and clay stone dominantly from the Colorado River; a Pliocene transitional unit of mudstone and sandstone; and the Pliocene Diablo Formation. The Diablo Formation includes crossbedded Colorado River-derived sandstone and red massive mudstone (Kirby 2005).

3.3.3 Seismicity

The Salton Trough is in a geologically active area. The San Andreas Fault Zone is found on the east side of the Salton Sea, the Imperial Fault is found south of the sea, and the San Jacinto and Elsinore Faults are found on the west side of the sea. Most of these

faults exhibit right lateral strike-slip motion. The Brawley seismic spreading zone is southeast of the sea and is an active geothermal area.

Active surface fault rupture has not been mapped in the project area as part of the Alquist-Priolo Earthquake Fault Zoning Act. The Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. However, fault ruptures from 1968, 1979, and 1987 have been mapped within a few miles of the Truckhaven area (CDC 1974a, 1974b, 1990). In 1987, 90 centimeters (35 inches) of displacement was associated with the Richter Magnitude 6.6 earthquake on the Superstition Hills Fault. Significant nearby earthquakes are listed in Table 3-4.

Table 3-4 Significant Nearby Earthquakes in the Past 100 Years

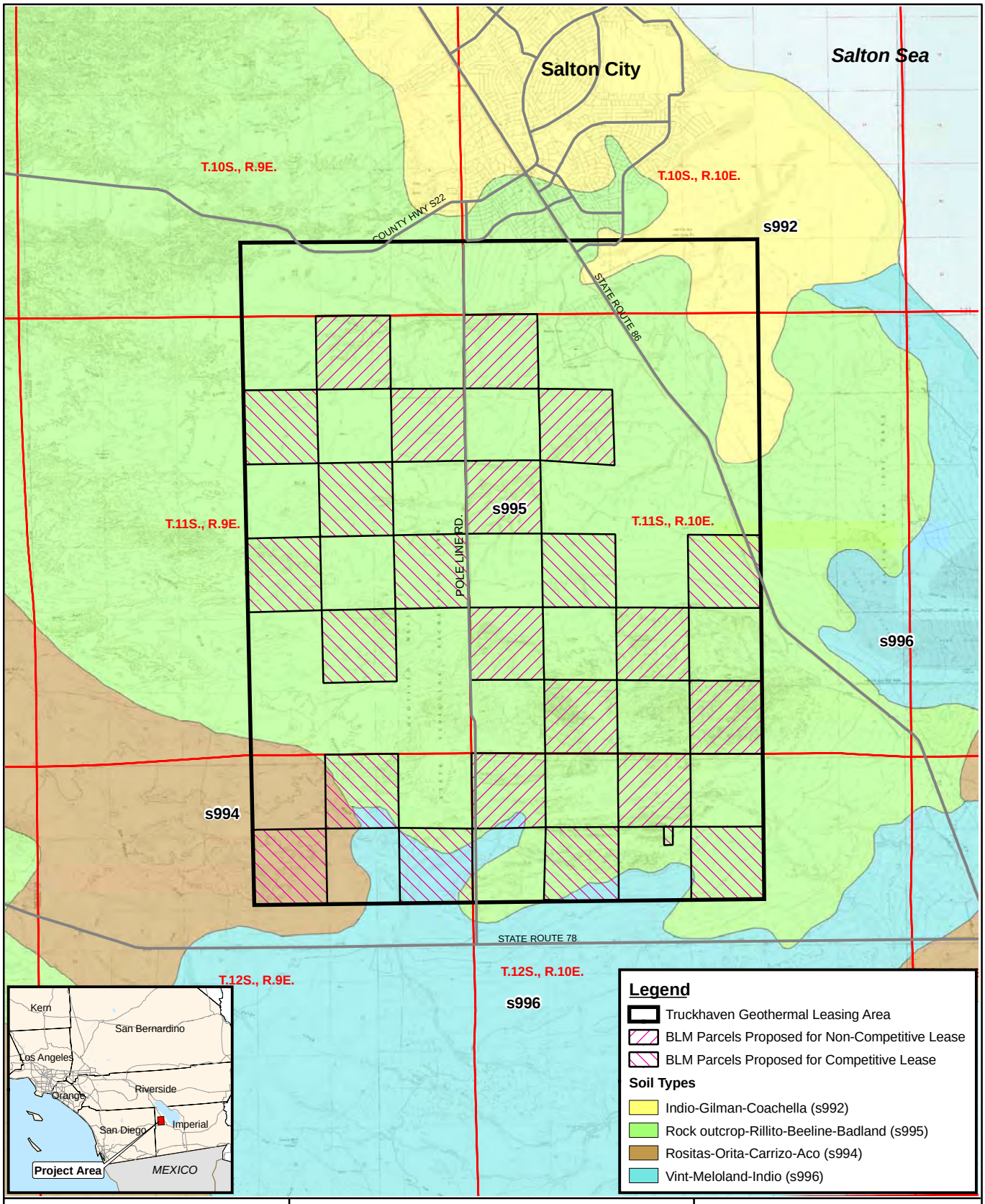
Date	Earthquake	Approximate Magnitude	Faults
March 25, 1937	San Jacinto (Terwilliger Valley)	6.0	San Jacinto Fault
May 18, 1940	Imperial Valley	6.9	Imperial Fault
April 8, 1968	Borrego Mountain	6.5	Coyote Creek Fault (branch of the San Jacinto Fault Zone)
October 15, 1979	Imperial Valley	6.4	Imperial, Brawley, and Rico Faults
November 23, 1987	Elmore Ranch/ Superstition Hills	6.2	Elmore Ranch and Lone Tree Faults
November 24, 1987	Elmore Ranch/ Superstition Hills	6.6	Superstition Hills Fault

