CHAPTER THREE
AFFECTED ENVIRONMENT

3.1 PLANNING AND REGULATORY FRAMEWORK

The West Mojave planning area includes eleven cities and portions of four counties. These cities and counties have land use planning responsibility for the private lands located within their jurisdictions. Map 3-1 (see attached CD Rom) displays political boundaries and land ownership within the planning area. Public lands within the western Mojave Desert are planned for and managed by the United States government (Bureau of Land Management, National Park Service and Department of Defense), and the State of California (CDFG, California Department of Parks and Recreation, and Caltrans). Land ownership political boundaries are displayed in Map 3-1. Table 3-1 lists the acreage of land within each political and land management entity (the acres given for the cities and towns do not include spheres of influence).

The following discussion identifies, by jurisdiction, land use and development trends, planning, and management actions that may be affected by the proposed action.

3.1.1 Bureau of Land Management

3.1.1.1 California Desert Conservation Area Plan

The BLM administers 3,263,874 acres of public lands within the planning area. Management is guided by the BLM's California Desert Conservation Area Plan, adopted in 1980 and amended on numerous occasions since then. Congress specifically directed the BLM to prepare the CDCA Plan the Federal Land Policy and Management Act of 1976. Finding that the California desert and its resources, "including certain rare and endangered species of wildlife, plants and fishes" are "seriously threatened by air pollution, inadequate Federal management authority, and pressures of increased use, particularly recreational use", Congress stated that "the use of all California desert resources can and should be provided for in a multiple use and sustained yield management plan to conserve these resources for future generations, and to provide present and future use and enjoyment, particularly outdoor recreation uses, including the use, where appropriate, of off-road recreational vehicles." To accomplish this, BLM was directed to prepare a plan for the "management, use, development, and protection of public lands within the California Desert Conservation Area" (of which the western Mojave Desert comprises the northwestern third). The plan would "take into account the principles of multiple use and sustained yield in providing for resource use and development, including, but not limited to, maintenance of environmental quality, rights of way, and mineral development."

Table 3-1
Acreage Summary by Jurisdiction

JURISDICTION	PRIVATE LAND	STATE LAND (SUBDIVIDED)	MILITARY LAND	BLM MAN-AGED LAND	OTHER FEDERAL	OTHER PUBLIC	TOTAL ACREAGE
Inyo Co. (Total Acreage)	30,057	12,658 – SLC	456,164	332,044	9 - NPS 116 - USFS	174	831,221
Kern Co. (Total Acreage)	757,959	2,076 - SLC 81 - CDFG 14,489 – Parks	287,227	505,093	1,720 - USFS		1,568,644
Kern Co. (Excluding Cities)	593,766	[same]	281,577	494,306	[same]		1,388,014
Los Angeles Co. (Total Acreage)	610,959	38 – SLC 12,454 – Parks	53,547	7,226	377 - USFS		684,602
Los Angeles Co. (Excluding Cities)	464,487	[same]	47,630	7,138	[same]		532,125
Riverside Co. (Total Acreage)	9,231	2,784 – SLC 10 – Parks		41,815	208,170 - NPS	57	262,066
San Bernardino Co. (Total Acreage)	1,621,024	53,503 – SLC 3,861 - CDFG 213 – Parks	1,870,508	2,377,671	84,510 – NPS 91 - USFS 167 - Tribal	912	6,012,511
San Bernardino Co. (Excluding Cities)	1,383,188	53,105 - SLC [same for others]	1,858,185	2.368,559	84,500 - NPS 90 - USFS 2 - Tribal	807	5,748,707
Tulare Co.	1			25			26
Adelanto (SB)	33,343		91	514			33,949
Apple Valley (SB)	45,464	43 – SLC		1,347		59	46,912
Barstow (SB)	19,027	40 – SLC	4,061	2,281			25,407
California City (K)	84,519			4,757			89,276
Hesperia (SB)	42,322		955	68	1		43,385
Lancaster (LA)	60,592						60,592
Palmdale (LA)	57,545		5,806	88			63,439
Ridgecrest (K)	6,103		4,972	1,163			12,238
Twentynine Palms (SB)	31,802		2,146	3,502	8		37,623
Victorville (SB)	41,699	38 – SLC	5,030	346		47	47,160
Yucca Valley (SB)	24,176	277 – SLC		1,052	2		25,508
Total Acreage	3,029,230	71,059 – SLC 27,166 -Parks 3,943 – CDFG	2,667,445	3,263,874	292,689 – NPS 2,356 - USFS 167 – Tribal	1,143	9,359,070

The CDCA Plan assigns a "multiple use class" designation to each parcel of public land, and provides land use and management guidelines for each class. These classes include:

- Class C – controlled use, that is, wilderness areas.
- Class L -- limited use, protecting sensitive, natural, scenic, ecological, and cultural resource values. Public lands designated as Class L are managed to provide for generally lower-intensity, carefully controlled multiple use of resources, while ensuring that sensitive values are not significantly diminished.
- Class M -- moderate use, providing for a controlled balance between higher intensity uses and resource protection.
- Class I -- intensive use, providing for concentrated use of lands and rresources to meet human needs.

Within the western Mojave Desert, 457,721 acres are designated Class C, 1,269,313 acres Class L, 877,042 acres Class M and 378,467 acres Class I. About 281,331 acres are unclassified.

The CDCA Plan also adopted 12 "plan elements." Each element provides desert-wide planning decisions that focus on a major resource or issue of public concern. Management of sensitive plant and animal species, including the designation of BLM crucial habitat and habitat management areas, is provided by the wildlife element. Procedures for establishing a motorized vehicle access network are set forth in the motorized vehicle access element.

3.1.1.2 Areas of Critical Environmental Concern

Thirty areas of critical environmental concern have been established by the BLM within the western Mojave Desert. These were designated by the 1980 CDCA Plan or added by subsequent amendments to that plan. Specific management plans have been prepared for most of these areas. The ACECs that would be affected by the West Mojave Plan are described below[1].

Afton Canyon (4,726 acres): This ACEC protects a sensitive Mojave River riparian community and the scenic canyon in which it is located. An Afton Canyon Natural Area management plan (1989) was prepared in cooperation with the CDFG under the Sikes Act and covers a larger area than the ACEC. The plan protects the ACEC and the adjacent desert habitat in the Cady Mountains, which is occupied habitat for bighorn sheep and contains nest sites for prairie falcon and golden eagle. Visitor facilities include two campgrounds, an equestrian campground, the Mojave Road, and interpretative signs and kiosks.

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1 The West Mojave Plan would not affect the following ACECs: Amboy Crater, Bedrock Springs, Big Morongo Canyon, Soggy Dry Lake Creosote Rings, Upper Johnson Valley Yucca Rings and Whitewater Canyon.

The 1989 management plan recommended these amendments to the CDCA Plan:

- Expansion of the boundary of the ACEC by 3,840 acres, and deletion of 480 acres, making the expanded ACEC 8,160 acres in size.

- Withdrawal of all lands within the expanded ACEC boundary from mineral entry.

- Changing the CDCA Plan multiple use class designations M to L on certain lands within the expanded ACEC.

Barstow Woolly Sunflower (314 acres): BLM established a botanical ACEC northeast of Kramer Junction to protect the Barstow woolly sunflower. Although the area protects a relatively large population of this species, it represents only a small proportion of the overall range, which is limited to the western Mojave Desert. The desert tortoise and Mohave ground squirrel are also found within the ACEC. The State of California owns nine sections of land to the east and west, which CDFG manages for protection of desert plants and animals.

Bedrock Springs (785 acres): Bedrock Springs, located at the edge of the Golden Valley Wilderness, was established by the CDCA Plan to protect prehistoric values.

Black Mountain (61,806 acres): The Black Mountain ACEC is one of the largest in the western Mojave Desert to protect the prehistoric and Native American values of this area northwest of Barstow. A management plan was approved in 1988. The ACEC lies entirely within the proposed Superior-Cronese and Fremont-Kramer DWMAs. The southeastern half is within the Black Mountain Wilderness. It includes critical habitat for the desert tortoise, and known occupied habitat for the Mojave ground squirrel, LeConte's thrasher, desert cymopterus and Barstow woolly sunflower. Nest sites are present for golden eagle and prairie falcon.

Calico Early Man Site (898 acres): This National Register Property was established as an ACEC in 1980, and a management plan was prepared in 1984. The plan designated a vehicle route network and specified ways to protect the evidence of ancient human occupation.

Christmas Canyon (3,444 acres): The Christmas Canyon ACEC protects prehistoric values. Most of the ACEC lies within the Spangler Hills Open Area in San Bernardino County. The 1988 ACEC management plan prescribed ways that the archaeological resources could be protected within an area open to recreational vehicle use.

Cronese Basin (10,226 acres): The BLM designated the Cronese Lakes, north of Interstate 15 between Barstow and Baker, as an ACEC to protect valuable cultural and natural resources. Ephemeral wetlands are present on the lakes, which serve as stopover points for migratory waterbirds and nesting sites for many species during very wet years. Mesquite hummocks and desert willow washes add to the biological importance, and the dunes and sand sheets are occupied habitat for the Mojave fringe-toed lizard. The desert tortoise is found in low densities. A management plan was published in 1985.

Desert Tortoise Research Natural Area (25,695 acres): The CDCA Plan of 1980 designated lands north of California City in Kern County as an ACEC and a Research Natural Area. A management plan for the ACEC, prepared under authority of the Sikes Act, was approved in 1988. The ACEC is jointly managed by the BLM, CDFG and the Desert Tortoise Preserve Committee, a non–profit group established to acquire and manage lands for protection of the desert tortoise.

Fossil Falls (1,667 acres): The Fossil Falls ACEC was established in 1980 to protect prehistoric values. A management plan was approved in 1986.

Great Falls Basin (9,726 acres): The Great Falls Basin ACEC management plan was prepared in 1987 in cooperation with the CDFG under the Sikes Act. It adjoins the Indian Joe Canyon Ecological Reserve and the northern portion is within the Argus Range Wilderness. The southern portion is within a BLM wilderness study area. The western boundary is contiguous with the China Lake Naval Air Weapons Station.

The ACEC protects unique and valuable wildlife and scenic resources. Foremost among these are the dozens of seeps and springs that serve as habitat for the threatened Inyo California towhee. Designated critical habitat for the towhee is present within the ACEC. In addition, large populations of quail and chuckar are present, as is a remnant population of bighorn sheep. Raptors nesting within the ACEC include golden eagle, prairie falcon, and long-eared owl. Potential habitat exists for the Panamint alligator lizard.

- **Harper Dry Lake (475 acres):** The ACEC was established to protect the remnant marshes at the southwestern edge of Harper Dry Lake. The marsh and alkali wetland community bordering Harper Dry Lake hold potential for discovery of several rare and restricted-range plant species.

The playa bordering the marshes supported nesting Western snowy plovers in the past, and surveys conducted in 2001 found these birds to be present and probably nesting. Harper Dry Lake is an area important for the conservation of Western snowy plover nesting habitat.

Harper Dry Lake is recognized as a Key Raptor Area by the BLM, which has designated 223 such areas nationwide. Key Raptor Areas are places known to be significant habitats for selected species of birds of prey, and Harper Dry Lake is one of seven Key Raptor Areas in the Mojave Desert. The species known to utilize the habitat at Harper Dry Lake are northern harrier, short-eared owl, ferruginous hawk and long-eared owl.

Harper Dry Lake has been improved as a Watchable Wildlife site, a program to provide access and facilities to visitors for birdwatching, photography and passive recreation. Arrangements are now being made to supply surface water to the remnant marsh, and interpretative kiosks, restrooms, and trails have been installed.

Jawbone/Butterbredt (187,486 acres): The 1982 Sikes Act Plan for Jawbone Butterbredt ACEC addressed the Sierra/Mojave/Tehachapi Ecotone Wildlife Habitat Management Area, a designated “special area” in the CDCA Plan. The ACEC plan incorporated all of the Rudnick Common Grazing Allotment and the vehicle management boundary agreement between the BLM and the Rudnick Estate Trust. Motorized vehicle routes of travel were designated within the ACEC, which includes both designated wilderness and the Jawbone Canyon Open Area. The Pacific Crest Trail crosses the ACEC as well.

The ACEC was established to manage and protect significant cultural and wildlife values of this transition zone between the mountains and the northwestern Mojave Desert. Among the wildlife habitats present are Butterbredt Springs, an important migratory bird stopover site, habitat for the yellow-eared pocket mouse in Kelso Valley, and the raptor and vulture migratory corridor between the Kern River Valley and the Mojave River. Nearly the entire range of a West Mojave endemic, the Kelso Creek monkeyflower, is located within the ACEC.

Juniper Flats (2,528 acres): An ACEC was established for the Juniper Flats Cultural Area in 1980, and a management plan was prepared in 1988. The foothill area south of Apple Valley containing springs and riparian habitat in a dense stand of junipers was an important Native American habitation and special use site. Juniper Flats also provides important habitat for the San Diego horned lizard and the gray vireo. The Willow fire in 2000 burned over the entire ACEC, leading to a temporary closure of the area until vegetative recovery had begun. Juniper Flats is an important equestrian riding area and provides access to the Deep Creek hot springs in the San Bernardino National Forest.

Last Chance Canyon (5,913 acres): The CDCA Plan designated Last Chance Canyon in the El Paso Mountains as an ACEC in 1980. A Plan Amendment in 1984 adjusted the boundaries to include additional prehistoric sites. This amendment implemented a recommendation of the ACEC management plan, which was completed in 1982. The archaeological sites are part of a larger archaeological district placed on the National Register of Historic Places in 1971.

Manix (2,897 acres): The Manix ACEC, located 20 miles northeast of Barstow along the Mojave River, was established in 1990 to protect paleontological and cultural resources. This site contains blowsand habitat for the Mojave fringe-toed lizard. No management plan has been prepared.

Mojave Fishhook Cactus (628acres): A CDCA Plan Amendment established the Mojave fishhook cactus ACEC in 1984. The ACEC is composed of two separate parcels in the Brisbane Valley. The purpose of the ACEC is to protect the yellow-spined form of the Mojave fishhook cactus. Subsequent studies have shown that this area may be important to the Mohave monkeyflower as well. A management plan was completed in 1990, which designated motorized vehicle routes within the ACEC.

Rainbow Basin (4,087 acres): This ACEC, established in 1980, lies ten miles north of Barstow. It includes two campgrounds, a scenic loop drive, hiking trails and an interpretive trail. The area is popular with visitors who come to see the colored geological formations. The ACEC protects two nest sites for the prairie falcon. The ACEC management plan, completed in 1991, addressed both the ACEC and a larger surrounding area where route designation was accomplished and recommendations were made for campground and trail improvements and closure to target shooting.   Hunting is allowed.

Red Mountain Spring (717 acres): This area was designated as an ACEC by the CDCA Plan to protect prehistoric values. A 1982 CDCA Plan Amendment listed this area as closed to vehicle travel. A management plan was completed in 1987. This ACEC was included in the route designation inventory and designation process for the Red Mountain subregion. It was formerly called Squaw Spring.

Rodman Mountains Cultural Area (6,204 acres): A 1988 CDCA Plan Amendment established this ACEC to protect cultural resources. Most of it is within the Rodman Mountains Wilderness. Portions outside the wilderness are part of the Ord-Rodman route designation subregion. The site contains raptor nests and limited desert tortoise habitat. No management plan has been prepared.

Rose Springs (859 acres): An area surrounding Rose Springs in Inyo County was designated as an ACEC by the CDCA Plan to protect prehistoric values. Access is limited by a gate, which has been vandalized in the past. A management plan was prepared in 1985. It recommended closure of the ACEC to motorized vehicles. Access is via a transmission line road and the Los Angeles Aqueduct road.

Sand Canyon (2,609 acres): The Sand Canyon ACEC was established to protect riparian habitat and wildlife in a canyon on the eastern slope of the Sierra Nevada Mountains. It is one of the most diverse areas in the West Mojave for species of small mammals and supports a wide variety of reptiles and birds. Two species nearly endemic to the West Mojave are found within the ACEC: the Ninemile Canyon phacelia and the yellow-eared pocket mouse. The riparian habitat is important to migratory birds, including the willow flycatcher. An ACEC management plan was prepared in 1989.

Short Canyon (754 acres): The Short Canyon ACEC was established by an amendment to the CDCA Plan in 1988. Most of the ACEC lies within the Owens Peak Wilderness. The purpose of the ACEC is to protect the unusual vegetation and diverse flora. Short Canyon is known to support occurrences of Charlotte's phacelia (*Phacelia nashiana*), a limited-range plant whose distribution falls almost entirely within the western Mojave Desert. In addition, a significant population of the state-listed Mojave tarplant (*Deinandra* [*Hemizonia*] *mohavensis*) was detected in the canyon in 1998. A management plan was prepared in 1990. The primary management action was to exclude grazing from the ACEC. This measure has been implemented through fencing and placement of cattle guards.

Steam Well (41 acres): This ACEC protects historic and prehistoric values. It lies within the Golden Valley Wilderness in San Bernardino County.

Trona Pinnacles (4,055 acres): The 1989 management plan for the Trona Pinnacles ACEC focused on protection of the outstanding scenery and geological features of this area ten miles south of Trona. The site is used for commercial filming and sightseeing. At least one prairie falcon nest site was reported within the ACEC, but falcons have not been recorded there for the past ten years.

Western Rand Mountains (17,877 acres): The Western Rand Mountains ACEC formerly supported high densities of desert tortoises, though tortoise numbers have declined substantially from historical levels. The ACEC is believed to support the Mohave ground squirrel, and is known to harbor the burrowing owl and the LeConte's thrasher. A Rand Mountains Fremont Valley Management Plan was completed in 1993. This plan, which also addressed surrounding lands such as Koehn Lake and lands to the northeast, was prepared in cooperation with the CDFG under authority of the Sikes Act. It received a "no jeopardy" Biological Opinion from the USFWS. The plan recommended several amendments to the BLM's CDCA Plan:

- Expand the West Rand Mountains ACEC by 13,120 acres
- Change Class M lands in the ACEC expansion and adjacent alluvial fan areas to Class L.
- Withdraw 32,590 acres within the Rand Mountains – Fremont Valley management area from mineral location and entry. The 6,090-acre Koehn Lake and an additional 8,320 acres within the management area will remain as class M and open to mineral entry.
- Close the entire management area to off highway vehicle use except for 129 miles of designated open routes.
- Categorize portions of the Rand Mountains – Fremont Valley management area as Desert Tortoise Category I habitat. These lands lie on both sides of the Randsburg-Mojave Road southwest of Red Mountain and are shown on Illustration #9 illustrated in the 1993 management plan.

The Rand Mountains Fremont Valley Management Plan reduced the number of open routes by 90%. Signs were installed to identify open and closed routes of travel. All open routes and many, but not all, closed routes were signed. In selected areas, hay bails and plastic safety fencing have been used to stop motorcycle use on closed routes or to stop cross-country travel. Hay bales and fencing have been more effective in reducing non-compliance that signs alone.

The plan established a goal of ranger patrols eight hours per week plus eight hours each weekend from March 1 to June 30, September 1 to November 1, and holiday weekends. Ranger staffing levels have not increased sufficiently to fully achieve this goal over the entire period since the plan was approved in 1993. During 2002, one Ranger was assigned primary patrol responsibilities for the Rand Mountains, Fremont Valley and the Desert Tortoise Natural Area. Patrol effort for the region is now meeting the management goal.

3.1.1.3 Wilderness Areas

By enacting the California Desert Protection Act of 1994, Congress designated 69 wilderness areas in southern California and directed that they be administered by the BLM pursuant to the Wilderness Act of 1964. Seventeen of these areas are within or partially within the planning area. Table 3-2 lists these 17 wilderness areas, together with the amount and percentage of public land ownership within each. For a detailed description of each wilderness area, see Appendix E.

Table 3-2
Wilderness Areas Within The
Western Mojave Planning Area

WILDERNESS NUMBER	WILDERNESS AREA	PERCENT PUBLIC LAND	PUBLIC LAND ACRES	TOTAL ACRES
55	Argus Range	95.8	17,493	18,262
23	Bighorn Mountain	99.6	26,681	26,790
39	Black Mountain	98.2	20,542	20,929
44	Bright Star	97.3	7,824	8,042
22	Cleghorn Lakes	82.6	32,857	39,798
63	Coso Range	94.2	49,295	52,320
65	Darwin Falls	92.0	7,935	8,620
43	El Paso Mountains	97.5	23,675	24,278
41	Golden Valley	99.9	36,487	36,515
40	Grass Valley	91.1	29,904	32,835
45	Kiavah	87.9	18,201	20,703
35	Newberry Mountains	73.2	20,300	27,746
51	Owens Peak	95.4	46,733	49,009
31	Rodman Mountains	86.8	29,782	34,315
54	Sacatar Trail	99.8	33,078	33,132
20	San Gorgonio	61.2	25,403	41,528
21	Sheephole Valley	96.3	32,625	33,891
	TOTAL	**90.1**	**458,814**	**508,715**

The purpose of wilderness, as defined in section 2(a) of the Wilderness Act, is "...to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas in the United States ... leaving no lands designated for preservation and protection in their natural condition....". Further, wilderness is defined in Section 2(c) of the Wilderness Act to be areas "...where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions…"

Section 4(c) of the Wilderness Act prohibits certain uses of wilderness. These prohibitions include commercial enterprise, permanent roads, temporary roads, use of motor vehicles, motorized equipment or motorboats, landing of aircraft, use of other forms of mechanical transport, and structures or installations. There are three classes of exceptions to some or all of the prohibitions. These include private existing rights (e.g., rights associated with a lease for a microwave tower that existed at the time of wilderness designation), actions necessary to meet the minimum requirements for the administration of the area, (e.g., use of motorized equipment to remove hazardous materials), and "Special Provisions" (e.g., livestock grazing that was established prior to designation).

The California Desert Protection Act, at Title I for BLM Wilderness, provides for motorized vehicle access for (1) fish and wildlife management activities by appropriate State agencies and (2) law enforcement. At Title VII, the CDPA establishes explicit federal water rights, allows access for Indian religious purposes, and provides mandates and procedures for acquiring State and private inholdings.

Wilderness areas include important habitat of several West Mojave species of concern. Foremost among these are the bighorn sheep, prairie falcon, and golden eagle. The majority of the known golden eagle and prairie falcon nest sites are within Wilderness. Desert tortoises are found at the edges of several wilderness areas, such as the Newberry Mountains and Rodman Mountains.

Five of the 17 Wilderness Areas are encompassed or partially encompassed within critical tortoise habitat. These include the Rodman Mountains, Newberry Mountains, Black Mountain, Grass Valley and portions of Golden Valley wilderness areas. The overlap of wilderness areas with critical habitat for other species is not yet determined, but the acreage is estimated to be small.

3.1.1.4 Land Tenure Adjustment Program

In January 1991, BLM adopted a "Western Mojave Land Tenure Adjustment Program," (LTA Program) developed jointly with Edwards Air Force Base and the County of San Bernardino. The purpose of the LTA program was to address potential conflicts surrounding the development of private lands adjacent to public lands and beneath airspace utilized by EAFB. The agencies were concerned (1) that such development could impact the management of natural resources on adjacent public lands, and (2) that Air Force use of airspace above high-density residential developments on private land could lead to public noise and safety complaints.

To prevent these conflicts from arising, the LTA Program proposed a voluntary land acquisition program based on the exchange of scattered parcels of public lands near urban centers for private inholdings in more remote areas. The LTA Program identified Consolidation Zones where exchange-based land acquisition would be focused, Disposal Zones composed of scattered public land parcels to use as an "exchange base", and Retention Zones, wherein the current land ownership pattern would be maintained.

The 1991 Record of Decision indicated BLM's intent to dispose 105,000 acres of public land, acquire 255,000 acres and retain 417,000 acres. Of the 672,000 acres of public lands either to be retained or acquired, 620,000 would be classified as "Multiple Use Class L", and 52,000 acres would be classified as "Multiple Use Class M"; no unclassified lands would remain within the LTA project area. By mid-2001, BLM had acquired 61,247 acres within the LTA project area. These were obtained through exchanges for public lands within the Disposal Zone, such as mineralized public lands in and adjacent to the U. S. Borax mine at Boron. (Bureau of Land Management, Annual Report to Edwards Air Force Base, August 15, 2001.)

As of March 2004, BLM had acquired 61,247 acres through the LTA program. In exchange, BLM has provided 18,359 acres to non-government entities.

3.1.2 Other State and Federal Agencies

3.1.2.1 United States National Park Service

The National Park Service manages 294,500 acres within the southern reach of the planning area. This is the northern half of Joshua Tree National Parkwhere Mojave Desert vegetation and wildlife prevail before entering the transition to the somewhat different conditions found in the Colorado Desert subdivision of the Sonoran Desert. Conservation management within JTNP is important for protection of the adjacent Pinto DWMA for the desert tortoise, bats, the Mojave fringe-toed lizard, the Little San Bernardino Mountains gilia, bighorn sheep, and a diversity of more common desert plants and wildlife.

3.1.2.2 California Department of Fish and Game

CDFG has acquired lands throughout the western Mojave Desert by direct purchase for wildlife conservation or by acceptance of mitigation and compensation lands from land developers. CDFG owns a total of 14,550 acres within the planning area. The location and status of these lands is described below.

Camp Cady Wildlife Area (1,552 acres): Camp Cady is a riparian oasis on the Mojave River, located between Barstow and Afton Canyon. The CDFG manages this site for wildlife protection, and it serves as a refugium for the endangered Mojave tui chub, an endemic fish. The mesquite thickets and riparian forest support a number of declining bird species, including Lucy's warbler, yellow-breasted chat, yellow warbler, summer tanager and LeConte's thrasher (Schroeder, 1993, Tennant, 2002). The highest numbers of Lucy's warbler within the western Mojave Desert occur at Camp Cady, and this site is important for nesting and wintering raptors, including golden eagle, prairie falcon, and ferruginous hawk. The western portion of Camp Cady contains sand dunes and hummocks supporting the Mojave fringe-toed lizard.

Studies of the vegetation and hydrology at Camp Cady have shown a decline in the vigor of the riparian habitat, including stress and failure in reproduction of mesquite thickets. Lowering of the groundwater table during the spring is the identified cause (Lines, 1999).

Fremont Valley Ecological Reserve (1,090 acres): The CDFG owns five properties within desert tortoise critical habitat in the Fremont Valley. The lands are managed for conservation of the desert tortoise and Mohave ground squirrel. Other species, including LeConte's thrasher, Barstow woolly sunflower and desert cymopterus may occur, but have not been verified.

Hinkley Conservation Easement (7.5 acres): CDFG owns a conservation easement on a parcel near Hinkley Road south of Highway 58 about nine miles west of Barsto**w.**

Indian Joe Spring Ecological Reserve (546 acres): The Indian Joe Spring Ecological Reserve consists of a parcel in a canyon of the Argus Range in Inyo County. This area contains significant riparian habitat and protects the endangered Inyo California towhee. Other riparian birds utilize the canyon during migration and for nesting, and both nesting and communal roost habitat is present for the long-eared owl. The surrounding lands provide nest sites for prairie falcon and golden eagle, and the water in the canyon supports a healthy population of quail and chuckar.

Indian Wells Valley Mitigation Lands (80 acres): CDFG obtained a parcel adjacent to Little Dixie Wash in Kern County with known occupied habitat for the desert tortoise, Mohave ground squirrel, and LeConte's thrasher.

King Clone Ecological Reserve (488 acres): A reserve was established to protect ancient creosote bush vegetation, including the oldest known specimen, a circular shrub estimated to be 11,700 years old. This reserve is surrounded by the BLM's Johnson Valley Open Area north of Lucerne Valley and has been fenced.

West Mojave Desert Ecological Reserve (11,817 acres): CDFG owns 22 properties north of Highway 58 between Barstow and Kramer Junction. These lands are within desert tortoise critical habitat and the Fremont-Kramer DWMA. The reserve contains occupied habitat for desert tortoise, Mohave ground squirrel, LeConte's thrasher and Barstow woolly sunflower. Other target species (e.g. desert cymopterus) may occur but have not been verified.

3.1.2.3 California Department of Parks and Recreation

The California Department of Parks and Recreation owns 25,400 acres that it operates as State Parks in four separate units. In addition, the CDPR's Division of Off-highway Vehicles contributes funds annually to maintain and monitor BLM Open Areas. The conservation lands affording protection to species addressed by the West Mojave Plan are described below.

Antelope Valley California Poppy Reserve: Located within Los Angeles County 15 miles west of Lancaster, the 1,750 acre Antelope Valley California Poppy Reserve protects extensive wildflower fields and receives thousands of visitors annually. The park is fenced to exclude grazing and prescribed burns are conducted to maintain the habitat. The reserve also supports nesting burrowing owls and provides wintering habitat for a variety of raptors, including the golden eagle, prairie falcon, northern harrier, and ferruginous hawk.

Red Rock Canyon State Park: The Park encompasses the southwestern portion of the El Paso Mountains, and was established for protection of outstanding scenic values and wildlife habitat. Within the 26,000-acre park is the majority of the range of two narrow endemic plant species, the Red Rock poppy and the Red Rock tarplant. The tarplant is listed as endangered by the State of California. The mountainous terrain contains nest sites for prairie falcons, and two unique alkali seeps support the alkali mariposa lily. Red Rock Canyon State Park provides a linkage between BLM lands to the east and west, and lies within the proposed Mohave Ground Squirrel Conservation Area.

Ripley Joshua Tree Woodland: The state established the 566 acre Ripley reserve to protect a Joshua tree and juniper woodland. This natural community has nearly disappeared in the Antelope Valley. Most of the site is fenced, and restoration efforts are underway.

Saddleback Butte State Park: Protection of Joshua tree woodland was the reason for establishing the 3,336-acre Saddleback Butte State Park. The desert floor surrounding the buttes has blowsand soils that support the westernmost population of the Mojave fringe-toed lizard and exhibits an outstanding display of wildflowers in wet years. Birds of prey nest on the buttes, and the Mohave ground squirrel is found on some of the surrounding lands to the north.

3.1.2.4 California Department of Transportation

Caltrans has been a major provider of protected habitat in the state for the past several years. Caltrans purchases replacement habitat as compensation for loss due to highway improvements, including some of the CDFG lands northeast of Kramer Junction. These commitments normally are specified as terms and conditions of biological opinions from the USFWS to the Federal Highways Administration (FHWA), which provides federal funding to major Caltrans projects, and as requirements associated with 2081 permits from CDFG.

3.1.3 Local Jurisdictions

Counties, cities and towns have land use planning authority over private lands in the West Mojave planning area. California law requires that local jurisdictions adopt and maintain a general plan as a guide to future development within their communities. The general plan includes a land use element that describes the distribution and intensity of land uses expected to develop within the jurisdiction over time, as well as a conservation element that establishes policy for the management of natural resources, including biological resources.

Cities and counties are required to conduct environmental review of development projects proposed within their jurisdictions pursuant to the California Environmental Quality Act. This review includes an assessment of the proposed development's affect on biological resources. In addition, some jurisdictions have adopted ordinances that establish biological mitigation requirements for ministerial permits not subject to CEQA. Figure 3-1 provides an overview of the existing review process for development projects that have the potential to affect listed or sensitive species. This process may vary somewhat by jurisdiction.

Following is a summary of existing development patterns, land use and conservation policies directing future development in the West Mojave's cities and counties.

3.1.3.1 Inyo County

Most of the private land available for development is located along the Highway 395 corridor. According to the county's 1984 General Plan Land Use Element, future population growth is expected to occur primarily in the Owens Valley. The Olancha area, at the very northern end of the planning area, has been designated by the General Plan as an urbanizing area with a full range of urban land use types including residential, commercial and industrial uses. The highest residential densities planned for this area are Rural High (one acre minimum parcel size) and Rural Medium (2 ½ acre minimum parcel size). Existing and planned development at Haiwee, Dunmovin, Coso Junction, and Little Lake is oriented towards highway service commercial, residential densities of one-acre minimum parcel size and greater, and agricultural activities. The Homewood Canyon area of the county has been designated for residential use at densities ranging from one dwelling unit per five to ten acres.

Land use goals for the county include creating opportunities for reasonable expansion of communities in a logical and contiguous manner, while providing and protecting open space areas; guiding growth to areas where services can accommodate urban growth; providing a range of commercial and industrial land uses to meet future needs; promoting recreation and a diverse tourist industry; and maintaining and expanding the county tax base.

The 1981 Conservation and Open Space Element of the county general plan, at page 22, has the following goal pertinent to biological resources: "Protect, conserve, develop and utilize natural resources, while at the same time protecting the environment."

The Inyo County General Plan also provides for the designation of Environmental Resource Areas (ERA) where special management attention is provided to protect the most important and critical environmental resources. Several sites within the planning area have been designated as ERAs including the Argus Bighorn Sheep Range, Haiwee Botanical Area, China Lake Naval Weapons Center, Rose Spring, and Little Lake-Fossil Falls. Residential densities for private lands within these areas are limited to one dwelling unit per 40 acres. Several general plan policies are established for the ERAs that support cooperation between public agencies, encourage additional wildlife studies, encourage development and maintenance of fisheries, retention of riparian vegetation and management of riparian areas under principles of multiple use. (Conservation and Open Space Element of Inyo County Plan at pages 31 through 37.)

3.1.3.2 Kern County

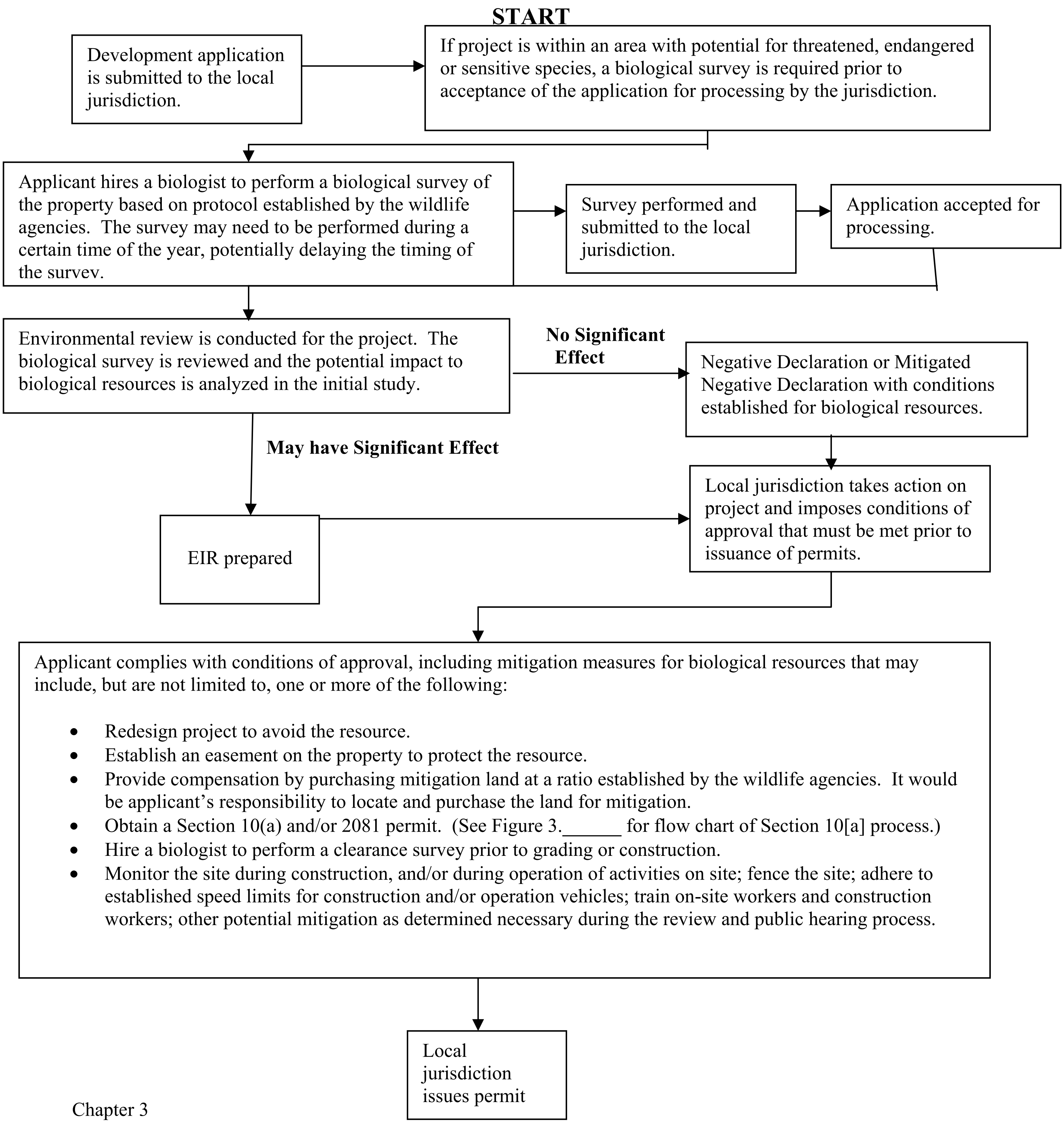
Most of the urbanized development within the unincorporated desert area of the county occurs around Mojave, Rosamond, and the Indian Wells Valley area near Ridgecrest. The Land Use, Open Space and Conservation Element of the County General Plan calls for the development of urban densities only in areas reasonably capable of receiving public services or alternative septic systems and encourages (1) higher density residential in urban areas near commercial facilities, (2) a variety of housing types and price ranges; and (3) the clustering of development as a means of preserving open space. A density bonus of 20% over general plan densities is allowed for residential development that provides complete public infrastructure improvements (County General Plan Land Use, Open Space, and Conservation Element at 5-2 through 5-3). Lower density residential, resource and agricultural uses exist throughout most of the remaining area.

The Kern County General Plan, at page 8-5, has the following policy pertinent to biological resources: "Habitats of threatened or endangered species should be protected to the greatest extent possible." The county general plan also provides for sensitive wildlife protection through “resource use” designation. Three resource areas list wildlife and botanical preserves among their primary permitted uses: Resource Reserve, Extensive Agriculture and Resource Management Areas. The Resource Management Areas include important open space lands and wildlife habitat (page 8-3). These areas are primarily for “recreational activities, livestock grazing…ranching facilities, wildlife and botanical preserves … one single-family dwelling unit” (page 8-3). The resource designations limit development to one dwelling unit per 20 acres (page 6-1). There are twelve areas zoned for Specific Plans within Kern County. These areas require surveys and mitigation for impacts on biological resources.

3.1.3.3 Los Angeles County

Antelope Valley Areawide General Plan: The 1986 Antelope Valley Areawide General Plan anticipates that most urban growth in Los Angeles County would continue near the urban centers of Lancaster and Palmdale. Quartz Hill is the largest of the unincorporated communities and the plan recognizes the predominately semi-urban character of the area by designating moderate residential densities for the areas already so developed, and lesser densities to the northeast and southwest of the community (Antelope Valley Areawide General Plan at page III-2). In addition, the General Plan provides for the protection of the existing rural low-density lifestyle of several rural communities including Acton, Crystalaire, Lake Hughes-Elizabeth Lake, Leona Valley, Littlerock, Pearblossom, Lake Los Angeles and Sun Village. Several very low-density rural villages are scattered throughout the Antelope Valley such as Juniper Hills and Antelope Acres (Id. at page III-2). According to the general plan, the principal elements that have shaped the pattern and intensity of land uses in the Antelope Valley include the major transportation corridors, Edwards Air Force Base, the future Palmdale International Airport, the U.S. Air Force Plant 42, and Fox Field (Id. at page III-1).

Figure 3-1
Typical processing Steps for Projects on Private Land with Potential for Endangered, Threatened or Sensitive Species



Significant Ecological Areas: There are a number of areas designated by the Antelope Valley Areawide General Plan as "Significant Ecological Areas" due to their unique plant and/or animal resources. Development within these areas is permitted by the general plan at very low intensities subject to standards providing for the protection of the resources. The general plan recommends that several areas be acquired by an appropriate public agency as permanent ecological preserves, including the Little Rock Wash, Big Rock Wash, Portal Ridge/Liebre Mountain, Tehachapi Foothills SEAs, and areas adjacent to the Califonia Poppy Preserve among others (Id. at pages III-3 and 4). There are 13 SEAs within the planning area. These include:

- SEA #47 – Edwards Air Force Base.
- SEA #48 – Big Rock Wash.
- SEA #49 – Little Rock Wash.
- SEA #50 – Rosamond Lake.
- SEA #51 – Saddleback Butte State Park.
- SEA #52 – Alpine Butte.
- SEA #53 – Lovejoy Butte.
- SEA #54 – Piute Butte.
- SEA #55 – Desert-Montane Transect.
- SEA #56 – Ritter Ridge.
- SEA #57 – Fairmont and Antelope Buttes.
- SEA #58 – Portal Ridge/Liebre Mountain.
- SEA#60 – Joshua Tree woodland habitat.

The SEAs at Big Rock Wash, Piute Butte, Alpine Butte, and Portal Ridge/Liebre Mountain provide important linkages and wildlife corridors.

The County is revising its general plan, and a proposal to combine the SEAs into three larger units is being reviewed. One SEA, Kentucky Springs, near the southwest boundary of the planning area, would be deleted. Formal action on the SEA proposals would not take place until after the West Mojave Plan is completed, and may consist of retention of the existing boundaries and land use standards, adoption of the consultant's recommendations, or revisions to the recommendations and standards as a result of public input and staff analysis. These new SEA proposals include the following:

- **Antelope Valley:** The Antelope Valley SEA would combine nine existing SEAs (Desert-Montane transect, Big Rock Wash, Little Rock Wash, Piute Butte, Alpine Butte, Saddleback Butte State Park, Lovejoy Butte, Rosamond Lake and Edwards Air Force Base) into a single designation. This area would extend from the Los Angeles-San Bernardino County line near Llano west to Little Rock Creek and from the Forest Service boundary north to Saddleback Butte State Park and just north of the southern boundary of Edwards Air Force Base. Portions of the SEA along Little Rock Creek, Big Rock Creek and Mescal Creek would extend into the Angeles National Forest. The proposed area comprises 222,325 acres, including 197,634 acres of unincorporated Los Angeles County, 9,887 acres within Angeles National Forest, 11,074 acres within the City of Palmdale and 3,730 acres within the City of Lancaster. Acreage of the recommended

SEA within EAFB was not specified, and a small unspecified acreage of BLM managed lands is also included. The County would have no permitting or land use authority over lands outside the unincorporated area.

The recommended SEA was designed to protect watersheds supplying the Rosamond and Rogers Lake playas as well as the desert buttes in the eastern Antelope Valley. The SEA contains riparian habitats, mesquite bosques, playa lakes, and seasonal pools. Portions of the SEA overlap the proposed Alkali Mariposa Lily Conservation Area and the Big Rock Creek Conservation Area, where gray vireo, San Diego horned lizard, short-joint beavertail cactus, and a number of riparian birds are found.

Wildlife corridors and habitat linkages between the San Gabriel Mountains and the Antelope Valley desert areas are included within the proposed SEA. The buttes support nesting birds of prey, including prairie falcon. The SEA would protect occupied habitat and the ecosystem processes of sand transport for the Mojave fringe-toed lizard.

- **Joshua Tree Woodland:** A proposed SEA of 4,732 acres would include undisturbed portions of existing SEA Number 60 (Joshua Tree woodland habitat) and make boundary corrections. All of the land is within uncorporated Los Angeles County, and is privately owned, with the exception of the California Aqueduct.

  This proposed SEA would include remnant stands of Joshua tree woodland, and contains potential habitat for burrowing owl and known foraging habitat for several species of raptors, including prairie falcon, golden eagle, and ferruginous hawk.

- **San Andreas Rift Zone:** The proposed San Andreas Rift Zone SEA extends from the westerly foothills of the Tehachapi Mountains in a southeasterly direction along the San Andreas Fault to include the foothills of Liebre Mountain and Sawmill Mountain, most of Portal Ridge, Leona Valley, Ritter Ridge, Fairmont and Antelope Buttes, Anaverde Valley and Lake Palmdale. A separate area surrounds Barrel Springs. It covers 89,698 acres, including 68,722 acres in unincorporated Los Angeles County, 15,285 acres in Angeles National Forest, 5,476 acres within the City of Palmdale and 215 acres within the City of Lancaster. The state Antelope Valley California Poppy Reserve is included within the SEA. Three small BLM managed parcels on Portal Ridge are also included. The County would have no permitting or land use authority over lands outside the unincorporated area.

  The proposed SEA would combine and modify the existing SEAs for Ritter Ridge, Fairmont and Antelope Buttes and Portal Ridge/Liebre Mountain.

  The SEA would include occupied habitat for the red-legged frog, southwestern pond turtle, short-joint beavertail cactus, San Diego horned lizard, burrowing owl, least Bell's vireo and potentially other target species of the West Mojave Plan. An important linkage between the Angeles National Forest and the Antelope Valley California Poppy Reserve would be included. Uncommon or rare wetland communities, wildflower fields, and native grasslands are also present.

Wildlife and Wildflower Sanctuaries: The Los Angeles County Department of Regional Parks owns several scattered tracts of land that are managed as wildlife and wildflower sanctuaries and are zoned as open space. Some of these sanctuaries are within existing SEAs or the proposed Antelope Valley SEA. Others are within the proposed Big Rock Creek or Mohave ground squirrel conservation areas, and one is within a proposed DWMA.

- Butte Valley Wildflower Sanctuary – 320 acres within proposed SEA and MGS CA
- Gerhardy Wildlife Sanctuary – 320 acres
- Payne Wildlife Sanctuary – 320 acres within existing SEA #55
- Mescal Wildlife Sanctuary– 100 acres within existing SEA #55
- Alpine Butte Wildlife Sanctuary– 320 acres within existing SEA #52
- Desert Butte Wilderness –within existing SEA #53
- Pinyon Hills Wildlife Sanctuary –within existing SEA #55
- East Bob's Gap Nature Preserve
- Longview Wildlife Sanctuary
- Littlerock Wildlife Sanctuary
- Phacelia Wildlife Sanctuary –within proposed SEA and DWMA

3.1.3.4 San Bernardino County

Development and land disturbance within the unincorporated areas is located primarily around the incorporated cities, near the foothills of the San Bernardino Mountains (Phelan, Oak Hills, Pinion Hills, Lucerne Valley), in the Morongo Basin and areas south of the Marine Corps Air Ground Combat Center at Twentynine Palms, and east of Barstow in the Newberry Springs Area.

San Bernardino County General Plan: The San Bernardino County General Plan divides the desert region of the county into five subregional planning areas that are coterminous with the boundaries of five Regional Statistical Areas (RSAs) for the desert portion of San Bernardino County. The County General Plan anticipates very little growth to occur within the Baker Subregional Plan Area (RSA31). The plan cites the lack of infrastructure facilities as a major constraint to development in this subregion, and expects the little growth that occurs to be around the existing communities of Newberry Springs, and the Searles Valley (San Bernardino County General Plan at page III-D1-1). Within the Barstow Subregional Planning Area (RSA 32a), the plan anticipates most of the future growth to occur in the incorporated City of Barstow and in Lenwood and other adjacent unincorporated communities (Id. III-D2-1). The San Bernardino County General Plan identifies the Victor Valley Subregional Planning Area (RSA 32b) as one of the fastest growing areas in San Bernardino County, with most of the growth occurring within the incorporated cities with long term development potential identified for the unincorporated areas of Phelan and Lucerne Valley (Id. at page III-D3-1). Most of the development within the Morongo Basin Subregional Planning Area (RSA 33) is concentrated in the Town of Yucca Valley and the city of Twentynine Palms, with scattered development occurring within the unincorporated areas (Id. at page III-D4-1). General Plan land use designations and densities generally reflect the growth patterns described above. Densities range from urban residential (maximum of 16 dwelling units per acre) to resource conservation with a maximum density of one dwelling unit per 40 acres. Much of the unincorporated area is designated for low-density residential use ranging from one dwelling unit per 2.5 acres to one dwelling unit per 40 acres.

The County General Plan also includes mapping which ties allowable land uses to the availability of the basic infrastructure required for development (roads, water and wastewater facilities). "Required levels of service are established for all areas ranging from the most intense urban areas (IL 1) to the least intense rural areas (IL 5). Development can be permitted to the degree allowed by a site's official land use designation only when infrastructure facilities are or planned to be in place at levels consistent with the designated IL areas." (San Bernardino County General Plan at II-D6-36.)

The San Bernardino County General Plan lists the following goals and policies pertinent to biological resources:

- Preserve rare and endangered species and protect areas of special habitat value; and
- Establish plans for long-term preservation and conservation of biological resources (San Bernardino County General Plan at II-C1-4).

San Bernardino County Development Code: The San Bernardino County Development Code also provides for the designation of a Biological Resource Overlay District where special management is provided for unincorporated areas in the county for the protection of important flora/fauna habitat. Surveys and mitigation measures are required for any new development or expansion of an existing land use by 25% or more (Development Code at Section 85.030220). The County has categorized desert tortoise habitat as one, two, and three; indicated Mohave ground squirrel range; and identified bald eagle roosts and habitat on the Biotic Resource Overlay. (San Bernardino County General Plan at II-C1-4 to 6).

Surveys of biotic resources on site and adjacent parcels and mitigation measures to reduce impacts to the identified resources are required in the Biotic Resource Overlay Districts for all proposed land use map changes and for discretionary land use proposals. These development policies are not restricted to those areas within the Biotic Resource Overlay District, but may be applied to any areas where there are listed or candidate species and their habitat. A monitoring program is also required. Survey results, mitigation and monitoring must be documented in a Biological Resources Report.

Mojave Narrows Regional Park: The Mojave River flows through the Victor Valley, forming the boundary between the cities of Victorville and Apple Valley. At the Narrows, groundwater is forced to the surface by underlying bedrock and a permanent stream supports extensive riparian forest. This oasis provides habitat for many West Mojave target species, particularly birds. The concentration of species at this location makes the Mojave Narrows Regional Park a biological hotspot, where 17 sensitive species are found together. The park is owned by the state Wildlife Conservation Board and is operated by San Bernardino County Department of Regional Parks. It comprises 850 acres, with 450 acres devoted to habitat.

Mojave River Forks Regional Park: At the junction of Deep Creek and the Mojave River in Hesperia, San Bernardino County manages a campground park through a contractor. Much of this facility is vacant land providing undisturbed habitat.

3.1.3.5 City of Adelanto

The City of Adelanto is located within San Bernardino County on the northern side of the Victor Valley. The city is bisected by U.S. 395, which runs north/south through the city. The City of Adelanto General Plan (1994) characterizes the city as having a very pro-active city government that is not only pro-growth, but that has provided leadership in establishing a positive environment for investment within the city (City of Adelanto General Plan Update at I-3). The general plan for the city anticipates a high rate of growth over the next several decades. The areas along U. S. Highway 395, Palmdale Road and the eastern segment of El Mirage Road are planned for general commercial uses. The land area located between Mojave Drive and Air Base Road is planned for manufacturing and industrial uses. Residential areas in the southern portion of the city are planned at a density of about four dwelling units per acre. Multiple family residential areas are planned west of Highway 395 north of Air Base Road, intermingled with single-family densities at four dwelling units per acre. Low-density residential development (one dwelling unit per 2.5 to 5 acres) is planned for the area generally east of Koala Road and north of Air Base Road. The plan also designates 871 acres of land within the city as Open Space/Public Land/Schools (Id. at III-12).

The Conservation/Open Space Element of the Adelanto General Plan establishes the goal of assuring "…adequate protection and conservation of all native vegetation and wildlife habitats" (Id. at VII-26). General Plan policies indicate: "…the City will only allow development which minimizes the destruction of biotic resources within the City, such as the Mojave River Corridor." Other policies calls for retaining areas of the Shadow Mountains as open space to protect their integrity as a unique habitat as well as a wildlife movement corridor, and for maintaining major stream courses as open space to be managed as wildlife movement corridors. The General Plan suggests use of preferential assessments on real property as an incentive for retaining open space or conservation easements to protect sensitive species and their habitats (Id. at VII-27 through 29).

3.1.3.6 Town of Apple Valley

The Town of Apple Valley is located within San Bernardino County, south and east of Interstate 15 in the Apple Valley. The town is directly east of the city of Victorville and northeast of the city of Hesperia. Highway 18 bisects the city. The 1991 Town of Apple Valley General Plan characterizes the town as "…primarily a community of homes, many of which are located on lots of approximately half-acre or more." (Town of Apple Valley General Plan at page 25.) Residential densities ranging from one dwelling unit per 0.9 acres to one dwelling unit per 1.0 to 2.5 gross acres predominate in the central and southern portions of the town, while low to very low density areas (one dwelling per one to five gross acres or more) exist in the northeastern and southernmost portions of the community. Commercial development is focused along Highway 18 and Bear Valley Road. A significant portion of the northern part of the town is designated as Community Reserve, which encourages the development of mixed-use or large-scale developments through specific plans with a residential density not to exceed two dwelling units per gross acre (Id. at page 9).

The Open Space/Conservation Element of the town general plan establishes a goal to "…conserve and protect natural resources within the planning area." Goal OSC-2 states: "The Town will make every effort to preserve significant mature native trees, native vegetation, landforms and wildlife habitat within the planning area" (Id. at page 9 and 10). Rock knolls in the town, Bell Mountain, Fairview Mountain, Apple Valley Country Club and the Mojave River Valley are identified as Open Space and are planned to remain in a natural condition (Id. at page 17). The objectives of Open Space Districts (OSD) include "the preservation of … native vegetation … and wildlife habitat" and "the preservation of the integrity, function, productivity and long-term viability of environmentally sensitive habitats" (Apple Valley Code at Section 9.55.020). The Apple Valley Code allows the designation of both Conservation and Recreation OSDs. Conservation OSDs are intended in part to "assure the continued existence of adequate wildlife habitat and foster the free movement of wildlife within the desert" (Id. at Section 9.55.020).

The **Lewis Science Center** is a regional educational facility located on the north side of the Mojave River in Apple Valley. The Center provides training for teachers from throughout the western portion of San Bernardino County and hosts many classroom visits. Riparian and adjacent upland habitat is protected at this location, including rock outcrops and portions of a levee that support the endemic Mojave shoulderband snail.

3.1.3.7 City of Barstow

The City of Barstow is located in San Bernardino County along the Mojave River at the intersection of Interstates 15 and 40. The Land Use Element of the City of Barstow General Plan (1996) identifies six Principal Growth Areas where most of the city growth over the next 20 years is expected to take place. The city has set general plan designations to accommodate this growth. The growth areas are as follows (City of Barstow General Plan at Part B, I.18 and 19):

- **Growth Area 1**: Most of the expected residential and associated neighborhood commercial activity is expected to occur adjacent to Barstow Road, between Rimrock Road and the southerly city limits. Barstow Community College and the California Veterans Home are located in this area.

- **Growth Area 2: "**Wholesale to the public" retailing outlets are expected to expand to the south along the east side of Interstate 15 from the existing outlet malls at Lenwood Road and 1-15.

- **Growth Area 3:** The Lenwood Specific Plan area located on either side of Lenwood Road, north of Interstate 15 is planned for new industrial and commercial activity.

- **Growth Area 4:** The area along the railroad between Highway 58 and West Main Street is expected to have commercial and industrial growth. Distribution activities and visitor oriented commercial uses are expected to predominate.

- **Growth Area 5:** The area north of the Mojave River in proximity to Highway 58 is expected to have commercial activity adjacent to the freeway access point, with low-density residential developments nearby.

- **Growth Area 6:** The area just north of the Mojave River and east of Interstate I-15 has the potential for a golf course with associated "executive estate" homes.

The city's general plan identifies several goals pertinent to biological resources. These goals include seeking to preserve the remaining biological resources in the planning area; conserving suitable habitat for threatened and endangered species whenever possible; establishing corridors for movement of wildlife between DWMAs and between tortoise critical habitat; striving to maintain native riparian and associated natural habitats along the Mojave River; and maintaining the Mojave River as a travel and watershed corridor to maintain the link between the natural areas to the north and south of the city. The general plan also identifies the need to perform site-specific studies prior to development to determine the mitigation necessary to preserve and enhance biological resources (City of Barstow, General Plan – Part B, II.9).

3.1.3.8 City of California City

California City is located in Kern County, north of Highway 58 and east of Highway 14. Nearly all of the existing development and population exists in an area comprising about twelve sections of land in the southwest corner of the city. Very limited development has occurred to the northeast in the vicinity of Twenty-Mule Team Road (California City General Plan 2012 at page 3). The general plan indicates that "approximately ninety percent of the subdivided land has been sold and more than ninety-five percent of the total land area remains empty, except for bladed roads and, in some cases, partial utilities." (Id. at page 22.)

Residential land use densities planned for the city range from Estate Density Residential densities of 2 to 5 dwelling units per acre, to high density residential (6 to 40 dwelling units per acre). General Commercial designations are shown along California City Boulevard, with Neighborhood Commercial dispersed in residential areas. Industrial development is planned in the western part of the city, primarily north of California City Boulevard near the airport. Several conservation areas are shown on the general plan, scattered throughout the eastern portion of the city. The General Plan text supports urban growth with emphasis placed on infill development of the central core. (Id. at page 24.)

The City is currently proposing a detachment of 12,450 acres in the northeastern part of the city; 1,846 acres adjacent to the Desert Tortoise Natural Area; and 4,144 acres in the south eastern part of the city. Coupled with the detachment is a request to annex 18,778 acres at the western end of the city stretching from the current city limits south to Highway 58. (Final Environmental Impact Report – Redevelopment Area Expansion, Detachment, Annexation, and Automotive Test Course Project, California City, October 4, 2002 at Figure 2.1-2-A.)

The Open Space and Conservation Element of the California City General Plan lists the following goals and policies regarding biological resources:

- Preserve and protect conservation resources of sensitive plant and wildlife species that are unique to California City environs (California City Plan at page 43).
- Protect sensitive plant and wildlife species, in accordance with State and federal laws and regulations, and provide for maintenance of supportive habitat for such species in balance with the needs of humans (Id. at page 44).

3.1.3.9 City of Hesperia

The City of Hesperia is located in the Victor Valley region of San Bernardino County, along Interstate 15, south of the City of Victorville and Town of Apple Valley. The City of Hesperia General Plan (at page L-6) indicates that most of the existing residential lots are located within the core area of the town, generally bounded by Maple Avenue and the Mojave River, and by Bear Valley Road and Ranchero Road. Within this area, lot sizes have historically ranged from 18,000 square feet to one acre in size. In 1991, the average residential lot size within Hesperia was approximately 39,000 square feet (CIC Research Inc., *A Citizen's Planning Survey for Hesperia, June 1989)*. Large expanses of land within the core area were subdivided into half acre, acre and two-acre tracts prior to incorporation of the city. Many of these lots are configured in a way that makes further subdivision infeasible and densities are anticipated to remain fairly low (City of Hesperia General Plan at page L-9). Residential general plan designations range from Rural Estate (0.1 to0-.4 dwelling units per acre) to High Residential (8 to 15 dwelling units per acre). The general plan identifies a trend towards more traditional sized single family residential (3 to 6 dwelling units per acre) in the western portions of the city west of Maple Avenue (Id. at page L-7). Specific plans for large-scale planned developments have been approved for the southern portions of the city in Summit Valley.

General Plan Land Use Goals for the city emphasize the protection of quality of life; accommodating growth "…within the limits of the natural environment and the capacity of its infrastructure" and "…managing the use of land so that development occurs in an orderly and beneficial manner…" (Id. at L-4 and 5.)

The City of Hesperia General Plan goals relative to biological resources call for preservation of sensitive or protected desert vegetation and animal species, and habitat areas throughout the planning area; conducting a biological assessment to identify sensitive habitat areas; and a site specific assessment of the impacts of a proposed development on biological resources (Id. at CN-26-27). The general plan also indicates that "biological resource conservation measures, including preparation of a habitat conservation plan for endangered species, designated preserve areas, and protection of Joshuas and other unique species, will be an integral part of planning within the City." (Id. at CN-7.)

The city has initiated a habitat conservation plan in cooperation with Caltrans, Rancho Las Flores and Summit Valley Ranch. The HCP would address potential impacts to three species, the arroyo toad, the southwestern willow flycatcher, and the Least Bell's vireo. The

HCP would include mitigation measures for the entire areas of the two specific plans as well as for the effects of the expansion of State Highway 138 to a four-lane road. As the specific plans and the State highway project were initiated and evaluated independently from the West Mojave Plan, mitigations would be applied outside of the parameters of the Plan, in accordance with the HCP and the indivisual environmental documentation for each project.

3.1.3.10 City of Lancaster

The City of Lancaster is located in the Antelope Valley region of Los Angeles County along Highway 14. Urbanized development in the city is concentrated in the central area of Lancaster and in the area surrounding the Quartz Hill community. The approval of large-scale developments in the eastern and western portions of the city has “set the stage for the development of several isolated nodes.” The General Plan notes, “There is a considerable amount of undeveloped land between these development nodes and the urbanized areas of the City.” These undeveloped lands are generally divided into 2.5 and 5.0-acre parcels, a land pattern that makes infill difficult. An area of mixed land uses is found in South Lancaster. Rural residential communities are found in the outlying areas of the city. (City of Lancaster General Plan at page VIII-2.)

The general plan specifies a range of residential land use densities from Nonurban Residential (up to 1 dwelling unit per 10 acres) to High Density Residential (15.1 to 30.0 dwelling units per acre). Land use goals include establishing a variety of land uses which further Lancaster’s transition from a suburb of Los Angeles to a community with a full range of urban and community services; managing growth to create a comprehensive urban structure; encouraging infill development; protecting rural areas from urban encroachment; creating an aesthetically pleasing environment; and promoting a regional perspective in land use decisions. (Id. at pages VIII-5 through 38.)

The City of Lancaster General Plan (at page II-20) establishes an objective pertinent to biological resources to “Identify, preserve and maintain important biological systems within the study area, and educate the general public about these resources, which include the Joshua Tree – California Juniper Woodlands, areas that support endangered or sensitive species, and other natural areas of regional significance.” Policies call for comprehensive management of programs for significant biological resources; cooperation with others in the development of the West Mojave Plan; the initiation of area wide studies to identify sensitive biological resources; protection of Prime Desert Woodlands through acquisition or other means; establishing standards for the development of property in Prime Desert Woodlands; and the preservation of significant desert wash areas and open space lands in and around the Poppy Preserve (Id. at pages II-20 through 27). There is one wash area (Little Rock Creek Wash) within the City limits, and it is designated Open Space.

The City is establishing a Joshua Tree Woodland Preserve. Forty acres have been acquired for the preserve, and 45 additional acres are being purchased. This area would serve as an educational outreach facility. It is not currently known what species are found at the Preserve. In 1991, the City passed Ordinance 577, which established fees for removal of native vegetation within defined Vegetative Management Areas. The fees collected under this ordinance are used to offset the costs associated with acquiring sites within the Prime Desert Woodland.

3.1.3.11 City of Palmdale

The City of Palmdale is located in the Antelope Valley region of Los Angeles County, south of the City of Lancaster. The developed portions of the City "…occupy an area generally bounded by the Littlerock Wash on the east, the California Aqueduct on the south, and 70th Street West on the west." Littlerock Wash forms a natural boundary between urban residential densities in the City and more rural development in the unincorporated community of Littlerock. "The northern extent of urban development in Palmdale follows an irregular path from Avenue M in the northwest portion of the City, around existing rural residential areas in the north central portion of the Planning Area, and south of the airport land along Avenue P." (City of Palmdale General Plan at page L-40.) The large expanse of airport land (over 22,000 acres) in the north and northeastern portions of the city have helped to shape growth patterns. The airport land is largely vacant except for Air Force Plant 42, minor agricultural uses and sewage treatment facilities, but if future airport uses occur, the land would provide economic development opportunities for the City and is designated for manufacturing land uses by the general plan. (Id. at page 42.)

The City General Plan identifies the following development trends for the city:

- "New housing for first time buyers will be constructed on the east side of Palmdale (east of 47th Street)."
- "Residential Development will continue to expand south into the Barrel Springs and Vincent Hills Areas."
- "…The southwest portion of the City between Verde Ridge and the southern sphere line, west of Hwy 14 to City Ranch will be a target for urban development if infrastructure is provided."
- "City Ranch and Ritter Ranch will begin construction on initial phases adjacent to Elizabeth Lake Road."
- "The City will complete annexation of many of the County island areas within the core areas."
- The City will encourage infill of vacant land and reuse of existing buildings in urbanized areas…" (City of Palmdale General Plan at pages L-48 and L-49.)

Biological resources are addressed in the City's General Plan Goal ER2, which calls for protecting "…significant ecological resources and ecosystems, including, but not limited to, sensitive flora and fauna habitat areas." Significant Ecological Areas are identified at Big Rock Wash, Little Rock Wash, Ritter Ridge, Portal Ridge and Alpine Butte. Biological surveys are required for any new development in these areas, and significant environmental resources are required to be considered and preserved to the extent feasible. The plan also calls for the preservation of natural drainage courses and riparian areas containing significant concentrations of ecological resources, as well as significant Joshua tree woodlands.

3.1.3.12 City of Ridgecrest

The City of Ridgecrest is located in northeastern Kern County in the southern portion of the Indian Wells Valley. Scattered residential land uses predominate in the city with linear commercial land uses occurring along Inyokern Road, China Lake Boulevard, Norma Street, and Ridgecrest Boulevard. (City of Ridgecrest General Plan at page I-3.) The General Plan limits the residential categories of medium density (up to 25 units per gross acre), low density (6,000 square feet to 5 acres per parcel), and recreational uses to the urban areas of the community. The less intensive uses such as open space and rural residential (minimum parcel size of 5 acres gross) make up the fringe areas west, south and east of the community. (Id. at page 1-5.)

The Conservation Element of the City's General Plan includes policies relative to habitat and wildlife that call for promoting the survival of native wildlife species and the preservation of their natural habitat; prohibiting off-highway vehicle use in designated habitat preservation areas; and supporting the concept of the Cerro Coso Community College's (CCCC) Natural Area as designated by BLM and CCCC. (City of Ridgecrest General Plan at page 5-5.) The plan also encourages the retention of natural desert flora to control soil erosion; supports education as a means to reduce impacts to natural resources; and encourages participation in BLM planning for public lands near the city (Id. at pages 5 through 12).

3.1.3.13 City of Twentynine Palms

The City is located in central San Bernardino County, in the Morongo Basin portion of the Mojave Desert. Twentynine Palms Highway bisects the community (east-west), and most of the commercial areas are along this highway and Adobe Road, which runs in a north-south direction. Multi-family (up to 8 dwelling units per acre) and higher density single-family development (at 4 dwelling units per acre) generally surrounds the downtown commercial area, with less dense development in the outlying portions of the City. (City of Twentynine Palms General Land Use Plan at Section IV.) The stated purpose of the City's Land Use Plan "…is to provide efficiency in land use, ensure development of quality neighborhoods with housing opportunities for all citizens, enhance the business district, provide a "tourist friendly" settng, and afford an opportunity for industrial development, while protecting natural resources and preserving the quality desert lifestyle." (Id. at Section II.) General Plan policies support infill development with limited densities in the outlying areas of the city. (City of Twentynine Palms General Plan – Conservation Plan, Program 1.2.1.)

The City's Conservation Plan identifies the primary purpose of the Conservation Plan to commit "…the City to a responsible plan of action in carrying out its role in environmental protection." (Id. Section XII B.) Program 1.1.3 in the Conservation Plan requires protection of the unique habitat in the Oasis of Mara. Goal 6 of the Conservation Plan calls for the preservation of the biological resources of the Mesquite Dunes, including the Mesquite Dunes Bosque and Playa Lakebed. The plan provides programs requiring specific review of projects occurring in the Mesquite Dunes, including limitations on grading, restrictions on sand extraction and removal of Honey Mesquite trees, and a requirement for a detailed clearance survey for desert tortoise.

3.1.3.14 City of Victorville

The City of Victorville is located along Interstate 15 in the Victor Valley region of San Bernardino County, at the southern end of the Mojave Desert. The City General Plan establishes thirteen planning areas for purposes of land use designation and analysis. City land use goals include maintaining a balanced community with a diversified economic base, providing adequate city services and maintaining an aesthetically pleasing community. (City of Victorville General Plan Land Use Element at pages 51 through 54.) Residential land use designations allow for development densities ranging from one dwelling unit per five acres (Open Space and Rural Residential) to twenty dwelling units per acre (Very High Density Residential). Development densities for industrial and commercial uses range from 40 to 60% site coverage.

Resource management goals identified within the General Plan indicate that the City would monitor new information regarding the status of sensitive floral and faunal species to revise its biotic inventory; would continue to require preservation of native Joshua tree woodlands and specimens where possible; would continue to require preservation of the Mojave River riparian habitat; would continue to participate in a cooperative effort with other agencies to monitor and review the management of resources; and would continue to cooperate and consult with federal, state, county and local agencies in resolving regional resource management issues. (City of Victorville General Plan – Resource Element at pages 48 through 52.) The City has designated areas along the Mojave River as Open Space. The General Plan indicates that the City requires that a survey be conducted by a qualified biologist to determine whether tortoise habitat exists prior to issuance of grading permits for undisturbed sites. (Id. at page 44.) The plan further indicates that the City has established a "no survey" area within the City based on the results of 370 completed biological surveys. This "no survey" area was established after consultation with the USFWS.

Rockview Nature Park: A small but important educational facility operated by the City of Victorville is located at the Lower Narrows of the Mojave River. School classes are hosted for educational programs, and the site protects rocky outcrops, Joshua tree woodland, and a portion of the Mojave River riparian habitat. Trails are present providing access to the river.

3.1.3.15 Town of Yucca Valley

The Town of Yucca Valley is located in the south central portion of San Bernardino County, in the Morongo Basin. Existing development in the town is focused along State Highway 62. Nearly all of the commercial development in the town is focused along this corridor, with residential development occurring to the north and south at progressively lower densities. Development in the area is constrained by the topography, and only about 25% of the lands in the town were developed as of 1995. [Yucca Valley Comprehensive General Plan, Draft Environmental Impact Report at page II-1]. Residential densities under the General Plan range from densities of one dwelling unit per 20 acres to 14 dwelling units per acre [Id. at I-9]. Other land use designations (Commercial, Industrial) limit development at varying levels of intensity [Id. at I-13]. A total of 511 acres are zoned Open Space for park lands, lands that pose a human hazard and biologically sensitive areas [Id. at I-9].

It is a goal of the town's general plan to "… protect and preserve the Town's biological resources, especially those sensitive rare, threatened or endangered species of wildlife and their habitats. Policies of the General Plan include specific steps to preserve the long-term viability of sensitive habitat and species." [Id. at III-74.] The General Plan further requires that development in areas with sensitive species and habitat be at a compatible intensity, and addresses the need for protection of Covington Wash as a wildlife corridor. [Id. at III-74 and 75.]

3.1.4 Federal Endangered Species Act

3.1.4.1 Background

The federal Endangered Species Act of 1973 (FESA) is intended "to provide a means whereby the ecosystems upon which Endangered species and Threatened species depend may be conserved, [and] to provide a program for the conservation of such endangered species and threatened species..." (FESA Section 2(b).) FESA requires that all federal agencies "seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this chapter." (Section 2(c)(1).) FESA assigns to the Secretary of the Interior the responsibility to maintain a list of threatened and endangered species and to designate critical habitat for these species (Section 4).

It is unlawful for any person to "take" a federally listed fish or wildlife species. (Section 9(a)(1)(B).) "Take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect. (Section 3(18).) Take includes significant habitat modification or degradation that actually kills or injures wildlife (*Babbitt v. Sweet Home Chapter*, 515 U.S. 687).

3.1.4.2 Listed Species

Species listed as threatened or endangered by USFWS and found within the western Mojave Desert are identified in Table 3-3.

Table 3-3
Species Listed by USFWS as Threatened or Endangered

SPECIES	STATUS	DATE LISTED
Arroyo toad (*Bufo californicus*)	Endangered	January 17, 1995
Bald eagle (*Haliaeetus leucocephalus*)	Endangered Threatened	March 11, 1967 August 11, 1995
California red-legged frog (*Rana aurora draytonii*)	Threatened	May 20, 1996
Cushenbury milkvetch (*Astragalus albens*)	Endangered	August 24, 1994
Cushenbury buckwheat (*Eriogonum ovalifolium* var. *vineum*)	Endangered	August 24, 1994
Cushenbury oxytheca (*Oxytheca parishii* var. *goodmaniana*)	Endangered	August 24, 1994
Desert tortoise (*Gopherus agassizii*)	Threatened	April 2, 1990
Inyo California towhee (*Pipilo crissalis eremophilus*)	Threatened	August 3, 1987
Lane Mountain milkvetch (*Astragalus jaegerianus*)	Endangered	October 6, 1998
Least Bell's vireo (*Vireo bellii pusillus*)	Endangered	May 2, 1986
Mojave tui chub (*Gila bicolor mohavensis*)	Endangered	October 13, 1970
Parish's daisy (*Erigeron parishii*)	Threatened	August 24, 1994
Southwestern willow flycatcher (*Empidonax traillii extimus*)	Endangered	March 29, 1995

3.1.4.3 Recovery Plans

USFWS has completed recovery plans for six of these federally listed species. The most important recommendations of these recovery plans are summarized below.

- *Bald Eagle* (August 25, 1986). Recovery of the bald eagle was addressed on a regional basis and the Pacific Bald Eagle Recovery Plan presented criteria for downlisting to threatened status, which were achieved in 1994. No recovery objectives or standards are applicable to the West Mojave, though the plan addresses the wintering population in the San Bernardino Mountains. Many of the eagles wintering at Lake Silverwood, Lake Arrowhead, and Big Bear Lake utilize a night roost at Las Flores Ranch, which is within the West Mojave planning area. This property is included in the Summit Valley HCP, a multispecies plan that is being prepared by the City of Hesperia. In 1999, the USFWS proposed delisting of the bald eagle because the national and regional goals for recovery were met (USFWS 1999). A decision is pending.

- *Desert tortoise* (June 28, 1994): Recovery of the desert tortoise to a point where it can be delisted depends on actions within specified recovery units, which are considered separately. The recommended conservation measures are based on establishment of DWMAs within each recovery unit, including the West Mojave Recovery Unit. Conservation actions to reduce impacts to tortoises from grazing, off-highway vehicle use, ravens, and incompatible land uses are recommended for each DWMA. In addition, a program of monitoring and environmental education is suggested.

- *Inyo California Towhee* (April 10, 1998): Recovery and delisting of the Inyo California towhee can be achieved with protection, management and enhancement of occupied riparian habitat in the Argus Mountains. Habitat enhancement includes the removal of invasive vegetation, removal of wild burros and limitations on off-highway vehicle access. The Recovery Plan also calls for monitoring of the habitat and towhee populations and development of a public outreach program.

- *Mojave tui chub* (September 17, 1984): The Mojave tui chub can be downlisted to threatened status after establishment of three additional self-sustaining populations. For delisting, re-introduction and establishment of viable populations into a majority of the historic habitat in the Mojave River is necessary. This fish is currently maintained at small refugia at China Lake NAWS, Zyzzyx, and Camp Cady.

- *Southwestern Arroyo Toad* (July 24, 1999): Protection of 20 occupied drainages and adjacent upland habitat in northern, southern and desert slope recovery units is necessary for the arroyo toad to be downlisted to threatened. Protection of an additional 15 populations in these recovery units is necessary for delisting. A portion of the desert slope recovery unit is within the West Mojave planning area, and includes Little Rock Creek in Los Angeles County and Deep Creek, Little Horsethief Creek and the Mojave River in San Bernardino County. Most occurrences of the arroyo toad are within the San Bernardino and Angeles National Forests, with a small extension of occupied habitat extending onto private and BLM lands in the western Mojave Desert.

- *Southwestern willow flycatcher* (August 30, 2002): Delisting of the southwestern willow flycatcher would require population increases and stabilization at specified river reaches within six Recovery Units. The Basin and Mojave Recovery Unit is found within the West Mojave Plan area, and contains two focus areas for management attention and conservation efforts: 1) the West Fork of the Mojave River from its headwaters to Mojave Forks dam (Hesperia area) and 2) the Mojave River between Spring Valley Lake and Bryman (Victorville-Apple Valley and San Bernardino County). The population size within these units must increase from the current level of 13 territories to 25 territories. Recommended habitat enhancement measures include removal of invasive riparian plants, such as Russian olive and saltcedar and trapping of brown-headed cowbirds, which parasitize flycatcher nests.

- *California Red-legged Frog* (May 28, 2002): Delisting can be considered after five criteria are met. The first is protection of 35 core areas. Within the West Mojave are two core areas: the San Gabriel Mountains and the Forks of the Mojave River. The San Andreas Rift Zone at the southwest edge of the planning area contains occupied habitat for this species, and the upper Mojave River contains suitable (and historical) habitat where the frog could be re-established. The remaining criteria are stability of the populations, sufficient geographical distribution, successful establishment in historical habitat and needed research completed.

Recovery Plans for other species (Least Bell's vireo, carbonate endemic plants) have been published in draft format and are awaiting public comment and finalization by USFWS.

3.1.4.4 Critical Habitat

Critical habitat has been designated for the desert tortoise and Inyo California towhee. Critical habitat designations for the least Bell's vireo and southwestern willow flycatcher do not extend into the West Mojave planning area. Designations for the arroyo toad and red-legged frog have been vacated by recent judicial decisions. On October 30, 2002, the United States District Court for the District of Columbia set aside the critical habitat designation for the arroyo toad and ordered the Service to publish a new final rule by July 30, 2004 (*Building Industry Legal Defense Foundation, et al., v. Gale Norton, Secretary of the Interior, et al., and Center for Biological Diversity, Inc. and Defenders of Wildlife, Inc.* Civil Action No. 01-2311 (JDB) (U.S. District Court, District of Columbia)). A similar ruling in a different case was made for the red-legged frog. A discussion of each of these designations follows.

- *Carbonate endemic plants:* Critical habitat for four of the five listed carbonate endemic plant species was designated in the West Mojave on December 14, 2002. Several distinct areas on the north slope of the San Bernardino Mountains near Lucerne Valley were designated to include known occupied habitat for Cushenbury milkvetch, Cushenbury buckwheat, Cushenbury oxytheca and Parish's daisy. A total of 1,585 acres of BLM land comprise the critical habitat, along with a smaller acreage of private land. [Designated December 2002, *Federal Register* 67(247):78570-78610.]

- *Desert Tortoise:* Critical habitat for the desert tortoise occupies substantial portions of the central and southeastern West Mojave planning area (USFWS 1994a). The designation includes parts of three military bases and covers much of three of the four participating counties, with an extension into Riverside County within Joshua Tree National Park. [Designated February 1994, *Federal Register* 59(26):5820-5866.]

- *Inyo California Towhee:* Critical habitat for the Inyo California towhee lies entirely within Inyo County and surrounds springs and seeps occupied by this endangered bird. The majority of critical habitat is located on the China Lake NAWS. [Designated 1987, *Federal Register* 52:28780-28788.]

3.1.4.5 Exceptions to FESA's Take Prohibition

Take may be allowed in certain cases where it is incidental to the carrying out of an otherwise lawful activity. These cases include: (1) FESA Section 7 consultation procedures, for projects authorized, funded or carried out by a federal agency ("federal actions"); and (2) issuance by USFWS of an incidental take permit, for non-federal actions. Each is discussed below.

Incidental Take Permits: The USFWS may authorize, by permit, takings of an animal listed by USFWS as threatened or endangered, which are incidental to, and not the purpose of, the carrying out of an otherwise lawful activity that is not a federal action. (FESA Section 10(a)(1)(B).) These "Section 10(a)" permits may be issued if an applicant for a permit submits to USFWS a "conservation plan" that satisfies the following permit issuance criteria:

> (i) The taking will be incidental;
> (ii) The applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking;
> (iii) The applicant will ensure that adequate funding for the plan will be provided;
> (iv) The taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild; and,
> (v) The measures, if any, required under [1539(a)(2)(A), "such other measures that the Secretary may require as being necessary or appropriate"] will be met, and [the Secretary] has received such other assurances as he may require that the plan will be implemented.... [Id. At Section 10(a)(2)(B).]

These criteria do not explicitly require that a conservation plan (also known as a habitat conservation plan, or HCP) contribute to the recovery of a listed animal species. Rather, an HCP need only ensure that the "likelihood of the survival and recovery of the species in the wild" will not be appreciably reduced.

Listed plants on private lands are treated somewhat differently. Section 10(a) permits and "no surprises" assurances cannot be issued for listed plants. Permit issuance procedures do, however, provide indirect protection for plants. This is because an HCP's conservation program may not jeopardize the continued existence of any listed species, including plants. If this could occur, the permit would not be issued.

The Section 10(a) permit applies to the federal Endangered Species Act only. A comparable permit (the "Section 2081 permit") applies to the California Endangered Species Act, and is issued by CDFG for species listed as threatened or endangered by the State of California (see discussion below, at Section 3.1.5.3 of this document).

The Section 10(a)(1)(B) incidental take permit should not be confused with the separate Section 10(a)(1)(A) permit, which is issued to scientists working with threatened or endangered species on federally-authorized research projects where take of the species is *intentional*.

Nine habitat conservation plans have been approved for lands within the planning area. These include the following:

- Cushenbury Sand and Gravel
- Hi Desert Power Project
- Miller Church Site
- Sunland Communities
- Wildwash Sand and Gravel Site
- Sunwest Homes
- Kern County Waste Management (Boron, Ridgecrest, and Mojave/Rosamond Sanitary Landfills)
- Department of Corrections Electrified Fence Project (California City State Prison)
- U. S. Borax 1940 Acre Expansion

Section 7 Consultations: A different procedure governs projects and activities that are "authorized, funded or carried out" by the federal government, including those located on public lands under BLM, National Park Service or Department of Defense jurisdiction. FESA requires that federal agencies shall, "in consultation with and with the assistance of [USFWS] insure that any [such] action ... is not likely to jeopardize the continued existence of any Endangered species or Threatened species or result in the destruction or adverse modification of [critical] habitat of such species..." (FESA Section 7(a)(2).) The term "jeopardize" means to "engage in an action that would reasonably be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers or distribution of that species." (50 Code of Federal Regulations (CFR) Section 402.02.)

Accordingly, a federal lead agency "consults" with the USFWS if it determines that a project "may affect" a threatened or endangered species. Consultation is initiated when the federal lead agency submits a biological assessment or similar document to the USFWS that describes the project, its anticipated impacts, and proposed mitigation. USFWS evaluates the information provided and determines if the effect can be avoided or if the effects are wholly positive. If so, only "informal consultation" will be carried out and the USFWS issues written concurrence that the project is not likely to adversely affect listed species or designated critical habitat. If an adverse effect cannot be avoided, "formal consultation" is required, and the USFWS issues a biological opinion that states whether the proposed project will jeopardize the continued existence of the species or will destroy or adversely modify critical habitat. If jeopardy is found, USFWS must suggest "reasonable and prudent alternatives" that could be implemented to prevent the species' existence from being jeopardized or critical habitat being destroyed. A "no jeopardy" opinion will provide "reasonable and prudent measures" to ensure that take is minimized. "Terms and conditions" are issued to provide specific guidance for implementing the reasonable and prudent measures. Because of this, no terms and conditions can be issued for listed plant species. Only non-binding conservation recommendations can be issued for plants.

If critical habitat is designated after issuance of a no jeopardy opinion, the federal agency is required to re-initiate consultation to obtain a determination of "no adverse modification" to the critical habitat. Because of the frequent time lag between species listing and critical habitat designation, several projects have been required to re-initiate consultations under Section 7 of the ESA.

Consultations Conducted Within the Planning Area: A total of 234 biological opinions authorizing 263 California and Nevada projects having the potential to affect tortoises were issued between 1990 and 1995. Of the 133 biological opinions issued in California, 101 led to ground disturbance when projects were developed, resulting in the loss of 53 tortoises (LaRue and Dougherty 1998)[2]. For these projects, terms and conditions were implemented that resulted in 919 tortoises being moved from harm's way at the time of construction (Circle Mountain Biological Consultants 1996, LaRue and Dougherty 1998). Because no comprehensive analysis has been completed for federal biological opinions since 1995, the following discussion is restricted to these 1990 - 1995 projects. Table 3-4 shows the project types, number of tortoises

2 During the same time, only four Section 10(a) permits were issued. Nine Section 10(a) permits have been issued to date for tortoises in California (Bransfield, pers. comm.).

handled, and number accidentally killed during construction of the 101 projects.

Table 3-4
Numbers Of Tortoises Handled And Accidentally Killed During Construction Of 101 Federally Authorized Projects In California Between 1990 And 1995

PROJECT TYPE	PROJECTS	TORTOISES HANDLED	DEAD TOTOISES
Pipeline	19	583	38
Transmission Line	15	227	7
Military	7	14	5
Mining	19	59	2
Highway	10	16	1
Tract/Parcel	13	13	0
Programmatic	13	5	0
Miscellaneous	2	2	0
Landfill	2	0	0
Hazardous Materials	1	0	0
Total	**101**	**919**	**53**

This summary shows that long, linear projects (transmission lines and pipelines) were responsible for most of the harassment and mortality take of tortoises in California. Although these two project types comprised only a third of the authorized projects (34 of 101 projects), they were responsible for 88% of the harassment take (810 of 919 tortoises handled) and 85% of the mortality take (45 of 53 tortoises accidentally killed). The study also identified the federal lead agencies associated with these 101 projects, as summarized in Appendix L.

BLM Consultation Procedures: Actions undertaken by, or permitted by, the BLM are federal actions that may require informal or formal consultation under Section 7 with the USFWS. BLM's consultation procedures are described below, using a crude oil pipeline proposal as an example.

A project proponent wishing to install a pipeline across public lands is required to obtain a right-of-way grant from the BLM. The proponent may also be required to obtain additional permits and authorizations from other federal agencies (e.g. Corps of Engineers). The federal agencies jointly identify a federal lead agency, usually the entity with the highest level of involvement. In the case of a crude oil pipeline crossing significant miles of public lands, BLM is likely to be identified as the federal lead agency. This can be the case even if the project proponent is a private entity and some or most of the lands crossed are private lands.

Both take authorization and compensation are based on the entire alignment, regardless of land ownership. In the case of the 70-mile Morongo Basin water pipeline, constructed between Hesperia and Landers in the mid-1990s, the biological opinion applied to the entire project although the alignment crossed fewer than five linear miles of BLM land. Tortoises were authorized to be moved out of harm's way, the proponent was obligated to revegetate all non-access areas within the right-of-way, and compensation was based on the width of the newly impacted area multiplied by the 70-mile length, which included private lands.

Based on presence-absence survey results and other available information submitted by the proponent, the BLM determines if the project may affect a listed species. If BLM determines that a project will not affect a listed species it does not have to consult, either formally or informally with the USFWS. BLM *may* ask the USFWS to concur in its no-effect determination, but it is not required to. If BLM makes a "may affect" determination, formal consultation will be required. The USFWS has 45 days to review materials provided by the BLM and project proponent, 90 days to draft a biological opinion, and an additional 45 days to deliver it. The biological opinion outlines reasonable and prudent measures and terms and conditions to minimize take of listed fish and wildlife on-site and compensate through land acquisition, habitat rehabilitation, and other measures off-site.

Minimization measures have proven effective to alleviate impacts at the time of construction (LaRue and Dougherty 1998). Clearance surveys are standard parts of take avoidance measures. The proponent is obligated to delineate the work zone and restrict all impacts to that area, maintain a litter-free environment to minimize the attraction of tortoise predators (feral dogs, coyotes, ravens, etc.), and keep vehicle speeds below a certain level. Construction personnel are given awareness programs to avoid crushing tortoises or their burrows.

In addition to take avoidance measures to be implemented on-site, protecting or enhancing habitats off-site is often required to compensate impacts. Between 1990 and 1995, land acquisition was required by 44% percent of the biological opinions issued in California (LaRue and Dougherty 1998). For BLM projects, the proponent typically pays a compensation fee to offset the impact to tortoises ($700/acre), and may also be required to pay endowment funds to the CDFG ($230/acre), although this latter cost has not been consistently applied to every federal project. Alternatively, the proponent may purchase and deed to the BLM or CDFG compensation lands that meet with the approval of the BLM, and occasionally the CDFG. In such cases, field staff completes a Proposed Lands For Acquisition Form (PLFAF).

A compensation ratio, developed for the interagency desert tortoise management oversight group (MOG) in 1991, uses seven variables to determine a multiplying factor that is applied to the acreage lost to development (Desert Tortoise Compensation Team 1991). The range of compensation rates for various BLM habitat categories is given as follows (Desert Tortoise Compensation Team 1991): Category I = 3 to 6, Category II = 2 to 5, and Category III = 1 (the standard in all areas). This means that the compensation ratio may be as high as 6:1, indicating that six acres of conservation habitat would be purchased for each acre of impact. For example, 40 acres of impact would be compensated by acquiring 240 acres of conservation land, or alternatively, paying $168,000 to BLM (240 acres at $700/acre).

3.1.5 California Endangered Species Act

3.1.5.1 Background

CESA (Cal. Fish and Game Code 2050 et seq) is administered by the CDFG as the trustee for fish and wildlife resources in the State of California. CESA authorizes the California Fish and Game Commission to establish a list of endangered and threatened species, and states that "no person shall...take...any species...that the commission determines to be an endangered species or a threatened species … except as otherwise provided in this chapter, the Native Plant Protection Act … or the Calfiornia Desert Native Plants Act." (Section 2080.) The State may designate plant species as rare, pursuant to the California Native Plant Protection Act, which has the same protection status as threatened or endangered species. That Act, however, allows those undertaking activities described in Section 1913, subdivision (a) and (b), to change the land use when they have been notified a rare or endangered plant is present as long as they give 10 days notice to CDFG to allow for salvaging the plant.

3.1.5.2 Listed Species

Species listed as threatened or endangered by CDFG are identified in Table 3-5.

Table 3-5
Species Listed by CDFG as Threatened or Endangered

SPECIES	STATUS	DATE LISTED
Bald eagle (*Haliaeetus leucocephalus*)	Endangered Endangered (Rev.)	June 27, 1971 October 2, 1980
Desert tortoise (*Gopherus agassizii*)	Threatened	August 3, 1989
Inyo California towhee (*Pipilo crissalis eremophilus*)	Endangered	October 2, 1980
Least Bell's vireo (*Vireo bellii pusillus*)	Endangered	October 2, 1980
Mohave ground squirrel (*Spermophilus mohavensis*)	Threatened	June 27, 1971
Mojave tarplant (*Hemizonia [= Deinandra] mohavensis*)	Endangered	August 1981
Mojave tui chub (*Gila bicolor mohavensis*)	Endangered	June 27, 1971
Red rock tarplant (*Hemizonia Deinandra] arida*)	Rare	July 1982
Southwestern willow flycatcher (*Empidonax traillii extimus*)	Endangered	January 2, 1991
Swainson's hawk (*Buteo swainsoni*)	Threatened	April 17, 1983
Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)	Threatened Endangered	June 27, 1971 March 26, 1988

3.1.5.3 Incidental Take Permit

Section 2081(b) of CESA authorizes the CDFG to allow, by permit, the take of an endangered, threatened or candidate species. Such a "Section 2081 permit" may be issued only if the following permit issuance criteria are met:

(1) The take is *incidental to an otherwise lawful activity*.
(2) The impacts of the authorized take shall be *minimized and fully mitigated*. The measures

> required to meet this obligation shall be *roughly proportional* in extent to the impact of the authorized taking on the species. Where various measures are available to meet this obligation, the measures required shall *maintain the applicant's objectives to the greatest extent practicable*. All required measures shall be capable of successful implementation. For purposes of this section only, impacts of taking include all impacts on the species that result from any act that would cause the proposed taking.
> (3) The permit is consistent with any regulations adopted pursuant to Sections 2112 and 2114.
> (4) The applicant shall ensure *adequate funding* to implement the measures required by paragraph (2), and for monitoring compliance with, and effectiveness of, those measures. [CESA Section 2081(b), emphasis added.]

CESA further requires that no incidental take permit may be issued if issuance of the permit would jeopardize the continued existence of the species, a determination that CDFG must make based on the best scientific and other information that is reasonably available. This must include consideration of the species' capability to survive and reproduce in light of known population trends, known threats to the species, and reasonably foreseeable impacts on the species from other related projects and activities.

The Section 2081 permit applies only to CESA. It does not excuse an applicant from obtaining a FESA Section 10(a) permit, issued by USFWS for species listed as threatened or endangered by the United States (see Section 3.1.4.5, above).

3.1.6 Acquiring Incidental Take Permits: Procedures and Costs

Several steps are currently necessary to determine whether Section 10(a) and Section 2081 incidental take permits are needed. This section reviews those procedures, and the costs associated with them. The permit procedures for the desert tortoise are used as a representative example of how the process works.

Overview: The project proponent's first step is to perform a tortoise "presence-absence" survey. This is usually done with the assistance of a trained consultant. If no tortoises are found, the developer can proceed with development. If tortoise sign is found, the developer must first obtain Section 10(a) and Section 2081 permits. The USFWS's regulations do not specify a time frame for issuing Section 10(a) permits, so a permit may take a year or more to process and issue. Section 2081 permits may require between six months and a year to obtain. A permit typically will require the permittee to: (1) mitigate with land purchase, (2) employ an authorized biologist to conduct a "clearance survey" and to monitor construction, and (3) provide endowment funds to CDFG.

Presence and Absence Survey Costs: Tortoise surveys are performed at about 4 acres/hour, for between $35 and $125 per hour, so that a presence-absence survey on 40 acres would cost between $350 and $1,250, depending on the consultant. When costs are included for travel, mileage, per diem, report writing and overhead, the final report for that 40-acre site may run between $500 and $5,000. If no tortoise sign is found, there are rarely other costs relative to threatened and endangered species, although Streambed Alteration Agreements, mitigation to avoid nesting birds and native plant salvage are occasionally separate permitting issues. If tortoise sign is found, the proponent must secure State and federal incidental take permits.

Obtaining an Incidental Take Permit: Information on the nine Section 10(a) permits issued for the desert tortoise in the planning area is available. These include the following projects: (1) California City Prison, (2) Cushenbury Sand and Gravel Mine, (3) High Desert Power Project, (4) Kern County Waste Management Project, (5) Miller Church Sites, (6) Statewide Electrified Fence Project, (7) Sunland Communities, (8) U.S. Borax Mine Expansion, and (9) Wildwash Sand & Gravel Mine. The Table 3-6 summarizes some of the pertinent aspects of eight of these projects; no information was available for the electrified fence project. Appendix G identifies the sources of the information displayed in this table.

Table 3-6
Section 10(a) Permits Previously Issued In Planning Area
As Of November 2002

PROJECT NAME	ACRES & LOCATION	DATE AND TIME FOR ISSUANCE	REPORT COSTS	COMPENSATION RATIO & COST	TORTOISES "TAKEN"
California City Prison	70 acres, Calif.City	1997, 6 to 9 months	Unknown	1:1 @ $1,600,000	None taken between 1998 and 1999, when completed
Cushenbury Sand and Gravel	115 acres, S Lucerne Valley	1993-4, 3-4 years	$7,500	1:1 @ $103,500 - $115,000	None; only +/- 15 acres developed, but habitat marginal, few expected
High Desert Power Project	175 acres, N Adelanto	1999, 3 years	$70,000	1:1, $900,000	None; tortoises were handled on the Section 7 portion of this project, but not on the 10a portion
Kern County Waste Management	40 acres Rosamond 20 acres Boron 121 acres Ridgecrest	1997, 5 years	Unknown	3:1, Unknown Cost	None; no tortoises have been handled or accidentally killed
Miller Church Sites	5 acres, Yucca Valley	1993, 18 months	$3,500	1:1 @ $9,000	None; only tortoise scat found at construction
Sunland Communities	160 acres, Victorville	1994, 3 years	$7,500	2:1 @ $220,000	None; project not developed as of 2002
U.S. Borax Mine Expansion	1,940 acres, Boron	1996, +/- 2 years	$250,000 including other docs	1:1 @ $969,900	None; 10 authorized, but none taken as of 2002
Wildwash Gravel Pit	35 acres, N of Victorville	1995, 11 months	$6,200	1:1 @ Unknown cost	None; only tortoise scat found at construction
Total: 8 Projects	2,647 acres	6 months – 5 years avg = 3 years	$3,500-$250,000	1:1 up to 3:1	No tortoise handled or accidentally killed on any project

Compensation Cost, in the 5th column, includes both land acquisition costs and endowment funds that were reported by the main information sources for each project

To obtain a Section 10(a) permit, the project proponent must submit a permit application, habitat conservation plan, environmental assessment or impact statement, and implementation agreement to the USFWS. The CDFG's Section 2081 permit application is very similar including sections identifying the applicant, listing species to be covered, project description and location, listed species to be taken, impact analysis, jeopardy analysis, mitigation and minimization measures, monitoring and reporting program, funding, and certification. A consultant is generally enlisted to draft these documents, which may cost from several thousand dollars to hundreds of thousands of dollars, depending on the complexity of the project. Costs of most small and larger projects range from $5,000 to $65,000.

