

CHAPTER 3

AFFECTED ENVIRONMENT

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CHAPTER 3
AFFECTED ENVIRONMENT

This chapter provides a general description of the affected environment in Arizona for the entire planning area and a more detailed description of the affected environment of the proposed Agua Caliente SEZ. The affected environment described in this chapter provides the basis for identifying the potential impacts described in **Chapter 4**, Environmental Consequences, and **Chapter 5**, Cumulative Impacts.

3.1 INTRODUCTION

The **planning area** is the geographic area within which the BLM will make decisions during a planning effort. A planning area includes all lands within a planning area boundary regardless of current jurisdiction; however, the BLM's planning decisions will only apply to the lands (including subsurface minerals) under the BLM's jurisdiction. For the RDEP, the planning area includes the entire state of Arizona.

Chapter 3, Affected Environment, presents a general description of the existing conditions and trends of resources and resource uses in the planning area that may be affected by implementing BLM's proposed alternatives as well as site-specific information relevant to the proposed Agua Caliente SEZ. The description of the affected environment in this chapter provides the basis for identifying potential impacts and is of sufficient detail to support the programmatic nature of this EIS. Climate change, a topic that may have an influence on the current conditions and potential trends of individual resources and resource uses, has been incorporated as a stand-alone topic.

The BLM Arizona manages large acreages of diverse public lands across the state, with topography ranging from low deserts to high mountains. The land uses are as varied as the terrain and include livestock grazing; fish and wildlife habitat; oil, gas, and mineral exploration and development; ROW authorizations; and a wide range of outdoor recreation activities. These uses are managed within a framework of numerous public land laws, the most comprehensive of which is the Federal Land Policy and Management Act of 1976. FLPMA establishes several fundamental policies regarding the management of public lands, including the policy directing that lands be managed "…on the basis of multiple use and sustained yield unless otherwise specified by law" (Section 102(a) of FLPMA). "Multiple use" means management so that "public lands and their various resource values…are utilized in the combination that will best

meet the present and future needs of the American people" (Section 103(c) of FLPMA). "Sustained yield" means the achievement and maintenance in perpetuity of a high level or regular periodic output of the variable renewable resources of the public lands consistent with the multiple use mandate (Section 103(h) of FLPMA).

The uses to which public lands are dedicated and the allocation of those uses is identified in BLM land use plans called resource management plans (see **Figure 3-1**, Arizona BLM Land Use Plans). RMPs are periodically prepared and revised through an open process that encourages input from the public and interest groups regarding the mix of potential uses of the public lands. Arizona has 16 BLM land use plans; seven of them may be amended by decisions being evaluated in this EIS.

The status of public lands in Arizona is constantly changing with the approval of new ROWs, land exchanges, withdrawals, and the implementation of land use plan and management decisions. Some of these changes could be very large, such as military base expansions; could happen through legislation expanding or creating protected lands, such as creation of a national monument; or could occur through ongoing consideration of applications for renewable energy development on BLM-administered lands.

3.2 AIR QUALITY AND AIR QUALITY-RELATED VALUES

Ambient air quality is affected by the type and amount of air pollutants emitted into the atmosphere, the size and topography of the air basin, prevailing meteorological conditions, and the conversion of air pollutants and other species by a complex series of chemical and photochemical reactions in the atmosphere. The levels of air pollutants are generally expressed in terms of concentration, either in units of parts per million (ppm), parts per billion (ppb), or micrograms per cubic meter ($\mu g/m^3$).

3.2.1 RDEP Affected Environment

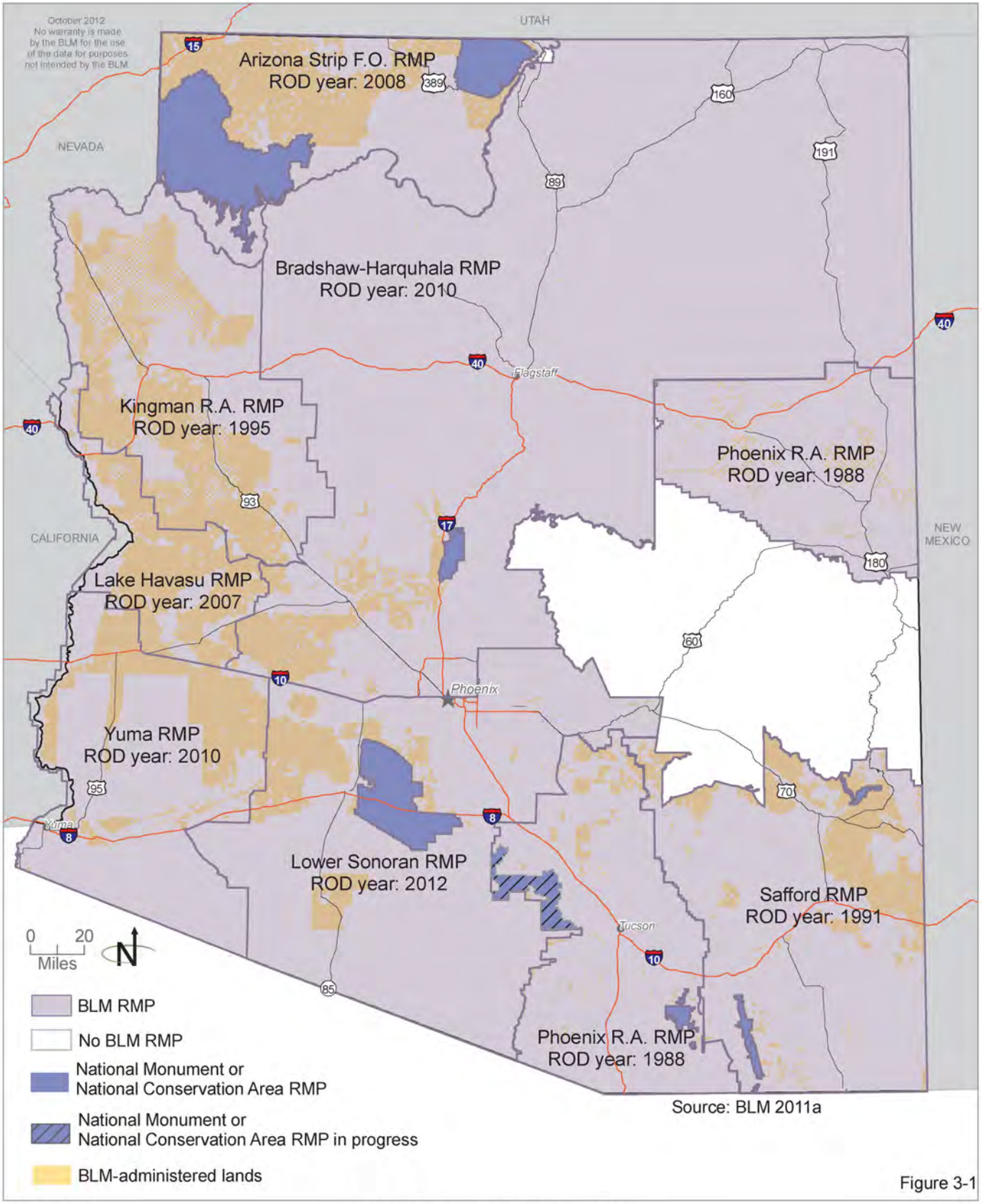
Regulatory Framework

Clean Air Act

The Clean Air Act (CAA) (42 United States Code [USC] §§ 7401−7642) established the principal framework for national, state, and local efforts to protect air quality in the U.S. Under the CAA, the U.S. Environmental Protection Agency (EPA) has set time-averaged standards known as national ambient air quality standards (NAAQS) for six air pollutants considered to be key indicators of air quality: carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide, lead, and two categories of particulate matter (particulate matter with an aerodynamic diameter of 10 microns or less [PM_{10}] and particulate matter with an aerodynamic diameter of 2.5 microns or less [$PM_{2.5}$]). States may set

Arizona BLM Land Use Plans

BLM land use plans called Resource Management Plans (RMPs) identify public lands uses and allocations of uses.



Source: BLM 2011a

Figure 3-1

their own ambient air quality standards, but these standards must be at least as stringent as the national standards. The State of Arizona has adopted the NAAQS to regulate air pollution in the state.

A NAAQS is composed of two parts – an allowable concentration of a criteria pollutant and an averaging time over which the concentration is to be measured. Averaging times are based on whether the damage caused by the pollutant is more likely to occur during exposure to a high concentration for a short time or to a lower average concentration over a longer period. For some pollutants, there is more than one air quality standard, reflecting both short-term and long-term effects. Primary standards set limits to protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. **Table 3-1**, National and Arizona Ambient Air Quality Standards, lists the standards.

Table 3-1
National and Arizona Ambient Air Quality Standards

Pollutant	Primary Standards		Secondary Standards
	Averaging Time	Level	Level
Carbon Monoxide	8-hour	9 ppm (10 mg/m^3)	None
	1-hour	35 ppm (40 mg/m^3)	None
Lead	Rolling 3-Mo. Average	0.15 µg/m^3	Same as Primary
Nitrogen Dioxide	Annual (Arith. Ave.)	53 ppb	Same as Primary
	1-hour	100 ppb	None
Particulate Matter (PM_{10})	24-hour	150 µg/m^3	Same as Primary
Particulate Matter ($PM_{2.5}$)	Annual (Arith. Ave.)	15.0 µg/m^3	Same as Primary
	24-hour	35 µg/m^3	Same as Primary
Ozone	8-hour	0.075 ppm	Same as Primary
Sulfur Dioxide	3-hour	None	0.5 ppm
	1-hour	75 ppb	None

Source: EPA 2011d

The CAA also regulates toxic air pollutants, or hazardous air pollutants, that are known or suspected to cause cancer or other serious health effects or adverse environmental impacts. EPA has issued rules covering 80 categories of major industrial sources as well as categories of smaller sources. Solar and wind generation facilities are not among these sources.

Clean Air Act Conformity Requirements

Section 176(c) of the CAA requires that federal actions conform to the appropriate State Implementation Plan. A State Implementation Plan is a plan developed at the state level that provides for the implementation, maintenance,

and enforcement of NAAQS and is enforceable by the EPA. The EPA has promulgated rules establishing conformity analysis procedures for transportation-related actions and for other general federal agency actions (40 CFR Parts 6, 51, and 93). The EPA general conformity rule requires preparation of a formal conformity determination document for federal agency actions that are undertaken, approved, or funded in federal nonattainment or maintenance areas when the total net change in direct and indirect emissions of nonattainment pollutants (or their precursors) exceed specified thresholds. No conformity determination has been prepared for this EIS, as no specific wind or solar renewable energy actions are being proposed. Project-specific NEPA analysis would include a determination of project conformance with the CAA general conformity rule.

Prevention of Significant Deterioration

Prevention of Significant Deterioration (PSD) regulations prevent areas that are in attainment of the NAAQS from being polluted up to the level of the standards. PSD regulations place limits on the total increase in ambient pollution levels above established baseline levels for sulfur dioxide, nitrogen dioxide, and PM_{10}.

Air quality control regions are classified either as Class I, II, or III to indicate the degree of air quality deterioration that the state or federal government will allow while not exceeding the NAAQS. Class I areas are special areas of natural wonder and scenic beauty, such as national parks, some national monuments, and wilderness areas, where air quality should be given special protection. Class II areas allow a moderate change in air quality due to industrial growth while still maintaining air quality that meets the NAAQS. No Class III areas have been designated in the U.S. Class I areas are subject to more stringent PSD limits than Class II areas. Actions located farther than 100 kilometers from Class I areas are generally presumed to not impact air quality-related values of the Class I area.