Source: SCEC 2006.

Other faults cutting Pliocene age strata have been mapped on BLM-administered land within the Truckhaven area. These faults include the Dump, En Echelon, Powerline, and Sand Dunes Faults (Kirby 2005).

3.4 Soils

Nearly all of the BLM-administered lands within the Truckhaven Geothermal Leasing Area belong to the Rillito-Beeline-Badland soil association with some possible rock outcrops in the hills. The Rillito and Beeline soils are well-drained soils that form on mixed alluvium, fan terraces, and hill slopes. The furthest southwestern parts of the Truckhaven area consist of Vint-Meloland-Indio soils, which form on nearly level land and are well-drained fine sand to silt loam. They tend to have high permeability and very low runoff characteristics. These soils are prone to wind and water erosion and are subject to flash flooding and ponding. With irrigation, Vint soil could support agriculture (Zimmerman 1981).



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ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington

TRUCKHAVEN GEOTHERMAL LEASING AREA

FINAL EIS

Figure 3-1
Soils Map

Job Id:

Date: 12/28/2006

GIS Analyst: avh

Map Source Information: USGS Topographic Quadrangle 1:24,000. Terraserver.

3.4.1 Erosion

Soil erosion affects stormwater quality and can damage surface structures such as roads. Therefore, soil erodibility should be considered when planning and designing access and maintenance roads. Soil erodibility is rated as slight, moderate, and severe. The rating is slight when the surface layer texture is clay that holds together, is thicker than 40 inches, and occurs on slopes of less than 15 percent. A moderate rating is given when the surface layer texture is clay loam, loam, or sandy loam that holds together moderately well, is between 20 and 40 inches thick, and occurs on slopes of between 15 percent and 30 percent. A severe rating is given to soils when the surface layer texture is sand or loamy sand that is weakly held together, is less than 20 inches thick, and lies on slopes of greater than 30 percent. Soils in the proposed action area that exhibit potentially severe and severe-to-very-severe water or wind erodibility occur throughout the Truckhaven area, particularly in the southwest (SDG&E 2006).

3.5 Water Resources

3.5.1 Surface Water Resources

Most of the Truckhaven area is in the West Salton Hydrologic Unit. The southern approximate one-third of the area is in the Ocotillo Lower Felipe Hydrologic Sub-Area. Annual average precipitation is about 2.5 inches (CEPA 2006). Surface drainage is northeastward to the Salton Sea. The southeast corner of the project area drains south and east to Tarantula Wash and San Felipe Creek, then to the Salton Sea. Among the major intermittent drainages within the project area are Arroyo Salada, located in the northern quarter of the lease area; and Tule Wash, which drains much of the central and northern portion of the area (CEPA 2005). The Water Quality Control Plan for the Colorado River Basin lists the beneficial uses of surface water from San Felipe Creek and Tule Creek as agriculture supply, groundwater recharge, recreation, warm freshwater habitat, and wildlife habitat (CEPA 2005). These two creeks have some water in them much of the year. The major drainages are subject to flash floods during heavy rainfall (FEMA 2006).