Drafting the HCP and supporting documents is a small percentage of the cost; mitigation and compensation are the major expenses. For example, it cost about $3,500 in 1993 to draft the HCP and associated documents for a five-acre church site in Yucca Valley (Tierra Madre Consultants, Inc. 1993) and $6,200 in 1995 for the documents associated with a 35-acre gravel mine site north of Victorville (Circle Mountain Biological Consultants 1995). U.S. Borax indicated that the Section 10(a) permit issued around 1996 for expansion of the U.S. Borax mine site at Boron allowed for expansion into 1,940 acres of marginal tortoise habitat. The approximate cost to draft the environmental documents, including documents relative to their Conditional Use Permit and SMARA requirements, was about $250,000.

Months or even years may pass between submittal of a permit application and issuance of the permit. For example, it took 18 months for the 1993 Section 10(a) permit to be issued for a five-acre impact by two church sites (Tierra Madre Consultants, Inc. 1993) and three years for the 1994 Sunland Communities Section 10(a) permit to be issued (Tierra Madre Consultants, Inc. 1994). By the time this latter permit was issued, there was no market for this proposed tract home development; despite the expenditure of $220,000 in mitigation funds, this residential project remains undeveloped as of 2002. Given backlogs, current workloads, and limited USFWS staffing, a one to two-year waiting period is likely for issuance of a new Section 10(a) permit. CDFG may issue a Section 2081 permit in six months to a year.

Clearance Survey: Section 10(a) and Section 2081 permits invariably require clearance surveys, where tortoises are moved out of harm's way immediately prior to mechanical vegetation removal. It takes a biologist about twice as long to clear the site of tortoises as to conduct a presence-absence survey. Thus the cost of a clearance survey is about $1,000 to $10,000 (compared to $500 to $5,000).

Mitigation/Compensation: Incidental take permits invariably have a land compensation component. Depending on the location of the land and size of the parcel, compensation land may cost between $500 and $1,300/acre, although the prison constructed in the northeastern portion of California City cost $5,000/acre (J. Stewart, pers. comm.) In addition, CDFG typically requires an endowment. Most Section 10(a) permits have been compensated at 1:1, although Kern County Waste Management reported a compensation ratio of 3:1 for three landfills. Sunland Communities purchased 320 acres of compensation land to partially offset the impacts to tortoises on the 160-acre parcel that was to be developed. The total mitigation cost was $220,000 for the 160-acre site, or about $1,375/acre (excluding document preparation or monitoring costs). The mitigation cost for California's first tortoise Section 10(a) permit was $9,000 for 5 acres, or about $1,800/acre (Tierra Madre Consultants, Inc. 1993). Dave Weiss (pers. comm. Nov 2002) indicated that U.S. Borax was required to compensate at a 1:1 ratio, replacing 1,940 acres of marginal habitat with more suitable, manageable habitats. Dennis Boyle, also of U.S. Borax, indicated that the compensation costs were $969,900, or about $500/acre. This cost did not include on-site compliance, biological monitoring, and other associated costs.

Monitoring: Monitoring is often the most expensive of all environmental protection costs. Depending on the project, an authorized biologist may remain on site for an hour, as a small parcel is brushed, or up to months and years, as an interstate pipeline is installed or a highway widened. Revegetation costs may also be very high, requiring the purchase of native seeds and the labor of contractors to broadcast and imprint the seed and to salvage cactus and yuccas. At present (2002), most monitoring costs are about $35 to $50/hour. Monitoring costs, then, may run from several hundred dollars for a day, up to $1,400 to $2,000 per week, $5,600 to $8,000 per month and, for long-term monitoring, $291,200 to $416,000 annually.

Consultation and Incidental Take Permit Processes Compared: The comparisons given above for eight Section 10(a) permits indicates that tortoises were neither handled (harassment take) nor accidentally killed (mortality take) during construction and operation on the sites. Given the delay between the presence-absence tortoise survey and permit issuance, which was found to be about three years, it is likely that tortoises were extirpated in the interim. Alternatively, tortoises still occur in adjacent areas but were not directly affected by the project. As such, under current management compensation fees ranging from $500 to $5000/acre have served to compensate lost habitat where tortoises have not been directly affected, and has done little to minimize the indirect impacts that are likely to affect the tortoises in adjacent areas.

Most of the existing development outside city limits occurs on private lands, where there have been only nine Section 10(a) permits issued in California in the past 12 years. For example, of the 47,538 structures digitized from 1995 aerials, 46,150 (97%) were found on private lands. Most of this land occurs within the known historic range of the tortoise, and much of it (i.e., 3,079,403 acres (4,812 mi^2) of Survey Areas on public and private lands outside DWMAs) is expected to continue to support tortoises. In fact, of 78 tortoise surveys performed in urbanizing areas, LaRue reported finding tortoise sign on 25 sites, or about a third (32%) of those surveyed. For comparison, only 1,388 of the 47,538 structures (3%) in 1995 occurred on public lands administered by the BLM, where there had been 50 biological opinions issued between 1990 and 1995.

In addition to BLM's 50 biological opinions, 42 were issued to the Department of Defense, NASA, and U.S. Army Corps of Engineers (Circle Mountain Biological Consultants 1996, LaRue and Dougherty 1998). During the same period, only three or four Section 10(a) permits were issued for private development. Relative private and public land acreage cannot explain this disparity between Section 7 and Section 10(a) authorizations. The disparity appears to be due to several other factors (see also discussion in LaRue 1994):

- Many private land developers have opted to abandon projects when faced with mitigation costs and permitting delays. Examples include the 160-acre Carl Jones site in Apple Valley, and the 52-mile long Copper Mountain Mesa pipeline, which was originally intended to be 102 miles long (LaRue, pers. comm.). The costs of permitting under Section 7 are invariably less because a consultant is not needed to draft the HCP, environmental assessment or impact statement, implementing agreement and other associated documents. In addition, Section 7 implementing regulations require the issuance of the biological opinion in 135 days, while no such time limit exists for processing a Section 10(a) permit.

- Because the Section 7 is cheaper and faster, project proponents select that alternative whenever federal lands, even a very small proportion of project lands, or other regulatory oversight is involved. This results in projects that cover large acreages of private lands and small to moderate amounts of federal lands being addressed under Section 7 procedures.

- The federal standard of "may affect" has a lower threshold for authorization than the standards for a private Section 10(a) permit. For Section 7, both direct and indirect impacts "may affect" tortoises, whereas authorization under Section 10(a) is required only if actual take will result.

- When construction or land disturbance on private land involves only ministerial permits, or is not subject to the jurisdiction's permitting authority (e.g.. agriculture), it is typically left to the project proponent and the USFWS to determine whether take will occur. Such projects, however, are individually minor enough that the wildlife agencies seldom become involved and the project proponent does not normally conduct biota surveys. The high costs involved with the Section 10(a) permitting process may contribute to the reluctance of local jurisdictions to incorporate additional oversight of ministerial projects into their zoning ordinances relative to biological resources.

Many of the differences between Section 7 and Section 10(a) permitting have been described and compared in LaRue (1994). In general, relative to Section 10(a), Section 7 has the following advantages for project proponents: (a) it is quicker; (b) it facilitates project completion; (c) it avoids interagency conflicts; and, (d) it is less expensive. Cumulatively, each of these factors has contributed, along with those given above, to more Section 7 authorizations as compared to Section 10(a). Recommendations were made to the USFWS in 1994 to expedite the issuance of small-project Section 10(a) permits: (a) provide meaningful direction to the private development community; (b) set a time limit for Section 10(a) permit review; (c) localize the review process; (d) ensure consistency; and, (e) ensure continuity (LaRue 1994).

One problem associated with development of private lands is the inconsistent approaches among the many different jurisdictions. In one city, for example, the planning department requires tortoise surveys on single-family residential lots, which are covered by ministerial permits in other jurisdictions and therefore not subject to biota surveys. Some cities have identified areas where tortoise surveys are no longer being performed. There are several examples where the biological consultant erroneously concluded that a few tortoise scat and/or old burrows did not constitute occupied habitat. Based upon the consultant's conclusion, jurisdictions did not require applicants to obtain necessary permits and, in several cases, tortoises were later found on site. There are numerous cases where the project proponent completed a focused tortoise survey, and the jurisdiction (or regulatory agency) later required the applicant to conduct additional focused surveys for burrowing owl, LeConte's thrasher, and Mohave fringe-toed lizards.

There are significant problems associated with the current regulatory process for determining and mitigating take of the Mohave ground squirrel. Fewer than a dozen biologists are permitted by CDFG to trap the MGS, and the trapping period (generally between March and May) is so restrictive that project delays are common. In fact, most project proponents forego trapping and assume presence, obtain Section 2081 permits, and complete appropriate mitigation and compensation (CDFG, pers. comm. 21 August 2002).

The cost of trapping studies depends on the size of the project area, and can exceed the cost to mitigate and compensate impacts. If the trapping result is negative, there is no need for issuance of a 2081 permit; if positive, the proponent would need the take permit and pay associated costs. Although this has resulted in CDFG having to issue more permits, including projects where the MGS may not occur, there have not been substantial delays, as current staff are issuing permits in a timely manner (i.e., within a few months).

3.2 AIR QUALITY, SOILS AND WATER

3.2.1 Climate and Air Quality

The climate and air quality of the western Mojave Desert is discussed briefly below. A more detailed discussion can be found in Appendix H.

3.2.1.1 Climate

The West Mojave planning area is a desert characterized by hot summer temperatures (average daily highs above 100 degrees Fahrenheit) and low annual precipitation (approximately 5 inches). Snow can occur during the winter. Probably more important than the averages is the extreme variability in the weather. Daily temperatures ranges of 40 degrees can occur. Precipitation extremes are also common: variations of 80% in annual precipitation can occur. Summer thunderstorms can drop more precipitation on a site in one event than the mean precipitation for that location. High winds can occur. Peak wind velocities above 50 miles per hour (MPH) are not uncommon and winds of 100 MPH occur every year.

Temperature: Extremes of temperature are common in the planning area. Below or near freezing temperatures are common at most weather stations. Seven of thirteen stations have average low temperatures below freezing in December and January. El Mirage has the lowest average temperatures in the planning area and Twentynine Palms has the highest average temperatures. Average daily temperature variation is 29 degrees for all stations. Seasonal variations are high. Ridgecrest, for example, has recorded highs of 118 degrees and lows of 0 degrees since the middle 1980s.

Precipitation: Deserts are noted for their low rainfall and the Mojave Desert is no exception. The blocking nature of the mountains on the western and southern boundaries of the desert results in a rain shadow on the desert side of the mountains where precipitation is far less than on the coastal side. Weather patterns and their resulting precipitation follow the seasonal wind patterns and changes. This results in winter precipitation generally arriving from the southwest and spreading eastward across the desert. Winter precipitation volumes normally are the highest in the western Mojave Desert and diminish toward the east. This is illustrated in the mean precipitation for western locations such as Lancaster and Mojave (over 6 inches) and eastern cities such as Twentynine Palms (4 inches) (see also precipitation tables in Appendix H).

All of the weather stations in the planning area receive some of their precipitation as snow. The total average snowfall ranges from under one inch in Trona to over three inches at Haiwee reservoir and Lancaster.

A cyclic weather phenomenon called the El Nino brings increased precipitation to portions of the eastern Pacific Rim. This is especially true in the western Mojave Desert. Weather Bureau records indicate that there have been 23 El Nino years since 1931. These 23 years represent approximately 1/3 of the years, but on the western edge of the desert, those years account for 65% of the precipitation. This east to west variability is also reflected in the pronounced east to west difference in the influence of the El Nino years. In Twentynine Palms, for example, only 44% of the precipitation falls in El Nino years as opposed to 65% along the western edge of the desert.

During the summer the western edge of the Mojave Desert is heavily influenced by the dry southwest airflows resulting in typically very dry weather. The influence of the southwest winds diminishes toward the eastern Mojave Desert. This results in a more continental influence and its resulting monsoonal weather patterns. This is illustrated by comparing Randsburg (along the western edge of the planning area) with Needles (in the eastern Mojave). In Randsburg, only two percent of the Julys and six percent of Augusts have more than 1 inch of precipitation. By comparison, in Needles, more than 1 inch of monthly precipitation falls in sixteen percent of the Julys and twenty-seven percent of the Augusts. Even sites within the eastern portion of the planning area (such as Twentynine Palms) average more precipitation in July and August than they do in January and February.

The consistent occurrence of two wet seasons in the eastern portion of the planning area is reflected in the vegetation. There is a distinction between plants having most of their photosynthetic activity during the late spring and summer (warm season plants) and plants having most photosynthetic activity during the winter (cool season plants). The vegetation in the eastern Mojave Desert includes warm season plants such as Mojave yucca (*Yucca schidigrea*), galleta grass species (*Pleuraphis spp.*) and others in addition to the cool season plants. The warm season plants are absent from the western edge of the desert. The break between the warm season area and the cool season area follows a north south line along the Mojave River and just west of Harper Dry Lake. The cool season areas are the Indian Wells and Searles Valleys south through the Antelope Valley and east to near the Mojave River.

Extreme variability is another characteristic of the precipitation. Some locations such as Mojave have a mean precipitation of 6.06 inches and a standard deviation of 4.04 inches. This means that the normal precipitation ranges from a low of 2.02 inches to 10.10 inches. This is an 80 % variation in precipitation volumes.

Drought: When precipitation is below average, it is considered a drought. The Palmer Drought Severity Index (PDSI) has become the semi-official drought index. The PDSI uses precipitation and other moisture data to develop a dryness index. The index uses "0" as normal for a site and negative numbers to indicate severity of a drought and positive numbers to indicate excess moisture. A minus 4 is considered a severe drought. The NOAA Drought Information Center has used instrument data in combination with tree ring data to construct a table of PDSI for the period of 1700 to 1995. One of the sites for which data has been collected is just east of Barstow. Using that data in combination with other PDSI data, Figure 3-2 was constructed to illustrate the long-term trend for this site. In addition a moving average was added to the chart to show the trend. From the chart it is apparent that a drought occurred from 1951 through 1979 that was the longest duration the current time and is the most severe in the last 300 years (see Appendix H).

3.2.1.2 Air Quality

Air Basins: The West Mojave planning area falls within portions of three different air basins. These are the Great Basin Valleys Air Basin (GBVAB), the Mojave Desert Air Basin (MDAB) and the Salton Sea Air Basin (SSAB) (see Map 3-2). The Great Basin Valleys Air Basin includes all of Inyo and Mono Counties. The Mojave Desert Air Basin includes the desert portions of Kern, Los Angeles, San Bernardino Counties and the Paloverde Valley portion of Riverside County. The Salton Sea Air Basin includes the Coachella Valley portion of Riverside County and Imperial County. The United States Environmental Protection Agency (USEPA) breaks these air basins into planning areas based upon various emission problem or watershed boundaries.

Air Quality Management Districts: The management/enforcement of the air quality standards falls on several different jurisdictions. The USEPA has the primary responsibilities under the Federal Clean Air Act (CAA). The USEPA had transferred a number of responsibilities to the states and in most cases, regional air quality management districts. The West Mojave planning area falls within five different regional air districts (see Map 3-3):

- The desert portions of San Bernardino County and the Palo Verde Valley portion of Eastern Riverside County are within the Mojave Desert Air Quality Management District (MDAQMD).
- Inyo and Mono Counties are within the Great Basin Unified Air Pollution Control District (GBUAPCD).
- The Antelope Valley Portion of Los Angeles County is in the Antelope Valley Air Quality Management District (AVAQMD).
- The Coachella Valley portion of Riverside County is within the South Coast Air Quality Management District (SCAQMD).
- The eastern (desert) portion of Kern County is within the Kern County Air Pollution Control District (KCAPCD).

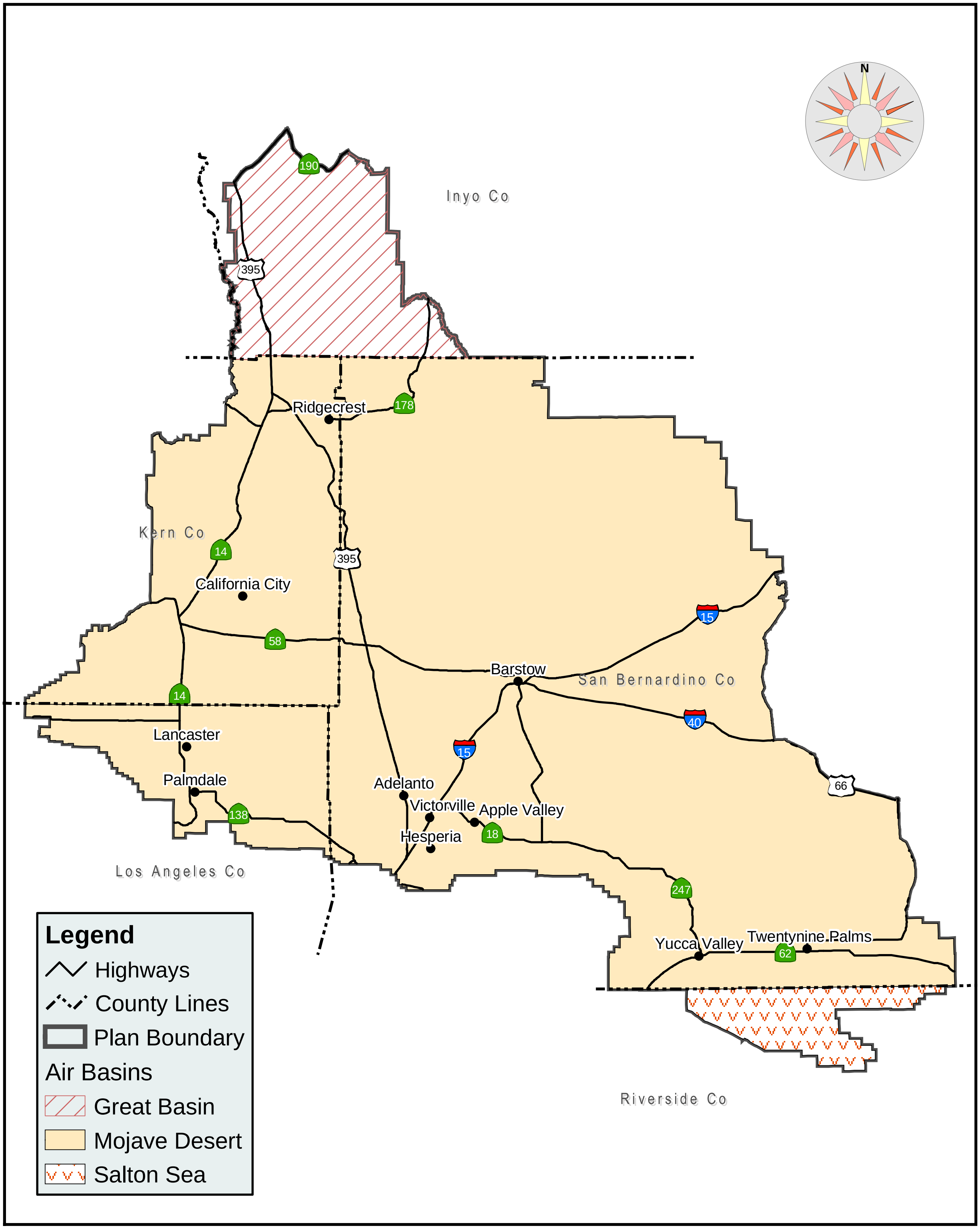
Air Quality Overview: Much of the time, air quality in the western Mojave Desert is good. There are, however, times that localized areas have not met air quality standards due to locally generated and/or transported in pollutants. The entire planning area has been classified as non-attainment areas for PM_{10} (Map 3-4), ozone (Map 3-5), sulfates and/or hydrogen sulfide under the state and/or national standards (see Table 3-7). In addition, there is concern for visibility reducing particles and PM10 precursor emissions including oxides of nitrogen (NOx), oxides of sulfur (SOx) and reactive organic gases (ROG). The designation of attainment/non-attainment areas for the new PM2.5 and 8-hour ozone standards will occur in the future. The state Air Resources Board has recommended to the USEPA that most of the Mojave Desert Air Basin be classified as federal ozone nonattainment areas under the new 8 hour standard.

The CAA and the California Clean Air Act contain the primary provisions relating to air quality. Among the most important provisions are the sections relating to the establishment of the National and State Ambient Air Quality Standards, nonattainment areas, the development of state implementation plans (SIP), prevention of significant deterioration (PSD), air toxics and federal conformity. The USEPA and the California Air Resources Control Board have issued rules to implement the federal and California Clean Air Acts.

The federal and state Clean Air Acts regulate certain forms of pollution under three main categories. These are criteria pollutants, air toxics and global warming and ozone-depleting gases. There is also regulation of a more general category of emissions that reduce visibility. These come under the titles of regional haze, prevention of significant deterioration (PSD) and visibility reducing particulates (VRP).

The definitions used in determining whether or not an area meets air quality standards are found in the federal and state Clean Air Acts and their associated ambient air quality standards. Criteria pollutants are defined as those pollutants for which the federal and state government have established ambient air quality standards, or criteria, for concentrations in order to protect public health. Under the federal Clean Air Act, the USEPA has established National Ambient Air Quality Standards (NAAQS) for seven criteria pollutants (ozone, respirable particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), carbon monoxide, nitrogen dioxide, lead and sulfur dioxide). These standards are used to classify all areas as to whether they are in attainment, in nonattainment or are unclassified for any of the NAAQS. California has established California Ambient Air Quality Standards for the same federal criteria pollutants plus an additional 3 pollutants (visibility reducing particulates, sulfates and hydrogen sulfide). The Ambient Air Quality Standards for California are stricter than the federal standards (see Table 3-7).

Air Basins



West Mojave Plan FEIR/S
Map 3-2

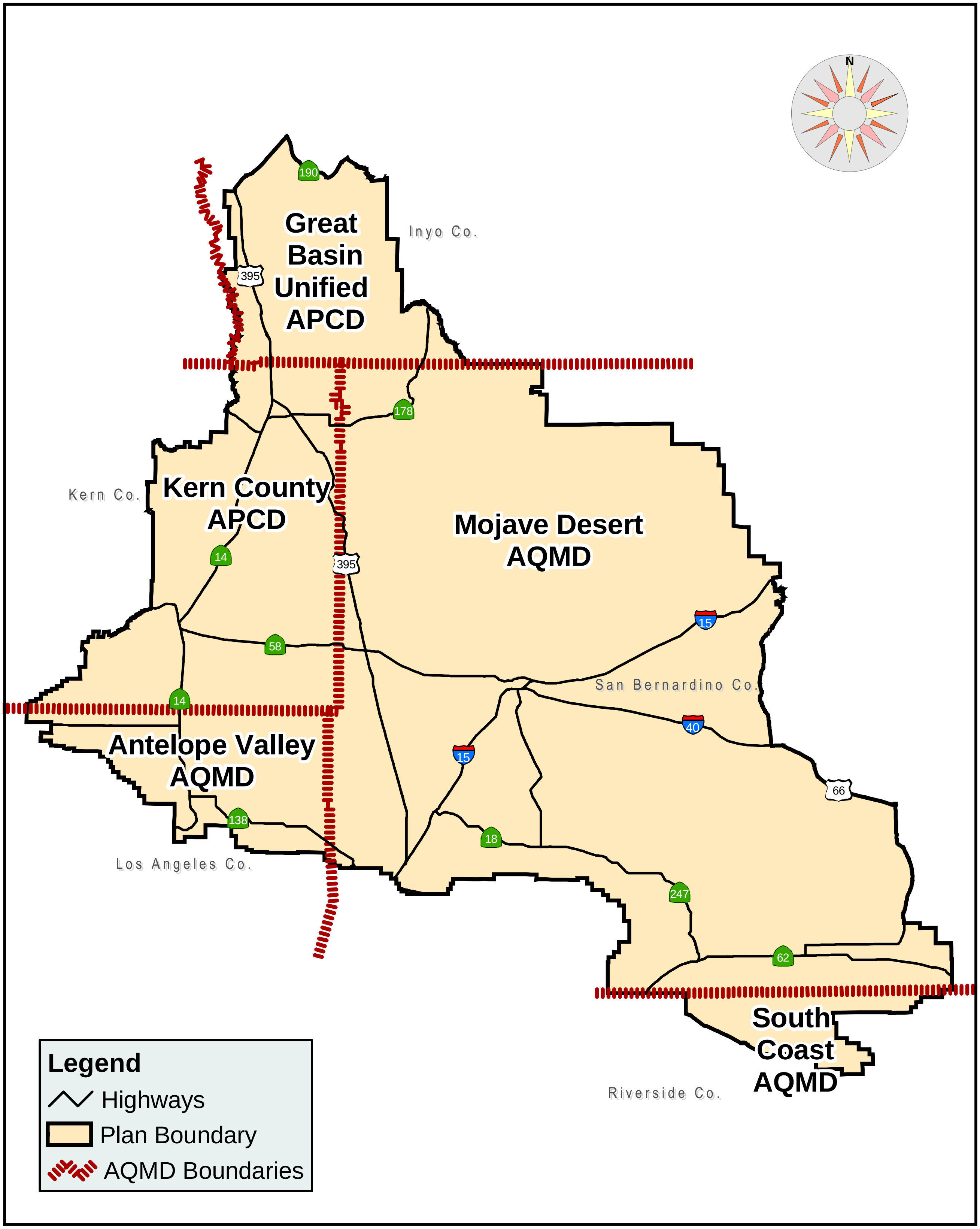
Scale: 1 : 1,750,000

0 10 20 30 Km

0 10 20 30 Miles

10/12/04

Air Quality Management Districts



West Mojave Plan FEIR/S
Map 3-3

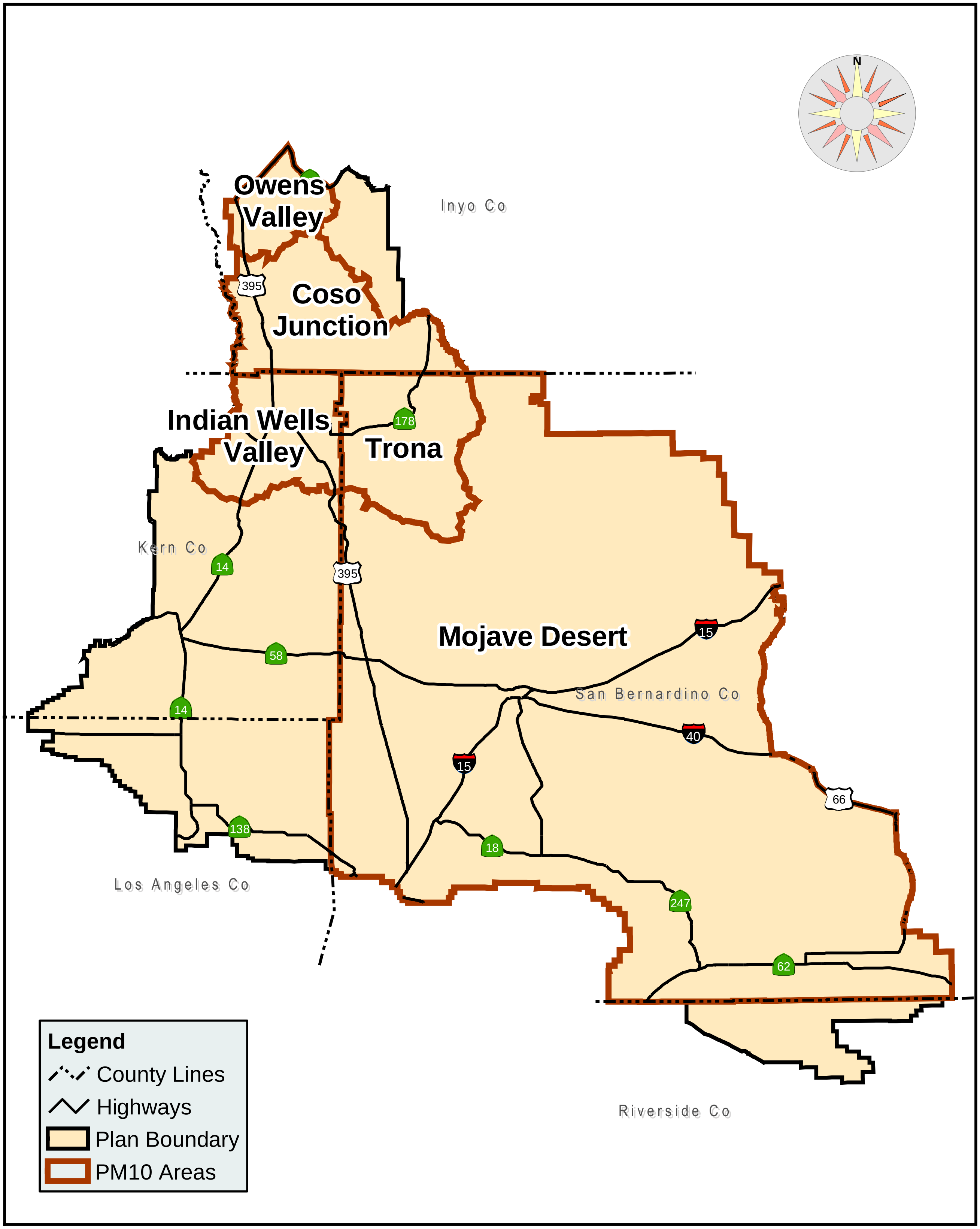
10/12/04

Scale: 1 : 1,750,000

0 10 20 30 Km

0 10 20 30 Miles

Federal PM10 Planning Areas

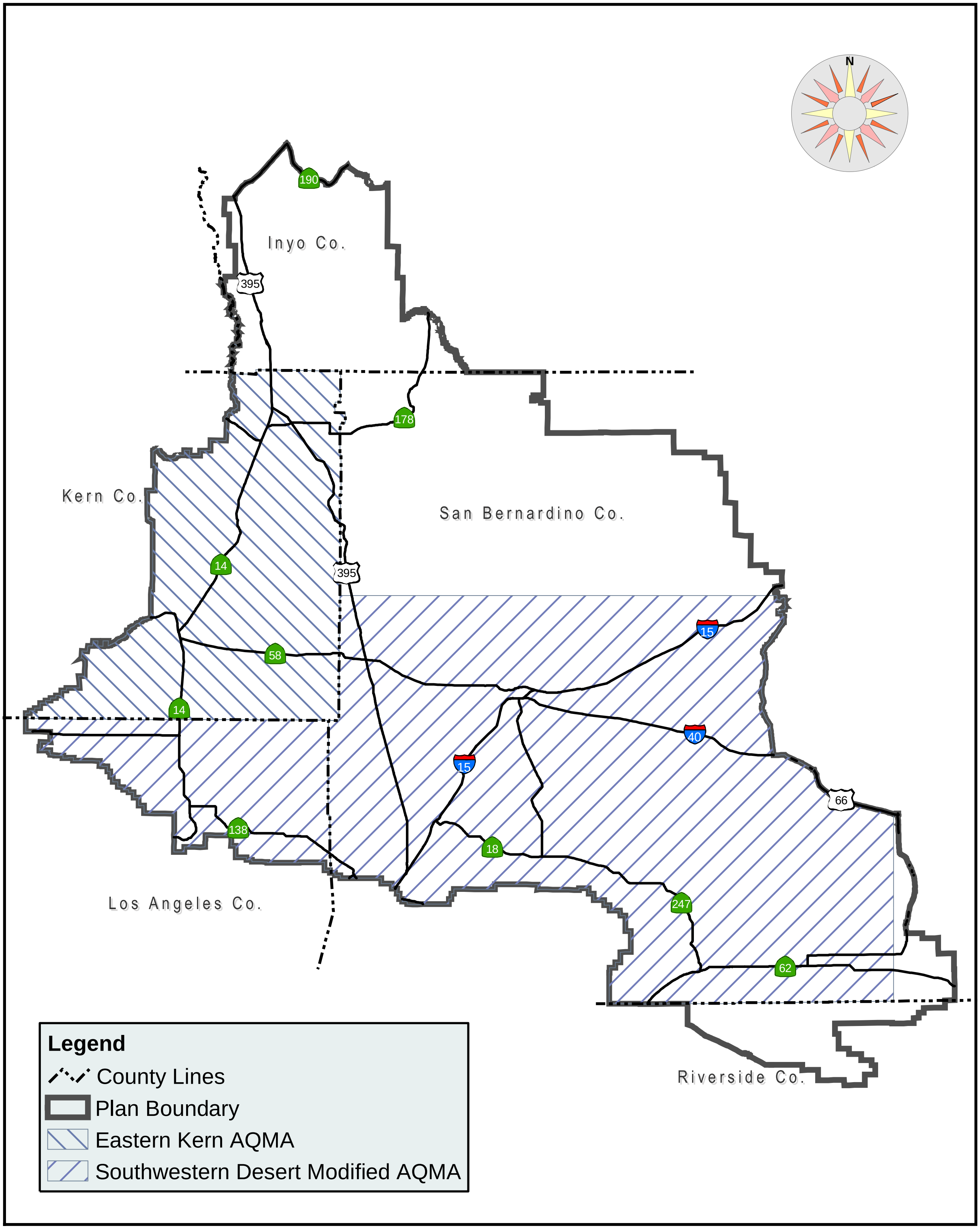


West Mojave Plan FEIR/S
Map 3-4

10/13/04

Scale: 1 : 1,750,000
0 10 20 30 Km
0 10 20 30 Miles

Federal Ozone Planning Areas



West Mojave Plan FEIS
Map 3-5

Scale: 1 : 1,750,000

0 10 20 30 Km

0 10 20 30 Miles

7/29/04

Table 3-7
Ambient Air Quality Standards

POLLUTANT	AVERAGING TIME	CALIFORNIA STANDARDS	FEDERAL STANDARDS	
			Primary	Secondary
Ozone (O_3)	1 hour	0.09 ppm (180 $\mu g/m^3$)	0.12 ppm (235 $\mu g/m^3$)	Same as Primary Standard
	8 hour			
Respirable Particulate Matter (PM_{10})	Annual geometric Mean	20 $\mu g/m^3$	——	Same as Primary Standard
	24 hour	50 $\mu g/m^3$	150 $\mu g/m^3$	
	Annual Arithmetic Mean	——	50 $\mu g/m^3$	
Fine Particulate Matter ($PM_{2.5}$)	24 hour		65 $\mu g/m^3$	Same as Primary Standard
	Annual Arithmetic Mean	12 $\mu g/m^3$	15 $\mu g/m^3$	
Carbon Monoxide (CO)	8 hour			None
	1 hour			
	8 hour (Lake Tahoe)			
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	——	0.053 ppm (12 $\mu g/m^3$)	Same as Primary Standard
	1 hour	0.25 ppm (470 $\mu g/m^3$)		
Lead	30 day average	1.5 $\mu g/m^3$		
	Calendar quarter		1.5 $\mu g/m^3$	Same as Primary Standard
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean		0.030 ppm (80 $\mu g/m^3$)	
	24 hour	0.04 ppm (105 $\mu g/m^3$)	0.14 ppm (365 $\mu g/m^3$)	
	3 hour			0.5 ppm (1300 $\mu g/m^3$)
	1 hour	0.25 ppm (655 $\mu g/m^3$)		
Visibility Reducing Particulates	8 hour (10 am to 6 pm, PST)	In sufficient amount to produce an extinction coefficient of 0.23 per kilometer ___ visibility of ten miles or more (0.07_30 miles or more for Lake Tahoe) due to particles when the relative humidity is less than 70 percent. Method: ARB method V (8/18/89)	No Federal Standards	
Sulfates	24 hour	25 $\mu g/m^3$		
Hydrogen Sulfide	1 hour	0.03 ppm (42 $\mu g/m^3$)		

Areas that are classified as nonattainment by the USEPA are required to prepare and implement a State Implementation Plan (SIP) that identifies and quantifies sources of emissions and presents a comprehensive strategy to control and reduce locally generated emissions.

Air quality quality degradation and exceedances of the ambient air quality standards have been episodal in nature. High PM_{10} concentrations that violated the National Ambient Air Quality Standards peaked in the early 1990s. In recent years, good monitoring data has led to reclassification requests to the USEPA for most of the region. Implementation of dust control rules and controls on a number of critical sources have led to the reductions in PM_{10} concentrations. The numbers of violations of the NAAQS for ozone has declined, but violations have continued. Rules establishing controles for Ozone precursor enissions have been implemented, but overwhelming transport of pollutants from the South Coast Air Basin and the San Joaquin Valley Air Basin continually impacts the desert. Both the South Coast and the San Joaquin Valley are both classified as serious nonattainment areas (see Table 3-8). The Southern California Association of Governments (SCAG) has projected population growth and future pollution levels through 2025. The projections are for a population increase of over 50% a reduction in ozone precursor levels over 30% and increases in PM_{10} levels of nearly 30%.

Table 3-8
Attainment Status By Air Basin and Air District

AIR BASIN	AIR QUALITY DISTRICT	POLLUTANT	PLANNING AREA NAME	FEDERAL DESIGNATION	STATE DESIGNATION
GBVAB	GBUAPCD	PM_{10} (federal)	Owens Valley	Severe Nonattainment	
		PM_{10} (federal)	Rose Valley	Moderate Nonattainment	
		PM_{10} (state)	GBVAB		Nonattainment
		All others	GBVAB	Unclassified/ attainment	Attainment
MDAB	KCAPCD	PM_{10} (federal)	Indian Wells Valley	Moderate Nonattainment	
		PM_{10} (state)	MDAB		Nonattainment
		Ozone (federal)	Eastern Kern County*	Nonattainment	
		Ozone (state)	MDAB		Nonattainment
		All others	Eastern Kern County	Unclassified/ attainment	Attainment
	MDAQMD	PM_{10} (federal)	Searles Valley	Moderate Nonattainment	
		PM_{10} (federal)	Mojave Desert	Moderate Nonattainment	
		Ozone (federal)	Mojave Desert modified	Nonattainment	
		Ozone (state)	San Bernardino Co. Wide		Nonattainment
		Sulfates (state)	Searles Valley		Nonattainment
		Hydrogen Sulfide (state)	Searles Valley		Nonattainment
		PM_{10} (state)	San Bernardino Co. wide		Nonattainment
		All others	MDAQMD Wide	Unclassified/ attainment	Nonattainment
	AVAQMD	Ozone (federal)	Mojave Desert modified	Nonattainment	
		PM_{10} (state)	Basin wide		Nonattainment
		Ozone (state)	Basin wide		Nonattainment
		All Others	Basin wide	Unclassified/ attainment	Nonattainment

AIR BASIN	AIR QUALITY DISTRICT	POLLUTANT	PLANNING AREA NAME	FEDERAL DESIGNATION	STATE DESIGNATION
SSAB	SCAQMD	Ozone (federal)	Coachella Valley	Nonattainment	
		PM_{10} (state)	SSAB		Nonattainment
		Ozone (state)	SSAB		Nonattainment
		All others	SSAB	Unclassified/ attainment	Attainment

Respirable Particulate Matter (PM_{10}): PM_{10} is the most important air pollutant in the West Mojave planning area. PM_{10} in the atmosphere can be caused by both environmental factors and human activities. Human activities that contribute to the PM_{10} emissions include combustion sources such as stack emissions, diesel exhaust and smoke from prescribed fire and wild fire, fugitive dust sources such as construction and demolition activities, off highway vehicle (OHV) travel, unpaved public roads and parking lots, industrial activities, OHV open areas and military activities. The combustion sources tend to produce smaller particulates (less than 5 μ) while fugitive sources tend to produce larger particulates (larger than 5μ).

One of the reasons for the concern with PM_{10} emissions is their adverse effect on human health. All of the PM_{10} particles are considered respirable particulate because they can be inhaled into the nose, throat and/or lungs. The fine PM_{10} particles are the largest threat to health because they tend to deposit in the air sacks. In addition, many of the fine particles are from precursor emissions many of which are toxic or carcinogenic. Fugitive dust is primarily coarse particulate that is not as likely to contain toxic materials. The newest studies report that a 100μ gm/m^3 increase in daily PM_{10} concentrations would increase mortality by 10%. The state PM_{10} standards are considered public health goals. The USEPA has established new NAAQS standards for $PM_{2.5}$ emissions. These standards are for particles at or below 2.5 μ. These fine particles have been implicated as an increased health risk and consist of chemical compounds that mostly result from combustion processes.

Nearly all of the planning area has recorded concentrations of PM_{10} in excess of the national and state ambient air quality standards for PM_{10} emissions. The USEPA has classified five areas within the West Mojave planning area as federal PM_{10} nonattainment areas. The five current federal nonattainment areas are: the Owens Valley PM_{10} Planning Area, the Coso Junction PM_{10} Planning Area, the Indian Wells Valley PM_{10} Planning Area, the Trona PM_{10} Planning Area and the San Bernardino County PM_{10} Area. The Owens Valley planning area is one of five serious federal nonattainment PM_{10} planning areas in the nation. Southeast Kern County and northeastern Los Angeles County (Antelope Valley) are currently listed as unclassified by the USEPA.

The Antelope Valley Area has recorded levels above the national threshold, but has not been classified as nonattainment by USEPA yet. The air quality management district has been working directly with USEPA to successfully reduce the PM_{10} concentration levels and avoid having the Antelope Valley Planning Area designated as a federal nonattainment area. Part of this effort is through the adoption and implementation of rules to control fugitive dust that constituted a majority of the total PM_{10} emissions.

The original Searles Valley PM_{10}Planning Area abutted the Owens Valley PM_{10} Planning area on the north and included Rose Valley, Indian Wells Valley and Searles Valley. The USEPA recently broke the federal nonattainment area into three separate nonattainment areas based upon the county lines. These three new federal nonattainment areas are called the Coso Junction, the Indian Wells Valley and the Trona PM_{10} nonattainment areas. Emission sources identified in the SIP include construction/demolition, public unpaved roads, paved roads, mobile sources, unplanned fires, public disturbed areas, fuel combustion (cogeneration boiler and stacks at Trona), North American fugitive, industrial roads, agricultural fields and military activities. In 1990 there was an estimated 3.98, 4.76 and 9.18 tons/day of PM_{10} emissions in the Coso Junction, Indian Wells Valley and Trona nonattainment areas respectively. Activities on BLM lands are estimated to contribute 8% of the total PM_{10} emissions in the Trona nonattainment area. The primary source of BLM emissions is OHV activity and unpaved road travel in the Spangler Hills Open Area and surrounding areas. The Trona PM_{10} SIP targets the BLM emissions for a 20% reduction. The Kern County APCD and Mojave Desert AQMD have developed rules to implement the SIPs. Current monitoring data has not indicated any recent exceedances of the NAAQS in any of these three nonattainment areas. As a result, documents have been prepared for the three areas requesting a reclassification from nonattainment to maintenance.

The USEPA classified the San Bernardino County desert area as a PM_{10} non-attainment area on January 20, 1994. The Mojave Desert AQMD prepared a "Particulate Matter (PM_{10}) Control Strategy Plan" and submitted it to the state for inclusion into the state SIP. The USEPA recently disapproved the plan and returned it to the Mojave Desert AQMD for revision. Emission sources identified in the plan include construction/ demolition, city and county unpaved roads travel and wind erosion, paved road entrainment, city and county disturbed areas and industrial activities. Four BLM open areas (Stoddard Valley, Johnson Valley, Rasor, and El Mirage) are within the nonattainment area and the West Mojave planning area. The draft plan called for BLM to prepare a Dust Control Plan for activities within the core problem area of the nonattainment area. At the present time there is no approved SIP for the nonattainment area to guide actions there. Currently new rules are being drafted to come into compliance with USEPA. These new rules will likely require BLM to prepare dust control plans for the entire federal nonattainment area.

Ozone: The South Coast Air Basin and the San Joaquin Valley Air Basin are both federal non-attainment areas for ozone. Much of the ozone pollution in the desert has been transported in from those two areas. Several studies have looked at the ozone pollution problem in the desert areas. The studies show that the peak ozone levels do not correspond to the peak temperatures and ultraviolet (UV) levels, but are occurring much later in the day indicating that the ozone is being formed down wind and is being transported into the area from its source by the prevailing winds. Heavily impacted areas by ozone transport include the Victorville-Barstow area, the Antelope Valley and Joshua Tree National Park. The NAAQS for ozone do not recognize transport as a factor in their standards. As a result, the USEPA has classified most of the Salton Sea and Mojave Desert Air Basins as non-attainment areas for ozone. The only exception is a strip along the northern and eastern edge of San Bernardino County that is excluded from the federal ozone nonattainment area. The state standards allow for the subtraction of transported ozone in determining attainment / nonattainment areas. However, the state standards are much tighter. As a result, all of the West Mojave planning area outside of Inyo County is in nonattainment of the California ozone standards.

Conformity Determination: The classification of an area as a federal nonattainment area brings an additional requirement for federal agencies. Section 176(c) of the Clean Air Act (CAA), as amended (42 U.S.C. 7401 et seq.), and regulations under 40 CFR, part 93,subpart W, state that "no department, agency or instrumentality of the Federal Government shall engage in, support in any way or provide financial assistance for, license or permit, or approve any activity which does not conform to an applicable implementation plan." This means that under the CAA 176(c) and 40 CFR, part 93, subpart W, (conformity rules), federal agencies must make a determination that proposed actions in federal nonattainment areas conform to the applicable implementation plan (SIP) before the action is taken.

3.2.2 Geology and Soils

Regional Geologic Overview: The West Mojave planning area is mainly in the Mojave Desert geomorphic province (Mojave Block) of California. However, it takes in a substantial portion of the Basin and Range province to the north, and overlaps with the Sierra Nevada province to the northwest and the Transverse Ranges to the southwest. The geomorphology of the province is dominated by broad basins filled with sediments shed from adjacent highlands and mountains, burying the old topography. The region may once have been a part of the Basin and Range province until separated from it when the Garlock Fault became active in the early to mid Tertiary Period. Although Paleozoic and early Mesozoic-age rocks are present, the desert itself is a Cenozoic-age feature, formed as early as the Oligocene, presumably from movements related to the San Andreas and the Garlock faults. During the Pleistocene (Ice Ages) this region of California had a cooler average temperature and lesser evaporation rate than present. While never a wet climate, it nonetheless once contained many small lakes, and the Mojave River still had water in it. The majority of the surface in the planning area is covered by Quaternary-age unconsolidated surficial deposits. These deposits are comprised primarily of alluvial, fluvial, lacustrine and aeolian derived material.

The *Mojave Desert province* can be divided into western and eastern portions. The "western Mojave" lies within the wedge where the San Andreas and Garlock faults meet, and is bounded on the east by the Mojave River and a line running northwest from Barstow to Red Rock Canyon (Sharp, p.28). Uplifts along the two major fault systems include the El Paso Mountains along the northwest side of the Garlock fault, and the San Gabriel and San Bernardino Mountains along the southwest side of the San Andreas fault. The western Mojave consists of great expanses of gentle surface with isolated knobs, buttes, ridges, and local hilly areas. The "eastern Mojave" consists of alluvial filled basins (downthrown blocks) between mountain ranges separated by normal faults, but includes thrust-fault-emplacement basin and ranges. In the southern half, the mountain ranges have a general northwest trend, whereas in the northern half these features have no consistent orientation. For more detailed geology, the reader is referred to the Geologic Map of California, San Bernardino Sheet (Bortugno and Spittler, 1986).

Basin and Range province is a geologic term referring to the structure of this province's valleys (basins) and mountains (ranges) aligned roughly north to south. The province extends from the Wasatch Mountains of Utah to the eastern side of the Sierra Nevada in California. This part of North America is a region where the earth's crust has been extended (stretched thinner) from east to west, and mountain ranges in this province are generally bounded by faults associated with this thinning and stretching. The planning area north of the El Paso Mountains and east of U.S. Highway 395 is part of the Basin and Range province. This includes the Coso Mountains, the Argus Mountains, the Slate Mountains and their adjacent valleys. The Coso Mountains consist largely of igneous/volcanic rocks, including pumice, basalts, cinders and obsidian, and is tectonically active with frequent, very small earthquakes. The Argus and Slate Ranges are mostly igneous/granitic rocks, with some volcanic rocks and exposures of limestone formations. Searles Valley is well known for its deposits of sodium minerals, which are the remnant of a Pleistocene lake that once formed the terminus of the Owens River.

The *Transverse Range* region is one of eastward-trending mountain ranges and valleys. It is so named because this trend is transverse to the generally northwesterly trending features of southern California. The lowlands of the San Bernardino and Los Angeles plains of the eastern part of this region rise abruptly northward to the San Bernardino and San Gabriel Mountains, respectively, two of the most rugged and highest ranges in southern California. The rock units of the Transverse Range region may be divided into two main groups, (a) crystalline basement complex composed of metamorphic and plutonic rocks, and (b) sedimentary and volcanic rocks. The metamorphic rocks of this complex include, from oldest to youngest, Precambrian gneiss and marble, Precambrian Pelona Schist, Paleozoic metasedimentary rocks hosting gold mineralization, and marble/limestone used for cement, specialty fillers and extenders, chicken grit, and aggregate, and Pre-Cenozoic rock (Dibblee, 1970, p. 36).

In summary, the age of the rocks within the area ranges from Precambrian to Recent and is characterized by great diversity including marine and nonmarine sedimentary rocks and a wide variety of volcanic and intrusive igneous rocks. The geologic events include those related to plate collision, metamorphism, and faulting. This diversity of rock types, long history of igneous activity, and the complex structural and geomorphic development of the region have resulted in the formation of a wide variety of mineral assemblages and their concentration to form the ore deposits that are present in the study area. Characteristics of favorable geologic environments, or "permissive terrains", for the potential occurrence of mineral resources in the area are discussed in an unpublished U.S. Geological Survey report (Tosdal, et al, 1992, 21 p.).

Soils: Soil surveys have been completed by the United States Department of Agriculture, Natural Resource Conservation Service on less than half of the planning area. Published soil surveys include the Southeastern Part of Kern County, San Bernardino County Mojave River Area, Fort Irwin National Training Center, Edwards Air Force Base, and the Marine Corps Air Ground Combat Center Twentynine Palms. Because of the large area within the Mojave Planning Area and incomplete soil survey coverage, general soil information will be used and extrapolated in areas that are not covered by soil surveys for this analysis.

The general soil information and maps provide information on broad areas that have a distinctive pattern of soils, relief, and drainage. Many different kinds of soil have formed thought the planning area. Ongoing soil forming processes are evident in desert soils. Several processes are involved in the formation of soils. These processes are the accumulation of organic matter, the formation of and translocation of silicate clay, the accumulation of silica and lime, weathering of parent material and the formation of desert pavement. General soils are divided into mapping units that represents a unique natural landscape. Typically a mapping unit consists of one or more major soils or miscellaneous areas and some minor soils. The soils in any map unit may differ from place to place in slope, depth, drainage, and other characteristics that affect management. The general map units have been grouped for broad interpretive purposes.

The San Bernardino County Mojave River Area is comprised of three groups:

- Soils of the Mojave Desert on flood plains, alluvial fans, and terraces and in basins are dominantly in low positions in arid areas and are comprised of seven map units. Slopes are nearly level to strongly sloping. Elevation ranges from about 1,700 feet to about 4,000 feet. Soils are very deep and shallow and are moderately to somewhat excessively drained. The surface layer is sand, loamy sand, loamy fine sand, sandy loam, loam, and clay. Soils are used mainly for irrigated crops, homesite development, wildlife habitat, and livestock grazing.

- Soils of the Mojave Desert on old terraces that have a desert pavement and on alluvial fans, foothills, and mountains are dominantly on scattered rock desert uplands on adjacent high terraces in the central and northern parts of the survey area. Elevation ranges from about 1,800 to 4,500 feet. The four mapping units in this group range in depth form very shallow, shallow, moderately deep to very deep. They are well drained with the surface layer is gravelly sand, very gravelly sand, cobbly sandy loam, gravelly sandy loam, sandy loam, and loam. Soils are used for wildlife habitat, grazing, and a source of gravel.

- Soils of the San Gabriel and San Bernardino Mountains on mountains, foothills, alluvial fans, and terraces are gently sloping to steep and range in elevation from 3,400 to 6,200 feet. The four mapping units in this group are moderately deep and very deep and are well drained and somewhat excessively drained. The surface layer is sandy loam and loamy fine sand. Soils are used for wildlife habitat, grazing, homesite development, irrigated crops and pasturelands.

The Southeastern Part of Kern County Soil Survey is comprised of two groups within the West Mojave Planning Area:

- Soils of the Mojave Desert occupy several different landscapes that range from low basins to high mountain ridges. Seven mapping units are incorporated into this group. Soils are nearly level to very steep ranging from 2,000 to 4,200 feet elevation and are shallow, deep, or very deep, and well to excessively drained. Surface layers range from sand to clay loam. Soils are used for rangeland, recreation, or wildlife habitat. Where water is available, a few of the soils are used for cropland or homesites.

Soil limitations include a high susceptibility to soid blowing of the sand surface layers and excessive erosion hazard due to slopes with inadequate plant cover.

- Soils on the Eastern Foot Slopes of the Sierra Nevada and Tehachapi Mountains are dominantly strongly to very steep with some soils in mountain valleys that are nearly level. Elevation ranges from 2,000 to 8,000 feet. Soils are shallow to very deep and well drained to somewhat excessively drained. Surface layers are gravelly sandy loam, gravelly loam, or sandy loam. Four mapping units in this group are used for woodland, rangeland, recreation, and wildlife habitat. Those soils in the more level mountain valleys are used irrigated cropland.

The Fort Irwin National Training Center Soil Survey is comprised of five groups and can be used to extrapolate information about soils for surrounding areas:

- Soils in basins and on basin rims are comprised of one mapping unit occupying alluvial flats, fan skirts, and playas landforms. Soils are somewhat poorly to excessively drained, very deep soils formed in mixed alluvial or lacustrine materials on nearly level to gentle slopes. Surface layers are sandy loam to fine sandy loam, coarse sand, loamy coarse sand, silty clay loam, silty clay or clay.

- Soils on alluvial fans and alluvial fan remnants are comprised of four mapping units. The surface layer is composed of sand, coarse sand, loamy coarse sand, sandy loam, loamy sand, loam, or silt loam. Soils are well drained and very shallow to very deep and are gently to strongly sloping.

- Soils on granitic pediments and inselbergs are comprised of one mapping unit somewhat excessively drained, very shallow over granitic bedrock soils formed in residuum. The surface layer is coarse sandy loam or sandy loam. Slopes are undulating to steep.

- Soils on fan remnants, erosion remnants, and ballenas are comprised of two mapping units. Landforms are undulating to hilly with very shallow to very deep, well-drained soils. Surface layers are loamy coarse sand, coarse sandy loam, sandy loam, or loam.

- Soils on hills and mountains are comprised of three mapping units. Landforms are rolling to very steep with very shallow to shallow well drained to excessively well-drained soils. Surface layers are sand clay loam, sandy loam, or loam.

Soils within the training center are used for military exercises and wildlife habitat. Soils outside the training center are most likely used for grazing, wildlife habitat, recreation, and homesite development.

The Marine Corps Ground Combat Center Twentynine Palms are comprised of three groups:

- Soils on bolson floors are comprised of one mapping unit with very deep, clayey or coarse loamy, salt affected soils formed in lacustrine deposits. The landform setting is smooth lake plains and playas. Elevation ranges from 600 to 2,900 feet. Soils are somewhat poorly drained to well drained.

- Soils on fan piedmonts are comprised of five mapping units located on fan remnants, alluvial fans, and fan aprons. Soils are very shallow to very deep, well to excessively drained. Elevation is 1,800 to 4,000 feet with gently to moderately steep slopes. Surface layers are coarse sand, loamy sand, loamy fine sand, loamy coarse sand, sandy loam, extremely gravelly sand, very gravelly sandy loam.

- Soils on mountains and hills are comprised of three mapping units. Soils are very shallow to bedrock, well drained to somewhat excessively drained. Elevation is 800 to 4,600 feet with moderate to steep slopes. Surface layers are extremely gravelly sand, very cobbly fine sandy loam, very gravelly loamy coarse sand, or extremely stony sandy loam.

The Edwards Air Force Base Soil Survey is comprised of three basic geomorphic units. These include the hills and rock pediments are scattered throughout the area and are surrounded by fan piedmonts and sand sheets, which for the most part internally drained to the alluvial flats and ultimately to the playas.

- The hills and rock piedments tend to be moderately steep, to steep. Soils are shallow or moderately deep; therefore, water runoff is somewhat high.

- The fan piedmonts and sand sheets are rarely flooded during thunderstorms when water moved from the surrounding hills and rock pediments down slope toward to the playas. Drainage of soils on these landscapes is somewhat to excessively drained.

- The alluvial flats between the playas and surrounding fan piedmonts and sand sheets are subject to occasional flooding as water moves down slope to the playas. Ponding occasionally occurs on the alluvial flats. Soils on the alluvial flats are dominantly moderately well drained.

Soil blowing is a major hazard in the survey area; especially those with coarse-textured surface layer of loamy fine sand and sand and are susceptible to soil blowing. Wind erosion occurs whenever bare, loose, dry soil is exposed to wind of sufficient speed to cause soil movement. The process will be accelerated whenever the natural equilibrium between climate, soils, and vegetation is disturbed. Wind speeds as low as 13 to 15 miles per hour one foot above the soil surface can initiate soil blowing under highly erodible conditions. The mere passing of vehicle tires or tracks over an erodible surface provides sufficient energy to initiate soil blowing. As medium size particles are detached they may enter the wind stream momentarily but then are pulled back by gravity. This causes them to impact other particles and set them into motions and can account to 50 to 80 percent of total soil movement. (NRCS, 29Palms)

3.2.3 Water

The planning area is one of the most arid areas in the nation; the potential annual water loss through evapotranspiration exceeds the annual water gain from precipitation even at the higher elevations. On the valley floor the evaporation exceeds the precipitation by at least 25:1.

Prominent mountain ranges have an important influence on moisture distribution within the plan area. As moist, unstable air masses from the Pacific Ocean rise up the windward slopes of the Southern Sierra, San Gabriel and San Bernardino Mountains, the air is cooled and water vapor condenses and falls as rain, snow, or ice. When these air masses descend the leeward slopes, they become warmer and more stable and thus retain most of the remaining moisture. Consequently, precipitation amounts are much greater on the windward slopes of the mountain ranges, whereas arid conditions prevail leeward of the mountains. All of the study area, except the Kelso Creek area is on the leeward side of these major mountain areas.

Because of the arid nature of the study area, water supply is the single most important resource. The presence or absence of a reliable supply of good quality water has determined the pattern of agricultural, urban, and industrial development and will continue to do so. Groundwater withdrawn by wells furnishes nearly all of the developed water. Many of the State or federally listed or BLM sensitive species, discussed elsewhere in this document, are dependent upon the presence of groundwater either directly or for their habitat.

Surface water is very scarce. Streams that originate high in surrounding mountains on the west and south may have perennial flow in the higher altitudes; at the lower altitudes and throughout the area virtually no water exists in streambeds or riverbeds, except locally after infrequent, heavy cloudbursts. The playas may be covered by water from the runoff for as long as two months a year. There are many locally important springs and seeps most of which are associated with the mountain areas.

3.2.3.1 Groundwater Basins

The water yielding materials in this area are in valleys and basins, and consist primarily of unconsolidated alluvial-fan deposits, although locally flood plain and lacustrine (lake) beach deposits may yield water to wells. The valleys and basins are internally drained; that is, water from precipitation that falls within the basin recharges the aquifer and ultimately discharges to the land surface and evaporates within the basin. Ground water is generally under unconfined, or water table, conditions at the margins of the basins, but as the unconsolidated deposits become finer grained toward the centers of the basins, the water becomes confined. Rarely, basins might be hydraulically connected in the subsurface by fractures or solution openings in the underlying bedrock. These multiple-basin systems end in a terminal discharge area, or sink, from which water leaves the flow system by evaporation. Along the Mojave River several basins or valleys are hydraulically connected, and ground water flows between the basins, mostly through the unconsolidated alluvial stream/flood plain sediments of the present and ancient river.

The most permeable basin-fill deposits are present in the depressions created by late Tertiary to Quaternary block faulting and can be classified by origin as alluvial fan, lake-bed, or fluvial deposits. At the time of major deposition, the climate was more humid than the modern climate. Lakes were in most of the closed basins and streams connected some basins. In general, the coarsest materials (gravel and boulders) were deposited near the mountains, and the finer materials (sand and clay) were deposited in the central parts of the basins or in the lakes. Occasionally, torrential storms produced heavy runoff that carried coarse material farther from the mountains and resulted in the interfingering of fine and coarse material. The distribution of sediment size is directly associated with distance from the mountains. Three geomorphic landforms can be distinguished on the basis of the gradient of the land surface. Alluvial fans border the mountains and have the steepest surface slopes and the coarsest sediments. Basin ward, individual alluvial fans flatten, coalesce, and form alluvial slopes of moderate gradient. A playa, or dry lakebed with a flat surface, is present in the lowest part of the basin, usually at or near the center of the basin, and most of the sediment deposited on the playa is fine grained. Parts of some of the valleys become encrusted to a depth of several inches with alkaline salts, which cover the surface as a powdery crust.

The most important hydrologic features of the basins are the alluvial fans. The basin fill receives most of its recharge through the coarse sediments deposited in the fans. These highly permeable deposits allow rapid infiltration of water as streams exit the valleys that are cut into the almost impermeable rock of the surrounding mountains and flow out onto the surface of the fans. The coarse and fine sediments within the alluvial fans are complexly interbedded and interfingered because the position of the distributary streams that transported the sediments continually shift across the top of the fan as a result of scour or deposition of sediment during floods.

Material deposited in perennial lakes or in playas consists principally of clay and silt with minor amounts of sand and is present in all of the basins. In most places, these sediments include some salts deposited by evaporation. The clay and salt deposits merge laterally into coarse-grained deposits of the alluvial slopes. Minor well-sorted beach sand and gravel are in the subsurface near the shores of once perennial lakes.

Except for the Mojave River that has a complex surface water/groundwater relationship, water is not discharged to major surface water bodies but is lost solely through evapotranspiration. Each basin has essentially the same characteristics: the impermeable rocks of the mountain ranges serve as boundaries to the flow system, and the majority of the ground water flows through basin-fill deposits. Most recharge to the basin-fill deposits originates in the mountains as snowmelt, and, where the mountain streams emerge from bedrock channels, the water infiltrates into the alluvial fans and replenishes the basin-fill aquifer. Intense thunderstorms may provide some direct recharge to the basin-fill deposits, but, in most cases, any rainfall that infiltrates the soil is either immediately evaporated or taken up as soil moisture; little water percolates downward through the unsaturated zone to reach the water table in the valleys.

Antelope Valley: Antelope Valley, Calif., which is in the Southwest corner of the plan area, is an example of a single, undrained, closed basin. Antelope Valley occupies part of a structural depression that has been down faulted between the Garlock and the Cottonwood--

Rosamond Faults and the San Andreas Fault Zone.

Alluvium and interbedded lacustrine deposits of Quaternary age are the important aquifers within the closed basin and have accumulated to a thickness of as much as 1,600 feet. The alluvium is unconsolidated to moderately consolidated, poorly sorted gravel, sand, silt, and clay. Older units of the alluvium are more compact and consolidated, somewhat coarser grained, more weathered, and more poorly sorted than the younger units. The rate at which water moves through the alluvium (the hydraulic conductivity of the alluvium) decreases with increasing depth.

Two aquifers, which are separated by the lacustrine deposits, are in the alluvial material. The upper aquifer is the principal and most used aquifer and contains water under unconfined, or water table, conditions. Where the lower, or deep, aquifer underlies lacustrine deposits, it contains water under confined, or artesian, conditions. Elsewhere, unconfined conditions prevail.

The use of ground water for agriculture in Antelope Valley began about 1880, when wells were drilled near the center of the valley and yielded flowing water in quantities sufficient for irrigation. In 1891, more than 100 wells were in use, but most had stopped flowing. About 1915, intense use of ground water began when a large number of wells were drilled and equipped with pumps. The maximum rate of withdrawal of about 400,000 acre-feet per year is about 10 times the estimated annual recharge to the basin. Water removed from storage in the aquifers was a major part of the ground-water withdrawals, and severe water-level declines resulted. By about 1950, studies showed that ground-water withdrawals in the valley were greatly in excess of natural recharge and withdrawals were curtailed. The Antelope Valley-Eastern Kern Water District is still serviced by ground water.

Antelope Valley illustrates the potential for overdraft in the groundwater basins in the plan area.

Water Quality: Although there are vast quantities of water within the ground water basins, some of the water is of poor quality. The mineral quality of the ground water within the study area varies greatly. The geologic setting of the basins directly affects the degree of ground water mineralization. In general, basins near the source of recharge are less mineralized than those that are more distant.

Very short flow paths generally characterize small local flow systems, usually no more than a few miles in length. Springs connected to these systems are usually located in or near the mountains and have highly variable annual ranges in discharge which respond to the precipitation that year or a few years previous. Discharge waters have small concentrations of dissolved sodium plus potassium and chloride plus sulfate, large concentrations of tritium, and water temperatures that commonly approach average air temperatures.

Large local flow systems are characterized by interbasin flow or flow confined to one basin with longer flow paths. Springs connected to these systems have moderate concentrations of the major salts, no significant concentrations of tritium and water temperatures from 50 to 60 degrees Fahrenheit.

Surface water was and is the major transport agent of the rock material from the mountains to the alluvial fans to the valleys. The intense short duration storms result in rapid floodwaters that have the energy to transport rock material both in the water column and along the beds of the arroyos. Longer duration storms with less intensity will still have the energy to transport finer sediment materials. All ephemeral streams in this area will have naturally high sediment concentrations. Flows resulting from groundwater sources will have low sediment concentrations until the runoff water predominates the flow. Playa water will usually have a high concentration of very fine sediment mixed into the column by wind action and will have varying salt concentrations depending on the geology of the area.

3.2.3.2 Mojave River

The Mojave River originates near the southern boundary of the plan area. Major watersheds in San Bernardino or San Gabriel Mountains contribute to the streamflow in the area. Sheep Creek originates in the San Gabriel Mountains. The West fork of the Mojave River and Deep Creek originate in the San Bernardino Mountains and are the headwaters of the Mojave River.

The Cajon Fan is at the southern edge of the Mojave Desert, in the southwestern part of the study area. It is a broad surface of coalescing alluvial fans and terraces. Part of the Cajon Fan is called Baldy Mesa. The Cajon Fan formed in sediment eroded from the San Gabriel and San Bernardino Mountains. The fan extends form the base of the mountains for 10 to 15 miles to the Mojave River east of Hesperia to Adelanto and to Mirage Lake. The center part of the upper edge of the Cajon Fan no longer joins the mountains. Tectonic activity in the surrounding area and subsequent erosion have truncated the upper edge to form the Inface Bluffs. Broad washes of the desert, such as the OroGrande Wash, at one time drained large watersheds and are also truncated at the Inface Bluffs.

The Mojave River flows along the eastern edge of the Cajon Fan. The river originates where the West Fork of the Mojave River joins Deep Creek, and it flows northward and then eastward past Barstow. The flood plain of the Mojave River is 0.5 to 1 mile wide along most of the river. The soils on the flood plain are nearly level. In some places, such as at Upper Narrows where the river cuts through hard rock, there is no flood plain. East of Barstow, the flood plain and river terraces form the broad Mojave Valley.

The Mojave River has only 3 major tributaries within the desert – the Fremont Wash, Buckthorn Canyon, and Oro Grande Wash. These Tributaries flow only after intense storms.

The water-bearing alluvial deposits of the Mojave River are a major source of ground water in the study area. Hard rock formations along the river divide the coarse river deposits into numerous subsurface basins. Water from the river recharges these basins.

The above ground flow of the Mojave River is intermittent in most places. Along most of its course, water flows above ground only after storms. Perennial flows occur near Victorville, in the vicinity of Camp Cady and in Afton Canyon. In these places hard rock barriers force ground water to the surface. Other basins in the area from which considerable ground water is removed are in the area of Lucerne Valley, El Mirage, and Harper Lake.

The amount of water in the Mojave River varies greatly from year to year. As measured at the Forks, it has been more than 300,000 acre-feet one year and less than 10,000 acre-feet another.

The Mojave Water Agency was formed by an act of the State legislature in 1960 to find ways to supplement the natural water supply. The agency has contracts with the State of California that entitle the agency to purchase as much as 50,800 acre-feet of water per year from the California Water Project. The California Aqueduct delivers the water. Three turnouts for water delivery were constructed.

3.3 BIOLOGICAL RESOURCES

The California Desert Conservation Area was inventoried for its flora and fauna in the late 1970s by the BLM Desert Plan staff. A total of 1836 vascular plant species in 116 families and 635 species of vertebrate animals were recorded. The West Mojave planning area was not tabulated separately, but contains a high proportion of the total. The diversity reflects the varied topography and landforms within the planning area. Investigations of invertebrates, such as insects, mollusks and fairy shrimp have been completed for only a few groups, but show widespread endemism and specialization to unique substrates, host plants and water sources. Thousands of additional invertebrate species are present.

The western Mojave Desert historically contained the highest densities of the desert tortoise and the only known populations of the Mohave ground squirrel, the focal species of this Habitat Conservation Plan and CDCA Plan Amendment. It supports one of the largest populations of the prairie falcon. The region contains at least four endemic animals and thirteen endemic plants. A number of disjunct localities exist where plants and animals range into the planning area far from their primary distribution.

Many of the rare species of the western Mojave Desert are concentrated at special sites, where unique substrates, water sources, or topography are present. Several areas have high biodiversity because of location at the desert-mountain transition zone. In addition, the vast open space in much of the western Mojave Desert provides room for species to survive in the harsh desert climate.

The eastern and southern Sierra Nevada Mountains extend into the West Mojave and represent areas of very high biodiversity. In the east Sierra canyons, riparian habitat and springs attract large numbers of nesting and migratory birds, including several target species. These canyons are known to harbor rare salamanders, endemic springsnails, and a high diversity of rodents and reptiles. The Owens Peak area stands out as a region of high endemism for plants. In the southern Sierras, the Middle Knob region is outstanding for its intact assemblage of predators and the Kelso Valley harbors endemic plants, and includes an important migratory flyway for turkey vultures, Cooper’s hawks, and Swainson’s hawks.

A relatively small number of introduced wildlife species (excluding insects) is found in the western Mojave Desert. A few of these species have very significant effects on the native environment, particularly feral burros, bullfrogs, and brown-headed cowbirds. In addition, feral dogs are a problem in several areas, where they may kill desert tortoises or Mohave ground squirrels. Although common ravens are "natural" predator of tortoises, population levels apparently increased by as much as 1,500% between 1968 and 1988 (BLM 1990). Increased raven populations are likely associated with new water sources (cattle troughs, agricultural fields, wildlife guzzlers), increased scavenging potential (refuse in urbanizing areas, animal carcasses found along highways), and more nesting substrates (transmission lines and a multitude of human structures like houses, abandoned vehicles). The number of invasive introduced plants is higher and in many respects more of a threat to the natural ecosystem. Riparian pests include tamarisk, Russian olive and *Phragmites*, which consume a lot of water and crowd out native willows and cottonwoods. Weedy annuals such as storksbill, several species of brome grass, Sahara mustard and others compete with native wildflowers and provide a nutritionally deficient food plant for the desert tortoise.

Following is a description of the natural communities of the western Mojave Desert, and the life history and status of the desert tortoise, Mohave ground squirrel, and other species addressed by the West Mojave Plan. The summaries of species other than the tortoise and ground squirrel are based on the Species Accounts prepared for this planning effort in 1998 plus subsequent information. Copies of the full species accounts are included on the compact disk attached to this final EIR/S.

3.3.1 Natural Communities

The western Mojave Desert comprises a distinct area of the Mojave Desert biome, where the flora and fauna has adapted to the local conditions and formed distinct natural communities, including species found nowhere else (i.e. "endemics"). It also incorporates the transitional ecotones from the Sierra Nevada, Tehachapi, San Gabriel, and San Bernardino Mountains and the Colorado Desert.

The predominant aspect of the West Mojave is a flat, sparsely vegetated region interspersed with mountain ranges and dry lakes. The area is a part of the high desert, large portions of which lie at elevations between 2500 and 4000 feet. Freezing temperatures are limited to a few days in the winter in most of the region, while summer temperatures regularly exceed 100 degrees Fahrenheit. The characteristic creosote bush and saltbush plant communities are covered with wildflowers in years of above-normal winter rainfall, and up to 90% of the flora are composed of annual plants.

The central and southeastern regions reflect the Pleistocene history of the Mojave River, which flows from the San Bernardino Mountains north to Barstow, then east to Silver Lake and the Mojave National Preserve. In the last Ice Age, extending from 30,000 to 10,000 years ago, the Mojave River discharged to the south into the Mojave Valley, Lavic Lake, Dale Lake, Bristol Lake, and other playas extending nearly to the Colorado River. The river (now dry) and playas supported species of invertebrates, fish, amphibians, and pond turtles, and attracted migratory birds dependent on water. Remnant populations of these animals are still present today, and comprise many of the rare species in need of conservation. The ancient river and lakes formed sandy beaches and prevailing winds carried the finer particles to the east, forming hummocks and dunes. These blowsand areas now support unique species of insects, plants, and reptiles, including the Mojave fringe-toed lizard, whose entire distribution can be traced to the former path of the ancient Mojave River and Amargosa River.

On the west, the western Mojave Desert exhibits communities reflecting the increased aridity on the east side of the Sierra Nevada and Tehachapi mountains, and the northern flank of the San Gabriel and San Bernardino mountains. These ranges capture rainfall from storms originating in the Pacific Ocean and falling over the coast and inland valleys and prevent all but the larger storms from reaching the desert. The western Mojave Desert is not influenced to a great extent by the summer thundershowers characteristic of the Sonoran Desert and the East Mojave, though infrequent episodic events from summer storms can cause flash flooding, playa filling, and redirection of stream flow on alluvial fans.

The mountainous transition zones within the western Mojave Desert extend downhill from open forests of blue pine in the north and pinon pine in the south, through a chaparral zone, to a diverse mixed woody scrub vegetation at lower elevations, often characterized by dense stands of Joshua trees. Of interest is the presence of many unique plant species in the southern Sierra Nevada, and Central Valley elements of the flora and fauna found in the Antelope Valley, Middle Knob, and Kelso Valley along the west-central boundary of the planning area.

The north and northeastern bioregions exhibit many elements of the Great Basin biome. Sagebrush scrub and plants associated with both the Owens Valley and Death Valley ecosystems extend into the planning area to a limited extent.

A limited expression of the Colorado Desert flora and fauna also extends into the West Mojave east of Twentynine Palms and south through Joshua Tree National Park and Morongo Valley and is prevalent in the proposed Pinto Mountain DWMA. However, the characteristic smoke trees, ocotillos and barrel cacti associated with the low desert are restricted to small regions along the West Mojave boundary.

Noteworthy landforms within the West Mojave include five major lava flows at Pisgah, Amboy, the Rodman Mountains, Black Mountain and Fossil Falls, the largest and flattest playa in the world at Rogers Lake, and sand dunes in several places, including Olancha, along the Mojave River, in the Mojave Valley, and at Twentynine Palms. Deposits of limestone and carbonate rock in the San Bernardino Mountains support several unique species of plants and some of the largest mines in the country. Alkaline seeps, springs, and meadows associated with the San Andreas and other earthquake faults are havens for unusual plants and invertebrates, while occasional fresh water springs support a variety of wildlife, including bighorn sheep.

Thirty-two distinct plant communities are found within the western Mojave Desert. By far the most common communities are creosote bush scrub and saltbush scrub, which occupy 75% of the natural lands. Mojave mixed woody scrub accounts for 13% of the native vegetation. The remaining 29 plant communities are found in isolated areas with unique conditions, such as freshwater or alkali wetlands, or occur along the south and west edges of the planning area, in the desert-mountain transition. Table 3-9 lists the natural communities and the acreage of each. Map 3-23, found on the attached CD-ROM, illustrates the location of the natural communities. Localized areas having special biological importance are described below.

Alkali wetland sites: CDFG and USFWS botanists, the California Native Plant Society and noted conservation biologist Reed Noss reviewed and discussed conservation plant species in the West Mojave during the planning process. Protection of alkali wetland communities, including seeps, springs, meadows and playas was identified as a top priority. These sites are very likely to result in new discoveries of disjunct and endemic species of rare plants. In addition, the unique conditions that support these communities, including faultline alterations to the water table, hot springs, and local enclosed basins require consideration of protection of ecosystem processes.

Two specific locations, Rabbit Springs and Paradise Springs, are relatively undisturbed alkali seeps known to support many rare species and represent botanical hotspots. Harper Dry Lake is a unique alkali marsh, a community found at few other sites in the Mojave Desert, most notably in Death Valley. Other sites along the Helendale Fault, San Andreas Fault and bordering major desert playas have high potential for discovery of unique elements of the desert flora.

Landforms and Soils: Some distinctive landforms and soil types found within the West Mojave that provide habitat for unique or listed species include:

- Sand dunes at Saddleback Butte, Dale Lake, Mojave River, Mojave Valley, Twentynine Palms, El Mirage, Alvord Mountain, and Pisgah Crater form habitat for Mojave fringe-toed lizard (Dean, 1978).
- Sand sheets at the east edges of playas constitutes habitat for desert cymopterus east of Cuddeback, Rogers, and Harper dry lakes.
- The remnant Pleistocene glacial surfaces at Middle Knob, termed “pebble plains” provide habitat for the extremely rare Kern buckwheat.
- Carbonate rock and soil on the north face of the San Bernardino Mountains provides habitat for several endemic plants, including four listed species.

Table 3-9
Natural Communities and Ownership In The West Mojave (In Acres)

COMMUNITY	PRIVATE	NPS	BLM	STATE	MILITARY	TOTAL
Alkali seep	59	0	0	0	0	59
Alkali sink scrub	5,429	0	5,408	59	16,019	26,915
Big sagebrush scrub	706	0	8,571	144	106,267	114,982
Blackbush scrub	37,576	59,183	35,312	531	73,042	205,644
Chamise chaparral	26,426	0	2,167	0	53	28,646
Cottonwood-willow riparian forest	5,350	0	6,183	0	0	11,533
Creosote bush scrub	1,554,339	48,765	2,350,012	72,304	1,658,226	5,683,646
Desert holly scrub	1,935	0	19,781	0	4,843	26,559
Desert wash scrub	14,067	468	19,894	66	47,182	81,677
Fan palm oasis	33	0	0	0	0	33
Freshwater seep	388	0	0	0	0	388
Gray pine-oak woodland	2,576	0	102	0	0	2,678
Greasewood scrub	706	0	2,780	175	0	3,661
Hopsage scrub	0	0	0	0	5,503	5,503
Interior live oak woodland	556	0	33	0	0	589
Jeffrey pine forest	1,150	0	662	0	0	1,812
Joshua tree woodland	6,755	0	3,275	353	18,443	28,826
Juniper woodland	47,453	0	13,926	154	1,453	62,986
Mesquite bosque	2,977	39	3,688	407	467	7,578
Mojave mixed woody scrub	174,672	127,236	377,250	10,431	409,019	1,098,608
Mojave riparian forest	4,638	0	28	20	242	4,928
Northern mixed chaparral	475	0	517	0	0	992
Pinyon-juniper woodland	73,087	53,943	56,332	601	0	183,963
Pinyon pine woodland	3,135	0	15,151	486	18,956	34,593
Montane meadow	964	0	2	0	8	974
Montane riparian scrub	1377	0	851	0	134	2,362
Native grassland	3,146	0	229	0	0	3,375
Rabbitbrush scrub	7,750	0	0	92	0	7,842
Scrub oak chaparral	22,624	0	13,761	0	0	36,385
Saltbush scrub	393,748	16	193,012	5,138	210,787	802,701
Semi-desert chaparral	108,488	0	19,527	215	0	128,230
Shadscale scrub	162	2	37,457	981	3,656	42,258
TOTAL	**2,502,747**	**289,652**	**3,185,911**	**92,157**	**2,574,300**	**8,640,926**

State includes State Lands Commission, State Parks, and Department of Fish and Game.
Other owners: Unknown = 1,844; County = 1,142; Bureau of Indian Affairs = 166.

3.3.2 Desert Tortoise

3.3.2.1 Regulatory Status

The Mojave population of the desert tortoise includes those animals living north and west of the Colorado River in the Mojave Desert of California, Nevada, Arizona, southwestern Utah, and in the Colorado Desert in California. On August 4, 1989, the USFWS published an emergency rule listing the Mojave population of the desert tortoise as endangered (54 *Federal Register* 32326). In its final rule, dated April 2, 1990, the USFWS determined the Mojave population of the desert tortoise to be threatened (55 *Federal Register* 12178). The USFWS designated critical habitat for the desert tortoise in portions of California, Nevada, Arizona, and Utah in a final rule, published February 8, 1994 (59 *Federal Register* 5820). (USFWS 2002.) The tortoise was also listed as threatened throughout its known range in California by the California Fish and Game Commission in 1989.

The desert tortoise is the official California State reptile, and has been protected by special State legislation that prohibits the taking or harming of the species since the 1930s. In 1983, the Desert Tortoise Council petitioned the CDFG to list the desert tortoise as a threatened species. The petition was withdrawn later, pending the federal status review by the USFWS. In August 1987, the Desert Tortoise Council resubmitted the petition to the California Fish and Game Commission (Commission). In November 1987, the Commission accepted the petition for review, and in June 1989, the Commission designated the desert tortoise as a threatened species. (BLM and CDFG 1992.)

The desert tortoise was designated a "sensitive species" in California in 1979 by BLM, which is authorized to designate species on public lands as "sensitive" after consultation with CDFG. The purpose of the designation was to provide increased management attention to prevent population and habitat declines that might result in federal or State listing as endangered or threatened. The designation raises the level of concern for desert tortoises in the environmental review process. No particular habitat or population management action is required or prohibited by the sensitive species designation, although other federal statutes (such as FESA and CESA) apply. (BLM and CDFG 1992.)

3.3.2.2 Tortoise Habitat Designations

During the past two decades, the BLM and USFWS have identified habitats that are important to tortoise management, conservation, and recovery. This section describes the establishment of management areas to protect these habitats (see Table 3-10), their intent and function, and relationships to other land designations.

Table 3-10
Current And Historic Tortoise Management Areas

NAME	DATE ESTABLISHED	NOTES
Crucial Habitat	1980	California Desert Conservation Area Plan Designation
Category I, II, and III	1993	California Desert Conservation Area Plan Designation
Critical Habitat	1994	Designation pursuant to FESA
Recovery Plan	1994	Suggests that DWMAs be established

BLM Crucial Habitat: Desert tortoise *crucial habitat* was first identified in the BLM's 1980 CDCA Plan (Map 4, CDCA Plan, 1980). The crucial habitat area was considered to be "…essential to the continued existence of the species." The BLM (1987) described crucial habitat as follows: "*Crucial habitat* includes portions of the habitats of officially designated BLM sensitive species that if destroyed or adversely modified could result in their being listed as threatened or endangered pursuant to Section 4 of the Endangered Species Act of 1973, as amended."

Within the planning area, the CDCA Plan recognized two areas of tortoise crucial habitat: (a) Western Mojave Desert Crucial Habitat, which included most of the proposed Fremont-Kramer DWMA, the western portions of the Superior-Cronese and Ord-Rodman DWMAs, and the Desert Tortoise Research Natural Area; and (b) two small polygons located near the northern and central portions of the Johnson Valley Open Area (see Map 4, CDCA Plan).

BLM Category I, II, and III Habitat: In 1992, the BLM and CDFG adopted a *California Statewide Desert Tortoise Management Policy.* The crucial habitat designation was expressly dropped in 1992 in favor of BLM tortoise Category I, II, and III habitat areas (BLM and CDFG 1992). This policy included management goals for Category I, II, and III tortoise habitats, as follows: *Category I:* maintain stable, viable populations and increase populations where possible; *Category II:* maintain stable, viable populations; *Category III:* limit declines to the extent possible using mitigation measures. In April 1993, the BLM amended the CDCA plan to delineate these three categories of desert tortoise habitat on public lands (Map 1A, CDCA Plan, as amended, 1999).

The BLM's and CDFG's long-range goals for the management of desert tortoises in these three categories were given as follows (BLM and CDFG 1992): (a) Restore and maintain stable, viable tortoise populations within designated Category I and II habitats in the species' existing natural range in the California Desert; (b) Minimize impacts to tortoises in Category III Habitat through humane, low-level mitigation and compensation requirements; (c) Reduce non-natural mortality to the extent possible; (d) Prevent deterioration and promote restoration of Category I and Category II habitats; (e) Acquire private lands within Category I and Category II habitats through purchase or exchange and through compensation for habitat losses in Category I, II, and III habitats; (f) Maintain and increase populations through translocation of wild tortoises into suitable unoccupied or depleted habitats within the historic range; (g) Achieve interagency coordination and demonstrate commitment necessary to maintain viable tortoise populations in the California Desert; and, (h) Develop and implement a monitoring program to determine progress toward meeting the overall management goal of maintaining viable tortoise populations in the California Desert.

USFWS Critical Habitat: Critical habitat is defined as (a) the specific areas within the geographical area occupied by the species at the time it is listed on which are found those physical or biological features which are essential to the conservation of the species and which may require special management considerations or protection; and (b) specific areas outside the geographic area occupied by the species at the time it is listed upon a determination by the Secretary of the Interior that such areas are essential for the conservation of the species (FESA Section 3(5)(A)). In 1994, the Service designated four critical habitat units in the planning area: Fremont-Kramer (518,000 acres), Superior-Cronese (766,900), Ord-Rodman (253,200), and Pinto Mountain (171,700) units (USFWS 1994a) (see Table 3-11)

Table 3-11
Desert Tortoise Critical Habitat

ENTITY	ACRES IN CRITICAL HABITAT	PERCENT OF CRITICAL HABITAT
Federal Government Department of the Interior		
National Park Service	27 mi^2	1%
Bureau of Land Management	1,533 mi^2	59%
Federal Government Department of Defense	305 mi^2	12%
State of California	51 mi^2	2%
Private	696 mi^2	26%
TOTAL	2,612 mi^2	100%

USFWS Recovery Units and Desert Wildlife Management Areas: The Desert Tortoise (Mojave Population) Recovery Plan (USFWS 1994b) established recovery goals and objectives for six "recovery units." The Western Mojave Recovery Unit is conterminous with the West Mojave planning area. The Recovery Plan stated that recovery units are "...essential to the long-term recovery, viability, and genetic diversity of the species." The Recovery Plan also recommended that Desert Wildlife Management Areas be established within each recovery unit. DWMAs were characterized as areas in which "...recovery actions will be implemented to provide for the long-term persistence of viable desert tortoise populations and the ecosystems upon which they depend."

The Recovery Plan recommended that DWMAs should: (a) be "...somewhere between 200 and 5,000 square miles..." with "...at least 1,000 square miles...recommended as the target size" (page 33); (b) have "…boundaries ... drawn to include the best examples of desert tortoise habitat in specific vegetation regions ... heterogeneous terrain, soil types, and vegetation within DWMAs will best provide protection for the entire ecosystem upon which healthy desert tortoise populations depend" (page 48); (c) contain "…the largest possible blocks of good tortoise habitat in an area, containing the most dense desert tortoise populations, should be included within DWMA boundaries" (page 48); and (d) consist of "…round or square patches of habitat are more likely to retain desert tortoise populations than elliptical or rectangular ones. Long, linear strips are least desirable" (page 49).

The Recovery Plan suggested that at least three of four potential DWMAs be established within the Western Mojave Recovery Unit. These particular DWMAs were recommended for the following reasons (USFWS 1994b, page F28):

> The Western Mojave recovery unit is the largest and most heterogeneous of the recovery units in terms of climate, vegetation and topography. It includes three major vegetation types - the Western Mojave, Central Mojave, and Southern Mojave - each of which has significant and distinctive elements...Four DWMAs within the Western Mojave recovery unit represent the diversity. The Fremont-Kramer DWMA represents the Western Mojave region; the Superior-Cronese DWMA represents the Central Mojave region; and the Ord-Rodman DWMA represents the Southern Mojave region. The Joshua Tree DWMA [Pinto Mountain], the fourth within this recovery unit, contains Southern Mojave and Eastern Colorado elements. The tortoises have responded to this habitat heterogeneity with different food habits and behavior in each of these areas. *Thus, three DWMAs are essential in this recovery unit to preserve the heterogeneity* [emphasis added]. Secure, large reserves are especially critical because of the severe population declines and heavy human use in these areas.

It is important to note that the Recovery Plan is advisory; federal agencies are not required to adopt its suggestions. The Recovery Plan recommends the general areas where DWMAs should be located, but leaves the task of delineating the DWMA boundaries to the land management agencies, in coordination with USFWS, CDFG, local stakeholders, and other interested parties. The principle agency mechanism for implementing recovery plan tasks is through amendments to existing resource management plans (BLM) or through the development of broader bioregional plans in collaboration with local government.

Relationships Among Tortoise Habitat Designations: Public lands designated as *critical habitat* were generally the same as those earlier delineated by the CDCA Plan as *crucial habitat*, with the following exceptions. The northern half of Brisbane Valley, most of the Stoddard Valley Open Area, and two 50-square mile areas in Johnson Valley Open Area were considered crucial habitat but were not designated as critical habitat. Areas south of Fort Irwin and Edwards Air Force Base, and most of the area east of Highway 247, which are now critical habitat, were not identified as crucial habitat. Similarly, BLM lands designated as critical habitat generally corresponded to Category I and II tortoise habitats.

The Recovery Plan (USFWS 1994b, page 56) distinguished *DWMAs* and *critical habitat*, noting that critical habitat does not accomplish the same goals or have as dramatic an effect upon tortoise conservation as does a recovery plan because critical habitat does not apply management prescriptions to designated areas. However, designation of critical habitat does provide protection of desert tortoise habitat until such time as the Desert Tortoise Recovery Plan is implemented and DWMA management is employed.

Existing Areas of Relatively Higher Tortoise Densities: The preceeding discussion pertains to official designations by one or more of the federal or State agencies. Based on surveys between 1998 and 2002, regions were identified as having "above average" or "higher density" tortoise occurrence. Although not an official designation, the differentiation between "higher density" and "lower density" tortoise areas is an important one relative to the plan's effectiveness of minimizing and mitigating take.

3.3.2.3 Tortoise Life History

The following life history information is taken from U.S. Fish and Wildlife Service (2002c). The desert tortoise is a large, herbivorous reptile found in portions of the California, Arizona, Nevada, and Utah deserts. It also occurs in Sonora and Sinaloa, Mexico. In California, the desert tortoise occurs primarily within the creosote, shadscale, and Joshua tree series of Mojave Desert scrub, and the lower Colorado River Valley subdivision of Sonoran desert scrub. Optimal habitat has been characterized as creosote bush scrub in which precipitation ranges from 2 to 8 inches, diversity of perennial plants is relatively high, and production of ephemerals is high (Luckenbach 1982, Turner and Brown 1982, Schamberger and Turner 1986). Soils must be friable enough for digging of burrows, but firm enough so that burrows do not collapse. In California, desert tortoises are typically associated with gravelly flats or sandy soils with some clay, but are occasionally found in windblown sand or in rocky terrain (Luckenbach 1982). Desert tortoises occur in the California desert from below sea level to an elevation of 7,300 feet, but the most favorable habitat occurs at elevations of approximately 1,000 to 3,000 feet (Luckenbach 1982, Schamberger and Turner 1986).

Chambers Group (1994) has reported that, in the Alvord Slope area, tortoises were most common on low to moderate slopes of 0 to 10%. They were most abundant on valley floors, bajadas, and lower portions of hills. Preferred substrates included sand, gravel, and desert pavement in plains, washes, fans, and hills.

Adult desert tortoises are most active in California during the spring and early summer when annual plants are most common although juvenile tortoises have been observed outside burrows throughout the year, including December through January when adults are generally in a state of hibernation (Dave Morafka, pers. comm.). Additional adult activity occurs during warmer fall months and occasionally after summer rainstorms. Adult desert tortoises spend most of the remainder of the year in burrows, escaping the extreme conditions of the desert. Further information on the range, biology, and ecology of the desert tortoise can be found in Burge (1978), Burge and Bradley (1976), Hovik and Hardenbrook (1989), Luckenbach (1982), Weinstein *et al.* (1987), and USFWS (1994b).

Tortoise activity is heavily influenced by the amount and timing of rainfall. Annual plants, which make up most of the tortoise's diet in the western Mojave Desert, vary depending on the timing of winter precipitation and the ensuing temperatures. Annual forbs, which are relatively more nutritionally balanced for tortoises, generally emerge following early winter rains with relatively warmer temperatures preceding and during the spring growing season. If winter rains do not come until late January or February, and temperatures are relatively cooler, native and non-native annual grasses will often emerge instead of native forbs. Such forage, particularly non-native grasses, offers little nutritional quality to tortoises.

Male tortoises may be more active during the fall, when their testosterone and viable sperm levels are higher than during the spring. Dr. Kristin Berry (pers. comm.) has shown that male sperm counts and viability are both relatively higher in the fall than in the spring of a given year. Data collected between 1998 and 2001, which were mostly restricted to the summer and fall periods (i.e., July through October), show that twice as many males were encountered in each of the three survey years as compared to females. Over the three-year period where gender could be determined, a total of 73 males and 35 females (2:1 ratio) were found, representing 26% and 13%, respectively, of the animals found (WMP data).

This was not observed during distance sampling, where surveys were performed in the spring. In 2001 and 2002, 87 males (40% of all animals where gender could be determined) and 69 (32%) females (1:1.26 ratio) were observed. Gender could not be determined for 60 tortoises, including 32 sexually immature animals. This probably indicates that males were somewhat more detectable than females in the summer and fall months when males are actively courting and mating with female tortoises, which is supported by numerous field observations.

Tortoises may be active throughout the year. Dr. David Morafka has shown that juvenile tortoises regularly emerge from burrows throughout the winter when conditions are favorable. Tortoises have recently been observed aboveground in early November west of California City (LaRue, pers. obs. 2002) and in late November at the DTNA (Michael Connor, pers. comm. 2001). Several were observed in early January 2003 in the Fremont Valley (Bob Parker, per. comm. 2003). Those animals may have opportunistically taken advantage of rain that fell in November and the early production of annual plants in January. Tortoises regularly emerge throughout the year at Edwards in response to several days of unseasonably warm temperature (Mark Hagan, pers. comm. 2003). These anecdotal accounts may represent a small fraction of adult animals in the population, and most animals may remain in their burrows through the winter.

Freilich et al. (2002) and Duda *et al.* (1999) have shown that tortoises are relatively more active in wetter years when compared to drier years. This observation is supported by distance sampling data collected in the Fremont-Kramer and Superior-Cronese DWMAs during the springs of 2001 (relatively wet year) and 2002 ("driest year in recorded history"). In the 2001, wet year, a total of 104 tortoises was encountered, including 29 (28%) in burrows and 75 (72%) in the open; in 2002, the dry year, of 112 tortoises observed, 57 (51%) were observed in burrows and 55 (49%) in the open. This indicates that about a quarter of the observed tortoises were in burrows in the wetter year, compared to about half of those observed in the dry year

Food resources for desert tortoises are dependent on the availability and nutritional quality of annual and perennial vegetation, which is greatly influenced by climatic factors, such as the timing and amount of rainfall, temperatures, and wind (Beatley 1969, 1974, Congdon 1989, Karasov 1989, Polis 1991 in Avery 1998). In the Mojave Desert, these climatic factors are typically highly variable; this variability can limit the desert tortoise's food resources.

Desert tortoises will eat many species of plants. However, at any time, most of their diet often consists of a few species (Nagy and Medica 1986, Jennings 1993 in Avery 1998). Additionally, their preferences can change during the course of a season (Avery 1998) and over several seasons (Esque 1994 in Avery 1998). Possible reasons for desert tortoises to alter their preferences may include changes in nutrient concentrations in plant species, the availability of plants, and the nutrient requirements of individual animals (Avery 1998). In Avery's (1998) study in the Ivanpah Valley, desert tortoises consumed primarily green annual plants in spring; cacti and herbaceous perennials were eaten once the winter annuals began to disappear. Medica *et al.* (1982 in Avery 1998) found that desert tortoises ate increased amounts of green perennial grass when winter annuals were sparse or unavailable; Avery (1998) found that desert tortoises rarely ate perennial grasses.