There are twelve Class I airsheds in Arizona: Chiricahua National Monument Wilderness, Chiricahua Wilderness, Galiuro Wilderness, Grand Canyon National Park, Mazatzal Wilderness, Mount Baldy Wilderness, Petrified Forest National Park, Pine Mountain Wilderness, Saguaro Wilderness, Sierra Ancha Wilderness, Superstition Wilderness, and Sycamore Canyon Wilderness (**Figure 3-2**, Class I Airsheds). The remaining areas are classified as Class II areas. As shown in **Figure 3-2**, Class I Airsheds, the majority of Arizona is classified as Class II under PSD guidelines, including all BLM-administered land. In addition, there are three Class I areas in Utah (Bryce Canyon, Zion, and Capitol Reef National Parks), one Class I area in Colorado (Mesa Verde National Park), one Class I area in New Mexico (Gila Wilderness), and one Class I area in California (Joshua Tree Wilderness) that are within 100 kilometers of Arizona. PSD requires major sources or major modification of sources to obtain permits

Class 1 Airsheds

The Clean Air Act, as amended, protects visibility and other air-quality related values within sensitive Class I areas such as wilderness areas and national parks.

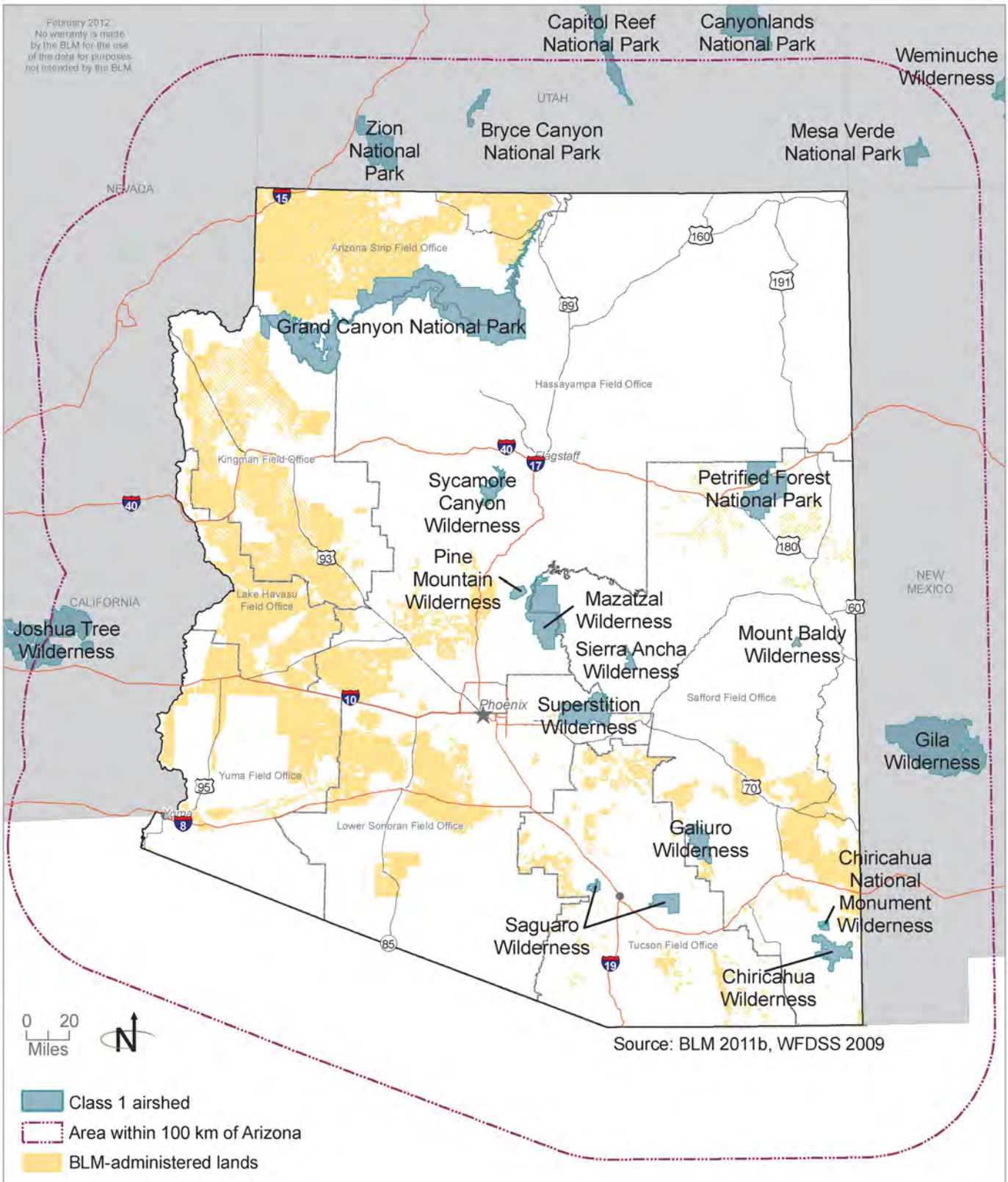


Figure 3-2

for attainment pollutants. Solar and wind generation facilities are not rule-listed emissions sources; therefore, the PSD trigger levels are 250 tons per year for each criteria pollutant emitted during individual facility operations.

Regional Air Quality

Based on measured ambient criteria air pollutant concentrations, the EPA classifies areas of the U.S. according to whether they meet the NAAQS. Areas that violate air quality standards are designated as nonattainment areas for the relevant criteria air pollutants. Nonattainment areas are sometimes further classified by degree (marginal, moderate, serious, severe-15, severe-17, and extreme for ozone, and moderate and serious for carbon monoxide and PM_{10}). Areas that comply with air quality standards are designated as attainment areas for the relevant criteria air pollutants. Areas that have been redesignated from nonattainment to attainment are considered maintenance areas. Areas of uncertain status are generally designated as unclassifiable but are treated as attainment areas for regulatory purposes.

Figure 3-3, Nonattainment and Maintenance Areas, shows the portions of Arizona that are not in attainment with the NAAQS (nonattainment areas) or that have been reclassified from nonattainment to attainment (maintenance areas). **Table 3-2**, Nonattainment and Maintenance Areas and CAA Conformity Threshold Levels, describe these areas and lists the applicable CAA conformity threshold limits.

3.2.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ, in southwest Arizona, in not within 100 kilometers of a Class I area and is in attainment for all NAAQS.

3.3 GREENHOUSE GAS EMISSIONS AND CLIMATE CHANGE

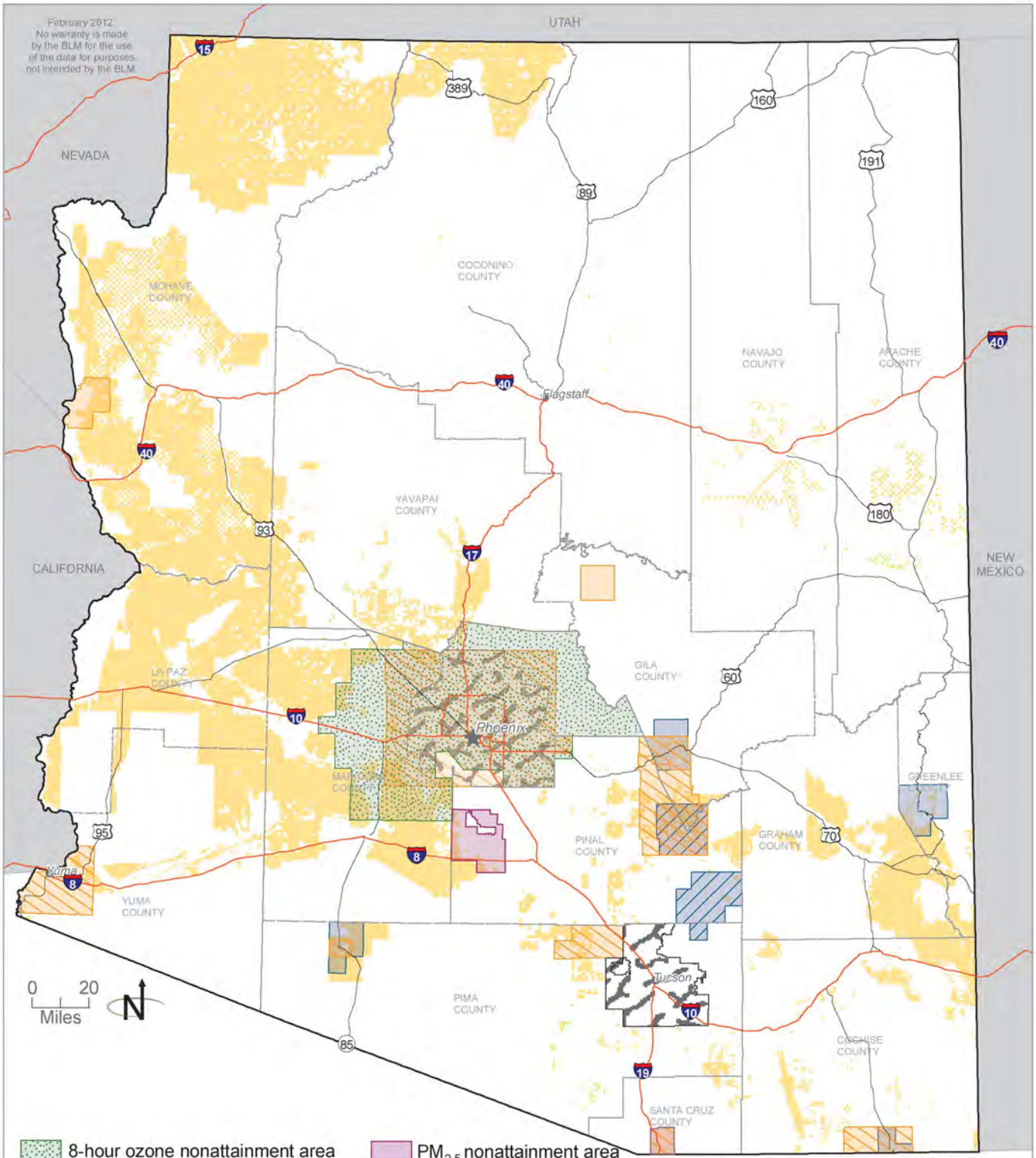
Greenhouse gases (GHGs) are chemical compounds in the Earth's atmosphere that allow incoming short-wave solar radiation but absorb long-wave infrared radiation re-emitted from the Earth's surface, trapping heat. Most studies indicate that the Earth's climate has warmed over the past century due to increased emissions of GHGs, and that human activities affecting emissions to the atmosphere are likely an important contributing factor (U.S. Energy Information Administration 2010).

Gases exhibiting greenhouse properties come from both natural and human sources. Water vapor, carbon dioxide, methane, and nitrous oxide are examples of GHGs that have both natural and manmade sources, while other GHGs such as chlorofluorocarbons are exclusively manmade. In the U.S., most GHG emissions are attributed to energy use.

Such emissions result from combustion of fossil fuels used for electricity generation, transportation, industry, heating, and other needs. Energy-related carbon dioxide emissions represent 82 percent of total manmade GHG emissions in the U.S. (U.S. Energy Information Administration 2010).

Nonattainment and Maintenance Areas

Most of Arizona is in attainment with the national ambient air quality standards. Areas of nonattainment are associated primarily with urban areas in southern Arizona.