3.5.2 Groundwater Resources

Most of the parcels available for lease are within the West Salton Sea Sub-basin of the Colorado River Hydrologic Region. The beneficial use of groundwater in the West Salton Sea Hydrologic Unit are listed in the Water Quality Control Plan as municipal and agricultural (CEPA 2005), with municipal usage limited to only a small portion of the hydrologic unit. Groundwater is found in unconsolidated younger Quaternary alluvial deposits and the underlying unconsolidated to semi-consolidated older Tertiary to Quaternary alluvial deposits. Fine-grained lacustral deposits of the former Lake Cahuilla may form confining layers that impede the downward and lateral movement of groundwater in the project area (CDWR 2003; CEPA 2005). There are few wells and little information available on the groundwater quality, use, capacity, or budget in this area. However, groundwater levels have reportedly dropped 64 feet in a well located in the northeast part of the basin between 1979 and 2000 (CDWR 2003).

Groundwater quality in this sub-basin is reportedly of marginal to poor quality for domestic and irrigation purposes because of elevated concentrations of fluoride, boron, and total dissolved solids (TDS). The aquifer, however, is an important natural resource for plants and animal communities (CDPR 2007). TDS concentration reportedly averages about 5,800 milligrams per liter (mg/L) (CDWR 2003). Because of the high TDS and mineral content, the groundwater has limited use in this sub-basin. Groundwater is found in monitoring wells at the Salton City municipal landfill at a depth of 20 to 32 feet below ground (CEPA 2006). This landfill is located the northern half of Section 12, T.11 S., R. 9 E. San Bernardino Meridian (SBM) (one of the sections up for lease in Alternatives 2 and 3). TDS in groundwater around the landfill ranges from 3,000 to 21,000 mg/L.

Geothermal fluids below 7,000 feet from the Salton Sea area can vary in TDS from 7,000 to over 200,000 mg/L and can contain some suspended solids. The suspended and dissolved solids that precipitate out of solution for a flash-type geothermal plant could present a disposal challenge as they could be hazardous waste, but combined solids typically contain designated waste materials not acceptable by municipal landfills. Therefore, most geothermal electrical power plants have waste discharge requirements on surface impoundments and drilling sumps to temporary store geothermal wastes. The waste discharge requirements are obtained from the Colorado River Basin Regional Water Quality Control Board. The TDS in geothermal fluids below Truckhaven can be expected to be no more than 5,000 parts per million.

3.5.3 Floodplains

The area's major drainages, such as Tule Wash and San Felipe Creek, are subject to flash floods during heavy rain storms and are located within 100-year flood zones (FEMA 2006).

3.6 Vegetation

Although a common attribute of deserts is the sparseness of vegetation, plants are an essential part of the desert ecosystem, providing essential habitat for wildlife such as burrows and protective cover from high temperatures and predators (USDI BLM 1999). Vegetation within the Truckhaven Geothermal Leasing Area has adapted to the arid climate of the Borrego Valley-West Mesa subsection of the Colorado Desert ecoregion (USFS 1998). This subsection lies on the southwest side of Imperial Valley, with elevations ranging from 230 feet below sea level at the Salton Sea to 2,200 feet above sea level at the Peninsular Ranges. Desert vegetation is supported by average annual precipitation of approximately 3 to 4 inches. Average high temperatures recorded at El Centro range from 70 degrees Fahrenheit (°F) in January to 107°F in July. Average low temperatures range from 40°F in January to 75°F in July (WRCC 2007b).