Recent work by Dr. Olav Oftedahl, of the Smithsonian Institution, has shown that tortoises may selectively forage on plants that have a high Potassium Excretion Potential (PEP Index) (Oftedahl 1996). Tortoises do not have salt glands or other physiological means of getting rid of high levels of potassium, although they may rid their systems of potentially lethal levels of potassium by voiding their bladders. It is speculated that water loss during drought conditions could be lethal to tortoises voiding their bladders, unless additional rainfall becomes available shortly thereafter. Oftedahl's studies have shown that tortoises regulate potassium levels by selecting plants that are high in water content and protein (nitrogen), which he refers to as "High PEP plants." These plants are generally restricted to native, annual forbs such as desert dandelion (*Malacothrix glabrata*) and many legumes such as species in the *Astragalus* and *Lotus* genera. As such, most of the High PEP plants are restricted in their availability to the spring following a winter of sufficient rainfall. In some years, no such plants are available, and may result in imbalances in potassium and other elements, which in turn could result in water imbalance and other physiological stresses to tortoises.

Oftedahl (pers. comm., Nov. 2002) expressed his concern that pervasive land uses, such as cattle grazing, may have severely reduced or eliminated the seed bank and germination potential for High PEP annual plants. He suggested that removing cattle from grazing allotments might not be sufficient to support new growth of these essential plants if they have already been eliminated or replaced by non-native forb and grass species. There may be the need to reintroduce some of these species back into heavily impacted tortoise conservation areas.

Desert tortoises can produce from one to three clutches of eggs per year. On rare occasions, clutches can contain up to 15 eggs; most clutches contain 3 to 7 eggs. Multi-decade studies of the Blanding's turtle (*Emydoidea blandingii*), which, like the desert tortoise, is long lived and matures late, indicate that approximately 70 percent of the young animals must survive each year until they reach adult size; after this time, annual survivorship exceeds 90 percent (Congdon *et al.* 1993). Research has indicated that 50 to 60 percent of young desert tortoises typically survive from year to year, even in the first and most vulnerable year of life. We do not have sufficient information on the demography of the desert tortoise to determine whether this rate is sufficient to maintain viable populations; however, it does indicate that maintaining favorable habitat conditions for small desert tortoises is crucial for the continued viability of the species.

Desert tortoises typically hatch from late August through early October. At the time of hatching, the desert tortoise has a substantial yolk sac; the yolk can sustain them through the fall and winter months until forage is available in the late winter or early spring. However, neonates will eat if food is available to them at the time of hatching; when food is available, they can reduce their reliance on the yolk sac to conserve this source of nutrition. Neonate desert tortoises use abandoned rodent burrows for daily and winter shelter, which are often shallowly excavated and run parallel to the surface of the ground.

Neonate desert tortoises emerge from their winter burrows as early as late January to take advantage of freshly germinating annual plants; if appropriate temperatures and rainfall are present, at least some plants will continue to germinate later in the spring. Freshly germinating plants and plant species that remain small throughout their phenological development are important to neonate desert tortoises because their size prohibits access to taller plants. As plants grow taller during the spring, some species become inaccessible to small desert tortoises.

Neonate and juvenile desert tortoises require approximately 12 to 16 percent protein content in their diet for proper growth. Desert tortoises, both juveniles and adults, seem to selectively forage for particular species of plants with favorable ratios of water, nitrogen (protein), and potassium. The potassium excretion potential model (Oftedal 2001) predicts that, at favorable ratios, consumption of plants with water and nitrogen allows desert tortoises to excrete high concentrations of potentially toxic potassium, which is abundant in many desert plants. Oftedal (2001) also reports that variation in rainfall and temperatures cause the potassium excretion potential index to change annually and during the course of a plant's growing season. Therefore, the changing nutritive quality of plants, combined with their increase in size, further limits the forage available to small desert tortoises to sustain their survival and growth.

In summary, the ecological requirements and behavior of neonate and juvenile desert tortoises are substantially different than those of sub-adults and adults. Smaller desert tortoises use abandoned rodent burrows, which are typically more fragile than the larger ones constructed by adults. They are active earlier in the season. Finally, small desert tortoises rely on smaller annual plants with greater protein content to be able to gain access to food and to grow.

3.3.2.4 Tortoise Populations

Tortoise population changes may be detectable using information gathered from BLM permanent study plots, distance sampling surveys and sign count surveys. Current data can be compared with older data to see, in general, if there have been declines or increases in abundance of tortoises or their sign. Population changes can also be detected through carcass observations. This section addresses (1) permanent tortoise study plots, (2) desert tortoise field surveys, and (3) desert tortoise distribution.

3.3.2.4.1 Permanent Study Plots

Table 3-12 summarizes Dr. Kristin Berry's tortoise density estimates (for adults only at the 95% confidence interval, with associated ranges) for the nine permanent study plots found in the West Mojave planning area between 1979 and 1996. Estimates are for the years that mark-recapture studies were performed (source: 1996 memorandum from Dr. Berry to BLM then-

Assistant District Manager Molly Brady)[3].

Table 3-12
Tortoise Density Estimates at Five Study Plots in the West Mojave.

STUDY PLOT	YEAR SURVEYED	ESTIMATED DENSITIES OF ADULT TORTOISES	RANGE
Fremont Valley	1981	116	(89-152)
	1987	78	(47-127)
	1991	33	(12-85)
DTNA Interior	1979	154	(117-202)
	1982	238	(184-308)
	1988	157	(121-204)
	1992	15	(5-39)
	1996	13	(5-33)
DTNA Interpretive Center - Inside	1979	181	(151-218)
	1985	179	(155-206)
	1989	81	(62-107)
	1993	47	(26-86)
DTNA Interpretive Center - Outside	1979	137	(106-178)
	1985	105	(82-134)
	1989	50	(32-78)
	1993	22	(14-38)
Fremont Peak	1980	70	(23-209)
	1985	38	(23-64)
	1989	27	(14-50)
	1993	5	(2-15)
Kramer Hills	1980	109	(78-153)
	1982	114	(85-152)
	1987	67	(43-103)
	1991	44	(26-75)
	1995	34	(19-61)
Stoddard Valley	1981	86	(58-125)
	1987	124	(89-172)
	1991	81	(57-116)
Lucerne Valley	1980	93	(66-132)
	1986	75	(53-107)
	1990	64	(43-95)
	1994	65	(45-95)
Johnson Valley	1980	69	(41-115)
	1986	49	(13-183)
	1990	15	(6-39)
	1994	16	(8-32)

3 Data from study plot surveys since 1996 at the DTNA and Fremont Valley by the Desert Tortoise Preserve Committee are currently unavailable. In her presentation at the Desert Tortoise Disease Workshop at Zzyzx in mid-November 2002, Dr. Berry presented additional data indicating additional declines on these study plots, although the magnitude of these declines remains unknown.

Using Dr. Berry's same data, Table 3-13 shows the percent declines observed at each of the study plots, the dates of the first and last surveys, and the elapsed time between the surveys (in parenthesis). Study plots are shown in descending order of observed tortoise decline, with the highest declines shown at the top and the lowest at the bottom.

Table 3-13
Percent Declines in Tortoise Numbers at Nine Permanent Study Plots in the West Mojave Planning Area, 1979 - 1996

STUDY PLOT	FIRST - LAST SURVEY DATES (ELAPSED YEARS)	PERCENT DECREASE
Fremont Peak	1980 - 1993 (13)	93%
DTNA Interior	1979 - 1996 (17)	91%
DTNA IC Outside	1979 - 1993 (14)	84%
Johnson Valley	1980 - 1994 (14)	77%
DTNA IC Inside	1979 - 1993 (14)	74%
Fremont Valley	1981 - 1991 (10)	72%
Kramer Hills	1980 - 1995 (15)	69%
Lucerne Valley	1980 - 1994 (14)	30%
Stoddard Valley	1981 - 1991 (10)	5%

These data indicate that tortoise declines have ranged from as much as 93% at the Fremont Peak study plot to as little as 5% at the Stoddard Valley study plot. In the past, there has been some criticism of extrapolating declines found at the study plots to surrounding areas. Tortoise sign count surveys conducted between 1998 and 2002 for the West Mojave Plan, however, have demonstrated that these regional declines indeed have occurred, and are not restricted to the permanent study plots. Moreover, the pattern of decline recorded at Dr. Berry's study plots mirrors the findings of the regional field surveys. Above average tortoise sign counts occur in regions that encompass the three plots where declines were least severe (Kramer Hills, Lucerne Valley, and Stoddard Valley). The plots where tortoise declines were between 93% and 72% (Fremont Peak down to Fremont Valley) occurred outside the above-average tortoise sign count polygons.

3.3.2.4.2 Desert Tortoise Field Surveys

Many types of focused desert tortoise surveys have been conducted:

- Since 1990, "presence-absence" surveys have been required by cities and counties to determine if tortoises would be adversely affected by a proposed project or land use.

- Since 1990, "clearance" surveys have been authorized under Section 7 and Section 10(a)(1)(B) of FESA to remove tortoises from harm's way during otherwise lawful activities.

- During 2001 and 2002, "distance sampling" surveys have been completed throughout the four proposed DWMAs, which are intended, over a relatively long period of time (i.e., 30 years), to estimate tortoise densities and population trends at the DWMA level.

- Since 1975, federal land managers (BLM and the military bases) have used “tortoise sign count” surveys to determine relative tortoise abundance and distribution over regional landscapes.

Desert Tortoise Presence-Absence Surveys (1990 - 2002): Since the tortoise was listed as threatened in 1990, city and county planning departments have required focused tortoise surveys on undeveloped lands as per USFWS (1992) protocol. Such sites have been surveyed along transects spaced at 30-foot intervals, which is intended to result in 100 percent coverage of the site and a determination of presence or absence of tortoises.

In 1998, about 250 consultant’s reports for presence-absence tortoise surveys were obtained from San Bernardino County. Of these, 234 reported either presence or absence of tortoise sign. An additional 595 presence-absence surveys associated with specific projects in San Bernardino County and elsewhere were obtained in 2002 by the planning team, have been digitized for GIS analysis, and are used in this analysis.

There have been at least five other, recent programmatic surveys or summaries of previous surveys for tortoise occurrence within urban areas: (1) 225 square miles in Lancaster (Tierra Madre Consultants, Inc. 1991); (2) 200 square miles encompassing portions of Adelanto, Apple Valley, Hesperia, and Victorville (Tierra Madre Consultants, Inc. 1992); (3) 100 square miles in Palmdale (Feldmuth and Clements 1990); (4) 38 square miles in Ridgecrest and Inyokern (Circle Mountain Biological Consultants 1997); and (5) 38 square miles in Yucca Valley (Tierra Madre Consultants, Inc. 1993).

Distance Sampling Surveys in the West Mojave Planning Area (2001 – 2002): Unlike the presence-absence surveys discussed above and sign count surveys discussed below, distance sampling surveys are intended to look only for animals. Carcass information is also collected, but is not used to determine tortoise densities. These data are collected in the spring when adult tortoises are most likely to be active, depending on climatic factors, particularly rainfall. They provide an independent look at tortoises during the spring (which can be compared to the summer-fall observations of tortoises that were incidentally observed during sign count surveys).

Using information collected during the 2001 survey, “encounter rates” were determined for each of the four proposed DWMAs. An encounter rate of 0.15 tortoises/kilometer indicates that the surveyors, on average, had to walk about 10 kilometers (about 6 miles) to see a tortoise. Encounter rates for the four DWMAs follow: 0.178 in the Ord-Rodman, 0.156 in Pinto Mountain, 0.145 in the Fremont-Kramer, and 0.115 in the Superior-Cronese. Higher encounter rates indicate that tortoises are seen relatively more often for the same unit area surveyed.

Encounter rates are only a small part of determining tortoise densities. Although densities were calculated for the 2001 distance sampling effort, they have wide-ranging “coefficients of variation,” which indicates that the estimates are very rough. For example, the number of tortoises per square kilometer was determined to be 11.66 for the Ord-Rodman, 10.31 for the Pinto Mountain, and 9.58 for the Fremont-Kramer and 7.59 for the Superior-Cronese DWMAs (source: Memo distributed at MOG TAC meeting in about June 2001). The corresponding coefficients of variation were 14.46, 26.69, 15.38, and 18.21, respectively. For

Pinto Mountain, with the highest coefficient of variation (26.69), the density estimate of 10.31 tortoises/km^2 has a possible range of 6.12 to 17.38 tortoises/km^2. The variation becomes important when one considers the large size of the regions involved.

The high degree of variation is primarily due to small sample size, in this case, one year. As such, it is too soon to interpret the distance sampling data for the West Mojave, as the density estimates derived from one year are far too variable. Relatively accurate density estimates may not be available until completion of the fifth consecutive year[4].

Desert Tortoise Sign Count Surveys (1975 - 2002): Unlike the study plot (mark-recapture) and distance sampling methodologies, sign count surveys are focused on tortoise scat and burrows rather than animals. Dr. Berry coordinated most of the earliest surveys in the mid-1970s until the late 1980s; LaRue coordinated the same-method surveys between 1998 and 2002[5].

Between about 1988 and 1998, most sign count surveys were performed on military installations. BLM public lands had not been surveyed for nearly 20 years. The most recent BLM sign count surveys had been conducted between 1975 and 1982 when 1,678 transects were surveyed within the CDCA, including 894 transects within the West Mojave planning area (see BLM 1999). In 1990 a BLM survey was conducted over a 150 square mile area at a density of three transects per square mile, throughout the DTNA, Fremont Valley, and Spangler Hills (including portions of the BLM Open Area).

The maps published in Berry and Nicholson (1984) were the most recent geographic portrayal of tortoise densities and distribution on public lands outside installations, until 1998, when new sign count surveys were conducted (Map 3-6). However, the 1984 range map (Map 3-7) was based, in part, on the early BLM surveys, and there have been documented declines in tortoise numbers in much of the West Mojave since the data were collected (Berry 1990, as amended; Corn 1994).

The data were used to identify only the relative abundance of tortoises (as judged by high versus low sign counts) and general distribution, given the imprecision inherent in using sign count data to determine tortoise densities (see Appendix L), rather than precise tortoise numbers. The results presented throughout this analysis equate each transect with one square mile (i.e.,

4 In Washington County, Utah, in support of the Washington County HCP at the Red Cliffs Desert Reserve, Ann McLuckie has supervised distance sampling over a consecutive five-year period, from 1998-2002. Looking at any given year, the coefficient of variation for Zone 3, for example, ranged from 15.86 up to 18.16 (McLuckie *et al*. 2002). However when the data are combined over the four-year period, the pooled coefficient of variation was given as 7.34, which a little more than two times more accurate than the estimates given for any one year.
5 Methodologies used between 1975 and 2002 were essentially the same (Berry and Nicholson 1984), where one transect was surveyed along a 1.5-mile equilateral triangle on a given square mile. The focus of the surveys has always been tortoise sign (hence, “sign count” surveys), although incidental sightings of live animals and carcasses were also recorded. Observable human disturbances were also tallied along each sign count transect. Disturbance data collected since 1998 have included: vehicles (paved roads, dirt roads, trails, tracks), garbage, shooting (shooting areas, individual shell casings), mining (test pits, markers), campsites, sheep sign, cattle sign, domestic dog sign, fence lines and posts, utility lines, denuded habitat, partially denuded habitat, old buildings, and ordnance.

“52 mi^2 of higher density tortoise areas,” “12 mi^2 of higher density vehicle-based impacts,” etc.). Dr. Krzysik has calculated that each sign count transect is sufficient to survey about 1.3% of a given square mile. As such, data collected along transects are best used as an *index*, not an absolute census of the population or its characteristics. Data from any one or two transects would have very low predictive value for the square mile(s) being characterized.

However, importantly, on a regional scale when all transects are combined, distribution patterns and relative occurrences (i.e., “above” versus “below” average concentrations) of tortoises are revealed. And even more importantly, they are corroborated by distance sampling data, and are consistent with trends reported on Dr. Berry’s study plots.

Sign count survey data were used to: (a) refine proposed DWMA boundaries (e.g., determine whether DWMA status was appropriate for the Iron Mountains, an area outside of critical habitat and north of Helendale/Silver Lakes where surveys identified significant amounts of tortoise sign); (b) determine the best places to close routes to minimize impacts in areas where tortoises most likely occur; and (c) determine alternative DWMA boundaries and compare EIR/S alternatives.

Sign count surveys conducted since 1988 (see Map 3-6) provide the most recent, available data on the distribution of tortoise sign, which Dr. Anthony Krzysik (2002a, b, c) has show to be positively correlated to incidence of tortoises. Over 8,100 transects have been surveyed on more that 6,300 square miles within the West Mojave planning area. These survey efforts are summarized in Appendix L

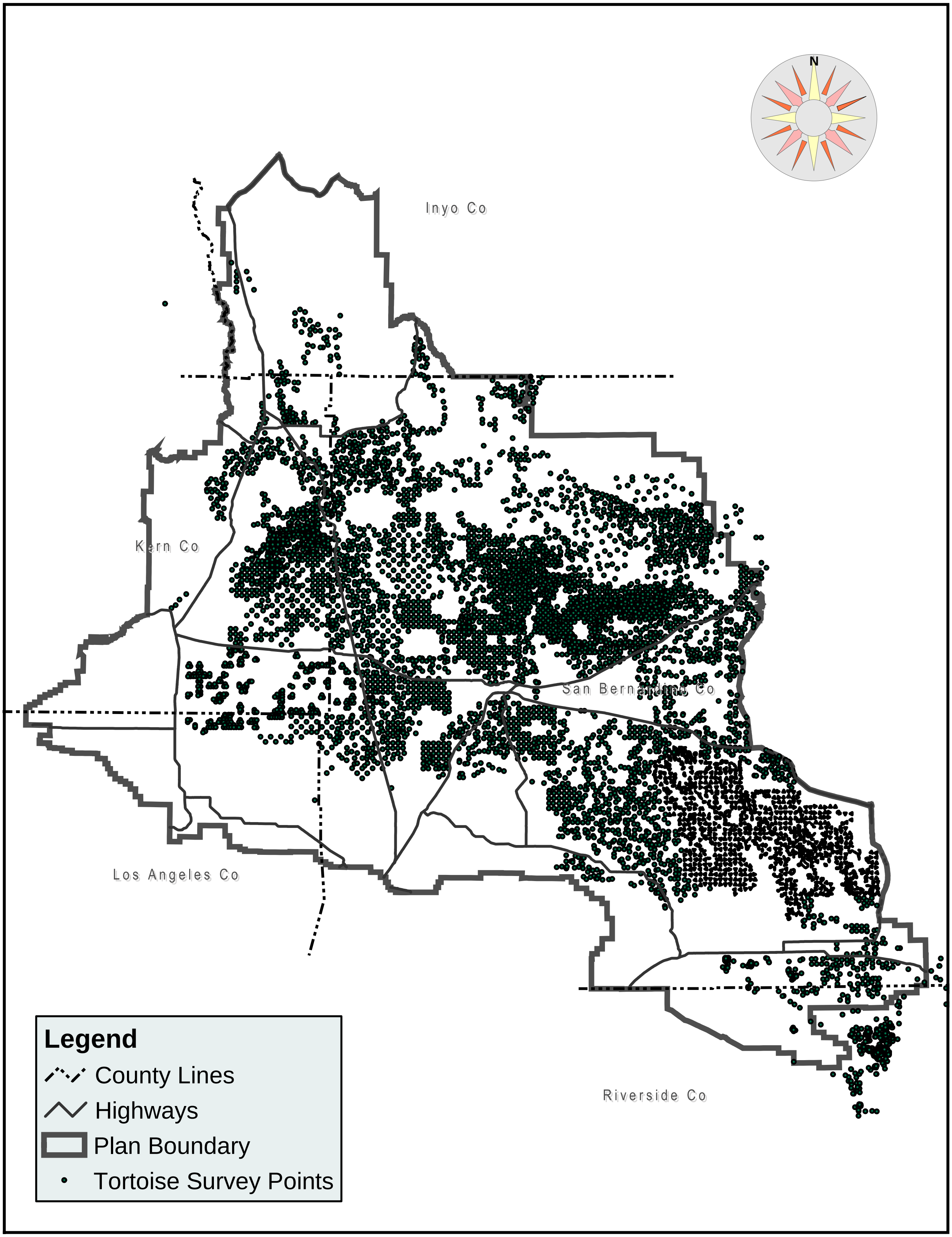
Most of the best available data on current tortoise distribution and observable human disturbances are encompassed in the 1998, 1999, and 2001-2002 data sets, when 3,372 transects were surveyed for the West Mojave planning effort. Relevant information is described below:

- 1998 West Mojave Regional Survey: This was the first regional sign count survey undertaken on BLM lands in the western Mojave Desert in nearly 20 years. Surveys were completed between July and September 1998 on 856 square miles.

- 1999 West Mojave-Fort Irwin Regional Survey: Conducted under the direction of the BLM, USFWS, and Army, biologists surveyed various Fort Irwin expansion alternative areas and remaining portions of the planning area, particularly in proposed DWMAs. Between July and September 1999 biologists surveyed 1,553 transects on 1,291 square miles around Fort Irwin and California City, among other places.

- 2001-2002 West Mojave Regional Survey: Biologists surveyed BLM lands within the planning area that were not surveyed in 1998 and 1999, might support significant aggregations of tortoises outside the proposed DWMAs (such as Searles, Indian Wells, and Rose valleys to the north), and could confirm areas of expected low-density (area encompassed by I-15, I-40, Troy Dry Lake, and the eastern planning boundary). Between July 2001 and January 2002, a total of 1,329 square miles meeting one or more of these criteria was surveyed.

Tortoise Sign Count Surveys Since 1988



West Mojave Plan FEIR/S
Map 3-6

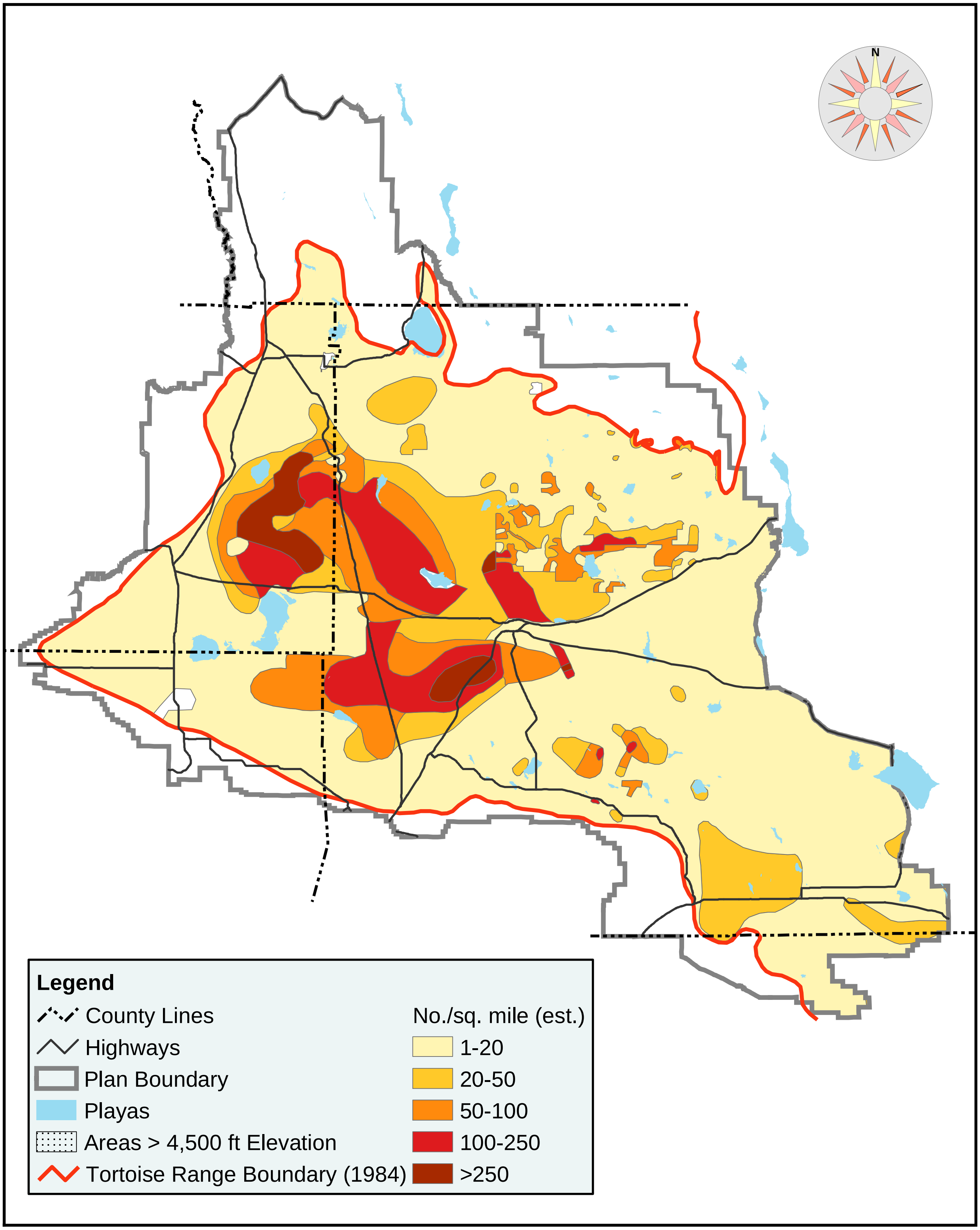
Scale: 1 : 1,750,000

0 10 20 30 Km

0 10 20 30 Miles

7/29/04

1984 Tortoise Range and Density Map



10/18/04

West Mojave Plan FEIR/S
Map 3-7

Scale: 1 : 1,750,000

0 10 20 30 Km

0 10 20 30 Miles

1998 –2001 Survey Results: During the three years 3,362 transects covering 3,378 mi^2 were surveyed, typically at a density of one transect per square mile. Of the 3,362 transects, 1,405 (42%) did not have any tortoise sign, with some tortoise sign found on the remaining 1,957 (58%) transects. The distribution of above-average sign counts reveals that higher density tortoise areas occur on a northeast-southwest axis, between Fort Irwin and south of Edwards Air Force Base (Map 3-8). There were three higher concentration areas in the Ord-Rodman DWMA, and none was observed in the Pinto Mountain DWMA. No higher density tortoise areas were found in the northern and western portions of the Fremont-Kramer and Superior-Cronese DWMAs, respectively.

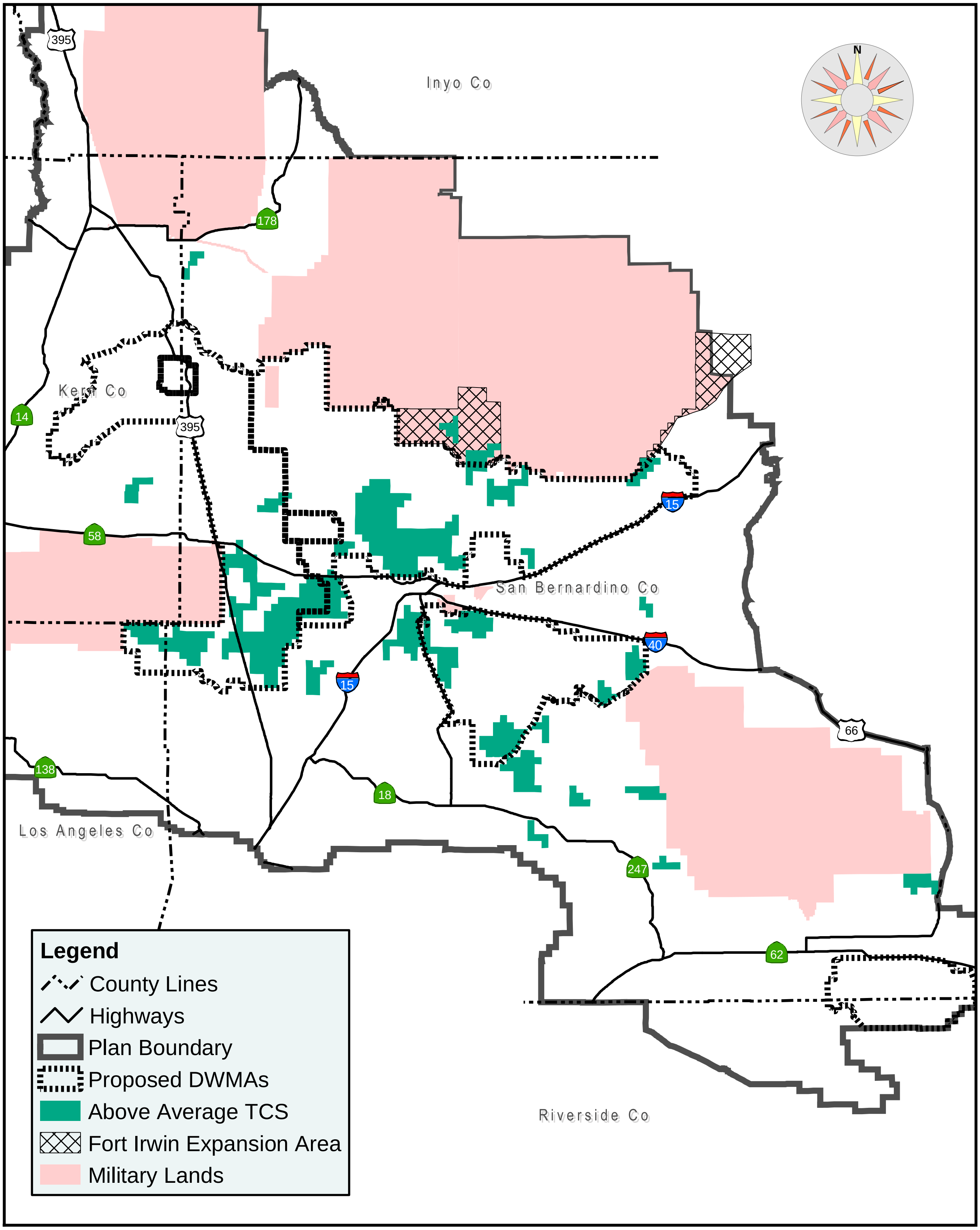
Tortoise Occurrence in Burrows versus Aboveground: During sign count surveys in the summer-fall, 275 tortoises were observed, including 202 (73%) in burrows and 73 (27%) aboveground. During distance sampling in the spring, 216 tortoises were observed, including 86 (40%) in burrows and 130 (60%) aboveground. For the survey period of 1998 to 2002, tortoises were mostly found in burrows (73%) in the summer-fall and mostly found aboveground (60%) in the spring. These data indicate that tortoises were relatively more active (i.e., aboveground, out of burrows) in the spring and relatively less active in the fall, which is consistent with the literature.

Male versus Female Tortoise Encounters: The seasonal activity patterns described above also affected the number of male versus female tortoises encountered. Of the 108 sign count tortoises observed where gender could be determined, 73 (68%) were males and 35 (32%) were females, which is a 2:1 ratio of males to females. Comparatively, of the 156 distance-sampling tortoises where gender could be determined, 87 (56%) were males compared to 69 (44%) females, which is a 1.26:1 ratio of males to females. These data suggest that, relative to females, male tortoises are twice as likely to be encountered in the fall, and males and females are encountered at about equal rates in the spring. The difference is apparently due to increased male (or decreased female) activity in the fall. The data indicate a 1:1 ratio of males to females encountered, which suggests a 1:1 ratio within the surveyed population.

Adult versus Subadult Tortoise Encounters: Of the 275 tortoises encountered during sign count surveys, both in burrows and aboveground, 238 (87%) were adults and 37 (13%) were subadults[6]. Of the remaining 178 (i.e., 83% of 216) tortoises where age class was determined, 146 (82%) were adults and 32 (18%) were subadults, which is very similar to the sign count observations. Combined, there were 453 tortoises where age class could be determined, including 384 (85%) adults and 69 (15%) subadults. The age classes for 38 of the 216 (17%) tortoises encountered during distance sampling were recorded as "unknown."

6 Surveyors used a cutoff of 180 mm to determine age class; carapace lengths of less than 180 mm characterized subadults, and adults were 180 mm or greater in length. Although age class determinations were affected by seasonal activity of tortoises, age class was also determined from burrow widths. In general, the width of a tortoise burrow opening is equal to the length of the tortoise constructing the burrow. As such, the age class for tortoises in burrows could be ascertained by measuring the width of the burrow opening. However, it is well documented that subadult tortoises are notoriously difficult to find, and generally under-represented in regional surveys.

Higher Density Tortoise Sign Count Areas (1998-2002)



West Mojave Plan FEIR/S
Map 3-8

Scale: 1 : 1,300,000
0 10 20 30 Km
0 10 20 30 Miles

10/14/04

Although these data indicate subadults comprised about 15% of the tortoise encounters, it does not necessarily indicate that subadults comprise 15% of the population. Subadults likely comprise more than 15% of the population because they are regularly under-represented in regional surveys, but how much more is unknown. In Boarman and Sazaki's (1996) study population south of Highway 58, the subadult component was estimated to be 20%. These observations are significant with regards to conservation management scenarios compared in Chapter 4. Alternative E, for example, would focus management on eliminating common ravens and disease impacts on tortoise in DWMAs. Effective raven management would provide most benefits for tortoises under 110 mm in length, which may comprise 10% or less of the DWMA population[7].

Krzysik Analysis of Tortoise Survey Results: Dr. Anthony Krzysik has analyzed the results of the recent tortoise sign count surveys (see Appendix K). Dr. Krzysik found that (a) desert tortoises are closely associated with their sign (i.e., burrows and scats); there is a highly significant correlation of live tortoises with burrows, scats, and Total Corrected Sign (TCS); (b) transects associated with live tortoises are typically also associated with appreciable sign counts; (c) both tortoise densities and tortoise mortality rates are similar in the four DWMAs analyzed; and (d) that the four DWMAs appear to be similar to one another in their tortoise and sign count densities, and therefore, of similar value as desert tortoise conservation areas.

Evidence of Tortoise Population Declines Between 1980 and 2002: Comparing sign count data collected prior to 1984 ("older data") with those of 1998-2002 ("newer data") shows a decline in the abundance of tortoise sign per transect. There were 213 older and 3,362 newer transects surveyed throughout the planning area. Comparisons are given in Table 3-14.

Table 3-14
Tortoise Total Corrected Sign Found in West Mojave Planning Area Between 1975 to 1982 and Between 1998 to 2002

TCS CATEGORIES	PREVALENCE OF TOTAL CORRECTED SIGN			
	1975 to 1982 Transects		1998 to 2002 Transects	
	Total No.	% Of Total	Total No.	% Of Total
0	38	18	1,405	42
1 to 3	57	27	1,113	33
4 to 8	45	21	583	17
9 to 16	46	22	195	6
17 to 28	20	9	56	1
29 to 50	6	3	10	<1
> 50	1	0	0	0
Totals	213	100%	3,362	100%

7 The 10% figure assumes that the subadult cohort in the surveyed population is 20% (i.e. 5% more than observed to account for lower detectability of this age class). It also assumes that many of the subadults encountered were between 120 and 180 mm, and therefore less vulnerable to ravens. There is no way to census (i.e., count every animal) subadult populations, and the data generally do not include measured lengths (i.e., more often recorded as "subadult" than measured), so these numbers are hypothetical.

When data for the three lowest sign count categories (i.e., 0 to 8) are combined, a total of 140 older transects (66% of 213) and 3,101 newer transects (92% of 3,362) were included. When data for the three highest categories (9 to 50) are combined, a total of 73 older (34%) and 261 newer (8%) transects were included. One sees that there has been a shift in the abundance of observed tortoise sign, with relatively few sign on proportionately more transects recently surveyed, corresponding to relatively more sign on proportionately more transects surveyed 20 years ago. In other words, there has been a proportional decline in the abundance of *tortoise sign* observed on transects between 1980 and 2002, indicating a decline in the abundance of *tortoises* between 1980 and 2002 (see Krzysik 2002a, b, c).

Regions of Higher and Lower Tortoise Concentrations: Regions within the DWMAs were identified relative to above average (higher density) and below average (lower density) sign counts. Polygons were established to encompass all areas meeting two criteria. The two criteria included: (1) There must be at least four contiguous square miles of above-average tortoise sign before a polygon could be established; and, (2) polygon boundaries must not span more than one linear mile not surveyed or having below-average sign counts. While this approach eliminated subjectivity from delineating polygon boundaries, it also resulted in encompassing some square miles where there were no data or the sign counts were lower than average.

The results of this analysis are depicted in Map 3-8, and are displayed in Table 3-15. Three regions were identified in the Fremont-Kramer DWMA, seven in the Superior-Cronese DWMA, and five in the Ord-Rodman DWMA that support above-average occurrences of tortoise sign (and therefore tortoises; see Krzysik 2002a, b, c). None was found in the Pinto Mountain DWMA.

Table 3-15
Above-Average Tortoise Sign Counts Observed
In Proposed DWMAs between 1998 and 2001

PROPOSED DWMA	NUMBER OF POLYGONS	ABOVE-AVERAGE SIGN COUNTS[8]	DWMA SIZE AND % ABOVE-AVERAGE
Fremont-Kramer	3	142 mi^2	779 mi^2 (18%)
Superior-Cronese	7	147	980 (15%)
Ord-Rodman	5	69	388 (18%)
Pinto Mtn.	0	0	173 (0%)
TOTAL	15	258	2,320 (15%)

Fremont-Kramer DWMA: There are three tortoise concentration areas on about 142 mi^2, comprising about 18% of the 779 mi^2 Fremont-Kramer DWMA, which are shown on Map 3-8. Two of the three tortoise concentration areas occur mostly south of Highway 58, and the third one occurs in a 9 mi^2 area north of Highway 58, near the northwest corner of Harper Dry Lake.

[8] In using the two rules to establish polygons, higher density tortoise areas included some square miles of lower densities and those that were not surveyed, as depicted on Map 3-7. However, only those square miles supporting higher sign counts within the polygons are included in the tallies shown in the table. "Above-average" or "higher density" areas were derived by excluding all transects with no sign and determining the average of the remaining values. In this comparison, only transects surveyed in DWMAs are included. As such, "above-average" transects/square miles are actually "average and above" transects found in DWMAs.

Importantly, no higher density polygons were found at the Desert Tortoise Natural Area and Fremont Valley, where tortoise densities in the early 1980's were 181-238 tortoises/mi^2 at the DTNA and 116 tortoises/mi^2 in the Fremont Valley. No higher density areas were found in the regions where Dr. Berry reported declines up to 90% on the associated study plots. Although tortoises certainly occur in areas north of Highway 58, it appears that many animals have died throughout the region since the late 1970's, a conclusion supported by the carcass data, described below.

Superior-Cronese DWMA: There are seven tortoise concentration areas on about 147 mi^2, comprising about 15% of the 980 mi^2 Superior-Cronese DWMA, which are shown on Map 3-8. The core area occurs north of Barstow and Hinkley, east of Harper Lake, and west of Irwin Road, in the Mud Hills-Water Valley area. Other concentrations are found in "Coyote Corner," which is southwest of Fort Irwin, and in the Cronese Lakes area, southeast of Fort Irwin. All, or a portion of, three higher density areas comprising 17 mi^2, are found in the Fort Irwin expansion area. There were also 34 mi^2 of higher density areas on Fort Irwin south of the UTM 9-0 line and adjacent areas, mostly to the northwest. The Fort Irwin expansion, then, would affect about 51 mi^2 of all higher tortoise areas. No higher concentration areas were observed north of Harper Lake to China Lake or in the western portions of Superior Valley. Some of these areas correspond to recent die-off regions, where numerous recently dead tortoises have been found (see discussion below).

Ord-Rodman DWMA: There are five tortoise concentration areas on about 69 mi^2, comprising about 18% of the 388 mi^2 Ord-Rodman DWMA, which are shown on Map 3-8. These concentration areas are included in three general regions: (1) northern portion of Stoddard Valley along Lenwood Wash, extending north over Daggett Ridge to near Barstow; (2) northern Lucerne Valley; and (3) in the northwest corner of the DWMA, north of the Johnson Valley Open Area and east of Box Canyon, bordering the Twentynine Palms Marine Corps Base. The Ord Mountains physically separate these three subregions, so that the absence of sign through the middle part of the DWMA may be due to natural causes (i.e., fewer tortoises in elevations above 4,500 feet), or may not have been surveyed. Relatively less tortoise sign was found in Stoddard Valley east of Highway 247, where Dr. Berry's 1984 range map showed that concentrations were at one time in excess of 250 tortoises/mi^2 (Map 3-7).

It is noteworthy that two of the nine BLM permanent study plots occur in the Ord-Rodman DWMA, both in areas of relatively higher density sign counts. The Lucerne Valley plot is located in the northern Lucerne Valley, in the southern tortoise concentration area, and the Stoddard Valley plot is located west of Daggett Ridge, in the northwestern concentration area. Dr. Berry's studies found a 30% decline on the Lucerne Valley plot and a 5% decline on the Stoddard Valley plot, which is relatively small compared to declines in excess of 75% in the northern and northwestern Fremont-Kramer DWMA.

Pinto Mountain DWMA: There were no above-average tortoise areas in the 173 mi^2 Pinto Mountain DWMA. Population densities appeared to be low, although few carcasses were found during sign count surveys performed since 1998. There also appeared to be no older or more recent die-off regions within this area.

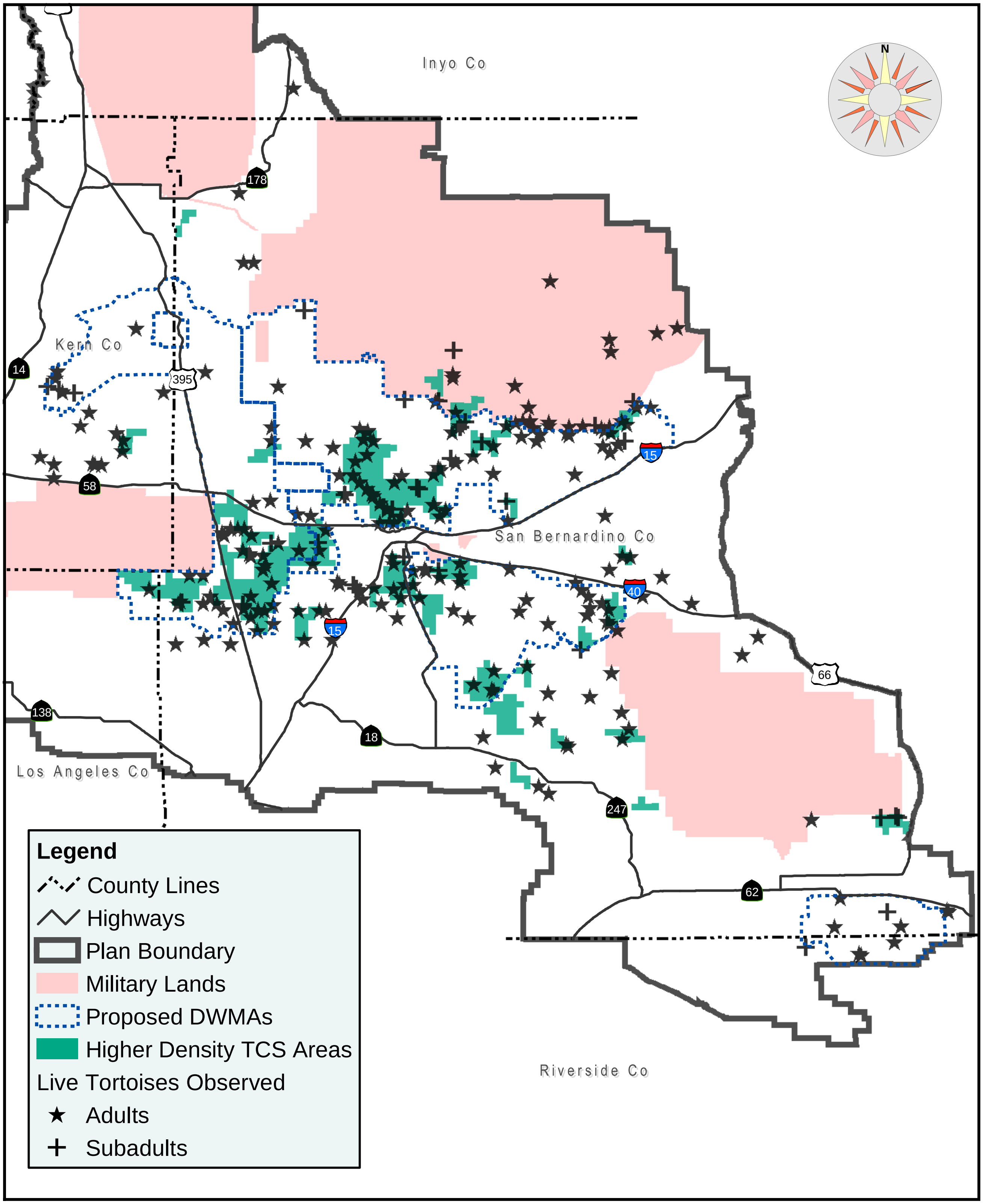
Occurrence of Tortoises Relative to Higher Density Sign Count Areas: Much of the preceding discussion relies on the assumption that relatively more tortoises are found in higher density sign count areas. One test of this assumption is to see what percentage of the tortoises observed during recent surveys occurred in these areas. Of the 275 tortoises observed during sign count surveys, UTM coordinates were available for only 261. Of these 261 tortoises, 101 (39%) were found within the higher density areas and 160 (61%) were found outside them, which is depicted on Map 3-9.

The comparison is more meaningful when the relative area of higher density and lower density sign counts are compared to DWMA size. Within the three DWMAs (i.e., 2,147 mi^2 excluding Pinto Mountain), there were 358 mi^2 (17% of the three DWMAs) of higher sign count areas and 1,789 mi^2 (83%) of lower sign count areas. Of the 261 tortoises, 101 (39%) were within higher sign count areas, compared to 160 (61%) lower sign count areas. One can see, then, that 39% of all tortoises were observed in 17% (i.e., higher density areas) of the three DWMAs; the remaining 61% of all tortoises were in 83% (i.e., lower density areas) of the three DWMAs. These findings suggest that tortoises are relatively concentrated in areas of concentrated sign counts.

Locations of live tortoises, segregated into subadult (i.e., <180 mm) and adult (≥180 mm) age classes, are shown on Map 3-9. There were 86 (85%) adult tortoises and 15 (15%) subadults found within higher density areas, which occupy only 17% of the planning area. These findings are important relative to management direction, as subadults are indicative of recent recruitment into the population (i.e., over the past 10 years), and represent future generations. Proactive raven management would be most effective in higher density tortoise areas, given that ravens likely focus their foraging activities where subadult tortoises are relatively more common.

It is noteworthy that no subadults and fewer than 10 adults were observed in the Fremont-Kramer and Superior-Cronese DWMAs between the DTNA and Water Valley/Mud Hills, which are separated by 40 to 45 miles. In fact, the only subadults (i.e., 13 observed during sign count and distance sampling surveys) observed within a 325 mi^2 area between Highway 395 and Highway 14 were *all inside or immediately adjacent to the DTNA*. These data suggest that recruitment is occurring at the DTNA, but was not detected in hundreds of square miles of surveyed critical habitat that was previously occupied (Berry and Nicholson1984 and elsewhere).

Distribution of Live Tortoises Observed Relative to Higher Density Sign Count Areas



West Mojave Plan FEIR/S
Map 3-9

Scale: 1 : 1,350,000
0 10 20 30 Km
0 10 20 30 Miles

10/14/04

Regional Declines in the Four DWMAs: In comparing the earliest survey efforts with later ones, it appears that there have been substantial declines in tortoise numbers in the northwest portion of the Fremont-Kramer DWMA. This area is bounded by Highway 58 to the south, Red Mountain to the north, Fremont Peak to the east, and the DTNA to the west. It encompasses the three DTNA study plots and those at Fremont Peak and Fremont Valley, where Dr. Berry documented tortoise declines ranging from 93% at Fremont Peak to 72% at the Fremont Valley study plot. No above-average tortoise sign polygons were identified anywhere within this region. Although there were a few transects with above-average tortoise sign, these were insufficiently concentrated for the polygon criteria to be met.

The analysis found above-average tortoise sign polygons to be oriented on a northeast-to-southwest axis, from about Fort Irwin to the northeast to areas south-southeast of Edwards Air Force Base (Map 3-8) in areas identified as having above-average tortoise sign; the Johnson Valley plot is east of this area. It is noteworthy that the Kramer Hills, Lucerne Valley, and Stoddard Valley study plots showed the smallest population declines during the 10 to 15 years they were surveyed (1996 Berry Memorandum), and are included in three regions that currently support higher sign count areas.

<u>3.3.2.4.3 Desert Tortoise Distribution</u>

Revised Tortoise Range Map: Survey data were used to produce an updated tortoise range map of current tortoise distribution (See Map 3-10). The 1984 range map (Map 3-7) identified approximately 11,255 mi^2 (7,203,107 acres) of tortoise habitat, whereas 11,134 mi^2 (7,125,842 acres) are identified in the 2002 Tortoise Range Map[9], which represents a reduction of about 121 mi^2.

Map 3-10 depicts three regions within the 2002 tortoise range: reduction areas, expansion areas, and areas requiring more surveys. These areas are discussed in detail in Appendix L.

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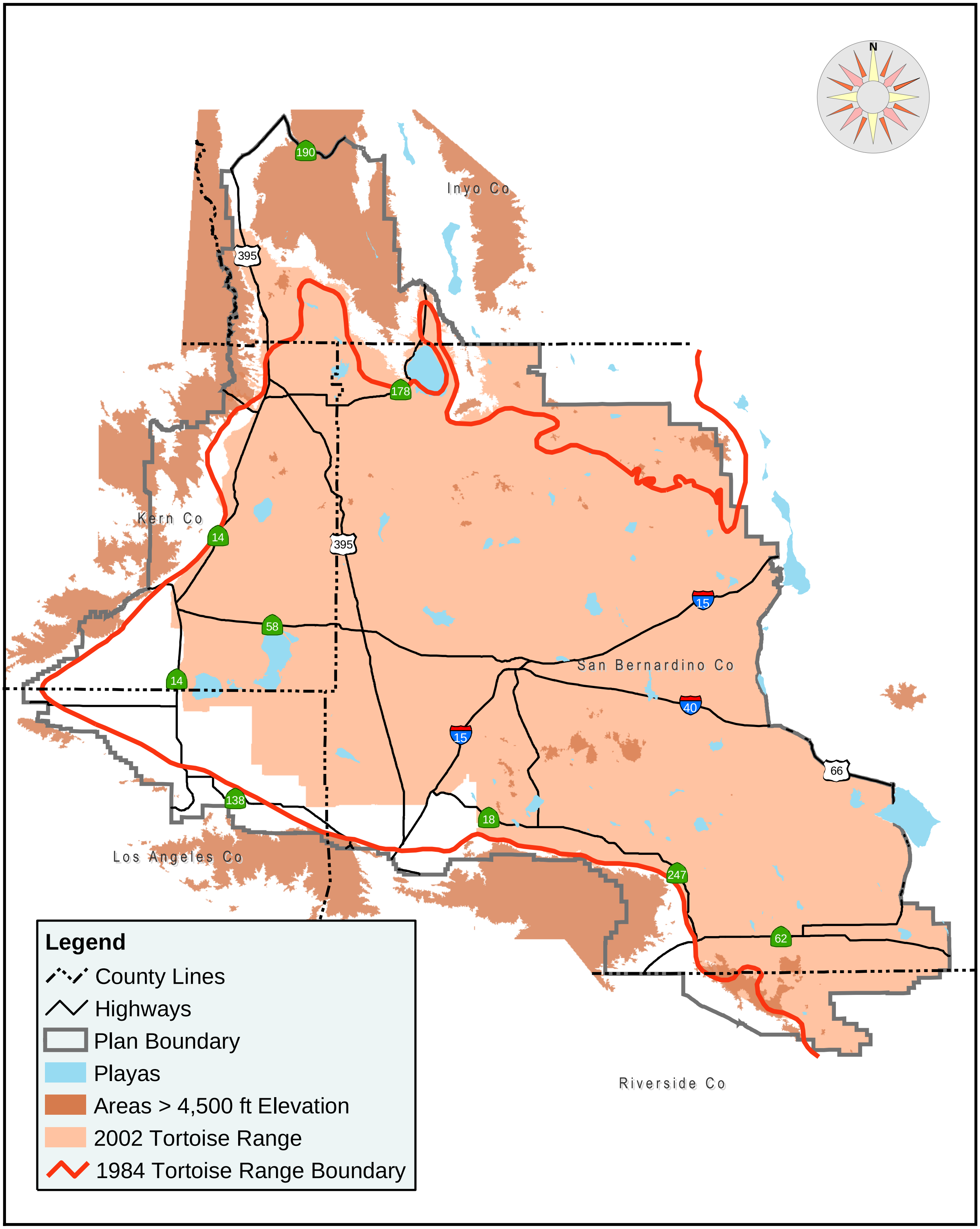
9 Each of these figures over-estimates occupied tortoise habitat, as dry lake playas, elevations above about 4,500 feet, and other marginal or unsuitable habitats are included within both range lines. Nor do they imply anything about the relative of densities occurring in the older and more recent ranges.

2002 Tortoise Range Map



West Mojave Plan FEIR/S
Map 3-10

Scale: 1 : 1,750,000

0 10 20 30 Km

0 10 20 30 Miles

10/14/04

Tortoise Distribution within the Revised Range: The TCS distribution map (Map 3-11 on attached CD Rom) was generated exclusively based on 1998 to 2002 sign count surveys. Map 3-11 uses TCS categories that have been traditionally used to estimate tortoise densities, which are useful to determine relative tortoise abundance and distribution. These categories include: 0, 1 to 3, 4 to 8, 9 to 16, 17 to 28, and 29 to 50 TCS/transect (i.e., which is mostly reported as "TCS/mi^2"). For convenience, the six categories are occasionally segregated into two categories of relatively low sign counts (0 to 8) or relatively high sign counts (9 to 50). The average number of TCS in DWMAs was found to be 5 mi^2, which was used as the demarcation to differentiate above- and below-average density areas.

This map reveals that there are few regions within DWMAs where tortoises are completely extirpated, or for other reasons, do not occur. It identifies areas where high sign counts were found on 261 transects, or conversely, no sign was found (transects along the Sierra Nevada, west of the aqueduct). In many cases, low-density areas may be adjacent to or surrounded by relatively higher density areas.

Natural Absences of Tortoises: Several safe assumptions can be made about tortoise distribution in the western Mojave Desert since the 1970s:

- Tortoises are mostly absent from dry lakebeds.

- Tortoises are absent from areas above 5,000 feet elevation, and nearly so at 4,500 feet. In 1999, only 5 of 609 (0.8%) transects with tortoise sign occurred above 4,000 feet; similarly, in 2001, only 12 of 991 (1.2%) transects with tortoise sign occurred above 4,000 feet. In 1998, all 875 transects were located below 4,500 feet.

- Tortoises may be naturally sparse in the northern portion of the range, from the Avawatz Mountains, through China Lake Naval Air Weapons Station, up to Rose Valley along Highway 395. Much of this area is protected on military installations or otherwise inaccessible to most casual desert visitors, yet no surveys since the 1970's have found significant areas of above-average tortoise sign. Weinstein (1989) found that latitude was a contributing factor to tortoise occurrence, and that in general densities decreased with increasing northern latitudes.

There are also places where local geological and hydrological factors may be responsible for relatively low tortoise numbers. The lavic flows associated with Black Mountain, north of Harper Lake, may be sufficiently unsuitable that tortoises are naturally uncommon, although there is an apparent abundance of tortoises at Pisgah Crater, a similar formation. During 1994, on the south-central and southwestern portions of Edwards Air Force Base (between South Rogers Dry Lake and Rosamond Dry Lake, including Buckhorn Dry Lake), the only tortoises found were restricted to a small hill that rose above the surrounding saltbush scrub, which was vegetated by the only creosote bush scrub observed in the region (LaRue, pers. obs.).

The more difficult question is, what is the evidence that tortoises occupied all areas where they are now presumed extirpated (missing)? Tortoises are extirpated from large portions of the Lucerne and Victor valleys and from the entire western portion of Antelope Valley; what is the evidence that they ever occurred there? Lucerne Valley is relatively straightforward because a few tortoises can still be found along the base of the San Bernardino Mountains, south of the developed portion of the community. They are documented to the north, east, and west, so it is clear that Lucerne Valley once supported suitable habitat, if not fully occupied by tortoises prior to recent development.

The Victor Valley's southern demarcation of natural tortoise absence (from western Lucerne Valley through southern Hesperia, Oak Hills, Baldy Mesa, to Phelan) cannot be well defined with existing data, which have mostly been collected since the 1990 listing. With the exception of two questionable data points near the southwestern corner of Hesperia, no tortoise sign has been found south of Highway 18 from Apple Valley to Highway 395 since 1990 (see Map 3-6). Highways 18 and 138 generally separate areas to the south where tortoises are apparently absent from areas to the north, where habitats are substantially degraded and only a few residual aggregations occur[10].

In 1990, it was judged that only about 90 square miles within the 225-square mile City of Lancaster and its sphere of influence still supported potential occupied tortoise habitat (Tierra Madre Associates, Inc. 1991). Only three carcasses were found during surveys along 330 linear miles of transects (LaRue, pers. obs.). No evidence of living tortoises was found, nor has any been found over the last 12 years during surveys required by the City of Lancaster (Brian Ludicke, pers. comm.). Even so, these carcasses, and numerous accounts documented by Berry and Nicholson (1984) show that the Antelope Valley, west of Highway 14 was historically occupied. Data were found for only four or five surveys in the southern half of the Antelope Valley, west of Lancaster. No 1975-1982 BLM data were collected there.

Carrying Capacity: Carrying capacity is the inherent ability of the land to support a given number of tortoises per unit area. The tortoise carrying capacity of any area cannot be stated with precision, except for certain lands (such as playas and lands above 5,000 feet elevation) where the carrying capacity is zero. Based on Dr. Berry's study plot data, there were as many as 238 adult tortoises per square mile at the DTNA in 1982 and as many as 70 at Fremont Peak in 1979. These are more accurately described as 1979-1980 baseline population numbers for two square miles and an unknown contiguous area containing similar vegetation, and are not reflective of the carrying capacity of the two regions in which they occurred. Nor do they reflect trends in the population that preceded the 1970's, when the baseline studies were first conducted. The declines observed on these two plots between 1980 and 1996, however, do apparently reflect declines that were occurring on a regional scale during that time.

These studies do not reflect how many tortoises may have occurred in the region in the 1950s, for example, or in 1900. Had high tortoise populations existed and suffered catastrophic die-offs, sufficient time would have elapsed for all carcasses to disintegrate in the interim, leaving no indication of tortoise populations even 20 years before the first study plots were surveyed.

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10 For example, tortoise sign was found on only 1.5 mi^2 in a 20 mi^2 area surveyed in this region in 2002.

Boarman (pers. comm., Nov 2002) has suggested that the lower rainfall levels experienced in the second half of the 20th Century may have reduced productivity, thereby reducing the capacity of the land to sustain as many tortoises are previously. Oftedahl (pers. comm., Nov 2002) has suggested that long-term cattle grazing may have depleted the natural seed bank of plants with a high potassium excretion potential (see discussion above) and that it may be impossible to regain that seed bank, even if grazing is discontinued.

Nor does the Recovery Plan indicate how or when the baseline population numbers should be established. In fact, that baseline is currently being established through line distance sampling surveys, which were initiated in the western Mojave Desert in 2001. It may take up to five years to determine a statistically valid baseline population. If so, the baseline would represent a snap shot of tortoise densities in the year 2005.

3.3.2.5 Threats to Tortoises: Mortality Factors

Available literature presents many threats that are known or suspected to affect tortoises and their habitats. Dr. William Boarman (2002) identified 22 impacts that may affect tortoises throughout the listed population: agriculture, collecting, construction, disease, drought, energy and mineral development, fire, garbage and litter, handling and manipulation, invasive weeds, landfills, livestock grazing, military operations, noise, non off-highway vehicle recreation, off-highway vehicles, predation, roads and highways, urbanization and development, utility corridors, vandalism, and wild horses and burros. Dr. Boarman's analysis is included in its entirety as Appendix J.

Dr. Boarman's discussion of threats is general and is not restricted to physical impacts and miscellaneous threats that are known to occur in the West Mojave planning area. The following discussion focuses on threats present within the planning area. It addresses (1) direct and indirect anthropogenic (i.e. human-caused) mortality factors, (2) natural mortality factors, and (3) carcass observations and die-offs suggested by recent data. The relationship between off highway vehicles and tortoises, an issue that has received a high level of public interest, is addressed separately in Section 3.3.2.6 (below).

A detailed analysis of carcass observations is presented in Appendix L. The reader is encouraged to review that analysis as an adjunct to summary carcass observations presented in the following sections.

3.3.2.5.1 Direct and Indirect Anthropogenic Mortality Factors

There are both *direct* and *indirect* anthropogenic mortality factors (see Boarman 2002 for discussion). Direct mortality factors have immediate results (incidental mortality during construction, removal of animals from the desert), whereas indirect mortality factors occur over time, and are not always easily associated with the direct mortality factors from which they arise.

Direct Anthropogenic Mortality Factors: These include blading a pipeline right-of-way, tract home development, and similar land disturbances where native vegetation is removed and tortoises residing in the area are either crushed or forced to move into adjacent areas of suitable habitat. Direct mortality factors also include crushing tortoises along paved and unpaved roads; intentional vandalism, such as shooting tortoises; pet collection; poaching for food or ceremonial purposes; loss of animals to fire; trampling by cattle; and animals lost to military maneuvers. Not all direct mortality factors are manmade; prolonged drought, wildfires caused by lightning, and naturally unsuitable geographical features (e.g., playas) are either direct mortality factors or natural features that directly affect tortoise densities and distribution (see Section 3.3.2.5.2, below).

Direct mortality factors are often researched in scientific studies, but such studies are typically limited in scope, for example, to a given cattle allotment or specific motorized race event. Such studies should not be dismissed, but they fail to identify either the geographical extent or severity of mortality factors on a regional scale.

To better understand both the distribution and severity of direct mortality factors on a regional scale, data recently collected in the field were used. These included 19 disturbance categories: Vehicles (Paved Roads, Dirt Roads, Trails, Tracks), Garbage, Shooting (Bullet Casings and Shooting Areas), Mining (e.g., test pits, markers), Campsites, Livestock (Sheep and Cattle), Wild Horses or Burros, Domestic Dogs, Fence lines and Posts, Utility Lines, Denuded Habitat, Partially Denuded Habitat, Old Buildings, and Military Ordinance. These data represent "observable human disturbances" and in many cases direct mortality factors. They are the basis for the following discussion.

The data have been used to to see *where* such impacts have occurred and are likely to persist or increase in the absence of proactive management. They allow the identification of areas where observable human impacts tend to be clustered or, alternatively, are uncommon. For example, the data clearly show that in DWMAs the most concentrated areas of cross-country vehicle tracks are adjacent to BLM open areas (particularly El Mirage and Johnson Valley) and desert communities (e.g., Silver Lakes). Data show that cattle are not constrained to allotments, as cow dung has been recorded up to several miles outside allotment boundaries. Illegal dumping is most common adjacent to urbanizing areas, as are domestic dogs. These data have been used to identify areas where focused management can further assess and remedy problems.

Direct mortality factors were recorded during both the 1998-2001 tortoise sign-count surveys and the 2001-2002 distance sampling surveys. Of 148 tortoises found dead where the suspected cause of death was given, 76 (51%) were attributed to mammalian predation (coyotes, kit foxes, occasionally feral dogs), 42 (28%) were identified as crushed by off-highway vehicles, 13 (9%) due to raven predation, 9 (6%) due to gunshot wounds, and 9 (6%) due to other causes.

Urbanization: Urbanization poses serious direct impacts to tortoises, and has resulted in regional extirpations, particularly within the southern and southwestern portion of its range. Historical records and anecdotal evidence indicate that tortoises once occupied all areas from eastern Antelope Valley, through Lancaster and Palmdale, Pearblossom, Lake Los Angeles, Hesperia, Victorville, Apple Valley, to Lucerne Valley. Current data for these areas show that tortoises are either extirpated (Lancaster, western Palmdale, southern Apple Valley, central and eastern Victorville, all of Hesperia) or very nearly so (remaining areas)[11].

Indirect effects of urbanization are less clear than the direct effects of mechanically removing 10 acres of occupied tortoise habitat, but, cumulatively, they remove tortoises from the landscape as effectively as heavy equipment. Wide-spread dumping, sheep grazing, unregulated off highway vehicle traffic, release of hazardous materials (i.e., motor oil drained on the ground, discarded paint, etc.), tortoise collection, loss of tortoises and habitat degradation by feral and pet dogs, and increased raven numbers are just a few of the impacts associated with urbanization that extend far into the desert. Where residential communities are immediately adjacent to tortoise habitat (Barstow, northern Lucerne Valley, Silver Lakes/Helendale, Hinkley, Twentynine Palms, etc.) the impact may be even more threatening to core aggregations of tortoises.

Between 1990 and 2001, LaRue surveyed 78 different project sites in urbanizing areas for evidence of tortoises. Urbanizing areas included in the survey, among others, were Apple Valley, Baldy Mesa, Barstow, California City, Hesperia, Joshua Tree, Lake Los Angeles, Lancaster, Landers, Lucerne Valley, Newberry Springs, Palmdale, Phelan, Ridgecrest, Rosamond, Silver Lakes/Helendale, Victorville, Yermo, and Yucca Valley. Table 3-16 reports the prevalence, in descending order, of observable direct impacts associated with these (and other) urbanizing areas.

Table 3-16
Disturbances Observed on 78 Projects in Urbanizing Areas

DISTURBANCE CATEGORY	NUMBER OF PROJECTS WITH DISTURBANCE	DISTURBANCE ON 100% OF TRANSECTS
Cross-country OHV travel	74 (95%)	39 (50%) project sites
Dumping	72 (92%)	
Domestic dog sign	69 (88%)	20 (26%) project sites
Dirt roads	67 (86%)	28 (36%) project sites
Shotgun shells	59 (76%)	
Misc. ground disturbance	24 (31%)	
Evidence of sheep grazing	19 (24%)	

Cross-country OHV tracks, dumping, domestic dog sign, and dirt roads are prevalent in these urbanizing areas. The third column reports the number and percentage of the 78 sites where the indicated disturbance was observed on 100% of transects surveyed. Thus, 39 of the 78 projects (50%) had vehicle tracks, 28 of 78 (36%) had dirt roads, and 20 of 78 (26%) had dog sign on 100% of all transects surveyed.

These data are comparable to those collected by LaRue and others in 1991 in the 225 mi^2 Lancaster planning area, where tortoises historically occurred but are now extirpated (Tierra Madre Consultants, Inc. 1991). In that study, aerial photographs revealed that only 90 of the 225

11 Each of the following reports has identified extensive areas where tortoises no longer occur: (a) 225 square miles of Lancaster (Tierra Madre Consultants, Inc. 1991); (b) 200 square miles encompassing portions of Adelanto, Apple Valley, Hesperia, and Victorville (Tierra Madre Consultants, Inc. 1992); (c) 100 square miles of Palmdale (Feldmuth and Clements 1990); and (d) 38 square miles of Ridgecrest and Inyokern (Circle Mountain Biological Consultants 1997).

mi^2 within the planning area supported vegetation communities that may still support tortoises. The remaining 135 mi^2 were developed for residential, industrial, commercial, and agricultural purposes, and no longer constituted suitable habitats. Table 3-17 reports the prevalence of the disturbances listed above in Table 3-17 that were observed on 72 mi^2 in the Lancaster sphere on influence (2nd column) and 18 mi^2 within Lancaster's city limits (3rd column), which comprised the 90 mi^2 of potential tortoise habitat.

Table 3-17
Disturbances Observed in the Lancaster Planning Area in 1991

DISTURBANCE CATEGORY	PERCENT OCCURRENCE IN THE SPHERE OF INFLUENCE	PERCENT OCCURRENCE WITHIN THE CITY LIMITS
Cross-country OHV travel	81%	88%
Dumping	92	100
Domestic dog sign	77	72
Dirt roads	60	72
Shotgun shells	97	89
Misc. ground disturbance	7	16
Evidence of sheep grazing	100	100

Several attempts have been made to determine if there is a statistical relationship between increased human disturbances and decreased numbers of tortoises, with limited success (Dr. Ross Kiester, pers. comm. 2000). Fifty-eight of LaRue's 78 surveys recorded the total number of human disturbances observed on each transect, and either the presence or absence of tortoise sign. Tortoise sign was found on 25 project sites (43%) and absent from 33 (57%) of them. Table 3-18 shows the average number of disturbances observed (of the 10 categories given) per transect for each of these categories.

Table 3-18
Human Disturbance Levels Observed
25 Sites Where Tortoise Sign Was Found and 33 Sites Where Sign Was Not Found

DISTURBANCE CATEGORY	PREVALENCE OF DISTURBANCES PER TRANSECT	
	Tortoise Sign Present (25 sites)	Tortoise Sign Absent (33 sites)
Cross-country OHV travel	2.40	2.83
Domestic dog sign	1.37	2.59
Dirt roads	1.56	2.04
Dumping	0.72	1.50
Shot gun shells	0.63	0.57
Evidence of sheep grazing	0.59	0.44
Misc. ground disturbance	0.40	0.26

These data show that cross country travel, domestic dogs, dirt roads, and dumping were relatively more prevalent on urban sites where tortoise sign was absent. Both direct and indirect impacts associated with these human uses result in degraded habitats and loss of tortoises.

In Table 3-19, data collected between 1998 and 2002 on 1,572 transects in the Fremont-Kramer and Superior-Cronese DWMAs are compared to disturbances observed on the 78 urban sites surveyed by LaRue between 1990 and 2001. These two DWMAs were chosen for their relative proximity to the urban and rural sites surveyed by LaRue.

Table 3-19
Comparison of Disturbances: DWMAs and Urbanizing Areas

	NUMBER (%) OF PROJECTS AND TRANSECTS WITH DISTURBANCE	
DISTURBANCE CATEGORY	ON 78 SITES IN URBAN AREAS	ON 1,572 TRANSECTS IN TWO DWMAS
Off-road OHV tracks	74 (95%)	833 (53%)
Dumping	72 (92%)	27 (2%)
Domestic dog sign	69 (88%)	6 (< 1%)
Dirt roads	67 (86%)	702 (45%)
Shotgun shells	59 (76%)	326 (21%)
Misc. ground disturbance	24 (31%)	26 (2%)
Sheep grazing	19 (24%)	200 (13%)

Human disturbances on the rural and urban sites surveyed by LaRue were significantly more prevalent than the same disturbances observed in two of the proposed conservation areas. Unimproved, dirt roads (53%) and OHV cross-country travel (45%) were the two most prevalent human disturbances observed in the proposed conservation areas. Domestic dog sign (< 1%), dumping (2%), and miscellaneous ground disturbance (i.e., denuded and partially denuded areas) (2%) were negligible in DWMAs compared to urbanizing areas (i.e., 88%, 92%, and 31%, respectively).

Maintained Roads: Trombulak and Frissell (2000) concluded that maintenance and use of roads contribute at least five different general classes of chemicals to the environment: heavy metals, salt, organic molecules, ozone, and nutrients. They found that most studies indicate that contamination declines within 65 feet (20 meters) but that elevated levels of heavy metals often occur 650 feet (200 meters) or more from the road. However, there is no evidence that chemicals are used on roads in the Mojave,

Nor are the effects of these contaminants on tortoises known. Dr. Berry, in collaboration with Dr. Bruce Homer, has suggested that heavy metals may be involved in the tortoise shell disease known as cutaneous dyskeratosis. The relationship between contaminants and cutaneous dyskeratosis is not understood, nor is the lethality of the shell disease. It was associated with a region-wide die-off of tortoises on the Chuckwalla Bench (i.e., decline from 225 tortoises in 1982 to 85 in 1992), but not necessarily the cause of it. The Chuckwalla Bench die-off was coincident with the 1988-89 die-off at the Desert Tortoise Natural Area, although 200 miles separate the two areas.

Tortoises often dig their burrows in the berms of roads, particularly along those that are not frequently used, and where there is little vehicle stray (LaRue, pers. obs., Copper Mountain Mesa, between Yucca Valley and 29 Palms). An erosion ditch found along Highway 395 apparently attracted at least one tortoise near that highway (LaRue 1992). Tortoises in such burrows would be in immediate harm's way during road maintenance that involved re-contouring road shoulders, erosion ditches, and berms.

There are places, such as one lightly used road in the Copper Mountain Mesa area, where 15 active tortoise burrows were found in the berms of a 1.5-mile long stretch of this road. However, this may be an exception. For example, only 1 occupied burrow of 202 found during sign count surveys was recorded as occurring in the berm of a road.

Lovich and Bainbridge (1999) reported that increased water availability from pavement runoff and increased retention of moisture under the pavement are probably responsible for the observed increase in plant vigor along roadsides. Vollmer et al. (1976) reported that productivity, diversity, and cover of Mojave Desert vegetation have been found to increase along roadsides. One problem associated with these "greenbelts" is that tortoises may be attracted to the vegetation and be crushed by normal use of the road, primarily, but also occasionally by maintenance activities. Boarman et al. (1996) indicated that tortoises are probably attracted to the edges of highways because increased water from rain collects along the shoulder facilitating growth of plants, some of which are species preferred by tortoises. Nicholson (1976) reported that tortoises might be attracted to roadsides, especially during a dry year, by the denser vegetation growing there.

Indirect Anthropogenic Mortality Factors: By their nature, indirect mortality factors are more difficult to quantify, and are in effect extensions of direct mortality factors.

Cattle and sheep grazing, cross-country OHV travel, blading rights-of-way for new construction, and agriculture (direct mortality factors) promote soil conditions that favor plant species that are not native to the desert, such as European weed species. Poor nutritional qualities of weeds may result in physiological conditions that leave tortoises more susceptible to disease and drought. Jennings (1997) summarized impacts of exotic plants as follows: (a) exotic plants are spread by roads and along utility lines; (b) exotic plants may pose threats to desert tortoises by competitively reducing or excluding important native forage species, compromising nutrition and health, and by contributing to the frequency and severity of fires in a region where fire was previously rare; (c) annual exotic grasses, *Schismus* sp., may be relatively deficient in key nutrients and may contain higher levels of metals than native plants.

Avery (1998) has found, during experimental tortoise foraging studies, that some tortoises prefer *Schismus*, an exotic, to all other native and non-native species he provided. Avery (1998) further found that dietary nitrogen in exotic plants was assimilated at significantly lower rates; tortoises were physiologically more capable of utilizing native vegetation compared to exotic vegetation; tortoises fed exotic plants lost body mass; and native vegetation was more nutritionally beneficial to desert tortoises than exotic vegetation [(see also Nagy et al. 1998, and Hazard et al. 2001)]. Johnson and Belnap (1996) found that shifts in vegetation resulting in exotic dominated stands could alter soil biota compositions and create conditions unfavorable to native plants.

Not all studies have found that tortoises prefer non-native forage. Jennings (1992) found that tortoises he studied at the DTNA preferred native species. Avery et al. (1997, 1998) found that tortoises consumed some exotic annuals (i.e., *Schismus barbatus* and *Erodium cicutarium*) but did not prefer them. Krzysik (1994) concluded that tortoises forage on exotic annuals, but the impact of these exotics on native ecosystems is unknown, and may remain unknown because baseline data are lacking. Grasses provide much lower quantities of protein than do forbs (Nagy et al 1998, Hazard et al. 2001), and may be relatively more abundant in habitats degraded by grazing, fire, and other ground disturbances.

These weeds in turn serve as fuel for wildfires. Lovich and Bainbridge (1999) reported that exotic annual plants, particularly red brome (Brooks 1998, Oldemeyer 1994), increase the fuel load and frequency of fire in desert communities, which are poorly adapted to fire. Red brome, split grass, Russian thistle, and mustards (particularly in fallow agricultural fields) provide fuels that burn hotter and carry flames between shrubs, thereby promoting the spread of fire and relatively more damage to native shrubs. (Brown & Minnich 1986; Brooks 1999.) Minnich (1994) reported that flames are carried by exotic species, notably *Bromus rubens*, *Schismus barbatus*, and *Brassica tournefortii*, which form a continuous, cured layer of flashy fuels; and that the greatest short-term impact of desert fires is the destruction of *Larrea tridentata* (creosote bush).

Ravens represent a direct impact to juvenile tortoise populations, but they are also an indirect impact (or symptom) of urbanization. Ravens are as common as they are because of increased opportunities provided by humans. Roads provide a ready source of raven food in the carcasses of small mammals and reptiles that result from vehicle collisions; increased nesting opportunities are provided by human structures; water is readily available at pastures, farmlands, sewage ponds, and wildlife guzzlers. Yet, ravens are often identified as “natural” predators of tortoises. In fact, ravens are subsidized predators, possibly preying on tortoises and other animals to get them through the summer and winter when resources are less plentiful (Boarman 1993).

The denuded hillsides that result from OHV hill climbs are extremely susceptible to erosion (indirect mortality factor), particularly if mechanized vehicles continue to frequent the area (a direct mortality factor). Both forage and shrub cover, which are critical to tortoise nutrition and denning, respectively, are adversely affected. In time, tortoises may abandon the area or suffer ill side effects from poor nutrition (i.e., malnourished, suppressed immune systems, etc.) or reduced denning potential (i.e., resulting in more exposure to predators and additional vehicle impacts).

Indirect mortality factors may occur far into the future and are often unforeseen. For example, the direct impact of a water pipeline is immediately mitigated and compensated, tortoises are moved from harm’s way with appropriate take permits, and the project is effectively complete, but the indirect effects are just beginning. Dozens of residents each year excavate their own ancillary pipeline trenches to connect into the main water line; these go unmonitored and tortoise protection is relegated to whoever is digging the trench. Such projects are the infrastructure that is intended to promote human population growth that will eventually eliminate animals from those regions. Mechanically denuded rights-of-way are often used for vehicle travel and may provide new access to tortoise populations that were not previously accessible to non-four-wheel drive vehicles. This was the case for extensive stretches of the Meade-Adelanto transmission line that was installed in 1995. Not only were 174 tortoises handled and 3 accidentally killed (LaRue 1996), but the line passed through areas where no previous utilities had passed, thereby opening new access to many areas.

Noise: Krzysik (1994) stated: "…noise and vibrations associated with live-fire exercises [at Fort Irwin] are detrimental to wildlife populations," but did not provide any data to support the conclusion. The Recovery Plan (USFWS 1994) listed the following potential impacts, again without any data to support the conclusions. Noise impacts may cause disruption of communication and damage to the auditory system, which may affect an individual's ability to effectively communicate and respond in appropriate ways. In several places, the Recovery Plan referred to "noise pollution" or listed noise as one of the potential impacts, but provided no specific data.

In his threats analysis, Dr. Boarman (2002) reiterated the information given in the Recovery Plan, which is recited above, plus the following observations. A study conducted by Bowles et al. (1999) showed very little behavioral or physiological effect on tortoises of loud noises that simulated jet over flights and sonic booms. They also demonstrated that tortoise hearing is fairly sensitive (mean = 34 dB SPL) and was most sensitive to sounds between 125 and 750 Hz, well within the range of the fundamental frequency of most of their vocalizations. The authors concluded that tortoises probably could tolerate occasional exposure to sonic boom level sounds (140 dB SPL), but some may suffer permanent hearing loss from repeated long-term exposure to loud sounds such as from OHV and construction blasts. Boarman (2002) also indicated noise or vibration might affect tortoises that live alongside railroads, but found there were no studies to document the impact. He concluded, it is not known if train noise negatively affects the behavior, audition, or reproductive success of these tortoises.

Habitat Recovery Rates: Lovich (1992) reported that recovery to pre-disturbance plant cover and biomass may take from 50-300 years while complete ecosystem recovery may require over 3,000 years. Webb et al. (1983), citing Lathrop and Archbold (1980), predicted a recovery time of a century for pipeline berms and trenches, pipeline road edges, and powerline pylons and road edges. They state that an estimate of recovery based on vegetative composition could be "at least three times greater" than the estimate for biomass, again assuming that recovery follows a linear trend. These researchers were referring to natural rehabilitation of unused sites. There is little or no opportunity for perennial plants to become re-established on road shoulders, erosion ditches, etc. that are regularly maintained.

3.3.2.5.2 Natural Mortality Factors

This section addresses "natural" mortality factors, including predators, drought and disease. The term "natural" does not, however, mean that these occur independently of man. Although some mortality factors may naturally occur, they are often exacerbated by human activities that have affected the natural balance that likely existed prior to man's use of the desert. Disease is discussed in this section, although its origin in wild tortoises (i.e. a natural occurrence) or pet populations (i.e. introduced by man) remains unknown. Natural predators of post-hatching tortoises include golden eagle, common raven, badger, coyote, kit fox (Berry 1990, Boarman 2002).

Canine Predators: This includes coyotes, kit foxes, and feral dogs, the latter of which is not a "natural" predator[12]. In 1982, Luckenbach concluded coyotes were probably the major predator of adult desert tortoises. Turner et al. (1997) determined that most failed tortoise nests were excavated by coyotes or kit foxes, but no data were presented (Boarman 2002). Turner and Berry (1985) reported that 76 of 159 (48%) tortoise nests at the Goffs Study plot in the East Mojave were lost to kit foxes and other predators. During his three-year study at the DTNA in the early 1990's, Peterson (1994) concluded that coyote predation was the main mortality factor observed. In 1998 and 1999, 47% and 12%, respectively, of nests studied at Twentynine Palms Marine Corps Base were dug up, probably by kit foxes (Bjurlin and Bissonette 2001). Predation by kit foxes and coyotes on tortoises may increase during periods of drought, when their normal prey base of small mammals is no longer available (Peterson 1993, 1994; Karl 2002).

Feral dogs also injure and kill desert tortoises, and are relatively more common adjacent to urban and rural communities than elsewhere. Domestic dog sign was found on 88% of the sites surveyed in urbanizing areas (LaRue, unpublished data) and on 75% of the transects surveyed in Lancaster (Tierra Madre Consultants, Inc. 1991). Comparatively, dog sign was observed on only 6 of 1,572 (i.e., <1%) transects surveyed in the Fremont-Kramer and Superior-Cronese DWMAs (WMP data, 1998 to 2002).

When 1998-2002 sign count data are combined with 2001-2002 distance sampling data, 76 of the 148 (51%) carcasses, where the cause of death was given, were recorded as being predated (or scavenged) by canine predators. The prevalence of canine predation did not differ between sign count data collected throughout the planning area (i.e., 53 of 104 carcasses, or 51% canine predation) and distance sampling data collected only within the two DWMAs (i.e., 23 of 44 carcasses, or 52%)).

USFWS (1994b) reported damaged burrows and two severely injured tortoises along Highway 58 in Kern County in the early 1970's, and many of the tortoises observed at the Lucerne Valley study plot in 1986 and 1990 had been gnawed or chewed by dogs. Berry (1990 as amended) reported evidence of domestic dog or cat predation at 4 of 12 study plots in California, where predation ranged from 1.8% up to 45.3% (Boarman 2002). Feral dogs have injured tortoises at 29 Palms Marine Corps Base (Rhys Evans, pers. comm.), and one death has been confirmed (Bjurlin and Bissonette 2001). Tortoises with chewed marginal scutes, and missing legs were particularly common to the south where the installation is bordered by the urbanizing portions of Twentynine Palms and the community of Joshua Tree (Peter Woodman, pers. comm.). Boarman (2002) concluded that the effect of feral dog predation on tortoise populations appears to be an emerging problem that warrants further documentation.

Common Ravens: Knowles and Berry (1990) found that ravens were most abundant in the West Mojave and least abundant in the southern Colorado Desert (also, Boarman 1992). Their 1989 study indicated that ravens were most common at landfills, agricultural fields, and along roads in the fall, declining through winter, spring, and summer. Landfills, followed by

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[12] Feral dogs may include individual animals, or dogs packs, consisting of 10 or more animals (LaRue, pers. obs.). The word, "feral," literally means "wild" or "untamed," and in the West Mojave, consists of domestic pets that have permanently left their owners or may return to their homes following forays into the desert.

agricultural fields, were the most common concentration areas. Only three of 17 sewage ponds showed consistent use by ravens.

Based on Breeding Bird Surveys (Robbins 1986) conducted by the USFWS, BLM (1990) estimated that the number of ravens in the Mojave Desert had increased by 1,528% between 1968 and 1988. Boarman (1992) felt that the increase was likely much higher in the West Mojave. Knowles *et al.* (1989a, 1989b) surveyed 801 linear miles of roads, 12 landfills, and 11 sewage ponds in the West Mojave, every two weeks throughout 1989. They found ravens concentrated around landfills, sewage ponds, agricultural fields, and urbanized areas. The highest density areas (i.e., between 250 and 1,000 ravens/100 mi^2) included the Victor Valley, Lancaster-Palmdale area, and around Ridgecrest (reported in Chambers Group, Inc. 1990).

Increased Raven Populations in Response to Human Resources: Boarman (1992) described ravens as "…predatory animals that survive and perhaps grow in part due to food, water, or other limiting resources provided by or associated with human activities. As a result of their association with humans, the populations are allowed to grow well beyond the natural carrying capacity of the habitat." Raven populations have likely increased due to increased availability of foods (e.g., landfills, sewage ponds, dumpsters, highways, cities) and water (e.g., sewage ponds, agricultural fields, golf courses), which sustain more individuals during times of low natural resource availability, such as winter and summer. Such artificial food sources may facilitate larger clutch sizes or increased frequencies of clutches and greater fledging success. In addition, human-made structures have increased numbers and distribution of perches and nest sites (e.g., power and telephone poles, bridges, billboards, freeway overpasses, etc.). (Boarman 1992, USFWS 1994b).

Prevalence of Raven Predation in the West Mojave Compared to Elsewhere: Boarman (2002) reported that the extent of raven predation could be estimated by evaluating juvenile tortoise carcasses found throughout the desert. He found that Campbell (1983) had reported 136 shells along the perimeter fence at the DTNA, which he attributed to raven predation. Over a four-year period in the early to mid-1980s, Woodman and Juarez (1988) found 250 tortoise carcasses beneath one raven nest near the Kramer Hills. Mean carapace length of the carcasses became progressively smaller over the four years (Woodman, pers. comm.), suggesting that ravens had removed most of the relatively larger animals, and were beginning to seek out smaller, harder to find tortoises. Krzysik (1994) reported that raven predation accounted for 4.5% of the tortoise mortality observed at Fort Irwin. During 1988 and 1990 surveys of various Fort Irwin expansion area alternatives, however, Chambers Group, Inc. observed no evidence of raven predation.

Between 1998 and 2002, of the 1,033 tortoise carcasses found throughout the WMP, cause of death was determined for 104 (10%) of them (WMP, unpublished data). Of these 104 carcasses, raven predation (or scavenging) was identified for 10 (9%) of them. These results are similar to those collected during distance sampling in the Fremont-Kramer and Superior-Cronese DWMAs in 2001 and 2002: cause of death was determined for 44 of 764 (6%) carcasses, and raven predation (or scavenging) was identified for 7% (i.e., 3 of the 40 carcasses). Thus, two independent data sets from the same region and time period attributed raven predation (or scavenging) to 9% (13 out of 148) of the carcasses found where the cause of death was given.

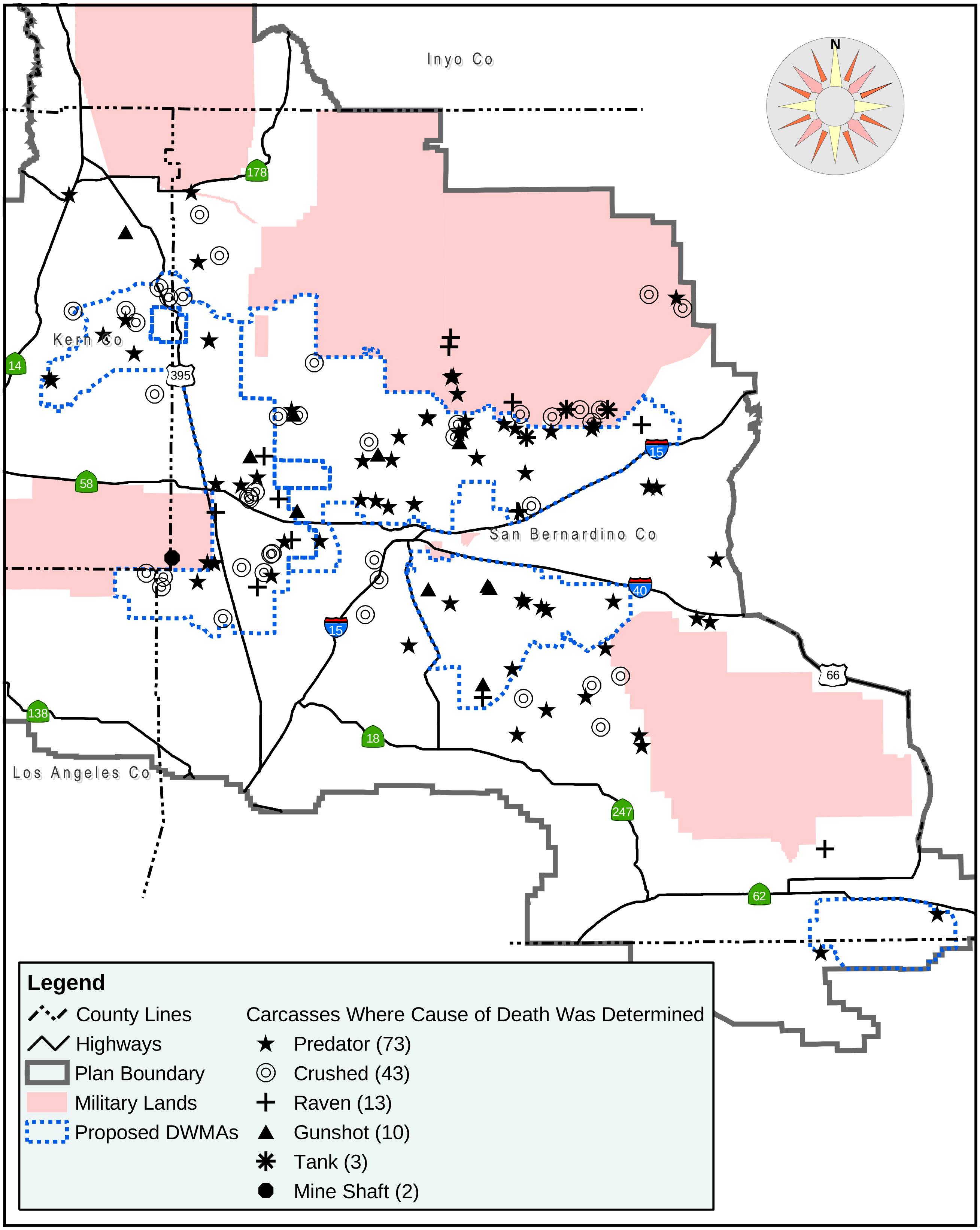
The spatial distribution of 12 of 13 raven-predated carcasses (see Map 3-12) relative to higher density areas reveals an interesting relationship. Of the 12 carcasses where coordinate information was available, 9 (75%) were within or immediately adjacent to tortoise concentration areas. It was reported previously that 43% of observed subadult tortoises are associated with these tortoise concentrations, which occur in only 17% of the surveyed areas. This provides clear direction that raven management should be focused on these higher concentration areas to maximize its effectiveness.

Boarman and Hamilton (in prep.) found 266 shells under an unknown number of raven nests throughout the Mojave. Boarman (2002) points out that not all of these tortoises definitely died from predation, as ravens are also scavengers and may have scavenged carcasses rather than killed living animals (see discussion below). Between 1991 and 1997, the most shells found at a single nest in one year were 28 (this occurred in the East Mojave). Berry (1990, as amended) reported that among juvenile and small immature carcasses found throughout the Mojave Desert, 72% of the deaths were attributed to raven predation (Boarman 2002). Berry (1985) evaluated 403 juvenile tortoise shells found on 27 desert tortoise study plots throughout the Mojave Desert, and determined that ravens killed about 35% (i.e., 141) of them.

Observations of Raven Foraging: In the East Mojave, Camp et al., (1992) found vertebrates comprised half of the total weight of raven food items, with mammals being the most important taxa. Reptiles were unimportant in terms of biomass, but occurred in almost 76% of all pellets, with iguanid lizards being most common. Invertebrates occurred in 90% of all pellets, and consisted primarily of ants and beetles. Human refuse occurred in almost a quarter of the pellets. (Boarman 2002).

Sign count and distance-sampling data suggest that in the West Mojave tortoises may be twice as active in wetter years than in drier years. These findings may be significant relative to raven management. Presumably, ravens are more likely to predate subadult tortoises that are aboveground. There are no reported accounts of ravens entering burrows to remove tortoises. Given that subadult tortoises are more likely to be aboveground in wetter than drier years, it is plausible that raven predation may affect relatively more tortoises in wetter years.

Tortoise Carcass Distribution



West Mojave Plan FEIR/S
Map 3-12

Scale: 1 : 1,320,000

0 10 20 30 Km

0 10 20 30 Miles

10/14/04

Predation Versus Scavenging of Juvenile Tortoises: Ravens are both scavengers (i.e., feeding on carcasses of animals they did not kill), and predators (i.e., killing and feeding on animals).

The Recovery Plan (USFWS 1994b) cited three types of evidence that ravens prey on, and not just scavenge, juvenile tortoises: (a) Ravens have been observed killing juvenile tortoises; (b) Large numbers of juvenile carcasses show signs consistent with raven predation; and, (c) large numbers of juvenile carcasses are found in and at the base of raven nests, as well as near perches. Boarman and Hamilton (in prep.) concluded ravens prey on tortoises throughout the Mojave Desert, but probably not all ravens nesting in tortoise habitat prey on tortoises.

Available data suggest that ravens prey on tortoises that are 110 mm (about 4 inches) or less in length [Berry 1985, Boarman and Hamilton (in prep)]. The 136 carcasses Campbell (1983) found at the DTNA were between 36 and 103 mm. Farrell's (1989) raven-predated carcasses in the East Mojave ranged in size from 42 to 110 mm. Intact, adult carcasses are rarely reported beneath raven nests; finding parts of larger tortoises at raven nests probably signifies scavenging rather than predation.

Effects of Ravens on Regional Tortoise Populations: Although the above anecdotal evidence and focused studies have found that ravens do predate (and scavenge) tortoises, and that predation may be locally common, the relative impact of ravens on regional tortoise populations remains unknown. There are no data available to accurately determine tortoise population levels, so there is no ready means of determining what percent of the population is affected. Available data indicate that about 9% of the tortoise carcasses found where cause of death could be determined were attributed to raven predation.

Available information suggests that ravens are opportunistic predators of small tortoises, and that some individuals or pairs of birds are likely to be responsible, rather than the entire raven population. It is apparent for many predators that they seek out prey items that are relatively abundant, and that they will switch from one prey species to another if preferred prey populations diminish. This is suggested by the observations of Woodman and Juarez. In their case, the first carcasses found beneath the nest were relatively larger than the smaller carcasses subsequently found. A plausible explanation is that the pair of ravens selected relatively larger, more easily found carcasses until they were depleted. Then, gradually, they adjusted their search image to find smaller tortoises, which are presumably more difficult to locate.

If this scenario proves to be true, raven predation would most likely occur where subadult tortoises are abundant, which coincides with the higher density areas, according to sign count data. However, the relative impact of ravens may be more significant in depleted tortoise populations, where every subadult is relatively more important to the future survival of that local or regional population.

Dr. Boarman, probably the foremost expert on raven predation in this population, concluded, "In the sense of hard science, these observations [of raven predation] do not consist of proof that ravens are causing significant harm to tortoise populations, but they do support the hypothesis" (Boarman 1992). In their synopsis, National Ecology Research Center (1990) concluded, “Conflicting evidence and incomplete data sets make analysis of raven-tortoise interactions a difficult task. We cannot determine the effect of ravens on tortoise populations throughout the Mojave Desert. However, it appears that ravens may decrease juvenile tortoise numbers in localized areas.” BLM (1990) concluded, “At this point the contribution of avian predation to tortoise population mortality remains unknown… Whether they [common ravens] can significantly depress a tortoise population is open to question.”

Efficacy of Raven Management Previously Applied: BLM implemented the first focused raven reduction program in 1989, using firearms and poison to eradicate ravens at two sites in the West Mojave (Rado 1990). In 1989, between 106 and 120 ravens were poisoning with Starlicide-treated baits at the 29 Palms Marine Corps Base landfill (Rado 1990). Rado concluded that the BLM’s raven control program had substantially reduced the number of ravens at both the base landfill and at the DTNA. However, there have been no follow-up studies to see what current raven populations are in these two places, so long-term effects of the reduction are unknown.

Boarman (1992) has reported that covering refuse with at least 6 inches of soil, the replacement of open landfills with enclosed transfer stations, and other measures would result in less available food, and may lead to reduced raven numbers. He felt that the most effective control for long-term raven management must address anthropogenic food sources and require low maintenance (Boarman 1992).

Drought: Boarman (2002) concluded that drought might cause episodic tortoise mortality that is punctuated by periods of low mortality during years with more abundant rainfall). He speculated that drought-induced stress in concert with other threats (e.g., disease, predation) might have resulted in significant mortality (Peterson 1994a).