Source: ADEQ 2012, BLM 2011b

Figure 3-3

Table 3-2
Nonattainment and Maintenance Areas and CAA Conformity Threshold Levels

County	Nonattainment Area	Maintenance Area	CAA Conformity Threshold Value
		PM_{10}	
Cochise	Paul Spur/Douglas area (moderate)	--	100 tons per year in moderate PM_{10} nonattainment areas and maintenance areas
Gila	Hayden area (moderate) Miami area (moderate)	Payson area	
Maricopa	Phoenix area (serious)	--	
Mohave	--	Bullhead City area	
Pima	Ajo area (moderate) Rillito area (moderate)	--	
Pinal	Hayden area (moderate) Phoenix area (serious)	--	70 tons per year in serious PM_{10} nonattainment areas
Santa Cruz	Nogales area (moderate)	--	
Yuma	Yuma area (moderate)	--	
		$PM_{2.5}$	
Pinal	West Central Pinal area	--	100 tons per year each directly emitted $PM_{2.5}$; sulfur dioxide; and (if determined to be a significant precursor) nitrogen oxides, volatile organic compounds, and ammonia
Santa Cruz	Nogales area	--	
		8-hour Ozone Standard	
Maricopa	Phoenix area (serious)	--	50 tons per year each volatile organic compounds and nitrogen oxides in serious nonattainment areas
Pinal	Phoenix-Mesa area (serious)	--	
		Sulfur Dioxide (primary standard)	
Cochise	--	Douglas area	100 tons per year in nonattainment areas and maintenance areas
Gila	--	Miami area	
Greenlee	--	Morenci area	
Pima	--	Ajo area	
Pinal	Hayden area	San Manuel area	
		Carbon Monoxide	
Maricopa	--	Phoenix area	100 tons per year in maintenance areas
Pinal	--	Tucson area	

Source: EPA 2011e; 40 CFR 93 Subpart B

Computer-based modeling suggests that rising GHG concentrations generally produce an increase in the average temperature of the Earth, which may produce changes in sea levels, rainfall patterns, and intensity and frequency of extreme weather events. Collectively, these effects are referred to as "climate change." The Intergovernmental Panel on Climate Change, in its Fourth Assessment Report, stated that warming of the earth's climate system is unequivocal and that warming is very likely due to anthropogenic GHG concentrations (Intergovernmental Panel on Climate Change 2007).

3.3.1 RDEP Affected Environment

In Arizona, GHG emissions have historically increased. Between 1990 and 2005, Arizona's net GHG emissions increased by nearly 56 percent, from an estimated 59.3 million metric tons carbon dioxide equivalent to an estimated 92.6 million metric tons carbon dioxide equivalent. In addition, electricity use accounts for nearly 40 percent of Arizona's gross GHG emissions, or about 35 million metric tons carbon dioxide equivalent (ACCAG 2006). However, in 2011 the EPA began regulating GHGs in the state. GHGs have been added to the list of pollutants covered under air quality permits (McKinnon 2011).

Arizona's GHG emissions are forecasted to increase by 148 percent from 1990 to 2020, taking into account the effects of recent energy efficiency actions adopted by the state in the 2006 Arizona Climate Change Action Plan (ACCAG 2006). A few of the actions proposed by the Climate Change Action Plan to reduce Arizona's GHG emissions include renewable energy incentives and tax credits, biodiesel/ethanol implementation, reforestation, and manure management/digesters. A complete list of the Climate Change Action Plan proposed actions and their corresponding reductions in GHG emissions can be found in the Arizona Climate Change Action Plan (ACCAG 2006). Without these actions, emissions growth in 2020 would be forecasted to increase by 159 percent over 1990 levels (ACCAG 2006).

3.3.2 Agua Caliente Solar Energy Zone Affected Environment

As stated above for the state of Arizona, GHG emissions have also increased in the region of the proposed Agua Caliente SEZ. However, due to the rural nature of the proposed Agua Caliente SEZ, the increase in emissions are not as large as more developed areas. Current activities on the proposed Agua Caliente SEZ generate low levels of GHG emissions and are primarily associated with vehicles and farm equipment.

3.4 CULTURAL RESOURCES

Cultural resources encompass a range of archaeological, traditional, and built resources that may include sites, structures, buildings, roads, trails, spiritual/sacred places, districts, and objects that are significant in regard to history, prehistory, architecture, archaeology, engineering, and/or cultural heritage. This term also may apply generally to non-tangible cultural practices (e.g., cultural uses of the natural environment).

Under the National Historic Preservation Act (NHPA), significant cultural resources are those "historic properties" that are eligible for nomination to the National Register of Historic Places (NRHP). To be NRHP eligible, a property must be at least 50 years old (with rare exceptions) and possess integrity of location, design, setting, materials, workmanship, feeling, and association. A site, building, structure, or district may be determined eligible if it meets at least one of four criteria (36 CFR 60.4):

- Criterion A: Associated with events that have made a significant contribution to the broad patterns of our history;
- Criterion B: Associated with the lives of persons significant in our past;
- Criterion C: Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values; or
- Criterion D: Have yielded, or may be likely to yield, information important in prehistory or history.

NRHP-eligible locations that meet these criteria may also include traditional cultural properties (TCP). NRHP Bulletin 38 (Parker and King 1998) defines a TCP as an eligible historic property that has an association with cultural practices or beliefs of a living community that are "rooted in that community's history," or "are important in maintaining the continuing cultural identity of the community." Although TCPs may be associated with living communities of various ethnic or cultural groups, they are an especially important consideration for Native American groups. Properties that possess such significance may include locations where tribal religious practitioners have historically gone, and are known or thought to go today, to perform ceremonial activities in accordance with traditional cultural rules of practice; and locations where a community has traditionally carried out economic, artistic, or other cultural practices important in maintaining its cultural heritage. Although tribal consultation under Section 106 of the NHPA may provide for the identification of TCPs, it is not uncommon for tribal members to be reticent to discuss or disclose the location of such sites to outside interests. As such, government-to-government consultation involving face-to-face meetings may be the only way to identify this information and to protect its confidentiality to the extent provided by law.

In addition to the NHPA, the BLM is obligated under the FLPMA, NEPA, and agency policy to protect cultural resource values and to consider and mitigate the potential impacts of proposed activities and land use plans. The BLM also allocates cultural resources to use categories, such as scientific and educational uses, that could be affected by renewable energy development.

3.4.1 RDEP Affected Environment

Cultural resources are present throughout Arizona, resulting from at least 10,000 years of human history. Although the numbers, density, and distribution of the resources vary widely over geographic areas, it is expected that some cultural resources are present within each proposed REDA.

BLM-administered lands in Arizona account for 12.2 million acres; about 817,400 acres (6.7 percent) had been surveyed for cultural resources by 2003 (Jarvis 2006). Jarvis estimated a rate of 1 cultural resource site per 59.5 acres for BLM lands in the 11 western states. Using this estimate, **Table 3-3**, Predictive Model for Previously Unrecorded Cultural Resources within the Six Proposed REDA Alternatives, shows the predicted number of new cultural sites under each REDA alternative (not including the Agua Caliente SEZ).

Table 3-3
Predictive Model for Previously Unrecorded Cultural Resources within the Six Proposed REDA Alternatives

Alternative	Total BLM-administered Lands (acres)	Unsurveyed Acres[1]	Predicted Number of New Cultural Resources[2]
Alternative 1	266,100	248,271	4,173
Alternative 2	185,700	173,258	2,912
Alternative 3	82,500	76,973	1,294
Alternative 4	266,100	248,271	4,173
Alternative 5	21,700	20,246	340
Alternative 6	192,100	179,229	3,012

[1]Calculations based on the assumption that approximately 6.7 percent of BLM-administered lands in Arizona have been subject to archaeological survey.
[2]Calculations based on the rate of 1 site per 59.5 acres.
WPZ= Water Protection Zone
Source: Rayle and Swanson 2011

Although the predictive equation provides a means for estimating the potential number of new cultural resources for each of the six proposed REDA alternatives, these are general estimates that do not take into account the exclusion of culturally sensitive areas, and do not attempt to direct development toward areas of relatively low sensitivity. Specifically, the statewide estimates are skewed due to the inclusion of areas of high site density that are not part of the REDA, and it is reasonable to expect that the potential of new cultural resources would be lower than the estimates in **Table 3-3**, Predictive Model for Previously Unrecorded Cultural Resources within the Six Proposed REDA Alternatives.

The BLM recently completed intensive inventories (surveys) for proposed renewable energy projects in western Arizona, which are included in the REDA under most alternatives. These include three proposed solar energy projects

(Sonoran Solar, Quartzsite, and Hyder) and one wind project (Mohave County Wind Farm). For these projects, the total area surveyed is 25,224 acres. The surveys recorded 55 archaeological sites (33 historic period sites and 22 prehistoric or Native American sites). The overall average is 1 site per 459 acres, a much lower density than the estimate of 1 site per 59.5 acres. As such, it is expected that, based on local conditions, there would be a range of 2 to 10 sites per square mile (640 acres).

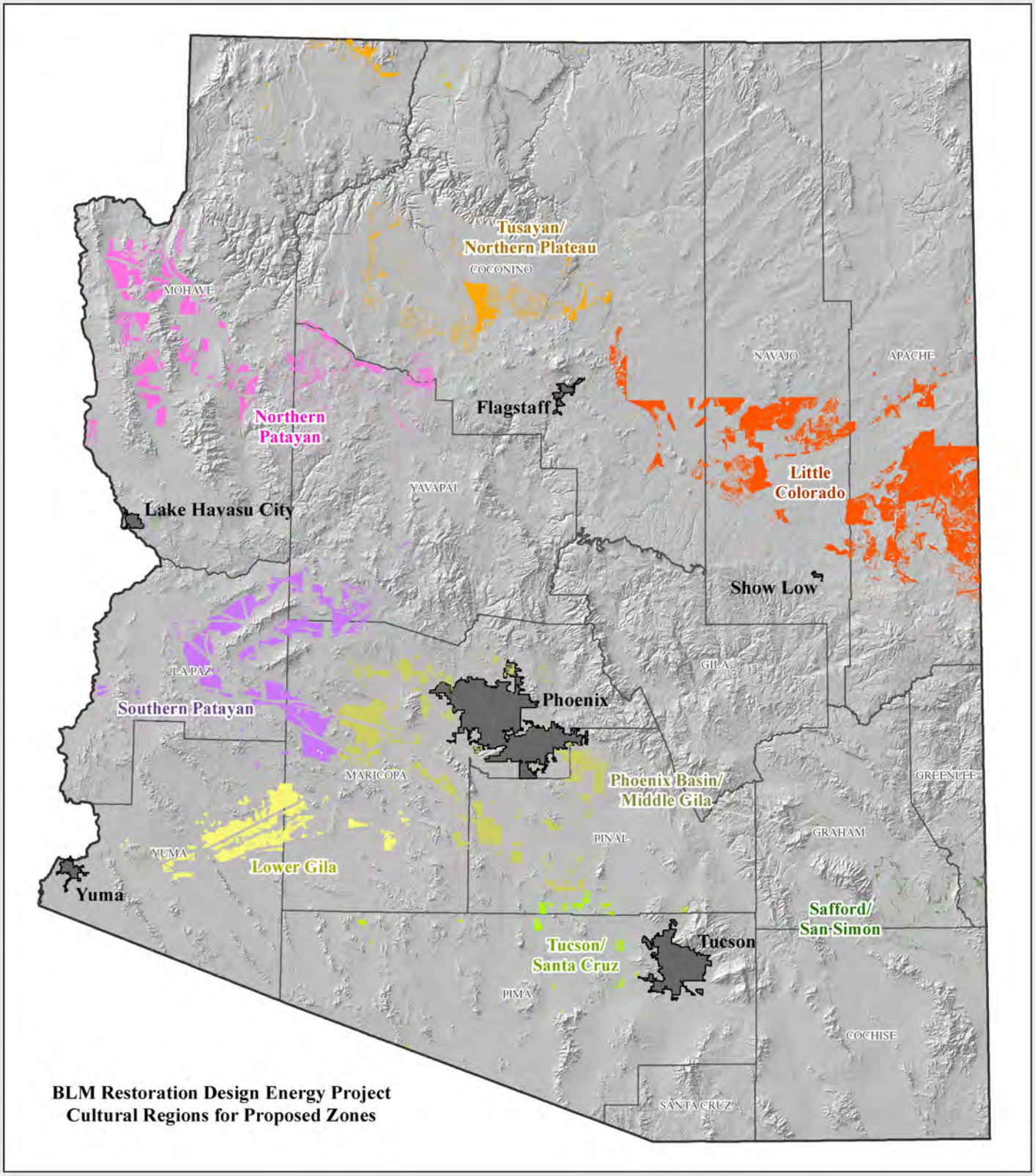
Based on an initial statewide assessment of potential REDA locations, REDAs in geographic areas containing similar histories or cultural characteristics were grouped in order to facilitate the EIS analysis. Labels assigned to these areas reflect either their geographic locations or the prehistoric cultural traditions affiliated with these areas. Boundaries for these cultural regions were drawn to group the REDAs and may include areas that have not been proposed as a REDA. These cultural regions include:

- Lower Gila;
- Southern Patayan;
- Northern Patayan;
- Tusayan/Northern Plateau;
- Little Colorado;
- Safford/San Simon;
- Santa Cruz/Tucson; and
- Phoenix Basin/Middle Gila.