Dominant vegetation is comprised of drought-tolerant plants, such as small, hard-leaved, or spiny shrubs, cacti, and hard grasses (CDFG 2006a). These plants survive in the desert because they have adapted methods of water conservation and storage. The two major vegetation communities within the project area include the creosote bush scrub and

saltbush scrub (USFS 1998). Eastern parts of the proposed action area and areas bordering the Salton Sea also include the allscale vegetation community. Individual plants in all these vegetation communities are widely spaced and provide little ground cover. Some portions of the desert may have no visible plants and are made of shifting sand dunes or nearly sterile salt flats. Depending on the duration and intensity of rainfall, perennial and annual species will vary.

3.6.1 Creosote Bush Scrub

The creosote bush scrub (Figure 3-2) is the most common plant community in the Truckhaven Geothermal Leasing Area (USFS 1998). This plant community typically occurs on well-drained secondary soils of slopes, fans, and valleys. This habitat type is generally characterized by relatively barren ground with wide-spaced shrubs. Common plants include pure stands of creosote bush *(Larrea tridentate)* or mixed shrubs, including species of burrobush/white bursage *(Ambrosia dumosa)*, brittlebush *(Encelia farinosa)*, ocotillo *(Fouquieria splendens)*, and saltbushes *(Atriplex)* (Sawyer 1995). Less abundant species may include desert-holly *(Atriplex hymenelytra)*, ephedras *(Ephedra* species*)*, box-thorns *(Lycium* species*)*, prickly-pears *(Opuntia* species*)*, and indigo bush *(Psorothamnus schottii)*.

Figure 3-2 Typical Distribution of Creosote Bush in the Truckhaven Area

A vegetation community closely associated with the creosote bush scrub is the ocotillo. This vegetation community occupies similar soils but is distinguished by conspicuous populations of ocotillo (USFS 1998). Common species include ocotillo *(Fouquieria splendens)* and creosote bush *(Larrea tridentate)* (Sawyer 1995). Less abundant species include those species associated with the creosote bush scrub as well as desert agave

(Agave deserti), blue palo verde *(Cerdidium floridum),* barrel cactus *(Ferocactus cylindraceus),* ironwood *(Olneya tesota),* and smoke tree *(Psorothamnus spinosa).*

3.6.2 Saltbush Scrub

The saltbush scrub is common on basin floors, occupying bajadas, flats, lower slopes, playas, and valleys (USFS 1998). This series is a temperate, broad-leaved, evergreen shrubland with common species that include fourwing saltbush *(Atriplex canescens),* shadscale *(Atriplex confertifolia),* big saltbush *(Atriplex lentiformis),* and allscale *(Atriplex polycarpa)* (Sawyer 1995).

3.6.3 Allscale

Often considered part of the saltbush scrub, the allscale plant community is found bordering the Salton Sea and may be found within the proposed action area. This series is found in old beach soils, lake deposits, dissected alluvial fans, and rolling hills. Dominant species include allscale *(Atriplex polycarpa)* and saltbushes *(Atriplex* species*)* (Sawyer 1995). Other common species include saltgrass *(Distichlis spicata),* California ephedra *(Ephedra californica),* buckwheats *(Eriogonum* species*),* algodones buckwheat *(Eriogonum deserticola),* California buckwheat *(Eriogonum fasciculatum),* cheesebush *(Hymenoclea salsola),* paleleaf goldenbush *(Isocoma acradenia),* bladderpod *(Isomeris arborea),* and honey mesquite *(Prosopis glandulosa).*

In years of good rainfall, annual species may include desert sand verbena *(Abronia villosa),* cryptantha *(Cryptantha* species*),* and birdcage evening primrose *(Oenothera deltoids* var. *deltoids)* (Dreyfuss 2006).

Several special status species are known to occur or may potentially occur within the vicinity of the proposed action. Special status species include federally listed endangered, threatened, proposed, and candidate plant species; California State-listed endangered, threatened, and rare plant species; and BLM sensitive plant species. See Section 3.8, Special Status Species, for discussion of these species.

3.6.4 Invasive Species

Invasive species are considered by BLM to be plants that have been introduced into an environment where they did not evolve (USDI BLM 2006). As a result, these plants usually have no natural predators to limit their reproduction and distribution, quickly spreading out of control. Invasive species can have dramatic impacts on the natural ecosystem by reducing habitat for native vegetation and can alter forage and wildlife habitat. Invasive species reduce the productivity of healthy rangelands, forest lands, riparian areas, and wetlands. Eradication of these species is intensive, time consuming, and costly.