One obvious effect of drought is the lack of available water for tortoises and other desert-adapted wildlife. Boarman (2002, pers. comm. from Dr. Kenneth Nagy) reported that tortoises can probably survive one to two years without drinking water but will start dying of dehydration after that. In very dry years, there is no production of annual plant species, which provide a substantial portion of a tortoise’s annual intake of water. In somewhat wetter years, annual production may be restricted to a few species, or there may be only a few individual plants of a wide array of species that germinate. The nutritional quality of these species becomes relatively more important when they are in limited supply and comprise a tortoise’s entire dietary intake for a given season. Boarman (2002) reports that Turner et al. (1984) and Avery (1998) found that tortoises might survive drought periods by eating less nutritious cacti and shrubs.

Desert Washes and Drought: The 261 tortoises observed during sign count surveys were observed in only six different plant communites. Tortoise occurrence within each of the six communities and the percent of the planning area occupied by each community (WMP 1996 vegetation map) are given in Table 3-20 (listed in descending order of tortoise occurrence):

Table 3-20
Prevalence of Tortoises in the Six Plant Communities Where Observed

PLANT COMMUNITY	% PLANNING AREA OCCUPIED BY PLANT COMMUNITY	NO. SIGN COUNT TORTOISES OBSERVED 1998-2002	% TORTOISES DIVIDED BY % COMMUNITY
Mojave Creosote Bush Scrub	63%	242 (92.7%)	1.5
Desert Saltbush Scrub	9%	14 (5.4%)	0.6
Mojave Desert Wash Scrub	0.3%	2 (0.7%)	**2.3**
Mojave Mixed Woody Scrub	11%	1 (0.4%)	0.4
Shadscale Scrub	0.5%	1 (0.4%)	0.8
Stabilized, Partially Stabilized Sand Dunes	0.3%	1 (0.4%)	1.3
Total	**84.1%**	**261 (100%)**	**N/A**

The data indicate that 261 observed tortoises occurred in six plant communities, which cover about 84% of the planning area. About 98% of the tortoises (256 of 261) occurred in creosote bush and saltbush scrub, which encompass 72% of the area. The key observation (and reason these data are given in this section) is that two tortoises were observed in Mojave Desert Wash Scrub, which occupies only 0.7% of the planning area. One can see in the fourth column, where the percent of tortoises is divided by the percent occurrence of each plant community, that the highest ratio (2.3) was observed in Mojave Desert Wash Scrub. This may suggest that tortoise occurrence in wash scrub is relatively more common when one considers how little of the planning area is occupied by this plant community.

There may be compounding circumstances, or synergistic effects, between the impacts of drought and the use of desert washes by both tortoises and recreational users. In relatively dry years it is common to see a wide swath of green shrubbery growing along washes in an otherwise gray-brown landscape. A creosote bush growing alongside a wash may be bright green and twice the size of all the creosote bushes within 100 feet of the wash. There are times when the only place where annual germination occurs is along the margins of washes (LaRue, pers. obs; Dave Morafka, pers. comm.). Tortoises have been documented to use washes as travel corridors seeking what appeared to be preferred, native forage (Jennings 1997). Wash resources support both sensitive bird and bat species. Water is nearest to the surface where washes and dry lakes occur. As a drought progresses, the last places remaining green in the absence of supplemental rainwater are along washes.

Recent evidence suggests tortoises may concentrate along washes in time of drought. For example, in the southeastern California desert, near Blythe, all tortoises found during one survey were restricted to several large tributaries along McCoy Wash and adjacent upland areas out to several hundred feet (Circle Mountain Biological Consultants 2000). Importantly, much of the site was below 600 feet elevation, which is about 400 feet below the "typical" 1,000 feet lower elevation threshold observed in many places for tortoises. Circle Mountain concluded that the wash, with its thick palo verde growth, provided sufficient resources for several animals to live in an otherwise inhospitable environment.

In October 2002, on a 100-acre site in eastern Twentynine Palms, four of five tortoises (including a hatchling and one-year old tortoise) were found in relatively thick growth of big galleta (a perennial grass) alongside two intermittent streams (Circle Mountain Biological Consultants, 2002.). Scat and burrows were found throughout the site, but four of five tortoises were clearly associated with washes. More recently (November 2002) during a training exercise located west of California City and east of Highway 14, 11 tortoises were observed, 10 of which were located within or immediately adjacent to Cache Creek (LaRue, pers. obs).

Based on the above observations, it is plausible that tortoises may concentrate around washes during drought conditions, which would put them at heightened risk if vehicles were concurrently using the washes. In extreme conditions, presumably even the wash-adapted plants will become dry. Given the relative denseness of the plant growth along washes, this may put them at some heightened risk for vehicle-caused fires. Certainly, there is no way to avoid drought, however restricting vehicle travel in washes may be the only mechanism available to minimize drought-related vehicle impacts to tortoises that are relying on washes for sustenance and cover.

Disease: Boarman (2002) provided the following summary on tortoise diseases (see his literature cited section for full references). Diseases can weaken individuals, reduce reproductive output, and cause mortality. Epidemic outbreaks of some diseases can become catastrophic, particularly in small or declining populations (Dobson and Meagher 1996, Biggins et al. 1997, Daszek et al. 2000). Upper Respiratory Tract Disease (URTD; Jacobson et al. 1991) and cutaneous dyskeratosis affecting the shell (Jacobson et al. 1994) are the two diseases most often implicated in tortoise declines. A third disease, a herpesvirus, was recently identified and may have population-level consequences, but very little is known about its relative mortality on infected tortoises (Berry et al. 2002, Origgi et al. 2002).

URTD has been found in several populations that have experienced high mortality rates, including some in the West Mojave (Jacobson et al. 1996, Berry 1997). Brown et al. (1994a) showed definitively that URTD could be caused by the bacterium, *Mycoplasma agassizii*. A second species, to be named "*Mycoplasma cheloniae*," was found in 2001 in tortoises in northern Lucerne Valley and at the DTNA (Kristin Berry, pers. comm.).

URTD, also referred to as "mycoplasmosis," is likely transmitted by contact with a diseased individual or through aerosols infected with *M. agassizii* or *M. cheloniae.* The organism attacks the upper respiratory tract causing lesions in the nasal cavity, excessive nasal discharge, swollen eyelids, sunken eyes, and in its advanced stage, lethargy and probably death (Jacobson et al. 1991, Schumacher et al. 1997, Homer et al. 1998, Berry and Christopher 2001). It must be noted, however, that some of these clinical signs may also be characteristic of other health conditions such as dehydration, allergy, or infection with herpesvirus or the bacteria *Chlamydia* or *Pasteurella* (e.g., Pettan-Brewer et al. 1996, Schumacher et al. 1997).

Malnutrition is known to result in immunosuppression in humans and turtles (Borysenko and Lewis 1979) and is associated with many disease breakouts. It is possible that nutritional deficiency in tortoises caused by human-mediated habitat change and degradation may be partly responsible for the apparent spread of URTD and its perceived impact on tortoise populations

(Jacobson et al. 1991, Brown et al. 1994a). Short-term droughts may temporarily reduce immune reactions and increase susceptibility to URTD (Jacobson et al. 1991), although this is speculative. Whereas animals may become debilitated by chronic immune stimulation, no biochemical indicators of stress have been identified in diseased compared to non-diseased turtles (Borysenko 1975, Grumbles 1993, Christopher et al 1993, 1997).

Although evidence indicates a correlation between high rates of mortality and incidence of URTD within populations (Berry 1997), there is little direct evidence that URTD is the cause of the high rates of loss. In two preliminary analyses (Avery and Berry 1993, Weinstein 1993), animals exhibiting clinical signs of or testing positively for URTD were no more likely to die over a one year period in the western Mojave Desert than were those not exhibiting signs or testing positive. This may be because factors other than disease caused much of the mortality or many animals not showing clinical signs of disease in the field were still infected.

A shell disease, cutaneous dyskeratosis (CD), has been identified in desert tortoise populations (Jacobson et al. 1994). CD consists of lesions along scute sutures of the plastron and to a lesser extent on the carapace. Over time, the lesions spread out onto the scutes. This disease may be caused by the toxic effect of chemicals in the environment, but evidence is lacking to test this hypothesis. Naturally occurring or human-introduced toxins such as selenium, chlorinated hydrocarbons, organophosphates, nitrogenous compounds, and alkaloids have all been implicated (Homer et al. 1998), but there are no data showing a direct link. The disease may also be caused by a nutritional deficiency (Jacobson et al. 1994). It is not known whether or not CD is caused by an infectious pathogen or if secondary pathogens act to enhance the lesions (Homer et al. 1998, Homer pers. comm.). It is unclear if the disease is actually lethal or responsible for declines in infected tortoise populations (Homer et al. 1998).

If the shell diseases are toxicoses, toxic responses to environmental toxins (e.g., heavy metals, chlorinated hydrocarbons, organophosphates, and selenium), then there may be a direct link between these diseases and human activities unless the toxin is a natural component of the physical environment. Chaffee et al. (1999) found no significant correlation between elevated levels of metals in organs of ill tortoises and in the soil where the tortoises came from.

There is some recent, albeit weak, preliminary evidence linking heavy metals to disease in tortoises. In necropsies of 31 mostly ill tortoises, Homer et al. (1994, 1996) found elevated levels of potentially toxic metals and minerals in the liver or kidney of one or more of the animals. Since most of the animals were ill to begin with, an association was made between the presence of the toxicants and presence of the disease. However, that study is strictly correlative, and fails to demonstrate a cause and effect relationship. Berry (1997) claims, "the salvaged tortoises with cutaneous dyskeratosis had elevated concentrations of toxicants in the liver, kidney, or plasma...and/or nutritional deficiencies." Homer (pers. comm.) has found significantly reduced levels of calcium in the livers of tortoises with CD, which suggests a nutritional deficiency may be involved in the disease.

Several other diseases and infections have been identified in desert tortoises (Homer et al. 1998). These include a poorly known shell necrosis, which can result in sloughing of entire scutes; bacterial and fungal infections; and urolithiasis, a solid ball-like deposition of urate crystals in the bladder (i.e., bladder stones; Homer et al. 1998). There is no evidence to suggest that any of these diseases are at this time widespread, threatening population stability, or hindering population recovery.

During sign count surveys in the fall and winter of 1998 through 2002, disease symptoms were observed in 7 of the 275 (2.5%) tortoises inspected. During distance sampling surveys in the spring of 2001 and 2002 in the Fremont-Kramer and Superior-Cronese DWMAs, 6 of the 216 (2.8%) tortoises inspected showed clinical evidence of disease. These very similar, independently derived results (i.e., 2.5% versus 2.8% of the tortoises observed) are summarized in Appendix L.

Evidence of URTD and possible cutaneous dyskeratosis was recorded for 13 adult tortoises. Clinical symptoms were not observed on any of the 69 subadult tortoises encountered (i.e., although the number in burrows that could not be observed has not been determined). One can see that all 13 of the tortoises were adults. Nine exhibited suspected signs of URTD, and four were identified as having cutaneous dyskeratosis (see footnote). Eight males (89%) and one female (11%) had URTD-like symptoms, and one male (25%) and three females (75%) appeared to have cutaneous dyskeratosis.

The spatial distribution for 12 of these 13 tortoises reveals that they were not clustered in any given region. Two were found south of Highway 58 in the Fremont-Kramer DWMA; four in the Superior-Cronese DWMA; two in the Ord-Rodman DWMA; and four outside DWMAs. Seven were inside or within a mile of higher tortoise concentration areas, and five were in lower concentration areas[13].

Six of the 12 tortoises (50%) observed with disease-like symptoms were inside or adjacent to newer tortoise die-off regions discussed below. Two of these six tortoises are proximate to recent die-off regions in the Fremont-Kramer DWMA south of Highway 58 (i.e., two with cutaneous dyskeratosis), and the other four (i.e., all with URTD-like symptoms) are proximate to newer die-off areas throughout the Superior-Cronese DWMAs.

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13 Sample sizes are too small to conclude how prevalent disease may be in the population. Nor are disease symptoms easily observed on all tortoises encountered, although the timing of surveys facilitates observations for clinical signs. Thus, 156 (72%) of the 216 tortoises encountered in the spring during distance sampling could be observed, compared to only 90 (33%) of 275 animals observed during sign count surveys in the summer-fall. The main difference appears to be the prevalence of tortoises in burrows that could not be observed in the summer-fall, compared to above-ground animals found during the spring, which were more readily observed. Even in the spring, 60 animals could not be clearly observed, likely because they withdrew into their shells before the surveyor could get a good look at them.

Dr. Francesco Origgi (pers. comm., Nov 2002) has found that herpesvirus lesions in tortoises may only be visible for about a 72-hour period, after which time the lesions disappear. Origgi's work has shown that the animal may be infected with no obvious clinical signs. This is also true for both clinical signs and laboratory assays (i.e., ELISA tests) of URTD-infected tortoises. Tortoises that have clinical signs or test positive for exposure to mycoplasma on one occasion are asymptomatic and test negative on subsequent occasions. Therefore, it would be misleading to draw conclusions about the prevalence or distribution of disease in the West Mojave population based solely on these data

3.3.2.5.3 Older and Newer Die-off Regions

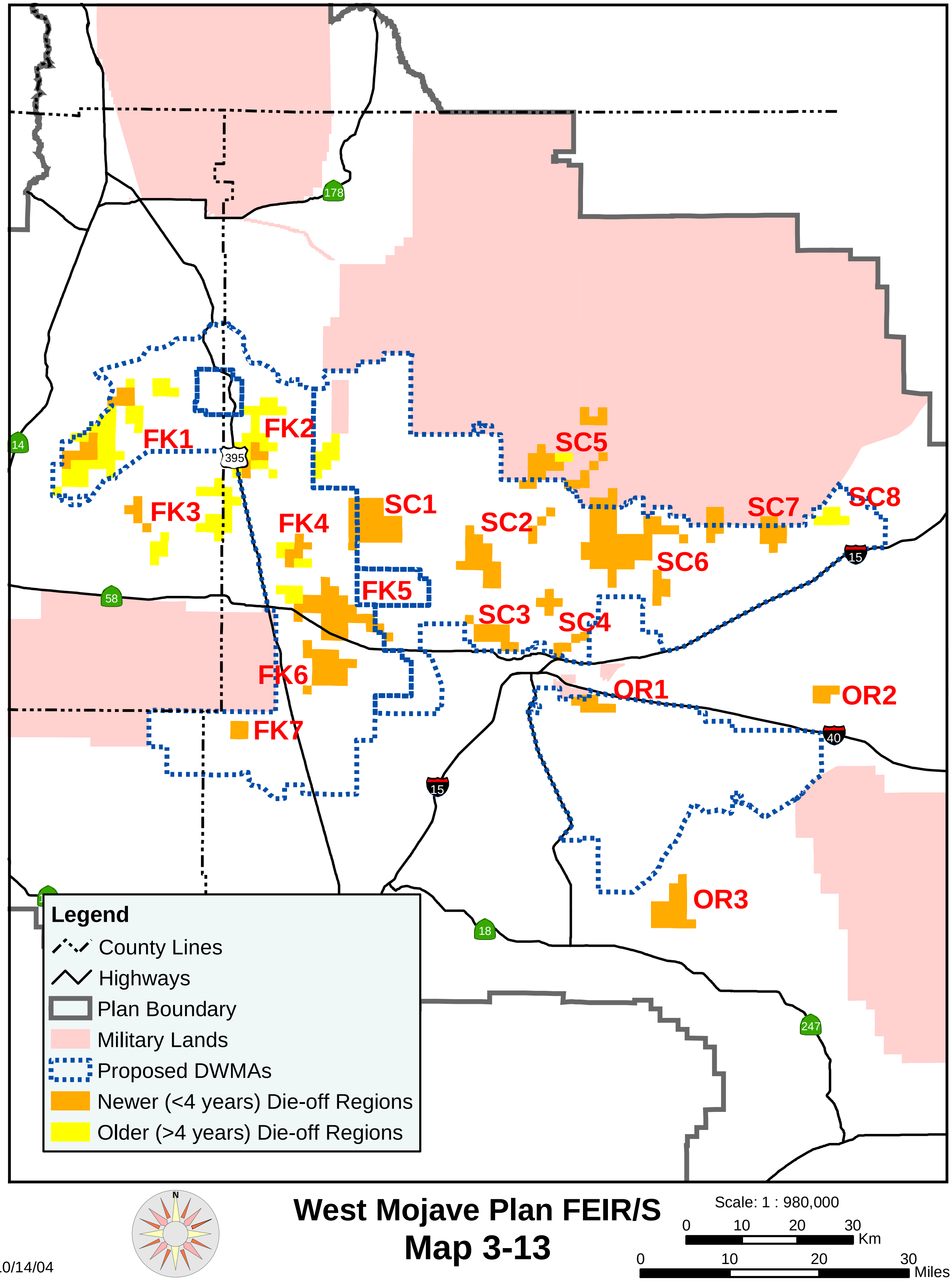
A total of 1,033 carcasses were found during the 1998-2002 sign count surveys. A detailed carcass observation analysis is presented in Appendix L. In the following discussion, carcasses are described relative to how recently the tortoises died: "older" refers to tortoises dying more than four years prior to being found; "newer" refers to those dying within four years of being found[14]. Similarly, "older die-off regions" are comprised of older carcasses, and "newer die-off regions" consist of newer carcasses, although there is some overlap, as described.

With three exceptions, all older die-off regions occur in the Fremont-Kramer DWMA. *All* older die-off regions, including the three in the Superior-Cronese, are located north of Highway 58 (Map 3-13). Newer regions are scattered throughout the older ones. Highway 58 bisects two substantially larger new areas. In the Superior-Cronese DWMA, there are three small older regions, but most carcasses and regions are of recent origin. Three broadly spaced newer regions occur within and adjacent to the Ord-Rodman DWMA. None was observed in the Pinto Mountain DWMA, which is not further discussed.

Fremont-Kramer DWMA: The seven die-off regions within the Fremont-Kramer are characterized in Table 3-21. Regions and subregions are identified alpha-numerically in the subsequent tables and throughout the text, and are displayed on Map 3-13.

14 Both sign count and distance sampling data are included in subsections describing locations of 12 symptomatic animals and 142 carcasses where the cause of death was given. As in other places, summaries include only square miles surveyed (i.e., number of transects), not the sizes of polygons. For example, there are 63 mi^2 within the DTNA die-off region (i.e., Region FK1 on Map 3-13), but only 50 mi^2 were surveyed. So, all data and subsequent discussion are relative to the 50 mi^2, not 63 mi^2.

Tortoise Die-off Regions



West Mojave Plan FEIR/S
Map 3-13

10/14/04

Table 3-21
Characteristics of Older and Newer Die-Off Regions
In the Fremont-Kramer DWMA

REGION NO. & NAME	AGE OF DIE-OFF	NO. MI^2	NO. CARCASSES	RANGE	AVERAGE
OLDER REGIONS NORTH OF HIGHWAY 58					
FK1. DTNA	**Older**	**50**	**72**	**1 to 5**	**2.7**
	Newer	13	30	1 to 5	1.8
Subtotal		*63*	*102*		*2.0*
FK2. Cuddeback Lake	**Older**	**36**	**53**	**1 to 4**	**2.2**
	Newer	5	11	1 to 4	1.8
Subtotal		*41*	*64*		*1.9*
FK3. California City	**Older**	**22**	**21**	**1 to 3**	**1.4**
	Newer	5	5	1 to 2	1.3
Subtotal		*27*	*26*		*1.4*
FK4. NE Kramer Jct.	**Older**	**15**	**24**	**1 to 4**	**1.4**
	Newer	6	7	1 to 2	2.2
Subtotal		*21*	*31*		*1.9*
TOTALS	**Older** Newer **4 Areas**	**123 (81%)** 29 (19%) **152 mi^2**	**170 (76%)** 53 (24%) **223**	**1 to 3/1 to 5** 1 to 2/1 to 5 **1 to 2/1 to 5**	**1.8** 2.1 **1.9**
NEWER REGION BISECTED BY AND SOUTH OF HIGHWAY 58					
FK5. N of HWY 58 bisect	Newer	32	37	1 to 4	1.7
FK6. S of HWY 58 bisect	Newer	19	26	1 to 5	1.4
FK7. Edwards Bowl	Newer	4	4	1	1.0
TOTALS	**Newer** Older **3 Areas**	**45 mi^2** **0 (0%)** **45 (100%)**	**67** 0 (0%) **67 (100%)**	**1/1 to 5** N/A **1 to 5**	**1.4** N/A **1.5**

Observations: Older regions north of Highway 58 comprised 123 mi^2 (81%) of the 152 mi^2 die-off region, with 29 mi^2 (21%) of newer die-offs interspersed. Of the 223 carcasses found, 170 (76%) were older and 53 (24%) were newer, with at least one and up to five carcasses found on each square mile surveyed. There were also two newer regions in the Fremont-Kramer, which are bisected by Highway 58 (Region FK5 and Region FK6 on Map 3-13). Region FK7 is 4 mi^2 and found near "Edwards Bowl." Only 1 tortoise/mi^2 was observed, so this is more likely an artifact of the survey as opposed to a regional die-off. The two bisected regions included 32 mi^2 in Region FK5 and 19 mi^2 in Region FK6. There were 37 fresher carcasses north of the highway and 26 to the south; given the similar region sizes, the average number of carcasses per transect was similar (i.e, 1.7/mi^2 to the north and 1.4/mi^2 to the south). Like the older regions to the north, there were between 1 and 5 carcasses found per transect. Unlike the older regions, 54 of 67 carcasses (81%) found in these two areas were estimated to have died within four years of being found.

Given the above observations, areas north of Highway 58, excluding Region FK5, are predominantly (81%) older die-off regions. Region FK5 and south of Highway 58 are (100%) newer die-off regions.

BLM Study Plots: Five of Dr. Berry's permanent study plots are found in the Fremont-Kramer DWMA, north of Highway 58. The three plots at the DTNA and one in Fremont Valley are within or adjacent to Region FK1 (see Map 3-13). The Fremont Peak study plot is in the vicinity of Region FK2. Declines included 93% at Fremont Peak, 91% at DTNA Interior, 84% at DTNA Exterior Interpretive Center, 74% at DTNA Interior Interpretive Center, and 72% at Fremont Valley.

These data support Dr. Berry's conclusions that the precipitous declines observed on the five square miles encompassing these study plots occurred throughout the northern and northwestern portions of the Fremont-Kramer DWMA. Two older die-off regions (i.e., Regions FK3 and FK4) are about seven miles southwest and eight miles south, respectively, of the Fremont Peak study plot. As such, Dr. Berry's documented die-offs in the DTNA, Fremont Valley, and Fremont Peak identified a smaller region, within a substantially larger one, where tortoises died between the mid-1980's and present day.

Distribution of Symptomatic Tortoises: Four of the 12 (33%) tortoises with disease symptoms were found in or in the vicinity of the Fremont-Kramer DWMA (Map 3-13). The two identified with cutaneous dyskeratosis were within and immediately adjacent to Region FK6, the newer die-off region south of Highway 58. One with URTD-like symptoms was found three miles northwest of Region FK7; the other was two miles southwest of Region FK3. Three of the four were within higher concentration areas; the fourth was three miles southwest of the *only* higher density area west of Highway 395.

Superior-Cronese DWMA: Given Dr. Berry's work and other observations, the die-off in the northern and northwestern Fremont-Kramer DWMA was already suspected, although the affected area is larger than expected. The die-offs in the Superior-Cronese have been suspected since 1998, when sign count data were first collected; however, this is the first documentation of the spatial distribution of these die-offs.

The recent die-off regions described herein in the Superior-Cronese are alarming new evidence that the entire population within this 980 mi^2 DWMA may be in jeopardy of becoming extinct (i.e., disappearing) within the next 20 years (see discussion below).

The eight die-off regions within the Superior-Cronese are characterized in Table 3-22 (see also Map 3-13).

Table 3-22
Characteristics of Older and Newer Die-Off Regions in the Superior-Cronese DWMA

REGION NO. & NAME	AGE OF DIE-OFF	NO. MI^2	NO. CARCASSES	RANGE	AVERAGE ($Carc/mi^2$)
SC1. N of Harper	Newer	27	29	1 to 4	1.1
SC2. Coolgardie Mesa	Newer	22	24	1 to 4	1.1
SC3. Hinkley	Newer	11	13	1 to 3	1.2
SC4. N of Barstow	Newer	10	13	1 to 2	1.3
Subtotal	*4 Newer*	*70*	*79*	*1 to 4*	*1.2*
SC5. E Superior Valley/ Goldstone	Newer	23	35	1 to 4	1.5
	Older	5	8	1 to 3	1.6
Subtotal	*1 Older/1 Newer*	*28*	*43*	*1 to 4*	*1.6*
SC6. Coyote Corner/ Paradise Valley	Newer	56	99	1 to 8	1.8
	Older	7	26	1 to 8	3.7
SC7. Alvord Slope	Newer	16	27	1 to 5	1.7
SC8. Cronese Lakes	Older	6	8	1 to 3	1.3
TOTALS	**Older**	**18 (10%)**	**42 (15%)**	**1 to 8**	**2.2**
	Newer	**165 (90%)**	**240 (85%)**	**1 to 8**	**1.4**

Observations: The three older die-off subregions were all relatively small (i.e., between 5 mi^2 and 7 mi^2), encompassed 18 mi^2, where 42 (15% of 282) carcasses found had died more than four years ago[15]. The seven older die-off subregions were all relatively large (i.e., between 10 mi^2 and 56 mi^2), encompassed 165 mi^2, where 240 (85% of 282) tortoises had died within four years of being found. As such, both older and newer die-off regions encompassed about 19% (183 mi^2 of 980 mi^2) of the Superior-Cronese DWMA. Whereas 19% may seem like an insignificant amount of land for this large, 980 mi^2 area, the spatial distribution (Map 3-13) was throughout the DWMA north of Highway 58, and all higher density live tortoise areas were proximate.

Only 18 mi^2 (10%) of the Superior-Cronese were indicative of older die-off regions. All carcasses in the remaining 165 mi^2 (90%) had died within four years of being found. Region SC8 was the only older region not associated with a more recent die-off. The other two older regions (i.e., SC5 and SC6) were encompassed within predominantly recent die-off areas. Unlike the Fremont-Kramer, which is characterized as an older die-off region (170 of 223 carcasses, or 76%), *the Superior-Cronese is a region of predominantly newer die-offs* (i.e., 240 of 282 carcasses, or 85%), where most observed tortoises had died since about 1990.

BLM Study Plots: None of the nine permanent study plots is within the Superior-Cronese DWMA (i.e. six are within the Fremont-Kramer and three are within or adjacent to the Ord-Rodman DWMA). Had plots been established in the Superior-Cronese, there may have been an opportunity to detect these recent die-offs earlier, as Dr. Berry had done in the Fremont-Kramer DWMA. Establishing study plots in remaining portions of higher density tortoise areas may be prudent to detect die-offs as they occur, rather than after the fact.

[15] Time since death is only a relative indicator. Taken literally, it would mean that the tortoises died between 1994 and 1997, relative to the survey dates of 1998 and 2001. It is a safer assumption that these tortoises died sometime after 1990.

Distribution of Symptomatic Tortoises: Four of the 12 (33%) tortoises with disease symptoms were found in the Superior-Cronese DWMA (Map 3-13). One was southeast of Cuddeback Lake, two were found in the Mud Hills area, and one was found in the northeast corner of Coolgardie Mesa. All four were within several miles of recent die-off regions. Three of the four were inside or within one mile of higher density tortoise areas.

Ord-Rodman DWMA: Although three newer die-off subregions are described in this section as being in the Ord-Rodman DWMA, only Region OR1 (5 mi^2) was actually found within the DWMA (Map 3-13). Region OR2 (7 mi^2) was found north of Interstate 40 and east of Troy Dry Lake, and OR3 (15mi^2) was found in the western part of the Johnson Valley Open Area. Pertinent data are summarized in Table 3-23.

Table 3-23
Characteristics of Older and Newer Die-Off Regions in the Ord-Rodman DWMA

REGION NO. & NAME	AGE OF DIE-OFF	NO. MI^2	NO. CARCASSES	RANGE	AVERAGE ($Carc/mi^2$)
OR1.	Newer	5	9	1 to 3	1.8
OR2.	Newer	7	4	1	0.6
OR3.	Newer	18	15	1 to 2	0.8
TOTALS		**30**	**28**	**1 to 3**	**1.1**

Observations: The three newer die-off subregions were between 5 mi^2 and 18mi^2, encompassing a total of 30 mi^2. Only 28 newer carcasses were found, with about half of these (i.e., 15 of 28, or 54%) located in the Johnson Valley Open Area. Region OR1 is the most significant, as it may indicate that ill tortoises have passed through the “corridor” from north to south (see “corridor” on Map 3-13). If this 5 mi^2 die-off area represents a contact zone for URTD or some other disease spread, it may have the potential to threaten tortoise populations on the north-facing bajada between Dagget Ridge/Newberry Mountain and Interstate 40, where 19 mi^2 of higher sign counts were found between 1998 and 2002.

BLM Study Plots: There are three permanent study plots within and adjacent to the Ord-Rodman DMWA; the Stoddard Valley plot in the northwestern part of the DWMA and Lucerne Valley plot to the south; the Johnson Valley plot is found in the open area, to the east of the DWMA. Both the Stoddard Valley and Lucerne Valley plots are within higher density tortoise areas. Interestingly, there was only a 5% decline on the Stoddard Valley plot (i.e., from 86 to 81 tortoises/mi^2 between 1981 and 1991) and a 30% decline on the Lucerne Valley plot (i.e., 93 to 65 tortoises/mi^2 between 1980 and 1994). For comparison, there was a 77% decline (i.e., 69 to 16 tortoises/mi2 between 1980 and 1994), which is not associated with a higher concentration area. These findings further support Dr. Berry’s findings that tortoise trends on the individual three square miles appear to represent tortoise trends for the three regions where the plots were located.

Distribution of Symptomatic Tortoises: Four of the 12 (33%) tortoises with disease symptoms were found within or adjacent to the Ord-Rodman DWMA (Map 3-13). Two of these were within the DWMA, including one of the three observed with suspected evidence of cutaneous dyskeratosis. One URTD-symptomatic tortoise was observed in the eastern portions of the Johnson Valley Open Area, and the fourth animal was observed about seven miles south of the open area. Two were within higher sign count areas, and the other two were within two to three linear miles. None was within recent die-off areas; the closest was in the southern portion of the Ord-Rodman DWMA, approximately three miles northwest of the nearest die-off region.

Summary of All Carcass Observations: Table L-11 (see Appendix L) summarizes the cumulative findings listed above. Region-wide, there were of 420 mi^2 of die-offs, including 279 mi^2 (66%) of newer die-offs and 141 mi^2 (34%) of older die-offs; given the overlap of 29 mi^2, there were a total of 391 mi^2 affected by both newer and older die-offs. This indicates that about 3.5% of the 2002 tortoise range (391 of 11,134 mi^2), or 11.6% of the surveyed area (391 of 3,362 mi^2), were within older and newer die-off regions.

A total of 600 carcasses were found within the die-off regions (59% of the 1,011carcasses where coordinate information was available), including 388 (65%) newer carcasses and 212 (35%) older carcasses. This is a significant finding, indicating that tortoises are continuing to die throughout the planning area, particularly in the Superior-Cronese DWMA, probably since about 1990. Newer die-off regions were characterized by 317 (85%) newer carcasses and 54 (15%) older carcasses; older die-off regions were characterized by 158 (69%) older carcasses and 71 (31%) newer carcasses. These latter findings suggest that tortoises continue to die in older die-off regions, even though older carcasses were twice as likely to be found as newer ones.

3.3.2.6 Tortoises and Off Highway Vehicles

One of the most controversial resource management issues within the western Mojave Desert concerns the relationship between desert tortoises and off-highway motorized vehicles. This discussion will address both casual OHV use and competitive events and the effects that both may, or may not, have on tortoises and habitat.

3.3.2.6.1 Dispersed Casual OHV Use

Off highway vehicles users visit the desert for many purposes. They explore the desert, hunt, and drive to campsites and trailheads for hiking or horseback riding, rockhounding and other activities. Commercial uses are also common, for mineral exploration, maintenance of existing facilities, and administrative or law enforcement purposes. This use occurs in a more dispersed manner than, for example, concentrated competitive events, and results in a low-density but continuing presence of vehicles throughout the desert. The following discussion addresses effects that have occurred as a consequence of such dispersed, casual use of the planning area by off highway vehicles.

Boarman (2002) conducted a literature review of 56 references that addressed OHV-based impacts on desert tortoises. His conclusion follows:

> Although each study comparing tortoise densities inside and outside of [OHV] areas has limitations, they all lend evidence to reductions in tortoise population densities in heavy [OHV] use areas. The causes for these declines are less certain. Tortoises and their burrows are crushed by [OHVs], although it is difficult to evaluate the full impact this activity currently has on tortoise

> populations, partly because there are probably relatively few tortoises in most open use areas. [OHVs] damage and destroy vegetation. Density, cover, and biomass are all reduced inside versus outside of [OHV] use areas, particularly following multiple passes by vehicles. Split grass (*Schismus barbatus*), a weedy introduced grass, in particular appears to benefit from [OHV] activity. Very light, basically non-repeated, vehicle use probably has relatively little long-term impact. Soil becomes compacted by vehicles. The compaction increases with moisture content of the soil, weight of vehicle (particularly high weight to tire surface area ratio), and soil type. Cohesionless sand, such as in sand dunes and washes, [is] largely immune to compaction while moist soils are much more susceptible than dry ones. Compaction, lower infiltration rates, loss of plants and cryptogamic soils all contribute to increased wind and water erosion and fugitive dust, particularly when such areas are several meters in width. More research is needed to understand the effect light [OHV] use has on tortoise populations and habitat.

Boarman (2002) reported that tortoise densities have been reduced through (a) *direct effects*, including crushing of tortoises and burrows, and (b) *indirect effects* of (i) compaction of soil, (ii) destruction of cryptogamic soils, (iii) changes in vegetation, (iv) erosion and loss of soil, (v) light OHV use, and (vi) human access to tortoise habitat.

The USFWS (2002) indicated that the degree of threat posed to desert tortoises by recreation increases with the speed, weight, and numbers of recreational units involved. They indicated, for example, that a small group of hikers posed much less threat to the desert tortoise and its habitat than a race that involved numerous all-terrain vehicles.

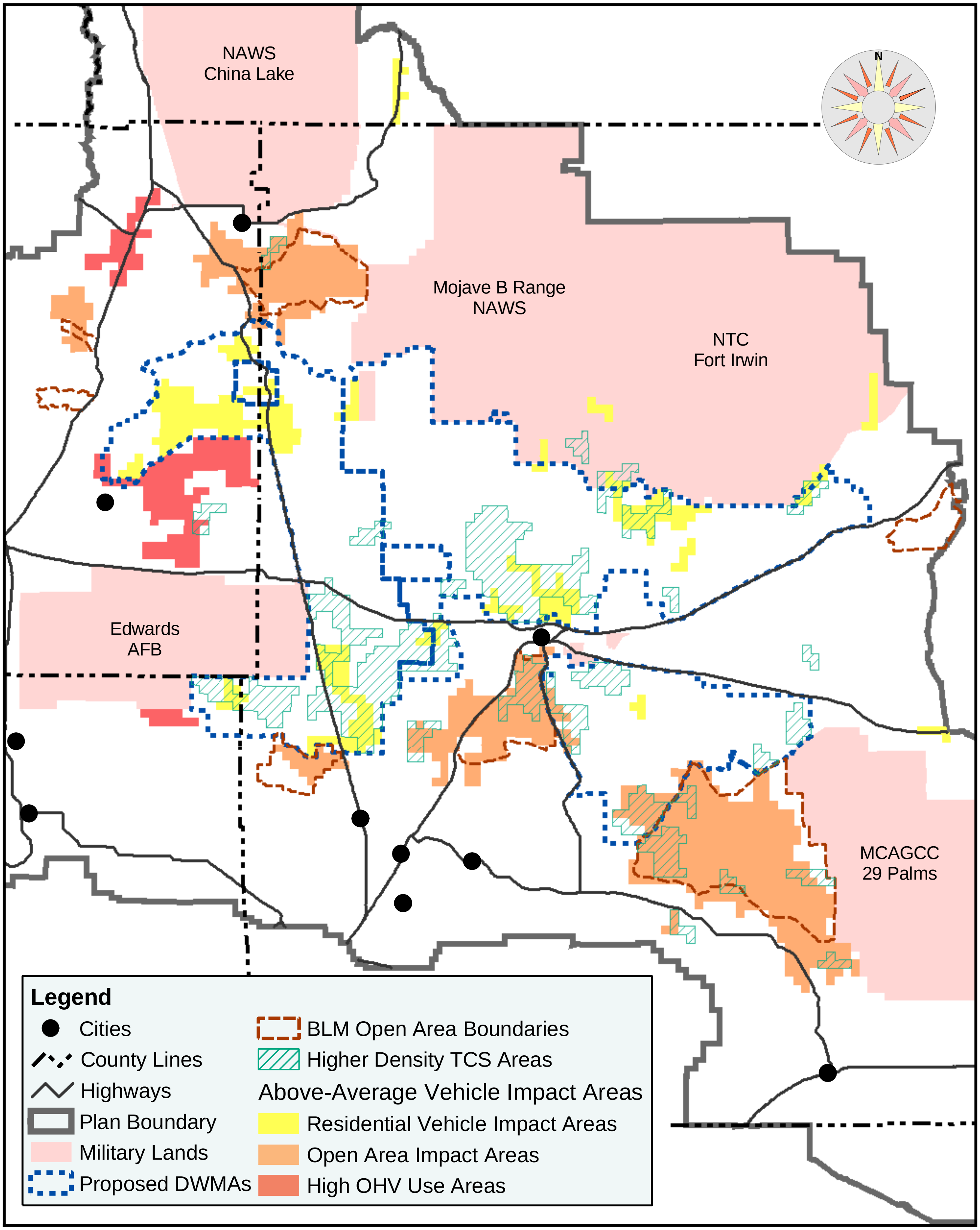
Positive Benefits of Motorized Vehicle Routes: Haskell (2000) reported that roads provided benefits to society such as opportunities for recreation and natural resource extraction. The USFWS (2002) felt that recreational use of the desert might benefit the desert tortoise in an indirect manner. They concluded that many people viewed the California desert as a unique place to enjoy nature and solitude, and that the enjoyment of the desert could promote private citizens to assist in volunteer projects to restore habitats, clean up trash, report problems to the BLM, and educate other users. The BLM's existing educational programs were identified as striving for these goals (USFWS 2002).

3.3.2.6.2 Direct Impacts of OHVs on Desert Tortoise Populations

As of 1980, the USFWS (2002) reported that OHV activities had affected approximately 25% of desert tortoise habitat in California. In 1986, Dodd (1986) concluded that nearly 70% of the remaining high-density tortoise populations in the California desert were subject to OHV impacts. In 1990, Chambers Group, Inc. (1990) found that 413 square miles (2.9%) of the planning area had been directly disturbed by OHVs, and that much of the disturbance had occurred in open areas or in unauthorized OHV-use areas.

Sign count data collected between 1998 and 2002 indicate that vehicle-based impacts are prevalent throughout tortoise habitats, including DWMAs. Within the Fremont-Kramer and Superior-Cronese DWMAs, cross-country travel was observed on 833 of 1,572 (53%) transects and roads were observed on 702 (45%) transects. There were 447 mi^2 with higher tortoise sign counts, 159 mi^2 (36%) of which overlapped with above-average vehicle-based impacts (see Map 3-14).

Distribution of Recreational and Residential Vehicle Impact Regions (1998-2002)



West Mojave Plan FEIR/S
Map 3-14

10/14/04

Scale: 1 : 1,100,000
0 10 20 30 Km
0 10 20 30 Miles

Although most of the above-average vehicle impacts are contained within BLM Open Areas, similar vehicle impact areas were observed from California City, north through the Rand Mountains, into Fremont Valley. In effect, this is a heavy OHV use area affecting both private lands around California City and about half of the region that is proposed for DWMA management. Beginning in the late 1970's and early 1980's, extending through 2002, data from permanent study plots indicate that tortoises decreased from about 72% to 93% in this region.

Reduced Tortoise Numbers Attributed to OHV Impacts: The literature suggests that OHV use has resulted in reduced tortoise numbers (National Ecology Research Center 1990, USFWS 1994b), including juveniles next to well-used dirt roads (USFWS 1994b). Berry (1996) found that tortoise populations decreased significantly with (a) increasing mileages of linear disturbances associated with roads, trails, routes, and tracks ($P<0.01$) and (b) increasing numbers of human visitors ($P<0.05$). She observed that stable or increasing tortoise populations had low mileages of linear disturbances and vehicle use, few human visitors, and relatively low percentages of introduced annual plants. For example, two of the 15 plots she surveyed in the northern Colorado Desert had stable or increasing populations and disturbance levels that were generally lower than elsewhere in the California deserts.

In 1994, the USFWS (1994b) concluded: (a) The density of paved and dirt roads, routes, trails, and ways in desert tortoise habitat has had a direct effect on mortality rates and losses of desert tortoises; (b) As mileage of roads, trails, and tracks increased on BLM study plots in California, desert tortoise populations declined at greater rates; (c) Even relatively low vehicle use had contributed to depressed desert tortoise densities in local areas; and, (d) the presence of routes of travel through or near the habitats of listed species presented an ongoing level of threat to those species from illegal vehicle use. In 2002, the USFWS (2002) concluded, "Given the precariousness of the desert tortoise in large areas of the California desert and the likelihood that declines will continue to spread at least for some time, the loss of even a few individuals could impede recovery of the species."

Data indicate that significant declines have occurred through much of the northern and northeastern portions of the Fremont-Kramer DWMA. URTD has been implicated, but sign count data reveal that it is also a region of very heavy vehicle impacts, and persistent sheep grazing is known to occur. These data also reveal that there are still higher density tortoise areas in the northern part of the Stoddard Valley Open Area and along the western boundary of the Johnson Valley Open Area.

One may interpret these data to indicate that OHV impacts have eliminated tortoises between California City and Fremont Valley, or conversely that OHV impacts are negligible in open areas, as evidenced by persisting regions of higher tortoise densities. Both arguments have inherent weaknesses, as do the literature sources that refer to "reduced numbers" and "significant decreases" of tortoises caused by OHV impacts. Both arguments are weakened by the lack of baseline data from the 1950's, for example, to which current population levels can be compared. Recent sign count data provide a static look at relative tortoise densities and distribution. Except for where numerous freshly dead carcasses have been found, or declines have been documented on BLM study plots and other places, the current distribution suggests nothing about population trends.

Tortoises and Burrows Crushed: Vehicle collisions are responsible for tortoise injury and mortality on dirt roads (Berry 1996), including lightly traveled roads (USFWS 1994b). Given the prevalence of cross-country OHV travel (WMP 1998-2002 data), tortoises have also been crushed in areas adjacent to roads (see also USFWS 2002), and mortality has likely occurred both above- and belowground (USFWS 1994b). Such cross-country travel has also resulted in loss (Jennings 1993) or damage (USFWS 1994b) of tortoise burrows.

Relative Impacts Attributed To Trucks versus Motorcycles: Data do not indicate if the tortoises (or carcasses) were crushed by motorcycles or trucks, but it was more likely by trucks, given the larger surface area affected by four large tires, and the following considerations. The location of tortoises and burrows likely affects the potential for them to be differentially crushed by trucks or motorcycles. Compared to trucks, motorcyclists are less likely to ride through and crush shrubs, so tortoises and burrows under shrubs are somewhat less vulnerable to this impact. The visibility from a motorcycle also makes it likely that cyclists can more readily see and avoid tortoises. Comparatively, operators of four-wheel drive trucks often crush shrubs, have limited visibility from inside the vehicle, and are probably more likely to crush tortoises and burrows than are cyclists.

Cross-country travel by both trucks and motorcycles results in degradation of habitat, which may result in poor forage quality and reduced burrowing potential. Motorcycles are significantly more maneuverable between shrubs, in mountainous areas above 20% slope, and many other places that are less accommodating to trucks. This maneuverability has resulted in more cross-country travel by motorcycles than by trucks, although there are exceptions in localized areas. The 27% increase of trails between 1979 and 1995 observed in the southern part of the Ord-Rodman DWMA was predominantly due to motorcycle traffic, and likely due to the proximity with Johnson Valley Open Area, which is immediately east. Therefore, although cyclists are less likely to crush tortoises than truck operators, they are more likely to leave roads, and are more likely to degrade habitats in areas with few roads, compared to trucks.

Prevalence of Vehicle Crushing: Sign count data indicate that vehicles crushed 28 (27%) of the 104 carcasses where the cause of death could be ascertained. These results are remarkably similar to those of distance sampling in the Fremont-Kramer and Superior-Cronese DWMAs, where vehicle crushing accounted for 32% (14 of 44) of all observed carcasses where cause of death was given.

Vehicle crushing has resulted in about a third of the tortoise deaths observed where cause could be determined, with only mammalian predation being more prevalent. Unlike catastrophic die-offs, where the cause of death is unknown, and mammalian predation, which is widespread and may not be controllable, vehicle impacts may be controlled. Route reductions, signing and fencing programs, restriction on competitive events in DWMAs, education program, and increased law enforcement are pragmatic ways of minimizing vehicle impacts.

Adult Versus Subadult Tortoises Crushed: The data suggest that adult tortoises are more likely to be crushed than subadult tortoises, although the lower detectability of smaller carcasses may, in part, account for the difference. Sign count data for the 28 crushed carcasses indicate that 23 (82%) were adults, 4 (14%) were subadults, and 1 (4%) was unknown. Similarly, distance-sampling data indicate that 12 of the 14 (86%) crushed carcasses were of adult tortoises, 1 (7%) was a subadult, and 1 (7%) was unknown.

Aboveground Tortoise Activity in Response to Wet versus Dry Years: Sign count and distance-sampling data indicated within a give year, tortoises are more likely to be aboveground (i.e., active) in the spring and in burrows (i.e., inactive) in the summer-fall. The distance sampling data suggest that increased activity patterns occur on a *regional* scale, not just on a *local* scale. This may the first evidence that increased tortoise activity patterns in response to rainfall occur on a population level instead of at the individual level.

These observations are significant for the following reasons:

- Heightened activity in wetter years may put more tortoises at risk to being crushed by vehicles, both on and adjacent to designated routes. This impact is more likely to occur in higher density areas where operators are more likely to encounter tortoises.

- Illegal activities that are facilitated by roads (i.e., poaching, pet collection, inter-regional translocations, intentional vandalism, etc.), may occur more frequently in wetter years, given that tortoises are substantially more visible aboveground than in burrows. Increased law enforcement in higher density areas during such conditions may minimize these impacts when and where they are most likely to occur.

- Vehicles traveling in washes in wetter years may impact relatively more tortoises than in dry years. It has been suggested that vehicle travel in washes during drought periods would result in more impacts. This may not be true if tortoise activity in washes occurs at reduced levels (i.e., although tortoises in burrows would still be affected by vehicle travel in washes).

Locations of Tortoises: There were 491 sign count and distance sampling tortoises observed between 1998 and 2002. Their locations and other information are given in Table 3-24. Distance sampling tortoises for 2001 and 2002 are given in the middle two rows of the table. Arrows show the directions to which percentages apply; the two middle rows are relative to "Distance Both Years" shown in the fourth row of data.

Table 3-24
Characteristics of 491 Tortoises Found Between 1998 and 2002

LOCATIONS OF TORTOISES[16]										
		288 IN BURROWS					203 ABOVEGROUND			
Type Years	Total	No Obs	Shrubs Rocks	Open	Wash Banks	Unk	No Obs	Open	Shrubs Rocks	Washes
Sign Count 98-99-01	275 ↓56%	202 ←74 ↓70%	116 ←57%	58 ←29%	20 ←10%	8 ←4%	73 ←26% ↓36%	67 ←92% ↓40%	3 ←4% ↓9%	3 ←4% ↓4%
Distance 2001	104 ↓21%	29 ←28% ↓10%	29 in Burrows; no location data				75 ←72% ↓37%	58 ←77% ↓34%	17 ←23% ↓37%	See footnote
Distance 2002	112 ↓23%	57 ←51% ↓20	57 in Burrows; no location data				55 ←49% ↓27%	43 ←78% ↓26%	12 ←22% ↓37%	
Distance Both Years	216 ↓44%	86 ←40% ↓30%	86 in both years				130 ←60% ↓64%	101 ←78% ↓60%	29 ←22% ↓91%	
Total	491	288 ←59%					203 ←41%	168 ←84%	32 ←16%	

OHV Impacts to Tortoises in Washes: During his studies at the Desert Tortoise Natural Area in the early 1990's, Jennings (1993, 1997a, 1997b) found that tortoises systematically located preferred forage along the margins of small washes. They spent a considerable amount of time traveling along washes, and apparently used washes as navigational aids to relocate burrows. For example, more than 25 percent of all plants on which tortoises fed, and three of the ten most-preferred plants, were in the washes and washlets, even though washes comprised only 10.3% of the study area habitats (1997). Given this information, he concluded that OHV use may disorient tortoises (1993) and that tortoises will be forced to select other less-preferred and possibly less-nutritious plant species (1997a).

Jennings (1997a) also found that tortoises generally spent more time traveling and foraging in hills, washes, and washlets than on the flats, and that hills and washes were favored in the planning area for use by OHV recreationists. Given this overlap, he concluded that tortoises are more likely to suffer direct mortality from vehicles than if they used the habitat randomly.

3.3.2.6.3 Direct Impacts of OHVs on Desert Tortoise Habitat

Habitat Degradation: Lovich and Bainbridge (1999) found that the wheel tracks of a full-size OHV vehicle operating in an undisturbed area could damage almost 1.25 acres (0.5 ha) with every 4 miles (6.44 km) traveled. Goodlett and Goodlett (1991) reported that impacts in the

[16] Sign count data are shown in the 1st row for 275 tortoises, and in the 4th row for 216 distance-sampling tortoises 86 animals found in burrows during distance sampling, but was provided for aboveground tortoises. The total aboveground estimates of 84% in the open and 16% under shrubs are for 200 tortoises observed outside washes. It would be incorrect to conclude that only 3 of 203 tortoises were in washes; the correct conclusion is that 3 of 73 (4%) were found in washes, in the summer to fall period; even this number is likely an underestimate, as surveyors likely failed to indicate all tortoises and burrows associated with washes.

Rand Mountain area were highest close to open routes. Open routes may induce negative impacts for substantial distances; even at 500-feet from an open route, unauthorized tracks were observed at a rate of almost one per 20 linear foot.

Negative effects on the desert environment have been summarized (National Ecology Research Center 1990, USFWS 1994b). Impacts include damage to and loss of habitat (Jennings 1997a, USFWS 2002) and severe declines in biomass of plants and vertebrates (USFWS 1994b). Both annual and perennial plants are affected (Jennings 1997a, National Ecology Research Center 1990), which in turn affect forage quality, water availability, and thermoregulation (USFWS 1994b).

Vollmer *et al.* (1976) reported that cross-country OHV travel impaired annual plant productivity, retarded shrub regrowth, resulted in less plant cover and density, and conspicuously decreased shrub biomass. In comparing areas of different disturbance levels, Webb *et al.* (1983) concluded that light OHV use might not cause the severity of impact that occurs in some ghost towns, but OHV pit areas have more soil and vegetation disruption than naturally recovering ghost towns. Berry (1996) indicated that OHV use directly affects plants and animals by disrupting the distribution, composition, structure, diversity, and biomass of animal and plant communities; changing the watershed; and promoting desertification.

The USFWS (2002) concluded that unauthorized activities, particularly OHV use, have degraded desert tortoise habitat. The access provided by the BLM for legitimate uses, such as recreation, facilitates some degree of unauthorized use (USFWS 2002). In addition to unauthorized roads and trails, areas that are frequently used for loading and unloading vehicles can be severely degraded (USFWS 2002).

Habitat Regeneration: Vollmer *et al.* (1976), upon revisiting their study plot 18 months after the tests were conducted, found that little damage to shrubs was apparent from a distance, but that when viewed from nearby, tracks were clearly discernible. They concluded that truck tracks can persist at least 10 to 12 years depending on the substrate, and that shrub cover may be re-established within a couple of decades if there is no further damage. National Ecology Research Center (1990) estimated full-recovery time required to ameliorate severe OHV impacts should probably be estimated in terms of human life spans; and that hundreds or thousands of years may be necessary for disturbed areas to recover. Stowe (1988) found that many of the older, smaller trails that were identified 1977-78 appeared to be unused in 1988, and in some cases the vegetation appeared to be growing back over the edges of the trails.

OHV Impacts to Wash Habitats: Jennings (1993, 1997a) found that vehicles' driving in washes disturbed relatively rare species of plants that were restricted to washes. LaRue (1997) found catclaw acacia and desert willow mostly restricted to washes in the Ord Mountain area. Damage observed in the Ord Mountains included disturbed soil and terrain, crushed shrubs, and eroded margins of washes, which led to widening of the washes. He found that some routes in washes became impassable when banks and boulders were encountered, which necessitated turning around and resulted in new shrub damage.

OHV Impacts to Soils: OHV use has resulted in the following impacts to soils (see also National Ecology Research Center 1990): damage or destruction of soil crusts (24), soil erosion (Trombulak and Frissell 2000, USFWS 1994b), and interrupted run-off patterns (Trombulak and Frissell 2000). Vollmer *et al.* (1976) found that OHV use changed soil compaction and permeability, and that disruption of soils may not be fully expressed until years after the original impact. Berry (1996) found alterations to and erosion (wind, water) of soil and soil crusts, and adverse effects to soil porosity, chemistry, moisture, and temperature. Lovich and Bainbridge (1999) observed that areas they considered least susceptible to water and wind erosion, following OHV use, were dunes, playas, and areas with abundant coarse surface material.

3.3.2.6.4 Indirect Impacts of OHVs on Desert Tortoises and Habitat

Human Access: Berry (1996) indicated that human access results in increased damage to plants, animals, and soils. This access results in exploitation, removal, unintentional or intentional disturbance, and harassment of wildlife. She also reported adverse effects on other visitors and increased deposition of garbage and refuse. Fire regimes are altered as a result of human-induced fires and the proliferation of alien or non-indigenous plants.

USFWS (1994b) indicated that the presence of routes facilitates the removal of desert tortoises (predation for food, collecting for pets, and commercial trade), vandalism, and release of captive desert tortoises. Dumping, numbers and locations of wild fires, harvest and vandalism of vegetation, and predation by dogs and ravens may increase proportionate to available access. Routes have been implicated in the proliferation of weeds, resulting in more wildfire (USFWS 2002, USFWS 1994b). Berry (1996) found that tortoise populations decreased with increasing percentages of introduced annual plants.

Spread of Weeds: Lovich (1992) concluded that, among other things, tortoise habitats have been negatively affected by construction of roads and utility corridors. Brooks (1998) and Frenkel (1970) concluded that dominance of alien annual plants is the highest where road densities are high, and that minimizing the number of paved and dirt roads and maintaining non-roaded wilderness areas may reduce the dominance of aliens.

Trombulak and Frissell (2000) listed seven general effects of roads, including spread of exotic species, and indicated that roads are commonly identified as important correlates or indicators of loss of ecological health. They reported that roads provide dispersal of exotic species via three mechanisms: providing habitat by altering conditions, making invasion more likely by stressing or removing native species, and allowing easier movement by wild or human vectors. Hourdequin (2000) found that, whereas roads negatively affect some species, others may benefit; that many exotic plant species thrive along roadsides; that roads can act as corridors for the dispersal of plant seeds; and that roads may also provide habitat and movement corridors for opportunistic species such as weeds. Tracy (1995) showed that fires are mainly started along roads, and that a majority of those are along paved roads.

Route Proliferation: USFWS (1994b) identified route proliferation as a threat. LaRue (1997) reported that there had been a 27% increase in detectable routes between 1978 and 1989 in the Ord Mountain area. Much of it resulted from motorcycle use in the southern parts of the proposed Ord-Rodman DWMA, west of and including the Cinnamon Hills. The USFWS (2002) reported that recreationists used legal routes to gain access to popular staging and camping sites, and that impacts emanated out from such areas, impacting less disturbed habitats. Stow (1988) reported that light OHV activity escalated into heavier use and more impacts. Vollmer *et al.* (1976) expressed concern that once an area was heavily used, recreationists would abandon the area in search of new and intact environments.

No OHV Impacts or Minimal Impacts Observed: Vollmer *et al.* (1976) found no indication that driving interfered with rodent reproduction, side-blotched lizard reproduction, or animal population trends. Few shrubs were outright killed, and plant density and diversity remained essentially unaltered. They found creosote bush recovered if root crowns were not destroyed; damaged plants were scarcely distinguishable after10 years. It was not clear that the density of annuals was reduced by vehicular traffic during their study.

OHV Impacts Uncertain: In 2002, the USFWS concluded that reductions in the amount of open routes are likely to provide some level of benefit to the desert tortoise. However, neither the BLM nor the USFWS had definitive information on how differing route networks may affect the desert tortoise; presumably, roadless areas would have the least adverse effect on desert tortoises and their habitat. Vollmer *et al.* (1976) found it difficult to gauge the impact of less intensive OHV-use areas. The extent that any changes in the access network affect the desert tortoise would be difficult to measure because of the slow reproductive rate of the species and other factors, such as disease, drought, and predation, that may be affecting the number of individuals in a region. No quantitative information was available concerning how frequently desert users leave routes of travel to camp, stop, and park outside of existing disturbed areas. In at least some areas that are occupied by the desert tortoise, the density of vegetation would likely prevent most desert users from leaving the routes of travel (USFWS 2002).

3.3.2.6.5 Off-Highway Vehicle Open Areas

Relative Tortoise Occurrence in Open Areas: Eight BLM open areas occur, including Johnson Valley, Stoddard Valley, El Mirage, Spangler Hills, Jawbone, Dove Springs, Rasor, and Olancha. Jawbone, Dove Springs, and Rasor are on the edge of the 2002 tortoise range, while Olancha is north of the known range. These areas were either not surveyed (Jawbone or Olancha) during sign count surveys, or no tortoise sign was observed during surveys at Rasor (i.e., 26 of 35 mi^2, 74%) and at Dove Springs (i.e., 3 of 6 mi^2, 50%). Survey coverage was relatively good at Johnson Valley (231 of 294 mi^2, 79%), Spangler Hills (i.e., 75 of 97 mi^2, 77%), and Stoddard Valley (i.e., 63 of 85 mi^2, 74%), and somewhat less representative of El Mirage (i.e., 16 of 40 mi^2, 40%). Most of the following discussion is relative to Johnson Valley, Stoddard Valley, El Mirage, and Spangler Hills open areas (see Appendix L for more information).

Higher Density Tortoise Areas: Higher density sign count regions within open areas are shown in Map 3-14. There were four higher density tortoise areas in the Johnson Valley Open Area, comprising 32 mi^2. Two of these (28 mi^2) were contiguous to the Ord-Rodman DWMA. Higher density areas were also found throughout much of the northern part of the Stoddard Valley Open Area, and were contiguous to higher density areas east of Highway 247, in the Ord-

Rodman DWMA. There were no higher density areas in El Mirage, although the survey effort was relatively light, and 5 mi^2 were found immediately northwest of Spangler Hills.

Relative Tortoise Occurrence in Open Areas[17]*:* Tortoise encounters were the highest in Stoddard Valley (i.e., 1 tortoise/10.5 linear miles of transects), intermediate in Johnson Valley (i.e., 1 tortoise/43.3 miles), and lowest in Spangler Hills (i.e., 1 tortoise/56.2 miles). El Mirage was relatively high (i.e., 1 tortoise/8.0 miles), but the sample size was sufficiently small that this was likely an artifact of the survey rather than a relative estimate of abundance.

The data suggest the following descending order of tortoise abundance in the four open areas: Stoddard Valley > Johnson Valley > (El Mirage, suspected) > Spangler Hills. Collectively, 22 live tortoises were observed over 520 linear miles of transects in these four open areas, for an encounter rate of 1 tortoise/23.6 miles of transects. For comparison, 154 live animals were observed on 2,293.5 miles of transects in three DWMAs (i.e., excluding Pinto Mountain), for an encounter rate of 1 tortoise/14.9 miles, or about 1.6 times higher than in open areas.

Relative Occurrence of Carcasses in Open Areas: Carcass encounters were the highest in Johnson Valley (i.e., 1 carcass/5.25 miles), intermediate at Stoddard Valley (i.e., 1 carcass/8.59 miles), and lowest in Spangler Hills (i.e., 1 carcass/12.5 miles). El Mirage was relatively high (i.e., 1 carcass/4.8 miles), but again, sample size was too small to be meaningful. The data suggest the following descending order of carcass abundance in the four open areas: Johnson Valley > Stoddard Valley > (El Mirage, suspected) > Spangler Hills.

Comparisons between Live Tortoises and Carcasses in Three Open Areas: The inverse relationship described previously for DWMAs was not observed in the three open areas. Table 3-25 shows the encounter rates for both tortoises and carcasses.

Table 3-25
Tortoise and Carcass Encounter Rates

AREA OF COMPARISON	ONE TORTOISE OBSERVED EVERY	ONE CARCASS OBSERVED EVERY
Stoddard Valley	10.5 mi	8.59 mi
Johnson Valley	43.3 mi	5.25 mi
Spangler Hills	56.2 mi	22.5 mi

Observations in three DWMAs (i.e., excluding Pinto Mountain) indicated an inverse linear relationship between live tortoises and carcasses; tortoises were more often encountered where fewer carcasses were found. Observations in the Stoddard Valley Open Area followed this pattern, but not for either Johnson Valley or Spangler Hills. Spangler Hills is relatively easily explained; very low encounter rates for both tortoises and carcasses suggests low densities of tortoises. Johnson Valley, however, appears to be an anomaly, as it was the only place where tortoises were difficult to find, but carcasses were relatively easy. Only 10 sign count tortoises

17 Appendix L shows encounter rates, carcass data and other calculations that were used in support of the above observations.

were observed in the 294 mi^2 Johnson Valley open area. Five were in higher sign count areas and five were outside. None was found in the 22 mi^2 higher density area southeast of the Ord-Rodman DWMA, where a recent die-off was detected. This may suggest that tortoises were once relatively more common than they are now (i.e., as evidenced by the prevalence of carcasses).

One measure is to divide the tortoise encounter rate by the carcass encounter rate. This ratio is 1.2 for Stoddard Valley, 2.5 for Spangler Hills, and 8.2 for Johnson Valley. The same ratio for the DWMAs is: 1.8 for Ord-Rodman, and 4.5 for Superior-Cronese and 7.0 for Fremont-Kramer. The lower ratios for Stoddard Valley, Ord-Rodman, and Spangler Hills (1.2, 1.8, and 2.5, respectively) coincide with regions of relatively more tortoise encounters compared to carcasses (excepting Spangler Hills, where both were less commonly found). This compares to the higher ratios for Superior-Cronese, Fremont-Kramer, and Johnson Valley (4.5, 7.0, and 8.2, respectively) where there were relatively fewer tortoise encounters compared to carcasses.

Dr. Berry documented a 77% decline between 1980 and 1994 on the Johnson Valley study plot, which is within the open area. All other such declines have occurred in the Fremont-Kramer and Superior-Cronese DWMAs. The two study plots showing the smallest declines were Lucerne Valley (i.e., 30% decreases between 1980 and 1994) and Stoddard Valley (5% between 1981 and 1991). These data suggest that there may be a differential die-off in Johnson Valley that is more similar to Fremont-Kramer and Superior-Cronese DWMAs than in Stoddard Valley and Ord-Mountain areas.

Relative Occurrence of Vehicle Impact Areas: Map 3-14 shows the spatial distribution of three types of vehicle impact areas that occur within the planning area: BLM open areas, heavy OHV use areas, and residential areas. Rules of polygon establishment described elsewhere were used to delineate these regions[18]. Importantly, only above-average vehicle impact data collected during sign count surveys (1998-2002) were used in polygon establishment. Although these types of impacts occur throughout many portions of the planning area not encompassed in the polygons, the identified regions (and data discussed herein) reflect the most severe and intense levels of vehicle impacts on lands where human uses are most concentrated (i.e., on at least four contiguous square miles where every square mile had above-average impacts).

Open areas are designated by the BLM for vehicle free play, and occur in seven specific areas. *Residential* impact areas occur in three general regions: west and northwest of the community of Silver Lakes, north of Hinkley, and in the "Coyote Corner," southwest of Fort Irwin. *Heavy OHV Use* areas are as disturbed as designated open areas, but are not officially designated for this form of vehicle use. The impact area between California City and the Rand Mountains is not a BLM open area, but it is very large and, in places, as impacted as open areas. Interestingly, there is also a 14 mi^2 area (i.e. East Sierra in Table 3-26) seven to eight miles north

[18] As in other similar calculations, although Map 3-14 shows the distributions of the larger polygons, only the square miles of data are included in the table and discussed in the text. Importantly, all data describe above-average vehicle impacts; there are individual square miles of similar disturbance and many other square miles affected by below-average impacts; these areas are significantly affected by vehicle impacts.

of Dove Springs that has experienced above-average vehicle impacts, but it is not clear if this is an extension of Spangler Hills impacts from the east or Dove Springs/Jawbone Canyon impacts extending north (likely the latter). These two, and the Edwards Bowl area south of Edwards AFB, are herein referred to as heavy OHV use areas.

Table 3-26
Relative Areas Affected by Recreational versus Residential Vehicle Impact Regions

TYPE OF IMPACT AREA	AFFECTED AREA		% TOTAL IMPACT AREA (TOTAL = 979 MI^2)
RECREATION			
Designated Open Areas	Inside	Outside	
Johnson Valley	205 mi^2	91 mi^2	296 mi^2 = 30%
Spangler Hills	71 mi^2	60 mi^2	131 mi^2 = 13%
Stoddard Valley	61 mi^2	58 mi^2	119 mi^2 = 12%
Dove Springs/Jawbone Canyon	2 mi^2	22 mi^2	24 mi^2 = 2%
El Mirage	14 mi^2	7 mi^2	21 mi^2 = 2%
Open Area Subtotals	353 mi^2	238 mi^2	
Open Area Total	591 mi^2		591 mi^2 = 60%

***Heavy OHV Use* Areas**		
California City/Rand Mountains	168 mi^2	= 17%
Edwards Bowl	31 mi^2	= 3%
East Sierra	14 mi^2	= 1%
Total	**213 mi^2**	**213 mi^2 = 21%**
Total Recreation	**(591 mi^2 + 213 mi^2) 804 mi^2**	**RECREATION 804 mi^2 = 81%**

RESIDENTIAL		
Coyote Corner	39 mi^2	= 4%
Silver Lakes	37 mi^2	= 4%
Hinkley	31 mi^2	= 3%
Total Residential	**107 mi^2**	**RESIDENTIAL 107 mi^2 = 11%**

Other	**77 MI^2**	**OTHER 77 MI^2 = 8%**

TOTAL ABOVE-AVERAGE VEHICLE IMPACT AREAS	**988 mi^2**	**ABOVE-AVERAGE VEHICLE IMPACT AREAS 988 mi^2**

Comparisons among these different regions are very important, as they differentiate *recreational* vehicle impacts from *residential* vehicle impacts. This is not to say that there is no overlap; there are likely both residential and recreational impacts in the northern Lucerne Valley and in the Rand Mountains, for example. However, in most cases, the impacts are clearly associated with either *recreational impact regions* (i.e., BLM open areas and heavy OHV use areas) or *residential impact regions*. The relative sizes of these different regions and subregions are given in Table 3-27, and summarized as follows. The "% of Impact Area," given in the fourth column, lists the percentages of each subregional impact area relative to the total above-average vehicle impact area observed throughout the planning area, which was determined to be 988 mi^2.

Table 3-27
Cumulative Totals of Above-Average Vehicle-Based Impacts in Open Areas, Heavy OHV Use Areas and Residential Impact Regions

Area	Total mi^2	Mi^2 Obs	Sum	Ave	Range	Mi^2 Obs	Sum	Ave	Range
TRAILS						**TRACKS**			
Open Area	591	494	9417	19.1	1-250	548	78909	144.0	1-4000
Heavy Use	213	128	954	7.4	1-35	184	8903	48.3	1-585
Residential	107	49	191	3.9	1-22	94	2761	29.4	1-341
Total	**911**	**671**	**10562**	**15.7**	**1-250**	**826**	**90573**	**109.6**	**1-4000**
LITTER						**DUMPS**			
Open Area	591	549	20819	37.9	1-1080	0	0	0	0
Heavy Use	213	199	4940	24.8	1-305	0	0	0	0
Residential	107	49	191	3.9	1-22	6	7	1.2	0-2
Total	**911**	**797**	**25950**	**32.6**	**1-1080**	6	7	1.2	0-2
TARGET						**HUNTING**			
Open Area	591	213	3456	16.2	1-325	61	126	2.1	1-18
Heavy Use	213	98	653	6.7	1-53	25	39	1.6	1-4
Residential	107	48	874	18.2	1-525	23	55	2.4	1-8
Total	**911**	**359**	**4983**	**13.9**	**1-525**	**109**	**220**	**2.0**	**1-18**
CAMPING									
Open Area	591	66	161	2.4	1-25				
Heavy Use	213	15	22	1.5	0-3				
Residential	107	10	16	1.6	1-4				
Total	**911**	**91**	**199**	**2.2**	**1-25**				

Again, it is important to note that each square mile of impact was above-average for one or more of the eight vehicle-based disturbances: roads, trails, tracks, garbage/litter, hunting areas, target shooting areas, and camping. There were a total of 988 mi^2 of above-average vehicle impacts within the surveyed area. This comprises about a third (29%) of the 3,362 transects surveyed between 1998 and 2002.

Vehicle-based recreation (open areas and heavy OHV use areas) was responsible for a total of 804 mi^2 (81% of 988 mi^2) of above-average impacts. This was further segregated into 591 mi^2 associated with open areas. Of this, 353 mi^2 (60%) occurred within open areas, and 238 mi^2 (40%) occurred on lands adjacent to open areas (Map 3-14). This is a key finding, as it clearly shows that vehicle impacts are not restricted to designated open areas; 40% of observable above-average impacts are adjacent to open areas, including DWMAs. One should not forget that there were additional above-average square miles and below-average impact areas spread throughout the planning area. Only above-average impacts are discussed in this section.

Both inside and adjacent to open areas, Johnson Valley, Spangler Hills, and Stoddard Valley (given in descending order of the size of the affected area) cumulatively affected 546 mi^2, or about 92% of the 591 mi^2 impacted. Areas affected included Johnson Valley at 296 mi^2 (54% of 546 mi^2 attributed to all open areas), Spangler Hills (131 mi^2 or 24%), and Stoddard Valley (119 mi^2 or 22%) open areas.

The three heavy OHV use areas occupied 213 mi^2, most of this (168 of 213 mi^2, or 79%) was associated with the large area around California City, in the Rand Mountains, and adjacent areas. There were also 31 mi^2 of impacts in the Edwards Bowl area, and 14 mi^2 in the East Sierra, about seven miles north of the nearest open area. These are significant findings, indicating that in addition to the spill over effect of open areas given above, there are other areas that are being treated as if they were open areas. Cumulatively, the 213 mi^2 corresponds to about 21% of the total impact area (988 mi^2).

As described above, there were also three residential areas of above-average impacts affecting approximately 107 mi^2. These were about equal in size, including 39 mi^2 in the Coyote Corner area, 37 mi^2 in the Silver Lakes area, and 31 mi^2 north of Hinkley, including some overlap into higher concentration tortoise areas. Residential area impacts were responsible for about 11% (107 of 988 mi^2) of all above-average areas. There were also 13 smaller polygons of up to eight miles that, cumulatively, have impacted about 77 mi^2 in the surveyed area, or about 8%. These smaller impact areas are shown among the others on Map 3-14).

Characteristics of Vehicle Impact Areas: The types and intensity of impacts associated with each region are listed in Appendix L.

Table 3-27 reports the cumulative totals for trails, tracks, litter, dumps, target shooting, hunting, and camping among open areas, heavy OHV use areas, and residential areas.

Data were collected between 1998 and 2001, and those given in the above table include the 911 mi^2 of the 988 mi^2 (92%) impacted, excluding the 77 mi^2 encompassed in 13 smaller regions. Key findings and implications are bulleted below relative to the region of comparison:

Open Areas. Importantly, the data presented for open areas include those observed impacts that are inside (60% of 591 mi^2) and outside (40%) designated areas. Trails (19/mi^2), tracks (144/mi^2), litter (38/mi^2), and camping (2/mi^2) were more common in open areas than either heavy OHV use areas or residential areas. Tracks were about three time more prevalent than in heavy OHV use areas (144/mi^2 compared to 48.3 mi^2), and five time more prevalent than in residential areas (29.4/mi^2). Litter was similar in open areas (37.9/mi^2) and heavy OHV use areas (24.8 mi^2), but significantly lower in residential areas (3.9/mi^2, or 10 less common than in open areas). This is a key finding relative to raven management, suggesting that the BLM needs to implement a proactive education program in the open areas to minimize the amount of litter (and presumably attractiveness to ravens) available to ravens and other predators (including feral dogs) that threaten tortoises.

As shown in Appendix L, Johnson Valley exceeded the following average impacts given in parenthesis in the previous sentence: trails (22/mi^2), tracks (180/mi^2), litter (41/mi^2), target practice (17.4 compared to 16.2/mi^2), and camping (3.1 versus 2.4/mi^2). Johnson Valley was the only open area to exceed the average number of tracks among the five open areas.

Heavy OHV Use Areas: Impacts in these three regions were intermediate to open areas (where more impacts were observed) and residential areas (where there were relatively fewer impacts). Both target shooting (6.7/mi^2 compared to 13.9/mi^2 on average) and hunting (1.6/mi^2 compared to the average of 2.0) were relatively lower in heavy OHV use areas than in open areas (16.2/mi^2 shooting, 2.1/mi^2 for hunting) and residential areas (18.2/mi^2 shooting, 2.4/mi^2 hunting). Heavy OHV areas were also slightly lower in terms of camping (1.5/mi^2 compared to average ofg 2.2/mi^2) than in open areas (highest at 2.4/mi^2) and residential areas (1.6/mi^2).

Among the three heavy OHV use areas, California City into the Rand Mountains is the most impacted in terms of trails (8.0/mi2 compareed to Edwards Bowl, the next highest heavy OHV use area was highest in terms of litter (47.6/mi^2 compared to California City/Rand Mountains at 21.1/mi^2) and target practice (7.8/mi^2 compared to 6.5/mi^2 at California City).

Residential Areas. Importantly, all three residential vehicle impact areas are inside DWMAs, and cumulatively affect 107 mi^2. They are all about the same size (i.e., 35 mi^2). There is also a spatial importance among the three areas; impacts from Silver Lakes are mostly affect the DWMA from the east, whereas Hinkley is partially within the DWMA, and Coyote Corner is fully within the DWMA.

Seven dumps were observed on 107 mi^2 surveyed, and were unique to this impact area, having not been recorded in either open areas or heavy OHV use areas. This is a significant finding relative to raven management, suggesting that dump clean up activities should be focused in these areas, all of which are within DWMAs.

Interestingly, both target shooting (18/mi^2 compared to 16/mi^2 in open areas) and hunting (2.4/mi^2 compared to 2.1/mi^2 in open areas) had the highest incidence of occurrence in residential areas. Again, on BLM-managed lands, this may help direct law enforcement to focal problem areas, which correspond to west of Silver Lakes in the Fremont-Kramer DWMA, north of Hinkley and in the Coyote Corner, both of which are within the Superior-Cronese DWMA.

Of the three residential areas, Hinkley was the highest for trails (5.1/m^2 compared to 3.6/mi^2 in Coyote Corner) and litter (104/mi^2 compared to 53/mi^2 in Coyote Corner). Coyote Corner was significantly higher in track counts (57/mi^2 compared to 15/mi^2 in Hinkley) and target shooting (37/mi^2 compared to 6/mi^2 west of Silver Lakes). Coyote Corner was also noteworthy for the amount of dumping, where 6 of 7 incidences (86%) were observed; the remaining dump was seen west of Silver Lakes, although dumping is far more common there, particularly just north of Shadow Mountain Road (LaRue, pers. obs.).

3.3.2.6.6 Organized Competitive OHV Events

OHV Speed Events: Unless otherwise noted, most of the following impact discussion for the Barstow-to-Vegas race was given in the Desert Tortoise (Mojave Population) Recovery Plan USFWS (1994b) and Burge's 1986 observations of the Frontier 500 Race. Burge (1986) found that the types of maneuvers that contributed to old and recent disturbances included circling in place, turning out, passing, backing up, parking, continuous paralleling of the road for a half mile or more, hill climbing, short coursing (short cutting), road widening, and leaving or joining the course from across open desert.

Competitive events have resulted in old routes being widened (1986, USFWS 1994b) and new routes being formed (Burge 1986, USFWS 1994b). Burge (1986) reported that the Frontier 500 Race resulted in stretches of existing roads that were widened 50 to 90 feet on each side. Burge (1986) and the USFWS (1994b) also identified straying from the designated course as a problem with both races. USFWS (1994b) reported that, during the Barstow-to-Vegas Race, motorcycles and other vehicles strayed beyond the designated course by an average of 30 feet, and caused damage or loss of hundreds of acres of desert tortoise habitat in the eastern Mojave Desert. Burge (1986) found that race-related tracks showed a 103% increase compared to pre-race track counts, and that 38% of discrete tracks, and hundreds of overlapping tracks, extended beyond the allowable course width of 100 feet.

Burge (1986) found that damaged shrubs were evident in every recent OHV track created by the Frontier 500 Race, and that 1,170 shrubs were crushed and uprooted along one transect surveyed after the event. Vollmer et al. (1976) reported that, in the course of one day, a motorcycle race in Kern County involving 700 motorcyclists, "devastated all vegetation in an area approximately 1-2 meters wide and 5 kilometers long." Prior to the Frontier 500 Race, Burge (1986) located and flagged 26 tortoise burrows, none of which was crushed, although she observed motorcycle tracks within one to two feet of several flagged burrows.

Impacts have also been associated with races that were not directly attributable to event participants. The USFWS (1994b) reported that non-event participants often camped in unauthorized areas, litter and garbage were often associated with such illegal campsites, and BLM and other monitors were unable to prevent or control these unauthorized activities.

Stoddard to Johnson Valley Competitive Event Corridor: BLM currently allows the use of the Stoddard-to-Johnson Valley Corridor, which runs through the southwestern portion of the proposed Ord-Rodman DWMA. Official use of this corridor for an organized event was last authorized by the BLM in 1994, when the "Stoddard Valley-to-Johnson Valley Point-to-Point Corridor Run" occurred.

The event, which occurred on 26 November 1994, was sponsored by the American Motorcyclist Association and monitored by the BLM and its appointees. Although the total racecourse was 173 miles long, all monitoring was restricted to the 21.25-mile Stoddard-to-Johnson Valley Corridor. Prior to the event, LaRue (1994) found a total of 24 tortoise burrows, including 17 burrows that were located between 6 inches and 40 feet from the designated route.

Although the event authorized participation of up to 500 motorcyclists, only 87 individuals actually participated (LaRue 1994). Racers were under "yellow flag conditions" that included (a) a well-marked route, (b) speed limits of 40 miles per hour for the eastern seven miles of the corridor and 30 miles per hour elsewhere, (c) pace motorcycles every 15 minutes that were not to be passed by event participates, (d) no passing of other racers while in the corridor, and (e) participants were timed and could not pass through the corridor in under 40 minutes. Additionally, there was light rain and snow immediately prior to and during the race, which likely reduced riders' tendencies to stray from the route to avoid dust created by the racer(s) that were immediately ahead of them (LaRue 1994).

LaRue (1994) found that 22 event-related tracks left the route for a total linear distance of 1,074 feet. The average track length was 48.8 linear feet and ranged from 10 to 300 feet in length. Perpendicular distances between the 22 tracks and the route averaged 3.95 feet and ranged from 0.5 to 20.0 feet. Most of the straying (i.e., 16 of 22 tracks, or 73%) occurred along Jensen Pass, which was the narrowest part of the corridor (i.e., 8.1 feet wide), and the remaining six tracks occurred along wider routes (i.e., widths ranged from 9.7 to 17.3 feet). Although the BLM employed 10 rangers, eight observers, and one helicopter between 24 and 26 November to enforce the closure of 119 square miles of desert that encompassed the corridor, LaRue (1994) still found 23 motorcycle tracks, 13 truck tracks, and 5 quad-runner tracks that were not caused by the racers. He concluded that the tracks were probably associated with monitors or unauthorized use by the general public.

Johnson Valley to Parker Competitive Event Corridor: The western portion of this corridor coincides with the northeastern boundary of the proposed Ord-Rodman DWMA. This is important because the USFWS (2002) reported that during events elsewhere along the route, riders were authorized to travel up to 100 feet from the centerline of the established road, along the southern side of the corridor to avoid impacts to the Chemehuevi DWMA in the East Mojave, which occurs north of the road. They (USFWS 2002) concluded that (a) this off-road travel was likely to kill or injure desert tortoises, disturb habitat, and could accelerate the spread of invasive species; (b) some potential existed for racers to cause degradation of habitat in the area surrounding the western end of the race (in the vicinity of the proposed Ord-Rodman DWMA); and (c) the proximity of the OHV event to the Chemehuevi DWMA posed, at a minimum, an indirect threat to the stability of the area, since tortoises travel beyond reserve area boundaries, and invasive plants may have more ready access to reserves if adjacent habitats are disturbed.

Dual Sport Events: The USFWS (2002) concluded that organized, non-speed events, such as dual sports rides in the western Mojave Desert, resulted in minimal habitat disturbance, if any, and that they were unaware of any injuries or mortalities of desert tortoises that have occurred during these events. They acknowledged that some level of mortality or injury may be undetected but impacts were anticipated to be minimal because dual sports occurred on existing roads and were usually conducted when most desert tortoises were inactive.

3.3.2.7 Current Effectiveness of Existing Protected Areas

Desert Tortoise Research Natural Area: Although there are several ACECs in tortoise habitat, only the DTNA was expressly established for conservation of the desert tortoise. The DTNA has been partially fenced since the late 1970's and completely fenced since the late 1990's. Even so, there are still threats to this most protected area. Each year a naturalist is employed by the Desert Tortoise Preserve Committee (DTPC) to educate the public about tortoise biology and protection. Several times each year, DTPC naturalists have encountered pet tortoise owners attempting to release their animals into the DTNA (Michael Connor, pers. comm., Nov. 2002). Some of these tortoises have been symptomatic for URTD or other diseases. The fence line has been cut from time to time and trespass motorcycle tracks have been seen bisecting the area within the fence (LaRue, 2001 pers. obs.). Feral dogs and ravens continue to be a problem.

Some have questioned the efficacy of fencing off large areas, such as the DTNA, when the data do not appear to show that tortoise populations are increasing inside the fence. Dr. Berry (pers. comm., Nov 2002) has shown that decreases have been similar on both sides of the fence, but that tortoise numbers within the fenced area remain somewhat higher than numbers outside the fence. Sign count and distance sampling data support Dr. Berry's findings that there have been significant declines in the DTNA and the surrounding region. Most importantly, they also show that there has been recent reproduction within the remnant population. Eight of 13 (61%) tortoises found inside the fenced area were subadult animals.

This may be a very significant finding, when one considers that the subadult cohort may only constitute 15 to 20% of the regional population. Within the 697 mi^2 area bounded by Garlock Road, Highway 14, Highway 58, and Highway 395, a total of 324 mi^2 (46%) were surveyed. All subadults observed within the 324 mi^2 surveyed area were located within, or immediately adjacent to, the DTNA (Map 3-9). The next nearest subadult was located 17 miles east of the DTNA, found in the spring during line distance sampling surveys. It is promising that there may be recruitment in an area that has experienced significant population declines, and noteworthy that no subadult animals were observed in any of the other older die-off regions. This may suggest that the perimeter fence is functioning in some manner to promote recruitment, and to minimize vehicle and sheep grazing impacts to reproducing females and new animals.

These recruits are exceedingly vulnerable to natural predators (especially coyotes and kit foxes), predators that have increased due to man (coyotes and ravens), vehicular cross-country travel, and trampling by sheep. Except for the predators, protective fencing has reduced or completely eliminated many of these impacts. And there is evidence that tortoise habitat is responding in a positive way. For example, during his studies at the DTNA, comparing various parameters inside and outside the fence, Dr. Matthew Brooks (1993) found (a) higher biomass of native annuals inside the fence; (b) higher biomass of non-native annuals outside the fence; (c) higher abundance of birds inside the fence; and (d) higher abundance of reptiles inside the fence. The increases, which likely show the results of habitat protection and rehabilitation, were attributed to less human use inside the fence.

Wilderness Areas: With the passage of the California Desert Protection Act, there are now a total of 684 mi^2 of wilderness within the planning area. This includes 17 wilderness areas, eight of which are completely or mostly outside the 2002 range of the tortoise[19]. Only the eastern 10 mi^2 of the 77 mi^2 Owens Peak Wilderness Area are within the range, where three transects were surveyed, and no tortoise sign found.

The remaining eight wilderness areas, encompassing 391 mi^2 (57% of all wilderness acreage), are fully within the tortoise range. As a general measure of tortoise conservation value, Table 3-28 lists the acreage of each area, acreage above and below 20% slope, and acreage above and below 4,000 feet elevation.

Table 3-28
Comparisons of Acreage, Percent Slope, and Elevation
Within Eight Wilderness Areas within the 2002 Tortoise Range

WILDERNESS AREA	TOTAL MI^2	$MI^2 > 20\%$ SLOPE	$MI^2 < 20\%$ SLOPE	$MI^2 >$ 4,000 FT	$MI^2 <$ 4,000 FT
Black Mountain	33 mi^2	7 mi^2 21%	26 mi^2 79%	0 mi^2 0%	33 mi^2 100%
Cleghorn Lakes	62	18 29%	44 71%	<1% 0%	62 100%
El Paso Mountains	38	12 32%	26 68%	7 19%	31 81%
Golden Valley	57	26 46%	31 54%	7 12%	50 88%
Grass Valley	51	3 6%	48 94%	1 2%	50 98%
Newberry Mountains	43	25 58%	18 42%	13 30%	30 70%
Rodman Mountains	54	20 37%	34 63%	17 32%	37 68%
Sheephole Valley	53	16 30%	37 70%	<1 0%	53 100%
Totals	391 mi^2 100%	127 mi^2 32%	264 mi^2 68%	45 mi^2 11%	346 mi^2 89%

Of the 261 tortoises observed during sign count surveys, 10 (3.8%) were found above 20% slope and 251 (96.2%) were observed below 20% slope. However, this is an artifact of survey effort, as only 214 of the 3,362 transects (6.3%) were surveyed above 20% slope. There were 10 tortoises found on the 214 transects surveyed above 20% slope, or 0.05 tortoises/transect (i.e., tortoises were observed on 5% of these transects). This compares to 251 tortoises observed on the remaining 3,158 transects surveyed below 20% slope, or 0.08 tortoises/transect (about 8% of the transects). Tortoises were encountered about 1.6 times more often below 20% slope than above that slope.

[19] The eight Wilderness Areas in the planning area that are outside or peripheral to the tortoise range include Argus Range, Bighorn Mountain, Bright Star, Coso Range, Darwin Falls, Kiavah, Sacatar Trail, and San Gorgonio.

Overall, one sees that 68% of the 391 mi^2 within these eight wilderness areas are below 20% slope, and therefore relatively more suitable tortoise habitat, in terms of this one factor. Grass Valley (94%), Black Mountain (79%), Cleghorn Lakes (71%), and Sheephole Valley (70%) are the wilderness areas that are predominantly below 20% slope. Newberry Mountain (58%), Golden Valley (46%), and Rodman Mountains (37%) rank as the three wilderness areas with relatively more area above 20% slope.

The 4,000-foot cut-off is another measure used in Table 3-28. The 3,362 transects were surveyed in an area[20] of 3,378 mi^2. There were 70 mi^2 surveyed above 4,000 feet and 3,308 mi^2 surveyed below 4,000 feet. Only one tortoise was observed above 4,000 feet, with the remaining 260 found below. When one factors in the area of survey, there were 0.014 tortoises/mi^2 (tortoises were observed in 1.4% of the survey area), compared to 0.078 tortoises/mi^2 (observed in 7.8% of the survey area). In general, then, tortoises were about 6 times more likely to be observed below 4,000 feet than above. As with 20% slope, most (89%) of wilderness areas occurs below 4,000 feet elevation, and are therefore relatively more suitable.

Given these observations, which suggest that wilderness areas are mostly below 20% slope (68%) and mostly below 4,000 feet elevation (89%), the next comparisons consider the data that were collected in these areas. The relative survey effort within each of the eight wilderness areas in the tortoise range where 141 sign count transects were surveyed between 1998 and 2002 are compared in the following table. Table 3-29 lists the number of transects surveyed, the area covered by the survey, and percent of the area surveyed within each of the eight wilderness areas.

Table 3-29
Sign Count Survey Effort within Each of the Eight Wilderness Areas in the Tortoise Range

WILDERNESS AREA	NO. TRANSECTS SURVEYED	NO. MI^2 SURVEYED	% OF AREA SURVEYED
Black Mountain	21 Transects	13 mi^2	39% of 33 mi^2
Cleghorn Lakes	12	12	19% of 62 mi^2
El Paso Mountains	10	4	10% of 38 mi^2
Golden Valley	14	6	10% of 57 mi^2
Grass Valley	35	30	59% of 51 mi^2
Newberry Mountains	15	10	23% of 43 mi^2
Rodman Mountains	29	24	44% of 54 mi^2
Sheephole Valley	5	2	4% of 53 mi^2
Totals	141 Transects	101 mi^2	26% of 391 mi^2

One can see that about 26% (i.e., 101 of 391 mi^2) of the eight wilderness areas was surveyed, ranging from a low of 4% in Sheephole Valley up to 59% in Grass Valley. Black Mountain (39%) and Rodman Mountains (44%) were also fairly well covered compared to many

[20] As in previous discussions, there is a slight discrepancy between the numbers of transects and the area surveyed. Both numbers are derived from GIS coverages, however the area surveyed is often smaller than the number of transects surveyed. Thus, in the table that follows, there were 141 transects covering only 101 mi^2, because only the area within a given square mile surveyed that occurs within wilderness is reported. These numbers should be considered as a rough index, and not necessarily characteristic of the entire area being described.

of the other wilderness areas. Although sample sizes were relatively small, data that were collected are given in Table 3-30, including the number of tortoises, number of higher density tortoise areas, tortoise sign (TCS), and carcasses observed. The area of survey is important relative to each of the observations, so the numbers of tortoises, carcasses, etc. are shown in parenthesis as the percent of transects surveyed within the area of comparison.

Table 3-30
Sign Count Tortoises, Carcasses, and Total Corrected Sign (TCS) Observed within Each of the Eight Wilderness Areas

	tortoise observations						
Wilderness Area (No. Transects)	No. Tortoises	No. of Carcasses	No./% w/out Sign	No./% w/ Sign	Range (Sum)	Average w/ Sign[21]	Mi^2 Above Average
Cleghorn Lakes (12)	3 (25%)	2 (17%)	4 (33%)	8/67%	0-20 (96)	12	8
Black Mountain (21)	1 (5%)	2 (9%)	3 (14%)	18/86%	0-34 (158)	9	6
Rodman Mountains (29)	4 (14%)	3 (10%)	8 (27%)	21/73%	0-14 (105)	5	5
Newberry Mountains (15)	2 (13%)	3 (20%)	3 (20%)	12/80%	0-4 (23)	2	0
Sheephole Valley (5)	0 (0%)	0 (0%)	2 (40%)	3/60%	0-14 (17)	6	0
Golden Valley (14)	0 (0%)	1 (7%)	9 (64%)	5/36%	0-1 (5)	1	0
Grass Valley (35)	0 (0%)	8 (23%)	23 (66%)	12/34%	0-3 (19)	2	0
El Paso Mountains (10)	0 (0%)	0 (0%)	7/70%	3/30%	0-3 (6)	2	0
Totals	**10**	**19**	**59**	**82**	**0-34 (53.6)**	**4.9**	**19**

The numbers would be interpreted using, for example, the Cleghorn Lakes Wilderness Area: 3 tortoises were found on the 12 transects (25%) surveyed; 2 carcasses (17%) were found; no sign was found on 4 (33%) transects; tortoise sign was found on 8 (67%) transects; a total of 96 pieces of sign were found, ranging from 0 to 20/transect; there was an average of 12 sign found on the 8 transects with sign; and there were 8 mi^2 of higher sign count areas.

These comparisons suggest that Cleghorn Lakes, Black Mountain, Rodman Mountains, and Newberry Mountains provide the most tortoise conservation value in terms of current tortoise occurrence. There were too few transects surveyed in the Sheephole Valley to determine where it would fit into this order. Golden Valley, Grass Valley, and El Paso may provide relatively less conservation value, although this may be more reflective of recent tortoise die-offs than lower conservation value. Note for example, that more carcasses were found in Grass Valley relative to the survey effort than any other area; so this area may have outstanding tortoise value, but older die-offs have affected the number of tortoises currently present.

The spatial distribution of the eight wilderness areas is an important factor regarding the relative value of these areas for tortoise conservation. Cleghorn Lakes and Black Mountain appear to be the two most valuable areas in terms of tortoise occurrence. The Cleghorn Lakes area is bisected by the 29 Palms Marine Corps Base, and the northern portions of this wilderness area on the base also support relatively higher tortoise concentrations (data were unavailable from 29 Palms for analysis, but show a concentration area immediately north of the one occurring on BLM-managed lands). It is very isolated from human uses, and not near any die-

[21] The "Average with Sign" column reports the average number of tortoise sign on the transects where sign was found, so that transects with zero sign counts have been excluded.

off regions discussed herein. Black Mountain is a diverse area of lava flows, with the western portions above 20% slope, and no areas above 4,000 feet elevation. The southeastern corner coincides with higher density areas over 6 mi^2. Die-off regions immediately west and southeast of this area may threaten tortoises that remain.

Both the Newberry and Rodman mountains wilderness areas are comprised of steep slopes (58% and 37%, respectively, occur above 20% slope), much of which is above 4,000 feet (30% and 32%, respectively). The southeastern portion of the Rodman Mountains includes 5 mi^2 of higher density areas. These two areas appear to be intermediate in terms of tortoise occurrence and conservation. Neither appears to be affected by recent die-offs, although such an area occurs several miles west of the Newberry Mountains. There are too few data to see how the Sheephole Valley may fit into the order given in the table; additional surveys in this area would be needed to determine its relative value for tortoise conservation.

Although the El Paso Mountains and Golden Valley wilderness areas were relatively under-represented in the surveys, neither of them occurs in regions where any higher density tortoise areas were identified. The Grass Valley Wilderness Area received more survey effort than any other wilderness area, yet sign counts were sufficiently low throughout the area that no above-average tortoise areas were identified. The prevalence of carcasses at Grass Valley suggests that it was once more densely populated than at present, which does not diminish its value in terms of serving as a potential head starting area. In terms of current tortoise distribution, these three areas may provide relatively less value for tortoise conservation.

Relative Overall Conservation Value of Wilderness Areas: Are wilderness areas, alone, sufficient to conserve and recover tortoises? The answer is no, for the following reasons.

Wilderness areas encompass about 19 mi^2 of the 358 mi^2 (5.3%) area identified with higher sign counts. Three of the wilderness areas (El Paso, Cleghorn Lakes, and Sheephole Valley) encompass 153 mi^2 that are outside proposed DWMAs, and include 39% of all wilderness acreage in the planning area within the 2002 tortoise range. Cumulatively, wilderness areas within the range encompass 391 of 11,134 mi^2, or 3.5% of the potentially occupied tortoise habitat in the planning area. The 358-mi^2 area represents about 15% the size of the four proposed DWMAs, and as given above, only 205 mi^2 (61% of wilderness areas) occurs in DWMAs, which is about 8.8% of that entire area. It would appear that the Grass Valley area has already been affected by die-offs within and adjacent to that region, and Black Mountain is in imminent harm's way, assuming spread of disease from adjacent areas. Given the prevalence of carcasses, Grass Valley may serve as an excellent location to conduct head starting studies.

De facto tortoise protection in wilderness areas relies on the assumption that there are no roads and therefore no threats to tortoises. This is a false assumption for several reasons. First, not all tortoise mortality is caused by impacts associated with dirt roads. Tortoises in wilderness areas are still susceptible to raven and feral dog predation, various diseases, and catastrophic die-offs that cannot be readily explained, although disease, drought, and/or synergistic effects have been implicated. Second, there are still known adverse human uses, even without roads. Sheep graze the Golden Valley Wilderness Area, and vehicular trespass is considered to be a serious problem in places.