With these cultural regions defined, EPG, Inc. conducted a limited Class I records search to summarize and provide an overview of resources throughout the state (**Figure 3-4**, RDEP Cultural Regions). A standard Class I review, incorporating detailed data from the statewide Arizona Archaeological Site and Survey Database (AZSITE) database, would be beyond the scope of this EIS; therefore, the review focused on the types of sites known to exist in each region and any historic properties currently listed on the NRHP within or near the proposed REDAs. For more-detailed information regarding relevant cultural histories, as well as the general site types that might be located within each of these eight regions, see Rayle and Swanson (2011), or refer to **Appendix D**, Cultural History Background of Arizona.

Lower Gila Cultural Region

This region of southwestern Arizona includes areas along the lower Gila River in Yuma County, extending eastward into Maricopa County. Much of the area identified in potential REDA zones includes private land used for agriculture. This region includes the proposed Agua Caliente SEZ on BLM-administered land.


Tusayan/
Northern Plateau
COCONINO
MOHAVE
NAVAJO
APACHE
Flagstaff
Northern
Patayan
Little
Colorado
YAVAPAI
Lake Havasu City
Show Low
LA PAZ
GILA
Phoenix
Southern Patayan
MARICOPA
Phoenix Basin/
Middle Gila
GREENLEE
PINAL
GRAHAM
YUMA
Lower Gila
Yuma
Safford/
San Simon
Tucson/
Santa Cruz
Tucson
PIMA
COCHISE
SANTA CRUZ
BLM Restoration Design Energy Project
Cultural Regions for Proposed Zones
Little Colorado
Lower Gila
Northern Patayan
Phoenix Basin/Middle Gila
Safford/San Simon
Southern Patayan
Tucson/Santa Cruz
Tusayan/Northern Plateau
Urban Area
County Boundary
0 10 20 30 40 50
Miles
Figure 3-4
Sources:
EPG 2011; ESRI 2010;
November 07, 2011
S:\EPG\Geospatial\Projects\EMPSi\BLM_RDEP\mxds\Cultural\State_Overview.mxd

Prehistoric cultural resources are affiliated primarily with the Archaic and Patayan cultural traditions. Site densities tend to be higher within one to two miles of the Gila River, including scatters of artifacts, pit houses, and other features that represent the remnants of dispersed villages and seasonal camps. Some areas near the river have concentrations of trails, rock art, and rock alignments that may have been associated with ceremonial activities. Trails along the river attest to its importance as a travel corridor.

Prehistoric site types include habitation sites, temporary camps, petroglyphs and pictographs, rock rings, intaglios and geoglyphs (designs created by scraping away "desert pavement" from the surface or making rock alignments), trails, hearths, quarries, and scatters of stone or ceramic artifacts deposited while hunting, gathering, or processing plants, raw materials, or other resources. These sites are located within a variety of environmental zones and attest to frequent and patterned movements across the landscape in the course of seasonal resource exploitation. Sites tend to be located near water sources, such as springs, tinajas, or larger washes, or other areas that offered concentrations of resources, such as cacti on the higher zones of desert basins. Some areas of the desert basins have a low incidence of archaeological sites (Stone 1986). However, on-the-ground surveys would be needed to identify the presence and distribution of sites within specific REDAs.

Many historic trails, roads, and railroads, including the Juan Bautista de Anza National Historic Trail, Butterfield Overland Mail Route, and Mormon Battalion Trail, followed the Gila River. Historic site types include trails, roads, railroads and associated facilities and work camps, mining sites, irrigation facilities, homesteads, ranches, and cemeteries. Historic sites are often located at or near the same locations as prehistoric sites, indicating similar needs for access to water and other resources. Also, this region may contain historic sites associated with military training activities in the Desert Training Center/ California-Arizona Maneuver Area during World War II, specifically in the vicinities of Camps Horn and Hyder.

NRHP listings in the vicinity of proposed REDAs include three historic structures. Two listed archaeological districts, Sears Point and Painted Rocks, are excluded from REDAs but could be subject to visual impacts of renewable energy development.

Southern Patayan Cultural Region

This region of western Arizona includes desert basins and mountains in portions of La Paz, Maricopa, and Yavapai Counties. Prehistoric cultural resources are affiliated primarily with the Archaic and Patayan cultural traditions. Archaeological and ethnographic evidence indicates that some groups lived in this area year round, traveling seasonally to exploit wild resources, or went to live temporarily along the lower Colorado River, while groups who lived along

the river often ventured into the deserts and uplands to hunt and exploit wild foods and other natural resources (Stone 1986, 1991).

Prehistoric and historic site types are similar to those of the Lower Gila Cultural Region. This region was also part of the Desert Training Center/California-Arizona Maneuver Area and was the location of Camp Bouse. Likewise, archaeological sites tend to be located near water sources, such as springs and large washes, and in or near the mountain ranges that contained relatively abundant game, wild food plants, and raw materials or minerals, such as the Eagletail, Harquahala, and Harcuvar mountains. The broad desert basins tend to have lower site densities, yet concentrations of Archaic and Patayan camps have been found along major washes or in areas where temporary pools of water formed during rainy seasons or wetter climates. Many of the REDAs in this region are on private lands that have been devoted to agriculture, and it is also the location of the Brenda SEZ, nominated in the Supplemental Draft Solar PEIS (BLM and DOE 2011).

NRHP listings in the vicinity of proposed REDAs include the Eagletail Petroglyph Site and the historic Harquahala Peak Smithsonian Observatory, both of which are excluded from development but could be subject to visual impacts from renewable energy facilities. The listings also include three historic structures or ranches near Quartzsite, Wenden, and Wickenburg.

Northern Patayan Cultural Region

This region in northwestern Arizona extends from the Colorado River through the desert basin and range province to the western edge of the Colorado Plateau, in Mohave, Yavapai, and Coconino Counties. Prehistoric cultural resources are affiliated primarily with the Archaic, Patayan, and Cohonina cultural traditions. In addition, trade and travel routes across Arizona linked the various tribes to groups in present-day California and New Mexico.

Prehistoric and historic site types are similar to those in other regions of western Arizona. Caves and rock shelters were frequently used for habitation and storage. Structures of rock masonry, known as pueblos, were used as habitations in later time periods. Small structures on hill tops may have had defensive functions or served as lookouts or signaling stations. Historic roads, railroads, and trails, many of which followed prehistoric routes, are a conspicuous type of historic archaeological feature in this region, along with sites associated with mining and ranching.

Archaeological site densities appear to be higher along the Colorado River and other streams, in the area between the Colorado River and the Black Mountains, and in mountain ranges and canyons. Sites are also present in some valleys and basins, such as the area surrounding Red Lake playa, which offered water, areas suitable for farming, or relatively dense concentrations of edible plant seeds. Other arid basins, such as the Detrital Valley, and the high Plateau grasslands appear to be areas of relatively low site density (Stone 1987).

During World War II, the U.S. Army expanded its Desert Training Center on the west side of the Colorado River into Arizona (see Lower Gila culture history), and designated a 2,000-square mile (1,280,000-acre) parcel of land that lies in the current Northern Patayan cultural region, under study as Area C (see **Figure 3-3**, Nonattainment and Maintenance Areas) (Bischoff 2008). Unrelated to the DTC/C-AMA expansion, the U.S. Army Air Corps (USAAC) established the Kingman Army Airfield in 1942 to serve as an aerial gunnery school. The airfield remained in operation until 1945, and was subsequently converted into a storage and scrap yard facility for obsolete USAAC aircraft. Between 1945 and 1946, approximately 10,000 aircraft landed at the facility for decommissioning (Rayle and Swanson 2011).

Sites listed on the NRHP in the vicinity of REDA zones include the Seligman Commercial Historic District and eight historic buildings, roads, or structures in the vicinity of Kingman, Ash Fork, and Bullhead City. Two listed structures on the Hualapai Indian Reservation would not be affected by development within the REDAs.

Tusayan/Northern Plateau Cultural Region

This region includes lands in northern Arizona on the Colorado Plateau in Coconino and Mohave Counties. Prehistoric cultural resources are affiliated primarily with the Archaic, Cohonina, Cerbat, Sinagua, and Ancestral Puebloan traditions. Major types of prehistoric sites are pithouse villages, pueblo settlements, caves, farming-related features, petroglyphs and pictographs, trails, and artifact scatters representative of camping and resource exploitation. This area also contains many quarries associated with rich sources of obsidian, a volcanic glass that was widely traded throughout Arizona for the manufacture of stone tools. It is difficult to clearly associate the distribution of sites with environmental zones, though many site concentrations of higher density are located near the base of major mountain peaks and near the obsidian sources.

Historic sites are associated with ranching, logging, mining, and transportation as well as the management of national forests and the development of tourism at the Grand Canyon. Camps and activities of the Civilian Conservation Corps also are evident in the archaeological record.

Many of the NRHP-listed sites in this region are within areas of the Kaibab and Coconino National Forests and Grand Canyon National Park that would be unlikely to be affected by renewable energy development in the proposed REDAs. However, visual impacts may be of concern. The Grand Canyon Railway, between Williams and Tusayan, is listed as a historic district and could be affected by visual impacts of renewable energy development.

Little Colorado Cultural Region

This region of northeastern Arizona spans the Colorado Plateau in Apache and Navajo Counties and eastern Coconino County. Prehistoric cultural resources are affiliated primarily with the Archaic, Sinagua, and Ancestral Puebloan cultural

traditions. Major types of prehistoric sites are pithouse villages, pueblo settlements, farming-related features, petroglyphs and pictographs, trails, and artifact scatters representative of camping and resource exploitation. Many of the pueblo sites consist of large villages containing several hundred rooms and circular ceremonial chambers known as kivas. Areas along the Little Colorado River and on mesa tops tend to have high site densities, as does the Petrified Forest National Park and adjacent zones, though site densities vary across the landscape. Archaeological sites of Navajo and Apache ancestors, who had a relatively mobile lifestyle, can be ephemeral and difficult to detect but include the foundations of temporary brush shelters. Sites of the historic period are associated with ranching, logging, mining, and the construction of major railroads and highways.

The NRHP listings for Navajo and Apache counties (outside of Indian reservations) include at least 15 prehistoric archaeological sites or districts whose location is given as "address restricted" for their protection. Some of these sites could be within or near REDAs. In addition, there are at least 30 listed historic sites and districts, consisting mainly of buildings within and near Holbrook and Winslow, highways, and highway bridges. About 19 of these locations could be subject to potential impacts based on their proximity to REDAs.

Safford/San Simon Cultural Region

This region in southeastern Arizona includes lands in the San Simon Valley near Safford in Graham and Greenlee Counties. Prehistoric cultural resources are affiliated primarily with the Paleoindian, Archaic, Ancestral Puebloan (primarily Mogollon), and Hohokam cultural traditions.