In California, it is estimated that 3 percent of plant species growing in the wild are considered invasive species. Despite this small percentage, these species occupy a much greater proportion of area (CIPC 2006). Known invasive species within the project area include Sahara mustard *(Brassica tournefortii)* and saltcedar *(Tamarix* species*)* (Dreyfuss 2006). Sahara mustard is highly invasive in the Colorado Desert, adapting to dry sandy

soils and out-competing native species, particularly desert annuals (CIPC 2006). Saltcedar thrives in riparian areas and wetlands but is also tolerant of arid ecosystems. Saltcedar out-competes native vegetation by consuming large quantities of groundwater and depositing salts, making the soil too dry and saline for native vegetation. The BLM El Centro Field Office has an active management plan to address saltcedar.

3.6.5 Wetlands/Riparian Areas

Wetland and riparian areas are a rare occurrence within the California Desert Conservation Area (CDCA) (USDI BLM 1999). There are no wetlands or riparian areas located within or immediately adjacent to the project area (USFWS 2006). Traversing the project area are four ephemeral streams that drain into the Salton Sea: the Arroyo Salada, Surprise Wash, Tule Wash, and Tarantula Wash. However, because this region receives only 3 to 4 inches of annual precipitation, these washes are most often dry and do not support distinct riparian vegetation.

3.7 Fish and Wildlife

3.7.1 Fisheries

Because of limited hydrological connection among water bodies within the desert, fish distribution is also limited. Some streams continually flow through desert regions, terminating in closed lakes or dissipating in the sand, while other streams originate from subterranean sources, emerging as springs. Springs occur throughout the desert ecosystem, ranging from quiet pools or trickles to active aquifers. Many larger springs emit warm water, with temperatures above the mean annual air temperature, and range from fresh to highly mineralized, carrying large amounts of dissolved materials or extremely low dissolved oxygen levels (Naiman 1981). Although each spring or pool is species-poor, most aquatic inhabitants of each pool are short-lived (1 to 2 years) and native to only a single locality (Naiman 1981; Page and Burr 1991). Surface water resources are negligible in the sandy, mountainous, and arid environment of the proposed action area; there are no fish-bearing waters (including springs, seeps, or slow-moving streams) within the Truckhaven Geothermal Leasing Area. However, there are waters in the greater surrounding area that contain fish suited for this harsh environment.

One fish that has adapted to this environment is the desert pupfish (*Cyprinodon macularius*), federally listed as endangered (see Section 3.8, Special Status Species, for more discussion on the absence of this species in the Truckhaven Geothermal Leasing Area). The desert pupfish range includes the basin of the lower Colorado and Gila Rivers, from southern Arizona to southeastern California and eastern Baja California, and the Sonoyta River of northern Sonora, Mexico (Sutton 1999). Pupfish are observed throughout the Salton Sink Basin, inhabiting springs, seeps, and slow-moving streams. Desert pupfish populations are remnants of those that inhabited ancient Lake Cahuilla.

3.7.2 Wildlife

Animal abundance and diversity are closely linked with the habitat types present, though abundance and distribution may vary by seasons. In the Salton Basin, vertebrate and invertebrate life forms, predominantly desert creosote bush habitat atop an extensive

alkali sink, have established populations in this unique and seemingly inhospitable landscape. The poor habitat conditions, limited foraging, high average temperatures, sparse precipitation, and limited vegetation cover limit the number of species and size of wildlife populations.

Desert animals are adapted to survive under extreme environmental conditions, including low, erratic rainfall and highly variable temperatures. Many small desert mammals require no freestanding water but survive on their own metabolic water and through water conservation measures. For example, reptiles and small mammals are active mostly at night and retreat to cool burrows or seek shelter under vegetation or in rock outcrops to avoid the midday sun and to reduce water loss.

A variety of reptiles and amphibians utilize the project area, including the San Sebastian leopard frog (or lowland leopard frog, *Rana yavapaiensis*), Couch's spadefoot toad (*Scaphiopus couchi*), and the flat-tailed horned lizard (*Phrynosoma mcallii*). These species are well-adapted to extremely dry conditions in areas with sandy, well-drained soils often occupied by creosote bush and mesquite trees, as is suitable for the Couch's spadefoot toad. Slackwater aquatic habitats, canals, roadside ditches, ponds, and riparian grasses of the Salton Basin also provide habitat, such as that of the San Sebastian leopard frog (CDFG 1994).