BLM Areas of Critical Environmental Concern: Thirty ACECs are found within the West Mojave planning area. Table 3-31 lists each ACEC, its size, focal protected resource, its location relative to the 2002 Tortoise Range Map, and the relative protection it provides [adopted from Current Management Situation (BLM 1999)].

Table 3-31
Tortoise Conservation Provided by ACECs

ACEC	SIZE ACRES	FOCUS OF COMMITMENT	SPATIAL LOCATION RELATIVE TO 2002 TORTOISE RANGE	RELATIVE PROTECTION AFFORDED BY EXISTING ACEC MANAGEMENT
Afton Canyon	8,160	Riparian habitat, raptors, bighorn, scenic values.	Fully within range, but focal area is canyon rather than surrounding bajadas	High. Routes are designated and mineral withdrawals are in place. Cattle grazing remains outside riparian zone.
Amboy Crater	679	Geologic landmark		Marginal tortoise habitat with little direct protection
Barstow Woolly Sunflower	314	Botanical resources, Barstow woolly sunflower in particular	Fully within range	Excellent protection from human impacts by perimeter fence
Bedrock Springs	785	Prehistoric values		Tortoises and habitat subject to OHV impacts from adjacent Spangler Hills Open Area
Big Morongo Canyon	28,274	Riparian habitat.	South of range	N/A, outside known range
Cronese Basin	10,226	Marsh, riparian, and lacustrine habitats.	Fully within range	High. Routes are designated
Desert Tortoise Research Natural Area	25,695	Desert animals and plants, Desert Tortoise in particular.	Fully within the 2002 Tortoise Range	Excellent protection from human impacts by perimeter fence
Fossil Falls	1,667	Prehistoric values		Within the northern portion of the range where tortoises are relatively less common
Great Falls Basin	9,726	Riparian habitat, Inyo California towhee	Eastern and southern portions of ACEC barely within range	Mostly north and west of the range.
Harper Dry Lake	475	Marsh habitat	Within range; 363 of 480 acres (76%) is non-habitat on the dry lake bed	Does not protect tortoise habitat.
Jawbone/ Butterbredt	187,486	Riparian and wildlife values.	At the western edge of range	Little protection, and 80% of the ACEC is outside the range
Juniper Flats	2,528	Cultural values	South of range	N/A, outside known range
Last Chance Canyon	5,913	Prehistoric and historic values		Not well protected from vehicle disturbance

ACEC	SIZE ACRES	FOCUS OF COMMITMENT	SPATIAL LOCATION RELATIVE TO 2002 TORTOISE RANGE	RELATIVE PROTECTION AFFORDED BY EXISTING ACEC MANAGEMENT
Manix	2,897	Paleontological and cultural values		Remote area with few tortoises
Mojave fishhook cactus	628	Botanical		Unfenced ACEC is subject to heavy impacts from sheep grazing and motorcycle use in the Brisbane Valley
Rainbow Basin	19,480	Geologic features, wildlife species (desert tortoise)	Fully within range, very near Mud Hills/ Water Valley concentration area	Moderate. Routes are designated, but off-road travel still occurs
Red Mountain Spring	717	Prehistoric values		Unknown
Rodman Mountains Cultural Area	6,204	Cultural Resources		Mostly within wilderness
Rose Spring	859		At northern edge of range	Unknown
Sand Canyon	2,338	Riparian habitat and wildlife	West of range	N/A, outside known range
Short Canyon	1,100	Riparian habitat, Plants in particular	West of range	N/A, outside known range
Soggy Dry Lake Creosote Rings	186	Ancient vegetation		Within the known range, but inside open area, which degrades habitat and results in tortoise crushing
Steam Well	41	Historic and prehistoric values		Little protection in this area where die-offs may have eliminated many tortoises
Trona Pinnacles	4,055	Scenery and geological features		Very marginal habitat; tortoise present subject to impacts from adjacent Spangler Hills Open Area
Upper Johnson Valley Yucca Rings	353	Ancient vegetation		Tortoises and occupied habitats threatened by use in Johnson Valley Open Area, which surrounds this ACEC
West Rand Mountains*	29,440	Species specific, desert tortoise	Fully within range	Major problems with compliance on OHV travel have been identified.
Whitewater Canyon	16,381	Wildlife		N/A, West Mojave portion of ACEC is at upper elevations, out of range

* Signed by CDFG under Federal Authority of the Sikes Act.

Existing ACEC protection ranges from very high protection at fenced sites (i.e., DTNA and Barstow Woolly Sunflower ACECs), to very little or no protection (i.e., Harper Lake and West Rand Mountains ACEC), to being inapplicable because the ACEC is outside the range. Only the DTNA is expressly managed for tortoise conservation; there are few formal ACEC management prescriptions that provide for more protection than other regulations (habitat management in BLM habitat categories, USFWS critical habitat, under FLMPA).

3.3.3 Mohave Ground Squirrel

3.3.3.1 Mohave Ground Squirrel Range

Distribution: The entire known range of the Mohave ground squirrel (MGS) is within the planning area (Map 3-15) except for a very small area northeast of Searles Valley, in the NEMO planning area. The known range (Gustafson 1993) is bounded to the south by the San Gabriel and San Bernardino mountains, to the east and southeast by the Mojave River, to the west by Palmdale and Lancaster[22], to the west and northwest by the Sierra Nevada, to the north by the Coso Range and Olancha, and to the northeast by the Avawatz and Granite mountains on the Fort Irwin National Training Center.

The MGS has apparently been eliminated from Lucerne Valley (Wessman 1977), where it was first trapped (at Rabbit Springs) in 1886. The most recent (1993) range map no longer includes the western portion of the Antelope Valley east to Highway 14 between Palmdale and Mojave, an area previously considered within the MGS's range (CDFG 1980). No new data collected since 1993 support either extensions or reductions of the known range.

The known range of the MGS is probably associated with elevation, rainfall patterns, temperature, suitable plant communities and substrates, topographical barriers, and other factors. In reviewing available records, Gustafson (1993) found that the highest known elevation was at 5,600 (1,728 meters) feet on China Lake NAWS (Michael Brandman Associates 1988). Laabs (1998) reported the highest known elevation at about 5,000 feet (1,524 meters), which occurred along the eastern slope of the Sierra (Freeman Canyon, Bird Spring Canyon, and Jawbone Canyon). The California Natural Diversity Data Base (CNDDB) has reported them from an elevation range of 1,800 to 5,000 feet (548-1524 meters).

Rainfall patterns, temperature, and plant communities are interrelated and influenced by elevation gradients. Gustafson noted that the northwestern portion of the ranges of both the MGS and Joshua trees are coincident near Olancha. Most of the 30 plant communities where the MGS has not been observed are associated with relatively higher elevations or are outside the range (LaRue, 1998 unpublished data). The northeastern part of the range, on Fort Irwin, may be limited due to rainfall and/or topographical barriers such as mountains, major washes, dunes, and dry lakes (Gustafson 1993). Gustafson suggested that lakes of the Pleistocene era might have restricted the current range from extending east of the Mojave River and north of the Owens Valley.

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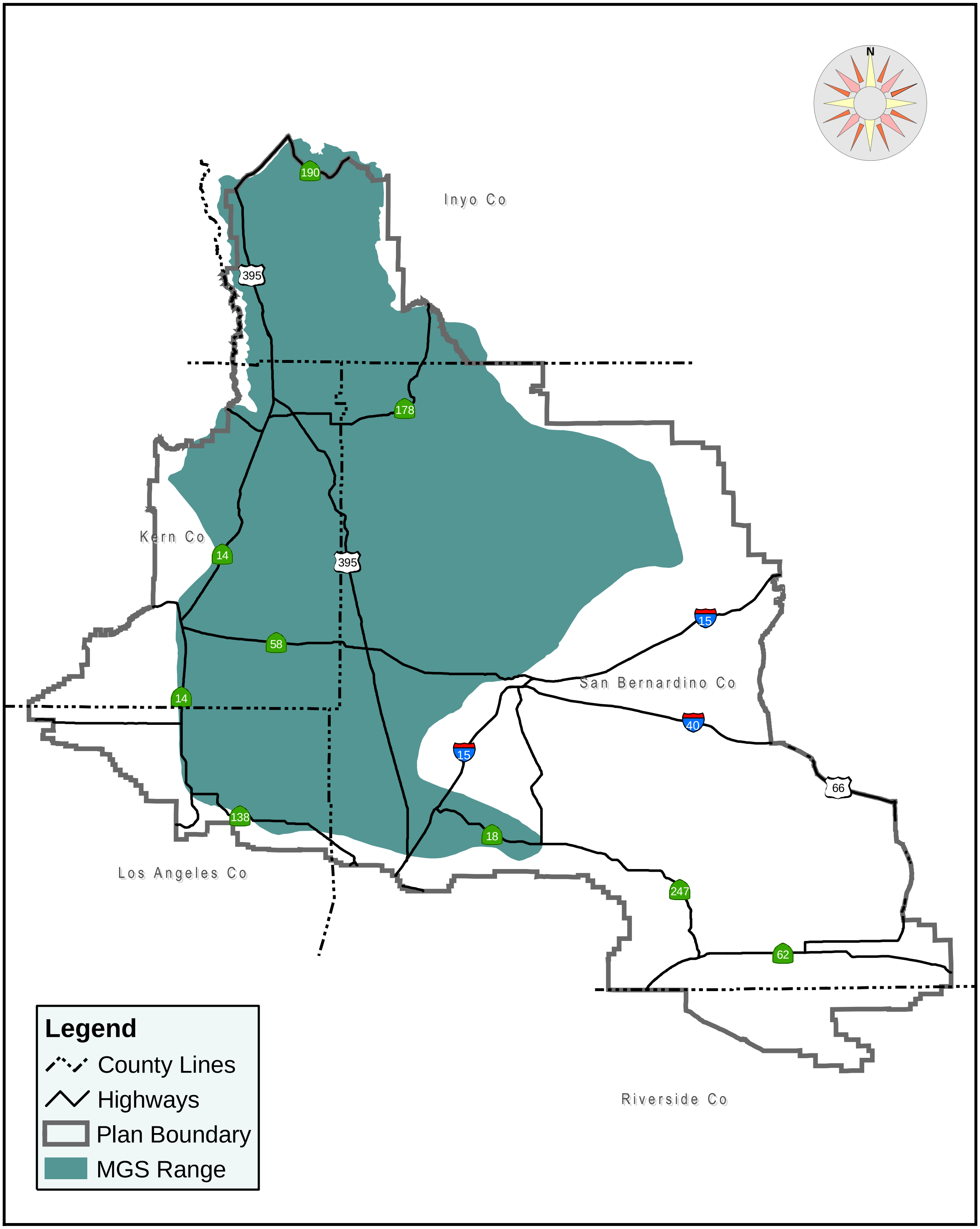
22 Laabs (1998) found no records for the Antelope Valley west of Palmdale and Mojave.

Range of Mohave Ground Squirrel



West Mojave Plan FEIR/S
Map 3-15

10/14/04

Scale: 1 : 1,750,000

0 10 20 30 Km

0 10 20 30 Miles

Gustafson (1993) indicated that local populations of the MGS might disappear in response to prolonged drought, but that under natural conditions, it is likely that such areas can be repopulated. He concluded, "There is no reason to believe that this pattern of extirpation and repopulation has not occurred for thousands of years in the range of the Mohave Ground Squirrel." What has changed, however, is pervasive and persisting human occupation of MGS habitat, particularly through the southern portion of its range from Palmdale to Lucerne Valley (WMP data). Although there are no historic records for the MGS west of Palmdale and Lancaster, Gustafson (1993) indicated that it is likely that the species once occurred west of Palmdale due to suitable plant communities (prior to their elimination for agriculture), topographies, and elevation.

Trends: Brooks and Matchett (2001) provide the latest statistical summary of MGS trapping success and potential trends. They reported that there had been 1,353 individual squirrels, found at 264 sites, between 1886 and 2000 that had been reported to the CNDDB. They concluded that trapping success had declined across most of the known range since the mid-1980s, and that this decline was not associated with decreased rainfall.

Their final conclusion was given as follows, "Recent attempts to locate populations for new studies have been hampered by low trapping success, even during a period in which winter rainfall was adequate for reproduction and survival (Leitner 2000) and at sites where Mohave ground squirrels were previously abundant from the mid-1970's through the early 1980's. The results of others (Leitner 2000), coupled with the decreased trapping success since the mid-1980's that was documented in the current study, have heightened concern that the Mohave ground squirrel may be undergoing a long-term decline in abundance."

3.3.3.2 Life History[23]

<u>3.3.3.2.1 Species Description</u>

The MGS is one of two members of the subgenus *Xerospermophilus*, which also includes the round-tailed ground squirrel (*Spermophilus tereticaudus*) of the eastern Mojave and Sonoran deserts (Hall 1981; Nowak 1991). The MGS measures 8.3-9.1 inches (210-230 mm) in total length, 2.2-2.8 inches (57-72 mm) in tail length, and 1.3-1.5 inches (32-38 mm) in hind foot length (Hall 1981), which helps differentiate it from the smaller antelope ground squirrel (*Ammospermophilus leucurus*) and the considerably larger California ground squirrel (*Spermophilus beecheyi*). Of these four species, the MGS is the only one found entirely within the western Mojave Desert.

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23 Unless otherwise noted, most of the following information is taken from the species account provided for the West Mojave planning effort by long-time MGS trapper, David Laabs, of Biosearch Wildlife Surveys, Santa Cruz, California (referenced as Laabs 1998). Many of the supporting documents were originally cited in Laabs (1998), and are herein included in the literature-cited section.

3.3.3.2.2 Seasonal Activity

The MGS exhibits a strongly seasonal cycle of activity and torpor (like hibernation), emerging from dormancy as early as January, but more typically in mid-February or March (Leitner and Leitner 1996). Dates of emergence appear to vary geographically. Males typically emerge one or two weeks prior to females (Recht, pers. comm.). Once a sufficient amount of fat has been accumulated, individuals enter a period of aestivation and hibernation (Bartholomew and Hudson 1961). Aestivation generally begins sometime between July and September, but may begin as early as April or May during drought conditions (Leitner, et al., 1995).

MGS population dynamics are dependent on the amount of fall and winter precipitation (Leitner and Leitner 1996). The failure to reproduce may result in dramatic population declines and, if poor conditions persist for several seasons, may become extirpated from a given area. This may be especially true in less optimal habitats. Therefore, entirely suitable habitats can be unoccupied during some years and become reoccupied in others.

3.3.3.2.3 Substrate Affinities and Burrow Use

The MGS generally occurs in flat to moderate terrain and is not found in steep terrain. Substrates in occupied habitats have ranged from being very sandy to, less frequently, very rocky (Best 1995, Wessman 1977). For example, of 102 transects surveyed in 1998 (see below) where the MGS had been previously detected, 91 (89%) were identified as predominantly sandy and 11 (11%) were identified as being rocky. The MGS is considered to be absent, or nearly so, on dry lakebeds, lava flows, and steep, rocky slopes (Clark 1993), although juveniles may disperse through such areas (Leitner, pers. comm. in Laabs 1998), probably excluding larger playas.

Individuals may maintain several residence burrows that are used at night, as well as accessory burrows that are used for temperature control and predator avoidance (Laabs 1998). Aestivation burrows are dug specifically for use during the summer and winter period of dormancy (Best 1995), and often occur beneath large shrubs (Leitner et al. 1995).

3.3.3.2.4 Home Ranges

Home ranges of adults vary between seasons and throughout a season, presumably in response to quantity and quality of food resources. The Leitners' studies in the Coso Range have indicated that there is considerable overlap in the home ranges of individual males and females, though there is no clear evidence that home ranges are defended (Laabs 1998). Juveniles are gregarious, initially staying close to their natal burrows. However, juveniles have demonstrated considerable dispersal abilities, having traveled up to four miles from their birthplace in a matter of a few months.

3.3.3.2.5 Reproduction

The reproductive success of the MGS is dependent on the amount of fall and winter rains (Laabs 1998) and the new growth of annual forage materials that result. Leitner and Leitner (1992) hypothesized that a standing crop of about 1 gram per square foot may be necessary for

MGS reproduction to occur. Leitner and Leitner (1996) found a clear correlation between fall and winter precipitation and the number of juveniles appearing on the same plots in subsequent years. Following low rainfall, annual herbaceous plants are not readily available, the MGS is unable to attain a minimum amount of body fat (identified by the Leitners as 180 g total body weight), and in such years the species forgoes breeding (Recht, pers. comm. in Laabs 1998; Leitner et al. 1995).

The Leitners have consistently observed that in years of poor rainfall (i.e., less than 75 mm since the MGS entered hibernation), the MGS foregoes reproduction in favor of attaining sufficient body fat to make it through the winter. This is likely a physiological adaptation to ensure adult survival, and to avoid birthing young when resources are not sufficient for juveniles to acquire necessary body fat to hibernate. Gustafson (1993) indicated that the "evolutionary strategy of suspending reproductive activity and concentrating on gaining weight ensures the survival of the species (Leitner and Leitner 1990), as long as droughts are of short duration and sufficiently large areas of habitat exist."

MGS adults are solitary except during breeding, which occurs soon after emergence from hibernation. Gestation lasts 28-30 days, at which time between 4 and 10 young are born per litter. Juveniles emerge from natal burrows within four to six weeks, and begin to establish their own home ranges by about mid-May. Mortality is high during the first year (Leitner and Leitner 1996). Females breed in the spring if environmental conditions are appropriate, while males do not normally mate until two years of age (Leitner and Leitner 1996). Laabs (1998) indicated that sex ratio is consistently female biased, with ratios as high as seven females for each male.

<u>3.3.3.2.6 Dispersal</u>

Juveniles begin making exploratory movements away from the natal burrow by about mid-May to early June, and some individuals eventually make long-distance movements (Leitner et al. 1997). Recent radio-telemetry data suggest that females are more likely than males to remain near their natal burrows (Leitner et al. 1997). In 1997, the majority of radio-collared juvenile males moved greater than 0.6 miles (1 km.), up to a maximum of 3.9 miles (6.2 km.). Juveniles can apparently traverse steep terrain during dispersal (Leitner, pers. comm. in Laabs 1998), and some are known to disperse 3-4 miles from their birthplace (Leitner 1998).

The current, 2002 status of the MGS, in terms of numbers of individuals and amount of occupied habitat, is difficult to assess due to the limitations of available data. The data that are available, the potential associations between MGS historic occurrences and existing habitat characteristics, results of recent trapping studies, etc. are compared and discussed in the following sections.

3.3.3.3 Winterfat, Spiny Hopsage, and MGS Occurrence

In the northern portion of its range, the MGS feeds on the leaves (in particular), seeds, and fruits of perennial plants (mostly shrubs) when annual plants are not available. Shrub species that were consumed most often at the Leitner's Coso study sites were spiny hopsage (*Grayia spinosa*), winterfat (*Krascheninnikovia lanata*) and saltbush (*Atriplex* sp.) (Leitner and Leitner

1996). As herbaceous annuals appear in the spring, the MGS shifts to leaves, flowers, seeds and/or pollen of forbs (annual plants). Once the ephemeral forage disappears in a normal rainfall year, the MGS resumes feeding on shrub parts until entering hibernation. If no ephemeral forage is available in a given season, the MGS subsists entirely on perennials.

The Leitners have shown, through repeated observations employing consistent live-trapping methodologies and fecal analyses, that winterfat, hopsage, and various saltbush species (genus *Atriplex*) are common components of the MGS diet in the northern part of its range, at Coso Hot Springs. They have demonstrated that winterfat and hopsage, in particular, comprise a large part of the MGS' diet during years when rainfall was below about 75 mm at their study plots. They have hypothesized that these two plants may be critically important in allowing the MGS to attain 180 g body weight during dry years when preferentially selected annual plants are unavailable.

It remains unknown, but is plausible, that these plants are equally important to the south. Dr. Anthony Recht (1977) found that MGS at Saddleback Butte in Los Angeles County consumed substantial amounts of Russian thistle (*Salsola tragus*), which he found to have a very high water content, and others have documented MGS feeding heavily on the seeds of Joshua trees (*Yucca brevifolia*) (Laabs 1998). The Leitners have been very cautious to apply their Coso results to MGS foraging preferences elsewhere in the planning area, because their study sites are located within about 15 to 20 miles of the northern range boundary line. The comparisons given below, however, suggest that there may be a relationship between the prevalence of these two plants and the relative occurrence of (trappable) MGS elsewhere in the western Mojave Desert.

Recent evidence suggests that winterfat and spiny hopsage may be important forage species well to the south of the Coso study sites. In 1998, 344 perennial vegetation transects were surveyed both within the range to the south and in the Ord-Rodman DWMA, east of the range[24] (Map 3-16). Each transect surveyed during this "1998 survey" consisted of a ¾-mile, equilateral triangle. All perennial plant species within one meter of each transect were counted. Transect locations included:

- 102 places where the MGS was previously observed (i.e., CNDDB, Debi Clark records, and 19 of 22 sites surveyed by Aardahl and Roush (1985) (the "Aardahl-Roush sites");
- 208 additional locations in "High" and "Medium" quality habitats[25] within the known range; and,
- 34 sites in the Ord-Rodman area, located east, south, and northeast of the known range.

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24 Surveyors (transects given in parenthesis) included LaRue (237 transects), botanists Dave Fleitner (87), Dave Silverman (7), and R.T. Hawke (3), and by biologist Dave Roddy (10). Transects were surveyed in the spring and summer of 1998. As indicated in the text, 34 transects were in the proposed Ord-Rodman DWMA).

25 The 208 transects were systematically (rather then randomly) located at about two-mile intervals within the 1993 polygons that CDFG and others identified as "High" and "Medium" quality habitats (although those designations have since been dismissed; see U.S. Bureau of Land Management 2000).

Table 3-32 shows the relative abundance of perennial and annual plants, winterfat, hopsage, and saltbush observed during the 1998 Survey on the 102 sites with historic MGS records and the 208 additional sites within the known range. Numbers represent the number of plants observed on a given (or average) transect.

Table 3-32
Comparisons Among Habitat Variables Observed Along 1998 Survey Transects

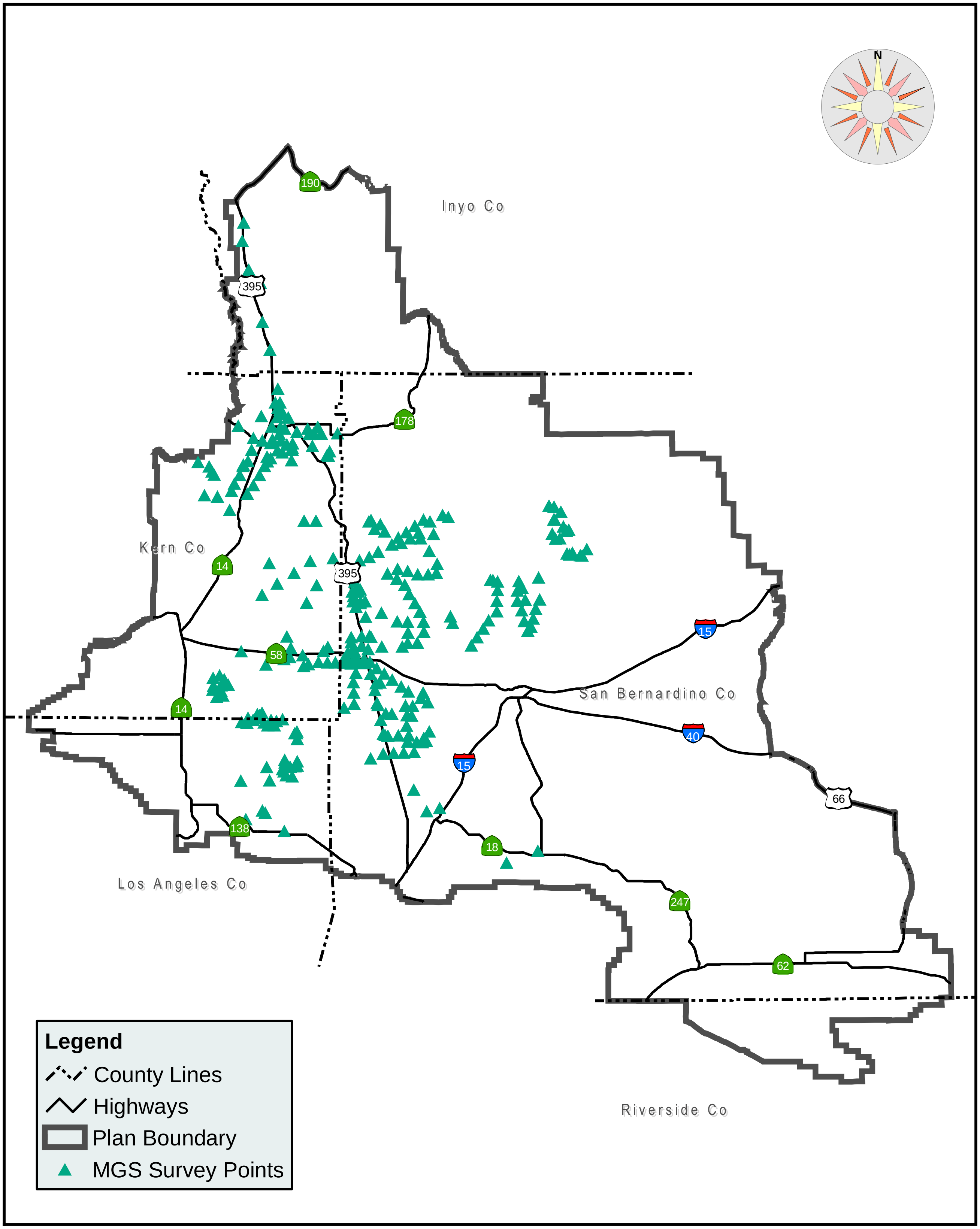
NUMBER OF PLANTS						
Transect Type	Perennial Plants	Annual Plants	Winterfat	Hopsage	Saltbush	Hopsage & Winterfat
102 With MGS Records	Range: 3 to 21 Mean: 9.8	3 to 38 19.5	0 to 458 15.1	0 to 164 14.6	0 to 463 89.2	1 to 164 / 1 to 458 28.0 32.0
208 Without MGS Records	Range: 2 to 19 Mean: 10.6	7 to 47 21.2	0 to 423 23.3	0 to 242 21.0	0 to 646 82.2	1 to 242 / 1 to 423 36.0 40.0
NUMBER (%) OF TRANSECTS WITH NO OCCURRENCES OF SPECIFIED PLANT						
102 With MGS Records	N/A	N/A	45 (44%)	38 (37%)	51 (50%)	24 (23%)
208 Without MGS Records	N/A	N/A	73 (35%)	60 (29%)	86 (41%)	39 (19%)

These data suggest that the average numbers of winterfat and hopsage observed were about the same within each of the two transect categories (15.1 versus 14.6 and 23.3 versus 21.0). The largest numbers of winterfat exceeded those of hopsage two times on 102 transects (211 and 458 for winterfat versus 164 for hopsage) and two times on 208 transects (367 and 423 versus 242). This indicates, on average, that winterfat and hopsage may occur in similar numbers on a regional scale, but that winterfat occasionally occurs in denser aggregations than observed for hopsage.

In comparing the two data sets, relatively more winterfat and hopsage occurred on the 208 transects than on the 102 surveyed at historic MGS locations. This is also reflected in the relatively lower percentages of the 208 transects where one or the other (or both) plants were absent. This is not clear evidence against the current hypothesis that these two plants (and probably others) may be critically important to MGS survival. Far too many factors govern MGS densities and distribution to fully understand the relationship between MGS and plant occurrence. For example, there is no evidence that MGS was absent from the 208 transects, which were all within the range. With the exception of transects surveyed between Lancaster and Lucerne Valley, most transects occurred in suitable, potentially occupied habitats, where there have been recent and historic observations.

In a memo dated 6 August 2002, Dr. Leitner indicated that 48 of these 310 transects included occurrences of: (1) 100 or more winterfat, hopsage, or the two combined or (2) between 50 and 99 of either hopsage or winterfat. He found that 33 of these 48 occurrences (69%) were concentrated in three specific areas: 12 (25%) in the Little Dixie Wash area, between the Sierra Nevada and Ridgecrest/Inyokern; 11 (23%) in the Cuddeback Dry Lake/Pilot Knob area; and 10 (21%) in the Coolgardie Mesa/Superior Valley area). The remaining 15 transects with the concentrations of these plants were generally scattered, with only five occurrences south of Highway 58.

1998 Mohave Ground Squirrel Transects



West Mojave Plan FEIR/S
Map 3-16

Scale: 1 : 1,750,000
0 10 20 30 Km
0 10 20 30 Miles

7/29/04

The 1998 vegetation data were independently assessed to determine if these three regions of MGS trapping success, compared to lower trapping success areas south of Highway 58, supported above-average occurrences of winterfat and hopsage[26]. The three regions and areas south of Highway 58 are listed in the first column of Table 3-33. Regional averages were then determined (see footnote) to be 33 winterfat/transect and 28 hopsage/transect where at least one of the two species was observed (as given in the footnote, transects without either of the plants were excluded from the analysis; the number of transects with at least one of the plants are given in the first column). The number and percent of transects reported in the second and third columns indicates the relative occurrences of these two species within each of the regions of comparison. MGS trapping success rates for the four areas were provided in Dr. Leitner's memo, and are listed in the fourth column. Data are presented in descending order of the prevalence of the two plants, as expressed in percentages in the second and third columns.

Table 3-33
Comparisons Among Four Regions for Occurrence of Above-Average Numbers of Winterfat and/or Hopsage

REGION (NO. OF TRANSECTS SURVEYED)	NO. (%) TRANSECTS WITH MORE THAN 33 WINTERFAT	NO. (%) TRANSECTS WITH MORE THAN 28 HOPSAGE	2002 TRAPPING SUCCESS WITHIN EACH REGION
Coolgardie Mesa/Superior Valley (23 transects)	13 (56% of 23 transects)	15 (65% of 23 transects)	4 of 4 sites (100%)
Little Dixie Wash (15 transects)	5 (33% of 15 transects)	4 (26% of 15 transects)	2 of 3 sites (67%)
Cuddeback Lake/Pilot Knob (59 transects)	6 (10% of 59 transects)	15 (25% of 59 transects)	6 of 7 sites (86%)
South of Highway 58 (117 transects)	14 (12% of 117 transects)	3 (2% of 117 transects)	1 of 9 sites (11%)

Vegetation sample sizes may be too small for meaningful statistical comparisons, but one can see that these two plants were relatively more common in the three regions where more MGS were trapped north of Highway 58 than to the south. When percentages are combined for the two plants within each region (in respective order given in the table), these plants were found on 60.5%, 29.5%, and 17.5% transects in the three regions north of Highway 58, compared to only 7% of the transects surveyed south of Highway 58. Dr. Leitner reported that MGS was captured at 13 (56%) of the 23 sites listed in the table. *Importantly, of the 13 sites where MGS was trapped, 12 (92%) were located in the three regions north of Highway 58*. MGS was trapped on only 1 (11%) of the 9 sites located south of Highway 58.

The average trapping success rate for the first three regions, which correspond to high incidences of winterfat and hopsage, was 84% compared to only 11% at the 9 sites surveyed south of Highway 58. This does not appear to be a sampling bias, as about 40% of the 2002 trapping effort occurred south of Highway 58, where the lower success rate was observed.

[26] The methods used for this analysis were similar to those used to determine above-average tortoise concentrations and vehicle-based disturbances. Using the 310 transects surveyed in 1998 within the range, all transects where no winterfat or hopsage were found were dropped; the average numbers of these two species were then determined. The prevalence of these two plants within the two regions was then compared. Data were used for transects shown on Map 3-18, and included the three regions of higher trapping success and all transects south of Highway 58.

Finally, the 84% success rate was associated with areas where 87% of the high winterfat and hopsage abundance was observed; only 5 (13%) of 38 high abundance transects were found south of Highway 58.

One interpretation of these findings is that the MGS is somewhat more common in surveyed areas of abundant winterfat and hopsage north of Highway 58, and somewhat less common in survey areas south of Highway 58. More studies are needed before firm conclusions can be made. It is entirely possible that the MGS is less common south of Highway 58 for reasons other than lower abundances of winterfat and hopsage. For example, MGS may be less common to the south due to relatively more human impacts, higher incidence of non-native annual species (which Dr. Leitner has suggested), or some unknown environmental factor.

The 1998 survey also recorded the occurrence of saltbush, since the Leitner's research found saltbush to be a recurring component in the MGS diet at the Coso study sites[27]. Five different saltbush species were observed, including *Atriplex canescens, confertifolia, polycarpa, spinifera, and lentiformis*. Based on these data and personal observation, saltbush was found to have a similar pattern of occurrence as winterfat. Although the upper range for saltbush (646) was 1.5 times higher than that observed for winterfat (423), only 4 transects exceeded winterfat's upper range. Average saltbush occurrence was 3.5 to 6 times more concentrated than the average winterfat occurrence.

Substrates for the 102 transects where MGS has been observed included 91 (89%) that were sandy and 11 (11%) that were rocky. For the remaining 208 transects within the known range, 188 (90%) were denoted as being sandy, while 20 (10%) occurred in more rocky areas.

Leitner and Leitner (1989, 1990) found that sites with the highest incidence of the MGS trapped at Coso in 1988 also had the highest standing crop of annual plants. During the 1998 studies (LaRue, unpublished data), as few as three and as many as 38 different species of annual plants were observed along the 102 transects surveyed at known MGS locations. Diversity of native species is also likely to be important to the MGS, and may be indicative of the relative lack of human disturbance in a given area. There are numerous places where OHV staging areas, sheep bedding and watering sites, and newly brushed pipeline corridors have either temporarily or permanently eliminated both annual and perennial plants.

Current Habitat Characteristics on the 19 "Aardahl-Roush Sites:" The Leitner's Coso studies provided annually-collected data since 1989 in both low and high density MGS populations, and have shown consistent patterns in MGS foraging and seasonal activity relative to rainfall. However, most trapping studies, including those of Aardahl and Roush (1985), rarely persisted for more than three or four consecutive years (see U.S. Bureau of Land Management 2000). Although the Aardahl and Roush (1985) survey was restricted to a single season, they trapped the MGS on *every one* of the 22 sites they surveyed, which has rarely been repeated in recent years. Table M-1 (Appendix M) reports their results, showing that they trapped as few as 1 (DTNA site) and as many as 68 (Golden Valley) MGS at a given site. Their surveys provide

27 Winterfat, hopsage, and saltbush are each members of the Chenopod family (often referred to as the "Goosefoot" family).

an excellent opportunity to compare current vegetation data with sites where multiple MGS have been observed.

The 1998 vegetation data relative to 19 of the 22 Aardahl-Roush sites are given in Table M-1 (Appendix M). Surveys were conducted prior to the current widespread use of GPS units, which is true for most of the non-military surveys up until a few years ago. However, transects locations were relatively more accurate because their 19 sites were delineated on 7.5' USGS quad maps, as opposed to CNDDB records, for example, which specify that a given MGS record occurred somewhere within a 160-acre, quarter section.

Aardahl and Roush (1985) trapped a total of 350 MGS on the 19 sites reported in Table M-1. Like many other studies, they did not differentiate between adults and juvenile MGS, so captured animals may have either been resident or dispersing through the trap area. That they trapped the MGS at every site is significant, when one considers recent trapping efforts on regional scales where no MGS have been trapped (see Brooks and Matchett 2001).

The 1998 surveys found that creosote bush scrub was found at 12 (63%) of their sites, saltbush scrub at 5 (26%) sites, and blackbush scrub at 2 (11%) sites. Of the 350 MGS trapped in 1985, 235 (67%) were in creosote, 107 (31%) were in saltbush, and the remaining 8 MGS (2%) were found in blackbush scrub. These data reflect what was also found on a regional scale when the prevalence of plant communities was compared to historic reports of the MGS: the prevalence of MGS is proportionate to the prevalence of a given plant community (Table 3-34, below), both at a regional level and among the 19 sites trapped by Aardahl and Roush[28].

Winterfat and/or hopsage were observed on 14 (74%) of the 19 sites. On one of the five transects where winterfat and hopsage were not observed (Aqueduct South), 16 winterfat plants were observed in adjacent areas, although none was observed along the transect. On two other sites (Bowman Road South and Kramer Hills), although there were no winterfat or hopsage, chenopods were well represented, with 294 and 141 saltbush found, respectively. Given these and other observations, it is important to exercise caution in reviewing results, such as the ones presented herein, and applying them to management practices. For example, it would be premature to identify "source areas" (i.e., areas where MGS persist during prolonged drought) based solely on the presence or prevalence of winterfat and hopsage. However, these results do support the hypothesis that chenopods (particularly winterfat and hopsage) may be important to MGS foraging ecology.

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[28]One must exercise caution when accepting plant community designations, for example, like "creosote bush scrub" and "saltbush scrub," because of the variability of shrubs comprising such communities. Creosote bush (*Larrea tridentata*), from which the community derives its name, is necessarily a part of the so-named plant community, but is often not the most abundant plant. For example, on the 12 Aardahl-Roush sites that LaRue identified as creosote bush scrub, creosote bush was the most abundant plant only on 1 (8%) of the 12 sites. The dominant perennials in the remaining 11 creosote bush scrub communities included burrobush (*Ambrosia dumosa*) at 10 (91%) sites and Cooper's goldenbush (*Ericameria cooperi*) at 1 (9%) site. Burrobush was also the most abundant perennial species at 2 (40%) of the 5 sites characterized as saltbush scrub.

LaRue characterized substrates at the 19 sites as “sandy” for 16 sites (84%) and “rocky” for the remaining three sites (16%). This is consistent with numerous reports in the literature, and with observations for the other 1998 survey sites.

The abundance and diversity of annual plants is directly related to the amount and timing of rainfall and temperature. Although rainfall data were not analyzed for Aardahl-Roush’s trapping effort in 1985 or for LaRue’s in 1998, the numbers of annual plants were similar. Aardahl and Roush reported between 12 and 33 annual plant species (average of 22 species) on their 19 sites, compared to between 3 and 38 species (average 19.5) on the 102 sites where MGS has been observed; there were between 7 and 47 species (average 23 species) in previously-identified medium and high quality habitats.

Ord-Rodman Winterfat and Hopsage Survey (1998): During the 1998 survey, 34 transects were surveyed in the Ord-Rodman mountains area to see if winterfat and hopsage may be associated with MGS occurrence (LaRue, 1998 unpublished data). This area is to the south, east, and northeast of the known. Either winterfat and/or hopsage were found on 14 (41%) of the 34 transects. These 14 sites were associated with (from west to east) Highway 247 in Stoddard Valley, Highway 247 in Lucerne Valley (to south of Cougar Butte), and along Camp Rock Road (both north and south of the bend that is located east of the Maumee Mine). Neither species was found on the 11 eastern-most transects, which were surveyed along Bessemer Mine and Box Canyon roads between Highway 247 and the Rodman Mountains. These data are insufficient to conclude that winterfat and hopsage are uncommon or absent from the region, but they appear to be less common in the survey areas as one proceeds to the east.

Neither winterfat nor hopsage were as common as they were on the 48 high abundance transects found within the range. When the numbers of winterfat and hopsage are combined for the Ord-Rodman area, only 1 (3%) of the 34 transects had more than 100 individuals (158 plants were observed on one transect located along Camp Rock Road, south of the Newberry Mountains). Two adjacent transects had the next highest combined counts of 81 and 68, and were located within several miles of each other, along Highway 247, several miles west of Bessemer Mine Road.

As such, only 1 (3%) of 34 transects surveyed in the Ord-Rodman area, outside the known MGS range, had more than 100 plants per transect, compared to 48 (15%) of 310 transects found within the range. It would appear, pending more study (particularly closer to the known range in western Stoddard Valley and Brisbane Valley), that winterfat and hopsage may be more prevalent within the known range.

3.3.3.4 MGS Associations with Regional Plant Communities

As of July 2002, the CNDDB listed locations for 260 MGS occurrences; 252 of these are within the range and 8 are just outside; one of these is five or six miles east of Barstow, and was probably a round-tailed ground squirrel that was misidentified. Only the 252 records within the range are included in the following discussions. When these occurrences are compared to the 1996 vegetation map[29] within the range, one finds that MGS occurrences are directly proportional to the prevalence of plant communities. Table 3-34 compares the occurrence of MGS sightings to the prevalence of each plant community within the range.

Table 3-34
Occurrence Of 252 Mgs Records With 16 Plant Communities

PLANT COMMUNITY	NO. AND PERCENT OCCURRENCE OF MGS	PERCENT OCCURRENCE OF COMMUNITY WITHIN MGS RANGE
Mojave Creosote Bush Scrub	136 (53.96%)	53.97%
Desert Saltbush Scrub	50 (19.84%)	19.84%
Mojave Mixed Woody Scrub	22 (8.73%)	8.73%
Urban	15 (5.95%)	5.95%
Agriculture	9 (3.57%)	3.57%
Blackbush Scrub	4 (1.58%)	1.59%
Mojave Desert Wash Scrub	4 (1.58%)	1.59%
Hopsage Scrub	3 (1.19%)	1.19%
Shadscale Scrub	2 (0.79%)	0.79%
Alkali Seep	1 (0.39%)	0.40%
Desert Sink Scrub	1 (0.39%)	0.40%
Greasewood Scrub	1 (0.39%)	0.40%
Mojave Wash Scrub	1 (0.39%)	0.40%
Mojavean Juniper Woodland	1 (0.39%)	0.40%
Playa	1 (0.39%)	0.40%
Ruderal	1 (0.39%)	0.40%
Total	100%	100%

These data show remarkable similarities between MGS occurrence (locations collected since 1886) and the prevalence of plant communities (determined in 1996) within the range. In fact, the percent occurrence of MGS and plant communities is exactly the same (two points right of the decimal point), even though these are independent data sets! These comparisons clearly indicate that the MGS is a generalist in terms of plant community preference; it is neither restricted to nor concentrated within any of the 16 plant communities where it has been reported; its occurrence is directly proportional to the occurrence of plant communities.

These are very important findings with regards to MGS conservation. Historically, the MGS was equally likely to occur in the 12 native plant communities (i.e., excluding Agriculture, Ruderal, and Urban communities, which are of recent origin, and Playa, which is likely an artifact of the analysis, or the animal may have been dispersing). Although true that one cannot differentiate between resident and dispersing MGS, these observations suggest that the 12 native habitats within the range are equally important to support both resident adult animals and dispersing juveniles.

29 The vegetation map used throughout Chapters 3 and 4 of this document was developed in 1996 by Tom and Debi Clark. U.S. Bureau of Land Management 2000 describes the fieldwork and methods used to develop this map. Although it likely has some inaccuracies, and lacks the resolution of other recent vegetation community mapping projects (e.g., at 29 Palms Marine Corps Base, Fort Irwin, and Edwards AFB), it represents the best scientific information available for the planning area.

There were no MGS occurrences in 28 of the 44 plant communities occurring within the planning area. When combined, however, these 28 plant communities comprise only 7.4% of the planning area, and are generally outside the known range. Three of the 28 plant communities, which comprise 4.2% of the 7.4%, are either not habitat (Playa at 1.7%) or mostly occur above the elevation range of the MGS (Semi-Desert Chaparral at 1.4% and Mojavean Pinion Juniper Woodland at 1.1%).

The analysis also provides one means of measuring the relative impact of urbanization and agricultural development on historically occupied habitats. Recall that the data have been collected since 1886, and the "vegetation communities" given above were derived in 1996. Therefore, the communities include both native plant communities and type-converted communities (i.e., native habitats that have recently been replaced by manmade communities). As such, *Urban* communities currently occupy about 6% and *Agriculture* communities occupy about 4% of the historical MGS range. Excepting a few anecdotal accounts of MGS in such areas (see below), these data suggest that about 10% of the native habitat has been converted to urban and agricultural uses, which are ultimately not suitable for the species (Laabs 1998).

3.3.3.5 Threats

This section provides a general discussion of threats and impacts that have been given in the literature, and includes recent data for comparison. Except for the first section, which describes human disturbances observed during the 1998 survey, the threats are presented in alphabetical order (as opposed to severity or importance of a given threat).

Human Disturbances Observed During 1998 Vegetation Studies: During the 1998 survey, biologists collected information on human disturbances observed along each of 310 transects, including those located near previous MGS reports (102 transects) and those located in high and medium quality habitats (208 transects). Table 3-35 indicates the prevalence of disturbance types found along these transects[30].

[30] "OHV" refers to cross-country vehicle tracks, which were created by trucks, motorcycles, and all-terrain vehicles. "Road" includes trails, and usually included routes passable by trucks. Sheep, cow, and dog sign were usually feces. "Guns" does not differentiate between legal activities (e.g., hunting, regulated target practice, etc.) and illegal ones (e.g., shooting glass and articles at dump sites). "Dumps" generally required a vehicle to off-load the materials, so does not include litter. "Mines" may have included pits and adits, exploratory excavations, borrow pits, etc. "Ord" refers to military ordnance, which typically included spent cartridges and clips from aircraft. Two transects occurred in areas previously burned. Most of the transects (237 of 310, 76%) were surveyed by LaRue, so subjective determinations among surveyors is not considered a significant problem.

Table 3-35
Prevalence of 10 Types of Disturbances
Observed within the Known Range of the MGS During the 1998 Survey

TRANSECTS			DISTURBANCE TYPES										
Total	Disturbances		OHV	Road	Sheep	Gun	Dump	Cow	Dog	Mine	Ord	Burn	Total
	None	Yes											
310	168	142	145	116	56	23	20	20	12	6	3	2	403
% of 310 transects			47%	37%	18%	7%	6%	6%	4%	2%	<1%	<1%	
% of 403 disturbances			36%	29%	14%	6%	5%	5%	3%	1%	<1%	<1%	

Surveyors found one or more disturbance categories on 142 (46%) transects, and none of the disturbances on 168 (54%) transects. The three most prevalent disturbances were cross-country travel on 145 (47%) of the 310 transects, roads on 116 (37%) transects, and sheep sign on 56 (18%) transects. Importantly, this represents another, independent data set showing the same relative levels of occurrence of these impact types. In an earlier table comparing impacts in DWMAs with urban areas, disturbances were reported for sign count data collected on 1,572 transects in the Fremont-Kramer and Superior-Cronese DWMAs between 1998 and 2002 (see tortoise section). In that independent data set, cross country travel was observed on 45% of transects (compared to 47% above), dirt roads on 53% of transects (37% above), and sheep sign on 13% of transects (18% above).

Agricultural Development: Gustafson (1993) estimated that approximately 39,000 acres (61mi^2) of MGS habitat had been affected by agricultural development. As reported above, about 4% of the historical MGS records occur in areas that have since been converted to agricultural fields. Agriculture could affect the MGS through conversion of habitat (and increase of non-native, weed species), exposure to pesticides and herbicides, and increases in California ground squirrel populations.

Agricultural development results in the elimination of habitat, but also the degradation of habitat, including the spread of invasive exotic weeds. Dr. Leitner has expressed concern that the prevalence of non-native annual plants south of Highway 58 could adversely affect MGS habitat (pers. comm., 2002). In 1972, Hoyt observed that in some areas the MGS seemed to be feeding extensively on alfalfa; a state rodent control program may have adversely affected populations (Gustafson 1993). In a letter from Jeff Aardahl, Gustafson (1993) reports that the Los Angeles Agricultural Commission systematically eliminated unspecified ground squirrel species from the Antelope Valley by spreading out poisoned grain; no date was cited for when this program occurred. No data are available for the prevalence of the California ground squirrel within the range, although it is mostly restricted to agricultural and urbanizing areas.

Grazing: Laabs (1998) indicated that grazing by livestock might affect the MGS through direct competition and changes in vegetative structure. At the Coso study area, overlap in the forage consumed by the MGS with that consumed by both sheep and cattle has been demonstrated (Leitner and Leitner 1996; Leitner et al. 1997). Competition for shrubs such as winterfat and spiny hopsage could be exacerbated during times of drought because alternative sources of food are not available (Laabs 1998). Grazing may lower the availability of annual herbaceous plants to the MGS. There is also evidence that cattle and sheep preferentially select certain shrubs (e.g. winterfat) that are important in the MGS diet (Leitner and Leitner 1996) (Leitner et al. 1997).

Gustafson (1993) indicated that, at that time, grazing was permitted on approximately 2,106,000 acres (3,290 mi^2) of military and BLM lands within the known range. BLM authorized cattle grazing on approximately 761,000 acres (1,189 mi^2) and sheep grazing on 592,000 acres (925 mi^2) of potential MGS habitat (see Appendix M for a list of cattle and sheep allotments within the known range of the MGS, and a discussion of cattle grazing outside of BLM allotments). Cattle may wander up to several miles beyond designated allotment boundaries (see Appendix M).

A total of 1,517,262 acres (2,370 mi^2) of BLM sheep allotments are actively being grazed within the known range, including 897,820 acres (1,403 mi^2) of public lands and 619,442 acres (968 mi^2) of private lands. On private lands, woolgrowers, or landowners giving them permission, are required to obtain federal Section 10(a) permits if their activities are likely to result in the take of tortoises. To date, there have been no such permits issued for sheep grazing. There is no discretionary action required by county or city jurisdictions for grazing on private lands, so consequently there is no clear means of regulating this impact on private lands outside sheep allotments.

There are no region-wide data to show the incidence of sheep grazing that is not associated with BLM allotments. However, because there exists the potential to graze in these areas, the total sheep grazing area given above likely underestimates actual sheep grazing within the known range.

Gustafson (1993) indicated that cattle may adversely affect the MGS by trampling and collapsing burrows, and that sheep may compete for limited annual forage and severely trample local areas. Sheep are generally grazed in the desert between late February and the middle of June (Gustafson 1993), which coincides with MGS emergence from hibernation (February) and the entire activity period, particularly during very dry years when the MGS may enter hibernation in June. These are critical times for both adult and juvenile MGS to attain sufficient fat reserves to enter and successfully emerge from hibernation. The severity of impacts may range from marginal in lightly used areas to extreme at cattle troughs and sheep bedding areas. No consolidated data are available concerning the spatial locations of these impacts.

Hybridization between Round-tailed Ground Squirrels and the MGS: Hybridization results when two different species interbreed to produce progeny that has genetic traits of each species. Physiological, behavioral, and geographical barriers generally segregate two species. Physiological barriers, such as incompatible genitalia, different mating seasons (which also suggests behavioral segregation), and similar biological factors tend to remain the same, pending evolutionary pressures. Geographical barriers may also take a long time to change (measured in geological time frames), as is the case with the gradual disappearance of lakes that were prevalent in the Pleistocene. However, some changes in habitat (often referred to as “type conversion”) can occur in an instant, as when a parcel is bladed, or during several human generations (e.g., spread of agricultural development).

Both agriculture and mechanized military maneuvers have resulted in a gradual trend from coarser to finer substrates (Krzysik 1994; LaRue and Boarman, in prep.). When the natural vegetative cover is removed for agricultural (and other) purposes, the soil is far more susceptible to wind erosion than if left undisturbed. The potential problem with converting relatively coarse substrates to finer materials is that the MGS tends to prefer the coarser materials, compared to the round-tailed ground squirrel, which prefers sandier substrates (Hafner and Yates 1983).

Gustafson (1993) reports that the contact zone between the two species is approximately 240 km (149 miles) between northern Fort Irwin and Victorville, with the Mojave River in between. MGS-round-tailed hybrids have been observed in the Helendale area (Wessman 1977; LaRue, pers. obs. 1997), adjacent to the Mojave River, and much of the river basin has been converted to agricultural fields (WMP data). Although agriculture is not likely to significantly expand outside the Mojave River, the Fort Irwin expansion would extend west into the known range of the MGS. If similar impacts are observed in the expansion area as has been documented on the existing installation (i.e., conversion of gravelly soils to sandier soils; Krzysik 1994), there is the potential for expanding preferred round-tailed ground squirrel habitat and reducing MGS habitat. If so, the potential for hybridization between the two species will be facilitated where it presently may not occur.

The only occurrences of hybrid (Wessman 1977) and suspected hybrid (Krzysik 1994; LaRue, 1997 pers. obs.) ground squirrels have been in the areas of Fort Irwin and Helendale. Gustafson (1993) reported that hybridization likely occurred in these areas due to ecological and behavioral changes in one or the other species that resulted from agricultural disturbances in the Helendale area and military maneuvers at Fort Irwin. Dr. Recht (2001 pers. comm.) has recently trapped the round-tailed ground squirrel in the Superior Valley, 10 or more miles inside the known range of the MGS. This suggests that there is potential for hybridization to occur well into the known range, and not just along the edges.

Gustafson (1993), citing Hafner (1992) discussed the low vagility (the potential for an animal to disperse) of the MGS, which results, in part, from the species being active for only three to four months of a given year. Hafner (1992) concluded that low dispersal potential, on the local population level, may be on average about 5 m per year, and that this low vagility would preclude the MGS from rapidly expanding into suitable habitats where it was previously extirpated. Since that time, the Leitners have found that juvenile MGS may disperse up to four miles from their natal burrows in a given year. So, although dispersal abilities may be more pronounced than previously thought, the quality (including sandiness) of habitat may still limit recolonization potential.

Military Maneuvers: Military maneuvers may affect the MGS through direct mortality, crushing burrows (and animals within them), or decreasing shrub cover (Laabs 1998). Krzysik and Woodman (1991) reported that coarse-grain soils were pulverized by mechanized equipment at Fort Irwin. Army maneuvers in the main corridors caused a reduction in the particle size, which led to dust storms and reduced human visibility to within several meters. China Lake NAWS reported that opening the Mojave B Range to Army maneuvers would create so much dust (which they compared to that blowing south out of the Owens Valley) that the Navy's mission would have been compromised by this use (Range Systems Engineering Office and

NAWS China Lake 1993). As discussed above, there is concern that sandy habitats resulting from new Army maneuvers in the Superior Valley may favor round-tailed ground squirrels at the expense of the MGS, which tends to prefer relatively coarser sands. Gustafson (1993) also noted that the residential areas of Edwards AFB, China Lake, and Fort Irwin (often referred to as cantonment areas) directly and indirectly affect MGS.

Military maneuvers and their observable impacts vary dramatically. Edwards AFB has cantonment areas west of Rogers Dry Lake, and logistical support facilities occur west of Rogers and east of the northern end (Leuhman Ridge facilities) that have resulted in MGS habitat loss. China Lake has a limited cantonment area (Ridgecrest serves that function) and office area, so support facilities have resulted in minimal impacts to either the northern or southern ranges. Given that both installations practice air-to-ground maneuvers, with limited day-to-day ground disturbance, most of the habitats are still intact and potentially occupied.

At Fort Irwin, mechanized vehicles and ground troops create new ground disturbances during each exercise (albeit in previously degraded areas). Gustafson (1993) reported that military training had affected approximately 130,000 acres (203 mi^2) in the known range. Most of the impacts are limited to areas below about 20% slope (LaRue and Boarman, in prep.), which coincides with the substrates most preferred by the MGS, where about 90% of 102 MGS records have occurred (LaRue, 1998 unpublished data). Approximately half of Fort Irwin [i.e., 353,644 acres (552 mi^2) of the 1,000 mi^2] installation within the MGS range is below 20% slope, and is therefore susceptible to some of the heaviest maneuver impacts. Krzysik and Woodman (1991) noted heavy shrub losses from the main maneuver corridors at Fort Irwin.

"Natural" Predators: Recently Dr. Leitner (pers. comm. 2000) indicated that common ravens might also prey on the MGS, although the evidence is anecdotal. He indicated that ravens are known to prey on Townsend's ground squirrels. In their Coso studies, the Leitners have found radio collars of several of their study animals at known raven perch sites. The extent of raven predation on the MGS is unknown. Although ravens are identified as a "natural" predator, they have also been referred to as a "subsidized predator" (Boarman 1993), and would probably not occur at current population levels in the absence of human resources. No data were found in the literature to indicate to what extent other predators (e.g., raptors, kit fox, coyote) may prey on the MGS.

Off Highway Vehicles: Off-highway vehicles may pose a threat to the MGS by crushing individuals or burrows, and degrading habitats (Gustafson 1993, Laabs 1998). With time, the plant diversity and abundance decreases in areas with intense OHV use (Laabs 1998), which reduces cover needed by the species for shade and forage. Gustafson (1993; citing Bury and Luckenbach 1977), reported that even light OHV use in the Mojave Desert can result in lost or compacted topsoil, unavailability of seeds for birds and mammals, and disrupted soil mantles. Gustafson (1993) reported, "…it is known that the squirrel is run over by vehicle[s]," but did not provide any specific reports.

There is anecdotal evidence that the MGS may be killed on both paved and dirt roads, although it has been suggested that they are too quick for this to happen. For example, during tortoise surveys conducted near Water Valley, northwest of Barstow, in 1998, LaRue crushed a juvenile male MGS on a dirt road as it attempted to cross in front of his truck. In 1997, LaRue observed a juvenile male (likely a hybrid) as it was crushed on National Trails Highway, several miles north of Helendale. One of the nine MGS observed in 1998 (LaRue, unpublished data) darted into burrows that were located in the berms of a dirt road. The juvenile female was observed for about 20 minutes eating cryptantha alongside the road, and later using two different burrows located in berms on opposite sides of the road. Recht (1977) also observed MGS feeding on Russian thistle that was congregated along shoulders of roads in northeastern Los Angeles County.

Goodlett and Goodlett (1991) have shown, in the Rand Mountains, that the heaviest vehicle impacts occur immediately adjacent to both open and closed routes. It is plausible, then, that individual MGS using resources adjacent to roads are more likely to be in harm's way than those animals occurring in roadless areas. It is also plausible that juvenile MGS, which are most likely to travel longer distances than adults, are somewhat more susceptible to vehicle impacts than adults. Although adults may still be susceptible to vehicle impacts within their somewhat-fixed home ranges, dispersing juveniles are likely to encounter more roads than an adult living within a fixed region.

The potential to crush squirrels likely increases as the prevalence and use of roads increases in a given region. Given the relatively higher incidence of cross-country travel in open areas (1998-2001 WMP data), vehicle impacts are more likely to occur there and other places with similar densities of cross-country tracks, depending on resident and dispersing populations of the MGS. This would suggest that there may be relatively more impacts in the Spangler Hills, Jawbone Canyon, Dove Springs and El Mirage open areas, which occur within the range, but does not negate the possibility that impacts may also be prevalent in heavy OHV use areas, such as occur in the vicinity of "Camp C" near the western end of the Rand Mountains.

In Table 3-36, incidences of six vehicle-based disturbances observed between 1998 and 2002 are compared between designated open areas and one heavy use area, between California City and the Rand Mountains. The first table lists data for trails, tracks, and litter; followed by targets, hunting, and camping in the second table.

The tables document the types of heaviest vehicle-based impacts observed within the range of the MGS in three open areas (excluding Olancha, which was not surveyed) and one hevy OHV use area. All vehicle-based impacts in these areas were above average, as described in the tortoise section. The data include vehicle impacts both inside and outside the open areas, the latter of which are clearly associated with the vehicle impacts emanating from open areas (see Map 3-14).

One can see that the Spangler Hills Open Area had the highest incidences of trails (19.3/mi^2 compared to 16.9/mi^2 at the next highest incidence at El Mirage), litter (39.1/mi^2 compared to 21.0/mi^2 at El Mirage), and target shooting (18.0/mi^2 compared to 17.6 at Jawbone Canyon/Dove Springs). El Mirage had the highest incidence of cross-country vehicle tracks (at 120.7/mi^2 compared to Spangler Hills at 95.6/mi^2) and hunting areas (2.3/mi^2 compared to 1.5/mi^2 in the heavy OHV use area).

Cumulatively, one finds there to be 274 mi^2 affected by above average trails, 324 mi^2 impacted by tracks, 319 mi^2 by litter, 160 mi^2 by target shooting, 38 mi^2 by hunting, and 25 mi^2 by camping. Tracks and trails are most likely to affect the MGS, as shooting has not been identified as a direct threat to the species. These impacts were most prevalent in the open areas, where this sort of activity will likely remain or increase under present and future management on these class I lands.

Table 3-36
Prevalence of Vehicle-Based Disturbances in Four Areas of Comparison

AREA	SQUARE MILES, SUM, AND AVERAGE VEHICLE-BASED DISTURBANCES OBSERVED (1998-2002) IN THREE OFFICIAL AND HEAVY USE AREA								
	Trails			Tracks			Litter		
	Mi^2	Sum	Ave	Mi^2	Sum	Ave	Mi^2	Sum	Ave
Spangler	121	2336	19.3	127	12140	95.6	121	4734	39.1
El Mirage	19	322	16.9	19	2294	120.7	20	437	21.9
Jawbone/Dove	24	370	15.4	22	406	18.5	22	381	17.3
Cal. City/Rands	110	878	8.0	156	8162	52.3	156	3295	21.1
Totals	274	3906	14.3	324	23002	71.0	319	8847	27.7

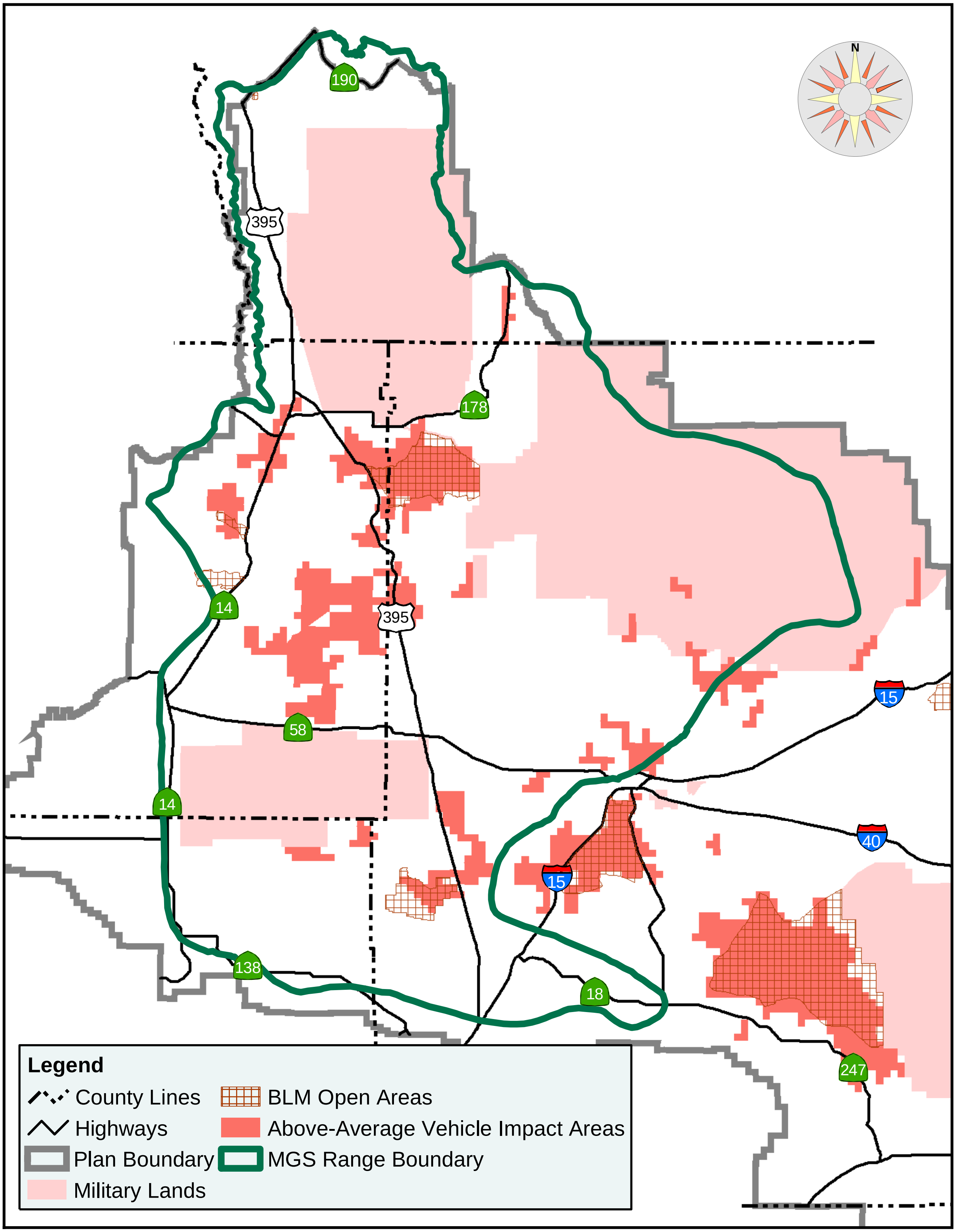
AREA	SQUARE MILES, SUM, AND AVERAGE VEHICLE-BASED HEAVY OHV USE AREA								
	Target			Hunting			Camping		
	Mi^2	Sum	Ave	Mi^2	Sum	Ave	Mi^2	Sum	Ave
Spangler	56	1006	18.0	12	13	1.1	7	18	2.4
El Mirage	12	136	11.3	6	14	2.3	2	2	1.0
Jawbone/Dove	16	281	17.6	1	1	1.0	2	5	2.5
Cal. City/Rands	76	498	6.5	19	28	1.5	14	21	1.5
Totals	160	1921	12.0	38	56	1.5	25	46	1.8

Two of the 23 sites trapped for the MGS in 2002 included the El Mirage and Spangler Hills open areas (Leitner, pers. comm. 2002) where no MGS were trapped. However, the absence of squirrels cannot be attributed to vehicle use in those two areas. El Mirage is located south of Highway 58, where no MGS were captured on eight of the nine trapping grids, including the one in the open area. Nor were any of the high concentrations of winterfat and hopsage identified in 1998 (LaRue, unpublished data) associated with either open area.

Data show that there is a "spill-over" effect from the open areas, where relatively higher incidences of vehicle impacts were found in adjacent areas, compared to non-adjacent lands (see Map 14). The prevalence of cross-country vehicle tracks north of El Mirage Open Area will probably be reduced due to boundary fencing installed in the late 1990's. Other areas, adjacent to Jawbone and Spangler Hills, remain susceptible to open area-related impacts as no fences have been installed.

Vehicle-based impacts may be prevalent in areas that are not adjacent to open areas. Within the MGS Conservation Area, these areas include lands within the Rand Mountains, west of Silver Lakes, within Kramer Hills, north of Hinkley, and southwest of Fort Irwin. Smaller areas also exist east and northeast of Fremont Peak, Fremont Valley, Iron Mountains north of Silver Lakes, Superior Valley (one 4-mile region), and southeast of Harper Lake (see Map 3-17).

Vehicle Disturbances and MGS Habitat



West Mojave Plan FEIR/S
Map 3-17

Scale: 1 : 1,250,000
0 10 20 30 Km
0 10 20 30 Miles

10/14/04

Citing Bury and Luckenbach (1977), Gustafson indicated "One result [of OHV activity] is a reduction in the number of spring annuals in areas of off-highway vehicle use" and "…off-highway vehicles detrimentally affect wildlife and creosote bush scrub habitat in the Mojave Desert." Brooks (1999a, 2000) found non-native plant species were more common alongside roads, and that roads served as dispersal corridors for weed species. Weeds, in turn, provide fuels that result in hotter fires and relatively larger burned areas. Non-native annuals serve to spread fires between shrubs far more readily than the native annual flora (Brooks 1999b). Gustafson (1993) indicated wildfires are probably hot enough to kill seeds, sprouting shrubs, and squirrels within their burrows. He felt this was a temporary impact that would be remedied when vegetation became re-established.

Urban Development: According to some authors, the primary threat to the MGS is destruction and degradation of its habitat (Laabs 1998, CDFG 1992). Habitat conversion not only decreases the amount of available habitat, it also fragments the remaining habitat, isolating populations from one another. Urbanization has resulted in the loss of considerable habitat, particularly surrounding the cities of Palmdale, Lancaster, Victorville and Hesperia. Urban development results in the direct loss of habitat, and likely has effects on surrounding native habitats, including increased numbers of domestic and feral cats and dogs. Dumping of refuse, abandoned vehicles, and other items is often most prevalent on undeveloped lands adjacent to residential, commercial, and industrial development (Gustafson 1993; WMP data).

Gustafson (1993) concluded: "No single small development threatens the squirrel's existence in the region, but the total cumulative impact is greater than the sum of the individual impacts." He reported approximately 165,000 acres (258 mi^2) of urban development and 215,000 acres (336 mi^2) of rural development occurred within the known range as of the early 1990's. Numerous historic localities for the MGS are in areas that have been converted to urban uses. For example, about 10% of the historic MGS range has been lost to urban (6%) and agricultural (3%) uses.

The MGS is not absent from all urban areas. A recent observation occurred south of Highway 138, near Pinyon Hills, and a second occurred near an aerospace industrial complex located adjacent to Palmdale (Becky Jones, pers. comm., 2002). In the first case, the site and adjacent areas are comprised of extensive tracts of undeveloped lands and those with relatively light rural development. At the second site, there are about five to six contiguous square miles of relatively undeveloped land, but the entire area is surrounded by urban and agricultural development.

The MGS has also been observed in residential backyards in Inyokern (Peter Woodman, 2000 pers. com.), and may be seen foraging on the golf course at China Lake (Tom Campbell, pers. comm., 2002). In 1991, Laabs (Tierra Madre Consultants, Inc. 1991) tentatively identified an MGS burrow in the edge of an agricultural field in northeastern Lancaster. One squirrel was recently trapped at the proposed Hundai facility south of California City, where the consultant had identified habitats as being marginal (Michael Connor, pers. comm., 2002). In these latter cases, the sightings are adjacent to extensive areas of undeveloped lands.

Given these observations, the only certain areas of MGS extirpation within the range are those that have been physically developed. Such areas include, but are not limited to, paved roads and parking lots; residential, commercial, and industrial sites occupied by buildings, graded areas, and other areas where vegetation has been mechanically removed; solar facilities at Kramer Junction and Harper Lake; and large mined areas (U.S. Borax, Rand Mining Company, portions of the Shadow Mountains located east of Edwards AFB).

Although urbanization and its affiliated impacts are prevalent in the Palmdale/Lancaster and Victorville/Apple Valley/Hesperia areas (Aardahl and Roush 1985), other communities within the range (e.g., Ridgecrest, California City,.) are also likely affecting MGS habitats. Whereas the MGS has been observed at the edge f urbanization (e.g., Barstow, China Lake golf course), it is unlikely that the species can persist for long in urban settings (Laabs 1998). Potential causes for the likely extirpation of the MGS from Lucerne Valley have included agricultural development (Laabs 1998) and the expansion of the California ground squirrel (*Spermophilus beecheyi*) in the area (Wessman 1977). The isolation of MGS in Lucerne Valley from the main portion of its range, located west and north of the Victor Valley, has also been cited (Gustafson 1993).

Uncertainties with the MGS That Do Not Affect the Desert Tortoise: There are significant differences, in terms of detectability and distribution, between the tortoise and the MGS that warrant brief mention.

- **Detectability:** The tortoise leaves behind evidence (scats, burrows, tracks, carcasses, courtship rings) that allows for detection that is not available with the MGS. Tortoise carcasses and fragments may persist for as many as 20 years, and still allow for positive identification. This is not true for the MGS. As such, it is relatively straightforward to determine occupied (or recently occupied) tortoise habitat. MGS detection, by contrast, relies on either observing or trapping animals, or occasionally finding road-killed squirrels. For these reasons, nothing comparable to the relatively accurate tortoise range map could be developed for the MGS without a focused trapping survey. Even the 1993 range reduction (Gustafson 1993) was based more on anecdotal information than on substantiated absence of the MGS west of Highway 14, in the Antelope Valley.

- **Records:** MGS records have been maintained for more than 100 years. This historic information is not available for the tortoise, for which records have only been available since the mid-1970s (except for anecdotal accounts). This is critically important, as it allows for a MGS range map that shows both historical and current distribution, even though current distribution cannot be fully ascertained based on available data. Given these data, it is possible to determine what percent of the known and historic range has been converted to urban, agricultural, and other uses.

- **Current Distribution:** It cannot be emphasized enough that *the entire known range of the MGS occurs within the West Mojave*; all but a small part of that, which is located northeast of Searles Dry Lake, *occurs within the planning area, west and north of the Mojave River*. The tortoise occurs in four different states on millions of acres, whereas the MGS is restricted to about 7,000 mi^2. The literature indicates that this is the smallest range for any full species of mammal in the United States.

Although it is not possible to produce a relatively accurate range map for the MGS, this problem is somewhat alleviated by available data. Several different studies corroborate the hypothesis that the MGS is a generalist, equally likely to occur in creosote bush scrub as in saltbush scrub. Its distribution is likely restricted by elevation limits (i.e., probably not above about 5,600 feet) and geomorphologic factors (i.e., absent from non-vegetated playa surfaces, and likely less common on steep, rugged terrain, although young MGS may disperse through such areas).

Implications for Conservation Strategy: Given this lack of information, any conservation strategy must necessarily rely on protecting as much quality habitat within the range as possible, regardless of current occupancy. Available data suggest that local MGS populations follow a "boom and bust" cycle, where they expand into habitats when conditions are favorable, and shrink back into core areas when conditions are less favorable, particularly when conditions such as drought occur over a several-year period. Therefore, one critical difference between conservation of the tortoise and that of the MGS is that *proactive conservation measures for the MGS must be applied to its habitat; they cannot be applied to animals only, and still succeed*. MGS conservation requires that a substantial portion of its known range is protected to allow for natural fluctuations in local and regional populations in response to climatic factors, particularly wetter and drier conditions.

3.3.3.6 Regulatory Protection of the Mohave Ground Squirrel

As a State-listed species with no federal status, there is limited regulatory protection for the MGS compared to the tortoise. For example, although tortoise management programs at Edwards AFB and China Lake minimize habitat loss and degradation of MGS habitat, the Air Force and Navy are not obligated to manage the installations to preserve State-listed species. The CDFG has no habitat designation that is analogous to federally designated critical habitat.

Even so, CDFG works closely with county and city jurisdictions to ensure that habitats are assessed for potential impacts to the MGS. CDFG is also given the opportunity to review base management plans for the three installations within the known range. Currently, private proponents must trap a proposed development site to confirm absence of the MGS, or assume presence, obtain a 2081 incidental take permit, and mitigate and compensate accordingly.

MGS also receives protection in several existing parks, wilderness areas, and BLM crucial habitat areas within the known range. These areas are managed in such a way that one or more known impacts to squirrels and habitats is somewhat minimized. For example, none of the areas discussed below is likely to be developed for either urban or agricultural uses. These lands constitute the most protected areas (outside military installations) within the known range. However, none of them is completely isolated from potential impacts to squirrels and habitat either. These areas include the following:

- **Red Rock Canyon State Park:** This 14,489-acre (22.6 mi^2)state park is located in the west-central portion of the known range. No grazing is allowed. There are centralized locations accommodating an unknown number of visitors each year, and remaining areas that are only accessible to foot traffic. The park is situated adjacent to the Dove Springs Open Area, and is therefore vulnerable to impacts from OHV traffic. Management actions have recently been implemented to minimize OHV impacts in the park.

- **Saddleback Butte State Park:** This 2,795-acre (4.4 mi^2) state park is located within the known range near its south-central boundary. The entire site is fenced, which minimizes direct impacts associated with OHV activity and grazing, both of which are prevalent in the region (LaRue, 2002 unpublished data). The community of Lake Los Angeles occurs several miles to the south, and individual residences are immediately adjacent to the east and north. Dogs and cats are both likely to affect any squirrels that may occur.

- **Desert Tortoise Research Natural Area:** The 25,695-acre (40-mi^2) DTNA is cooperatively managed by the BLM and the Desert Tortoise Preserve Committee (DTPC) for desert tortoise conservation, which should also benefit the MGS. For example, DTPC has conducted an aggressive land acquisition program to acquire private inholdings. The DTNA is completely fenced. The fence precludes sheep grazing, which is prevalent on the surrounding lands. Occasional OHV trespass occurs when the fence is cut, but this is generally limited to one or several passes by the perpetrator. Sign count data indicate that tortoises within the fenced area are reproducing, but few subadult tortoises were observed in the larger, surrounding region. This suggests that the tortoise population receives protection within the fence that would also extend to the MGS, which like the tortoise, is exposed to extreme levels of sheep grazing and cross-country OHV travel outside the fence.

- **BLM Wilderness Areas:** As shown in Table M-11 (Appendix M), there are a total of 18 wilderness areas within then WMPA, which encompass 430 mi^2 within the MGS range. Six wilderness areas (274 mi^2) are fully within the range, five (478 mi^2 total) are partially within the range (156 mi^2 are inside), and seven (604 mi^2) are fully outside the range. One (Malpais Mesa) is outside the WMPA, but partially within the range. Although these areas are designated roadless areas, vehicle trespass occurs, some areas (Golden Valley) are sheep grazed, etc. Other uses, such as agriculture, urban development, etc. are precluded (see discussion in tortoise section for characteristics of these wilderness areas and impacts that continue to occur).

Other BLM Special Management Areas: The 1980 CDCA Plan established three management areas for MGS: Rose Valley Western Mojave Crucial Habitat, and Superior Valley. The CDCA Plan also identified Crucial Habitat for the MGS, which occurred within the three MGS management areas and in two others as well: DTNA and Sierra-Mojave-Tehachapi Ecotone (see Table M-10, Appendix M). Cumulatively, these five areas encompassed about 773,000 acres (1,208 mi^2), or about 16% of the 7,691 mi^2 range of the entire MGS range. The CDCA Plan's wildlife element identified management objectives, planned actions and implementation needs, which are also given in Appendix M.

Habitat Management Plans (HMPs) were to be prepared for each of the five areas, to be finished no later than 1987, with implementation occurring no later than 1989. Specific management actions varied, as did long term goals, but each of the five areas had the long-term goal of protecting, stabilizing, and enhancing resource values. During the early preparation of these HMPs, conflicts with some of the multiple use class guidelines were identified. Because an HMP, unlike an ACEC, cannot override multiple use class guidelines, it was determined that an HMP was not an effective tool for MGS management. Rather, a plan amendment would be necessary, to be implemented through the West Mojave planning process.

Rand Mountains Fremont Valley Management Plan: The BLM completed a Rand Mountains Fremont Valley Management Plan (Rand Plan) in August 1993 (U.S. Bureau of Land Management 1993), which included 65,020 acres (101.6 mi^2) of public lands 35 miles south of Ridgecrest and immediately north of California City. The area encompasses about 24,320 acres (38 mi^2) of previously designated MGS Crucial Habitat. The Rand Plan ranked the MGS as second only to the desert tortoise on its list of the most sensitive wildlife resources in the management area. The Rand Plan called for: (1) amendment of the CDCA Plan to reflect a proposed 13,120 acre (20.5 mi^2) expansion of the Rand ACEC and a BLM multiple use class change from class M to class L; (2) acquisition of private lands; and (3) a mineral withdrawal. To date, the CDCA Plan has been amended for the ACEC expansion and multiple use class change; acquisitions of private lands and mineral withdrawal have not occurred. Facilitating implementation of the Rand Plan is considered a high priority for MGS conservation in the West Mojave Plan.

3.3.4 Bats

Six species are addressed by the plan: long-legged myotis, California leaf-nosed bat, spotted bat, pallid bat, Western mastiff bat and Townsend's big-eared bat.

Life History: The California leaf-nosed bat and Townsend's big-eared bat are colonial cave dwellers thought to have declining populations. The California leaf-nosed bat is known to be dependent on desert wash foraging habitat near the roosts. The Townsend's big-eared bat is dependent on riparian habitat within five miles of the roosts.

The spotted bat and western mastiff bat are cliff dwellers. In desert habitats, pallid bats roost mostly in rock crevices, although they might be found in tree cavities, old buildings, under bridges, in caves and mine adits, and mud tubes when these istes are available. The long-legged myotis is primarily a tree-dweller occurring at higher elevations than those found in the planning area.

Population Status in the Planning Area: All except one of the identified significant roosts are on public (NPS and BLM) lands. The Dale Mining District in the Pinto Mountains, including portions of Joshua Tree National Park, contains many shafts and adits known to harbor bats of several species. Six significant roosts have been located, and the potential for several more is present. The largest roost known, containing over 10,000 bats of several species, is under the Interstate 15 bridge at the Mojave River crossing. This site is currently under investigation. It may not be a significant roost for the six target species.

The only identified cliff roosts for spotted bat are within Red Rock Canyon State Park. No roosts of western mastiff bat have been located, but roosts are suspected within Joshua Tree National Park.

Regulatory Status: BLM sensitive (except long-legged myotis), California Species of Special Concern (except long-legged myotis).

Threats Affecting Bats: The most serious direct threats to bats are disturbances of hibernation and maternity roosts and destruction of roosting habitat, primarily old mines and natural caves. Old buildings and bridges also provide roosts for some species. Loss and degradation of foraging areas threatens certain species. Potential recreation impacts include access to significant roosts and degradation of foraging habitat for Townsend's big-eared bat and California leaf-nosed bat.

3.3.5 Other Mammals

3.3.5.1 Bighorn Sheep

Life History: Bighorn sheep were originally distributed from Baja California to Texas in the south to the Canadian Rockies in the north, with the eastern boundary reaching western Nebraska and the western boundary in California extending from Mount Shasta in the north to the crest of the central and southern Sierra Nevada to the Transverse Ranges and the east side of the Peninsular Ranges in the south. Traditional taxonomy dating back more than half a century broke bighorn sheep from the southwestern desert region into four subspecies, one of which, the Nelson Bighorn (*Ovis canadensis nelsoni*), included bighorn from the Transverse Ranges through most of the desert mountain ranges of California, including the West Mojave planning area, and adjacent Nevada and northern Arizona to Utah. Recent research indicates a lack of support for Cowan's (1940) desert subspecies and instead has found previously unrecognized north-south variation of the Nelson Bighorn. The transition between the southern (warm desert) and the northern (cold desert) forms occurs in the middle of the West Mojave planning area, with I-15 east of Barstow representing the approximate boundary. Within the West Mojave planning area no populations north of I-15 persist that have not been reintroduced or augmented with sheep from south of I-15.

Within the West Mojave planning area, 16 bighorn sheep populations are known to have existed as defined by mountain range complexes. Five of these 16 areas no longer contain populations, three have been reintroduced, and two have been augmented with sheep from another population. For the past decade, bighorn sheep populations in California have been viewed in a metapopulation context. Within the West Mojave planning area there are three metapopulations whose geographic boundaries are now formed by major fenced highways (I-15 and I-40) -- the south, central, and north Mojave Desert metapopulations (Torres et al., 1994, 1996).

Basic to the biology of bighorn sheep is their agility on steep rocky terrain, an adaptation used to escape predators. Preferred habitat of bighorn is primarily on or near mountainous terrain above the desert floor.

Radio telemetry studies of bighorn sheep in various southwestern deserts, including the Mojave Desert of California, have found considerable movement of these sheep between mountain ranges. This is especially true of males, but also of ewes. Within individual mountain ranges, populations often are small. Levels of inbreeding could be high in such populations, but intermountain movements provide a genetic connection with a larger metapopulation, and this will counteract potential inbreeding problems.

Surface water is another element of desert bighorn habitat considered to be important to population health. Male and female bighorn sheep inhabiting desert ecosystems can survive without consuming surface water, and males appear to drink infrequently in many situations ; however, there are no known large populations of bighorn sheep in the desert region that lack access to surface water.

Population Status in the Planning Area: The majority of bighorn sheep herds are located on military bases, especially China Lake NAWS and Twentynine Palms MCAGCC. Additional populations are found in the Rodman and Ord Mountains (occasionally ranging west onto Sidewinder and Stoddard ridges), Newberry Mountains, and on the north slope of the San Bernardino Mountains. Much of the habitat is within designated Wilderness.

Regulatory Status. BLM Sensitive.

Threats Affecting the Bighorn Sheep: Potential threats to bighorn include loss or disturbance of springs and waterholes, incremental loss of habitat, contact with domestic sheep that can introduce disease, and blockage of linkages by roads, canals, or fences. Significant mountain lion predation in the San Bernardino Mountains is a threat. Vehicle intrusion into occupied habitat, especially lambing areas, can be a minor threat.

Rural development with fencing threatens corridors; one corridor formerly extended through the city of Twentynine Palms. The bighorn traveling between the Pinto Mountains and the Bullion Mountains on Twentynine Palms MCAGCC now travel through the Sheephole Mountains (BLM, 2002). The dispersal corridor between the San Bernardino Mountains and the Granite Mountains is threatened by rural development in western Lucerne Valley. Mining operations have not been shown to significantly impact bighorn numbers in the San Bernardino Mountains, although the mines result in a loss of habitat, block access to water sources and pasture, and bring new disturbances into the permanent range. New cyanide heap leaching mines have the potential to harm bighorn if open water containing cyanide is present on operations within bighorn habitat.

3.3.5.2 Mojave River Vole

Life History. The Mojave River vole occupies moist habitats along the middle reaches of the Mojave River.

Population Status in the Planning Area: The range of this subspecies is entirely within the West Mojave planning area. It is found in wetland and riparian habitats along the Mojave River between Victorville and Helendale. Additional potential habitat lies upstream of Victorville towards Hesperia. Voles have been captured at Harper Lake, Edwards Air Force Base near Piute Ponds and Rogers Dry Lake, and at China Lake Naval Air Weapons Station. It is unknown which subspecies these specimens are.

Regulatory Status: BLM Sensitive, California Species Of Special Concern.

Threats Affecting the Mojave River Vole: Habitat destruction and fragmentation due to agriculture and urbanization are the primary threats. Concentrated off-highway-vehicle use and other surface-disturbing activities are also threats. Virtually all the potential habitat along the Mojave River, with the exception of the Mojave Narrows Regional Park, is in private ownership.

3.3.5.3 Yellow-eared Pocket Mouse

Life History: This mouse inhabits the eastern slopes of the Piute Mountains and Sierra Nevada along the western fringe of the Mojave Desert. Little information is available regarding habitat requirements except that it has been found in Joshua tree woodland, desert scrub, pinyon-juniper, mixed and montane chaparral, sagebrush and bunchgrass habitats. It occurs primarily in sandy soils with sparse to moderate shrub cover with elevations of known localities ranging between 1030-1615 meters.

Population Status in the Planning Area: Most of the range of the yellow-eared pocket mouse is within the West Mojave on the eastern slope of the Sierra Nevada and Piute Mountains. The species is known from Kelso Valley, Horse Canyon, Sage Canyon, Freeman Canyon, Indian Wells Canyon and Sand Canyon. Similar habitat, which may harbor the species, is present both north and south of this region, as well as in intervening canyons.

Regulatory Status: BLM sensitive.

Threats Affecting the Yellow-eared Pocket Mouse: Given the small range of the yellow-eared pocket mouse, any major disturbance of its known or suspected habitat could have significant deleterious effects. Cattle and sheep grazing pose a potential threat due to the effects on plant assemblages or erosion of soils. Off-highway vehicle activity and mineral extraction are other potential threats, due to their effects on native vegetation. Most of the canyons supporting the species have roads and are therefore accessible. Wind-energy production also poses a potential threat, resulting from impacts associated with road networks.

3.3.6 Birds

3.3.6.1 Bendire's Thrasher

Life History: This species breeds in desert areas containing cactus, Mojave yuccas, and Joshua trees.

Population Status in the Planning Area: The primary distrubution of Bendire's breeding habitat in the WMPA extends as a discontinuous band in suitable habitat from Joshua Tree National Park to near Victorville. The most extensive documented populations are in JTNP. The planning area comprises a small portion of the total range, which extends east to the east Mojave and Arizona. The historical range in the West Mojave was considerably larger than at present, and the occupied habitat in 1986 consisted of six disjunct populations: 1) Yucca Valley; 2) Kelso Valley; 3) Coolgardie Mesa; 4) Joshua Tree National Park; 5) SE Apple Valley; and 6) N. Lucerne Valley.

Surveys conducted in 2001 failed to detect Bendire's thrasher at most of these locations or at a control site in the east Mojave. Only Coolgardie Mesa and Joshua Tree National Park had nesting birds. The thrashers have been seen in abundance in the east Mojave in 2004.

Regulatory Status: California Species of Special Concern.

Threats Affecting the Bendire's Thrasher: Identified threats include habitat destruction through rural and urban development, off-road vehicle activity during the nesting season, and removal of yuccas and cholla cacti. Grazing has shown both positive and negative effects on this species. Fragmentation of the small remaining populations is a serious long-term threat.

3.3.6.2 Brown-crested Flycatcher

Life History: This neotropical migrant occurs in riparian woodland or forest dominated by cottonwoods and willows, usually in a climax stage. The presence of woodpeckers or other cavity-excavating species is important. No data exist on the minimum area of riparian habitat required by brown-crested flycatchers.

Population Status in the Planning Area: In the western Mojave Desert, this species has nested at the following localities: the Mojave River at Victorville (1-3 pairs annually), Cushenbury Springs (one pair in 1991), and Morongo Valley (1-2 pairs annually). It was reported from Indian Wells Canyon June 18, 2001. Fifteen birds were seen in the Mojave River between Victorville and Helendale in 2000.

Regulatory Status: California Species of Special Concern.

Threats Affecting the Brown-crested Flycatcher: Habitat destruction is the primary potential threat to brown-crested flycatchers in the western Mojave Desert. Habitat destruction can occur in several ways, with the most catastrophic losses resulting from clearing of large tracts of forest or woodland for agriculture, development, or flood control. Activities such as wood cutting for fuel or pumping of groundwater can degrade or destroy suitable breeding habitat for this species.

3.3.6.3 Burrowing Owl

Life History: This species is found in level grassland, prairie or desert floor habitat. It has adapted well to locations on the urban fringe, such as flood control channels or agricultural areas.

Population Status in the Planning Area: Existing records of burrowing owls include 53 records within the western Mojave Desert. These represent only a small sample of the locations at which burrowing owls have recently been or currently are present. Of the 53 records, 23 (43%) are from within Edwards Air Force Base; all of these have no specific locale or date. Of the other 30 records, only 13 have specific locales and dates. Probable or confirmed breeding was noted at five locales.

Regulatory Status: California Species of Special Concern.

Threats Affecting the Burrowing Owl: Potential threats include direct mortality from man (including vehicle collisions– this species has a high tolerance for vehicle disturbance, but this causes high numbers of collisions), pesticide and rodenticide poisoning; habitat degradation, destruction and loss; and predators. Disturbance by vehicles at nest sites is a threat.

3.3.6.4 Ferruginous Hawk

Life History: The ferruginous hawk can be found throughout the West Mojave in winter, but it prefers agricultural areas where prey is relatively abundant.

Population Status in the Planning Area: The ferruginous hawk is relatively abundant in winter in the Antelope and Mojave Valleys, and is occasional elsewhere, such as at Mojave Narrows Regional Park. Harper Dry Lake has been identified by the BLM as a Key Raptor Area for ferruginous hawk.

Regulatory Status: California Species of Special Concern.

Threats Affecting the Ferruginous Hawk: Electrocution on electric transmission and distribution lines is a potential problem. Shooting remains a minor threat.

3.3.6.5 Golden Eagle

Life History: This species uses rugged and remote mountain ranges for nesting; foraging over open desert in a range approaching 100 square miles.

Population Status in the Planning Area: Golden eagle is widespread in mountainous areas of the planning area. The Argus Mountains, El Paso Mountains, Newberry Mountains, Red Mountain and the southern Sierra Nevada Mountains contain several golden eagle nest sites. Within the China Lake NAWS Mojave B Range, the Eagle Crags provide outstanding habitat for golden eagle. The Great Falls Basin area contains several nest sites.

Where development has encroached on historical nesting sites, golden eagles sometimes make new nests on electrical transmission lines, as in Adelanto.

Regulatory Status: California: Fully Protected, Species of Special Concern

Threats Affecting the Golden Eagle: The three main threats to the Golden Eagle are: 1) shooting; 2) electrocution from electrical distribution and transmission lines; and 3) lead poisoning from eating carrion with bullet fragments. Disturbance from vehicles or human activities at nest sites is a minor threat. Golden Eagle numbers are limited within the planning area by the availability of nest sites. Protection of known nest sites is therefore the most effective method of preserving Golden Eagles in the planning area.

3.3.6.6 Gray Vireo

Life History: This species is found on arid slopes dominated by short, densely branched, stiff-twigged shrubs. It is migratory, occurring in the western Mojave Desert from early April until mid-August.

Population Status in the Planning Area: Gray vireos breed in small numbers at a few sites on the southwest margin of the West Mojave planning area. In Los Angeles County one singing bird was present in summer 1997 just west of the junction of Pallett Creek and Big Rock Creek (elevation = 3800 ft.) near Valyermo. This is approximately 8 mi. (5 km) west of Bob's Gap (elevation = 4200 ft.), which was occupied by 1-3 pairs from 1981 to 1992. In 1985 an additional territorial bird was found along Largo Vista Road, southeast of Pearblossom; this is approximately 8 mi. (5 km) east of Bob's Gap.

In San Bernardino County, gray vireos have bred consistently in the Round Valley/Rose Mine area of the eastern San Bernardino Mountains (elevation = 6890-7870 ft.), and likely breed locally in similar habitat elsewhere in those mountains. Territorial males were located in the upper Crystal Creek drainage, west of Cushenbury Canyon, in 1988; this is only 1-2 mi. (1.5-3 km) south of the West Mojave Plan boundary. They formerly bred in chamise-dominated chaparral in Cajon Pass. Egg sets were taken south of Hesperia, at the southern edge of the West Mojave Plan area, in 1937 and 1949. There were recorded breeding gray vireos at Black Rock Spring, Quail Spring, and Smithwater Canyon, all in the northern portion of Joshua Tree

National Park.

In Kern County gray vireos have bred on the west side of Walker Pass. There is a single sight record of uncertain authenticity at Castle Butte, east of California City in 1977.

Regulatory Status: BLM Sensitive, California Species of Special Concern.

Threats Affecting the Gray Vireo: The reasons for the apparent decline of this species in southern California are unclear. Cowbird parasitism is a likely threat.

3.3.6.7 Inyo California Towhee

Life History: The Inyo California towhee is a narrow endemic whose range is almost entirely within the planning area. The USFWS has prepared a Recovery Plan and critical habitat has been designated. In 1998, an extensive survey of the entire range of this bird was conducted.

The bird nests near riparian vegetation, including very small springs and seeps, and forages in mixed Mojave desert scrub. It ranges from 2680 feet to 5630 feet in elevation. All towhee sightings have been within 700 yards of a water source.

Population Status in the Planning Area: This bird is restricted to the southern half of the Argus Range in Inyo County. The extent of occupied habitat has been estimated at 24,176 acres. This figure does not include mountainous areas between nesting territories that may be used for dispersal or in the non-nesting season.

Two thirds of the range of the Inyo California towhee falls within the boundaries of the China Lake NAWS. Current management is compatible with conservation of this bird, and the Resources Management Plan for the base will address conservation of this species. The remaining one third of the range is managed by BLM and the CDFG. These agencies have established the Great Falls Basin ACEC, the Argus Mountains Wilderness, and the Indian Joe Canyon Ecological Reserve.

The 1998 survey and census of the Inyo California towhee detected a total of 640 adult towhees, representing 317 breeding pairs and 23 single adults.

LaBerteaux and Garlinger (1998) conducted an Inyo California towhee survey during the 1998 breeding season. A total of 640 adult towhees representing an estimated 317 pairs and 23 single adults were detected at 210 sites within the Argus Range. Prior to the 1998 survey, the towhee population was estimated to be no more than 200 individuals. Along with an increase in the numbers of birds detected, the 1998 census documented a range expansion 15 km to the north. Seventy-three percent of the population occurred on U. S. Navy lands, 25% on BLM lands on the east slopes of the Argus Range, and 2% on State-owned and private lands.

The towhee recovery plan established, as a criterion for delisting, the maintenance of a population of at least 400 birds for a period of five years. The 1998 survey was performed in an exceptionally wet year, and subsequent censuses have not been performed to determine if the high numbers observed then have been maintained.

Regulatory Status: Federal Threatened, California Endangered.

Threats Affecting the Inyo California Towhee: Destruction and degradation of habitat by feral burros and horses is a primary threat. Other potential threats include cattle grazing, off-highway vehicle activities, mining, and encroachment by rural residents. Water exportation from occupied springs (Bainter Spring, Alpha Spring, Benko Spring, North Ruth Spring #3) is a current threat or potential threat. Trespass camping and hunting near the springs may impact the birds and their habitat. Invasive exotic plants are present at some of the water sources that can reduce the quality of the nesting habitat.

3.3.6.8 LeConte's Thrasher

Life History: The habitat for this species is creosote bush scrub with stands of cholla cactus, Joshua trees, and thorny shrubs.

Population Status in the Planning Area: LeConte's thrasher is widespread throughout the planning area, favoring areas of cacti, Joshua trees, and desert washes. It is absent from playas and mountainous areas.

Regulatory Status: California Species of Special Concern.