Spanning an extremely long range of time, this region includes notable occurrences of ancient Paleoindian and Archaic sites, some of which may be deeply buried and therefore subject to discovery during construction activities. Prehistoric site types include pit house and masonry structures; agricultural features (including the extensive "waffle garden" series of rock alignments near Safford); petroglyphs and pictographs; Hohokam ball courts; and artifact scatters representing a variety of activities and resource uses. Sites of the historic period are associated with ranching, mining, Spanish settlement and exploration, 19th century military campaigns, and activities associated with the Civilian Conservation Corps. Sites tend to have higher densities near streams and transportation routes.

Listed NRHP properties in the vicinity of REDAs include two prehistoric archaeological districts near Safford whose location is confidential. Most of the listed sites are historic buildings in Safford and other towns, which are remote from proposed REDAs.

Santa Cruz/Tucson Cultural Region

This region in southern Arizona includes lands north and west of Tucson in Pima and Pinal counties. Prehistoric cultural resources are affiliated primarily with the Archaic and Hohokam cultural traditions. Types of prehistoric sites include pit houses and settlements with above-ground architecture; ball courts and platform mounds; canals; other agricultural features such as constructed terraces and rock pile fields; petroglyphs and pictographs; and artifact scatters. Diverse types of sites are present in a variety of environmental zones, with higher densities of more substantial sites near the Santa Cruz River and other water sources, and on the upper bajada slopes adjacent to mountain ranges. Intricate series of terraces, known as trincheras, were constructed on some steep hill slopes such as Tumamoc Hill in Tucson.

Historic site types are those associated with the settlement and growth of Tucson and surrounding areas, and some are associated with Spanish exploration starting in the 1500s. Sites include homesteads, ranches, mines, trails, roads, military facilities, and missions.

The region includes more than 100 sites and districts that are listed on the NRHP, consisting mostly of historic buildings and structures in Tucson. Some of these could be affected by the development of disturbed sites such as mines and landfills that are nominated as REDAs. Away from the urban area, approximately 17 listed properties may be proximate to REDAs, consisting mainly of historic structures but also including several prehistoric sites and districts.

Phoenix Basin/Middle Gila Cultural Region

This region in south-central Arizona includes lands that surround Phoenix in Maricopa and Pinal Counties. It is the location of the Gillespie SEZ. Prehistoric cultural resources are affiliated primarily with the Archaic, Hohokam, and Patayan cultural traditions. Types of prehistoric sites are similar to those of the Santa Cruz/Tucson region, as are types of historic period sites with the exception of those related to Spanish exploration and missions. Hohokam settlements are concentrated along the Salt, Verde, Agua Fria, and Gila Rivers and extend as far west as the Gila Bend area. The co-occurrence of Hohokam and Patayan artifact types in the western area may indicate social relationships or co-occupation of the same settlements. Away from the rivers, site densities tend to be higher near major water courses and near mountain ranges with productive natural resources.

The region includes more than 300 properties listed on the NRHP, consisting mainly of historic buildings and structures in Phoenix and the surrounding metropolitan area. Outside the urban area, approximately a dozen listed properties, mostly historic buildings and highway bridges, could be proximate to REDAs.

3.4.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ lies on the Palomas Plain in northeast Yuma County, Arizona. A Class I cultural resource records check was conducted through AZSITE, the Arizona State Historic Preservation Office (SHPO), the BLM Yuma Field Office, and General Land Office (GLO) plat maps available from the BLM. The records search was performed to identify previously completed Class III cultural resource inventories and previously recorded sites within the analysis area. The study area consists of the approximately 22,000-acre planning area, plus a 1-mile buffer around the planning area, in compliance with SHPO requirements.

Since publication of the Draft EIS, new archaeological surveys have been conducted within the boundaries of the proposed Agua Caliente SEZ. The Class II inventory covered 1,120 acres and resulted in finding segments of prehistoric trails, habitation sites, and artifact scatters (SWCA Environmental Consultants 2012). The habitation sites included remnants of hearth features, pottery, flakes, and projectile points and were recommended as eligible for the National Register of Historic Places. Fourteen sites were found within the dispersed, 40-acre sample units that were surveyed in the central and northern portions of the proposed SEZ. Subsequent inspections by BLM revealed that some of the sites extended beyond the sample unit boundaries. The survey found no sites within sample units in the southern and more disturbed areas of the SEZ near the current solar development. The new data indicates that there could be more eligible properties within the SEZ boundary and additional Class III inventories will be needed in the area.

Fourteen previously recorded sites occur within one mile of the planning area; these sites are shown in **Table 3-4**, Summary of Previously Recorded Cultural Resources. Previously recorded prehistoric sites consist of artifact scatters, some of which contain extant features such as hearths, geoglyphs, trails, and rock rings. All of these prehistoric cultural resources remain unevaluated except for AZ Y:3:28(ASM), a prehistoric lithic scatter that has been recommended as eligible for the NRHP, and AZ-050-2384(BLM), a prehistoric rock ring that has been recommended as not eligible for NRHP listing.

The five previously recorded historic cultural resources consist of a segment of the Southern Pacific Railroad, a segment of the Bunyan-Hyder-Horn 69-kV Power Line, the White Wing Ranch, Camp Horn, and the Horn Railroad Station (see **Table 3-4**, Summary of Previously Recorded Cultural Resources). The SHPO has determined that the Southern Pacific Railroad: Wellton-Phoenix Spur is eligible for inclusion on the NRHP. The White Wing Ranch and Camp Horn have been recommended eligible for inclusion on the NRHP, while the Bunyan-Hyder-Horn 69-kV Power Line and Horn Railroad Station have been recommended as not eligible for NRHP listing.

Table 3-4
Summary of Previously Recorded Cultural Resources

Site Number/Name	Description	Size	Eligibility
AZ S:14:6(ASM)	Prehistoric lithic scatter	Unknown	Not evaluated
AZ S:14:7(ASM)	Prehistoric ceramic scatter	Unknown	Not evaluated
AZ S:14:8(ASM)	Prehistoric lithic scatter	Unknown	Not evaluated
AZ S:15:7(ASM)/Bunyan-Hyder-Horn 69/12-kV Power Line	Historic power line and access roads	1.4 miles x 200 feet (within study area)	Recommended not eligible
AZ T:10:84(ASM)/Southern Pacific Railroad: Wellton-Phoenix Spur	Historic railroad	7 miles x 200 feet (within study area)	Determined eligible
AZ Y:2:29(ASM)/Horn Railroad Station	Historic railroad station	455 x 375 feet	Recommended not eligible
AZ Y:2:49(ASM)/Camp Horn	Historic Army divisional camp	4.5 miles x 7,392 feet	Recommended eligible
AZ Y:3:28(ASM)	Prehistoric lithic scatter	110 x 45 meters	Recommended eligible
AZ Y:3:29(ASM)	Patayan/Yuman artifact scatter	100 x 100 meters	Not evaluated
AZ Y:3:30(ASM)	Patayan/Yuman artifact scatter with hearths	160 x 150 meters	Not evaluated
AZ Y:3:5(ASM)	Prehistoric camp site	Unknown	Not evaluated
AZ Y:3:70(ASM)/White Wing Ranch	Historic ranch	375 x 300 feet	Recommended eligible
AZ-050-0938(BLM)	Prehistoric geoglyph, trail and lithic scatter	100 x 20 meters	Not evaluated
AZ-050-2384(BLM)	Prehistoric rock ring	2 x 2 meters	Recommended not eligible

Source: Rayle and Swanson 2011

In addition to the formally recorded sites, unpublished archaeological field maps completed by Malcolm Rogers and Julian Hayden in the 1940s suggest the presence of three prehistoric trails within the study area. The new inventory data suggest that trails are present and may be the same three Rogers initially identified. Rogers believed that these trails may have served as links between settlements on the Colorado and Gila Rivers. Artifacts, rock rings, and rock piles found in association with the recorded trail segments confirm his assumption that such features are frequently associated with prehistoric trails.

There is a high potential for previously unidentified historic military-related cultural resources due to the U.S. Army's presence in the area during World

War II. Specifically, the planning area lies in close proximity to Camp Horn and Camp Hyder, two significant World War II-era divisional training camps in operation from 1943 through 1944. Comparison of period maps (Bishcoff 2008) with modern topographic maps of the area reveals that at least three military ranges located northeast of Camp Horn lie directly within the current planning area, and much of this area remains free of agricultural-related disturbance. These ranges consisted of the East Artillery Range and two combat ranges used for .30-caliber small arms training. Moreover, topographic maps and aerial imagery reveal the presence of at least two landing strips within the current planning area. At this time, no archival research has been undertaken to identify these extant airfields; however, it is likely that they are military-related and date to the period of significance at the Desert Training Center/California-Arizona Maneuver Area (1942–1944).

Training of troops at Camp Horn and Camp Hyder consisted of conducting division-scale maneuvers in the area. According to Bischoff (2008, p. 85), planting operations at the White Wing Ranch following the Army's departure resulted in the discovery of several buried crates containing grenades and rifles. Furthermore, local residents claim to have observed a number of exploded and unexploded ordnance in the area, including 20-mm projectiles and cartridges, 2.36-inch bazooka rockets, 81-mm mortars, 25-pound practice bombs, and .50-caliber bullets and cartridges. Therefore, it is very likely that a Class III cultural survey would result in the identification of historic military-related features, exploded and unexploded ordnance, other small arms bullets and cartridges, and other cultural material directly associated with Camp Horn. As such, a Class III survey would be required for any potential projects within the Agua Caliente SEZ.

3.5 ENERGY AND MINERALS

Arizona contains a variety of energy and mineral resources. This section focuses on those energy and mineral resources that are managed on BLM-administered lands; information on other energy and mineral resources not managed on BLM-administered lands are limited to a general overview. Energy and mineral resources include leasable minerals (both solid and fluid), locatable minerals, mineral materials (salables), and renewable energy. These resources are defined as follows:

- **Leasable minerals** include fluid minerals such as oil, gas, and carbon dioxide (CO_2), and solid minerals such as coal and sodium. Leasable minerals are governed by the Mineral Leasing Act of 1920, as amended, which authorized specific minerals to be disposed of through a leasing system. Geothermal resources are also a leasable mineral and are governed by the Geothermal Steam Act of 1970.
- **Locatable minerals** include both metallic minerals such as gold, silver, and copper, and nonmetallic minerals such as gemstones, silica, and perlite. Locatable minerals rights are established by

staking a mining claim in accordance with federal and state laws and regulations. Related mining operations are governed by federal, state, and local environmental and safety laws and regulations.

- **Mineral materials** (or saleable minerals) include common varieties of sand, gravel, aggregate, clay, limestone, cinders, and decorative rock as well as building or dimensional stone.

3.5.1 RDEP Affected Environment

Leasable Minerals

Leasable minerals defined by the Mineral Leasing Act (February 1920; and 43 CFR 3000-3599, 1990) include the subsets leasable solid and leasable fluid minerals. The rights to explore for and produce these minerals on public land may only be acquired through leasing.

Solid Leasable Minerals

Leasable solid minerals discussed in this section include coal, potash, and sodium chloride.

Coal. The two noteworthy coal fields in Arizona, the Black Mesa and Pinedale coal fields, are within the Colorado Plateau in the northern portion of the planning area. The Black Mesa coal field is the most extensive coal reserve in Arizona and is entirely within the Navajo and Hopi Indian Reservations. It is therefore outside of the project planning area and not discussed further. The Pinedale coal field is in the southern part of Navajo and Apache Counties. The rank of the coal is assumed to be subbituminous (Averitt and O'Sullivan 1969). There is no known production from this coal field (Kirschbaum and Biewick 2000). Smaller remnants of Arizona Cretaceous rocks are indicated in the northern, far eastern, and southeastern portions of the state, but no production has occurred at any of these sites (Peirce et al. 1970).