Talus slopes, cliffs, and rock outcrops provide nesting and feeding habitat, thermal and escape cover, and resting sites for a variety of wildlife. In addition, the extensive root systems of desert plants such as creosote bush provide access to subsurface openings for toads, salamanders, lizards, snakes, and small mammals. Many other small wildlife species may create burrows in open areas to escape the heat or predators. For example, the flat-tailed horned lizard has been observed retreating to a burrow when daytime surface temperatures have approached 120°F (USDI BLM 2003b).

The flat-tailed horned lizard is of particular interest to the BLM and was designated as a sensitive species by the agency in 1980 (see Section 3.8, Special Status Species, for more discussion). This designation provides increased management attention to prevent population declines and habitat loss or degradation within the Salton Basin. Local populations of this lizard fluctuate greatly between years and because of winter/spring precipitation and production of annuals in spring; as a result, these populations are very susceptible to anthropogenic activities (USDI BLM 2003b).

Areas of the Salton Basin, including the proposed action area, are home to a variety of resident and migrating and wintering birds (USFS 2005). Resident birds, including the burrowing owl (*Athene cunicularia*) and Le Conte's thrasher (*Toxostoma lecontei*), feed on insects (i.e., grasshoppers, scorpions, large beetles, moths, and crickets). The burrowing owl also feeds on a vast array of small mammals, including mice, rats, voles, gophers, and bats.

The Salton Sea is a vital link in the Pacific Flyway as birds migrate along this coastal corridor. With more than 400 bird species recorded at the Salton Sea, approximately 100 of these species have established breeding populations (Patten et al. 2003). The Sonny

Bono Salton Sea National Wildlife Refuge, near Niland on the eastern shore, helps support the bird population and provides significant bird watching recreation opportunities. Migratory birds within the project area include Swainson's hawk (*Buteo swainsoni*), southwestern willow flycatcher (*Empidonax traillii extimus*), and California black rail (*Laterallus jamaicensis coturniculus*). The Salton Basin is important to these bird species as the area provides ample food sources during migrations north or south.

While the geothermal lease areas do not incorporate the Salton Sea, the proposed action area is within 2 miles of the western shoreline. Although there may not be suitable habitat for migratory birds within the proposed action area, its close proximity to the Salton Sea allows migratory birds to potentially transition through the area during migration.

A variety of mammal species are found in the surrounding habitat as well. These include desert pocket mice (*Perognathus* species), desert kangaroo rat (*Dipodomys deserti*), rabbits, and ground squirrels. In addition, large wildlife species such as mule deer (*Odocoileus hemionus*) seek the protection of the heavier vegetation. Mule deer rarely travel far from water or forage, and tend to bed down within easy walking distance of both. This species typically forage around dawn and dusk while bedding down in protected areas during mid-day. However, in the arid climates (such as the Salton Basin), mule deer may migrate in response to rainfall patterns.

Another larger wildlife species that may occur in the proposed action area is the coyote (*Canis latrans*). This opportunistic predator preys upon small mammals such as rabbits and squirrels, which comprise the bulk of its diet. Like the mule deer, coyotes tend to be more active during the early morning and sunset. This inactivity during the heat of the day exhibited by both the coyote and mule deer is a behavioral adaptation to the desert environment that conserves water and maintains the body temperature within livable limits.

3.8 Special Status Species

A literature search for special status plant and wildlife species known to occur within the project area and surrounding region was conducted by consulting the following lists: the California Department of Fish and Game's (CDFG's) California Natural Diversity Database, the California Native Plant Society's (CNPS's) Electronic Inventory, the U.S. Fish and Wildlife Service (USFWS) Threatened and Endangered Species System database, and the BLM's *California Sensitive Plants* and *Special Status Wildlife Species*.

3.8.1 Vegetation

The 12 plant species detailed below have the potential to occur in either the Truckhaven Geothermal Leasing Area or the surrounding area (Table 3-5).