Threats Affecting the LeConte's Thrasher: The primary threat is loss of habitat and fragmentation of habitat into segments too small to support a viable population in the long term. LeConte's thrashers are sensitive to vehicle traffic during the nesting season, especially off road travel in washes.

3.3.6.9 Long-Eared Owl

Life History: Riparian groves of willows and cottonwoods, stands of oaks in desert mountains, and dense stands of junipers are the preferred nesting habitat in the California desert. The long-eared owl disperses widely and can migrate long distances, and appears to exhibit low nest site fidelity. Therefore, protection of the woodland habitat is more important than protection of individual nest sites. This species often nests communally in the winter, preferring dense stands of trees, even plantings near human habitation.

Population Status in the Planning Area: Long-eared owl has been found in several locations in the Argus Mountains, and is known to nest at the largest riparian sites in the western Mojave Desert, including Big Morongo Reserve and Mojave Narrows Regional Park. Other recorded sites, presumably for nesting birds, are Leona Valley near Elizabeth Lake, and several sites near Lancaster. It is not clear whether the majority of birds are winter visitiors. Most records appear to be breeding. Communal winter roosts have been detected at Harper Dry Lake.

Regulatory Status: California Species of Special Concern.

Threats Affecting the Long-Eared Owl: Flood control projects can impact or convert riparian habitat. Habitat degradation and disturbance at nest and roost areas are potential threats. This includes degradation of adjacent open foraging habitat. The increase of great horned owls and their predation of long-eared owls may be having an impact. Shooting remains a minor threat.

3.3.6.10 Prairie Falcon

Life History: The prairie falcon is found throughout the western Mojave Desert, although it generally avoids urbanized areas. Nests are located on cliffs in rugged mountain ranges, often within ½ mile of a water source. Mountain ranges near agricultural areas also are favored because of increased prey density near nest sites. In winter, birds disperse widely, and are joined by migratory birds from northern latitudes.

Population Status in the Planning Area: Prairie falcons are widespread in mountainous areas of the planning area. Three sites are recognized as high-density nesting locations: Red Mountain/El Paso Mountains, Robber's Roost, and Newberry Mountains/Granite Mountains. In addition, a substantial population has been reported from the Mojave B Range of the Naval Air Weapons Station.

Regulatory Status: California Species of Special Concern.

Threats Affecting the Prairie Falcon: Human disturbance at certain prairie falcon nest sites is a threat. Urbanization surrounding an historical eyrie gradually degrades the foraging habitat and increases disturbance at the nest site so that they are abandoned. New mining projects occasionally threaten selected nest sites. Eggshell thinning due to ingestion of pesticides may be a problem.

3.3.6.11 Southwestern Willow Flycatcher

Life History: The southwestern willow flycatcher breeds only in riparian woodland, typically adjacent to or even over water. Surface water or saturated soil is usually present in or adjacent to nesting sites during at least the initial portion of the nesting period.

Population Status in the Planning Area: Summering willow flycatchers appear to be known from only two sites in the western Mojave Desert:

(1) At Big Morongo Canyon Preserve, one nesting pair in 1981. Subsequent years' regular study, however, failed to reveal any further resident willow flycatchers. The birds' use of the site is evidently only ephemeral.

(2) Along the Mojave River. Since the specimen from Oro Grande in 1920, two observations: one at Mojave Narrows Regional Park in 1990 and the second about one-quarter mile downstream (north-northwest) of the Interstate 15 crossing in 1994 and 1995.

Regulatory Status: Federal Endangered, California Endangered.

Threats Affecting the Southwestern Willow Flycatcher: Habitat loss and degradation and brood-parasitism by the brown-headed cowbird are the biggest threats.

3.3.6.12 Summer Tanager

Life History: Western populations of the summer tanager require riparian woodland or forest dominated by cottonwoods and willows, usually in a climax stage. Little quantitative data exist regarding the composition of summer tanager habitat in the California deserts. Five vegetation plots conducted within tanager territories at Mojave Narrows Regional Park in 1991 revealed a canopy cover of 60-85%. The same plots had shrub cover from 1-23%, and herbaceous cover from 25-90%.

Population Status in the Planning Area: Summer tanagers have nested at the following localities within the western Mojave: Big Rock Creek near Valyermo (1-2 pairs annually, Little Rock Creek (1-2 pairs in the West Mojave, and 1-2 pairs on the adjacent Angeles National Forest), Mojave River at Victorville (10-15 pairs annually), Cushenbury Springs (1 pair, at least sporadically), Morongo Valley (2-4 pairs annually), and Yucca Valley (1 pair annually). A female or immature was observed at Camp Cady in August 1997, suggesting potential breeding.

Numbers along the Mojave River at Victorville have increased notably over the past 11 years: from 3 or 4 pairs in 1987 to 12-15 pairs in 1996, and at least 12 pairs in 1997. In 2000, 15 birds were counted in the Mojave River between Victorville and Helendale in an area not previously surveyed. The population at Big Rock Creek has remained stable since the early 1980s at 1-2 pairs annually. Breeding at the golf course at Yucca Valley has been sporadic. Regular fieldwork has not been conducted at Cushenbury Springs, so the summer tanager's continuity there is not known.

Regulatory Status: California Species of Special Concern.

Threats Affecting the Summer Tanager: Habitat destruction is the primary threat to summer tanagers in California. Habitat destruction can occur in several ways, with the most catastrophic losses resulting from clearing of large tracts of forest or woodland for agriculture, development, or flood control. On a smaller scale, activities such as woodcutting can degrade or destroy suitable breeding habitat for this species. Groundwater pumping can gradually make the riparian habitats unsuitable.

3.3.6.13 Vermilion Flycatcher

Life History: This species occupies habitat with open riparian areas with accessible water and dominated by mesquite with willow and Fremont cottonwood. It uses parkland or golf course settings that support either native or non-native trees, and may or may not have accessible water. In native habitats, trees used for nesting range from massive cottonwoods, sycamores, and even oaks to smaller trees such as willow and mesquite.

Population Status in the Planning Area: The Vermilion Flycatcher breeds in many locations in the Mojave Desert, almost all of which are well above 500 ft. elevation. For example, this species breeds regularly (up to 3 pairs) in Morongo Valley (San Bernardino County), at both Covington Park and the northern edge of the Big Morongo Canyon Preserve. Additional areas within the West Mojave where the Vermilion Flycatcher has recently nested are Yucca Valley, San Bernardino County (up to 3 pairs from 1991 through 1999); Jess Ranch in Apple Valley, San Bernardino County (1 pair in 1995 and 1997); Fort Irwin, San Bernardino County (1 pair in 1996); Ridgecrest, Kern County (1 pair in 1992 and 1994); China Lake, Kern County (1 pair in 1994); Antelope Valley northwest of Lancaster, Los Angeles County (1 pair in 1998); and Leona Valley, Los Angeles County (1 pair in 1994). In 2000, six birds (2 pairs and 2 adult males) were found along a 1mile stretch of the Mojave River bounded by alfalfa fields south of Helendale.

Regulatory Status: California Species of Special Concern.

Threats Affecting the Vermillion Flycatcher: The primary threat to the Vermilion Flycatcher is habitat loss and nest parasitism by the Brown-headed Cowbird.

3.3.6.14 Western Snowy Plover

Life History. The Western snowy plover nests in the West Mojave on certain playas and wetland areas. Most appear to depart for the winter, but migrants and wintering birds are known from a few localities. They favor playas, seasonal wetlands, and sewage treatment ponds or ponds managed for wintering waterfowl.

Population Status in the Planning Area: Western snowy plover appears to nest with regularity on Edwards AFB at Piute Ponds. Other reported nest locations are Harper Dry Lake, Koehn Lake, China Lake, Rosamond Lake, Dale Lake, and the evaporation ponds at the Edison facility in Daggett, although the birds may not use these sites every year. A survey of nesting sites for this species at Searles Lake in 2001 recorded 14 broods of chicks and 2 nests were found (LaBerteaux, 2001). No plovers were detected at Koehn Lake in spring 2001 (Cunningham, 2001). No plovers or habitat were detected at Superior Dry Lakeor at East and West Cronese Lakes (Wehjte, 2001). Six plovers (five males, one female) were seen at Harper Dry Lake on May 30, 2001, but none were seen on July 6. One pair was judged to be breeding at Harper Dry Lake. At least two pairs were reported to nest at Harper Dry Lake in 2003 and 2004. The bird may use all of these sites in winter.

Regulatory Status: California Species of Special Concern.

Threats Affecting the Western Snowy Plover: Nests are vulnerable to human disturbance, including vehicle traffic and pets. Insufficient water supply to permanent and seasonal wetlands is a problem in many areas, including Harper Dry Lake. Rising water levels that inundate nests is a problem at managed ponds and during exceptional wet years at natural playas. They are very susceptible to predators, including ravens, coyotes, foxes and feral dogs and cats.

3.3.6.15 Western Yellow-billed Cuckoo

Life History: Yellow-billed cuckoos have one of the most restrictive suites of macro-habitat requirements of any bird species. Not only are they restricted to a single habitat type, the size and configuration of the habitat is also extremely important. During the breeding season in California, they are confined to cottonwood-willow riparian forest containing a tall canopy.

Population Status in the Planning Area: While there are no records of nesting areas within the planning area, birds have been seen during the breeding season along the Mojave River between Victorville and Barstow. Desert oases, with willows and cottonwoods, could provide habitat for migrating yellow-billed cuckoos. One migratory bird was observed in 2001 at upper Sand Canyon in Kern County.

Regulatory Status: Federal Candidate, California Endangered.

Threats Affecting the Western Yellow-billed Cuckoo: The primary threat to this bird is riparian habitat loss.

3.3.6.16 Yellow-breasted chat

Life History: All breeding in the western Mojave Desert occurs in riparian habitats dominated by cottonwoods and willows. Nesting habitat must have dense understory vegetation and larger trees that are used for singing perches.

Population Status in the Planning Area: Yellow-breasted chats have nested at five localities: the Mojave River at Victorville (6-10 pairs annually), Camp Cady (2 pairs in 1985), Morongo Valley (2-7 pairs annually), Cushenbury Springs (1 pair, sporadically), and Afton Canyon (1 pair in 1977).

Yellow-breasted chats are uncommon to rare migrants throughout the West Mojave. They have not been reported during winter.

Regulatory Status: California Species of Special Concern.

Threats Affecting the Yellow-breasted Chat: Habitat destruction and parasitism by brown-headed cowbirds are the primary threats to breeding yellow-breasted chats in the western Mojave Desert. Habitat destruction and degradation occurs in many ways, with the most catastrophic losses resulting from clearing of large tracts of forest or woodland for agriculture, development, or flood control. Groundwater pumping can also lead to loss of suitable nesting habitat.

3.3.6.17 Yellow Warbler

Life History: In the California desert, yellow warblers occur in riparian woodland or forest dominated by cottonwoods and willows. This species nests in habitats with dense understory vegetation that contain cottonwoods and willows. Fremont cottonwoods and larger willows typically form the canopy at breeding sites such as Big Morongo Canyon and the Mojave River at Victorville.

Population Status in the Planning Area: The yellow warbler has nested at only four localities: the Mojave River at Victorville (8-12 pairs annually), Camp Cady (1 pair in 1985), Morongo Valley (1-6 pairs annually), and Big Rock Creek (1-2 pairs annually). Yellow warblers were present and potentially breeding at several of the east Sierra Canyons in 2001.

As a migrant, yellow warbler is common throughout the western Mojave Desert. Hundreds have been observed in mid-May at Butterbredt Spring; fall daily maxima in the same area are typically between 50-100. It is casual during winter. Recent records exist for Arrastre and Grapevine Canyons south of Apple Valley and in the east Sierra Canyons of Kern and Inyo counties.

Regulatory Status: California Species of Special Concern.

Threats Affecting the Yellow Warbler: Habitat destruction and parasitism by brown-headed cowbirds are the primary threats to breeding yellow warblers in the western Mojave Desert. Groundwater pumping in the Mojave River is a potential threat.

3.3.7 Reptiles

3.3.7.1 Mojave Fringe-Toed Lizard

Life History: The Mojave fringe-toed lizard in endemic to southern California and a small area of western Arizona. This species is an obligate sand-dweller, found in dunes, sand fields, sand hummocks, and other sand deposits throughout the Mojave Desert in California. Its elevation ranges from 300 to 3000 feet. Its survival requires conservation of the blowsand ecosystem processes, including the sand source, fluvial sand transport areas, aeolian sand transport areas, wind corridors, and the occupied habitat.

Population Status in the Planning Area: Mojave fringe-toed lizards occur at several disjunct localities in the planning area. Occupied habitat is found at the Saddleback Buttes region of Los Angeles County, Edwards Air Force Base, El Mirage, Mojave River near Barstow, Mojave Valley, Alvord Mountain, Pisgah, Cronese Lakes, Dale Lake, Twentynine Palms, and Harper Dry Lake.

Regulatory Status: California Species of Special Concern.

Threats Affecting the Mojave Fringe-toed Lizard: Urban and rural development has fragmented populations along the Mojave River and at Twentynine Palms. Agricultural development has eliminated and fragmented populations in the Mojave Valley. These threats will continue during the duration of the permit.

Other major threats are flood control structures which prevent the waterborne flow of sand towards the occupied habitat, windbreaks that impede the aeolian transport of sand to the occupied habitat and vehicle use within the occupied habitat.

3.3.7.2 San Diego Horned Lizard

Life History: The San Diego horned lizard is endemic to southern California and northern Baja California, Mexico. This lizard prefers areas with loose, fine soils, an abundance of open areas for basking, and plenty of native ants and other insects. Within the planning area, the San Diego horned lizard is restricted to juniper woodland, Mojave mixed woody scrub and chaparral habitats above 3,000 feet elevation.

Population Status in the Planning Area: The San Diego Horned Lizard is found in the Antelope Valley California Poppy State Reserve, east along the base of the San Gabriel and San Bernardino Mountains to Joshua Tree National Park. This lizard is believed to be extirpated from the Mojave River near Oro Grande and from many areas near Palmdale.

Regulatory Status: California Species of Special Concern.

Threats Affecting the San Diego Horned Lizard: Urban and rural development on the north slope of the San Gabriel Mountains is the primary threat to the long-term viability of the desert populations. Increased predation by cats and dogs are a threat. Collection by collectors and children has contributed to the decline in numbers of this species, and this threat may continue today. Off-road vehicles pose a potential threat, particularly at the Mojave Forks dam. The introduction of Argentine ants and their elimination of the native ant food base may be contributing to the decline.

3.3.7.3 Southwestern Pond Turtle

Life History: Pond turtles are found within and adjacent to perennial water, especially at locations containing ponds. The turtles utilize adjacent uplands as well as the wetland habitats. Nest sites may be located several hundred feet from the water's edge.

Population Status in the Planning Area: The Southwestern pond turtle is found within the Mojave River in areas of permanent water, such as Mojave Narrows, Camp Cady, and Afton Canyon. It is known historically from Deep Creek at the southern edge of the planning area in the San Bernardino Mountains. A relatively large population is found west of Palmdale at Lake Elizabeth. It also occurs along Amargosa Creek and may occur along its tributaries.

Potential habitat is found on public and private land in the Kelso Valley at the northwest boundary of the planning area. Additional potential habitat is located within the Jawbone Butterbredt ACEC and at Barrel Springs near Palmdale.

Regulatory Status: California Species of Special Concern.

Threats Affecting the Southwestern Pond Turtle: The greatest single threat to this species is habitat destruction. Urban and rural development on the north slope of the San Gabriel Mountains is the primary threat to the long-term viability of the Elizabeth Lake and Amargosa Creek populations. Urban and agricultural demands on the water sources are a threat for the Mojave River pond turtle locations. Collection by collectors and children has contributed to the decline in numbers of this species. Bullfrog predation may impact populations.

3.3.7.4 Panamint Alligator Lizard

Life History: The Panamint alligator lizard is found most often in canyons with riparian habitat and nearby permanent springs. They forage in thick brush and along talus slopes where they may be observed basking on rocks in open areas, near thick vegetation.

Population Status in the Planning Area: The Panamint alligator lizard is endemic to California, where it is known only from 16 disjunct localities in the Panamint Mountains (Brewery and Limekiln Springs, Surprise Canyon, Pleasant Canyon), Nelson Mountains (Grapevine Canyon), Inyo Mountains (Daisy Canyon, Lime Hill), and White Mountains (Batchelder Spring, Marble Canyon, Tollhouse Spring, Westgard Pass) of Inyo County, California. Sight records (12) have been reported for the eastern Argus, Cosos, Panamint, Inyo, and White Mountains of Inyo and southeastern Mono counties, California.

Surveys conducted in 2002 at the China Lake NAWS have located the Panamint alligator lizard in the Argus Mountains at Mountain Springs Canyon. There are no verified records from the planning area outside of the China Lake NAWS.

Regulatory Status: BLM Sensitive, California Species of Special Concern.

Threats Affecting the Panamint Alligator Lizard: A potential decline in Panamint alligator lizard populations may be attributed to the direct loss of riparian habitat. Although there are no baseline data that suggests a current decline in population numbers, habitat loss or alteration due to expanded mining operations, off-highway vehicle (OHV) activity, grazing (domestic and feral), and introduction of non-native invasive plant species (e.g., Tamarisk) could have serious adverse effects in riparian areas where this species occurs.

3.3.8 Plants

3.3.8.1 Alkali Mariposa Lily

Life History: This species is most often found at the edges of alkali sinks and playas, in floodplains with alkali soils, and at alkali seeps and springs. The alkaline floodplain north of Lancaster and south and east of Edwards AFB appears to provide a large block of undisturbed habitat for alkali mariposa lily. Sheet flooding of the flat terrain supports the plants, which are abundant in wet years. The saltbush scrub north of Highway 138 and west of EAFB has not been well surveyed.

Population Status in the Planning Area: The western Mojave Desert comprises the majority of the range of alkali mariposa lily, although the Kern River Valley east of Lake Isabella supports substantial populations. Within the Planning area are some very significant populations as well as smaller, scattered populations. Large numbers of alkali mariposa lilies are known from Edwards AFB (>100,000 plants), Los Angeles County just south of the southwest corner of Edwards AFB (10,000 plants), and Paradise Spring near Fort Irwin (2-3,000 plants). The Kelso Valley contains alkaline meadows supporting >2,000 plants in 1988. This area is a southern extension of the Lake Isabella group of occurrences.

Smaller populations of this species are known from Red Rock Canyon State Park and Cushenbury Springs. Collections have been recorded from several playas and alkaline springs between EAFB and Fort Irwin, and one outlying population was recorded from Twentynine Palms in 1902. Many playas within the planning area have not been surveyed for this species.

Regulatory Status: California Species of Special Concern.

Threats Affecting the Alkali Mariposa Lily: Many occurrences are threatened with urbanization, especially the very large populations in the Amargosa Creek floodplain near Lancaster. Reduction of water supply to playas and alkaline floodplains could pose a threat. Maintenance of sheet flooding in the Rosamond Lake basin is essential, and the west part of this basin is becoming fragmented by agriculture and urban development. Lowering of groundwater to alkaline springs and seeps is a potential threat. The next greatest threat is urbanization in the Lancaster area where the largest populations are concentrated.

Grazing is a potential threat to the plants on private ranch lands in the Kelso Valley.

3.3.8.2 Barstow Woolly Sunflower

Life History: This species is a western Mojave Desert endemic. It is found on bare areas with little soil, often containing a shallow subsurface caliche layer.

Population Status in the Planning Area: Most known locations are between Kramer Junction and Harper Dry Lake. The range of Barstow woolly sunflower, however, extends west of Kramer Junction and includes Edwards Air Force Base. It is also located east of Harper Dry Lake on the Coolgardie Mesa. The BLM has established a 320-acre ACEC for protection of this species east of Kramer Junction. CDFG mitigation lands northeast of Kramer Junction are believed to support this species.

Regulatory Status: BLM Sensitive.

Threats Affecting the Barstow Woolly Sunflower: Populations are subject to removal within the utility corridor between Kramer Junction and Harper Dry Lake. Military operations at Edwards AFB could be a threat in the future. Current management at EAFB is compatible with protection of this species. Off-road vehicle travel is a threat.

3.3.8.3 Carbonate Endemics (Cushenbury Buckwheat, Cushenbury Milkvetch,Cushenbury Oxytheca and Parish's Daisy)

Life History: These species are restricted to limestone and dolomite substrates in the San Bernardino Mountains at the southern edge of western Mojave Desert. The majority of the range of these species is on the adjoining San Bernardino National Forest. An extensive database of localities and underlying land uses has been assembled in cooperation with the University of Redlands.

These species are substrate dependent; carbonate outcrops and soils on the north slope of the San Bernardino Mountains and conservation of habitat generally protects all species in the plant community. Parish's daisy and Cushenbury milk vetch are found at lower elevations than Cushenbury oxytheca and Cushenbury buckwheat.

Population Status in the Planning Area: Restricted to the north slope of the San Bernardino Mountains on carbonate substrates. The majority of the populations are on Forest Service lands at higher elevations. The distribution of Parish's daisy extends east to the Town of Yucca Valley.

Regulatory Status: Federal Endangered – Cushenbury buckwheat, Cushenbury milkvetch, Cushenbury oxytheca, Federal Threatened – Parish's daisy.

Threats Affecting the Carbonate Endemics: The primary threat is mining, which has fragmented some existing populations and eliminated others. Existing regulatory mechanisms under the mining law are inadequate to prevent fragmentation of populations. The extent of mining claims covering the carbonate substrates limits the opportunities for conservation. Vehicle travel on occupied habitat is a minor potential threat and travel off roads could adversely modify designated critical habitat.

3.3.8.4 Charlotte's Phacelia

Life History: Parish's phacelia is a striking blue and white annual wildflower, about seven inches tall, blooming from April to June. The flower falls off before the fruits develop. It is generally associated with naturally disturbed or unstable habitats such as loose sand, talus, and washes, and is most often found on open, arid slopes ranging in elevation from 2,500 to 7,200 feet. Population numbers fluctuate considerably from year to year, probably depending on rainfall.

Population Status in the Planning Area: This species occurs in the high Sierra Nevada, its desert-facing foothills, and the adjacent El Paso Mountains, mostly from the foothills above Fremont Valley, north through Red Rock Canyon State Park, to east-facing canyons above Indian Wells Valley. The range is almost entirely within the planning area. Most documented populations are near roads or trails in the lower canyons and washes, or are in high-interest natural areas (e.g., Red Rock Canyon State Park). Several locations are associated with the Los Angeles Aqueduct and its various access roads. In view of the documented locations at the Sierra Nevada crest and on its lower slopes, it is likely that additional undocumented populations occur on the inaccessible mountain slopes above the foothills, washes, and lower canyons. Additional populations also are likely to occur within the China Lake Naval Air Weapons Center.

Regulatory Status: BLM Sensitive.

Threats Affecting the Charlotte's Phacelia: Most of the known populations are within grazing allotments. Grazing is mentioned repeatedly in CNDDB records, but there appears to be no documentation of population declines in response to grazing. Other potential threats are off-road vehicles and wildflower collecting.

3.3.8.5 Crucifixion Thorn

Life History: Crucifixion thorn is long-lived, thorny leafless shrub or small tree of washes and other sites where water accumulates. It is particularly characteristic of non-saline dry lakes. It is mostly restricted to outwash plains and reported not to occur on rocky slopes. Plants occur as scattered colonies of fairly small size that never extend far across the landscape. Fruits remain on the plant for long periods, up to several years, and may be distributed by vertebrate herbivores. The plants are dioecious, that is, male and female flowers occur on separate plants.

Population Status in the Planning Area: This species is disjunct from its primary range and is found in the sand fields and washes north and east of Pisgah Crater and southeast of Fort Irwin, where it forms a distinct community, termed crucifixion thorn woodland. Two populations are known in the western Mojave Desert, from the Pisgah area and 5 miles southeast of Fort Irwin. Three of the ten occurrences are on private land. Another site is located near Amboy, just outside the planning area. A single plant was located near Newberry Springs during the 1999 tortoise surveys.

Regulatory Status: No special status.

Threats Affecting the Crucifixion Thorn: No significant human threats are known to exist. Some populations are, or were, somewhat impacted by OHV recreation, but the mature plants are large and stout enough that they are generally avoided. Seedlings could be damaged or destroyed by OHV activity.

3.3.8.6 Desert Cymopterus

Life History: Desert cymopterus is a long-lived herbaceous perennial, which has conspicuous purple flowers during early spring, but dies back completely aboveground in the summer, fall and early winter. It survives drought by storage of food in its large taproot, and is termed a geophyte. Flowering and seed production appear to be episodic, with large numbers of viable seed produced in wet years and little or no flowering and seed production in dry years. Desert cymopterus is generally found on sandy soil.

Population Status in the Planning Area: This species is a western Mojave Desert endemic, found from California City east to the Superior Valley and from the Cuddeback Lake area south to near Kramer Junction. Early collections of this plant from Lucerne Valley, Victorville and Apple Valley are from areas now developed, and the most recent records date from 1941.

Desert cymopterus is found in low densities and is widely dispersed. The vast majority of known recent occurrences >90%) are from Edwards AFB. Several studies of utility corridors have verified presence northeast of Kramer Junction on BLM and private lands, and additional locations were detected in 200 and 2001 near Hinkley and in the Superior Valley, the latter on lands transferred to the Army for the Fort Irwin expansion. Desert cymopterus remains one of the rarest and least known of the West Mojave target plant species.

The pattern of distribution of desert cymopterus suggests that it favors lands on the east side of desert playas where blowsand has accumulated.

Regulatory Status: BLM Sensitive

Threats Affecting the Desert Cymopterus: Threats to the desert cymopterus are not obvious. Urbanization in the Victor Valley and utility development east of Kramer Junction have eliminated some plants or reduced available habitat. Off-road vehicle travel has been cited as a threat, but documentation of loss of plants is missing. Cattle and sheep formerly grazed in occupied habitat, but livestock grazing is mostly restricted at known populations. Herbivory to the leaves by native insects, rodents, and perhaps tortoises is apparent, but the extent of damage to population size is not documented.

3.3.8.7 Kelso Creek Monkeyflower

Life History: Loamy, coarse sands on alluvial fans and deposits of granitic origin within the Joshua tree and juniper woodlands of the Kelso Valley in Kern County.

Population Status in the Planning Area: Seven of eight known occurrences are within a 12 square mile area in the Kelso Valley, with the remaining occurrence outside the Planning area nine miles to the northwest. Approximately 990 acres of public land and 1,000 acres of private land are occupied habitat. An additional 1,600 acres of potential habitat on public land has been identified.

Regulatory Status: Federal Candidate.

Threats Affecting the Kelso Creek Monkeyflower: Identified threats include trampling by cattle and off-highway vehicle activity. The main threat to this species is the present or threatened destruction, modification, or curtailment of its habitat or range. Mobile home and subdivision developments, including road access, threaten populations on private land. Fire-fighting operations have damaged one population in the past.

3.3.8.8 Kern Buckwheat

Life History: Kern buckwheat is found on ridge tops in poorly draining depressions in white bentonite clay soils thought to be from volcanic ash. These depressions have pebbles, gravel and rock cemented into the soil surface.

Population Status in the Planning Area: All of the known populations are within the planning area. There are two to four populations on public land and one or two on private land. All are located in the southern Sierra Nevada Mountains in Kern County either west of Middle Knob and south of Pine Tree Canyon, or on Sweet Ridge. There are four populations east of Sand Canyon described as follows:

- Population A - "Near" Zond Windfarms transmitting Station; a 2-5 acre site in a basin below the station.
- Population B - On Zond property; a 1 acre site, bisected by the road.
- Population C - On BLM managed land ca. 1/2 mile south of population B; a 2-3 acre site, bisected by the road.
- Population D - On BLM managed land about 3 miles south of population C; perhaps 4 to 5 acres.

Regulatory Status: BLM Sensitive

Threats Affecting the Kern Buckwheat: Maintenance of wind energy facilities poses a threat to this species. Other potential threats are off highway vehicle (OHV) use, future construction and grazing.

3.3.8.9 Lane Mountain Milkvetch

Life History: Lane Mountain milkvetch is an herbaceous perennial that grows up within a host plant, which it uses for support. Plants occur on granitic substrates with shallow soils.

Population Status in the Planning Area: The Lane Mountain milkvetch is a very local endemic species found primarily on public and military land. Its entire known range is within the western Mojave Desert between Goldstone and Barstow, San Bernardino County, in an area no more than 13 miles in diameter.

In 2001 and 2002 the Army conducted extensive surveys for Lane mountain milkvetch and found four primary population areas. These are found on public (BLM) lands, on Fort Irwin National Training Center, at the Goldstone Deep Space Communications Complex, and on private lands on the Coolgardie Mesa. The Fort Irwin population is fenced, and most training activities take place outside the fence.

Regulatory Status: Federal Endangered.

Threats Affecting the Lane Mountain Milkvetch: Few threats now exist for Lane Mountain milk vetch. Its low numbers make it susceptible to extinction from stochastic (unanticipated random) events. Expansion of training corridors at Fort Irwin could threaten this species. Increased activity within Fort Irwin or Goldstone Deep Space Communications Complex could threaten undiscovered populations of this species. Club mining activities on Coolgardie Mesa are a potential threat. Off-road travel within occupied habitat is a potential threat.

3.3.8.10 Little San Bernardino Mountains Gilia

Life History: This plant is found in dry canyons and along desert washes on alluvial fans. It requires sandy, well-aerated soil on flat ground with few or no competing species. Dense stands of weedy annuals are never present at occupied sites, which are all at the margins of streambeds.

Population Status in the Planning Area: The plant is restricted to the Little San Bernardino Mountains and the northeast portion of the San Bernardino Mountains. Of twelve major areas of occurrence, ten are within the western Mojave Desert. These are scattered into a number of discrete population segments, generally defined by drainage basins and washes.

Regulatory Status: BLM Sensitive.

Threats Affecting the Little San Bernardino Mountains Gilia: The greatest threat to the species is rural and suburban development near Yucca Valley and the community of Joshua Tree. A secondary threat is OHV recreation in washes. Future channelization or flood control projects could threaten the occupied drainages. Two of the ten West Mojave occurrences are within Joshua Tree National Park, one is on BLM lands, and seven are on private land.

3.3.8.11 Mojave Monkeyflower

Life History: Mojave monkeyflower is found in Joshua tree woodland and creosote bush scrub communities. It favors granitic soils, and is most often found on gravelly banks of desert washes. Occasionally it is found in sandy openings between creosote bushes and on rocky slopes above washes, areas that are not subject to regular water flows.

Population Status in the Planning Area: The Mojave monkeyflower is a restricted endemic whose entire range is within the western Mojave Desert. All occurrences are east of the Mojave River, and most are south of Barstow. Major populations are found between Victorville and Barstow west of Interstate 15, and in the Ord-Rodman-Newberry Mountains area. Populations in the Waterman Hills north of Barstow are not threatened.

Regulatory Status: BLM Sensitive.

Threats Affecting the Mojave Monkeyflower: Populations between the Mojave River and Interstate 15 are situated in a patchwork of private and public lands. Quarries and rural development on private land have fragmented some populations, a trend which may continue. Exchange of BLM lands for the Air Force Land Tenure Adjustment program could lead to loss of occurrences on public lands in the Brisbane Valley.

Populations south of Barstow and Dagget are threatened by off-road vehicle activity. Several populations are in or adjacent to the Stoddard Valley OHV open area. Some populations are bisected by Stoddard Valley Road and Camp Rock Road, and adjacent OHV trails have eliminated some plants.

Livestock grazing (Ord cattle allotment) occurs within this species' range and some damage to plants may arise from trampling. Mining does not appear to threaten Mojave monkeyflower at this time, though expansion of quarries near Oro Grande could result in the loss of occupied habitat.

Utility Corridor O traverses the western edge of the Brisbane Valley. Utility Corridor D, the Boulder Corridor, traverses the southeast edge of the Brisbane Valley unit and bisects the eastern part of the proposed Conservation Area near Daggett Ridge.

Because numbers of this annual species are dependent on winter rainfall, a potential threat is inbreeding, genetic bottlenecks, and lack of sufficient pollinators.

3.3.8.12 Mojave Tarplant

Life History: Mojave tarplant is found in Joshua tree woodland, creosote bush scrub, and mixed desert scrub communities at scattered locations throughout the planning area. Mojave tarplant is found near springs, seeps, wetland margins, swales and stream channels.

Population Status in the Planning Area: Within the planning area, the Mojave tarplant occurs in fairly large numbers at the base of the southern Sierra Nevada Mountains. An historical locality at Mojave Forks apparently no longer supports this species. Outside the planning area, this species occurs in the Peninsular Ranges of Riverside and San Diego counties.

Regulatory Status: BLM Sensitive, California Endangered.

Threats Affecting the Mojave Tarplant: Few threats are known to Mojave tarplant. At the historical Mojave Forks locality, extensive off-road vehicle activity has degraded the habitat.

3.3.8.13 Parish's Alkali Grass

Life History: Parish's alkali grass is found in alkali seeps and springs.

Population Status in the Planning Area: Parish's alkali grass is known from a single location, Rabbit Springs near Lucerne Valley, on private land within the planning area. This location is considered to be an important and interesting disjunct occurrence, and is in an area of considerable importance to the botanical history of the western Mojave Desert.

Regulatory Status. No special status.

Threats Affecting the Parish's Alkali Grass: Anything that lowers the water table at the springs will likely result in the destruction of the only known California population of this species, as this plant is absolutely dependent upon continued surface flows for its existence. Grazing, and potential road maintenance or widening threatens the small population.

3.3.8.14 Parish's Phacelia

Life History: Parish's phacelia is found on alkaline flats, that is, playas and dry lakebeds. It is most common on the silty and clayey soils of the lowest portion of the dry lakebeds south of Fort Irwin.

Population Status in the Planning Area: This species has a large population in California, disjunct from its primary range in Nevada. It occurs on the series of unnamed dry lakes (playas) south of Fort Irwin between the Manix tank trail and Coyote Dry Lake.

Regulatory Status: No special status.

Threats Affecting the Parish's Phacelia: No threats have been identified, but vehicle activity, including military vehicles, could be a major impact to the population. Surface disturbance on the private lands could eliminate the plants in those locations. The likelihood of development of these lands is very low. Because there are only one or two known occurrences in California, it may be at risk of stochastic or catastrophic extinction.

3.3.8.15 Parish's Popcorn Flower

Life History: Parish's popcorn flower is a distinctive member of a large genus of annual wildflowers, many of which are found in wetlands. This species is a wetland obligate.

Population Status in the Planning Area: A single site at Rabbit Springs in Lucerne Valley supports this species, which emerges and flowers every year because of the reliability of the groundwater at this alkali seep. The only other recent records of this plant in California are from freshwater springs at the edge of Owens Lake in Inyo County.

Regulatory Status: BLM Sensitive.

Threats Affecting the Parish's Popcorn Flower: No current threats. Groundwater pumping has been reported as a potential threat. Because the single location is so small, even minor disturbances to the seep habitat could significantly affect the population.

3.3.8.16 Red Rock Poppy

Life History: This species occurs at elevations between 2300 and 3280 ft. It appears to be found in a rather common rock type of rhyolite tuffs, granitics and similar rocks.

Population Status in the Planning Area: All known occurrences of Red Rock poppy, including a probable occurrence on Edwards Air Force Base, are within the western Mojave Desert. A possible location in the Black Mountains is outside the eastern boundary of the planning area.

The taxon is definitely known from only four locations: Red Rock Canyon State Park (many locations); Mesquite Canyon, 0.4-0.6 miles north of Randsburg Road; 2 miles southeast of Searles Station (which may be in San Bernardino County, and is in the Summit Range); and on an "unnamed road" 1.2 miles north of Red Rock-Randsburg Road at a junction 3.3 miles east of the junction of California highway 14 and the Red Rock-Randsburg Road.

Regulatory Status: BLM Sensitive.

Threats Affecting the Red Rock Poppy: The CNPS inventory (Skinner and Pavlik, 1994) states that vehicles threaten the Red Rock poppy, but the extent of this threat is unknown. There may be other threats in various areas, but so little is known about this plant that it is impossible at this time to outline the nature of any additional threats.

3.3.8.17 Red Rock Tarplant

Life History: The Red Rock tarplant is found in seeps, springs and seasonally moist alluvium in an extremely hot and arid part of the Mojave Desert in the rain shadow of the southern Sierra Nevada Mountains. Specifically, it is found in: 1) sandy to gravelly washes, 2) moist alkaline margins of seeps and springs, 3) sandy alluvium at the foot of ridges and cliffs, and 4) ledges of dry colluvium supported by ribs of bedrock on cliffs.

Population Status in the Planning Area: The Red Rock tarplant is a very local endemic of the western El Paso Mountains. Once thought to only occur in Red Rock Canyon, it is now known to occur in adjacent Last Chance Canyon as well. Within Red Rock Canyon it occurs along the bottom of the canyon for about 4-5 miles.

Regulatory Status: California Rare.

Threats Affecting the Red Rock Tarplant: Repeated disturbance is the biggest threat to this species. OHV activity posed the greatest threat in the past, but it is now restricted within Red Rock Canyon State Park.

3.3.8.18 Salt Springs Checkerbloom

Life History: This plant is an herbaceous perennial, blooming from April to June, then dying back to ground level in the late summer, fall and winter. Specimens have been collected in a variety of habitats, including chaparral, coastal sage scrub and yellow pine forest. In the desert, it appears to be restricted to alkali seeps and springs.

Population Status in the Planning Area: Although formerly widespread outside the desert, virtually no records are available since 1966. A single site at Rabbit Springs in Lucerne Valley supports this species, which emerges and flowers every year because of the reliability of the groundwater at this alkali seep.

Regulatory Status. No special status.

Threats Affecting the Salt Springs Checkerbloom: Urbanization has eliminated most historical locations.

3.3.8.19 Shockley's Rock Cress

Life History: Shockley's rock cress is a perennial herb found on limestone and quartzite outcrops and gravelly substrates at 3,000 - 6,000 feet elevation.

Population Status in the Planning Area: This plant is found primarily in the San Bernardino National Forest on the north slope of the San Bernardino Mountains, although it ranges to Inyo County, Nevada, and Utah. Nine occurrences have been reported by the NDDB within the planning area, 3 on public lands and 6 on private lands. The latter have been surveyed more intensively. In 1998, this plant was found within 51 plots randomly placed across the proposed carbonate plants conservation area, mainly within the San Bernardino National Forest. One isolated historical record is from Highway 247 north of its junction with Highway 18 in Lucerne Valley.

Regulatory Status: No special status.

Threats Affecting the Shockley's Rock Cress: Populations have been reduced by large-scale mining operations and this threat continues. The majority of public lands where this plant occurs have mining claims. Off road travel within occupied habitat is a minor potential threat.

3.3.8.20 Short-joint Beavertail Cactus

Life History: Short-joint beavertail cactus is mostly associated with Joshua tree, pinyon pine, and juniper woodlands, although it also occurs in chaparral and Mojave desert scrub communities. It has been reported from a wide variety of well-drained soils, from sandy to rocky, in open streambeds and on rocky slopes.

Population Status in the Planning Area: Short-joint beavertail cactus is found along the north slopes of the San Gabriel Mountains from the Anaverde Valley west of Palmdale east to the Cajon Pass. It occurs between elevations of 3000 – 6500 feet, and is found within the Angeles National Forest south of the West Mojave boundary. At the eastern edge of its range, between Cajon Pass and the Mojave River Forks Dam in the San Bernardino Mountains, the populations show intergradation with *Opuntia basilaris* var. *basilaris*.

Regulatory Status: BLM Sensitive.

Threats Affecting the Short-joint Beavertail Cactus: Nearly all of the occurrences of short-joint beavertail in the western Mojave Desert are on private land, and the primary threat is rural development in the Pinon Hills, Oak Hills, and Phelan areas in San Bernardino County, and suburban development in and near Palmdale. Large-scale developments at Las Flores Ranch and Summit Valley may threaten this species or the intergrade populations.

Off-road vehicle activity in the hills south and east of Phelan has damaged some habitat, and may eliminate plants.

3.3.8.21 Triple-ribbed Milkvetch

Life History: This species is only found in California and it is primarily known from the vicinity of Whitewater Canyon (the type locality) and from Dry Morongo Canyon along Highway 62, as well as from scattered occurrences farther east in the Little San Bernardino Mountains, including an anomalous, relatively high elevation, site at Key's Ranch in Joshua Tree National Park. It is restricted to sandy or gravelly soils in arid canyons. It appears that no well-established permanent population of any size has ever been found.

Population Status in the Planning Area: Most of the populations occur just outside of the planning area; but there are three locations within the western Mojave Desert: Little San Bernardino Mountains in Joshua Tree National Park (perhaps at Key's Ranch only), Big Morongo Canyon at the Riverside/San Bernardino counties line (several collections and observations), in the Whitewater River drainage within the San Gorgonio Wilderness and in Dry Morongo Canyon just north of the San Bernardino County line (several collections). There is additional habitat along the southern part of the planning area that is not well explored that may have additional populations: in the upper reaches of Mission, Dry Morongo and Big Morongo Creeks, as well as in the western lobe of Joshua Tree National Park.

Regulatory Status: Federal Endangered.

Threats Affecting the Triple-ribbed Milkvetch: Threats are not well known because this species is not well studied and it is often difficult to find in remote and rugged areas. Vehicle travel in desert canyons and washes of the Little San Bernardino Mountains is a potential threat.

3.3.8.22 White-Margined Beardtongue

Life History: This species is disjunct from its primary range and is found in the sand fields and washes north of Pisgah Crater.

Population Status in the Planning Area: This plant is found in the Pisgah Crater area. Twenty-two occurrences have been recorded. Three of these are on private lands. The

BLM/Wildlands Conservancy purchase of lands from Catellus Development Corporation in January 2000 put three occurrences into public ownership. Populations at Twentynine Palms MCAGCC have been disturbed by military activities in the past. A new population was recorded from the base in 1998.

Regulatory Status: BLM Sensitive.

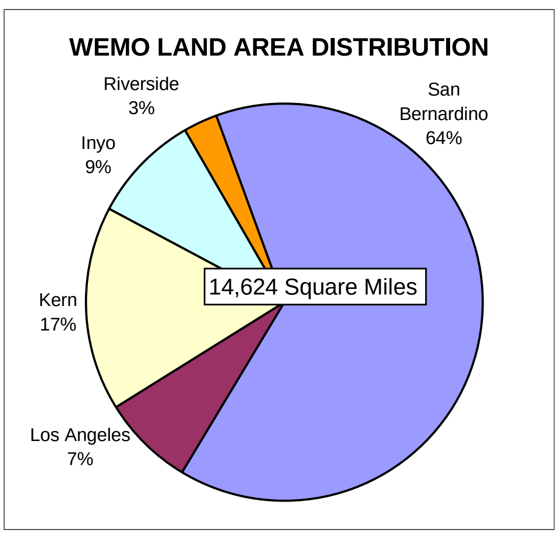
Threats Affecting the White-margined Beardtongue: Vehicle use of the occupied habitat is a threat. Maintenance of utility access roads and facilities has been a threat in the past. Military operations at Twentynine Palms MCAGCC have potential to damage the small population(s) on the base.

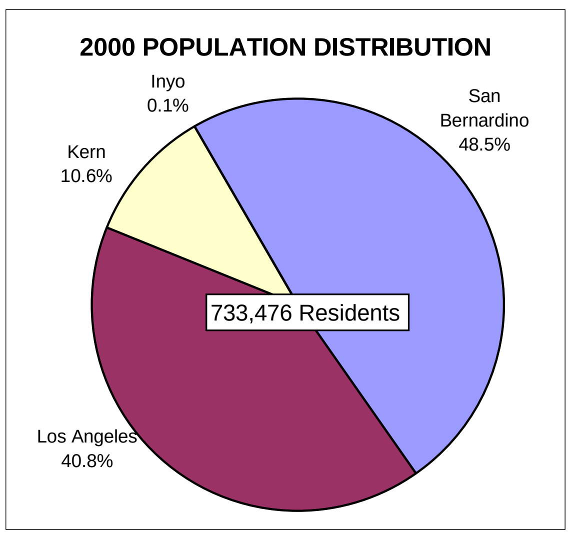
3.4 SOCIO-ECONOMIC

3.4.1 Regional Economic Profile

The following information pertaining to existing economic and demographic conditions in the panning area is excerpted from the Socio-Economic Analysis of the project alternatives, prepared by Alfred Gobar and Associates. The complete socio-economic technical report is contained in Appendix N of this FEIR/S. Further detail and technical data is contained therein.

Encompassing nearly 9.36 million acres, the planning area (also WEMO) is a substantial geographic region. This large study area includes over 733,000 residents (2000 Census) and encompasses portions of five separate counties. The corresponding land area and resident population base within each of the respective county subareas that comprise the planning area is graphically shown below.





3.4.1.1 Regional Environment

In totality, the West Mojave's existing population base is significant but is widely dispersed in scattered concentrations ranging from as few as 25,000 residents in such areas as Barstow and Ridgecrest to more than 200,000 in the Palmdale-Lancaster area of Los Angeles County and also the Victor Valley area of San Bernardino County. The West Mojave population base is too small and geographically dispersed to be realistically considered a self-generating economy, even though certain industries such as aerospace, mining, military, and government operations have long provided local employment to area residents.

The West Mojave, while relatively remote, is situated along the periphery of Southern California and its huge metropolitan population and employment base. Overall economic growth throughout the West Mojave is increasingly influenced and driven by growth trends describing the larger economic region of Southern California for a number of reasons. The six-county Southern California region (Los Angeles, Orange, San Diego, San Bernardino, Riverside, and Ventura counties) hosted 19.7 million residents and 8.0 million nonagricultural wage and salary jobs in 2001. Due to the sheer volume of employment opportunity in more developed regions of Southern California a large number of workers residing in outlying areas commute to jobs in such central locations. In 2000, about one in five workers residing in cities throughout the West Mojave commuted at least 60 minutes each way to work. By contrast, the high desert environment of the West Mojave continues to offer a diverse range of options for a growing urban population seeking recreation and leisure activities or passive relief in vast natural settings. The high desert region has attracted nearly 2.0 million visitor-trips a year for off-highway vehicle recreation and nearly 1.5 million visitors to State and National Parks in the area. Recreation travel in the West Mojave also provides support for local businesses and related jobs. Growth in employment throughout Southern California therefore constitutes one of the principal factors driving demand for household formation in outlying sub-regions, such as the West Mojave.

Historic Regional Trends

Population: A wide variety of socio-economic factors can be evaluated with regards to growth trends, but changes in population, employment, and housing reflect principal drivers of urbanization and associated economic activity. Area population growth is a product of household formation. Household formation is primarily driven by the availability of employment, with the exception of retirement households.

Total population within the six-county region of Southern California, plus Kern County, grew by 6.54 million residents over the 21-year period from 13.8 million residents in 1980 to 20.4 million residents in 2001. The resident population of Inyo County has remained relatively static since 1980 (about 18,000 residents) and is not explicitly evaluated in relation to regional trends since it hosts roughly 600 residents or less than 0.1 percent of WEMO population.

Total population throughout Southern California grew at an average annual rate of 1.84 percent. Since 1990, the rate of population growth has slowed relative to the average rate experienced over the past 21-years. Los Angeles County continues to account for the largest share of absolute population in Southern California due to its size. The pattern of growth, however, is shifting and outlying sub-regions are capturing a greater share of total growth. Since 1980, outlying counties such as Riverside, San Bernardino, and Kern County have steadily increased their respective share of total population.

Employment: Southern California population growth trends are largely influenced by nonagricultural employment trends and related housing construction. Non-agricultural employment correlates best with household formation, associated housing demand, and population growth since a large segment of agricultural employment reflects transient and seasonal labor with limited capacity to occupy market rate housing. In addition, agricultural employment has been declining in absolute terms and as a share of total Southern California employment. For these reasons, non-agricultural employment growth will constitute a principal force driving future housing growth and urbanization in the WEMO area.

Between 1980 and 2001 nonagricultural employment in Southern California grew 34.0 percent from 5.85 million jobs in 1980 to 8.24 million in 2001. Over this period 1.57 million new jobs (net) were created between 1980 and 1990 compared to 0.86 million (net) since 1990. Aggregate employment has grown at a slower rate in absolute and relative terms since 1990, in part due to significant job losses during the early 90's. The overall slower pace of employment growth is indicative of broader trends describing the outlook of future economic growth in the region.

Not only is total employment in Southern California starting to grow more slowly, outlying areas are capturing larger shares of such growth. In 1980, Los Angeles County accounted for 62.1 percent of nonagricultural employment throughout the Southern California region, including Kern County. In 2001, Los Angeles County's respective share was down to 49.7 percent. By comparison, San Bernardino County has captured an increasing share of employment (from 4.2 percent in 1980 to 6.8 percent in 2001), while the corresponding share for Kern County has remained relatively constant (2.4 percent). Both Riverside and San Bernardino County are commonly recognized as a single metropolitan statistical area (Inland Empire) for purpose of tracking most socio-economic trends. On the basis of this definition, the Inland Empire has actually led Southern California in net employment gains since 1990 (314,400 jobs). As these trends suggest, the proportionate share of nonagricultural employment growth has been shifting over the 21-year reference period, principally from Los Angeles County to the other six counties.

Housing: Southern California housing growth trends are characterized by year-to-year volatility and shifting development activity throughout the region. Since 1980 roughly 1.93 million construction permits have been issued for new housing development. The average annual volume of development activity for all forms of housing (detached, attached, condo, apartment, etc.) is summarized in Table 3-37.

Table 3-37
Average Annual Units Constructed - All Housing

Period	Southern California Los Angeles County	Orange County	Riverside County	San Bernardino County	San Diego County	Ventura County	Total So Cal	Kern County	So Cal Including Kern Co.
1981-85	31,073	13,211	11,904	13,654	21,740	3,694	95,276	4,912	100,188
1986-90	50,112	20,366	23,277	21,556	27,547	4,916	147,773	4,496	152,269
1991-95	10,166	7,911	7,920	5,708	6,658	1,977	40,338	3,556	43,894
1996-00	11,963	11,379	11,799	5,927	12,353	3,265	56,686	3,008	59,694
2001	18,118	8,585	18,097	8,395	15,468	3,453	72,116	3,494	75,610
22 Yr Avg	25,611	12,902	13,656	11,410	16,824	3,488	83,890	3,925	87,815

Source: Bureau of the Census - Construction Statistics Division; Alfred Gobar Associates.

Identified trends clearly show that the volume of development activity throughout all of Southern California has dropped considerably since peak building activity during the late 80's. At that time, housing construction activity was significantly outpacing sales volume just as the Southern California economy was being impacted by the post-Cold War recession. In effect, the bottom dropped out of Southern California's aerospace and defense industry, heavily concentrated in Los Angeles County, which fueled more wide spread job losses after 1990. During the subsequent recovery period (1995 to 2000), annual job growth began to approach previous peak levels but housing development has continued at much more moderate levels. In addition, the pattern of new housing development has shifted to outlying areas of Southern California more rapidly than corresponding shifts describing non-agricultural employment growth.

Job-Housing Mix: The Southern California economy has been characterized by a shifting pattern of employment, housing, and population growth trending outward from the traditional urban centers. The Southern California's economy as a whole has effectively generated 1.20 nonagricultural wage and salary jobs per household, although this average has fluctuated in cyclical fashion. Despite substantial employment losses during the early 90's, Los Angeles County recently has been generating local jobs at a ratio approaching its long-term average rate (1.31 jobs per household). Relatively isolated employment submarkets in Ventura County and Kern County have also increased relative job-housing performance since the early 90's. The rate of local job growth in San Bernardino County and Riverside County has accelerated since 1995, but these sub-regions continue to lag the overall region in terms of jobs per household. A significant portion of housing growth within these two sub-regions continues to reflect affordable housing opportunities for workers who in turn commute to jobs in the major metropolitan employment centers.

3.4.1.2 Study Area Demographics

The West Mojave extends across large portions of four Southern California counties (Los Angeles, San Bernardino, Kern, and Inyo) which all combined host 11.7 million residents (2000 Census) or nearly 35.0 percent of the Statewide population (33.8 million residents). As a matter of course demographic traits describing an area are most often compared to corresponding traits describing a larger geographic setting of which it is a part. Roughly 80.0 to 90.0 percent of all residents within Southern California, however, reside in areas that are substantially more developed and urbanized than is the case with the West Mojave.

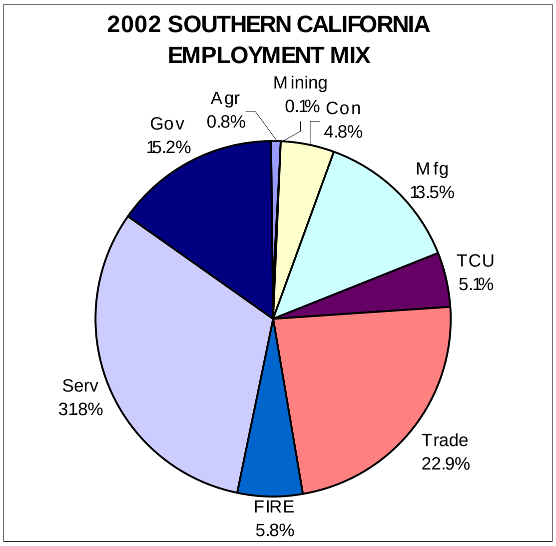
Typical population densities generally range from roughly 2,500 persons per square mile in growing suburban areas to more than 7,500 persons per square mile in urbanized areas. By comparison, the corresponding population density for the eleven West Mojave cities combined (accounting for 71.0 percent of the West Mojave population base) only averages about 680 persons per square mile (487,000 acres of land area divided by 520,000 residents in 2000). The Census Bureau utilizes a minimum threshold of 1,000 persons per square mile to denote an urbanized setting. The West Mojave is more characteristic of a large rural environment. As such, demographic traits that describe the West Mojave reflect distinctly different circumstances than is true for more urbanized portions of Southern California, thereby minimizing the usefulness of direct comparisons. Instead, the State of California, which includes a sizeable rural population, periodically serves as a comparative reference to denote overall distinctions describing West Mojave residents.

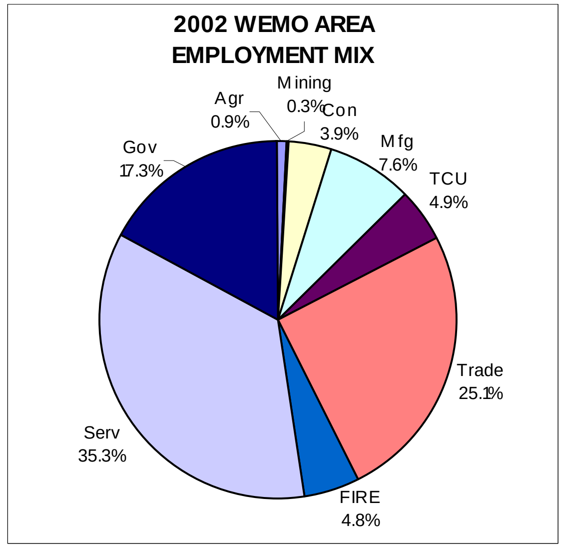
Demographic traits describing the 2000 population base of the four West Mojave subarea regions are detailed in Exhibit 8 of the Socio-Economic Analysis in Appendix N. Similar traits describing the resident population of West Mojave cities are summarized in Table 3-38.

The West Mojave consists of a relatively young population base but is aging more rapidly than the State overall and more rapidly than central metropolitan areas of Southern California. The West Mojave includes a heavy composition of families and similarly has a greater proportion of residents 20 years of age or younger. As result, there are relatively fewer small households (two persons or less). The West Mojave is still attracting a relatively large number of new households but at a slower rate than experienced through the 80’s and mid-90’s. The affordability of housing in the West Mojave remains a principal attraction to new households given 1 out of every 5 workers commutes 60 minutes or more to their job.

Workforce participation (workers, not jobs) among West Mojave households continues to lag the State and Southern California economy. Census data indicates there was an average of 1.11 workers (persons indicating a place of work) per household throughout the West Mojave compared to a Statewide average of approximately 1.28 workers per household. Similarly, current estimates of local employment (local jobs, as distinct from resident workers) also indicate that there are fewer job opportunities in the West Mojave (0.94 jobs per occupied household) than is true for the State economy or Southern California as a whole (1.20 jobs per household – long term average). The incidence of local job opportunities in the West Mojave, however, is comparable to other outlying regions of Southern California, including Kern County (0.92 jobs per household) and the Inland Empire (0.98 jobs per household).

Current estimates from the California Employment Development Department and data purveyors place the 2002 employment base throughout the West Mojave at approximately 232,500 civilian jobs available to a base of 758,000 persons or 247,900 households. Surprisingly, the mix of local employment opportunities is roughly comparable to the broader mix of employment throughout Southern California as suggested below:

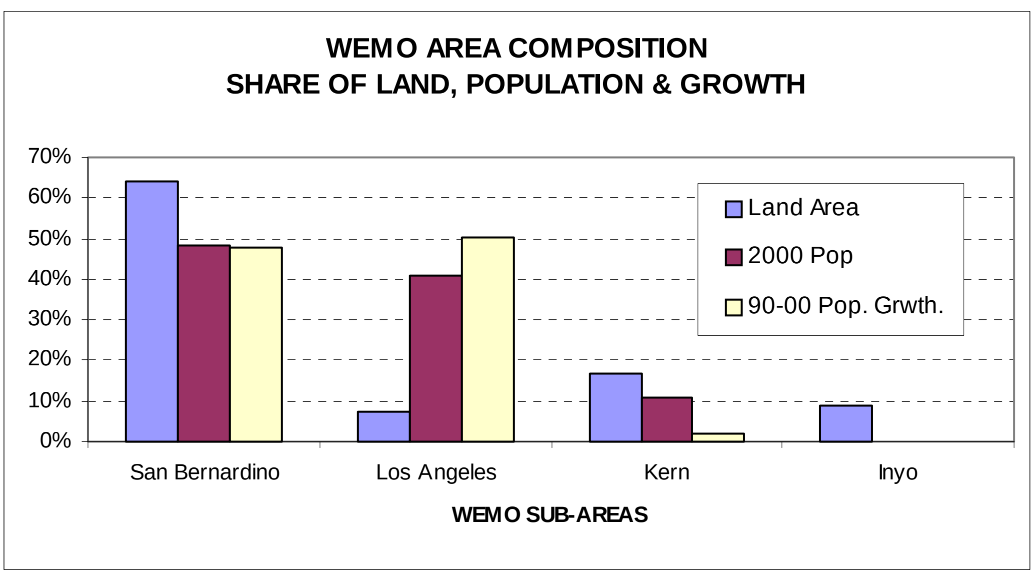




Source: Alfred Gobar Associates; California Employment Development Department; Claritas, Inc.

Factors that distinguish the current employment base of the West Mojave include a higher proportion of service and trade sector jobs (consistent with rural and emerging growth areas). The West Mojave also has a moderately higher mix of government jobs, reflecting the historical role of Federal and State agencies in the region. The manufacturing base within the West Mojave is significantly underrepresented by comparison to the broader Southern California economy. Agriculture (including grazing activities) and mining have a long and proud history in the West Mojave but account for little more than 1.0 percent of current employment opportunities or about 2,500 jobs in the area.

Demographic traits and growth trends describing the West Mojave overall can vary considerably among the four subareas. This is particularly evident with respect to the distribution of population and land area throughout the West Mojave as summarized below:



The San Bernardino subarea accounts for 64.0 percent of the West Mojave's land area, nearly 49.0 percent of the 2000 resident population, and nearly 48.0 percent of population growth between 1990 and 2000. By comparison, the Los Angeles subarea only accounts for 7.0 percent of the West Mojave's land area, but 41.0 percent of the 2000 resident population, and over 50.0 percent of corresponding population growth. The Kern subarea accounted for 11.0 percent of the 2000 population base but less than 2.0 percent of total corresponding growth. The Inyo subarea with roughly 600 residents accounts for less than 0.1 percent of the West Mojave population base and has experienced an overall decline in population since 1990. On a combined basis, the Los Angeles and San Bernardino subareas accounted for over 98.0 percent of total population growth between 1990 and 2000.

Census data strongly suggest that population and housing growth throughout the West Mojave over the past 12 years area has been substantially concentrated within cities and unincorporated enclaves located closest to the major employment centers of Southern California.

TABLE 3-38

2000 CENSUS DEMOGRAPHIC COMPARISON

INCORPORATED CITIES WITHIN WEST MOJAVE PLAN REGION

Census Variable	**Combined Cities**	City of Adelanto	Town of Apple Valley	City of Barstow	City of California City	City of Hesperia	City of Lancaster	City of Palmdale	City of Ridgecrest	City of Twentynine Palms	City of Victorville	City of Yucca Valley
Total Population	**520,428**	18,130	54,239	21,119	8,385	62,582	118,718	116,670	24,927	14,764	64,029	16,865
% Share of Total	**100.0%**	3.5%	10.4%	4.1%	1.6%	12.0%	22.8%	22.4%	4.8%	2.8%	12.3%	3.2%
Population Growth (1990-2000)	**24.9%**	146.6%	17.2%	-4.2%	39.8%	22.2%	22.4%	47.5%	-9.7%	24.5%	24.2%	1.7%
Families as % of Households	**75.5%**	81.5%	77.4%	68.7%	73.6%	79.0%	72.4%	82.0%	68.1%	68.2%	76.0%	64.6%
Population in Group Quarters	**2.1%**	8.2%	0.7%	1.9%	0.7%	0.5%	5.9%	0.1%	1.2%	0.3%	1.0%	1.8%
Average Household Size	**3.00**	3.53	2.90	2.71	2.72	3.12	2.92	3.40	2.51	2.60	3.03	2.38
Housing by Tenure												
Owner-Occupied	**65.6%**	63.8%	70.0%	54.1%	67.1%	72.3%	61.4%	71.0%	63.0%	43.3%	65.1%	68.0%
Renter-Occupied	**34.4%**	36.2%	30.0%	45.9%	32.9%	27.7%	38.6%	29.0%	37.0%	56.7%	34.9%	32.0%
Unit Vacancy	**9.4%**	15.0%	8.0%	16.5%	13.8%	6.5%	8.4%	7.6%	13.1%	18.7%	7.1%	12.6%
Median Housing Value	**$89,377**	$81,700	$112,700	$75,700	$81,900	$95,900	$103,700	$116,400	$72,400	$75,400	$98,700	$83,200
Average Housing Value	**$113,064**	$84,431	$129,408	$82,575	$84,607	$107,287	$119,696	$129,805	$80,712	$79,641	$106,300	$97,088
Median Rent	**$495**	$391	$483	$418	$450	$526	$563	$551	$418	$416	$506	$421
Average Rent	**$498**	$412	$501	$417	$416	$491	$548	$565	$412	$343	$505	$430
Median Household Income	**$40,095**	$31,594	$40,421	$35,069	$45,735	$40,201	$41,127	$46,941	$44,971	$31,178	$36,187	$30,420
Average Household Income	**$49,051**	$35,912	$51,299	$43,671	$53,620	$47,898	$51,080	$54,994	$53,898	$37,843	$43,254	$38,361
Workforce Characteristics												
Workers per 1,000 Population	**359**	**256**	**357**	**373**	**395**	**351**	**357**	**362**	**442**	**419**	**344**	**340**
Occupation (Age 16+)												
White Collar	**69.0%**	63.1%	70.3%	68.3%	69.0%	65.4%	70.7%	69.4%	73.1%	70.1%	67.9%	68.9%
Blue Collar	**31.0%**	36.9%	29.7%	31.7%	31.0%	34.6%	29.3%	30.6%	26.9%	29.9%	32.1%	31.1%
Worked in Home Town	**35.4%**	**22.0%**	**28.4%**	**51.3%**	**24.3%**	**26.5%**	**44.7%**	**26.3%**	**58.4%**	**28.7%**	**36.7%**	**44.0%**
Commute Less than 10 min	**14.1%**	5.3%	11.0%	28.3%	13.4%	9.0%	16.2%	8.9%	35.5%	17.1%	11.5%	20.3%
Commute 10-30 min	**42.5%**	42.1%	49.6%	40.7%	42.9%	39.0%	45.2%	33.9%	51.6%	65.1%	42.8%	34.5%
Commute 30-60 min	**19.9%**	29.3%	17.2%	22.3%	34.8%	27.2%	16.4%	20.3%	6.1%	8.4%	23.1%	30.3%
Commute 60 min or more	**20.5%**	20.7%	17.8%	6.8%	7.3%	20.7%	19.6%	34.2%	4.2%	7.2%	19.6%	11.2%

Source: Alfred Gobar Associates; U.S. Bureau of the Census; AnySite Online.

3.4.1.3 Study Area Growth Capacity

Economic growth within a given area is ultimately affected by the underlying capacity to host additional amounts of land use development where related residential, employment, educational, and leisure activities are to occur. The underlying holding capacity of the area is greatly influenced by General Plan policy that defines the location, supply, and intensity of land use available to host economic activity. The ultimate growth capacity of the West Mojave is largely defined by General Plan land use policy of 15 separate jurisdictions (11 cities and 4 counties). To determine the land use capacity of West Mojave land use designations were quantified and classified by type and intensity. Because the West Mojave encompasses such a vast geographic area special attention was placed on determining the specific intensity of permitted land use rather than estimating land use intensity on the basis of common nomenclature used to describe type of land use. Specific quantities and corresponding population and employment levels used to describe the growth capacity of the West Mojave are detailed in Exhibit 9 and Exhibit 10 of the Socio-Economic Analysis in Appendix N.

Overall, roughly 1.78 million acres of land area throughout the West Mojave is designated for residential land use at a target capacity of approximately 1.58 million residential dwellings. In all about 240,000 acres of land area is designated for a variety of non-residential land use such as office, retail, industrial, and institutional development. The balance of area, or roughly 7.0 million acres, is designated for open space, utility easements, resource production, agriculture, military installations, conservation land, etc. Overall, the 15 affected local agency jurisdictions have General Plan policies in place guiding the ultimate use and development of roughly 9.0 million acres. With respect to population and employment, the designated supply of residential and nonresidential land use has the capacity to support roughly 4.86 million residents and 3.09 million local jobs if all West Mojave properties are developed and utilized according to General Plan policy.

In terms of economic realities expected to influence growth opportunities throughout the West Mojave over the long haul, current General Plan policies in aggregate are out of balance. The West Mojave is effectively over-supplied in terms of the amount of non-residential land required for the housing unit capacity currently designated. Conversely, it might be argued there exists an undersupply of designated housing capacity needed to warrant the amount of non-residential land use planned. The market reality is such that single-family detached housing will represent the dominant form of residential constructed throughout the West Mojave during the 30-year life of the habitat conservation plan (HCP) project.

If all West Mojave land uses were developed according to General Plan policy, the area would effectively host 1.95 local jobs per housing unit (rough equivalent of 2.15 jobs per occupied household). Since 1990, overall workforce participation throughout the West Mojave has been declining from about 1.16 workers (including self-employed) per household to 1.11 workers per household in 2000, with about one-fifth of these workers commuting to jobs in the metropolitan regions of San Bernardino and Los Angeles County. The corresponding rate of workforce participation for the State has been increasing from 1.63 workers per household in 1990 to 1.71 workers per household in 2000. To fully develop the designated supply of non-residential land area in the West Mojave, workforce participation trends in the area would need to undergo a dramatic reversal to the point of exceeding equilibrium levels describing the Statewide economy. A more balanced policy mix of residential and non-residential land use throughout the West Mojave suggests limiting office, retail, industrial, and institutional land use (excluding local school sites) to roughly 160,000 acres.

Recent growth trends and the long-term outlook for housing development is summarized in Table 3-39 based on Census reported changes in area housing.

Table 3-39
West Mojave Housing Development Outlook
Effective Mix Of Detached Vs Higher Density Product

TYPE HOUSING	BUILDOUT	2000 EST	1990 EST	CHG 2000 BUILDOUT	CHG 1990-2000
All Housing	1,580,000	271,250	230,125	1,308,750	41,125
Higher Density	253,000	41,775	38,900	211,225	2,875
% High Density	16.0%	15.4%	16.9%	16.1%	7.0%

Source: Bureau of Census; Alfred Gobar Associates.

3.4.1.4 Study Area Market Share

Residential construction constitutes the form of land use likely to result in the greatest amount of permanent ground disturbance (subdivision grading) among common development activities closely associated with the future urbanization of the West Mojave (retail, office-institutional, and industrial land use reflecting the other principal urban land forms). During the most recent 10-year period of construction activity, the effective share of building permits issued within the principal growth locations of the West Mojave is summarized in Table 3-40.

Table 3-40
Residential Permits – 10-Year Average Share/Mix

		ALL UNITS	SFD	MF/OTHER
San Bernardino Subarea		52.0%	52.8%	25.5%
Los Angeles Subarea		45.9%	45.0%	61.5%
Kern Subarea		2.1%	2.2%	13.0%
	WEMO Overall	100.0%	100.0%	100.0%
	WEMO Unit Mix	100.0%	89.6%	10.4%

Source: U.S. Bureau of the Census - Residential Construction Branch.

As shown, within the last 10 years, the San Bernardino subarea has accounted for the largest share of total permits, followed closely by the Los Angeles subarea.

The 10-year average share of permit activity in each of the subareas described above is not static but in fact reflects a shifting pattern of growth. Overall, the total share of housing activity in the San Bernardino and Kern subareas has been declining, while the corresponding share occurring in the Los Angeles subarea has been growing.

Long-term growth in the West Mojave is not solely driven by regional employment gains but is also influenced by increases in the local population base, which generates population-serving employment and attendant housing demand from jobs created.

Housing submarket locations with relatively strong housing demand tend to support higher average product pricing, reflecting market preferences of prospective residents. Table 3-41 summarizes the estimated average unit value for new single-family detached homes issued building permits during the first eight months of 2002.

Table 3-41
West Mojave Average Housing Value –
New Single Family Detached Units

	2002 AVG.	10-YR. INDEX	2002 INDEXED AVERAGE	
WEMO Location	SFD Value	vs. WEMO	vs. 1992	vs. WEMO
Palmdale	$242,800	1.08	1.64	1.17
Victorville	$232,500	0.94	1.74	1.12
Lancaster	$211,800	1.09	1.37	1.02
Hesperia	$203,000	0.95	1.28	0.98
Apple Valley	$189,800	1.05	1.22	0.91
California City	$164,600	0.88	1.34	0.79
Ridgecrest	$161,000	0.88	1.42	0.78
Yucca Valley	$153,300	0.83	1.14	0.74
Barstow	$139,500	1.01	1.07	0.67
29 Palms	$112,900	0.75	0.91	0.54
Adelanto	$91,100	0.53	1.23	0.44
San Bernardino Subarea	$192,100	0.91	1.60	0.93
Los Angeles Subarea	$231,800	1.11	1.47	1.12
Kern Subarea	$163,400	0.89	1.38	0.79
WEMO Overall	$207,600	1.00	1.54	1.00
WEMO Counties (3)	$257,900	1.29	1.39	1.24

Source: U.S. Bureau of the Census - Residential Construction Branch; Alfred Gobar Associates.

Within theWest Mojave, cities and housing submarket locations closest to metropolitan employment centers have consistently realized higher average unit values. Indicated pricing patterns are symptomatic of demand preferences expected to drive future growth. The City of Adelanto reflects the notable exception. Historically overlooked, Adelanto is now experiencing increased housing activity due to its location along the principal growth vector of the City of Victorville. Overall, the West Mojave remains a price-competitive market in relation to the broader Southern California housing market.

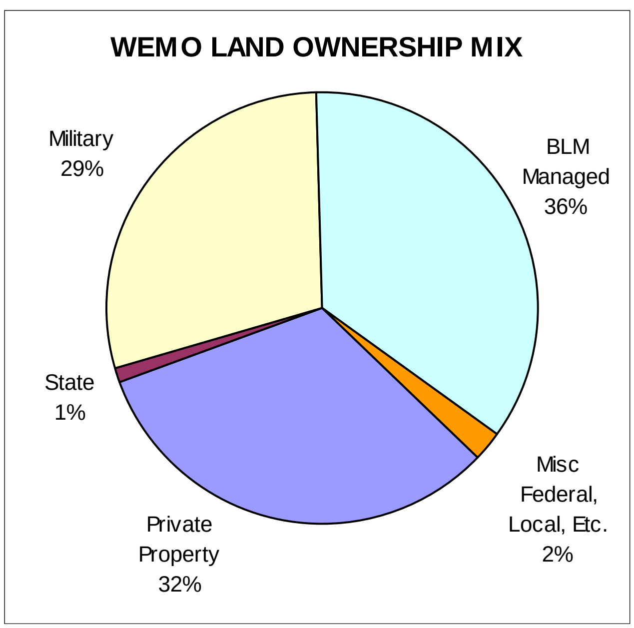
During the past 10 years, West Mojave has captured nearly a 14.0 percent average share of all new home construction activity within the four counties surrounding the West Mojave (Los Angeles, San Bernardino, Kern, and Inyo County).

3.4.1.5 Study Area Property Valuation

Property valuation throughout the West Mojave represents an important consideration in relation to the HCP program. The assessed value of West Mojave property largely determines the amount of property tax revenue appropriated to each of the eleven West Mojave cities and four county governments in order to provide necessary public services (police, fire, health & safety, cultural and community, etc.). The assessed value of property within selected portions of the West Mojave, namely the Habitat Conservation Areas (HCA's), also determines the mitigation fee that would be imposed within the HCP compensation framework for Allowable Ground Disturbance (AGD) and incidental taking permits needed to facilitate future development and generate funds to acquire additional habitat area. These two areas of consideration are important for the following reasons. As the HCP is implemented and privately owned property in the HCA's is purchased and removed from the tax rolls, affected City and County governments will need to forego corresponding property tax revenue used to support public service responsibilities. The HCP mitigation fee establishes a definitive expense that that must be shouldered by site-specific development in order to eliminate case-by-case cost uncertainties associated with enforcement of current endangered species regulations (CESA and FESA). The following discussion is supplemented by additional exhibits and discussion in the Socio-Economic Analysis (Appendix N to this FEIR/S).

<u>3.4.1.5.1 Subarea Valuation</u>

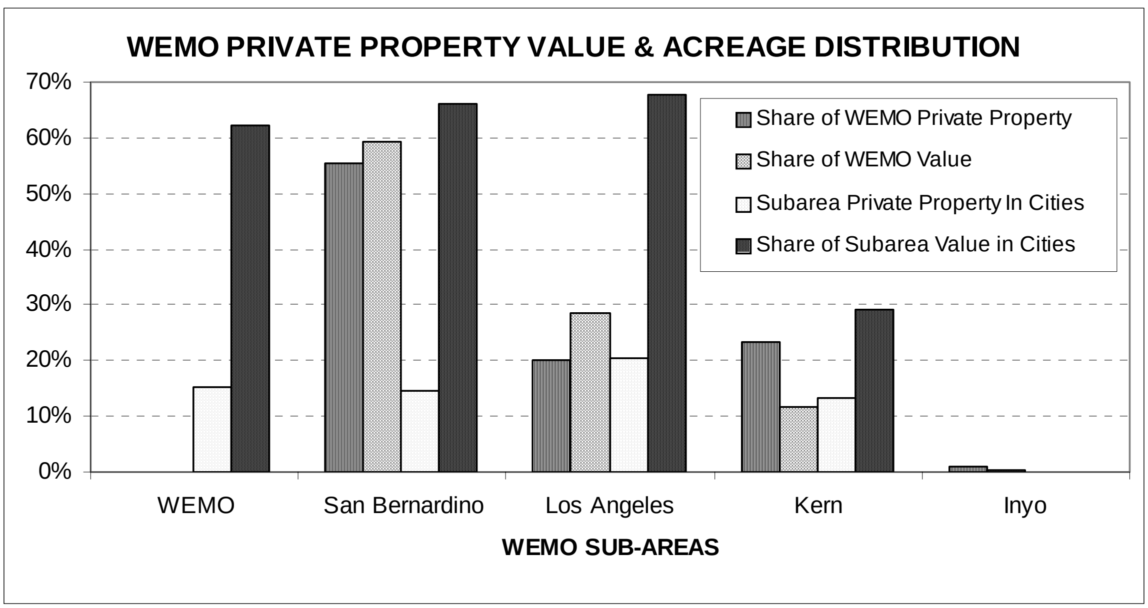
Property tax revenue-generating potential within a given jurisdiction is largely limited to the assessed value of private property, since government owned land is exempt from direct payment of property tax. Although the four-County region of the West Mojave encompasses more than 9.0 million acres, the vast majority of land area reflects government owned land as illustrated below:



As shown, only 32.0 percent or 2.9 million acres of the West Mojave is privately owned and subject to property tax. Under current taxing regulations, private property is taxed according to a basic levy equal to 1.0 percent of its assessed value. City and County governments are allocated a portion of the property tax proceeds, along with other government service agencies (school districts, flood control districts, vector control districts, cemetery districts, library districts, etc.). The relative supply of private property within a given jurisdiction affects the amount of fiscal operating revenue that can be anticipated in the form of property tax versus other fiscal sources (sales tax, transient occupancy tax, franchise fees, motor vehicle fees, government subventions, service revenue, fines and forfeitures, etc.).

The private property portion of the study area accounts for the greatest share of total land area within the Los Angeles Subarea at 89.0 percent, followed by the Kern Subarea at 46.0 percent, the San Bernardino Subarea at 27.0 percent, and finally the Inyo Subarea at 4.0 percent.

The overall 2002 assessed value generating property tax revenue is estimated at roughly $22.2 billion. The relative distribution of private property acreage and taxable value (see Exhibit 11 in the Socio-Economic Analysis in Appendix N is graphically summarized as follows:



The above graph compares the amount of private land in various subareas of the West Mojave and the corresponding share of assessed value. The bar describing the "Share of WEMO Private Property" illustrates how private property is currently distributed across the four subareas. The bar depicting "Share of WEMO Value" illustrates a similar distribution with respect to total assessed value. The bar depicting "Subarea Private Property in Cities" identifies the proportion of private property in each given subarea that is situated within a City limit boundary. The final bar depicts a similar ratio with respect to the assessed value of such private property.

The supply of private property in the San Bernardino and Los Angeles subareas represents 55.0 and 20.0 percent of total private land in the West Mojave. The corresponding share of private property value, however, equates to nearly 60.0 percent and nearly 30.0 percent of the total assessed value of the West Mojave. In general, private property in the San Bernardino and Los Angeles subareas is being assessed at a higher value per acre than is the case for private property in Kern and Inyo County.

For the West Mojave overall, only about 15.0 percent of all private property is located within a City but accounts for 62.0 percent of total assessed value. A substantial portion of West Mojave assessed value (principal determinant of property tax revenue) is concentrated on relatively limited amounts of private property located within existing City jurisdictions.

3.4.1.5.2 Habitat Conservation Area Valuation

To account for vast distinctions that might influence average land value throughout the West Mojave, a large sample of 2002 property data exceeding 500,000 records was compiled from County Assessor records as procured from electronic appraisal data purveyors. In effect, a data sample was compiled that consists of all property records available from Assessor Map Book records roughly approximating the entire West Mojave in order to reduce bias that may be inherent to a limited sampling randomly selected from diverse micro-market environments. The sample set used to estimate the average value of private unimproved land within the HCA is based on a smaller subset of roughly 38,500 data records due to vast amounts of government owned lands in these areas.

The appropriate mitigation fee reflects an average value reference describing lands to be acquired for habitat conservation, specifically unimproved private property within the proposed HCA. Table 3-42 below summarizes the estimated average value of unimproved private property closely associated with the proposed HCA boundaries.

Table 3-42
West Mojave Habitat Conservation Area – Reference Land Value

	REF. VALUE	SAMPLE	SAMPLE	REFERENCE	LAND AREA	EST. OF PRIVATE
Private Lands/Subareas	Per Acre	Records	Mix	Land Area	Mix	Land Value
2002 Assessed Value						
San Bernardino	$489	20,208	52%	401,005	64%	$196,091,000
Los Angeles	2,587	7,755	20%	77,842	12%	201,377,000
Kern	650	10,509	27%	95,682	15%	62,193,000
Inyo[1]	0	0	0%	0	0%	0
Previously Acquired						
LR2000 Database	$457	38	0.1%	51,769	8%	$23,658,000
Critical Habitat Lands:	$772	38,510	100%	626,298	100%	$483,319,000
Source: County Assessor Records; BLM LR2000 Database; Alfred Gobar Associates						
Note: The designated HCA within Inyo County specifically excludes privately held property.						

HCA boundaries in the Inyo subarea specifically exclude any private property holdings. As a result, no effective weighting has been assigned to Inyo County portions of the HCA. The estimated 2002 average assessed land value describing unimproved private property throughout the HCA's equates to $770 per acre.

3.4.2 Livestock Grazing

There are a total of 31 public land grazing allotments (a designated area suitable for grazing) within the West Mojave planning area (see map 3-18). The type of livestock and type of forage allocation for allotments have been designated in the BLM's CDCA Plan. Allotments are designated as ephemeral, perennial, or ephemeral/perennial based on the type of forage that is available on the allotment. Cattle, sheep, and, horses, or a combination of these may be authorized to graze on an allotment. Table 3-43 indicates the livestock type and forge type designated for each allotment.

Table 3-43
Livestock Type and Forage Type for Allotments

ALLOTMENT NAME	TYPE OF LIVESTOCK	FORAGE TYPE
Antelope Valley	Sheep	Ephemeral
Bissell	Sheep	Ephemeral
Boron	Sheep	Ephemeral
Buckhorn Canyon	Sheep	Ephemeral
Cady Mountain	Cattle	Perennial
Cantil Common	Sheep	Ephemeral
Cronese Lake	Cattle	Ephemeral/Perennial
Darwin	Horses	Perennial
Double Mountain	Cattle	Ephemeral
Gravel Hills	Sheep	Ephemeral
Hansen Common	Cattle/Sheep	Ephemeral/Perennial
Harper Lake	Cattle	Ephemeral/Perennial
Johnson Valley	Sheep	Ephemeral
Lacey-Cactus-McCloud	Cattle	Perennial
Lava Mountain	Sheep	Ephemeral
Monolith-Cantil	Sheep	Ephemeral
Oak Creek	Cattle	Perennial
Olancha Common	Cattle	Perennial
Ord Mountain	Cattle	Ephemeral/Perennial
Pilot Knob	Cattle	Ephemeral
Rattlesnake Canyon	Cattle	Ephemeral/Perennial
Round Mountain	Cattle	Ephemeral/Perennial
Rudnick Common	Cattle/Sheep	Ephemeral/Perennial
Shadow Mountain	Sheep	Ephemeral

ALLOTMENT NAME	TYPE OF LIVESTOCK	FORAGE TYPE
Spangler Hills	Sheep	Ephemeral
Stoddard Mountain	Sheep	Ephemeral
Superior Valley	Sheep	Ephemeral
Tunawee Common	Cattle/Sheep	Perennial
Valley Well	Horses	Ephemeral/perennial
Walker Pass Common	Cattle	Ephemeral/perennial
Warren	Sheep	Perennial

The allotments are classified as either Taylor Grazing Act Section 3 grazing permits or Section 15 grazing leases. Allotments with perennial forage have an established limit of forage based on the quality and quantity of perennial plants, stated in animal unit months (AUMs) for a defined period of grazing use. An AUM is a measure of perennial or ephemeral feed that will support a cow and its calf, a ewe and its lambs, or a bull for one month. Perennial forage consumption is typically authorized at the same level from year to year unless forage production does not meet seasonal norms. In contrast, grazing use in allotments with ephemeral forage does not have an established level or specified period of use. Instead the amount and length of grazing use is based on ephemeral production and determined just prior to authorizing the grazing use.

In most cases, BLM authorizes grazing by permit or lease for a period of 10 years. A shorter period of time is sometimes issued for special circumstances, such as to accommodate a shorter-term lease of the base property or when the Authorized Officer determines that a shorter-term authorization is in the best interest of range management. Additionally, non-renewable grazing authorization may be issued for special short-term needs such as trailing, or when there is short-term surplus forage available for grazing. All permits and leases are subject to modification and to annual adjustments. Such modifications are implemented through consultation between the permittee or lessee and the BLM.

The permit or lease identifies the number, kind and/or type of livestock that may graze the allotment, and the grazing period (usually with specific beginning and ending dates). In addition, many permits and leases also require adherence to prescribed grazing prescriptions in the form of grazing systems such as deferred, deferred-rotation, or rest-rotation. Other authorizations may have conditions pertaining to turnout dates based on vegetation conditions. Some permittees and lessees have specific grazing utilization standards and other specified conditions to protect site-specific areas, such as riparian areas, wildlife habitat, and special status plant populations. Usually these conditions have been developed in consultation and cooperation between BLM and the livestock operator in the form of an allotment management plan or other planning effort.

Often there are occasions when the permittee or lessee elects to graze less than the full amount of grazing authorized for the grazing season. Sometimes this is due to environmentally related factors such as droughts or fires, and in other cases it may be to accommodate the livestock operator’s need to adjust livestock numbers for marketing or livestock husbandry purposes. Normally the BLM will authorize the requested amount of non-use on a short-term basis. In some situations the BLM may temporarily authorize another qualified applicant to graze the amount of authorized non-use in an allotment, but this is seldom done.

Grazing use of perennial vegetation in all allotments is expected to continue except where the permittee or lessee voluntarily relinquishes their lease or permit. Overall, livestock producers have voluntarily reduced stocking rates for much of the 1990s, resulting in less livestock use than the lease or permit allows. Both cattle and sheep grazing have been authorized under existing biological opinions in desert tortoise habitat (see Appendix Q).

Since 1992, BLM Barstow Field Office lessees with allotments classified as ephemeral/ perennial have not requested, nor has grazing been authorized for, ephemeral forage or temporary non-renewable (TNR) perennial forage. During the same period, lessees and permittees in the BLM Ridgecrest Field Office with ephemeral/ perennial allotments have routinely requested ephemeral authorizations, and have requested and been authorized to use TNR perennial forage. The authorization of ephemeral sheep grazing is common in both areas when sufficient ephemeral forage production occurs, although the number of sheep has declined over the last 10 years.

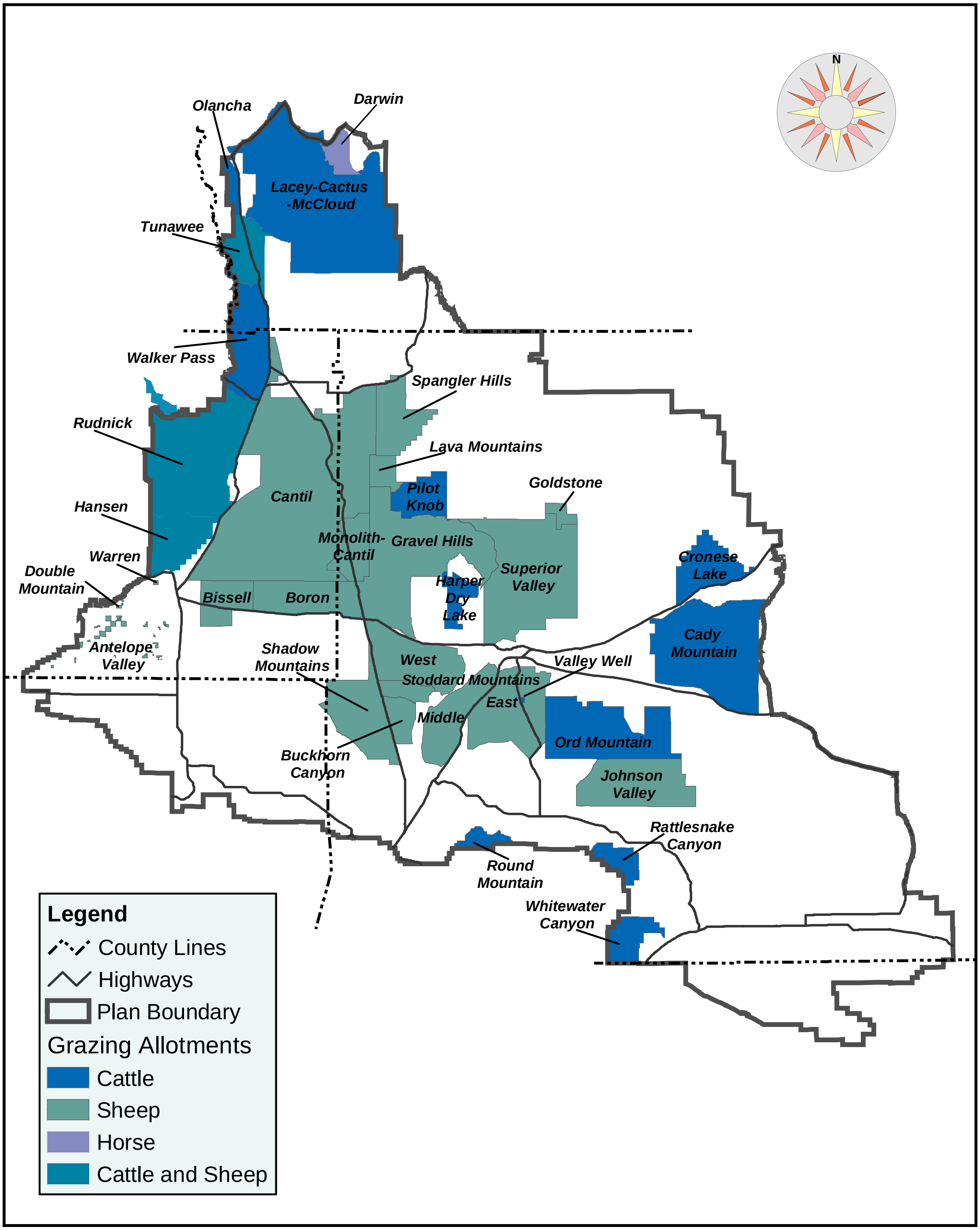
Fewer range improvements have been installed in the last 10 years than in prior years. Installation of new improvements is based on a case-by-case analysis and available funding. Periodic and annual maintenance is required on existing facilities. Some range improvements are located in designated wilderness areas, primarily on public lands administered by the BLM Ridgecrest Field Office. Ongoing maintenance of existing improvements coupled with the addition of new infrastructure has marginally increased demands for maintenance.

The vast majority of grazing allotments is within habitat and/or designated critical habitat for the desert tortoise. Table 3-44 lists the current grazing permits and leases within desert tortoise habitat in the planning area.

Allotment Management Plans (AMPs) have been prepared for about 42 percent of the allotments. Most of the AMPs apply to Ridgecrest Field Office allotments.

Table 3-45 presents information on each cattle and sheep grazing allotment. Appendix O includes a profile of each allotment, and a table detailing past livestock use of the allotment.

Grazing Allotments



West Mojave Plan FEIR/S
Map 3-18

Scale: 1 : 1,750,000

0 10 20 30 Km

0 10 20 30 Miles

10/14/04

Table 3-44
Grazing Permits and Leases for Allotments
Within Desert Tortoise Habitat

ALLOTMENT	ACRES IN CRITICAL HABITAT	ACRES IN NON-CRITICAL HABITAT
Antelope Valley	0	1,048
Boron	0	10,868
Bissell	0	5,596
Buckhorn Canyon	12,364	7,634
Cady Mountain	0	160,104
Cantil Common	91,930	318,949
Cronese Lake	30,080	34,170
Goldstone	11,061	0
Gravel Hills	135,544	0
Hansen Common	0	3,549
Harper Lake	21,194	5,120
Johnson Valley	0	109,186
Lacey-Cactus- McCloud	0	1,800
Monolith- Cantil	33,193	4,592
Ord Mountain	102,141	34,047
Pahrump Valley	0	31,338
Pilot Knob	37,857	7,762
Rattlesnake Canyon	0	12,800
Round Mountain	0	0

Table 3-45
Grazing Allotment Information

ALLOTMENT NAME	ALLOTMENT ACRES		ACTIVE AUMS	RANGE TYPE 3/	KIND OF LIVESTOCK	ACRES OF TORTOISE CRITICAL HABITAT	ACRES OF TORTOISE NON-CRITICAL HABITAT	SEASON OF USE 4/	MANAGING FIELD OFFICE	MULTIPLE USE CLASS (M, I & C)	AMP COMPLETED (YES OR NO)
	P. L. 1/	TOTAL 2/									
Antelope Valley	627	7,871	0	E	Sheep	0	1,048	NA	Ridgecrest	C	No
Boron	10,868	82,892	0	E	Sheep	0	10,868	NA	Ridgecrest	C	No
Bissell	5,596	48,889	0	E	Sheep	0	5,596	NA	Ridgecrest	C	No
Buckhorn Canyon	12,364	27,053	NA	E	Sheep	12,364	7,634	NA	Barstow	C	No
Cady Mountain	160,104	231,897	0 5/	E/P	Cattle	0	160,104	Y-L	Barstow	I	Yes
Cantil Common	318,949	555,421	0	E	Sheep	91,930	318,949	NA	Ridgecrest	M	Yes
Cronese Lake	54,250	65,304	500	E/P	Cattle	30,080	34,170	Y-L	Barstow	I	Yes
Darwin	430	7,232	44	P	Horses	0	0	Y-L	Ridgecrest	I	Yes
Double Mountain	2	576	38	P	Cattle	0	0	5/1-11/30	Ridgecrest	C	No
Gravel Hills	135,544	230,165	NA	E	Sheep	135,544	0	NA	Barstow	C	Yes
Hansen Common	34,848	72,102	354	E/P	Cattle & Sheep	0	3,549	12/1-9/30	Ridgecrest	M	Yes
Harper Lake	21,602	26,314	600	E/P	Cattle	21,194	5,120	Y-L	Barstow	I	Yes
Johnson Valley	109,186	118,320	NA	E	Sheep	0	109,186	NA	Barstow	M	No
Lacey-Cactus-McCloud	421,172	421,172	1,425	P	Cattle	0	18,000	11/1-5/31	Ridgecrest	I	Yes
Lava Mountain	20,902	20,902	0	E	Sheep	2,165	18,737	NA	Ridgecrest	M	No
Monolith-Cantil	37,771	47,553	0	E	Sheep	33,193	4,592	NA	Ridgecrest	M	No
Oak Creek	23	177	16	P	Cattle	0	0	NA	Ridgecrest	I	No
Olancha	1,582	15,876	606	P	Cattle	0	0	4/1-6/30	Ridgecrest	M	Yes
Ord Mountain	136,188	154,848	3,632	E/P	Cattle	102,141	34,047	Y-L	Barstow	I	Yes
Pilot Knob	38,994	45,619	0	E	Cattle	37,857	7,762	NA	Ridgecrest	I	No
Rattlesnake Cnayon	26,832	28,757	1,081	E/P	Cattle	0	12,800	Y-L	Barstow	I	No
Round Mountain	15,253	18,093	880	E/P	Cattle	0	0	12/1-3/31	Barstow	M	No
Rudnick Common	150,154	236,184	6,218	E/P	Cattle & Sheep	0	62,503	Y-L	Ridgecrest	I	Yes
Shadow Mountain	52,258	121,677	NA	E	Sheep	35,013	69,395	NA	Barstow	M	No

ALLOTMENT NAME	ALLOTMENT ACRES		ACTIVE AUMS	RANGE TYPE 3/	KIND OF LIVESTOCK	ACRES OF TORTOISE CRITICAL HABITAT	ACRES OF TORTOISE NON-CRITICAL HABITAT	SEASON OF USE 4/	MANAGIN G FIELD OFFICE	MULTIPLE USE CLASS (M, I & C)	AMP COMPLETED (YES OR NO)
	P. L. 1/	TOTAL 2/									
Spangler Hills	57,695	69,141	0	E	Sheep	0	54,143	NA	Ridgecrest	C	No
Stoddard Mountain	190,186	312,045	NA	E	Sheep	112,772	126,202	NA	Barstow	M	Yes
Superior Valley	169,200	236,316	NA	E	Sheep	232,507	0	NA	Barstow	C	No
Tunawee Common	51,729	55,931	1,540	E/P	Cattle & Sheep	0	1,800	2/16-5/31	Ridgecrest	I	No
Valley Well	480	480	24	E/P	Horses	0	0	Y-L	Barstow	C	No
Walker Pass Common	88,158	96,974	3,368	E/P	Cattle	0	32,058	11/1-6/30	Ridgecrest	I	Yes
Warren	4	584	55	P	Sheep	0	0	Y-L	Ridgecrest	M	No

1/ Acres of Public Land in the grazing allotment.
2/ The acres of private, State, BLM, and other ownerships that comprise the area of the grazing allotment.
3/ Those allotments classified as ephemeral (E) produce forage from primarily ephemeral (annual) plants. Those allotments classified as perennial (P) produce forage from perennial grass and shrubs. Those allotments with ephemeral and perennial (E/P) forage have a mixture of both range (forage) types.
4/ The period livestock typically graze forage on the allotment. Grazing use on some allotments is authorized to occur all Ayear-long≅ or Y-L. The grazing period of use does not apply (NA) to ephemeral allotments because grazing use occurs when forage is available.
5/ The 1982 California Desert Conservation Area Plan Amendment process authorized 2,010 AUMs of perennial forage for the Cady Mountain Allotment.