Potash. The Colorado Plateau east of Holbrook is underlain by a potash deposit estimated by the Arizona Geological Survey (AZGS) to contain between 682 million and 2.27 billion metric tons of mineral (AZGS 2011). The potash is present near the top of extensive salt (halite – sodium chloride) deposits in the Permian Supai formation. The deposit is located many hundreds of feet underground and underlies lands that include private, State Trust, tribal, and National Park Service holdings. The deposit is approximately centered on Petrified Forest National Park, making extraction challenging.

To date there has been no commercial production of potash in Arizona on BLM-administered land or otherwise, either by conventional or solution mining (Rauzi 2008).

Sodium Chloride. Salt of Permian age underlies about 3,500 square miles in the Holbrook Basin on the Colorado Plateau. Massive salt deposits at least 6,000

feet thick and possibly more than 10,000 feet thick have accumulated in the Hualapai Valley north of Kingman and the Luke Basin west of Phoenix (Rauzi 2002). Arizona hosts one solution-mining operation and two liquefied petroleum gas facilities. The solution-mining operation and one of the liquefied petroleum gas facilities are west of Phoenix in the Luke salt deposit. Portions of this deposit lie on BLM-administered subsurface lands. The other liquefied petroleum gas facility is east of Holbrook in the Holbrook salt basin (Rauzi 2002).

Fluid Leasable Minerals

Leasable fluid minerals discussed in this section include helium, geothermal, and oil and gas resources.

Helium. Helium is a valuable gas that has many uses because of its unique physical properties (small atom, extreme mobility, low boiling point and density, and completely inert). Some of the uses include coolant for high-temperature gas-cooled nuclear reactors, lifting gas for balloons and other lighter-than-air activities, and purging and pressurizing fluid in aerospace applications. In the 1960s and 1970s, some of the richest helium-bearing gas in the world was produced from wells in the Holbrook Basin in northeastern Arizona. The only helium production in Arizona at this time, however, is from wells in the Dineh-bi-Keyah oil field on the Navajo Reservation in the Four Corners area (Rauzi and Fellows 2003). As mentioned previously, the Navajo Reservation is outside the project planning area and therefore is not further discussed.

Geothermal. In May 2008, the BLM signed a ROD for the Geothermal Leasing PEIS, in which the BLM reviewed the potential for geothermal energy on BLM, Bureau of Indian Affairs, and U.S. Forest Service lands in the western U.S., except Alaska. This document serves as the baseline for the assessment of geothermal resources in the planning area.

High-temperature geothermal resources have yet to be discovered in Arizona, and most known resources of any temperature are located south of the Colorado Plateau (BLM 2008b). The BLM has one geothermal lease in eastern Arizona, located in the Safford Field Office (Greenlee County), but no exploration has occurred. Likewise, there is no reported leasing or development activity for geothermal energy resources throughout the state. A resource exploration report was written in 2005 to evaluate the geothermal resources of the Clifton Hot Springs area in Greenlee County for an electric power production project (Brown 2007). Three additional Arizona locations that may warrant exploration are Buckhorn Baths in Apache Junction, Castle Hot Springs in the Bradshaw Mountains, and Childs on the Verde River (BLM 2008b).

Oil and Gas. Proper conditions for formation and accumulation of commercial reservoirs of oil and gas are known to have existed only in the extreme northeastern corner of the state, from which all production in Arizona has

come (Duncan and Mancini 1991). These lands are located entirely within the Navajo Reservation, and are therefore outside the scope of the RDEP.

Other areas in Arizona with thick accumulations of sedimentary rocks that have been explored for oil and gas include Holbrook Basin, Mogollon Slope, Pedregosa Basin, and the Gulf of California Embayment. While potential is thought to occur in these areas, none have produced. Furthermore, whether these areas will yield oil and gas is unknown and largely dependent on the intensity with which they are explored (Duncan and Mancini 1991).

Leasable Minerals Summary

As the population in Arizona continues to grow, so will competition for land uses. There is potential for an increased interest and development of leasable minerals in Arizona. Good potash deposits are rare, and there are few global producers despite the growing global demand for potash. As a result, the potash resource appears to be an economically attractive and viable target for development. The U.S. Geological Survey (USGS) report titled "Assessment of Moderate- and High-Temperature Geothermal Resources of the United States" estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Arizona during the next 30 years at 26 MW, with a total low-high range of 4 MW to 70 MW (Williams et al. 2008). Arizona could experience increased interest in geothermal development, particularly for indirect use. Depressed petroleum prices in the 1990s caused exploration expenditures to decline. As petroleum prices rise, exploration efforts for oil and gas will likely increase.

Locatable Minerals

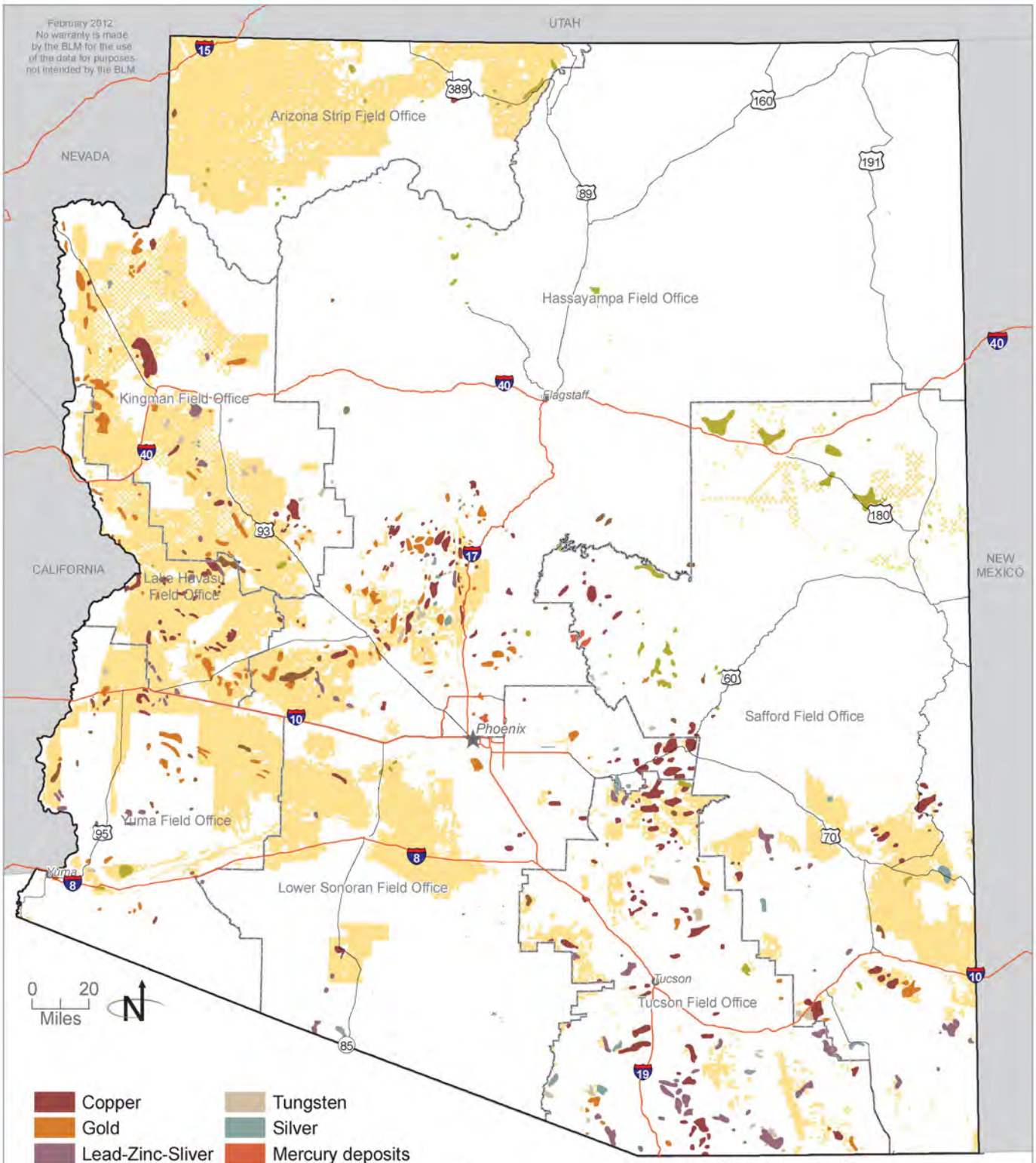
The General Mining Law of 1872, as amended, opened the public lands of the United States to mineral acquisition by the location and maintenance of mining claims. Mineral deposits subject to acquisition in this manner are generally referred to as "locatable minerals." Locatable minerals include both metallic minerals (e.g., gold, silver, lead, copper, zinc, and nickel) and nonmetallic minerals (e.g., fluorspar, mica, certain limestones and gypsum, tantalum, heavy minerals in placer form, and gemstones).

The planning area has several designated metallic mineral districts that were delineated according to geologic criteria (age and style of mineralization) in 1983 (Keith et al. 1983) (**Figure 3-5**, Metallic Mineral Districts).

A statewide high occurrence of metallic minerals data layer was developed in 1993 (Arizona Bureau of Mines 1993) (**Figure 3-6**, High Potential for Known Mineral Deposits). There are approximately 1.1 million acres with high potential for known mineral deposits in the planning area, 395,100 acres of which are on BLM-administered lands.

Metallic Mineral Districts

Metallic minerals are locatable minerals. Metallic mineral districts were delineated according to geologic criteria (age and style of mineralization).

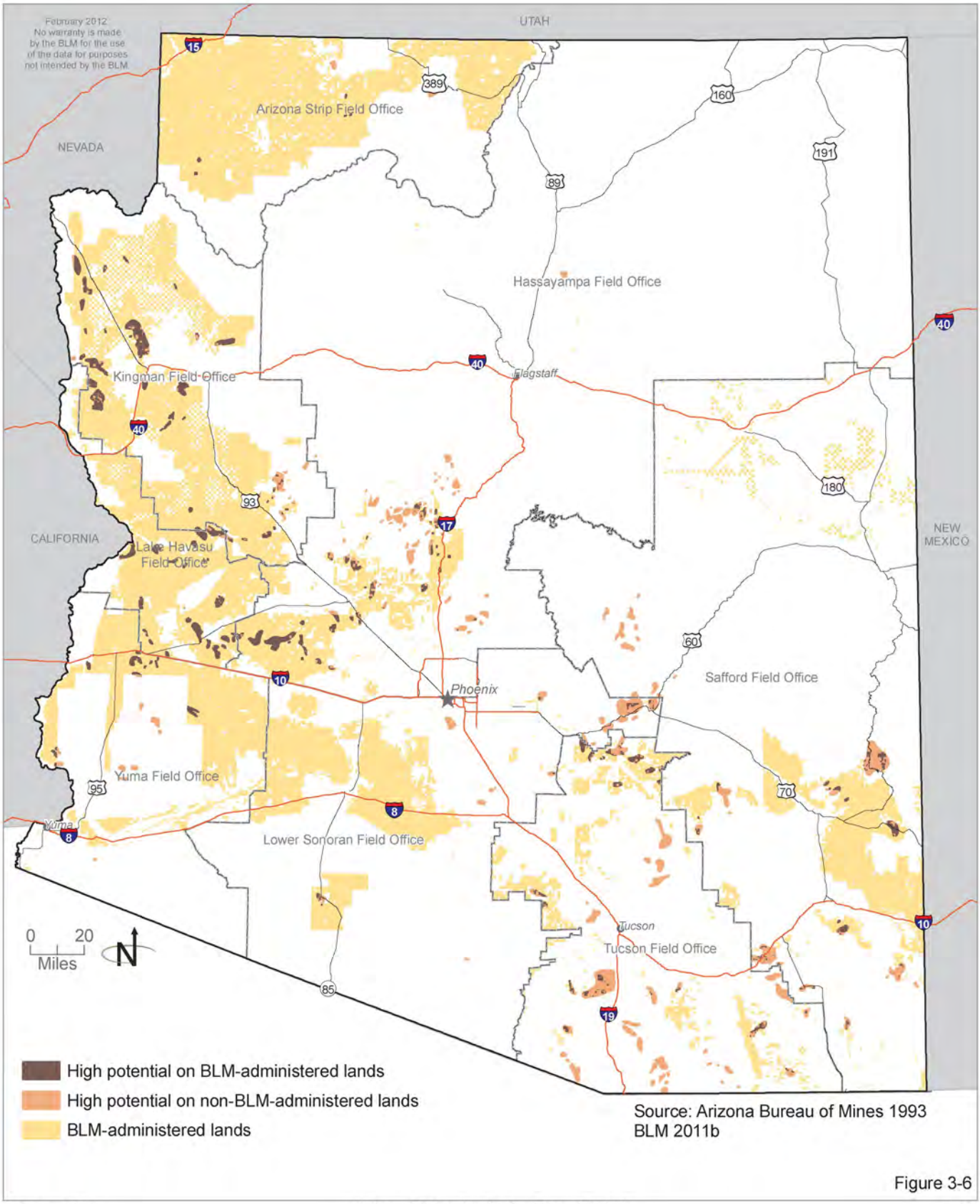


Source: Arizona Bureau of Geology and Mineral Technology 1983, (original map may be ordered from Arizona Geological Survey), BLM 2011b

Figure 3-5

High Potential for Known Mineral Deposits

Mineral deposit areas for locatable minerals include metallic and nonmetallic minerals.



Source: Arizona Bureau of Mines 1993
BLM 2011b

Figure 3-6

In conjunction with **Figure 3-5**, Metallic Mineral Districts, **Table 3-5**, Metallic Mineral Districts in the Planning Area, illustrates the wide variety of metallic minerals in the planning area. There are 646 mineral districts in the planning area, which cover more than 1.7 million acres. Of those, 226 mineral districts are on BLM-administered lands and cover approximately 402,600 acres.

Table 3-5
Metallic Mineral Districts in the Planning Area

Metallic Mineral Type	No. of Mineral Districts in the Planning Area	Planning Area Acres	No. of Mineral Districts on BLM Land	BLM Acres
Copper	114	417,300	59	101,800
Copper, Gold, and Silver with or without Zinc. Stratabound volcanogene massive sulfide	28	42,400	16	14,100
Copper with or without Gold or Lead; veins	58	137,000	35	73,800
Gold with or without Copper or Lead	153	396,400	96	192,200
Iron, stratabound and contact metasonatic	2	3,000	--	--
Lead-Zinc-Silver veins and replacements	77	245,100	39	58,400
Manganese	49	91,200	28	55,400
Mercury deposits	6	16,300	1	300
Silver with or without Lead and Zinc; veins and replacements	31	70,000	13	21,000
Taconite-like Iron formations, Maricopa and Yavapai Counties	16	6,500	4	2,100
Tungsten; skarn and veins or pegmatites with or without Beryllium or Lithium	44	90,300	21	29,400
Unclassified (altered zones, no production)	5	6,900	2	1,200
Uranium with or without Vanadium	63	206,900	22	42,600
Total	**646**	**1,729,300**	**336**	**592,300**

Source: Arizona Bureau of Geology and Mineral Technology 1983

The most prevalent mineral type in the planning area and on BLM lands is "gold with or without copper or lead" followed by "copper." Combined, these two mineral types make up 47 percent of the planning area (50 percent of the BLM-administered lands). Currently, there is limited activity related to gold mining and prospecting on BLM-administered lands. According to BLM's LR2000 database, as of October 31, 2011, there are six authorized gold mining operations on BLM-administered lands (BLM 2011h). As illustrated by **Figure 3-5**, Metallic Mineral Districts, and **Figure 3-6**, High Potential for Known Mineral

Deposits, there is a northwest-trending belt of metallic mineralization that spans the entire state. The southeastern part of this belt is dominated by porphyry copper and associated lead, zinc, gold, and silver deposits. These deposits are associated largely with granitic rocks that were intruded 70 to 55 million years ago. Many important deposits in central Arizona are associated with Precambrian (1,750 to 1,650 million years ago) volcanic activity. The western end of the belt is dominated by gold deposits, mostly related to volcanic activity between 25 and 15 million years ago. In addition, economically significant uranium deposits are concentrated in the northern and northeastern portions of Arizona.

Copper

Arizona leads the nation in copper production. As of 2008, Arizona was producing over 60 percent of the United States' newly mined copper. Domestic production in 2007 was worth $5.5 billion (Singh 2008). By-products of mining porphyry copper deposits have also been significant, accounting for a large percentage of Arizona's gold, silver, and molybdenum production.

In Arizona, most copper mining occurs in the southeast portion of the planning area. While most mine cores are located on private land, the fringes usually overlap federal and state lands. It is reasonable to assume that most copper mines in the planning area include a portion of BLM-administered lands.

Uranium

In the late 1940s and early 1950s, uranium was discovered in association with many of the old copper mines in the Grand Canyon region in geologic features called breccia pipes. Today, some of the highest grade uranium ore in this country is believed to be located in the many mineralized breccia pipes scattered across the Grand Canyon region (Alpine 2010). Many of these breccia pipes are on BLM-administered land, making this mineral noteworthy of discussion.

The Arizona 1 uranium mine resumed operation in 2009 after being in stand-by status for more than 20 years. The Arizona 1 mine is located on BLM-administered land within the BLM's Arizona Strip Field Office (Mohave County), about 45 miles southwest of Fredonia and 10 miles from the boundary of Grand Canyon National Park. The deposit is located within a 1,500-foot-deep breccia pipe (Cole 2010). The uranium in this mine is estimated to be mined out in 2012. There are two additional mines on the Arizona Strip where mining activities are scheduled to resume in the near future.

On July 21, 2009, the Department of the Interior published notice of the Secretary's proposal to withdraw approximately one million acres of federal locatable minerals in northern Arizona (near the Grand Canyon) from location of new mining claims and entry under the Mining Law (BLM 2011c). Publication of this notice segregated the land from location of new mining claims under the Mining Law for two years while studies were being completed (including an EIS)

to provide information to the Secretary on whether it is necessary to withdraw some, all, or none of the segregation area for up to 20 years to protect the area from the potential adverse effects of mineral exploration and development.

The lands that were analyzed are contained in three parcels: two parcels on BLM-administered land to the north of the Grand Canyon (including the area containing the Arizona 1 uranium mine) and one on the Kaibab National Forest south of the Grand Canyon. The segregation expired on July 21, 2011, and the Secretary immediately implemented a six-month emergency withdrawal of these same lands to allow completion of the Northern Arizona Proposed Withdrawal EIS process. The Final EIS was published on October 28, 2011. On January 21, 2012, the Secretary of the Interior signed Public Land Order 7787, *Withdrawal of Public and National Forest System Lands in the Grand Canyon Watershed, Arizona*, withdrawing approximately 1,006,545 acres for a period of 20 years.

Additional uranium deposits are located in northeastern Arizona, but these deposits are on the Navajo Reservation, which is outside of the project planning area and therefore not discussed further.

Non-Metallic Minerals

Occurrences and prospects of non-metallic locatable minerals in the planning area are extensive. Arizona is known for its turquoise and peridot. Other non-metallic locatable minerals include limestone, feldspar, dolostone, gypsum, mica, perlite, and zeolite. Uncommon varieties of mineral materials in the planning area are also regulated as locatable minerals[1]. A statewide map of non-metallic locatable minerals is currently unavailable.

Rights to locatable minerals are obtained by filing a mining claim. According to BLM's LR2000 database, as of October 31, 2011, there are 45,298 active mining claims in Arizona. Of this total, 34,102 mining claims are on BLM-administered lands (BLM 2011h).

Continued strong demand and high prices for copper are driving exploration and development activity to the highest level in many years (Singh 2008). Byproducts of mining porphyry copper deposits also continues to be significant, accounting for all of Arizona's gold, silver, and molybdenum production (Singh 2008). It is anticipated that this trend will continue as long as the price of copper continues to increase.

Locatable Minerals Summary

Exploration for and mining of locatable minerals will continue to be an active aspect of mineral development on BLM-administered lands. The withdrawal of approximately 100,000,000 acres from uranium mining will limit activities in

[1]A determination that a variety is "uncommon" and subject to the General Mining Law is made by BLM on a case-by-case basis.

northern Arizona, but continued activity related to exploration and development of gold, copper, and related minerals, along with industrial minerals, is expected to remain strong.

Mineral Materials

Mineral materials are some of our most basic natural resources, such as sand, gravel, dirt, and rock, and are used in everyday building and other construction uses. Arizona ranks first in the United States for pumice and pumicite and second in reserves of construction-grade sand and gravel (AZGS 2011). Other mineral materials common in the planning area include clays, perlite, cement, and crushed stone.

Generally, salable minerals are widespread, of low unit value, and often used for construction or landscaping materials. Their value depends largely on market factors, quality of the material, availability of transportation, and transportation costs. Extraction of salable minerals from public land requires either a sales contract or a free-use permit. Salable minerals are sold at the resource's appraised fair-market value. Under a free-use permit, salable minerals may be provided at no cost to government agencies for use in public projects. The locations of known occurrences and prospects for salable minerals in the planning area are too numerous to discuss on an individual basis.

The salable mineral industry is strongly influenced by population and industrial growth and the condition of the economy. The current demand for salable minerals in Arizona is primarily to supply the construction market. This trend is expected to continue, particularly in expanding urban areas that place demands on materials such as sand, gravel, and decorative rock.

3.5.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ is located within the BLM's Yuma Field Office boundary. As such, this section is largely based on data from the Yuma Field Office RMP, approved in 2010 (BLM 2010g).

Leasable Minerals

The proposed Agua Caliente SEZ is in an area with less than moderate potential for oil and gas. There are no documented proven oil and gas reserves in the proposed Agua Caliente SEZ, and there has been only minor leasing interest in the surrounding BLM Yuma Field Office (BLM 2010g).

The proposed Agua Caliente SEZ is within the geothermal potential area as identified by the BLM Geothermal Leasing PEIS (BLM 2008b); however, no high or moderate temperature geothermal resources exist in the proposed Agua Caliente SEZ. There are no geothermal leases within the proposed Agua Caliente SEZ.

There are no known occurrences or prospects for coal, carbon dioxide/helium, potash, sulfur, or sodium resources within the proposed Agua Caliente SEZ.

Locatable Minerals

There are no metallic mineral districts within the proposed Agua Caliente SEZ, and it is not within an area identified as having high potential for mineral occurrence. According to BLM's LR2000 database, as of November 1, 2011, there are no active mining claims within the proposed Agua Caliente SEZ, nor are there any active mines (BLM 2011i). The LR2000 database indicates that historically some mining claims have been located in the general area. However, there does not appear to have been related mining or exploration activities related to these mining claims. These claims are no longer active, and the commodities found on the claims were not recorded.

Mineral Material

The proposed Agua Caliente SEZ is in an area open for the disposal of salable minerals and is designated as having moderate potential for salable minerals, including sand, gravel, aggregate, cinders, decorative rock, and building stones (BLM 2010g). The locations of known occurrences and prospects for salable minerals in this area are too numerous to discuss on an individual basis.