3.4.3 Mineral Potential and Development

This section describes (1) the mineral potential of the western Mojave Desert; (2) strategic and critical minerals found in the planning area; (3) the region's most important deposits, (4) current and historic mineral commodity production; (5) issues unique to Coolgardie Mesa, and (6) restoration and reclamation procedures. Additional materials, including a description of mineral management programs adopted by BLM, state and local governments, can be found in Appendix P.

3.4.3.1 Mineral Potential

The Southern California region, including portions of the Mojave Desert, is one of the most highly mineralized areas in the United States. The minerals are grouped into four categories: metallic minerals, industrial/nonmetallic minerals, energy minerals, and construction materials. These are classed on public lands by disposal categories that include: locatable, leaseable, and saleable. Current management practices are described in part 3.4.3.6. Mineral potential maps (Maps 3-19, 3-20, 3-21 and 3-22) show zones of moderate and high potential for occurrence of mineral resources[31].

According to the U.S. Bureau of Mines, undiscovered mineral deposits likely exist within the western Mojave Desert, with quantities and grades of minerals that would support profitable development (U.S. Bureau of Mines, Oct. 1993, Executive Summary, p. 4). When the U.S. Bureau of Mines asked which deposits were the most important non-operating deposits in the Desert Tortoise Priority Habitat (DTPH; Categories I & II), it was found that the commodities with the most value include borate, decorative stone, and gold, and collectively accounting for 87 percent of the total in place value (Almquist, et al., 1993, p. 4). The expected value for undiscovered mineral deposits, at 1992 prices and technology, is over $2 billion (U.S. Bureau of Mines, Executive Summary, Oct. 1993. p. 5; Almquist, et al, 1993, p. 15).

Tables 3-46 and 3-47 show acres of moderate and high mineral potential and percentage of those areas having mineral potential.

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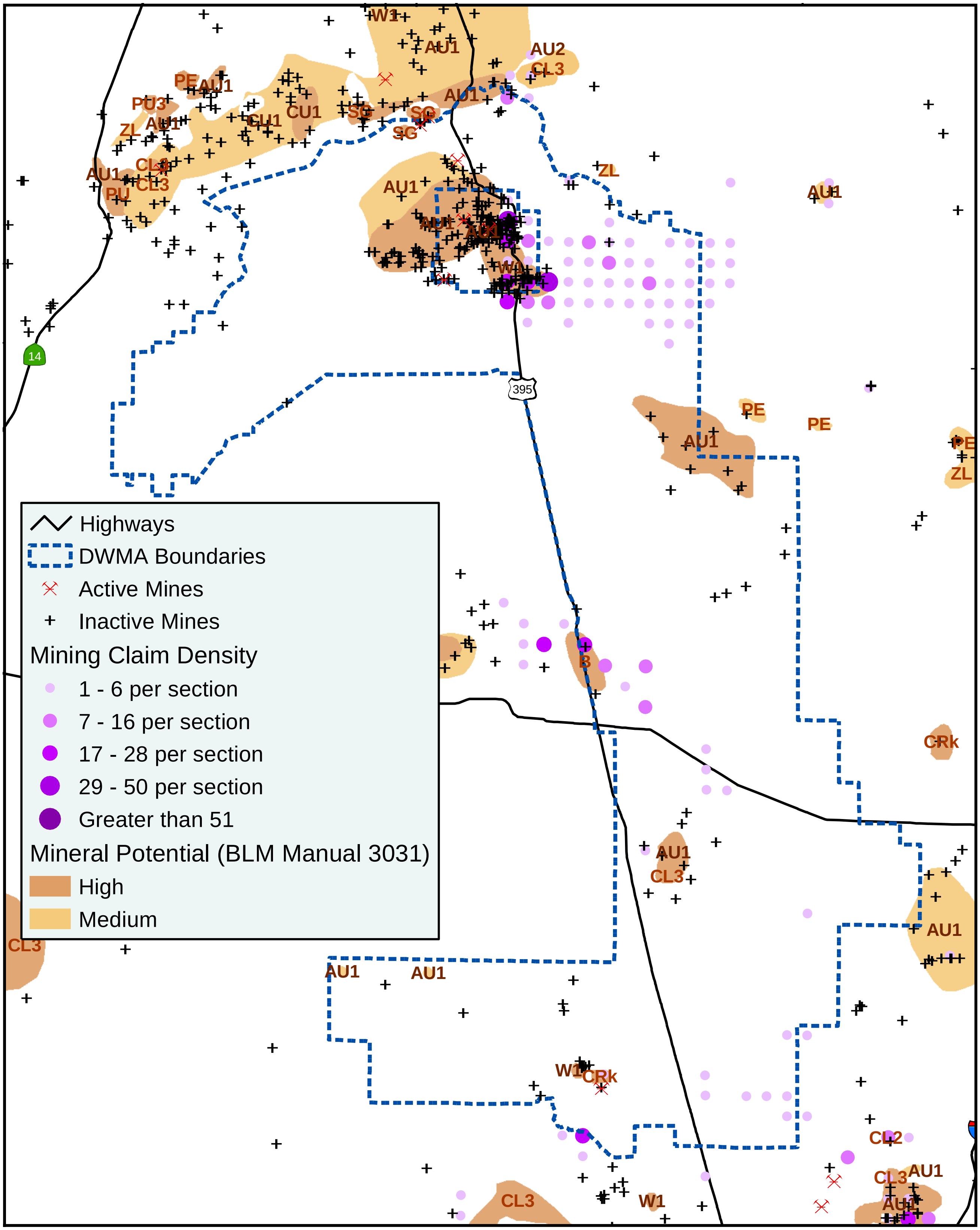
31 Maps are based largely on the mineral inventory for the BLM's CDCA Plan (1980) and supplemented in most areas by the Mineral Resource Zones (MRZ) from the SMARA classifications done by the California Department of Conservation, as well as classifications completed by the USGS and the U.S. Bureau of Mines for wilderness study areas. An explanation of the process for gathering and summarizing the data may be found on page 97 of the CDCA Plan. An explanation of the methodology of the mineral inventory may be found on pages 1-15, Vol. G, Appendix XIV of the Final EIS and Proposed Plan for the CDCA. The BLM mineral potential classification system may be found in BLM Manual 3031 (Energy and Mineral Resource Assessment). It should be emphasized that this classification system is for occurrence and not development of mineral resources.

Mineral Potential, Active and Inactive Mines, and Mining Claim Density - Fremont-Kramer DWMA

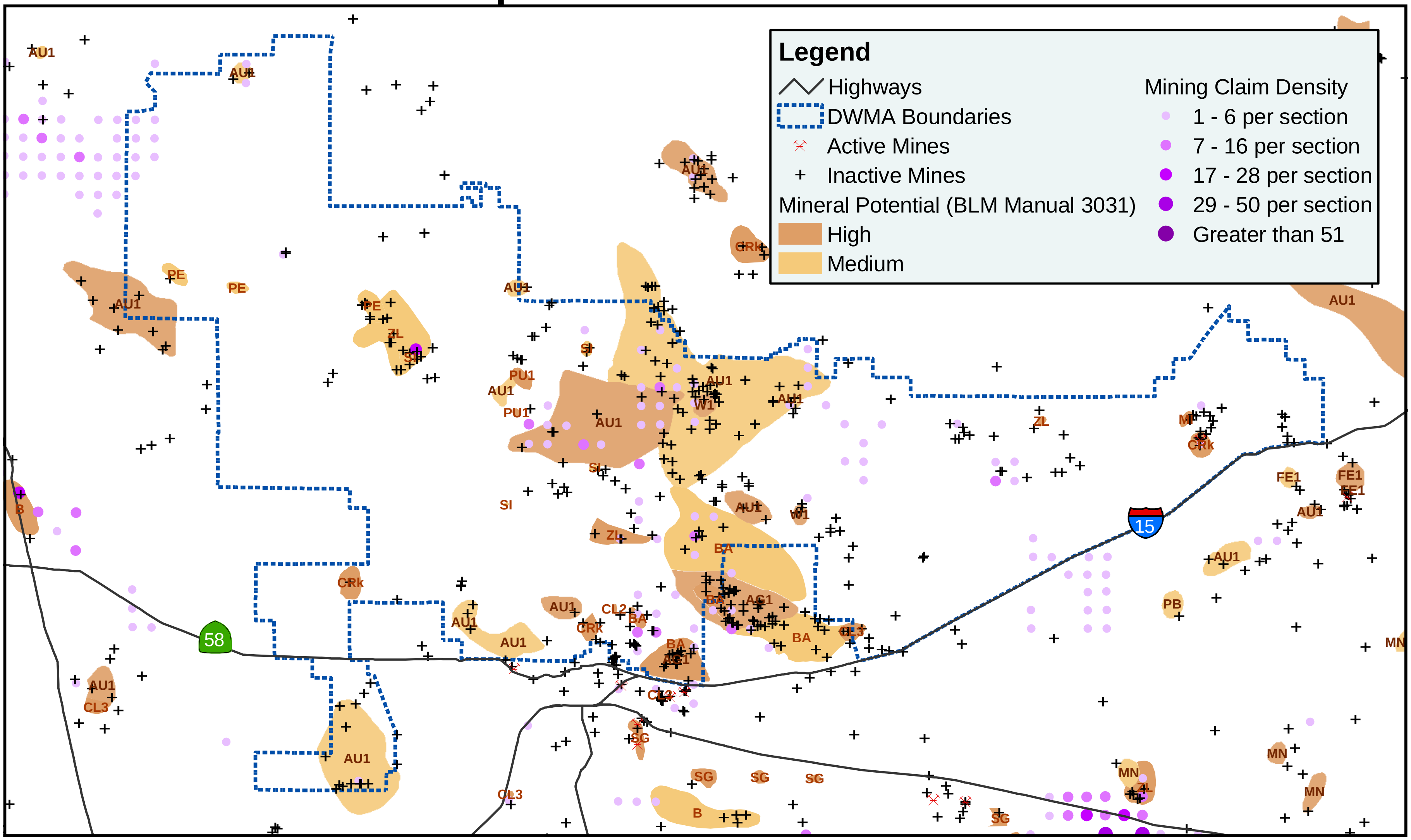


West Mojave Plan FEIR/S
Map 3-19

Scale: 1 : 450,000
0 10 20 Km
0 5 10 Miles

10/14/04

Mineral Potential, Active and Inactive Mines, and Mining Claim Density
Superior-Cronese DWMA

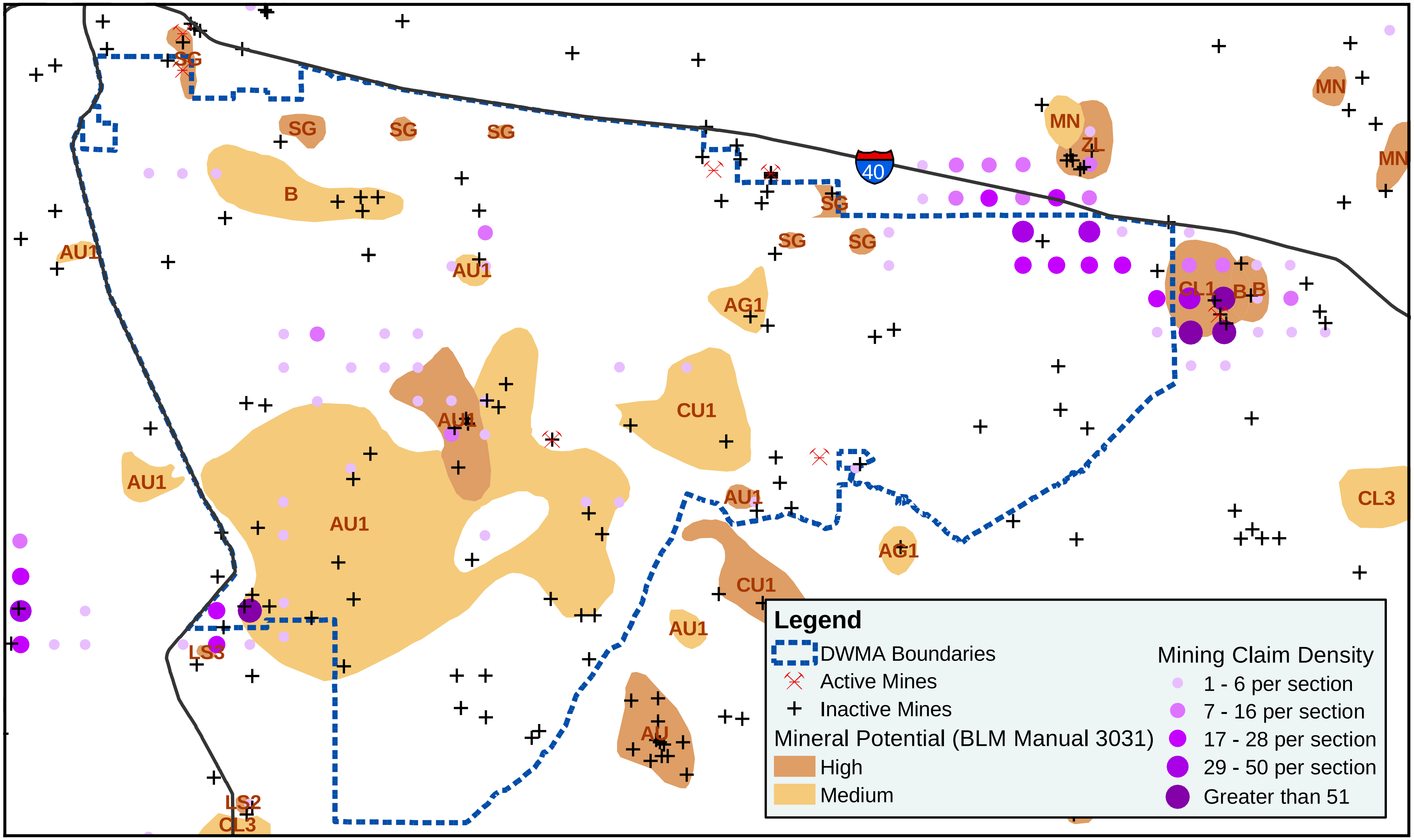


West Mojave Plan FEIR/S
Map 3-20

Scale: 1 : 500,000
0 10 20 Km
0 10 20 Miles

10/14/04

Mineral Potential, Active and Inactive Mines, and Mining Claim Density
Ord-Rodman DWMA



West Mojave Plan FEIR/S
Map 3-21

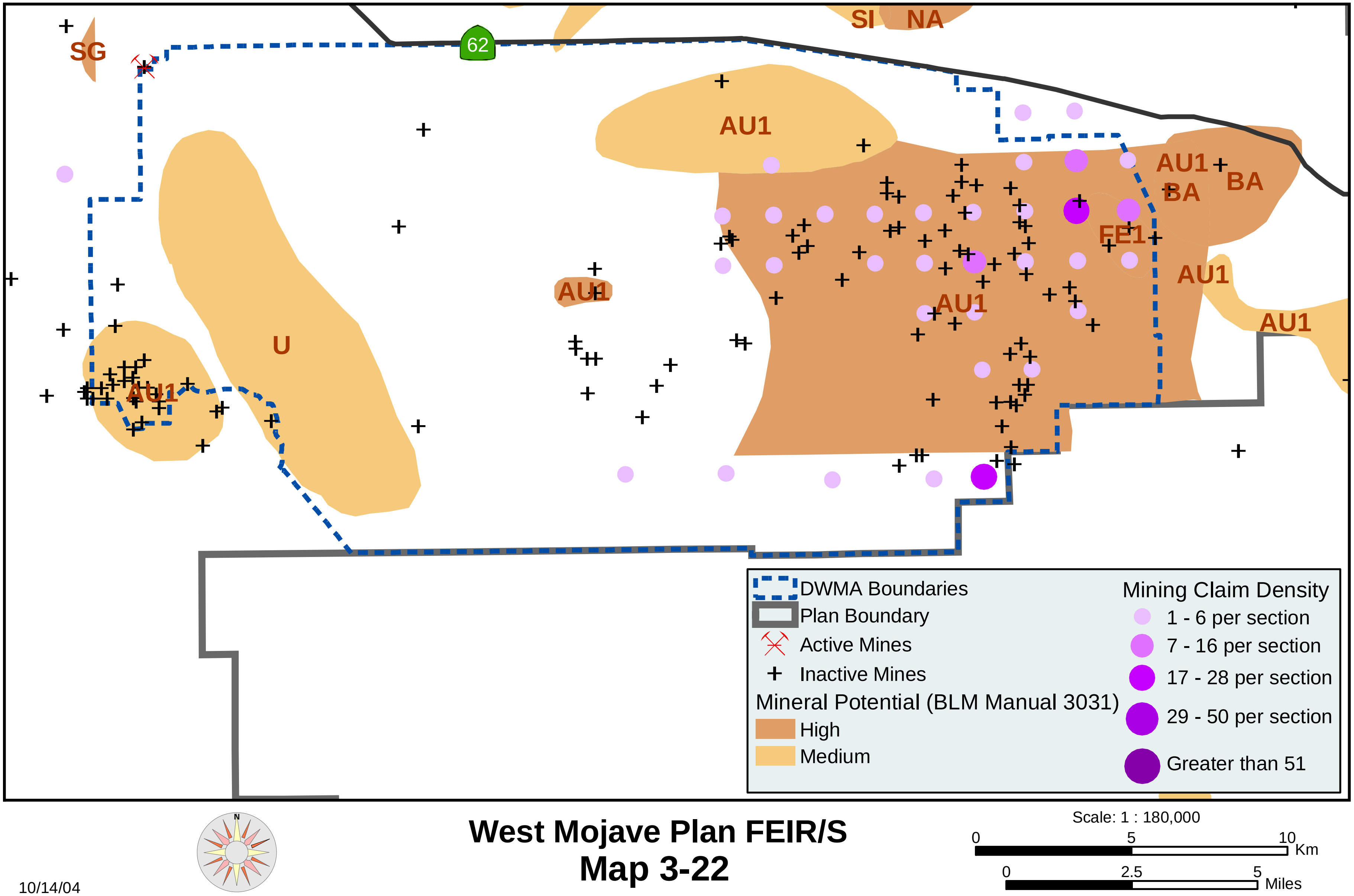
Scale: 1 : 280,000

0 10 20 Km

0 5 10 Miles

10/14/04

Mineral Potential, Active and Inactive Mines, and Mining Claim Density
Pinto DWMA



West Mojave Plan FEIR/S
Map 3-22

10/14/04

Locatable Minerals: Known and undiscovered locatable metallic mineral deposits occurring and expected to occur include gold, silver, base metals (copper, lead, and zinc), tungsten and iron. Zones of moderate and high potential for precious and base metals are scattered throughout the plan area, with the exception of the military bases where data is scarce, and alluvial filled valleys to the southwest where exposures are poor. Mining claim density for locatable (metallic and industrial) minerals may be found on Maps 3-23, 3-24, 3-25 and 3-26.

Areas of potential for the occurrence of placer gold deposits include the Rand Mountains – Fremont Valley area, the Coolgardie Camp-Superior Valley area and Dale District. The Coolgardie area has 1,806 acres having moderate potential and 9,890 acres having high potential for metallic mineral resources within the Lane Mountain milkvetch HCA (and Superior-Cronese DWMA). There is no estimate for the number of ounces of unrecovered gold for the Coolgardie placer area in San Bernardino County but there is a persistent occurrence of placer gold over an area of about 4 square miles (Leszcykowski, et al., 1993, p. 43).

Areas having high potential for the occurrence of hard rock gold (disseminated and in veins) include the Randsburg and Mojave Districts in Kern County. Gold production, mostly from Randsburg in Kern County, is estimated to be over $25 million per year. Gold reserves at the Yellow Aster were estimated in 1993 to be 46.8 metric tons with a grade of 0.02 ounces per ton (opt) of gold (0.63 grams per metric ton) (Leszcykowski, et al., 1993, p. 37).

High potential areas for tungsten are from brines located at Searles Lake, and from quartz vein and metasomatic lode deposits around Atolia, northeast of Lane Mountain, the Shadow Mountains, and scattered locations in the Sierra Nevada. Iron potential zones occur in metasomatic deposits associated with carbonate rock and plutonic intrusions in the Cave Mountain area, upper Johnson Valley, and the Bullion Mountains northwest of Dale Lake. There are manganese resources in the Cady Mountains, particularly at Sleeping Beauty Mountain in the southern part of the range.

Potential zones for nonmetallic minerals are associated with known outcrops. Limestone is known to occur along the east side of the Sierra Nevada, Tehachapi Mountains, Iron Mountain (between Victorville and Barstow), Oro Grande, Victor Valley, Lucerne Valley, Afton Canyon, and the Alvord Mountains.

High potential zones for feldspar are located east of Fremont Peak (proposed Superior-Cronese DWMA) and near the Ord Mountains (Ord-Rodman DWMA). Barite resources occur in the Calico Mountains, the Cady Mountains, and the Waterman Hills north of Barstow. Borates are known to occur in Searles Lake, near Kramer Junction (proposed Fremont-Kramer DWMA), the Calico Mountains, Daggett Ridge, and near Hector. Zeolites are known to occur in the Mud Hills, Opal Mountain (both proposed Suerior-Cronese DWMA), near Hector, Alvord Mountain, and the El Paso Mountains. Hectorite clay occurs near the Hector railroad siding off of Highway 40, and bentonite occurs in the Mud Hills, Kramer Hills, and the El Paso Mountains.

Leasable Minerals: The Coso Known Geothermal Resource Area (KGRA) has high potential for geothermal steam development beyond the area that has already been developed. The hills east and southeast of Goldstone Lake on Ft. Irwin have high potential for geothermal development based on the results of drilling five temperature-gradient holes in which water temperature ranges from 78.5 to 85 degrees F. at a depth of 500 feet. A 5,000-foot hole is planned in Pink Canyon. If steam is not found at depth, the hot water could be used in a binary electrical plant where a heat exchanger with a working fluid such as freon is used to run a turbine with lower temperature geothermal fluids. Alternatively, the hot water could be used for space heating at Ft. Irwin.

The Rand KGRA northeast of Red Mountain has high potential for the occurrence of geothermal steam resources based on the occurrence of a known steam well. The KGRA has low potential for development, however, because of the distance from populated areas, and because the high potential area is included in the Red Mountain wilderness area, closed to mineral leasing from public lands.

Nearly 30 square miles have moderate potential for low temperature geothermal energy in the Twentynine Palms area. The best locations for exploration drilling are on the northeast side of the town, within a nearly eight-square-mile area extending about a mile and a half north and south from Amboy Road from Adobe Road east beyond Bullion Mountain Road (Rogers, 1987, p. B1).

The planning area is deemed to have low potential for the occurrence of oil and gas based on a lack of evidence for marine source beds. Paleozoic marine rocks are, in general, too metamorphosed to retain any oil and gas that they may have originally contained. Further confirmation drilling has never substantiated “showings”, although they have been reported on drill logs (Dibblee, 1967, p. 128-129; Bowen, 1954, p. 181).

Both Searles Lake and Boron are Known Leasing Areas for sodium minerals. In addition, Searles Lake is known valuable for potassium minerals. Koehn Lake is known valuable for sodium minerals and still has three current sodium leases. Dale Lake is prospectively valuable for sodium, and like Koehn Lake is a past producer. The Boron deposit, west of Kramer Junction, is known valuable for sodium minerals (borates). All of these areas have high potential for the occurrence of sodium minerals.

Saleable Minerals: Saleable minerals consist mostly of construction materials such as crushed and dimension stone and sand and gravel in addition to clay used for pond sealant. These deposits are known to occur in many locations throughout the plan area. For example, veneer stone is produced from private and public lands at Rand Mountain in Kern County and landscaping rock is produced from private and public lands near Barstow in San Bernardino County. Resources for the schist flagstone at Rand Mountain exist over an area of 640 acres (2.6 square kilometers (Leszcykowski, et al., 1993, p. 39). The estimated wholesale value of the stone produced from public lands is $1.2 million per year ($80 per ton x 15,000 tons) for the Rand schist, and $1.5 million for decorative stone near Barstow.

High quality sand and gravel deposits, suitable as aggregate for Portland cement concrete or asphalt concrete, are surprisingly few in number and becoming more difficult to develop because of zoning and environmental restrictions. Such deposits, like gold, are where you find them and cannot be moved to a more convenient spot to be mined. Many of the sand and gravel potential areas are actually borrow deposits, suitable for fill, road repair work or subbase. By necessity, these must be located near roads and highways. Local sources of aggregate are critical to lowering construction costs. The average cost of a ton of aggregate will double if it is hauled 35 miles (Beeby et al., 1999).

Common clays occur in the playas and Tertiary-age sedimentary rocks. Whether these deposits have potential for development depends on the proximity to markets and conflicts with other resources.

The El Paso Mountains are particularly favorable for the occurrence of pumice and pumicite.

3.4.3.2 Strategic and Critical Minerals

Strategic and critical materials are materials that (1) would be needed to supply the military, industrial, and essential civilian needs of the United States during a national defense emergency, and (2) are not found or produced in the United States in sufficient quantities to meet such needs (U.S. Bureau of Mines, 1983, p. 1). A strategic and Critical Materials Report to the Congress is submitted annually by the Department of Defense. The report details the operations of the National Defense Stockpile (NDS) and includes tables of the subject metals, minerals and materials. Among the 33 items on Table 5 (Stockpile Goals and Inventory Status) are manganese ore, tungsten ore, lead, silver and zinc, which occur in the planning area.

Three zones in the Cady Mountains have high potential for the occurrence of manganese resources, and several hundred tons of ore were produced during the first and second world wars (Wright et al., 1953, p. 114-117). Manganese is used for hardening steel and the United States has an import reliance of 100 percent, with most coming from Gabon, Brazil, and Australia.

Tungsten resources occur at Atolia and Searles Lake. As previously mentioned, up until 1938, Atolia was the principal source of tungsten ore in the state. Tungsten is used in high-temperature structural materials and electrical elements, and the United States import reliance is 68 percent, with most coming from China.

Table 3-46
Potential for Metallic, Industrial and Construction Minerals
For Each Conservation Area

MANAGEMENT AREA	METALLIC MINERALS		INDUSTRIAL MINERALS		CONSTRUCTION MATERIALS			
	High Potential	Moderate Potential	High Potential	Moderate Potential	High Potential	Moderate Potential	Total High Potential	Total Moderat Potential
Superior-Cronese DWMA	30,760	45,563	18,896	36,843	1,397		51,053	82,406
Newberry-Rodman DWMA	4,581	44,275	4,798	14,479	1,398		10,777	58,754
Pinto Mountains DWMA	29,888	20,463		43			29,888	20,506
Fremont-Kramer DWMA	18,419	10,119	3,051	649	2,805	108	24,275	10,876
Mojave Ground Squirrel Conservation Area	65,442	131,648	3,574	25,979	13,778	23,597	82,794	181,224
Carbonate Endemics			177	4,416	80		257	4,416
Alkali Mariposa Lily			1,691				1,691	
Barstow Wooly Sunflower								
Bendries Thrasher	2,186	7					2,186	7
Big Rock Creek					2,404		2,404	
Lane Mtn Milkvetch	9,890	1,705					9,890	1,705
Little San Bern Mtns Gilia								
Middle Knob								
Mojave Fringe-toed Lizard	124		1,430	171	0		1,554	171
Mojave Monkeyflower Newberry	17	426	0	0	1,168	0	1,185	426
Mojave Monkeyflower Brisbane	5,338	549	651	0	730	0	6,719	549
Mojave Monkeyflower Kelso								
North Edwards				30				30
Pisgah Crater			8,817				8,817	
Total Acres								

Table 3-47

Percentage of Each Conservation Area Having High and Moderate Mineral Potential

MANAGEMENT AREA	MANAGEMENT AREA ACRES				ACRES			
	BLM Managed	Pivate and State Managed	Other Federal Managed	Total Management Area	Total High Potential	Percent of Management Area	Total Moderate Potential	Percent of Management Area
Superior-Cronese DWMA	402,962	209,979	9,646	622,587	51,053	8%	82,406	13%
Newberry-Rodman DWMA	195,046	48,440	54	243,540	10,777	4%	58,754	24%
Pinto Mountains DWMA	109,090	7,240	655	116,985	29,888	26%	20,506	18%
Fremont-Kramer DWMA	320,468	190,389	4	510,861	24,275	5%	10,876	2%
Mojave Ground Squirrel Conservation Area	669,352	86,612	1,790	757754	82,794	11%	181,224	24%
Carbonate Endemics	4,393	762	10	5,165	257	5%	4,416	85%
Alkali Mariposa Lily	67,330	15		67,345	1,691	3%		
Barstow Wooly Sunflower	18,327	17,884		36,211				
Bendries Thrasher	9,363	16,390	98,126	123,879	2,186	2%	7	<1%
Big Rock Creek		10,746	38	10,784	2,404	22%		
Lane Mtn Milkvetch	12,100	4,975		17,075	9,890	58%	1,705	10%
Little San Bern Mtns Gilia	2,863	22,511	7	25,381				
Middle Knob	17,671	2,802		20,473				
Mojave Fringe-toed Lizard	21,767	902	1556	24,225	1,554	6%	171	1%
Mojave Monkeyflower Newberry	25,997	10,427	7	36,431	1,185	3%	426	1%
Mojave Monkeyflower Brisbane	10,447	207		10,654	6,719	63%	549	5%
Mojave Monkeyflower Kelso								
North Edwards	1,140	13,198	5	14,343			30	<1%
Pisgah	17,439	4,678	42	22,159	8,817	40%		

A third item, yttrium (on the USBM list but not the NDS list) occurs as undeveloped resources in the southern part of the planning area. Similar to the “rare earth” elements, yttrium is found in the mineral xenotime in Music Valley at the edge of the Pinto Mountains in Riverside County. In 1998 Draco Exploration identified 330,000 short tons of resources containing over 700,000 pounds of Yttrium oxide and nearly 1.2 million pounds of additional rare-earth oxides (Moyle & Cather, 1992, p. 57). The United States imports 100 percent of its yttrium, with most coming from China. There are no satisfactory substitutes for yttrium regarding its use in electronics, lasers and phosphors in color television and computer monitors (Hedrick, 2002, p. 186-187).

Although celestite (along with kyanite, mica and talc), has been determined to be “neither strategic nor critical” in the Stockpile Report to Congress for fiscal year 2001 (DOD, p. 55), celestite (an ore of strontium) has been on the stockpile inventory in years past. About 100 acres in the planning area have high potential for the occurrence of strontium resources, and several thousand tons of celestite were mined during both world wars from the southern edge of the Cady Mountains. By far the largest deposits of strontium minerals in California occur in the foothills of the Cady Mountains (Ver Planck, 1957, p. 607). Strontium is used for ceramics, ceramic magnets, and glass, particularly television plate glass because of its ability to block X-rays. It also produces the red flame in pyrotechnics, including ammunition tracers and flares. The United States import reliance on strontium is 100 percent.

A 1992 study by the U.S. Geological Survey estimated the occurrence of the critical metals lead, silver and zinc in the planning area. The report included a figure showing the probability distributions for each metal in all of the undiscovered deposits that were evaluated. Figures in metric tons were plotted against probability of occurrence ranging from zero to one. At a probability of 0.5, the estimated number of metric tons in the study area was predicted to be 200 tonnes of lead, 300 tonnes of silver and 7 tonnes of zinc (Tosdal, et al., Dec. 1992, p. 78). Silver is often produced as a byproduct from gold mining. Gold is being mined at Randsburg and has been recently mined in the Mojave gold mining district.

3.4.3.3 Identified Resources by Commodity

Within the planning area there are approximately 426,000 acres having moderate to high potential for the occurrence and accumulation of metallic mineral resources, 126,000 acres having potential for the occurrence of industrial minerals, and 47,700 acres having potential for the occurrence of construction materials. In addition, there are nearly 13,000 acres having moderate to high potential for the accumulation of sodium and potassium minerals. There are approximately 119,000 acres classified as Known Geothermal Resource Areas and 480,000 acres classified as prospectively valuable for geothermal resources (BLM Manual 3031). Within the plan area there are about ten active mines in critical habitat for the desert tortoise.

There are twelve sites near Barstow in San Bernardino County with important resources amounting to 16 million tons (Almquist, et al., 1993, p. 4) for landscaping rock (10 crushed stone & two flagstone): black granite, pink granite, beige, Afton green rock (3 quarries), mint green, pink volcanic rock, dusty rose and wine. Flagstone is mined from two sites in the Rand Mountains. These figures do not include the brown or “gold” colored rock east of Barstow because the study was done before that site was known to be habitat for the desert tortoise.

Identified resources for selected producing deposits are discussed above, and non-producing deposits are presented below beginning with gold.

The Kramer Hills gold deposit on private land has identified resources reported to be 2.0 million metric tons (2.2 short tons) averaging 1.3 grams per ton (0.004 ounces per ton) gold and inferred resources of about 2.7 million metric tons (3 million short tons). Metal resources are about 2,600 kilograms (5,700 pounds) of contained gold (Lewszcykowski, et al., 1993, p. 52).

The Olympus mine in San Bernardino County has moderate potential for the occurrence of vein gold deposits with 1.8 million tons of resources containing 0.11 to 0.22 opt (3.4 to 6.8 grams of gold per metric ton).

The disseminated deposits in the Calico district contain the largest resources of silver in the study area with the Waterloo and Langtry deposits near Barstow containing 27 million tons (24.5 million metric tons) averaging 105 grams per ton (3 opt) silver and 11.8 percent barite and 15 million tons (13.6 million metric tons) averaging 85 grams per ton (2.5 ounces per ton) and 6.0 percent barite respectively (Fletcher, 1986; Tosdal, et al., March 1992, p. 8). Over 4,000 acres in the Calico Mountains have been classified under SMARA as MRZ-2b (moderate potential for occurrence) for silver and barite resources by the California Department of Conservation (Bezore et al., 1997, p. 37).

Over 500 acres on the south slope of Ord Mountain (Ord-Rodman DWMA) has been classified under SMARA as MRZ-2b (moderate potential for occurrence) for copper and molybdenum resources by the California Department of Conservation (Bezore et al., 1997, p. 24). Sulfide resources are estimated to be 2,600,000 tons (0.26% copper & 0.12% molybdenum), and combined oxide resources are estimated to be 489,000 tons (0.4% copper & 0.07% molybdenum).

The most important borate resources outside of the active mining area at Boron are the Rho and 395 Hill colemanite deposits northwest of Kramer Junction in San Bernardino County. The Rho deposits contain an estimated total of 86 million metric tons (95 million short tons) of material averaging 5 percent to 17 percent B_2O_3, and the 395 Hill contains an unknown quantity of colemanite-bearing shale with abut 3.7 percent B_2O_3 (Leszcykowski, et al., 1993, p. 47 & 48).

The Alvord Mountain limestone deposit has identified resources of 20 million short tons (18 million metric tons) of high-grade whiting limestone and an accompanying 20 million short tons of cement grade limestone inside a window surrounded by tortoise habitat (Leszcykowski, et al., 1993, p. 45).

In 1993 the Calspar feldspar deposit (Ord-Rodman DWMA) contained "a proven ore reserve of 150,000 short tons (136,000 metric tons) of milling grade rock…" (Leszcykowski, et al., 1993, p. 57; Randol Mining Directory, 1990, p. 114.) The feldspar occurs in two zones of roughly 60 acres and 115 acres on either side of Camp Rock Road and has been classified under SMARA as MRZ-2a and MRZ-2b, respectively (high and moderate potential for occurrence) by the California Department of Conservation (Bezore *et al*., 1997, p. 36 -37).

The Mud Hills zeolite deposit north of Barstow contains resources of at least 207,000 tons (188,000 metric tons; Leszcykowski, et al., 1993, p. 52). The Opal Mountain zeolitic tuff has an estimated resource of 2 million tons (1.8 million metric tons) (Leszcykowski, et al., 1993, p. 41 & 44), and the Alvord Mountain zeolite deposit has resources estimated in the range of 276,000 tons (250,000 metric tons).

Chemical analysis of water from wells at Kohen Lake in Kern County indicate the water contains sodium at 0.6 percent to 3.6 percent (6,000 to 36,000 milligrams per liter), chloride at 0.9 percent to 5.6 percent (9,000 to 56,000 milligrams per liter), and sulfate at 0.5 percent to 5.4 percent (1,500 to 5,400 milligrams per liter). Sodium chloride or salt is a leasable mineral and has potential use for specialized agricultural products (Leszcykowski, et al., 1993, p. 36).

Important resources of sand and gravel occur northwest of Afton Canyon and in the Soda Mountains, southwest of Baker in San Bernardino County. The deposit in the Cronese Mountains, northwest of Afton Canyon, is one of two identified by Caltrans as a suitable source of aggregate along Interstate 15 between Barstow and the Nevada state line. It contains an estimated 6.8 million metric tons (7.5 million short tons) of sand and gravel (Leszcykowski, *et al*., 1993, p. A-99). The second deposit, known as Opah Ditch, contains an estimated 3 million short tons of sand and gravel between the Soda Mountains Wilderness Study Area (WSA) and the utility corridor. A similar quantity probably occurs within the WSA. The Blackhawk landslide, between Highway 247 and the San Bernardino Mountains, contains an estimated 400 to 500 million tons of naturally crushed dolomitic limestone which is potentially suitable for aggregate, road-base, railroad ballast, concrete rock and sand (Fife, 1982, p. 483). The Big Rock Creek fan in Los Angeles County contains 2,400 acres having high potential for the occurrence of sand and gravel. Present extraction is occurring on the nearby Little Rock Creek fan.

Future production is expected to be concentrated in the categories of gold (especially with a price increase), aggregate (particularly along I-15), and nonmetallic minerals, including borates specialty clays and limestone (calcite marble and dolomite). Only minor activity is anticipated in lead-zinc-silver deposits due to the small vein type deposit models exhibited by these metals, high operating costs to mine and recover these minerals, and depressed commodity prices.

3.4.3.4 Current and Historic Mineral Commodity Production

Overview: Mining in the California Desert can be traced back to the early nineteenth century, when silver and gold were mined along the Colorado River prior to the Sutter's Mill gold discovery in northern California in 1848. Since that time, 19 different metallic and 27 non-metallic mineral commodities have been extracted from the desert (Bureau of Land Management, 1980, p. 96). Mineral commodities mined currently or in the recent past include metallic minerals such as: gold, silver, lead, zinc, silver tungsten and iron; industrial minerals such as barite, boron, hectorite, bentonite, zeolites, gypsum, sodium, and calcium salts and compounds, potash, and limestone; materials necessary for transportation and construction such as sand and gravel, crushed rock, lightweight aggregate (pumice and cinders), dimension stone;

and minerals of intrinsic and scientific value such as turquoise, opal, jasper, and specimen materials. Construction aggregate is the highest tonnage and highest dollar-value commodity produced in California. In 2000, 240 million tons of construction sand and gravel and crushed stone were produced with a dollar value of 1.4 billion dollars (Kohler, 2000, p.7.3).

Annual mine revenue from production from existing mines in the western Mojave Desert, for Category I and II tortoise habitat alone, is estimated to be $22.2 million, accumulating to 248.6 million over the lives of the mines (U.S. Bureau of Mines, Executive Summary, Oct. 1993, p. 4; Almquist, et al., Oct. 1993, p. 7). Prospecting for gold continues throughout the planning area and production is occurring at Randsburg. Inactive small mines and prospects are scattered throughout the planning area. A few select commodities of particularly significance are presented below.

Table 3-48, showing known active mines in each conservation area, lists eight active mines (i.e. a mine with a SMARA plan) in proposed tortoise DWMAs and eight active mines in the MGS Conservation Areas. In addition there is an aggregate operation in the carbonate endemic management area downslope from the Mitsubishi plant with plans to begin production after a rail spur can be acquired.

Table 3-48
Active Mines Within Conservation Areas

CONSERVATION AREA	ACTIVE MINES	
	BLM Managed	Private And State Managed
Superior-Cronese DWMA	Beige stone, Afton green stone, Mud Hills zeolite, Opal Mountain zeolite	
Newberry-Rodman DWMA	Redtop cinders	
Pinto Mountains DWMA		
Fremont-Kramer DWMA	Rand Mountain stone	Rand Mountain stone, Shadow Mountains dolomite
Mohave Ground Squirrel	Coso Mountains pumice, Trona sand and gravel, Trona clay, Back Springs bentonite, Mud Hills zeolite, Opal Mountain zeolite	Rand Mountain stone, Shadow Mountains dolomite
Carbonate Endemics		
Alkali Mariposa Lily		
Barstow Woolly Sunflower		
Bendire's Thrasher		
Big Rock Creek		
Lane Mountain Milkvetch	Coolgardie gold	
Little San Bernardino Mountains Gilia		
Middle Knob		
Mojave Fringe-toed Lizard		Hectorite, borate, cinders
Mojave Monkeyflower – Newberry		
Mojave Monkeyflower – Brisbane		
Kelso Valley Monkeyflower		
North Edwards		Boron clay

Table 3-49 shows the number of mining claims and sites within each conservation area. There are approximately 110 active notices and 55 plans of operations within the planning area boundary.

Table 3- 49
Mining Claims and Sites Within Management Areas

MANAGEMENT AREA	MINING CLAIMS AND SITES			
	LODE	PLACER	MILL SITE	TUNNEL SITE
Superior-Cronese DWMA	73	169	21	0
Newberry-Rodman DWMA	163	53	0	0
Pinto Mountains DWMA	67	46	0	0
Fremont-Kramer DWMA	63	268	1	0
Mojave Ground Squirrel Conservation Area	146	534	40	0
Carbonate Endemics	11	30	0	0
Alkali Mariposa Lily Conservation Area	0	0	0	0
Barstow Wooly Sunflower Conservation Area	28	0	0	0
Bendries Thrasher Conservation Area	0	1	0	0
Big Rock Creek Conservation Area	0	0	0	0
Lane Mtn Milkvetch Conservation Area	0	22	0	0
Little San Bern Mtns Gilia Conservation Area	0	0	0	0
Middle Knob Conservation Area	0	0	0	0
Mojave Fringe-toed Lizard Conservation Area	0	11	0	0
Mojave Monkeyflower Conservation Area	40	27	2	0
North Edwards	0	0	0	0
Pisgah Crater Conservation Area	230	65	85	0
Total Mining Claims and Sites in MA's:	821	1,230	149	0
Total Mining Claims and Sites in the Planning Area:	1,577	1,604	268	0

Numbers reflect the November 2001 43 CFR 3833 recordation database maintained by BLM. Locations are to the nearest ¼ section. Numbers are by management area and do not differentiate those mining claims lying within two or more management area overlaps.

Saline Deposits: The most important nonmetallic commodities found in the California desert region are borate and associated evaporite minerals and saline brines, collectively known as saline deposits (Dellinger, 1989, p.57).

One of the most outstanding discoveries took place in 1863 when J.W. Searles found borax near present day Searles Lake at Trona, in San Bernardino County. Production of borax, and 14 other associated minerals, from the brines of Searles Lake continue to this day. Searles Lake is an in-situ solution mine administered under the solid leasable mineral regulations at 43 CFR 3500. It has a current mine and reclamation plan approved by the BLM and State Mine and Reclamation Act (SMARA). Mining is conducted on thirty Federal mineral leases (consisting of twenty two sodium leases and eight potassium leases) and one sodium permit aggregating 25,662 acres of BLM-administered public lands. There are 6,647 acres of private lands included within the mining area. The Trona, Argus and Westend Plants are located on private lands adjacent to the mining area. Mining began at Searles Lake in the early 1900s and is expected to continue for many years due to its location at the end of a chain of Pleistocene lakes where rich mineral deposition occurred. Brines are pumped from the playa lakebed to the plants where desired minerals are removed, then the brine is returned to the lakebed. Annual production from the mine is about 1,400,000 tons of soda ash, 130,000 tons of borates, 43,000 tons of boric acid, 220,000 tons of sodium sulfate and 42,000 tons of salt. These products are used for glass, detergents, water treatment, petroleum refining, circuit boards, ceramics, insulation and paper manufacturing.

Production of borax and other sodium minerals in the California desert is of national and local significance. About 97 percent of the United States production and 43 percent of the world production of borax comes from Searles Lake at Trona, and U.S. Borax at Boron. The California Desert produces over $500 million worth of borate minerals per year (Kohler, 2002, p. 49). The mine at Searles Lake has over 700 employees with additional contractors, consultants and services. It is the largest employer in Trona and the second largest employer for Ridgecrest. The Federal sodium and potassium mineral leases generate over $3 million Federal mineral royalties each year, half of which go into the Federal general treasury and half of which are returned to the State of California for the direct benefit of local public education.

Another significant find was the borax deposit at Boron, in Kern County, discovered accidentally in a water well drilled in 1926, and mined continuously since 1927. The U. S. Borax Company mines approximately 9,000 tons of ore daily (Siefke, 1991, p. 6.) and 1,100 men and women are employed at the Boron facility (Lyday, 2001, p. 13.2). Borates have many uses including the manufacture of high quality glass, fiberglass and chemicals.

The world's largest hectorite mine occurs south of the Cady Mountains in the West Mojave Desert Planning Area. Hectorite is a specialty clay used in high quality paints, pharmaceuticals, cosmetics, and personal care products.

In the Calico Mountains, near Barstow, about $9 million worth of borate minerals were produced from 1884 to 1907. Over 15 million ounces of silver were mined from the Calico Mountains from 1881 to 1890.

Gold: The western Mojave Desert has been an important source of gold production. Beginning in 1893, mineral production from the Randsburg district was nearly 1 million troy ounces of gold and 18 million troy ounces of silver. In addition, more than one million short ton units (10,000 tons) of tungsten trioxide were mined from the Atolia district form 1904 to the 1950s. Gold production up to 1970 was over $20 million (Clark, 1970, p.167). Current gold production from the district is estimated to be 80,000 ounces per year. Between 1890 and 1942, 185,000 troy ounces (5.8 metric tons) of gold was produced from the Dale District, which occurs in both Riverside and San Bernardino Counties (Tosdal, et al., 1992).

Up until 1938, Atolia was the principal source of tungsten ore annually in the state, and production amounted to over 8,000 metric tons of tungsten (Tosdal, et al., 1992, p. 49).

Iron: Iron was produced from the Cave Mountain (Baxter) and Bessemer mines as well as from numerous small deposits in San Bernardino County as early as 1930. The Cave Mountain mine has been active for a number of years. California Portland Cement Company produces about 75,000 tons per year from the mine for use as a flux for making cement (Brown & Monroe, 2000, p. 45).

Limestone: Limestone mining in the Victor Valley area began in 1910 at Oro Grande by Golden State Portland Cement Company (currently owned by TXI) (Taylor, 1994, p. 33). This was followed in 1914 by the Black Mountain quarry operated by Southwest Portland Cement Company (currently owned by Cemex). Their Victorville cement plant has recently completed a 1-million short ton per year plant expansion (Kohler, 2002, p.50).

The capacity of California Portland Cement's Creal plant was 1.3 million tons per year in the early 1990s. Located 9 miles west of Mojave and well outside of any HCAs, the plant is the fourth largest in California (PCA, 1997).

Lucerne Valley is one of the largest limestone producing districts in the United States and is the leading producer of white, high-purity calcium-carbonate products in western North America. In 1987 the district had an estimated gross value in excess of $80 million (Brown, 1987, p. 52). Annual production is about 1.7 million tons of Portland cement and about 1.5 million tons of ground calcium carbonate (Economic & Planning Systems, Inc., 2002, p. 29 & 31). Ground calcium carbonate is used principally for joint cement, carpet backings, asphalt roofing, paint, plastics, paper, rubber, plastics, and even chemical grade for food-and pharmaceutical-grade products (Economic & Planning Systems, Inc., 2002, p. 30). Production is from mostly private land just south of the planning area boundary.

The first commercial white limestone-dolomite operations in north Lucerne Valley began in the 1940's at Peterman Hill (Fife, 1988, p. 175). The Cushenbury limestone quarry was opened in 1947, and operated intermittently and on a small scale until it was shut down in 1950 (Taylor, 1994, p. 33). From 1953 to 1957 Kaiser Steel (currently owned by Mitsubishi Cement Corporation) brought a railhead to Lucerne Valley to construct the first cement plant and to open the first large limestone quarry in Cushenbury Canyon (Fife, 1988, p. 176). This cement plant is reported to be the largest in California. In the early 1960's, Chas Pfizer Mineral and Pigments Division (now Specialty Minerals) acquired deposits in Furnace and Marble canyon area in the San Bernardino Mountains. From the mid 1960s to about 1994 Partin produced limestone from its Terrace Springs operation on Forest Service land east of Blackhawk Mountain. The limestone was used for a white pigment filler-extender used extensively in white stucco and swimming pool construction (Gray, 1982, p. 217). Since 1980, the Marble Canyon deposit has been mined continuously (Taylor, 1994, p. 52). In the mid 1970's Pluess-Staufer (now OMYA) took over the limestone plant originally developed by Sentinel Mining in the upper Crystal Creek drainage (Fife, 1986, p.36). At the White Knob quarry the Bullion Member of the Monte Cristo Limestone yields exceedingly coarse-grained, very white translucent calcite marble (Taylor, 1994, p. 53).

Geothermal: At Coso Basin, on China Lake NAWS, geothermal steam was recovered in 1981 and brought into production in 1987. Present production is about 76 megawatts (MW) per year, compared with about 195 megawatts for the CDCA, and 930 megawatts for the state. The Coso Geothermal Resource Area, located on both public lands administered by the BLM and withdrawn lands administered by China Lake NAWS, is one of the largest and hottest geothermal fields in the Western United States. There are four production wells on BLM-managed land in addition to 10 production wells and two water injection wells on Navy administered land, three 25 MW power-plants under construction or completed, with four power-plants planned for the near future. Presently there are two producing leases covering 5,100 acres, and an additional lease of 2,555 acres is considered "held in production" on BLM-managed land. Since December 1988, the Minerals Management Service has collected approximately $50 million in royalty, with 50 percent going to the state.

Roughly 30,000 tons per year of pumice are produced from the Coso Mountains in Inyo County.

Aggregates: Sand and gravel and other aggregates are produced at a number of locations within the planning area from alluvial fans and other sedimentary deposits. Commercial deposits, however, are limited by transportation costs and, therefore, are usually located near market areas. These commodities are used primarily for ongoing major highway construction and repair and as aggregate for concrete in urban areas.

Service Rock Products (previously Owl) has produced sand and gravel from the Barstow pit on private land since the 1960s. The Crystal Creek drainage in Lucerne Valley has been mined for sand and gravel as early as the 1950s. The current operator is Hi-Grade Materials. The aggregate resources in this area have an average thickness of 225 feet based on mining in this area (Miller, 1993, p.39). Production in the Little Rock Creek deposit (near Palmdale and Lancaster) began in 1941 (Joseph et al., 1987, p.10) with several operators in production by the 1950s (Evans, et al, 1979, p.17). The pit in Twentynine Palms off of Mojave Road has been operating since the early 1950s by Hi-Desert Concrete Products, now owned by Granite Construction. Channel Basin & Reclamation is opening the Cushenbury pit in Lucerne Valley with a production capacity of a million tons per year (Heter, 2002). The Opah Ditch site, in the Soda Mountains southwest of Baker, has been used in the past and will undoubtedly furnish aggregate for paving jobs along Interstate 15 in San Bernardino County. About 10,000 tons per year of sand and gravel are produced from BLM lands in Inyo and Kern County. Crushed stone sales in the Barstow area for roofing and landscaping rock are estimated to range from 40,000 to 50,000 tons per year. Flagstone production from public land in Rand Mountain is estimated at around 15,000 tons per year.

A summary of the most important deposits in the planning area, listed by county, is presented in Table 3-50.

Table 3-50
Most Important Deposits By County
Ranked In Order Of Relative Contribution

COUNTY	COMMODITY	ESTIMATED ANNUAL PRODUCTION/ RESOURCES*	HCA N/A = OUT OF HCA
San Bernardino	Borates[1]	130,000 tons	N/A
	Sodium Minerals[2]	1,662,000 tons	N/A
	Portland Cement[3]	4,500,000 tons	N/A
	(mostly limestone)	___	___
	(Victor Valley & Oro Grande)	___	___
	Sand & Gravel[4]	9,800,000 tons	N/A
	Sand & Gravel[5]	Confidential	N/A
	Crushed Stone[6]	24,000 tons	Sup.-Cron, Fre.-Kramer
	Crushed Stone[7]	480,000 tons	N/A
	Hectorite clay	Confidential	N/A
Kern	Borates[8]	3,300,000 tons	N/A
	Gold[9]	80,000 ounces	N/A
	Portland Cement[10] (mostly limestone)	1,200,000 tons	N/A
	Flagstone (BLM)[11]	15,000 tons	Fremont-Kramer DWMA
Inyo	Geothermal[12]	76 megawatts	N/A
	Pumice[13]	30,000 tons	MGS
	Black Springs Clay[14]	2,500 tons	MGS
Los Angeles	Sand & Gravel[15]	13,000,000 tons	N/A
Riverside	Yttrium (undeveloped)[16]	*330,000 tons	Pinto Mtns. DWMA
	Additional rare-earth oxides (undeveloped)	*1.2 million tons: oxides	

[1]"Borates" from BLM leases at Searles Lake includes a variety of compounds and products such as borax & boric acid. Production figures from Kathleen Cox, BLM Geologist, Ridgecrest F.O. Production from the Ft. Cady project near Hector site is unknown.

[2]"Sodium Minerals" from BLM leases at Searles Lake includes sodium sulfate, soda ash and salt. Production figures from Kathleen Cox, BLM Geologist, Ridgecrest F.O.

[3]Production figure for Portland cement is a rough estimate based on estimates of the production capacity for the three plants on private land at Black Mountain, Victorville, and Oro Grande. The Mitsubishi plant is omitted because it is outside of the WEMO planning area.

[4]Production estimate for private lands in the district including Barstow, Victorville, Oro Grande and Lucerne Valley takes into account imports from Lytle Creek; source: Miller, R.B., 1994, Mineral land classification of concrete aggregate resources in the Barstow-Victorville area: California Geology, v. 47, no. 1, p. 8, published by Calif. Div. of Mines and Geology.

[5]Sand and gravel has been produced since about 1955 from a pit in Twentynine Palms originally owned by Hi-Desert Concrete Products and currently owned by Granite Construction.

[6]This figure is a rough estimate for production of decorative rock from three quarries near Lead Mountain (BLM, northeast of Barstow), Afton (BLM, nearly 40 miles northeast of Barstow), and the Shadow Mountains (patented, northwest of Adelanto).

[7]Production represents an estimate for the composite of four quarries for decorative stone near Barstow, a quarry off of Hodge road and southeast of I-15, and a larger quarry for railroad ballast in the Newberry Mountains (400,000 tons), all on private land.

[8]The production rate was converted to short tons from the stated 3,000,000 metric tons of raw ore per day from four zones mined by open pit on patented land at Boron (Lyday, P.A., 2001, Boron: U.S. Geological Survey, Minerals Yearbook 2001, p. 13.2). The amount of borate compounds produced was reported to be 570,000 metric tons, equivalent to 628,000 short tons for the year 2000.

[9]This gold production figure is a very rough estimate for the Rand mine (BLM land) furnished by Randy Porter, BLM Geologist, Ridgecrest F.O.

This estimate compares with a figure of 100,000 ounces for the year 2000 stated by the Glamis Rand Mining Co. on their web site: www.glamis.com.

[10]The production figure is based on a rough estimate for the production capacity of the Creal cement plant located on private land 9 miles west of Mojave. The California Portland Cement plant is owned by Taiheiyo Cement and is the fourth largest in California.

[11]Production figure for Rand Mountain schist (flagstone on BLM land) furnished by Randy Porter, BLM Geologist, Ridgecrest F.O.

[12]Production of 76 MW off of BLM leases: Sifford, A. & Bloomquist, R.G., 2000, Geothermal electric power production in the United States: a survey and update for 1995-1999, proceedings World Geothermal Congress 2000, Fig. 8, p. 448.

[13]Estimate of production from BLM land from Randy Porter, BLM Geologist, Ridgecrest F.O.

[14]Estimate of bentonite production is from George Diverse, BLM Geologist, Ridgecrest F.O. The bentonite is trucked 220 miles to Riverside County where it is used for making roofing tiles.

[15]Estimate of production from several companies operating in Little Rock Creek for 2002-2006 (mostly private land): Joseph, S.E. et al., 1987, Mineral land classification of the greater Los Angeles area, Calif. Div. of Mines and Geology, Special Report 143, Part V, p. 25.

[16]Estimate of resources on BLM land (no production): Moyle, R.R. and Cather, E.E., 1992, Mineral classification in the California Desert Conservation Area, Open File Report 62-92, prepared to illustrate the variety of potential impacts which could occur should the California Desert Act or similar legislation become law, U.S. Bureau of Mines, Western Field Operations Center, Spokane, WA, p. 57.

3.4.3.5 Coolgardie Mesa

The Coolgardie mining district, about 15 miles northwest of Barstow, is within the proposed Superior-Cronese tortoise DWMA and overlaps with the west portion of the proposed Lane Mountain Milkvetch Conservation Area. This part of the CDCA is managed for mining activity under Multiple Use Class L (limited). Gasoline or hand-powered dry washing or sluicing has been done intermittently in this area since 1900 and the total historical output was reported by Clarke (1970, p. 157) to be $100,000. The deposits are in a broad valley and the gold is found as mostly tiny particles in the upper few feet of alluvial cover.

Although the heaviest concentration of mining claims lies to the west, there are twenty-two mining claims within the Coolgardie Mesa portion of the proposed Lane Mountain Milkvetch Conservation Area (see Table 3-51):

Table 3-51
Lane Mountain Milkvetch Conservation Area Mining Claims

TOWNSHIP	RANGE	SECTION	CAMC NUMBER	CLAIM NAME
11N	01W	03	178797	Lane View
			264175	Sheepe-Sheepe
			274362	New Century I
			274363	New Century II
			274364	Millenium I
			274365	Millenium II
			274366	Millenium III
			274367	Millenium IV
12N	01W	31	065897	Rams Head #1
			065898	Rams Head #2
			065899	Rams Head #3
			065900	Rams Head #4
		32	279094	Malek F.L.P.
32S	46E	34	119639	Two Quartz #1
			119640	Two Quartz #2
			119641	Two Quartz #3
			270500	J ZERO 1
			272481	PETE
			272711	3 WITHCES
			280425	3 WITCHES
32S	47E	32	266188	RQ#5
		33	270373	Rocky Dog

There are a few very old-pits scattered throughout the area. The vast majority of these pits have been filled with sand, and vegetation is growing in the disturbed areas. There are a few buildings left at the Kinney camp, half a mile west of the proposed conservation area.

Members of at least four recreational prospecting and mining clubs frequent the area. The larger clubs may have a membership of 400 families. Most of these individuals are operating under casual use and may continue to do so as long as they reclaim their hand-dug pits and the cumulative disturbance does not cause more than “negligible” disturbance. Club members police themselves so as to not to cause unnecessary or undue degradation. One person lives at the site in a trailer and is operating under a plan of operations. Club activities are discussed in more detail in Appendix P.

3.4.3.6 Reclamation and Restoration Procedures

Reclamation: This includes all activities associated with rehabilitating disturbed areas and generally returning it to a second, best productive use. In regulations under 43 CFR 3809.5, reclamation means taking measures required by this subpart following disturbance of public land caused by operations to meet applicable performance standards and achieve conditions required by BLM at the conclusion of operations.

Reclamation includes those activities associated with recontouring waste piles, reshaping pit walls and other excavations, removal of permanent or temporary facilities or structures, soil placement, soil preparation, and in some cases, reseeding and revegetation. Reclamation may also include measures to enhance previously disturbed areas or modify areas to conditions that previously existed. Habitat restoration may be required. This normally entails inventory and consideration of the desired plant community, as well as development of measures and time frames to assure recovery.

Operations under reclamation may utilize the same equipment to affect the reclamation requirements specified in the plan of operations where dirt work is needed, especially for the small level of operations examined under this assessment. Timeframes for completion of reclamation are considerably shorter than the length of time to create the disturbance. However, monitoring to assure complete reclamation or restoration may take many years, and access to the site as well as maintenance of facilities associated with reclamation maintenance (e.g., watering systems, water sampling sites/wells) are required to be in place during the period.

Restoration: This generally means to return the disturbed area to a condition that existed prior to surface disturbing activities. Elements typically include recontouring the surface to a pre-existing or natural shape, revegetation or the ability to revegetate with species native to the area. It may include placement of vegetation in the same locations that existed prior to conduct of operations, and re-channeling stream drainages to pre-existing locations and conditions.

3.4.3.7 State Designated Regionally Significant Construction Aggregate Resources

SMARA identifes a program for the classification and designation of regionally significant construction aggregate resources. When an area of the state is classified, the State Geologist transmits a classification report to the State Mining and Geology Board (SMGB) and to the lead agency (e.g the county where the lands identified are located). After receiving this classification information, the SMGB may designate specific geographic areas of the State as having "statewide or regional significance" for their mineral resources. Pub. Res. Code Section 2790. In designating an area, the SMGB takes into account "the adverse effects that might result from premature development of incompatible land uses, the advantages that might be achieved from extraction of minerals of the area, and the specific goals and policies to protect against the premature incompatible development of the area."

Areas designated as regionally significant are identified as "known to contain a deposit of minerals, the extraction of which is judged to be of prime importance in meeting future needs for minerals in a particular region of the state within which the minerals are located and which, if prematurely developed for alternative land uses, could result in the permanent loss of minerals that are of more than local significance." Pub. Res. Code Section 2726.

Varous lands throughout the planning area have been designated as a "Regionally Significant Construction Aggregate Resource Area" pursuant to the provisions of SMARA. The designation of these lands has been codified in the California Code of Regulations, at Title 14, Section 3550.9. The designation process included substantial environmental review, and included the participation of Federal, State and local agencies.

3.4.4 Recreation

Located only 90 minutes from downtown Los Angeles, the West Mojave is the recreational backyard of the metropolitan area's 17 million residents, of whom nearly 2 million participate in OHV activities and even greater number camp, hike or drive for pleasure. The Mojave Desert provides an easily accessible, uncrowded recreation experience. The many recreation opportunities of the West Mojave arise from the variety of its mountains, bajadas, dry lakes and badlands, the diversity and affluence of its visitors and the sheer volume of space that its landscape provides.

The types of recreation are highly varied. Due to its vastness, many visitors feel a greater freedom from regulations that encourages them to try new forms of recreation while not having to worry about bothering others. Given the scale of the desert and this sense of freedom, it is not surprising that many of the recreational activities center around vehicles, speed events or activities that require a great deal of acreage and separation from other visitors. These include motorcycle activities, four wheel drive exploring, sight seeing, target shooting, hunting, experimental vehicles/aircraft, model rocketry, and dry land wind sailing. Many other recreational pursuits that don't revolve around the recreational aspect of vehicle use are by necessity (due to the distances involved) dependent upon motorized vehicles. Examples of this include endurance equestrian rides and support vehicles, hiking, mountain biking, bird watching, botany, rockhounding, camping, and picnicking, for which vehicles are a means to access various destinations.

3.4.4.1 Patterns of Use

Although most recreational activities are widely dispersed, certaom activities have "hot spots" that have been established over time. How or why they were established varies from case to case, but may be due to the *features* (topography, geology) of the area, *proximity* to urban areas, the availability of *access* into the area, and *publicity*. Understanding recreation patterns and hot spots is critical to the design of an effective motorized vehicle access network.

Particular *features* or land-characteristics may make a given area highly desirable for a certain type (or types) of recreational activity. For instance, flat, expansive terrain is often desirable for recreational activities such as target shooting, plinking, driving for pleasure, and more quick-paced race events. On the other hand, mountainous terrain is often more conducive to such activities as rock (rope) climbing, rock hounding or technical four wheel rock crawling.

The relative *proximity* of the Mojave Desert to urban centers makes it easy and convenient for recreationists to visit those "hot spots" and other areas having the features that they desire. About 85% of all visitors to the Mojave Desert are from the urban areas of Southern California. The BLM public lands are closer to the Los Angeles basin than most other similar recreation areas, such as Death Valley National Park, and offer a far wider variety of recreational experiences.

Motorized vehicle *access*, or at least the degree of access, into areas affects the desirability of that area depending upon the nature of the recreational activity. Access is itself a feature or characteristic that may or may not be sought. For example, a recreationist hoping to photograph or film particular wildlife undisturbed in its natural habitat would not want access so convenient that it attracts a large number of other visitors. Recreationists seeking to hike and camp in remote, difficult to reach areas to experience solitude would not find a location that has ready access from a major highway to be desirable. Conversely, a recreationist seeking to ride his dune buggy over sand dunes with groups of other people would appreciate easy access.

Publicity about an area's recreational opportunity often attracts users. Although some of this publicity can come through the mainstream news media (newspapers, television news reports), much of it comes by "word of mouth." A recreation club (motorcycle riding club, four wheel drive club, dune buggy club, hiking and camping club, equestrian endurance riding club, rock hounding club, rock climbing club, photography club, or wildlife viewing club) may send out newsletters to its members identifying areas that have those features that are considered ideal for the type of recreational activity that the club engages in. This promotes discussion among club members about those areas, and encourages them to recreate there. Recreation clubs are often drawn to hot spots where people participating in that particular type of recreation can gather and socialize.

Publicity is not limited to recreational clubs. Individuals share their experiences with each other through "word of mouth." A camper may learn of an excellent campsite that possesses desirable features or characteristics. Through one-on-one conversations between different campers, such an area can become a "hot spot."

Guidebooks and maps publicize favorite recreation sites. Guidebooks are available that describe areas in the Mojave Desert that offer significant rockhounding and gem collecting opportunities. These guidebooks typically describe the areas of interest in sufficient detail to lead recreationists to the most promising regions for the activity. Maps published by the American Automobile Association are particularly popular, for they indicate areas where different types of recreational activities occur. Because they are widely distributed, areas highlighted on these maps can receive a great deal of notoriety.

Recreationists engage in activities that make use of more than one type of feature or terrain, and often desire to travel to locations where multiple types of terrain are readily available or that are relatively close to other areas having different terrain. In dual sport motorcycle touring, for instance, recreationists use motorcycles that are licensed for use on regular streets and highways but are capable of off-road travel. Recreationists engaged in such touring can ride to the desert on major highways, and then go off-road once a desired trail or special recreation opportunity has been reached. Since a motorcycle is being used, the recreationist can fit through tight spaces that a larger vehicle, even one with four-wheel drive, is unable to access.

The four-wheel drive vehicles have their attractions as well. A single four wheel drive SUV can accommodate more people and items than can a dual sport motorcycle, and can switch from regular highway travel to off-road touring without missing a beat. A trend among some recreationists is to alternate between areas having very different features since the use of their vehicles grants them such access opportunities. This affords the recreationist a much broader range of activities at any given time.

Table 3-52 presents a summary of recreation uses throughout the West Mojave. It describes the primary destinations and recreational activities that occur at particular geographic locations within the planning area. Detailed tables presenting visitor use levels at popular sites throughout the West Mojave are presented in Appendix T.

Table 3-52
Summary of Recreational Activities in the West Mojave Planning Area

AREA	LOCATION	PRIMARY DESTINATIONS AND RECREATIONAL ACTIVITIES
North El Paso	West of Ridgecrest & north of the EL Paso sub region.	This area is dispersed BLM ownership with an approximate size of 60 square miles. The area provides access from Ridgecrest to the El Paso Wilderness and the El Paso sub region.
Panamint Valley	Between North Searles and the Manly Peak Wilderness.	The Panamint Valley BLM area is solid ownership with an approximate size of 180 square miles and serves as access to North Searles sub region, Manly Peak Wilderness and Death Valley National Park.
Central Searles	Between North and South Searles and surrounding the town of Trona.	Central Searles is lightly dispersed BLM ownership comprising about 60 square miles and offering mining opportunities and access to North and South Searles sub regions.
East Fremont	West of US 395, north of Edwards Air Force Base and east of California City.	East Fremont BLM area is greatly dispersed BLM ownership with an approximate size of 200 square miles. The area offers desert exploring, rock hounding and mining opportunity in close proximity to California City.
West El Mirage	West of El Mirage sub region and west of El Mirage OHV Recreation Area.	West El Mirage is greatly dispersed BLM ownership with an approximate size of 100 square miles. The area offers access to OHV touring and El Mirage Dry Lake.
South Kramer	Between Kramer sub region and Highway 15, just north of Victorville.	Moderately dispersed BLM ownership with an approximate size of 120 square miles. The area offers OHV touring, exploring, mining opportunity and access to Stoddard Valley OHV Area.
South New-berry/ Rodman	South of the Rodman Mountains Wilderness and on the north edge of the Johnson Valley OHV Area.	This is a consolidated BLM ownership of approximately 8 square miles. The east boundary fronts a transmission line corridor offering OHV touring. Also the area offers access to the Rodman Mountains Wilderness and the Johnson Valley OHV Area.

AREA	LOCATION	PRIMARY DESTINATIONS AND RECREATIONAL ACTIVITIES
Johnson Valley South	South of Johnson Valley OHV Area and North of Bighorn sub region.	Johnson Valley South is moderately consolidated BLM ownership of approximately 50 square miles in size, mixed with State Lands and private lands. The area offers access to Johnson Valley OHV Area and the BLM Bighorn sub region and Soggy Lake & Creosote Rings Special Management Areas.
Copper Mountain	North of Joshua Tree National Park and northwest of the City of Twentynine Palms.	The Copper Mountain area is a greatly dispersed BLM ownership of about 100 square miles. The Twentynine Palms Marine Base bounds the area on the north, and Joshua Tree National Monument forms the south border. The area offers OHV touring and dual sport activity.
West Cleghorn	West of the Cleghorn Lakes Wilderness and bounded by Twentynine Palms Marine Base to the north and west.	The West Cleghorn area is a 30 square mile area of consolidated BLM ownership offering access to the Cleghorn Lakes Wilderness.
North Pinto	North of the BLM Pinto sub region and south of the Cleghorn Lakes Wilderness.	The North Pinto is a moderately consolidated BLM area approximately 60 square miles in size, offering OHV touring, mining and rock hounding.
South Coyote	About 30 miles east of Barstow, south of Afton Canyon Natural Area and north of the Sleeping Beauty sub region.	The South Coyote BLM area is a checkerboard ownership and is comprised of about 250 square miles. The Cady Mountains are located in the center of the area. The area serves as access to the Kelso Dunes Wilderness and Afton Canyon Natural Area and Sleeping Beauty sub region.
East Avawatz	About 12 miles north of the City of Baker on Highway 15. Wilderness Study Areas, which surround this area are the Soda Mountains to the south and Avawatz to the west.	The East Avawatz BLM area is about 100 square miles in size and is largely consolidated ownership offering access to Wilderness Study Areas. OHV touring and mining opportunities are available in the area.

BLM's CDCA Plan has designated several areas within the West Mojave as "Open Areas." Within open areas, unlike limited vehicle access areas, there is no "route designation." Motorized vehicles may travel anywhere, so long as the vehicle is operated responsibly in accordance with regulations, and subject to the permission of private landowners.

The OHV Open Areas receive high levels of dispersed OHV riding. Many repetitive OHV routes have been created in these areas that riders generally follow. In areas where the use is particularly concentrated, the density of routes can be very high. Table 3-53 briefly describes each open area, visitor use levels and the principal recreation activities that occur there.

Table 3-53
Characteristics of BLM Open Areas

OPEN AREA	SIZE ACRES	VISITS	VISITOR DAYS	PRINCIPAL RECREATION ACTIVITIES	OHV USE PATTERNS
Dove Springs	3,840	82,000	Not Available	Motorcycle hill climbing, ATV/Quads, rails; camping, shooting and hunting.	The entire Dove Springs open area is used for camping and OHV driving. OHV driving centers on riding up and down the hillsides using all types of OHVs.
El Mirage	25,600	253,374	391,075	Unrestricted OHV recreation. Approximately 50% of the activity is not classival OHV activity (i.e. motorcycles, quads, jeeps). The dry lakebed attracts visitors with experimental vehicles, aircraft, land wind-sailors, etc. The predominant OHV activity is motorcycle use.	Most of the visitor use is concentrated on and around the dry lakebed. Significant motorcycle use takes place away from the lakebed towards the mountains to the northwest. Visitors generally stay on long-established pre-existing routes. Permitted events, sightseeing, camping, and dispersed camping occurs in the area.
Jawbone Canyon		60,000	Not Available	Predominantly dirtbike motorcycle use engaging in hill climbing activities, as well as dual sport motorcycle and 4WD touring/sightseeing	Camping areas are oncentrated along three miles of the Jawbone Canyon Road. OHV users enjoy the challenge of riding up and down hillsides throughout the canyon. The steepness of the hillsides that the riders use varies from moderate to extremely steep.
Johnson Valley	188,160	Not Available	Not Available	Unrestricted OHV recreation. Predominantly dirt bike motorcycle use, as well as dual sport motorcycle and 4WD touring/sightseeing. Permitted events, camping, and dispersed camping occur in the area.	Primarily "Green Sticker" motorcycle use participating in "trail riding". Approximately 50% of the Open area's total use occurs in this area. Approximately 50% of that use takes place in the form of permitted "organized" events (e.g. races).
Rasor	22,400	23,702	36,357	Unrestricted OHV recreation. Predominantly dirt bike motorcycle use, as well as dual sport motorcycle and 4WD touring/sightseeing. Camping, dispersed camping, and sightseeing occur in the area.	Dispersed OHV use
Spangler Hills	62,080	Not Available	Not Available	Predominantly dirtbike motorcycle use, as well as dual sport motorcycle and 4WD touring/sightseeing on gentle rolling desert terrain.	The area provides many OHV routes through open, gentle desert terrain.. There are some more challenging routes through hills along the sides of

OPEN AREA	SIZE ACRES	VISITS	VISITOR DAYS	PRINCIPAL RECREATION ACTIVITIES	OHV USE PATTERNS
				Organized competitive events.	the open area. Three popular camping areas are Teagle Wash, Wagon Wheel and east of US-395.
Stoddard Valley	54,400	Not Available	Not Available	Unrestricted OHV recreation. Predominantly dirt bike motorcycle use, as well as dual sport motorcycle and 4WD touring/sightseeing. Permitted events, camping, and dispersed camping occur in the area.	OHV use is widely dispersed. Approximately 50% of the use is estimated to be associated with permitted events (e.g. MC, rails, jeeps). Heaviest use at staging areas. Visitors tend to stay on pre-existing routes as the terrain becomes rougher and as they travel away from the staging areas.

3.4.4.2 Trends

California's population is increasing rapidly. The State's population is projected to grow from 34 millon in 2000 to 46 million by 2020. The population of the planning area is projected to grow from 795,000 in 2000 to more than 1.5 million people by 2035.

California has the greatest number of off-highway vehicle recreation enthusiasts in the country[32]. Its 3.5 million recreationists constitute 14.2% of all California households. Since 1980, however, the number of acres available to OHVs for recreation has decreased 48 percent in California's deserts alone (from 13.5 million acres in 1980 to 7 million acres in 2000). At the same time, off-highway vehicle "green sticker" registrations have increased by 108%. Attendance at the State of California's State Vehicular Recreation Areas (SVRAs) increased from 1985 to 2000 by 52%.

OHV Vehicle Trends: Californians have embraced the sport utility vehicle (SUV). As SUV sales increase, the demand for off-highway opportunities for SUV owners is also on the rise. Simultaneously, there have been notable declines in motorcycle sales in California with steady increases in ATV and SUV sales. As a consequence, there appears to be a trend toward wider trails for larger off-highway vehicles (i.e., SUVs) as opposed to single-track trails used for motorcycling.

While the demand for OHV recreational opportunities is increasing along with California's growing population, OHV opportunities are decreasing. The increase in California's population has caused significant increases in urban development. Encroachment by cities threatens many rural OHV recreation areas. As more species are listed as threatened or endangered, sensitive habitats have been closed to OHV access. Air pollution controls imposed by the California Air Resources Board's Red Sticker Program have restricted the use of two-

32 OHV recreation contributes more than $3 billion to California's economy annually. OHV recreation generates roughly $1.6 billion in personal income and affects about 43,000 jobs within California.

cycle engine motorcycles in OHV riding areas to a limited number of months in the year instead of year-round.

Access for Disabled and the Elderly: OHVs allow disabled and elderly people to visit areas that are not otherwise available to them. In 1994, surveys were conducted at the Oceano Dunes SVRA. This survey revealed that approximately 9% of all those surveyed had within their group a disabled individual who was able to access the dunes and beach because vehicles were allowed in those areas. Increasing numbers of senior citizens will want to experience remote outdoor areas via OHV access. As the baby-boomer population continues to age, they would find it increasingly difficult to access these areas without the use of off-highway vehicles.

Behavioral Trends: With expanded leisure time and growing affluence of Southern Californians, conflicts have arisen between those who use vehicles as a means of access and those who operate vehicles as a recreational activity. Access can be for a variety of purposes, including economic pursuits and for recreation such as hunting and rockhounding. In addition, recreationists compete for space with other resource users. While strongly advocating that recreational facilities and regulations remain minimal, desert recreationists increasingly demand the protection of the natural and cultural values that are essential to most desert recreation. The public often cites scenic values as the Desert's most important resource.

"Tread Lightly!" is a national land-use ethics program designed to educate the public on using but not abusing the environment. This program has educated many OHV users on being respectful and responsible land users. As a result of such educational efforts, attitudes within many communities have improved on responsible OHV use.

A program called "Off-Road Pals," sponsored by the OHMVR Division and various law-enforcement agencies around California, has reached out to troubled youths, teaching them respect for the environment and for other people, while learning how to maintain and ride OHVs. This program has thus far provided more than 1,500 youths with positive and life-changing experiences. Such programs help to reduce juvenile delinquency and improve the lives of formerly at-risk youths.

Many OHV enthusiasts have donated their time to projects combating erosion, replanting recently burned forests, trash collection, renovating trails to improve rider safety, patrolling of OHV areas, and more. Such volunteerism indicates that most OHV enthusiasts care about the environment and are responsible in their use of off-highway vehicle areas.

Technological Improvements: OHV manufacturers have made huge strides in improving their vehicles to minimize excessive noise. Since 1990, noise levels from motorcycle dirt bikes have decreased from 96 to 88 decibels. Noise reduction can also be accomplished by utilizing specific design and construction techniques in OHV areas, through careful trail planning and construction of berms to impede or dissipate sound. Further technological innovations are being made to reduce noise, and air, pollution.

3.4.4.3 Off-Highway Vehicle Use

Users of off-highway vehicles engage in many different types of recreation in the Mojave Desert. These can be categorized into two general groups: (1) Where the driving of the vehicle is itself the recreational activity, and (2) Where the vehicle is a means of access to other forms of recreation.

3.4.4.3.1 Driving OHVs for Recreation

There are various types of OHV recreation. These include general vehicular touring, motorcycle recreation, and ATV and four-wheel-drive use.

General Vehicular Touring: Many people engage in recreational touring. Such touring allows visitors to see vast areas of the desert while spending less time on the land itself. OHV touring may occur on both flat and mountainous terrain using jeeps and similar vehicles.

OHV touring vehicles such as the popular SUV have four-wheel-drive (4WD) capabilities to handle off-road work and are designed to be comfortable for normal street usage. They do not have to be towed by another vehicle to particular staging areas; rather, they can be driven on the highway and, when opportunity presents itself, they can follow a dirt trail. Vehicles that have 4WD capability have a broader range of access opportunities since they can traverse different types of terrain features.

In the mid-1980s, off-road enthusiasts, and state and local government agencies collaborated to provide a system of interconnected roads and "jeep" trails. Today, over 600 miles of trails have been designated by the State of California as "Back Country Discovery Trails". A goal of this trail system is to provide a backcountry opportunity for non-traditional trail users such as persons with disabilities, senior citizens and families with small children.

The California Backcountry Discovery Trail system is one of shared-use. Equestrians, hikers, and cyclists are welcome, although the trail system is designed for off-road enthusiasts. The existing roads that make up the "principle route" network were selected with a stock, sport utility vehicle in mind. The CBDT network provides recreationists with an abundance of OHV touring opportunities. "Alternate trails" departing and later rejoining the principle route provide more challenging experiences, and are open to greensticker vehicles.

Motorcycle Recreation: Many desert recreationists engage in motorcycling and motorcycle events. In most (but not all) cases, the motorcycles, equipment and supplies have to be transported to the desired locations by street-legal vehicles, such as SUVs.

There are many popular motorcycle events, including enduros, hare n' hound, hare scramble, European scramble, and the grand prix. These events allow participants to ride in varying types of terrain, which present different challenges and require varying degrees of skill. Table 3-54 presents a descriptive summary of motorcycle events.

One popular activity is dual sport motorcycling. Dual sport motorcycles are designed to perform off-road, and they are also "street legal" for operation on paved roads. Therefore, the use of a street-legal vehicle to transport the bike is not necessary. A person using this type of motorcycle can enjoy riding on the highway, and then go off-road when the desired trail is reached. The dual sport motorcycle gives the rider a broader and more flexible recreational experience[33].

Table 3-54
Types of Motorcycle Events

NAME	TYPE OF START	SPEED EVENT YES/NO	COMMENTS
Grand Prix	Staggered	Y	The course is ten miles, and speed is important
European Scramble	Mass	Y	The race course is ten miles, using a mass start by class
Hare Scramble	Mass	Y	The race course is a 30 mile loop repeated for stronger riders
Hare & Hound	Mass	Y	The racecourse is two thirty-mile loops configured as a figure 8, not repeating the same track in the second loop. The second loop continues with only half the riders, and riders are spread out to such an extent that the second loop can be in a DWMA.
Enduro	Staggered	N	This is a time-controlled event, and speeds can be slowed through sensitive areas. Riders loose two points for every minute they are early to the finish and one point for every minute they are over the specified course time.
Dual Sport Ride	NA	NA	This is a tour event and portions of the ride can be on paved route as well as travel off road. The participant numbers can be limited to 50 to 100 entrants and speeds can be limited as well.

Each year there are a few commercial tours and dual sport rides on public land. These activities generally use well-defined public land vehicle routes. These tours typically involve motorcycle and 4-WD sightseeing and exploration tours. There are generally two types of commercial tour events: guided and unguided (self-guided):

- *Guided Tours:* A typical guided tour operator might lead two to three tours each year, with participants following a trail leader. The group stops together several times during the day to see and learn about various natural and man made features. The trip leader is generally an expert on the particular area, and is able to relay information pertaining to natural and historic resources to participants.

- *Unguided Tours (including Dual Sport Events):* Dual Sport Events, those events designed for street legal motorcycles capable of off highway travel, are the best example

33 The use of SUVs to transport dual sport bikes to motorcycle parks, other staging areas, or trailheads may still be the desired method of access. This is due largely to the distance that such recreationists travel, and the bulk of equipment and supplies that are often needed. An SUV allows for safe storage of equipment at the staging area.

of unguided tours. In these events, participants are given a map and "Roll Chart" that depict the tour route turn by turn. There is no element of competition so participants may arrive at the final destination at their convenience. Often "bail out" opportunities are identified so that participants can safely leave the off highway portion of the route to return to paved roads and the final destination on their own.

All Terrain and "Technical" Four Wheel Drive Recreation: ATVs are small motor vehicles with wheels or tractor treads for traveling over rough ground. They often have four-wheel-drive capability. ATVs are often viewed as being more agile than other four-wheel drive vehicles and can access narrower routes since they are relatively small and handle like motorcycles. ATVs, however, are only allowed to accommodate one person. ATVs are generally not appropriate for dual sport activities, since they are not legal on public highways.

Typical four-wheel-drive vehicles (SUVs and jeeps) have fairly similar capabilities, including the capability to travel off-road on rocky terrain. They are significantly larger than ATVs, as they can accommodate several passengers, supplies and equipment. Four-wheel-drive vehicles such as SUVs and jeeps often have "dual sport" capabilities and perform efficiently both on regular streets, roads, and highways, as well as off-road. SUVs are generally used to traverse relatively flat, yet rough, terrain, while jeeps with their narrower and shorter wheelbase are more capable of negotiating rougher terrain tnan a typical stock SUV.

Technical four-wheel-drive vehicles constitute a class of vehicle that includes jeeps, trucks and SUVs that have been significantly modified from their "stock" condition. Through the addition of specialty tires, transmissions, engines and suspensions these vehicles are less functional in open-highway situations, but very effective in traversing otherwise impassible routes (e.g. large boulders). "Rock-crawling" is an example of an activity that utilizes vehicles of this class. Travel is typically very slow (i.e. less than 5 mph) over and around rocks, in contrast to SUV and even jeep touring. Enthusiasts must possess a high level of technical "four-wheeling" skill. They may even employ the use of power winches to pull the vehicle over the more difficult rock formations. The challenge in technical four-wheel-drive use is to apply one's skills to cross the rocks, rather than tour large regions.

Competitive Events: The BLM Ridgecrest Field Office permits about 30 competitive events annually. These include about 20 OHV events and 10 dual sport, equestrian, mountain biking and running events. There are 50 miles of "C" (i.e. competition) routes established adjacent to the Spangler OHV Area. The use of these routes for competitive events was discontinued in 2001.

The BLM Barstow Field Office permits about 60 competitive events annually. These include about 50 OHV events and 10 dual sport, in addition to other events. Most of these events occur in the Stoddard and Johnson Valley Open Areas. The best known among these events are the Barstow to Vegas and Johnson Valley to Parker motorcycle races, neither of which has been run in over a decade.

Compliance With Regulations: Compliance has generally become better with implementation of the CDCA plan. With the exception of a few areas, OHV free play has gradually moved to the OHV open areas. Compliance is worst in areas of historic OHV use and adjacent to local communities. Compliance appears to be best achieved when a pro-active approach to vehicle management is used, including the identification of outstanding recreation opportunities to direct recreationists to, such as through quality signing and mapping to help visitors locate appropriate opportunities, as well as through enforcement and additional education efforts.

The best program for achieving compliance in designated route areas involves:

- Keeping open routes well signed.
- Revegetating and otherwise rehabilitating closed routes so that they are not apparent or easy to use.
- Maintain a field presence of BLM personnel to contact, inform visitors, and enforce the law.
- Establishing BLM-trained and supervised volunteer groups who can assist in keeping the routes signed and who can contact visitors in order to explain applicable use policies.

Once vehicle routes have been designed, they need to be maintained as a way of keeping users on those open routes. If open routes become too difficult to travel, recreational visitors would be more likely to utilize closed routes.

3.4.4.3.2 Driving OHVs to Access Other Recreation

Many visitors use the vehicle as a means to attain a recreation end, rather than as the end itself. These recreation types fall into two classes: (a) point and (b) dispersed forms of recreation.

Point Forms of Recreation: Often an OHV is driven to a specific destination such as a trailhead, staging area, or campsite. For instance, equestrians use an OHV to tow horse trailers and other equipment to designated staging areas where they can set up for horseback riding. The recreational activity is not the driving of the OHV itself; it is merely used to access the staging area for the equestrian ride. Similarly, hikers may use an OHV to travel to a trailhead; once there, the recreationist would then begin their hike.

Dispersed Forms of Recreation: This form of recreation is more dependent upon vehicle use than point forms, but the use of the vehicle is still not viewed as the primary source of recreation. For instance, a recreationist who desires to photograph a particular species of wildlife or wildflower may hike, ride a horse or use an OHV to search for a subject. Driving a vehicle is not the primary recreation; photography is. Because there is no specific destination, this form of recreation is referred to as “dispersed” rather than “point.”

3.4.4.4 Economic Contribution of OHV Recreation

Off highway vehicle recreationists, whether they use OHVs as a means to access other forms of recreation, or find recreation opportunities in the driving of the OHV itself, will contribute to the local economies of the planning area in a variety of ways. These depend on the level of use in areas surrounding desert towns, and the future significance of that contribution depends on the nature of ongoing recreation use trends. Table 3-55 addresses the various ways by which recreation contributes dollars to local economies.

Table 3-55
Recreation Economic Contribution

REGION OR CITY	PRINCIPAL RECREATIONAL ACTIVITIES ON ADJOINING PUBLIC LANDS	OHV USE IN NEARBY AREAS	SOURCES OF ECONOMIC CONTRIBUTION	TRENDS IN GROWTH	COMMENTS
Inyo County (Pearsonville Little Lake)	Commercial filming Motorcycle touring	Low	Fuel, food	Increasing as the LA Basin grows	Most visitors to the area will acquire supplies in larger communities further south
Kern County	Large range of vehicle dependent recreational activities	Cummala-tively High	Lodging, meals, supplies, vehicle repairs, fuel.	Increasing	Given the close proximity of this portion of Kern County to the LA Basin and that it serves as the "Gateway" to the Sierras and the Desert growth is high and is expected to increase.
California City	OHV touring in the Rand and El Paso mountains – off road motor cycle play	Moderate	Fuel, camping supplies, and food	Has been increasing with the growth of the LA Basin.	Visitors coming over the Tehachapi and headed to the Rands and El Paso mountains will likely stop in California City. In spite of recent closures in the Rands, the level of use outside of California City has not diminished. The closures have in fact increased demands on local law enforcement due to increased private property trespass.
Mojave	SUV touring, Off-Road Events for 4 X 4 and motorcycle and all desert play vehicles	High	Vehicle repairs and vehicle parts, fuel, camping supplies, motels, and food	Increasing significant-ly with growth in LA Basin and the increasing popularity of desert.	The Tehachapi pass carries a significant load of Recreation Traffic from the San Joaquin valley headed to the Mojave Region. Certainly any increase in recreation activity has a potential for economic gain for Mojave.

REGION OR CITY	PRINCIPAL RECREATIONAL ACTIVITIES ON ADJOINING PUBLIC LANDS	OHV USE IN NEARBY AREAS	SOURCES OF ECONOMIC CONTRIBUTION	TRENDS IN GROWTH	COMMENTS
Ridgecrest	SUV touring, organized OHV events, rock hounding, commercial filming	High	Vehicle repairs and parts, fuel, camping supplies, food, hotels	Increasing	Viewed as both a significant current and future source of economic revenues
San Bernardino County	Large range of vehicle dependent recreational activities	Cummala-tively High	Lodging, meals, supplies, vehicle repairs, fuel.	Increasing	Given the close proximity of this portion of San Bernardino County to the LA Basin and the "Inland Empire" and that it serves via I-15/US 395 as the "Gateway" to the Sierras and the Desert growth is high and is expected to increase.
Baker	SUV Touring, OHV Events, 4WD and motor cycle play, rock hounding, mining exploration	Low	Vehicle repairs and vehicle parts, fuel, camping supplies, motels, and food	Slight increase due to remoteness.	Baker is at the eastern edge of the study area and most users come out of the LA basin and the San Joaquin Valley. Therefore most recreation expenditures for the Mojave come from recreation users not going thru Baker.
Barstow	SUV Touring, OHV events, 4WD and motorcycle play, rock hounding, mining exploration	High	Vehicle repairs and vehicle parts, fuel, camping supplies, motels and food	Increasing	Barstow is at the heart of the Mojave Study Area with traffic coming in from LA via highway 15 and from the west via highway 58. An increase in recreation related expenditures could have a significant positive effect on Barstow.
Dagget	SUV touring, OHV Events, 4WD and motorcycle play, rock hound, mining exploration	Low	Fuel, and Food	Increasing Slightly	Dagget is located about 5 miles east of Barstow and majority of travelers will stock up in Barstow and only use Dagget for last minute supplies. Therefore a light increase in recreation activity will have a very slight economic impact to this small community.

REGION OR CITY	PRINCIPAL RECREATIONAL ACTIVITIES ON ADJOINING PUBLIC LANDS	OHV USE IN NEARBY AREAS	SOURCES OF ECONOMIC CONTRIBUTION	TRENDS IN GROWTH	COMMENTS
Lucerne Valley	SUV Touring, Desert exploring via 4WD and motor cycle, rock hounding, and mining exploration	Low	Fuel, camping supplies, and food	Slight increase; due to the fact that the area is somewhat “off the beaten path” the level of growth is less than other areas.	Lucerne Valley is located just north of the San Bernardino Mountains about 10 miles east of Apple Valley. The following BLM sub regions surround Lucerne Valley: Juniper, Granite, Ord, and Bighorn, also to the east is Johnson Valley Off-Highway Vehicle Recreation Area. Lucerne does not serve a large number of travelers.
Ludlow	SUV touring, OHV Events, 4WD and motorcycle play, rock hound, mining exploration	Low	Fuel, and Food	Increasing Slightly	Ludlow is located about 50 miles east of Barstow and majority of travelers will stock up in Barstow. Therefore a light increase in recreation activity will have a very slight economic impact to this small community.
Newberry Springs	SUV touring, OHV Events, 4WD and motorcycle play, rock hound, mining exploration	Low	Fuel, and Food	Increasing Slightly	Newberry Springs is located about 18 miles east of Barstow and majority of travelers will to their business in the bigger city. Therefore a light increase in recreation activity will have a very slight economic impact to this small community.
Trona	Commercial filming, motorcycle touring	Low	Fuel, food	Increasing as visitation increases to Death Valley NP	Although most visitors to the area get supplies in Ridgecrest, the future economic contribution to this economically depressed community is significant

REGION OR CITY	PRINCIPAL RECREATIONAL ACTIVITIES ON ADJOINING PUBLIC LANDS	OHV USE IN NEARBY AREAS	SOURCES OF ECONOMIC CONTRIBUTION	TRENDS IN GROWTH	COMMENTS
Victorville / Apple Valley	SUV Touring, OHV Event, 4WD and motorcycle play, rock hounding, mining exploration	High	Vehicle repairs and vehicle parts, fuel, camping supplies, lodging, food	Increasing	Victorville does receive a high volume of recreation traffic leaving the LA basin on Highway 15. It is close to The Stoddard Valley OHV Area, Johnson Valley OHV Area, and Granite, Ord, and Juniper BLM Sub Regions. Any increases in OHV recreation could result in significant monetary inputs into the local economy.
Yucca Valley	SUV touring, desert exploring via 4WD and motor cycle, rock hounding, and ming exploration	Low	Fuel, camping supplies and food	Slight increase; most of the recreation growth is to the northwest.	Yucca Valley is east of the San Bernardino Mountains, and south of the BLM sub region of Bighorn and north of the Morongo sub region. Yucca Valley not on major highway and relative to other cities not serve large volume of recreation traffic

Source: Advance Resource Solutions, Inc.

3.4.5 Circulation and Landfills

3.4.5.1 Circulation Element

3.4.5.1.1 Transportation Methods

Transportation methods in the West Mojave are not unlike those of other communities. The movement of humans and agricultural and industrial products in and out of the planning area is provided by a variety of systems associated with smaller urban centers and rural areas. The planning area serves as a major transportation corridor taking goods and people in and out of the Los Angeles and Kern County metropolitan areas. With the completion of the Alameda Corridor the movement of goods is expected to continue to increase. Relatively inexpensive housing and the rural lifestyle of the planning area make commuting into the more populated coastal area attractive for many residents. This trend is expected to continue with the large increase in population that is expected. The planning area has a number of different means of transportation and these systems have been developed to connect farm/industrial/commercial centers to cities, and cities to communities within the County and state, and in other states and other nations.

State System - California Department of Transportation (Caltrans): The State of California has established a series of state-constructed and maintained routes in accordance with the Street & Highway Code, Art. 3, Sec. 300 et.seq. State roadways in the planning area consist of Interstate freeways, freeways, expressways, highways and surface streets. For more than 100 years, Caltrans and its predecessors have been responsible for designing, building, operating and maintaining the California state highway system. Over time, as the population of California has increased, Caltrans' role has expanded to include rail and mass transit systems. In addition to a changing mix of transportation modes, such as highways, rail, mass transit and aeronautics, Caltrans professionals must consider the integration of various transit issues with land use, environmental standards and the formation of partnership between private industry and local, state and federal agencies.

Caltrans operates and maintains 15,000 miles of roadways included in the State Highway System, and is responsible for ensuring proper distribution of the State Transportation Improvement Program, including the application of $3 billion used for construction (1997).

Mass Transit: Mass transit and rapid transit systems in the planning area are limited to the more conventional modes, specifically bus. There are many sources of bus public transit within the plan area. The largest providers in the area include:

- *Victor Valley Transit Authority:* The Victor Valley Transit Authority (VVTA) serves the cities of Adelanto, Hesperia and Victorville; the Town of Apple Valley; and the unincorporated communities of Phelan, Wrightwood, Pinon Hills, and Helendale. This transit system carries more than a million passengers annually. Service includes standard bus operations, plus curb-to-curb service for disabled persons.

- *Morongo Basin Transit Authority:* The Morongo Basin Transit Authority transports nearly 143,000 passengers each year in the City of Twentynine Palms, Town of Yucca Valley and the unincorporated communities of Joshua Tree, Landers, Flamingo Heights, and Yucca Mesa.

- *Barstow Area Transport:* The City of Barstow administers the operation of the Barstow Area Transit, as well as two San Bernardino County-supported specialized services for seniors and persons with disabilities in the communities of Big River and Trona. The system carries more than 144,000 passengers each year.

- *Antelope Valley Transit Authority:* The Antelope Valley Transit Authority serves the Lancaster/Palmdale area. They provide a variety of services including local and commuter services. The transit system carries more than a million passengers annually.

- *Kern Regional Transit (KRT):* KRT operates a fleet of 30 vehicles ranging in size from 15 passenger paratransit minibuses to thirty-foot, heavy duty transit buses, with service in excess of 1.2 million miles. The Kern Regional Transit connects Taft, Frazier Park, Lancaster, Mojave, Wasco/Shafter, Delano, California City, Tehachapi, Ridgecrest, and Inyokern with Bakersfield and with a ridership of over 450,000 passengers.

Rail: The West Mojave planning area is a major rail corridor for bringing goods in and out of the Southern California ports and metropolitan area. The entire rail network is operated by the private sector with the Southern Pacific, the Burlington Northern – Santa Fe rail systems carrying freight through and beyond the boundaries of the planning area. With the completion of the Alameda Corridor rail traffic is expected to increase to even higher levels in the future.

Aviation: There are several airports operating in the planning area. These facilities provide opportunities for air traffic and the movement of goods. A wide variety of air flights come out of the region including small private plane operations, passenger flights and freight movement. In addition to the municipal and community airports, there are several military airfields located within the planning area.

Non-motorized Transportation: The climate in the West Mojave is well suited for bicycle travel at many times during the year. Bikeways exist in most cities and in some unincorporated portions of the planning area. Most bikeways exist as marked lanes on surface streets within the communities. Many of the more recently developed portions of the planning area provide for foot traffic along sidewalks in residential areas while some of the older subdivisions make no provisions for pedestrians. Generally speaking, foot traffic pathways between unincorporated communities are nonexistent.

Motor Vehicles: Automobile, truck, and motorcycle traffic can use the varied network of roads and highways developed by the State and County. This mode of transportation is by far the most used system in the planning area, with roadways under State, County, service area, and private entity control. In addition to the movement of goods by rail, the planning area is a major corridor for the movement of goods by truck, again connecting Southern California to the rest of the United States. Caltrans, the Counties of Inyo, Kern, Los Angeles and San Bernardino and each incorporated community manage motor vehicle systems in the planning area. The counties maintain many of the roadways within cities by contract.

3.4.5.1.2 West Mojave Planning Area Roads

The road system within the planning area is mostly composed of four classifications of roads: major highways, arterials, collectors and local streets. Design, construction and maintenance of the surface road system is the responsibility of each local jurisdiction's roads department or Caltrans.

The following road standards are left purposefully vague do to the numerous jurisdictions within the planning area. Specific road standards are available from each local jurisdiction.

Major Highways - There are many major roadways that connect this large plan area. Most of the roads are two to four lane roads with some expanding to eight lanes in the more urban section of the planning area. These roads are state and US routes and are maintained by Caltrans. These roadways include:

- State Route 14: This route is classed as a major conventional highway/freeway. It is a north-south route located in Los Angeles County.

- State Route 18: This route is classed as a major conventional highway. It is an east-west route located in the southern portion of the plan area in San Bernardino County, with a short section in Los Angeles County.

- State Route 58: This route is classed as a major conventional highway/freeway. It is an east-west route located in San Bernardino and Kern Counties. This highway has many four-lane sections along its alignment.

- State Route 62: This route is classed as a major conventional highway. It is an east-west route located in San Bernardino County.

- State Route 127: This route is classed as a conventional highway. It is a north-south route located in San Bernardino and Inyo Counties.

- State Route 138: This route is classed as a major conventional highway/expressway. It is an east-west route located in Los Angeles and San Bernardino Counties.

- State Route 178: This route is classed as a conventional highway. It is an east-west route located in Inyo, Kern and San Bernardino Counties. This Highway expands to four lanes through Ridgecrest in the plan area.

- State Route 190: This route is classified as a conventional highway. It is an east-west route located in Inyo County.

- State Route 202:This route is classed as a conventional highway. It is an east-west route located in eastern Kern County.

- State Route 223: This route is classed as a conventional highway. It is an east-west route located Kern County.

- State Route 247: This route is classed as a conventional highway. It is a north-south route located in San Bernardino County.

- U.S. Route 95: This route is classed as a major conventional highway. It is a north-south route located in Eastern San Bernardino County.

- U.S. Route 395: This route is classed as a major conventional highway/expressway. It is a north-south route passing through San Bernardino, Kern and Inyo Counties.

- Interstate Route15: This route is classified as a major interstate. It runs northeast through San Bernardino County from the southwest corner of the plan area to the northeast.

- Interstate Route 40: This route is classified as a major interstate. It runs east west through the southern section of the plan area through San Bernardino County.

Arterials: Arterials are routes with high traffic carrying capacity. An arterial might be defined as a road which is used, designed to be used, or is necessary to carry high volumes of traffic. An arterial, when constructed to its ultimate standard, are typically two lanes of traffic and a parking lane each way separated by a median with additional right-of-way on either side. Access is typically limited in order to minimize potential conflicts. Subdivision standards limit access to two intersecting local streets between arterials and collectors (1/2 mile distance), with no intersection closer than 660' to another. Also, developers are usually required to abandon the right of vehicular access from lots adjacent arterials. Actual listing of arterial locations is too numerous for this report. Arterials are usually within a 110' right-of-way and provide a connecting route between population centers and major highways. Arterials may also form the boundaries for neighborhoods. At present, numerous arterial alignments, especially in the rural areas, exist at local street standards (approximately 60-foot right-of-way). It is anticipated that development and traffic demand would result, ultimately, in the widening of these roads.

Collectors: Collectors are the next lower level of traffic carrying capacity. These routes carry lower volumes of traffic than arterials, but more than local streets. Collectors serve as collections for local street systems directing traffic to the arterials. These roads occasionally serve as boundary streets for neighborhoods and as a general rule are located along mid-section lines. The collectors usually have two-travel lanes and a parking lane each way with minimal additional right-of-way. While some residential lots may have access to collectors, it is preferable that access is limited and access to properties is directed to local streets.

Local Street: Local circulation routes generally provide access directly to abutting properties. Under existing standards, these roadways consist of approximately 40 foot traveled way improved sections and 10-foot parkways on each side. The width of these roads varies a great deal with newer developments usually having wider travel lanes.

3.4.5.2 Landfills

Solid waste produced in the planning area is collected by private contractors and deposited in the numerous landfills located throughout the region. Landfills in each county are described below. Descriptions include[34]: size and location, presence of septage ponds and fencing, the method of covering the working face, litter control measures, and planned future use of the site. Inactive sites are included on the list. A landfill is a waste management unit at which waste is discharged in or on land for disposal. This does not include surface impoundment, waste pile, land treatment unit, injection well, or soil amendments. The State Water Resources Control Board establishes the classification for landfills. A Class III facility is permitted to accept residential, commercial, industrial, agricultural, demolition and non-hazardous inert wastes. In addition to permitted and active landfill sites, illegal dumping occurs throughout the planning area, including at many "closed" landfill sites. Solid waste management agencies are implementing actions to discourage illegal dumping, such as providing convenient locations for transfer stations in more remote communities.

34 Source of data is California Integrated Waste Management Board, Solid waste Information System (SWIS) at www.ciwmb.ca.gov/SWIS

Inyo County: There are no landfill sites located within the planning area. The Olancha landfill has been closed and converted to a transfer station. The Olancha transfer station is located about a mile east of Olancha on highway 190, and accepts mixed municipal wastes. This transfer station has a permitted capacity of 36 cubic yards. There is another limited volume transfer station on Homewood Canyon Road, about one mile west of Trona-Wildrose Road, which serves the Valley Wells area. The Inyo County Integrated Waste Management Department operates both transfer stations.

Kern County: The Kern County Waste Management Department operates Class III landfill sites at Boron, Mojave-Rosamond and Ridgecrest. In addition, a transfer station equipped with 14 three-cubic yard trash bins is available for local resident use in the community of Randsburg. Property owners are charged a $57 special assessment on their property tax bill for waste management services. There is no gate fee for residents at the landfills for disposal of household or yard waste that would normally go into a residential waste can. Commercial/industrial waste disposal fees are $29.00 per ton, and the cost for disposing of dead animals is $5.00 if 200 pounds for less, and $10.00 for animals larger than 200 pounds. A 50% discount is available for disposal of source separated recyclable materials at a disposal site that has a recycling program in place for the type of material being disposed.

***Boron Sanitary Landfill*:** The Boron landfill is a Class III landfill located in the community of Boron in the southeast portion of the county, and is owned and operated by the Kern County Waste Management Department. The 20-acre facility has about 14 acres of disposal area. The facility is permitted through the California Integrated Waste Management Board for 200 tons per day and has a permitted capacity of 1,002,819 cubic yards. Remaining capacity as of June 21, 2001 was 208,632 cubic yards. The estimated closure date for this landfill is 2013. The facility is limited to a landfill; there are no septage ponds. The site is completely fenced with chain-link for security; however, dogs and other scavengers can access the area by digging under the fence. Ravens are present. The working face is covered daily with a minimum of 6 inches of compacted soil or an approved alternate daily cover (ADC) such as a geosynthetic tarp. Litter is controlled with a temporary fence that is located downwind from the working face. Litter pick-up crews are deployed after heavy winds.

Mojave-Rosamond Sanitary Landfill: This Class III landfill is located on Silver Queen Road in the community of Mojave. The facility is owned and operated by Kern County Waste Management Department. The 40-acre landfill has about 27 acres of disposal area. This facility is currently being re-permitted to allow for disposal of up to 470 tons per day with a permitted site capacity of 2,262,243 cubic yards. The facility has a remaining capacity of 443,681cubic yards (as of January 2002 Capacity Study). The estimated closure date for the landfill is 2014. Facilities are limited to an area method type landfill; there are no septage ponds. The site is completely fenced with chain-link and hog wire for security. Ravens are present. The working face is covered daily with a minimum of 6 inches of compacted soil or an approved ADC, such as a geosynthetic tarp. Litter is controlled with a temporary fence that is located downwind from the working face. Litter pick-up crews are deployed after heavy winds.

Ridgecrest-Inyokern Sanitary Landfill: This is a Class III landfill located on Bowman Road, 5 miles southwest of Ridgecrest. The facility is owned and operated by the Kern County Waste Management Department. The facility is located on 321 acres, 91 acres of which is devoted to waste disposal activities. The site has a permitted capacity of 5,992,700 cubic yards, and a remaining capacity, as of January 2002, of 1,287,587 cubic yards The landfill is permitted to accept 701 tons of waste per day, and has an estimated closure date of 2012. Facilities are limited to an area method type landfill; there are no septage ponds. The site is completely fenced with chain-link and hog wire for security. Dog and other scavengers are able to get in under the fence at certain locations, but ravens are not a major problem. The working face is covered daily with a minimum of 6 inches of compacted soil or an approved ADC, such as a geosynthetic tarp. Litter is controlled with a temporary fence that is located downwind from the working face. Litter pick-up crews are deployed after heavy winds.

Randsburg Transfer Station: This facility is located on Goler Road in the community of Randsburg to facilitate the handling of solid waste in this rural community. It is a limited volume transfer operation with a maximum permitted throughput of 60 cubic yards per day.

In addition to the Kern County landfill sites, U.S. Borax owns and operates a class III landfill for construction/demolition and industrial wastes at its site on Boron Road in the community of Boron. This site is permitted for 8,500,000 cubic yards with a permitted throughput of 443 tons per day. Remaining capacity for this site as of May 17, 2001, is 1,400,000 cubic yards. This site has an estimated closure date of 2023.

Edwards Airforce Base recently closed a small (2 tons per day) class II solid waste disposal site located approximately 1.5 miles south of Leuhman Ridge, east of Mars Blvd. This site was officially closed as of August 1, 2002. The Edwards AFB Main Base Sanitary Landfill is still operational and accepting waste. This facility is permitted to accept up to 180 tons of waste per day.

Los Angeles County: Two regional landfill sites are located in the Antelope Valley area of Los Angeles County, and serve the cities of Palmdale and Lancaster, as well as the rural unincorporated areas. Tipping fees at these facilities is $38.00 per ton. Loads less than one ton are charged a $20.00 fee. Additional information on these and other facilities in the area are as follows:

Antelope Valley Public Landfill: This class III landfill facility, located on West City Ranch Road in Palmdale, is owned and operated by Waste Management of California, Inc. This site serves the City of Palmdale and the surrounding unincorporated county area. This facility was permitted in June 1997 with a permitted throughput of 1,800 tons per day. As of December 31, 2000, there was 9,093,000 tons of remaining capacity. It is located on 756 acres of which 54 acres are indicated for waste disposal. The site includes a landfill with no septage ponds. It is fenced with six-foot chain-link for security. No scavenger problems of any type have been noted. The working face is covered daily with a minimum of 6 inches of compacted soil or with a special cover made of lightweight fibrous material and anchored with tires. Litter control is provided by a high net fence and portable units located near the working face.

Lancaster Landfill and Recycling Center: This class III landfill facility is located on East Avenue F, Lancaster, and serves the city of Lancaster and the surrounding unincorporated county area. The landfill is owned and operated by Waste Management of California, Inc. It occupies 276 acres, of which 209 acres are identified for waste disposal. The facility is permitted for a capacity of 22,645,000 cubic yards with a permitted throughput of 1,700 tons per day. As of December 31, 2000, there was 20,583,180 cubic yards of remaining capacity. The site includes a landfill with no septage ponds. It is fenced with six-foot chain-link for security. Ravens have been noted in the area but not in substantial numbers. The working face is covered daily with a minimum of 6 inches of compacted soil or with a special cover made of a light weight fibrous material and anchored with tires. Litter control is provided by a high net fence and portable units located near the working face.

In addition to these two landfills, the City of Lancaster owns and maintains a medium volume transfer/processing facility at their city yard on North 7th Street West. This 16-acre facility has a permitted capacity of 11,550 cubic cards with a throughput of 100 tons per day.

San Bernardino County: County of San Bernardino Solid Waste Management Division (SBSWMD) is responsible for the operation and management of San Bernardino County's solid waste disposal system. SBSWMD owns and operates three landfills and eight transfer stations within the planning area. Landfill operations are no longer occurring at the following locations because they are in the process of being closed: Newberry Disposal Site (SWIS # 33-AA-0039), the Phelan Refuse Disposal Site (SWIS # 36-AA-0044, the Hesperia Refuse Disposal Site (SWIS # 36-AA-0050), the Twentynine Palms disposal Site (SWIS# 36-AA-0060), the Lenwood-Hinkley Refuse Disposal Site (SWIS # 36-AA-0061), The Lucerne Valley Disposal Site (SWIS # 36-AA-0062), the Yermo Disposal Site (SWIS # 36-AA-0047) and the Apple Valley Disposal Site (SWIS #36-AA-0048).

Disposal fees at all county sites is as follows:

- $10.00 for up to 500 pounds of ordinary residential waste
- $34.30 per ton for residential waste over 500 pounds (prorated)
- $84.30 per ton for waste requiring special handling
- $103.78 per ton for tires

The SBSWMD operates the facilities through its contract operator, Burrtec Waste Industries, Inc. The contract operator handles the day-to-day operations and maintenance of the County's Solid Waste Disposal System, including both its Landfills (both active and inactive) and its Transfer Stations.

Additional information on solid waste facilities in San Bernardino County is as follows:

Barstow Landfill (SWIS # 36-AA-0046): The Barstow Landfill (BSL) is a Class III disposal facility with two, Class II, lined surface impoundments accepting only non-hazardous solid wastes. The BSL began operations in 1963 and has been in continuous operation since that time. The landfill is located in an unincorporated portion of the County on Barstow Road, approximately 3 miles south of the City of Barstow, off State Highway 247. The landfill disposal operations are currently being conducted within an approximately 47-acre refuse disposal footprint of an approximately 640-acre site; the remaining land is utilized for the scale facility, land farming and surface impoundments. Approximately 480 acres are still undisturbed and are reserved for future expansion. The landfill has a permitted capacity of 3,584,000 cubic yards of which 94,086 cubic yards was remaining as of July 8, 2002. The current operation at the current pit has an estimated closure date of 2007. The site is located in an area designated by the USFWS as critical habitat for the desert tortoise. The facility includes a landfill and two septage ponds. The active landfill area is fenced for security but the fence is not adequate to keep scavengers out. The ponds are not covered and may attract ravens. The working face is covered daily with a minimum of 6 inches of compacted soil.

Landers Landfill (SWIS # 36-AA-0057): The Landers Sanitary Landfill (LSL) is a Class III facility on 637 acres, 44 of which are used for solid waste disposal. The site is located on Winters Road, east of S. Avalon Avenue in the unincorporated community of Landers**.** The LSL was acquired by SBSWMD in a land transfer from the Bureau of Land Management in November 2000. The landfill has a permitted capacity of 3,080,000 cubic yards, with a permitted throughput of 1200 tons per day. Remaining capacity was 326,201 cubic yards as of July 8, 2002. The site has an estimated closure date of 2008. After that date the material will be transported and be replaced by transfer stations and solid waste will be transported to Victorville or Barstow. Facilities include a landfill and four septage ponds. The site is about 80 percent fenced with chain-link for security, which is probably not adequate to keep scavengers out. Recent inspections indicate a very large number of ravens at this facility compared to nine other landfills visited in San Bernardino County. The working face is covered daily with a minimum of 6 inches of compacted soil.

Victorville Landfill (SWIS # 36-AA-0045): The Victorville Sanitary Landfill (VSL) is a Class III regional landfill facility and is located on Stoddard Wells Road, in Victorville. The site has a total acreage of 80-acres, 67 of which are used for waste disposal, seven acres were used as septage drying ponds and six acres comprised a daily/intermediate soil cover borrow area. In 1998, the facility ceased accepting liquid waste and in September 2000, the liquid waste surface impoundments were clean closed in compliance with applicable regulations.

This facility has a permitted capacity of 7,700,000 cubic yards, with permitted throughput of 1,600 tons per day. The remaining capacity was 277,879 cubic yards as of July 8, 2002. The active area of the landfill that is currently in operation has an estimate closure date of 2005. The expansion area would continue to operate beyond this date. The facility includes a sanitary landfill, the inactive surface impoundment area, and a borrow pit. The entire site is fenced with six-foot chain-link for security and to reduce entry by scavengers. The working face is covered daily with a minimum 6 inches of compacted soil. There is illegal dumping outside of the fenced area and litter controls have, at times, not been effective.

A biological opinion (1-8-94-F-8) was issued for the 37.5 acre borrow pit located adjacent to the landfill. The terms and conditions are generally the same as for the mining operation, including the installation of tortoise proof fences to keep tortoises out of the pit area.

Limited Volume Transfer Operation is an operation that receives less than 60 cubic yards, or 15 tons of solid waste per operating day for the purpose of storing the waste prior to transferring the waste to another solid waste operation or facility and which does not conduct processing activities. Limited salvaging activities and volume reduction may also be conduct as part of the operation.

Apple Valley Community Collection Center: This facility, located on Laguna Secca Drive in Apple Valley, is a limited volume transfer operation. The facility accepts mixed municipal waste and has a permitted capacity and throughput of 60 cubic yards per day.

Baker Community Collection Center: This facility, located south of I-15 on Kelbaker Road in the community of Baker, is a limited volume transfer operation. The facility accepts mixed municipal waste and has a permitted capacity and throughput of 60 cubic yards per day.

Daggett/Silver Valley Community Collection Center: This facility, located on the northeast corner of Hidden springs Road and National Trails Highway in the community of Daggett, is a limited volume transfer operation. The facility accepts mixed municipal waste and has a permitted capacity and throughput of 60 cubic yards per day.

Hesperia Community Collection Center: This facility, located on Hesperia Dump Road in Hesperia, is a limited volume transfer operation. The facility accepts mixed municipal waste and has a permitted capacity and throughput of 60 cubic yards per day.

Yermo Community Collection Center: This facility, located on Minneola Road in the unincorporated community of Yermo, is a limited volume transfer operation. The facility accepts mixed municipal waste and has a permitted capacity and throughput of 60 cubic yards per day.

Large Volume Transfer/Processing Facility is a facility that receives 100 tons or more of solid waste per operating day for the purpose of storing, handling or processing the waste prior to transferring the waste to another solid waste operation or facility.

Lucerne Valley (Camp Rock) Transfer Station (SWIS # 36-AA-0317): This facility, located on 7 acres on Camp Rock Road in the unincorporated community of Lucerne Valley, is a large volume transfer station. The facility accepts mixed municipal waste and has a design capacity and a permitted throughput of 14 tons per day.

Newberry Springs Transfer Station (SWIS # 36-AA-0371): This facility, located on 3 acres on Troy Road and Poniente Drive in the community of Newberry Springs, is a large volume transfer station. The facility accepts mixed municipal waste and has a permitted capacity of 140 cubic yards per day and a permitted throughput of 7 tons per day.

Phelan (Sheep Creek) Transfer Station (SWIS # 36-AA-0382): This facility, located on 5 acres on Buckwheat Road in the unincorporated community of Phelan, is a large volume transfer/processing facility. The facility accepts mixed municipal waste and has a design capacity of 1,600 cubic yards per day and a permitted throughput of 198 tons per day.

Trona-Agrus Transfer Station (SWIS # 36-AA-0391): This facility, located on 2 acres on 1st Street approximately 1 mile north of Trona Road in the unincorporated community of Trona, is a large volume transfer/processing facility. The facility accepts mixed municipal, agricultural, construction/demolition, industrial waste and tires. It has a permitted capacity of 352 tons and a permitted throughput of 88 tons per day.

29 Palms Transfer Station (SWIS # 36-AA-0390): This facility, located on Pinto Mountain Road in Twentynine Palms, is a large volume transfer/processing facility. The facility accepts agricultural, ash, construction/demolition, industrial, and mixed municipal waste and tires. It has a permitted capacity of 1,600 cubic yards with a permitted throughput of 200 tons per day.

Medium volume Transfer/Processing Facility is a facility that receives equal to or more than 60 cubic yards or 15 tons (whichever is greater) of solid waste per operating; or a facility that receives any amount of solid waste, up to 100 tons per operating day, for the purpose of processing solid waste prior to transferring the waste to another solid waste operation or facility.

Trail's End Transfer Station (SWIS # 36-AA-0377): This facility, located on 2 acres on Malibu Trail in the unincorporated community of Morongo Valley, is a medium volume transfer/processing facility. The facility accepts mixed municipal waste and has a permitted capacity of 120 cubic yards per day, and a permitted throughput of 95 tons per day.

In addition to the landfills owned by San Bernardino County, there are several other permitted solid waste facilities located within the plan boundaries. Some of these are owned and operated by private industrial plants for disposal of waste related to their operations. Table 3-56 lists these facilities:

Table 3-56
Private Industrial Solid Waste Disposal Sites in San Bernardino County

FACILITY & LOCATION	PERMITTED ACTIVITY	WASTE TYPES	ACRES	CAPACITY/ THROUGHPUT (C/T)
Ace Plant Dump Site Mariposa Street, Trona	Solid Waste Landfill	Ash	65	T: 198 tons per day
Argus Ash Disposal Site 700 Ft. N of First St. Trona	Solid Waste Landfill	Ash	77	C /T: 250 tons per day
Mitsubishi Cements Plant Cushenbury L.F. Highway 18, Lucerne Valley	Solid Waste Landfill (Class III)	Industrial	15	C: 520,400 cubic yards T: 40 tons per day
Oro Grande Kiln Waste Dust Dump NE of Oro Grande	Inert Waste Disposal Site (Class II)	Other designated	104	T: 233 tons per month

There is also a privately owned and operated large volume transfer/processing facility, waste tire facility and materials recovery facility, located within the City of Hesperia and serving the residents of that area, and solid waste facilities located at Fort Irwin. The Mojave Desert and Mountain Solid Waste Authority owns a transfer/processing facility in the City of Victorville. Additional information regarding these facilities is as follows:

Advance Disposal Transfer/Processing Facility (SWIS # 36-AA-0337)**:** This facility, located on 7 acres on Mesa Street in the City of Hesperia, is owned and operated by Advance Disposal Company. This company handles waste disposal for the City of Hesperia. The site is permitted as a large volume transfer/processing facility, waste tire location and materials recovery facility. Permitted capacity and throughput for the transfer/processing facility is 600 tons per day.

Fort Irwin Sanitary Landfill (SWIS # 36-AA-0068 & 0413)**:** This facility is owned and operated by US Dept. of the Army at Fort Irwin. It is a class III solid waste landfill with a permitted capacity of 19,000,000 cubic yards and a permitted throughput of 100 tons per day. The site has 460 acres identified for disposal, and a remaining capacity, as of May 30, 2001, of 14,738,5900 cubic yards. There is also a composting facility permitted on 6 acres for the composing of green materials and sludge (biosolids). The composting facility is permitted for 18,000 cubic yards per day.

Victor Valley MRF and Transfer Station**:** This facility is located on 13 acres in the City of Victorville, at the northwest corner of Abbey Land and "B" Street. It is owned by the Mojave Desert and Mountain Solid Waste Authority and operated by Burrtec Waste Industries, Inc. It is permitted as a large volume transfer/processing facility with a permitted capacity of 500 tons per day and a permitted throughput of 600 tons per day.

3.5 MOTORIZED VEHICLE ACCESS NETWORK

3.5.1 Policies and Legislation

3.5.1.1 Federal Land Policy and Management Act (FLPMA)

The Federal Land Policy and Management Act (FLPMA), of 1976, long considered the landmark legislation that changed the operations of BLM forever, provides a multiple use framework for managing the nation's public lands that focuses on the needs of both present and future generations. Under FLPMA, land managers are required to take into account the long term needs of present and future generations as they make important decisions in the management of renewable and nonrenewable resources, including recreation, timber, minerals, watershed, fish, wildlife, rangeland, scientific and historical values. The Act requires BLM to execute its management powers under a land use planning process that is based on multiple use and sustained yield principles.

The BLM is an agency of the U.S. Department of the Interior with responsibility for managing more than 264 million surface acres of America's public lands, and also administers 700 million acres of sub-surface mineral estate throughout the nation. The BLM accomplishes this by planning and managing such resources as outdoor recreation, livestock grazing and mineral development, and by conserving natural, historical, cultural, and other resources on the public lands. Most of the public lands managed by BLM are located in 12 Western states, which includes California. The 25-million-acre California Desert Conservation Area contains over 12 million acres of public lands, which BLM manages.

3.5.1.2 Executive Order No. 11644

In 1971, Presidential Executive Order No. 11644 established the first uniform policies regarding OHV use on public lands. Each land management agency was directed by this Order to issue directions as to which trails and areas were open for OHV use and which were not. The Order required that OHV use be monitored to assess and minimize associated impacts.

3.5.1.3 Federal Regulations (43 CFR 8342.1)

The CDCA Plan's motorized-vehicle access element was amended (1982 Plan Amendment Three, approved May 17, 1983) to conform with 43 CFR 8342.1 which requires route approval to be based on the following criteria:

- Areas and trails would be located to minimize damage to soil, watershed, vegetation, air, or other resources of the public lands, and to prevent impairment of wilderness suitability.
- Areas and trails would be located to minimize harassment of wildlife or significant disruption of wildlife habitats. Special attention would be given to protect endangered or threatened species and their habitats.
- Areas and trails would be located to minimize conflicts between off-road vehicle use and other existing or proposed recreational uses of the same or neighboring public lands, and to ensure the compatibility of such uses with existing conditions in populated areas, taking into account noise and other factors.
- Areas and trails would not be located in officially designated wilderness areas or primitive areas.
- Areas and trails would be located in natural areas only if the authorized officer determines that vehicle use in such locations would not adversely affect their natural, esthetic, scenic, or other values for which such areas are established.

3.5.1.4 California Desert Conservation Area Plan

Section 601 of FLPMA was included by Congress to give direction about the California Desert Conservation Area. In section 601, Congress required the preparation of a comprehensive, long-range plan for the CDCA. The purpose of the CDCA Plan is to establish guidance for the management of the public lands located in the California Desert by BLM in clear accordance with the Congressional intent as stated in the law.

Goals of CDCA Plan: The goals stated in the CDCA Plan's Motorized-Vehicle Access Element follow:

- Provide for constrained motorized vehicle access in a manner that balances the needs of all desert users, private landowners, and other public agencies.
- When designating or amending areas or routes for motorized vehicle access, to the degree possible, avoid adverse impacts to desert resources.
- Use maps, signs, and published information to communicate the motorized vehicle access situation to desert users, making sure all information materials are understandable and easy to follow.

The goals in the CDCA Plan's Recreation Element follow:

- Provide for a wide range of quality recreation opportunities and experiences, emphasizing dispersed undeveloped use.
- Provide a minimum of recreation facilities. Those facilities should emphasize resource protection and visitor safety.
- Manage recreation use to minimize user conflicts, provide a safe recreation environment, and protect desert resources.
- Emphasize the use of public information and education techniques to increase public awareness, enjoyment, and sensitivity to desert resources.
- Adjust management approach to accommodate changing visitor use patterns and preferences.
- Encourage the use and enjoyment of desert recreation opportunities by special populations, and provide facilities to meet the needs of those groups.

The goals for motorized-vehicle access / routes of travel designations / recreation are to:

- Designate routes of travel consistent with the criteria at 43 CFR 8342.1, discussed below.
- Provide for competitive off-highway vehicle events in a manner that protects desert resources.
- Establish stopping, parking, and vehicle camping limitations consistently.

The CDCA Plan defined open and closed routes as follows:

- Open Route. Access on the route by motorized vehicles is allowed. Specific uses with potential for resource damage or significant conflict with other use may require specific authorization.

- Closed Route. Access on route by motorized vehicles is prohibited except for: (1) fire, military, emergency or law enforcement vehicles when used for emergency purposes; (2) combat or combat support vehicles when used for national defense purposes: (3) vehicles used for official purposes by employees, agents, or designated representatives of the federal government or one of its contractors. Use must be consistent with the multiple use guidelines for that area.

Route designations apply only to routes and portions thereof on public lands; the designation of routes as “open,” and “closed” is not applicable on non-public lands.

3.5.1.5 Route Designation Definitions

Route designation definitions of open and closed routes were established in the amended CDCA plan. The definitions are shown here as an aid to the reader.

- Open Route. Access on the route by motorized vehicles is allowed. Specific uses with potential for resource damage or significant conflict with other use may require specific authorization.

- Closed Route. Access on route by motorized vehicles is prohibited except for: (1) fire, military, emergency or law enforcement vehicles when used for emergency purposes; (2) combat or combat support vehicles when used for national defense purposes: (3) vehicles used for official purposes by employees, agents, or designated representatives of the federal government or one of its contractors. Use must be consistent with the multiple use guidelines for that area.

In determining route designations, the following must be kept in mind:

- Route designations approved through the WEMO Plan constitute CDCA Plan decisions; future changes to these decisions would require amending the CDCA Plan.

Route designations apply only to routes and portions thereof on public lands; the designation of routes as “open,” and “closed” is not applicable on non-public lands.

3.5.2 Motorized Vehicle Access

There is a close relationship between the pursuit of recreational activities and motorized-vehicle use in the California desert, whether motorized vehicles are driven for pleasure or are simply a means of access to recreation destinations such as campgrounds and wilderness trailheads. Given the desert's vast expanse and great distances to recreation sites, it is difficult, if not impossible, in many circumstances, to engage in recreational activities in this region without employing a motorized vehicle in some fashion. Therefore, actions that restrict vehicular access may affect opportunities for recreation depending on the specific activity pursued and/or the specific location at which such restrictions are imposed. Routes of travel designations directly influence opportunities for recreation and affect access for non-recreational pursuits. Accordingly, motorized-vehicle access, routes of travel designations, and recreation are addressed as a single issue.

3.5.2.1 Motorized Vehicle Access Needs

Motorized vehicle access to public lands in the planning area is needed for a variety of activities. These include OHV touring, motorcycle events (e.g., challenges, speed, and other competitive events), trailheads and staging areas (for hiking, camping, equestrian riding, gem collecting and rock hounding, hunting, etc.), private land access, utility maintenance, and mineral production.

OHV Recreational Touring: OHV touring often occurs on flat terrain, but such touring also takes place in mountainous terrain using jeeps and similar vehicles. Vehicles that allow for multi-terrain travel have a broad range of access needs since they can traverse different types of terrain features.

Motorcycle Events: OHV access is necessary, not only due to the distance that must be traveled to reach the site of a motorcycle speed, challenge, or other competitive event occurs, but also because significant equipment and supplies must be brought to event staging areas. This is true even for dual sport motorcycles, despite their "street legal" status, because a larger OHV may still be necessary to transport related equipment and supplies to motorcycle parks, other staging areas, or trailheads. This is due largely to the distance that such recreationists travel to participate in their activity, and the motorcycle's limited carrying capacity.

Camping and Hiking: Visitors need OHV access to staging areas and trailheads, and must bring supplies to camp in the Desert areas. Campers generally stay at locations that are fairly remote to obtain the level of solitude that is associated with the camping experience. In the desert, these locations are typically not located along major highways. Hikers use OHVs to reach trailheads and staging areas that are often quite remote.

Equestrian Riding: Equestrians use motorized vehicles to pull their horse trailers, and other equipment and supplies, to staging areas where they unload their horses, saddle up, and otherwise prepare for rides. Without the use of OHVs, equestrians would be unable to reach these staging areas, where watering holes, corals, and related facilities are commonly present.

Gem Collecting and Rock Hounding: This activity generally occurs in geologic areas that offer the possibility of finding desired gems and rocks. Many of these areas are remote, and a four-wheel-drive OHV is needed to access them. The vehicle is also required to bring the variety of supplies necessary to safely participate in this form of recreation.

Hunting: Hunters require OHV access to reach trailheads and staging areas, which tend to be remote. From here, they can set out to hunt. Hunters use motorized vehicles to carry their supplies and equipment, which may include camping gear.

Private Land Access: Private lands may be surrounded by public lands, or abut public land in a checkerboard type fashion. The surrounding public lands may lack major highways, and have rough terrain on which street vehicles cannot travel. Four-wheel-drive OHVs are required to access these private inholdings.

Utility Maintenance: Many powerlines, pipelines and fiberoptic cables cross the desert; microwave and other sites are located on public lands. Although many of these sites are not in extremely mountainous terrain, they may not be accessible by major paved highways. Access using unpaved desert routes may be necessary to allow routine maintenance of these facilities to occur.

Mining Production and Exploration: Many mineral production sites cannot be accessed by paved road, and the terrain where they are located may be rather rough. Motorized vehicles may be necessary, however, both to haul supplies and equipment in, and to bring minerals out.

3.5.2.2 Off Road Vehicle Designations Prior to 2002

Off-road vehicle designations have been completed by BLM in the West Mojave planning area, although they have not yet been adopted as a component of the CDCA Plan. These designations occurred through a West Mojave-wide effort in the middle 1980s, during the preparation of ACEC plans, and during a late 1990s pilot project at Ord Mountain, and identified 3,266 miles of open routes within the planning area.

1985-87 Off-Road Vehicle Designations: BLM conducted a field and map inventory of off highway vehicle routes throughout the planning area in the mid-1980s and, based upon that inventory, identified a network of open motorized vehicle access routes. BLM personnel inventoried and evaluated existing routes of travel. Information from existing maps and aerial photos was supplemented by field checks. This information was then utilized to create a known route inventory that primarily consisted of known “two-track” routes (i.e. “single-track” motorcycle routes were generally not part of the inventory). Public meetings were conducted and members of the public also reviewed these route inventories. Criteria for determining which routes were to remain open was based upon public access needs, recreational values and resource conflicts. Following public meetings, decisions to designate the route network were announced.

On August 21, 1985, BLM published a Notice in the Federal Register titled *Off-Road Vehicle Designation Decisions; Ridgecrest Resource Area, CA* (Federal Register, Vol. 50, No.182). Two years later, on June 19, 1987, BLM published Federal Register notice titled *Off-Road Vehicle Route Designation Decisions for the California Desert District, Barstow Resource Area* (Federal Register, Vol. 52, No.118, p.23364); and, on September 22, 1987 BLM publishes a Federal Register notice titled *Off-Road Vehicle Route Designation Decisions for the California Desert District, Barstow Resource Area* (Federal Register, Vol. 52, No. 183, p. 35589). These notices opened 2,949 miles of off highway vehicle routes.

Other Off Road Vehicle Designations: Since 1980, many BLM ACEC and other local management plans identified identified motorized vehicle access networks, collectively identifying 317 miles of open routes. Table 3-57 lists these plans, together with the date the route network in each was developed.

Table 3-57
ACEC Route Networks and Principal Recreation Activities

ACEC NAME AND NUMBER	SIZE ACRES	ROUTE DESIGNATION YEAR	ROUTE STATUS	PRINCIPAL RECREATION ACTIVITIES
Afton Canyon (43)	4,726	1989	26 mile designated route system	Camping, vehicular touring, equestrian, rock hounding, recreational mining on outside edges of area.
Amboy Crater National Natural Landmark (87)	679	NA	One access route to parking area.	Geologic exploration, rock hounding
Barstow Woolly Sunflower (36)	314	1982	Mapped routes excluded; vehicles Excluded From NW ¼ of Section 11; T11N; R6W	Non-vehicular dependent: Hiking, botanizing
Bedrock Springs (24)	785	1987	Mapped designated route system	Access to prehistoric values and Northern portion of the Golden Valley Wilderness Area
Big Morongo Canyon (50)	28,274	1982 1996	Mapped designated route system; Routes designated in 2002 Coachella Valley Plan Amendment	Hiking, wildlife viewing, picnicking
Black Mountain (35)	61,806	1988	26-mile designated route system	OHV recreation and touring, equestrian riding, hiking, camping, prehistoric and historic interpretation, recreational mining on northeastern fringe of area, wilderness recreation.
Calico Early Man Site (40)	898	1984	Mapped designated route system	OHV touring, hiking, camping, prehistoric and historic interpretation
Christmas Canyon (23)	3,444	NA	No route designation because most of ACEC is within Open area	OHV recreation and touring, historic interpretation. Located in between Spangler Hills OHV area and China Lake Naval Weapons Center.
Cronese Basin	10,226	1984	Mapped designated route system	OHV touring, bird-watching, wildlife viewing
Desert Tortoise Research Natural Area (22)	25,695	1988	Designated closed to vehicular use; protected by perimeter fence	Hiking, wildlife viewing, shooting.
Fossil Falls (10)	1,667	1986	Designated route system	OHV touring, prehistoric appreciation. Located at north end of East Sierra subregion.
Great Falls Basin (12)	9,726	1987	Mapped designated route system	OHV touring, picnicking, bird-watching, wildlife viewing. Located just north of Trona.

ACEC NAME AND NUMBER	SIZE ACRES	ROUTE DESIGNATION YEAR	ROUTE STATUS	PRINCIPAL RECREATION ACTIVITIES
Harper Dry Lake (37)	475	1982	Mapped designated route system; all routes within 100 yards of marsh vegetation closed	OHV touring, bird-watching, equestrian riding. Located southwest of Black Mountain Wilderness Area.
Jawbone/Butterbread (20)	187,486	1982	133 mile designated route system	OHV touring, bird-watching, wildlife watching, rock-climbing. Located south of East Sierra subregion.
Juniper Flats (45)	2,528	1988	Mapped designated route system	Equestrian riding, OHV recreation and touring, access to Deep Creek hot springs. Located north of San Bernardino Mountains.
Last Chance Canyon (21)	5,913	1982	Designated route system	OHV recreation and touring, historic appreciation, wildlife viewing. Located south of El Paso Mountains Wilderness Area.
Manix (85)	2,897	NA	None	Paleontological and historic interpretation, OHV touring. Located south of Coyote subregion.
Mojave Fishhook Cactus (77)	628	1990	Designated route system	OHV touring, botanizing
Rainbow Basin (39)	4,087	1991	30 mile designated route system	Camping, OHV touring, equestrian riding, hiking, geologic, paleontological and prehistoric interpretation. Located in middle of Superior subregion.
Red Mountain Spring (formerly Squaw Spring) (26)	717	1987	Mapped designated route system; area closed to vehicular travel	Prehistoric and historic interpretation. Located in northern portion of Red Mountain subregion.
Rodman Mountains Cultural Area (84)	6,204		Routes outside Rodman Mtns. Wilderness were designated as part of Ord-Rodman Plan	OHV touring and recreation, cultural interpretation, hiking, wilderness recreation.
Rose Springs (7)	859	1985	Routes designated closed	Hiking, wildlife viewing, prehistoric interpretation, hunting. Located in north end of East Sierra subregion.
Sand Canyon (11)	2,609	1989	Specific route closures	Hiking, wildlife viewing, bird-watching, hunting, cultural interpretation. Located - in part- in central East Sierra subregion.

ACEC NAME AND NUMBER	SIZE ACRES	ROUTE DESIGNATION YEAR	ROUTE STATUS	PRINCIPAL RECREATION ACTIVITIES
Short Canyon (81)	754	1990?	Most of the ACEC routes are closed because they are within wilderness	Hiking, botanizing, wildlife viewing, bird-watching, hunting. Located in East Sierra subregion, borders Owens Peak Wilderness.
Soggy Dry Lake Creosote Rings (47)	186	1982	All vehicular routes closed to protect unique vegetation	Botanizing, hiking. Located just south of Johnson Valley OHV area.
Steam Well (25)	41	1982	Designated route system; All routes closed with inclusion of ACEC in the Golden Valley Wilderness Area	Prehistoric and historic interpretation. Locate din southwest edge of Golden Valley Wilderness area.
Trona Pinnacles (16)	4,055	1989	Designated route system	Sightseeing, commercial filming, OHV touring, geologic interpretation. Located in South Searles subregion.
Upper Johnson Valley Yucca Rings (46)	353	1982	Specific routes designated closed	Botanizing, OHV recreation and touring. Locate din Johnson Valley OHV area.
Western Rand Mountains (2)	17,877	1994	128 mile designated route system	OHV touring and recreation. Applied to ACEC and surrounding lands.
Whitewater Canyon (49)	16,381	1982	Designated route system	OHV touring, wildlife viewing, hiking

Ord Mountain Pilot Off Road Vehicle Designations: In 1995 the BLM undertook a pilot project within the Ord Mountain area to test methods to acquire an inventory of routes of travel. A pilot digital aerial photograph was used together with GIS digitizing equipment to identify 549 miles of existing routes of travel in the area. From this inventory, a proposed open route system was identified by BLM and addressed in an environmental assessment.

3.5.2.3 OHV Route Subregions and BLM 2001-2 Route Inventory

Twenty-one “subregions” have been identified for route designation planning purposes. Table 3-58 describes each of these subregions, as well as the recreational activities and access needs associated with each subregion, the miles designated open by BLM in 1985 and 1987 and, where applicable, the miles of routes inventoried by BLM in 2001-2. A more detailed narrative discussion can be found in Appendix R, section R.2.

Table 3-58
Off Road Vehicle Designation Subregions

SUB REGION	PRINCIPAL RECREATION ACTIVITIES	ROUTE MILEAGE		COMMENTS
		DESIGNATED OPEN: 1985-87	2001 ROUTE INVENTORY	
Amboy	Off-highway touring, rock-hounding, recreational mining		N/A	Need to maintain commercial access to America Mine and other mine claims, recreation access to the Amboy Crater ACEC and military access to the Marine Corps Air Ground Combat Center.
Bighorn	Off-highway touring, sightseeing, equestrian riding.	218	N/A	Contains Bighorn Mountain Wilderness; provides access to San Bernardino National Forest. Transition area of desert valley floor into the mountains.
Coyote	Rock hounding, off-highway touring/ sightseeing, mining.	178	411	Calico Early Man Archaeological Site, Cronese Lakes ACEC, and Soda Mountains Wilderness Study Area. OHV recreation relatively light. Most OHV activity occurs in southwestern sectors.
East Sierra	Hiking, camping, rock hounding, OHV, equestrian.	109	N/A	OHV touring allows hunting, wildlife observation, and equestrian staging. Area important for access to remote backcountry activities.
El Mirage	OHV, recreational mining	49	267	El Mirage OHV recreation area borders sub region to the south. Area of more historic use than current use. Once more popular for races which have since shifted to the Open Areas. Edwards bowl in the western sector popular as a motorcycle area creates some conflicts with adjoining private property owners. Shadow Mountain once very popular with motorcyclists. Use now restricted due to conflicts with hamlet of Shadow Mountain to the south. Bajadas north of Shadow Mountain have been found to have higher than average desert tortoise sign.
El Paso	OHV use, rock hounding, shooting/hunting.	324	465	Last Chance Canyon ACEC and El Paso Mountains Wilderness abut the sub region. Very mountainous area universally popular for a variety of visitor types including jeepers, motorcyclists, miners, campers, rock hounders, equestrians, historical explorers and upland game hunters
Fremont	OHV use, shooting/ hunting, rock hounding, equestrian riding, hiking, recreational mining.	214	582	Contains Barstow Woolly Sunflower ACEC, Harper Dry Lake ACEC, and the Black Mountain Wilderness. Northern hilly sectors very popular longstanding MC area; Gravel Hills and Hamburger Mill northwest of Fremont Peak known for long-term historical use. Bajada areas in the southern sectors not nearly as popular as the above-described areas to the north. Bajadas areas in the south and central sector known for historically high populations of desert tortoise.
Granite	OHV touring, recreational mining, rock climbing, hiking, dispersed camping, day use.	38	N/A	Stoddard Valley OHV Area borders sub region to the north. Fairview area in southern portion of region receives moderate to high dispersed, day use including hiking, rock climbing, and social gatherings.
Juniper	Equestrian riding, recreational mining, hiking, MC riding, hunting	108	N/A	Hunting opportunities are found in the Juniper Flats area as well as on national forest lands. Visitors can camp at Bowen Ranch area and at locations throughout the national forest, to the south. OHV touring allowed in appropriate areas.
Kramer	OHV use/dual sport, rock hounding, shooting/ hunting	254	642	Mining and homestead site established in the late 19th and early 20th century exists in the area, some of which may have historical significance.

SUB REGION	PRINCIPAL RECREATION ACTIVITIES	ROUTE MILEAGE		COMMENTS
		DESIGNATED OPEN: 1985-87	2001 ROUTE INVENTORY	
Middle Knob	OHV touring/ sightseeing, camping, hiking, hunting	N/A	91	Cultural resources are significant in the sub region. Contains biological values of special concern, including habitat for desert tortoises.
Morongo	Wildlife viewing education, hiking	18	N/A	The Big Morongo Canyon Preserve, a wildlife refuge, is located - in part - within the sub region
Newberry-Rodman	Equestrian, OHV touring, sightseeing, dual sport, rock hounding, mining	142	210	Sub region contains the Newberry Mountains Wilderness, the Rodman Mountains Wilderness and the adjoining Rodman Mountains ACEC. Rock art and cultural sites are within the sub region.
North Searles	OHV use/dual sport, rock hounding, equestrian rides.	99	N/A	Shooting/hunting occur in the Argus Range Wilderness that borders the northwestern portion of the subregion. The Great Falls Basin/Argus Range ACEC lies within the sub region.
Ord	Recreational mining, OHV touring/ sightseeing	38	549	The historic Ord Mountain Road and the Daggett Wash Road are accessible by four-wheel drive vehicles and motorcycles (OHV/dual sport). The Stoddard Valley OHV Recreation Area to the west and the Johnson Valley OHV area to the southeast of the sub region provide for OHV/dual sport activities.
Pinto	Rock hounding, OHV touring/ sightseeing, mining			The sub region is bordered by the Joshua Tree National Park to the east, west, and the south.
Red Mountain	OHV touring/ sightseeing, shooting hunting, OHV/ dual sport, hiking, equestrian riding, mining.	234	733	The Grass Valley Wilderness is partly contained in the sub region and the Golden Valley Wilderness borders the sub region to the north. These bajadas areas in the central west sector west of Cuddeback Lake, are known for historically high populations of desert tortoise and extremely high historical mining activity.
Ridgecrest	Hiking, equestrian OHV/dual sport	106	328	The Rademacher Hills trails open to the hiking, jogging, horseback riding and mountain biking.
Sleeping Beauty	Rock hounding, recreational mining.	58	N/A	Historic Route 66 borders the sub region to the south.
South Searles	Rock hounding, shooting, OHV touring/sightseeing, mining.	36	N/A	Sub region contains the Trona Pinnacles National Natural Landmark ACEC. Historical and cultural resources are located in the sub region.
Superior	OHV/dual sport, rock hounding, camping, mining.	396	668	Contains the Rainbow Basin National Natural Landmark ACEC. The Black Mountain Wilderness lies to the west of the sub region and the Calico Mountains lie to the south east of the sub region.

3.6 ENERGY PRODUCTION AND TRANSMISSION

3.6.1 Powerlines, Pipelines and Fiberoptic Cables

CDCA Plan Utility Corridor Network: The CDCA Plan, as amended, established a network of sixteen utility planning corridors across the Mojave and Colorado Deserts. All new linear utilities exceeding the following thresholds must be located within a utility corridor:

- New electrical transmission towers and cables of 161 kV (kilovolts) or above;

- All pipelines with diameters greater than 12 inches;
- Coaxial cables for interstate communications; and,
- Major aqueducts or canals for interbasin transfers of water.

Seven of these corridors cross the planning area: Corridors A, B, BB, C, D, G, and H. Each corridor is between two and five miles wide. The intent of the corridors is to provide a delivery system network that meets public needs in a manner that minimizes the proliferation of widely separated rights of way by encouraging the joint use of corridors for utilities. By locating a project within a corridor a project proponent does not receive immediate approval to construct a project: a federal right of way grant must still be obtained and a NEPA document prepared.

Occasionally the unique needs of a project may require that it be located outside of a corridor. To accommodate these situations, several "contingent" corridors were identified by the CDCA plan that could be activated through a CDCA plan amendment. A project could be located outside of either an activated or contingent corridor, but only through a CDCA plan amendment that examined whether the need for a one-time exemption from the corridor network warranted construction in a non-corridor location. This has happened only once since the CDCA plan was adopted, for the All American Pipeline in 1983, in a region outside of the western Mojave Desert.

Utility Biological Opinions: Table 3-59 presents the abbreviated terms and conditions found in 10 biological opinions addressing utility projects. Table 3-60 presents the take authorized by those opinions (mortality, harassment, and acreage where provided). These include includes **5 pipelines** (2 crude oil, 1 gasoline, 1 natural gas), **3 transmission lines**, and **2 fiber optic cables**. They include only those biological opinions that had a mortality and/or harassment take limit specified for maintenance activities. Appendix Q presents a more detailed summary of the terms and conditions found in the biological opinions.

Although maintenance was the primary focus of the tables, the terms and conditions of the biological opinions also apply to other activities, including construction and installation, operations, routine inspections, repair, and responses to emergency situations.

Table 3-59
Prevalence of Terms and Conditions for 10 Linear Projects

TERMS AND CONDITIONS	NUMBER OF PROJECTS WITH THIS TERM AND CONDITION
Education	10
Flag boundaries, restrict activities to impact area	10
Tortoise preconstruction surveys	10
Biological monitor required	10
Speed limits (4 at 20 mph, 2 at 25, 1 at 10)	8
Litter free workplace	8
Project-end reporting	8
Unauthorized firearms prohibited	7
Use existing roads	6
Check under vehicle for tortoise	6
Designate Field Contact Representative	6
Avoid entrapping tortoises in excavations	6
No pets in the construction area	5
Revegetation required	5
Compensate impacts with fees or acquisition	4
Raven prevention measures	2

Table 3-60
Authorized Mortality and Harassment Take for 10 Linear Projects

IMPACTING ACTIVITY	AUTHORIZED MORTALITY	AUTHORIZED HARRASMENT
Maintenance and/or Repair	6 per year	8 per year
Maintenance and/or Repair	15	2 unlimited
Construction	8	125
Construction and Maintenance	6	20
Routine Inspections, Emergencies	5	---

3.6.2 Energy Generation Plants

Energy generation plants are currently located within or in close proximity to the West Mojave Plan. Table 3-61 provides data regarding the megawatts (MW) of electricity generated by these plants.

Table 3-61
West Mojave Energy Generation [35]

FACILITY TYPE	ONLINE MEGAWATTS	NO. OF PERMITTED FACILITIES
Biomass	.25	1
Coal	177	3
Geothermal	240	3
Hydroelectric	39	2
Natural Gas	738	6
Solar	409	9
Wind	701	45

Electricity demand increased 16% in the SCAG region during the 1990's, and is projected to continue to grow at about 2% per year. This increasing demand for electrical energy will result in continued efforts to conserve and develop new energy sources in California. The reliability of the energy needed to meet projected demand will depend in part on developing a diversity of energy sources (SCAG- Regional Comprehensive Plan and Guide – Energy Chapter Update 2002). The West Mojave region contains the natural resources to support the development of alternative energy sources such as wind, geothermal and solar facilities, and there will likely be future proposals for the development of these resources as energy demands increase. Proposed thermal energy facilities of 50MW or greater and related facilities (i.e., transmission lines) are subject to the permitting authority of the California Energy Comission (CEC). The Commission's siting process provides:

- Assurance that only power plants actually needed will be built;
- Review by independent staff with technical expertise in public health and safety; environmental sciences, engineering and reliability;
- Simultaneous review and full participation by all state and local agencies, as well as coordination with federal agencies;
- One regulatory permit;
- A decision within a specific time frame; and,
- Full opportunity for participation by public and interest groups. [36]

Thermal energy facilities of less than 50MW on private lands are subject to the permitting authority of the city or county within which the proposed project resides and typically require the issuance of a conditional use permit. On public lands managed by the BLM, new thermal energy facilities (other than geothermal – see below) require a right of way permit per 43

35 Data source: California Energy Commission
36 *Energy Facilities Licensing Process – A Guide to Public Participation.* California Energy Commission Web page at www.energy.ca.gov.

CRF Part 2800. Coordination with the CEC permitting process for facilities of 50MW or greater on public land would also occur.

The Renewable Resource Data Center (RReDC), managed by the Department of Energy's Office of Energy Efficiency and Renewable Energy has identified major wind resource areas throughout the United States that have been estimated to have suitable wind energy potential for wind turbine applications ("Class 3" or greater annual average wind power). Within the planning area the Tehachapi Pass, near Mojave, possesses Class 6 wind energy potential. The western part of the Antelope Valley is another area of high wind resource potential with site data in the extreme west end of the Antelope Valley indicating a Class 6 wind resource. RReDC has estimated Class 3 or higher wind resource over much of the southern and western parts of the Antelope Valley. Another wind corridor exists in the vicinity of Daggett (just east of Barstow) where winds are channeled between the Calico and Rodman Mountains. Site data from the Daggett Airport indicate Class 3 to 4 windpower in this area. For each of these wind resource areas, the maximum wind resource occurs in the spring and summer. [37]

Wind energy development within the plan area is currently concentrated in Kern County near the communities of Techahapi and Mojave. Approximately 700 MW are produced from the wind farms located in this area. In February 2002, the BLM issued a Temporary Use Permit (CACA-43088) to Sea West Wind Power for a term of five years for the placement of five meteorological masts on Daggett Ridge.

The amount of sunlight received at any given location varies greatly depending on geographical location, time of day, season and clouds. The southwestern United States is one of the world's best locations for solar energy production with the desert region receiving almost twice the sunlight as other regions in the United States[38]. Major solar energy facilities have been developed in the Daggett area, at Kramer Junction and at Harper Dry Lake. Online energy production for solar these power plants is approximately 409 MW.

The majority of the coal and natural gas fueled power plants within the study area are cogeneration facilities, the one exception being the Coolwater facility east of Barstow. In May of 2000, the California Energy Commission granted approval to the High Desert Power Plant Project, a new natural gas fueled 750 MW facility. This facility is proposed to be located on a 25-acre site of the Southern California International Airport, formerly George Air Force Base, in the city of Victorville.

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37 *Wind Energy Resource Atlas of the United States*. Renewable Resource Data Center [www.nrel.gov]
38*Solar Energy.* Renewable Resource Data Center [www.nrel.gov]

3.7 CULTURAL RESOURCES

3.7.1 Archaeological, Historical, Paleontological and Ethnographic Resources

3.7.1.1 Area of Effect

Effects to cultural resources would be generated by specific implementing actions, such as fence construction, structure and debris removal, and route designation. Because specific locations for some actions have not yet been identified, it is not possible at this time to fully identify the entire area of potential effect (APE). Decisions that result in actions that disturb the ground surface or items on the surface would define the actual area of potential effect for most cultural resources. For these actions, all work areas, including parking for equipment, loading and unloading areas, would also fall within the APE. In some cases, actions may affect larger areas, such as landscapes that have cultural, traditional, or sacred values. For route designation, which is the action being considered by the West Mojave Plan with greatest potential to affect cultural resources, the area of effect is the actual routes under consideration plus the 600-foot-wide corridor along open routes that is available for pulling off, parking, and camping, plus areas near or adjacent to routes that may be subject to effects related to use of the route. Such effects include access to historic and prehistoric sites in the area that may be subject to vandalism, artifact theft, removal of wood for campfires, and other similar types of effects. In some cases, presence of vehicle access may have effects on traditional landscapes that extend well beyond the route and 600-foot corridor of use.

3.7.1.2 Existing Database

The existing cultural resources database consists of inventory reports, archaeological site records, and related information maintained by BLM in each field office and a database maintained by the State of California Office of Historic Preservation (SOHP). To a large degree these databases overlap through sharing of information over the years. The state database has been maintained by individual Information Centers around the state and until recently was, like the BLM database, a hard copy system of maps, site records, inventory reports, and photographs. For the past several years a cooperative effort between BLM and the SOHP has been underway to digitize the database and make it available to qualified users in an electronic format that would allow more refined manipulation of the data. This electronic system, the California Historical Resources Information System (CHRIS) is still under development. Currently, a static version of data that has been entered into the CHRIS system has been provided to each BLM field office on a compact disk (CD).

In 1966 the National Historic Preservation Act was passed, which requires that federal agencies take into consideration the effects of decisions on cultural resources. By the mid-1970s BLM archaeologists were surveying project areas for Bureau-initiated and non-Bureau-initiated proposed actions. Similar requirements of state law apply to development of private lands. Since then, the overwhelming bulk of archaeological inventory carried out within the planning area has been generated by the need to meet legal compliance requirements. Since location of inventory has been almost wholly determined by where development was planned, the available data does not fully reflect the nature, location, and significance of the resource on the ground. The primary exception to this is the archaeological inventory carried out during preparation of the California Desert Conservation Area Plan, beginning in 1969 and continuing until the CDCA Plan was signed in 1980. Each planning unit in the California Desert was subject to systematic sample inventory, stratified by various environmental factors that are thought to influence archaeological site distribution. The sample was low, ranging from 0.5% to 2% per planning unit and averaging 1% desert wide. Nevertheless, approximately 280 square miles were systematically inventoried and another 50 square miles were subject to less intensive reconnaissance. A total of 2,903 historic and prehistoric sites were recorded (USDI, BLM 1980, Appendix VII). This effort substantially increased our knowledge of the distribution of historic and prehistoric sites within the California Desert.

3.7.1.3 Regional Overview: Prehistoric

For detailed regional overviews of the prehistory, history, and ethnography of the study area see Norwood *et al.,* 1980, Stickel *et al.* 1980, Hall *et al.* 1981, Garfinkel 1976, Norris and Carrico 1978, and Warren and Roske 1981. These reports were prepared during preparation of the CDCA Plan and summarized available data at that time. More recent overviews may be found in W & S Consultants 2000 and Whitley, Whitley and Simon n.d.

The California Desert has been inhabited for at least 8,000 to 10,000/12,000 years and perhaps longer, although most of the extant remains date to much later periods. Evidence of the earliest occupations is sparse and difficult to date or interpret. Between 8,000 to 12,000 years ago settlement was centered on lakes, which are now the dry playas so characteristic of the Mojave Desert and Great Basin. These lakes, and especially marsh environments along their edges, were particularly rich in plant and animal species that provided food, fibers, medicines, tools, clothing, and ritual objects necessary for daily existence. From 8,000 to 6,000 years ago, climatic change caused the lakes to dry, necessitating cultural adaptation to the loss of a prime habitat. One of the adaptations included increased use of upland areas. (There is evidence that use of upland areas actually began earlier than this while the lakes were still present.) Around 6,000 years ago, food gathering and land use patterns began to appear that continued into the historic period. These involved use of a greater variety of habitats and plant and animal resources. Grinding implements such as manos and metates made their appearance. Around 2,000 years ago a shift in projectile point types from larger forms (e.g. Elko and Gypsum points) to smaller forms (e.g. Rose Spring and Eastgate Points) may indicate the introduction of the bow and arrow to replace spears and atlatls. The expansion of bow-and-arrow technology is indicated by the late prehistoric introduction of Desert Side-Notched and Cottonwood Triangular points, which are found throughout the area. These point styles are key indicators of the age of archaeological sites in which they occur. By this time, because of the drier climate, primary habitation sites were located near reliable water sources such as springs and flowing streams. Secondary habitation sites were established as needed in areas in which particular resources were seasonally collected. Sites relating to ritual or religious activity, such as rock art sites, sometimes occurred near habitation sites but were also remote from such sites to protect the sacred nature of the sites and the ritual activities. People generally followed a pattern of exploitation of seasonally available resources by moving through a more-or-less defined homeland, usually returning to a primary habitation ("village") for winters. This pattern of seasonal movement from place to place resulted in use of large areas by relatively small populations, and left the remains that are now archaeological sites widely scattered over the landscape.

3.7.1.4 Regional Overview: Historic

The first documented exploration of the Mojave Desert by non-indigenous peoples occurred in the mid-1700s when Francisco Garces, a Spanish Franciscan priest, looked for a practical route from Arizona to northern California. Between Garces' exploration in 1776 and 1880, only agriculture or precious metals attracted Spanish-Mexican and American settlers. Much of the history of the region turns on its use as a corridor (Warren 1980: 195).

In the early 19th century, fur trappers and caravans crossed the desert. Jedediah Smith led the way in 1826, followed by other mountain men like Ewing Young in 1829; both followed the Mojave Indian Trail. Antonio Armijo is credited with leading the first caravan of pack animals across the Mojave in 1830. Traders William Wolfskill and George C. Yount used the Old Spanish Trail in 1830-1831. Other groups who used the trail during Mexican control of the western Mojave include Don Jose Aveita's commercial caravan in 1833-1834, Jacob P. Leese in 1834, William Slover and Isaac Pope in 1837, and Jose Antonio Salazar's caravan in 1839-1840. John C. Fremont, a lieutenant in the U.S. Army Corps of Topographical Engineers, described his survey and travel in 1844 along a variant route (Warren 1980:201). Other trails arising from commerce include the Mojave Trail and Salt Lake Trail, both of which run through present-day Barstow. Joseph Walker is credited with pioneering a trail across the Sierra Nevada Range, enabling access between the San Joaquin Valley and the desert.

Settlement by Americans and the growth of coastal and inland trade culminated in the annexation of California by the United States in 1848. In that same year, gold was discovered in California and the gold rush was on, ushering in a massive influx of prospectors. The Death Valley forty-niners, led by William Lewis Manly, traveled through the project area along Indians Big Trail, also known as Owens River Road, the Midland Trail, and Bullion Road, which connected the northern Mojave and Owens Valley area with Los Angeles, via connections with the Tehachapi Pass road and Walker's Pass road. In the late-19th century, these roads were used to transport goods, people, livestock, food and ore between the Mojave Desert and Los Angeles. Temporary camps or stage stops were set up along the routes, including Indian Wells Station, Coyote Holes Station, and Panamint Station. The western Mojave Desert became a major contributor to California's mining industry. Small mining towns, such as Calico and Coolgardie, and ranching operations were established and proposed.

The California Gold Rush contributed to pressure to establish railroad routes across the desert. Railroad surveys began in 1853 with Lieutenant Amiel Weeks Whipple and Lieutenant Robert Stockton Williamson conducting surveys in the western Mojave. The San Pedro, Los Angeles and Salt Lake Line, predecessor of the Union Pacific through the Mojave Desert, was completed in 1905, and the Tonopah and Tidewater finished its line from Ludlow on the Atlantic & Pacific via Death Valley Junction to Beatty, Nevada in 1907 (Warren 1980:207). Spur lines were constructed to serve mines and mining camps. The Harvey house originated from an early railroad roadhouse located at the junction of the Santa Fe Mojave-Needles line and the California

Southern line coming north from Cajon Pass.

Development of automobile routes began in the early-20th century and increased in importance in the second quarter of the 20th century (Warren 1980:239). Following completion of the Atlantic & Pacific Railroad, a road was constructed in 1914 parallel to the tracks, which road became the precursor of U.S. 66. In 1925, construction began on U.S. 91, a new alignment of an older trail, which opened up the desert to the general public.

Ranching and agricultural industries at the beginning of the 20th century and increasing populations in Los Angeles created a need for more water than the immediate landscape could supply. In rural areas, the demand was met by small irrigation ditches and canals, but Los Angeles' need was met by construction of the Los Angeles Aqueducts in 1908-1913 and in the 1920s.

Military bases were established in the desert prior to U.S. entry into World War II. Large tracts of land were set aside for military use near Ridgecrest, Barstow, Lancaster, and Twentynine Palms.

3.7.1.5 Known Significant Sites

Prehistoric and historic properties and traditional cultural properties on federal lands are formally identified as significant by being listed in the National Register of Historic Places or determined eligible for listing (see Table 3-62). Properties on state or private lands are formally identified as significant by being listed in the California Register of Historic Resources or designated as a California Historic Landmark or California Point of Historical Interest. Some local governments also offer designation/registration programs for local properties. These lists are not comprehensive; they include only those properties that have been selected for special attention or have been evaluated as part of project development. Most sites have not been evaluated for significance. Federal regulation requires that caution be exercised when dealing with unevaluated properties to avoid damage or alterations that might affect qualities that could make them eligible for listing in the National Register of Historic Places.

Table 3-62
West Mojave Sites listed in the National Register of Historic Places

RIDGECREST FIELD OFFICE			
PROPERTY NAME	COUNTY	SITES INCLUDED	KNOWN VALUES
Bandit Rock (Robber's Roost)	Kern	1 (several sites present were not included in nomination)	Historic (sites not included in nomination are prehistoric)
Blackwater Well	Kern	17	Prehistoric
Last Chance Canyon (Includes Last Chance Canyon ACEC within boundaries)	Kern	160 (an additional 55 sites within 2 mile radius of boundary)	Prehistoric/historic/ Native American
Red Mountain Spring Archaeological District	San Bernardino	23 formally recorded; a number of others being documented as a result of recent research	Mostly prehistoric but some historic remains

RIDGECREST FIELD OFFICE			
PROPERTY NAME	COUNTY	SITES INCLUDED	KNOWN VALUES
Fossil Falls Archaeological District (includes part of Fossil Falls ACEC)	Inyo	32	Prehistoric
Steam Well Archaeological District	San Bernardino	4	Prehistoric
BARSTOW FIELD OFFICE			
Fossil Canyon	San Bernardino	SBR2841, SBR2058	Scientific, conservation, traditional use, public
Rodman Mountain Petroglyphs	San Bernardino	SBR307A, B, C (Deep Tank), SBR306A, B, C (Surprise Tank)	Scientific, conservation, traditional use, public
Black Mountain Rock Art District	San Bernardino		Scientific, conservation, traditional use, public
Newberry Cave	San Bernardino		Conservation, traditional use
Harvey House	San Bernardino		Conservation, public; 1911 Railroad station.
Alf's Blacksmith Shop	San Bernardino		Conservation, public; Only known complete blacksmith shop remaining in San Bernardino County.
Lake Mojave	San Bernardino	CA-SBE-140	Scientific

Table 3-63 lists sites of significance on public lands administered by the BLM Barstow Field Office.

Table 3-63
West Mojave Sites of Significance Administered by BLM Barstow Field Office

NAME	CULTURAL RESOURCE VALUES
CA-SBR-1606	Scientific
CA-SBR-2081	Scientific
CA-SBR-2085	Scientific
CA-SBR-2094	Scientific
Pinto Basin	Scientific
Salt Springs	Scientific
Amargosa Canyon	Scientific, conservation, public
Awl	Scientific
Rock Spring	Scientific, public
Saratoga Springs	Scientific
Oro Grande	Scientific
Rustler Rockshelter	Scientific
Deep Creek	Scientific
China Ranch	Scientific
Shoshone Rockshelter	Scientific
Fort (Camp) Cady	Scientific, conservation, public; 1860 military fort built by Major James H. Carleton.
Deadmans Point	Public

NAME	CULTURAL RESOURCE VALUES
Finger Rock (Hercules' Finger)	Public; site of 1840 battle between ranchers and rustlers.
Black Canyon	Scientific, conservation, traditional use, public
Calico Ghost Town/Mining District	Public; silver mining district
Coolgardie Camp	Public; 1890s gold mining camp.
Inscription Canyon	Scientific, conservation, traditional use; public

A number of other sites/districts are currently being nominated for listing in the National Register and many sites have been determined to be eligible for listing in the National Register.

Table 3-64 describes the areas of critical environmental concern that have been designated within the West Mojave planning area.

Most archaeological sites have not been evaluated for their significance or eligibility for listing in any formal roster of significant sites. Because one of the criteria for determining whether or not a site may be eligible for listing in the National Register is that the site has "yielded, or may be likely to yield, information important in prehistory or history" (36 CFR 60) many site types are *a priori* eligible for listing and are treated as such for management purposes regardless of whether or not formal determinations have been made. Such site types include permanent or semi-permanent habitation sites ("villages"); temporary camps containing multiple tool types, especially if they contain obsidian; and utilized shelters or caves that contain the same types of materials. As analytical techniques improve or new technologies are perfected, the kinds of data that can be extracted from archaeological materials increase. In contrast to most archaeological sites, which generally provide information on aspects of material culture and relationships between sites and groups of people, sites containing rock art (petroglyphs and pictographs) can provide glimpses into the intellectual and spiritual aspects of culture.

Historic sites may yield information on industrial technologies and how they were used or adapted in individual situations; ethnic, gender and age make-up of working populations; food preferences; availability of luxury items to various groups; and even how speculation on Wall Street affected small mining operations in the western United States (Barnes 2001).

All of this means that many, many archaeological sites, both recorded and unrecorded, are likely to be found to be significant and eligible for listing in the National Register of Historic Places if formally evaluated. For these reasons the actual number of sites listed in the National Register is not an accurate indicator of the significance of the resource base as a whole

3.7.1.6 Potentially Significant Areas

All of the lands within the planning area that are administered by the BLM's Ridgecrest Field Office may be characterized as sensitive for cultural resources with a few exceptions. Reasons for the intensity of prehistoric occupation include the presence in the past of a series of Pleistocene lakes and the Owens River as well as the fact that this area is on the boundary between the Mojave Desert and the Great Basin and presents a greater than usual variety of environments and associated natural resources.

Table 3-64
Cultural Resource ACECs in Western Mojave Desert

RIDGECREST FIELD OFFICE	
ACEC	CULTURAL RESOURCE VALUES
Rose Spring	Contains several prehistoric sites. Research at these sites started in the 1950s and continues (Lanning 1963, Riddell 1956). These sites are type sites for cultural chronology of the western Great Basin.
Fossil Falls	Large complex of prehistoric sites associated with Pleistocene Owens River, 32 of which are listed in the National Register. Research here dates back to work of M.R. Harrington in the 1950s. Area includes the Stahl site, on private land, also an important type site for explication of western Great Basin/Northern Mojave cultural chronology.
Last Chance Canyon	Prehistoric. Part of the Last Chance Canyon National Register District; the portion of the District considered to be most at risk was selected for ACEC status. Also includes important historic resources.
Jawbone-Butterbredt	Native American values. Contains a number of locations that were identified by a Kawaiisu elder whose family had lived in the area, including prehistoric and proto-historic/historic archaeological sites, sacred areas, and areas that were known or thought to contain burials.
Christmas Canyon	Prehistoric. Subject of current research that is revealing a large and very significant complex of sites, including examples of rare cultural phenomena. Some sites are related to various stands of Pleistocene Lake Searles and preliminary dates indicate great age for some of them, while at least one site contains historic materials, indicating a very long period of use.
Bedrock Spring	Prehistoric. Subject to current research by BLM, this ACEC also contains a variety of site types including habitation sites, rock shelters, rock art, milling, and others. Publication of current research will add materially to our understanding of prehistory in this portion of the Mojave Desert.
Steam Well	Prehistoric. Contains four petroglyph sites
Red Mountain Spring	Prehistoric. Contains 23 recorded sites and other sites that have been located during recent research by Cal Poly Pomona archaeologists. Site types include habitation sites, lithic scatters, milling features, rock art, trails, stacked stone structures, and hunting blinds. Although the ACEC was designated for prehistoric resources there are also historic materials within the ACEC.
BARSTOW FIELD OFFICE	
Afton Canyon	Moderate density and complexity of sites. Twenty recorded prehistoric sites, including quarries, lithic scatters with ground stone, and occupation/multi-use sites. Represent riparian and lacustrine resource exploitation, tool manufacture, trade, and desert settlement (Bureau of Land Management 1989:38). Scientific use.
Calico Early Man Site	Lithic tools and debitage are associated with possibly the earliest human occupation on the North American continent. Continued research investigates human occupation and settlement of the Western Hemisphere (Bureau of Land Management 1984:2.1). Public use.
Black Mountain	Area contains the most extensive assemblages of prehistoric petroglyphs within California. Quarry and lithic workshops are found within the ACEC as well as evidence for obsidian trade (Bureau of Land Management 1988:6). Scientific, traditional use.
Cronese Lakes	This area contains sites representing occupation beginning 8,000 years ago. Cultural remains provide information regarding subsistence and settlement patterns in the Great Basin (Bureau of Land Management 1985:1-5). Scientific use.
Denning Spring	Cultural resource values include at least four major resource locations. In addition to historic resources not formally recorded, prehistoric sites are designated SBR3828 and SBR 3829B and 3829C (Bureau of Land Management 1982:3). Scientific use.
Greenwater Canyon	Contains multi-purpose sites indicative of occupation beginning about 12,000 years ago to historic contact. Sites include rockshelters, petroglyphs, pictographs, hunting blinds, and diagnostic lithic tools (Bureau of Land Management 1988:6-10). Scientific, traditional, public use.

ACEC	CULTURAL RESOURCE VALUES
Juniper Flats	Numerous sites have open trash middens, evidence of cooking, tool manufacture, hunting, and plant/animal processing. An occupied rockshelter is also present. Early historic remains are related to homesteading and mining (Bureau of Land Management 1988:9). Scientific use.
Rodman Mountains	
Rainbow Basin	The badlands within the planning area expose one of the best known and most intensively studied late Miocene age fossil assemblages in the United States. Fourteen archaeological sites have been located, characterized by temporary habitation, flake scatter, petroglyphs, historic mining remnants (Bureau of Land Management 1991:32, 36). Scientific, traditional, public use.
Salt Creek Hills	Site of the first hard rock gold mine in the Mojave Desert (Bureau of Land Management 1992:5). Public use.

The area including the shore of Owens Lake, Haiwee Reservoir, Rose Valley, Cactus Flat, and McCloud Flat down to the Fossil Falls-Little Lake area is characterized by extremely high prehistoric site densities related to the presence of Owens Lake and Owens River and the nearby Coso and Sugarloaf obsidian quarries. Sites from this area have been important in defining cultural chronologies for the western Great Basin. Many more prehistoric sites may be expected in this area than have been formally recorded. The area also contains examples of Coso-style rock art, both painted and pecked. Recent archaeological and ethnohistorical research, moreover, suggests that the Numic religious and artistic tradition in the Coso region may represent 10,000 or more years of continuity (Whitley et al. 1999a, 1999b) – thus making this the longest-lived religious tradition so far identified in the world (National Register Nomination Form, Whitley2002). The Coso Mountains and adjacent areas were an important center of Shoshone habitation during the late prehistoric period.

The west edge of the planning area includes a series of canyons along the east flank of the Sierra Nevada. Nearly all of these canyons contain significant prehistoric sites and almost no formal inventory has been carried out in any of the canyons. They may be expected to contain sites that relate to middle to late-prehistoric settlement-subsistence patterns whereby resources at various elevations were exploited seasonally. The lower portions of the canyons that fall within the western Mojave Desert are known to contain what were probably winter habitation sites. Although a number of these sites are known, none have been subject to scientific study. These canyons extend into the Jawbone-Butterbredt ACEC south of Walker Pass.

The El Paso Mountains are known to contain extremely high site densities. Black Mountain in the El Pasos (and now in wilderness) was considered a sacred mountain by late prehistoric peoples. The entire mountain range is characterized by complexes of sites such as habitation sites, stone quarry sites, rock art sites (both painted and pecked), rock shelters, milling stations, rock alignments, and other site types. The total acreage that has been inventoried in the El Pasos is relatively small, so there are undoubtedly many unrecorded sites.

On the east side of the planning area there are complexes of prehistoric sites that appear to be related to the presence of Pleistocene Searles Lake, as well as sites relating to later periods. In the past year BLM archaeologists have inventoried approximately 1200 acres near Searles Lake and have found very high site densities as well as uncommon archaeological manifestations such as rock alignments, trails, and stacked stone features. Materials from some of these sites have been dated by radiocarbon and other dating methods and the area appears to have been inhabited from the late Pleistocene-Early Holocene (c. 11,000 years ago) down to the historic period. The Lava Mountains should also be included in this high sensitivity area.

Historic mining occurred in a number of areas, including Darwin and adjacent areas, and Homewood Canyon. Extraction of borax and borates from Searles Lake that began in the late 1800s left historic remains on and adjacent to Searles Lake. Red Mountain, Randsburg, and Johannesburg all began as centers for historic mining operations in the area and remains of historic mining, milling, and prospecting are abundant.

The very low inventory levels, less than 1% in most areas, leaves the probability that there are many unrecorded prehistoric and historic resources and areas of high sensitivity that have not yet been identified.

3.7.1.7 Ethno-historic Overview

The ethnohistoric period begins with European contact in the 18^{th} century, and is documented in diaries, official documents, narratives, and scholarly studies, the latter including interviews with native peoples.   At the time of European contact, Paiute, Shoshone, Kawaiisu, Kitanemuk, Serrano, Vanyume, Chemehuevi, and Mojave occupied the planning area. Owens Valley Paiute occupied the far northern edge of the planning area, near Owens Lake, although this was peripheral to their primary areas around Owens Lake and River. The Western Shoshone lived south and east of Owens Lake, as far south as Little Lake. Kawaiisu occupied the southern Sierra, as well as Indian Wells Valley, El Paso Mountains, Tehachapi Mountains, and adjacent areas. Kitanemuk and Serrano occupied the southwestern portion of the planning area, as far south as the San Bernardino Mountains. The Vanyume lived along the Mojave River, north and east of Victorville. The Chemehuevi are the southernmost band of the Southern Paiute, and their extensive traditional territory included the eastern Mojave Desert. By the mid-19^{th} century, they had settled along the Colorado River in traditional Mojave territory. The Mojave controlled the area north of Bill Williams River up to the Nevada border, but their main settlements were in the Mojave Valley.

The Owens Valley Paiute, Mojave, and Chemehuevi, after the latter's relocation to the Colorado River, farmed as well as harvested native wild plant foods. There is no record of farming among the other tribes. Ethnographic and ethnohistoric accounts indicate native populations had efficient processes to obtain food and raw materials, and had extensive knowledge of plants, animals, and the environment. Group settlement and subsistence patterns were within well-defined territories, but the length of time spent in any one camp varied among the tribes. Organization of society also varied among tribes, but can generally be described as loosely structured, allowing families to be self-determining while recognizing an importance of kinship lines. A sense of tribal identity, including language, customs, history, and religious beliefs, held members of each tribe together.

Under the National Historic Preservation Act, a federal agency consults with tribes so that they might identify traditional cultural properties of cultural and religious importance, and consider the effect of its actions on those places. Places meeting the criteria for traditional cultural properties are then evaluated under criteria for the National Register. Under the American Indian Religious Freedom Act and Executive Order 13007, a federal agency must consider the effects of its actions on Native American spiritual places and on access to such places by religious practitioners. Consultation usually combines compliance with both laws. A traditional cultural property is a place that is eligible for inclusion in the National Register of Historic Places because of its association with cultural practices or beliefs of a living community that are rooted in that community's history and are important in maintaining the continuing cultural identity of the community. Traditional cultural properties may overlap a number of categories of cultural resources such as archaeological sites, historic sites, areas where natural materials are collected, sacred sites, or sacred landscapes.

3.7.1.8 Significant Paleontological Localities

A triangular area roughly bounded by the Sierra Nevada Front, Highway 395, and Garlock Road has been subject to paleontological research for several decades and has been found to contain important paleontological resources. The Dove Spring Wash area contains a fossil assemblage known as the Dove Spring Lignites Local Fauna (Whistler 1990). Containing mollusks and a diversity of small vertebrates, "the Dove Spring Lignites Local Fauna is the most diverse, Late Pleistocene vertebrate assemblage recovered from fluviatile deposits in the Mojave Desert outside of the Mojave River basin" (Whistler 1990).

East of Dove Spring Wash, but within the same triangular area, the El Paso Mountains have been subject to paleontological study for over 50 years. The Raymond Alf Museum of Claremont, California is currently actively engaged in paleontological research of localities containing Paleocene (–60 million years old) mammals. The El Paso Mountains are the only locality on the west coast of the United States known to contain mammal fossils of this age; the closest known locations are in Wyoming. Consequently, these fossil localities are quite important (Lofgren n.d.).

A number of locations around Lake China that contain fossil remains of Rancholabrean megafauna have been recorded and studied. Although these sites are on China Lake Naval Air Weapons Station and not BLM, similar situations may apply around the edges of other Pleistocene dry lakebeds, such as Searles Lake within the planning area.

This area no doubt contains other important paleontological localities that have not been discovered or formally investigated.

Table 3-65 presents an overview of paleontological resources found within the planning area.

Table 3-65
Paleontological Resources Overview

MYA	CENOZOIC EPOCH	MAMMAL ASSEMBLAGES	
0			
		Rancholabrean	Rancho La Brea, Carpinteria Faunas (56).
1	PLEISTOCENE	Irvingtonian	Manix, Bautista Faunas (Savage & Downs 1954:56).
2			Coso Mt., San Timoteo Faunas
	PLIOCENE	Blancan	(Savage & Downs 1954:52).
5			
		Hemphillian	Mt. Eden, Kern R. Fauna (Savage & Downs 1954:52).
10		Clarendonian	Ricardo, Avawatz, Tejon Hills, Mint Canyon Faunas
			(Savage & Downs 1954:52).
15	MIOCENE	Barstovian	Barstow Fauna (Savage & Downs 1954:49).
			Tick Canyon Fauna (Savage & Downs 1954:49).
20		Hemingfordian	
25		Arikareean	Tecuya Fauna (Savage & Downs 1954:49).
30	OLIGOCENE	Whitneyan-Orellan	Kew Quarry Fauna (Savage & Downs 1954:47).
35		Chadronian	Titus Canyon Fauna (Savage & Downs 1954:47).
40		Duchesnean	Pearson Ranch Fauna (Savage & Downs 1954:47).
45	EOCENE	Uintan	Poway Fauna (Savage & Downs 1954:47).
50		Bridgerian	
		Wasatchian	
55		Clarkforkian	
		Tiffanian	
60	PALEOCENE	Torrejonian	
65		Dragonian-Puercan	
70			

(Woodburne 1978:26)

Tecopa Lake Beds consist of lacustrine siltstone and mudstone interbedded with layers of tufa and ash that range from 100 feet to 200 feet thick. Multiple vertebrate fossils have been recovered from exposures east of Tecopa Hot Springs, though numerous finds occur west and north. This area is one of only two placed that provide good examples of small Irvingtonian-age mammals. Additionally, it has yielded remains of a unique camel-like animal unknown elsewhere (Woodburne 1978:37).

The Avawatz Formation occurs in the rugged canyon land exposures on the south and southwestern flank of Avawatz Peak as well as along slivers of the Garlock and Death Valley Fault Zones. These deposits consist of coarse-grained conglomerate overlain by interbedded claystone, sandstone, and coarse- to fine-grained conglomerate. Coarse-grained breccia overlies the claystone section and is capped by arenaceous clastic sediments and some tuff with coarse-grained sandstone at the top. Faunal remains occur in the upper Clarendonian age unit (Woodburne 1978:49).

Pleistocene-age fossil bones have been reported in the lake sediments of Salt Spring Hills Playa, but not collected (Woodburne 1978:51).

Superior Dry Lake West consists of playa lakebeds near the southwest shore of Superior Dry Lake. Fossil bone and tooth fragments have been reported and are thought to be Rancholabrean (Woodburne 1978:53).

Jack Rabbit Spring is at the north end of Coyote Dry Lake. Playa lake deposits reportedly contain fossil camel bones dating to possibly the Rancholabrean (Woodburne 1978:54).

Cronese is comprised of sediments from the Barstow Formation. The relatively sparse fossil mammals are important because they probably represent the youngest Barstovian-age sample in the Mojave Desert. They show a relatively evolved Merychippus and are associated with tuffs dated at 12.3 million years (Woodburne 1978:56).

Alvord Mountain has a relatively thick sequence of tuffaceous sediment interbedded with tuffs and basalt flows, which is exposed in a valley drained by Spanish Canyon and its tributaries on the east flank of Alvord Mountain. The main fossil bearing unit is the Barstow Formation, followed by the Clews Fanglomerate and Spanish Canyon Formations of Hemingfordian age. Most of the fossils occur within a few feet in the middle of the Barstow unit. The stratigraphic succession of faunal remains corroborates the biostratigraphic and evolutionary sequence seen in the Barstow Formation in the Mud Hills (Woodburne 1978:57).

A series of sites occur in alluvial gravel, sandstone, and siltstone along bluffs overlooking the Mojave River. The bluffs occur from the Daggett-Yermo are east to Camp Cady. These deposits are Rancholabrean in age (Woodburne 1978:59).

Manix-Afton Canyon. The Manix Lake Beds consist of a succession of fine-grained lacustrine sediments interbedded with tufa and tuffs. They are unconformably overlain by alluvium and are cut by the Mojave River and its tributaries that flow into Afton Canyon. During the Pleistocene, Manix Lake extended westward into the Mojave Valley and north into present day Coyote Lake. This is one of the few well-studied Rancholabrean-age fossil assemblages, though much of the information is possibly unpublished as yet (60). The Manix beds near Barstow, CA have yielded an assortment of fossil mammal remains, most of which are limb bone fragments. This assemblage may be around 2 million years old, but evidence for exact dating is poor at present (Savage, Downs, and Poe 1954:53). Recovered specimens include true horses (*Equus*), jackrabbits (*Lepus*), camelids, true deer (*Odocoileus*), pronghorns (*Antilocapra*), and tapirs (*Tapirus*) (Savage, Downs, and Poe 1954:56).

The Cady Mountains comprise a relatively broad, sprawling range south of Afton Canyon. Like many Mojave ranges, a core of pre-Tertiary plutonic basement rock is overlain by a succession of mostly volcanic, then volcanic and sedimentary rocks that have been folded and faulted and are roughly Miocene age. These are overlain by less extensive coarse-grained approximately Pliocene deposits and Quaternary fan deposits, which are all finally cut by present streams whose valleys are filled with alluvium. Fossils in the Cady Mountains are derived from Miocene interbedded fluviatile clastic and tuffaceous sediments. The deposits are designated as the Hector Formation, which is composed of coarse- to fine-grained alluvial deposits interbedded with tuffs and a basalt flow. Total thickness is approximately 1,500 feet.

In the southern area, fossils of late Arikareean and early Hemingfordian fauna are separated by a tuff dated at 21 million years. This is one of the best calibrations of the boundary between currently known mammal ages. To the north near Afton Canyon, fossils are mainly of Hemingfordian age. This area is one of the most important regions in the Mojave Desert for biostratigraphy and geologic history. It provides one of the best single reference areas for the late Arikareean to late Hemingfordian interval in California and would form a secure base with which to evaluate the geological history of this part of the Mojave Desert (Woodburne 1978:62-63).

Southwest of Crucero, Rancholabrean age mammal remains were observed in conglomerates and sandstones (Woodburne 1978:65).

Daggett Ridge, about 4 miles southwest of Daggett, consists of a few hundred feet of fine-grained sandstone and siltstone and a thin, lower bed of gray sandstone that produces bone chips. This Miocene deposit contains small camels, a cervoid, and a horse. These remains date to about the middle of the Hemingfordian and could contribute significantly to an understanding of the little known faunas of this age in the Mojave (Woodburne 1978:66).

The Calico Mountain range east of Barstow contains the Jackhammer, Pickhandle, and Barstow Formations (Woodburn 1978:67). Fossil vertebrates have been found in the Calico Mountains in the Barstow Formation, which is approximately 3,000 feet thick. The primary specimen is of the grazing-browsing horse (*Merychippus intermontanus*). Insect-bearing nodules also occur. The Calico Range has definite potential to yield fossils, but much of it is located on private land with limited access (Woodburne 1978:67-68).

The Mud Hills, about 8 miles north of Barstow, contains outcrops of Jackhammer, Pickhandle, and Barstow Formations. The Barstow Formation, named for the Barstow fossil beds, is a non-marine, late Miocene age geologic unit derived from stream and lake deposited sediments in a basin subject to periodic volcanic ash fall and dust (Woodburne 1978:69; Savage, Downs, and Poe 1954:48). Deposition occurred about 15 million years ago. Many fossils occur in strata of mud mixed with volcanic ash. These strata often erode out as green and dark brown layers.

Fresh-water shells are abundant, but sabel palm is the only identified plant. Various institutions in the United States have collected a large number of mammal bones. Grazing-browsing horses (*Merychippus*) and camelids appear to be the most abundant. Many other mammal species have been described, including browsing horses (*Hypohippus*), dog-bears (*Hemicyon*), pronghorns, peccaries, chipmunks, field mice, rabbits, dogs, sabre cats, true cats, mastodons, large oreodonts (*Brachycrus*), and shrews. Two hawks, several ducks, a gull, a flamingo-like bird (*Megapaloelodus*), and a quail-like bird (*Cyrtonyx*) have been identified. The characteristics of the flora and fauna (called "Barstovian" fauna) suggest that grassland was available as well as vegetation similar to that of northern Mexico (Woodburn 1978:71; Savage, Downs, and Poe 1954:48). An overview of Barstovian Fauna is presented in Table 3-66.

Table 3-66
Barstovian Fauna

HERBIVORES		CARNIVORES	
Mastodonts	Gomphotherium	Dog-bears	HEMICYONIDS
Browsing horses (large)	HYPOHIPPUS	Dogs	Tomarctus
Grazing-browsing	Protohippus, Merychippus	Hyaenoid dogs	Aelurodon?
horses (intermediate)		Sabre-toothed cats	Machairodonts
Browsing horses (small)	Archeohippus	True cats	Pseudaelurus
Pronghorns	Merycodus		
Oreodonts	Brachycrus,	BIRDS & REPTILES	
Deer	Rakomeryx	Condor	
Camels	Hesperocamelus	Mourning Dove	
Peccaries	Dyseohyus	Ducks	
		Flamingo-like	Megapaloelodus
RODENTS		Gulls	
Rabbits	Hypolagus	Hawks	
Chipmunks	Tamias	Owls (Great Horned)	
Pocket mice	Perognathoides, Peridiomys	Quail-like	Cyrotonyx
Deer mice	Peromyscus		
Shrews	Limnoecus	Tortoise	

(Savage, Downs, and Poe 1954:49; Davenport and Goldbrandsen 1963:4; Woodburn 1978:69-71).

The Black Mountain-Gravel Hills region is a small-scale badlands north of Harper Lake. Most of the Tertiary section consists of the Barstow Formation, which is the most extensive unit in the Gravel Hills. Barstovian faunal remains of Merychippine horses and Merycodonts have been recovered from tuffaceous sandstone near Black Canyon (Woodburne 1978:74).

A number of sites occur in relatively coarse-grained fluvial sandstone and gravel beds near Victorville and extend north along the Mojave River to Barstow. These deposits relate to the uplift of the San Gabriel Mountains to the south and the history of the Mojave River. The best fossil specimens have been obtained from the gravel pits by Victorville, but others are known from exposures to the north. *Equus* is the most common species, among other Rancholabrean fauna (Woodburne 1978:84).

The Cushenbury beds are often referred to as the Old Woman Sandstone of Shreve and comprise a succession 200 feet to 1,000 feet of massive reddish-buff and red-brown conglomeratic arkose with a matrix of uncemented, poorly sorted, coarse-grained, angular fragments of quartz, feldspar, and hornblende that support subangular to subrounded pebbles of andesite, gneiss, quartzite, and other minor types. These lithologies are the oldest Tertiary deposit to be derived from the San Bernardino Mountains, on the north side, and reflect uplift of the ranges. A small, but important, and growing collection of small mammal fossils has been collected from the Cushenbury beds. They appear to be Blancan or late Blancan age and suggest that the San Bernardino Mountains began shedding debris to the north about 2 million years ago. These fossils provide the only evidence for the age of that uplift (Woodburne 1978:85).

At Twenty-Nine Palms, there is an unnamed succession of mainly northeast-dippling fluvial and lacustrine sediments interbedded with tuff a few miles east of the main north road from Twenty-Nine Palms. The exposures are relatively isolated patches of older sediments surrounded by younger alluvium. A small collection of Rancholabrean fauna, mostly large mammals, has been collected. These include *Equus*, *Odocoileus*, *Tanupolama*?, *Hemiauchenia*?, *Bison*, *Ovis*, *Breameryx*? *geopherus*, *Nothrotheriops*? *taxidea*, *Camelops* (Woodburne 1978:87).

3.7.2 Tribal Governments and Policies

Eight tribal governments who might attach religious and cultural significance to historic properties within the planning area were contacted in June 2000 and from May to July 2001. These included the Lone Pine Paiute Shoshone, Timbisha Shoshone, San Manuel Band, Morongo Band, 29 Palms Band, Fort Mojave Tribe, Chemehuevi Tribe, and Colorado River Indian Tribes. Contact was made via letter and phone. When contacted by phone in July 2001, the Lone Pine Paiute Shoshone, Timbisha Shoshone, Fort Mojave Tribe, Chemehuevi Tribe, and Colorado River Indian Tribes requested additional information, and information packets were sent to those tribes. In August 2001 a briefing was presented to the Native American Lands Conservancy at their request. As a consequence of contact, no tribe or band identified religious or cultural significance to historic properties within the planning area.

3.7.3 BLM Consultation Procedures

CDCA Plan Policies: The CDCA Plan recognizes the importance to the public, scientists, Native Americans, and others of prehistoric, historic, and paleontological resources. Plan goals are to conduct inventory to the fullest extent possible to expand knowledge of these resources, protect and preserve to the greatest extent possible representative samples of resources, give full consideration to these resources during land-use planning and management decisions, manage to maintain and enhance resource values, ensure BLM's activities avoid inadvertent damage to these resources, and achieve proper data recovery where adverse impacts cannot be avoided. Specific guidance regarding vehicle route approval is to use resource data during the route approval process to help minimize or eliminate adverse impacts on these resources from access and vehicle use.

The CDCA Plan also states that cultural and religious values held by Native Americans will be considered in all CDCA land use and management decisions. CDCA Plan goals are to identify Native American values through regular contact and consultation; give full consideration to Native American values in land use planning and management decisions consistent with statue, regulation, and policy; and manage and protect Native American values wherever prudent and feasible.

Compliance With Pertinent Statutes and Regulations: The BLM has responsibilities and authorities to consider, plan for, protect, and enhance historic properties and other cultural resources under the National Environmental Policy Act, Archaeological Resources Protection Act, Native American Graves Protection and Repatriation Act, American Indian Religious Freedom Act, National Historic Preservation Act, and other authorities.

Section 106 of the National Historic Preservation Act requires Federal agencies to consider the affect of undertakings on historic and prehistoric resources and give the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking. Section 101 (d)(6))B) of the Act requires Federal agencies to consult with any Indian tribe or Native Hawaiian organization that attaches religious and cultural significance to historic properties that may be affected by an undertaking. When Indian tribes and Native Hawaiian organizations attach religious and cultural significance to historic properties off tribal lands, the Act requires Federal agencies to consult with such tribes and organizations in the Section 106 process. In following the Section 106 process, a Federal agency documents the area of potential effects, compiles and analyzes cultural resource data and literature, seeks information from consulting parties, synthesizes information, identifies historic properties, assesses adverse effects, and seek ways to resolve adverse effects. BLM meets its responsibilities under the National Historic Preservation Act through a Programmatic Agreement with the Advisory Council on Historic Preservation and the National Conference of State Historic Preservation Officers and through State Protocols.