3.6 FISH AND WILDLIFE

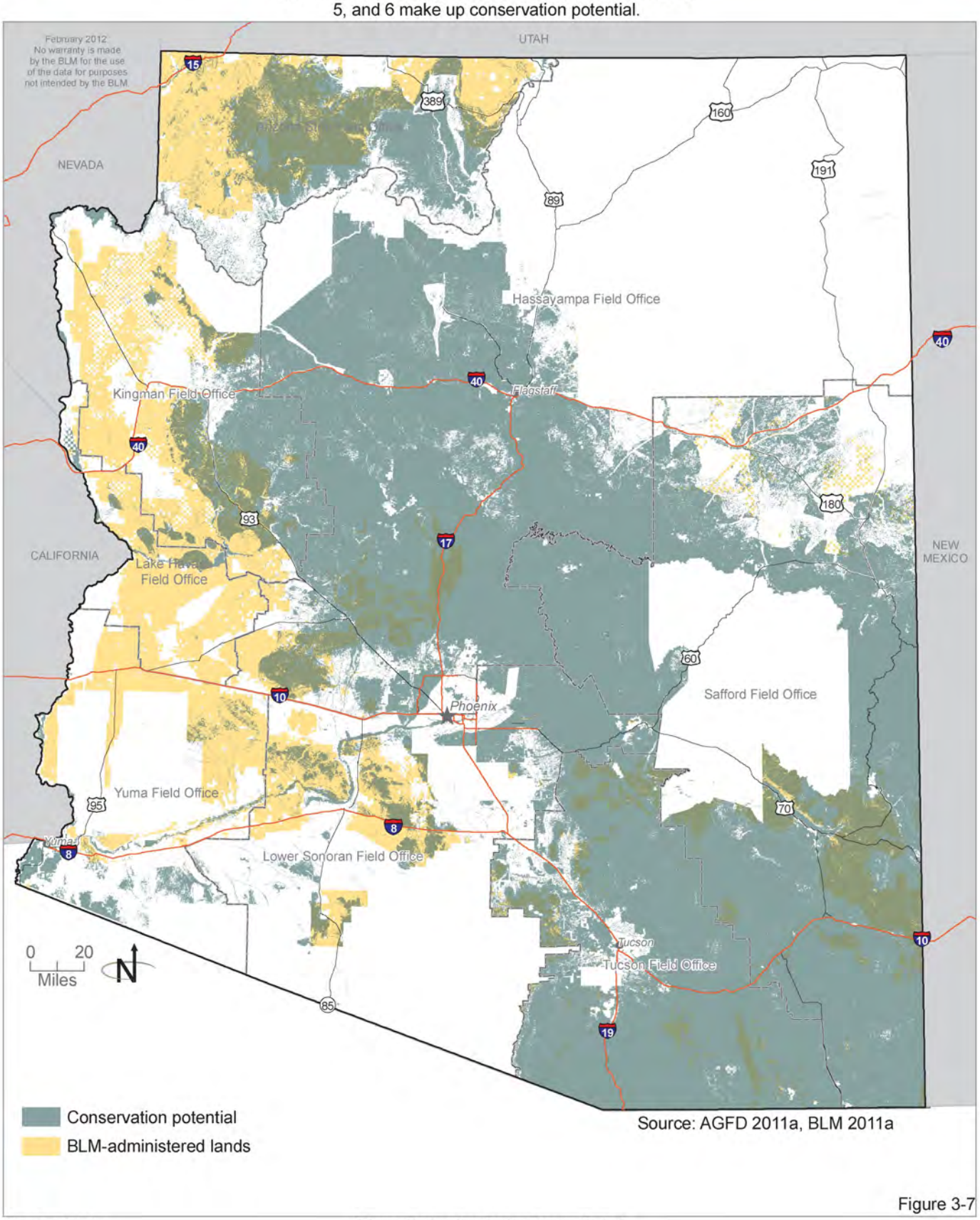
The various ecoregions encompassed by the study area include a wide range of habitats that support a high diversity of terrestrial wildlife species and aquatic biota (AGFD 2006). Further details on ecoregions are included in **Section 3.21**, Vegetation. Species present at a particular location will depend upon the plant communities and habitats present; further analysis of fish and wildlife species would be conducted at the project-specific level prior to site development.

3.6.1 RDEP Affected Environment

The BLM has active wildlife management programs within each field and district office. Wildlife management programs are largely aimed at habitat protection and improvement. The general objectives of wildlife management are to maintain, improve, or enhance wildlife species diversity while ensuring healthy ecosystems, and to restore disturbed or altered habitat with the objective of obtaining desired native plant communities, while providing for wildlife needs and soil and hydrologic stability. The BLM is primarily responsible for managing habitats, while the AGFD has the responsibility for managing the big game, small game, and nongame fish and wildlife species in cooperation with the BLM. AGFD has developed management plans and conservation strategies for game and non-game species in the state. The AGFD has defined conservation potential areas in the state; the department vision for critical habitat areas is to preserve these areas and interconnected networks between them to support viable populations of wildlife, while providing ample opportunity for people to enjoy and benefit from the presence of wildlife (**Figure 3-7**, Arizona Game and Fish Department Species and Habitat Conservation Guide Conservation Potential). The conservation potential areas were determined by utilizing a model assessing five indicators of wildlife conservation value:

Arizona Game and Fish Department
Species and Habitat Conservation Guide Conservation Potential

AGFD Species and Habitat Conservation Guide tiers 4, 5, and 6 make up conservation potential.



Source: AGFD 2011a, BLM 2011a

Figure 3-7

1. The importance of the landscape in maintaining biodiversity, represented by the Species of Greatest Conservation Need.
2. The economic importance of the landscape to the AGFD and the community, represented by the Species of Economic and Recreational Importance.
3. The economic importance of the water bodies and aquatic systems to the AGFD and the community, represented by sportfish.
4. Large areas of relatively intact habitats, represented by unfragmented areas.
5. The importance of riparian habitat to wildlife, represented by riparian habitat.

Wildlife corridor information also will be added to the model as it becomes available. For any given area, each indicator was given a score from one to ten and combined in the conservation potential model. The resulting gradient was reclassified to six tiers based on qualities, with tier 1 indicating the lowest conservation potential, and tier 6 indicating the highest conservation potential.

In addition, AGFD has categorized big game habitats based on densities of animals in a given area (e.g. high, medium, and low density); acres of each density category within the planning area are presented under the subheaders for each big game species below.

State statutes provide protection for wildlife, including the Arizona Revised Statute, Title 17, which protects all of Arizona's native species. The USFWS has oversight of migratory bird species, bald and golden eagles, and all federally threatened, endangered, proposed, or candidate species as discussed in **Section 3.19**, Special Status Species. The following discussions present general descriptions of the fish and wildlife species and special categories of species that may occur in the planning area.

Fish

A total of 36 fish species are native to Arizona and are found in the Colorado River, Gila River, and their tributaries and in springs. Some native species are adapted to the desert environment with an ability to adjust to periods of drought and flash floods. In addition, many of the native species that occur are specially adapted to local conditions and are endemic (i.e., native to a certain locality or system).

The majority of Arizona lies within the Lower Colorado River hydrologic region, with the exception of a small portion of the northeast corner of the state, north of Lees Ferry, which falls within the Upper Colorado hydrologic region. The Colorado and Gila Rivers comprise the major drainages within the Upper Colorado hydrologic region. The native fish community within the Lower Colorado River hydrologic region is dominated by fishes within the minnow and

sucker families. The Lower Colorado River was historically a warm, turbid, and swift river. Construction of dams and reservoirs within the region has now altered habitat conditions and changed flow regimes by creating a series of cold, clear impoundments. These changes, along with the introduction of nonnative fishes and a variety of other habitat changes due to development, have resulted in declines in native fish populations throughout much of the Lower Colorado River Basin. In 1994, the USFWS designated critical habitat for four endangered fishes within the Colorado River Basin (bonytail chub [*Gila elegans*], razorback sucker [*Xyrauchen texanus*], humpback chub [*Gila cypha*], and Colorado River pikeminnow [*Ptychocheilus lucius*]; Lower Colorado River Multi-Species Conservation Program 2004). The Gila River drainage provides habitat for the following species: loach minnow (*Tiaroga cobitis*), spikedace (*Meda fulgida*), gila topminnow (*Poeciliopsis occidentalis*), Gila trout (*Oncorhynchus gilae*), and Apache trout (*Oncorhynchus gilae apache*). These species are discussed in **Section 3.19**, Special Status Species. In the planning area as a whole, one species (Santa Cruz Pupfish [*Cyprinidon arcuatus*]) is already extinct, 34 have been identified as Species of Greatest Conservation Need by the AGFD, and 20 have been federally listed as endangered or threatened (AGFD 2011b).

Sport fishing opportunities in Arizona include more than 1,500 miles of stream and around 80 lakes that are managed for trout. Warmwater fishing opportunities include about 355,000 acres of impounded water (lakes, reservoirs, ponds, and tanks) and 35,840 acres of flowing water. There are approximately 27 species commonly sought by Arizona anglers: eight are cool or coldwater fish and 19 are warm-water species. Today, sport fish management involves many activities, including monitoring, research, stocking, habitat improvement, evaluation, information, and education (AGFD 2011b).

Impoundments, water diversions, changes in water quality, and predation by and competition with nonnative fishes have led to population decreases in native fish. Native fish management is therefore a priority in the state and includes on-the-ground conservation projects, threatened and endangered species recovery, statewide population monitoring, creation and implementation of conservation agreements, provision of research grants, and public education and outreach. Current strategies are moving away from management for individual non-game or game species and moving towards a watershed approach, managing at the ecosystem level.

Birds

The Migratory Bird Treaty Act of 1918, as amended (MBTA) (16 USC §§ 703-712) makes it unlawful to, among other things, pursue, hunt, take, capture, kill, or possess any migratory bird or part, nest, or egg of such bird listed in four separate wildlife protection treaties between the U.S. and Great Britain (on behalf of itself and Canada), Mexico, Japan, and the former Union of Soviet Socialist Republics. The MBTA currently covers 1,007 species, as specified in 50 CFR Section 10.13.

A total of 534 species of birds have been documented in Arizona. Approximately 300 species have been documented as breeding in the state. Seven nonnative species have, through the actions of humans, become established in the state (AGFD 2011b). Details for important groups of birds and bird areas are described below.

Important Bird Areas

Important bird areas are locations that provide essential habitats for breeding, wintering, or migrating birds. While these sites can vary in size, they are discrete areas that stand out from the surrounding landscapes. Important bird areas must support one or more of the following:

- Species of conservation concern (e.g., threatened or endangered species);
- Species with restricted ranges;
- Species that are vulnerable because their populations are concentrated into one general habitat type or ecosystem; or
- Species or groups of similar species (e.g., waterfowl or shorebirds) that are vulnerable because they congregate in high densities.

The important bird area program has become a key component of many bird conservation efforts. Within the planning area, a number of important bird areas have been identified by the Audubon Society. These include 5 important bird areas of global significance (537,600 acres) and 35 of state significance (3,141,500 acres) (Arizona Audubon 2011).

Migratory Birds

Many of the bird species in the planning area are migratory seasonal residents. These birds include waterfowl, shorebirds, raptors, and neotropical songbirds. The USFWS has the legal mandate and the trust responsibility to maintain healthy migratory bird populations. Federal regulations to protect the migratory birds include the MBTA and Executive Order 13186: Responsibilities of Federal Agencies to Protect Migratory Birds. There is also a Memorandum of Understanding (MOU) between the BLM and USFWS to promote the conservation of migratory birds. The purpose of the MOU is to strengthen migratory bird conservation by identifying and implementing strategies that promote conservation and avoid or minimize adverse impacts on migratory birds through enhanced collaboration between the two agencies, in coordination with state, tribal, and local governments. The USFWS has also outlined a plan to conserve and protect migratory birds in its Migratory Bird Strategic Plan 2004-2014. The strategy includes direct collaboration with the BLM in making land use and planning decisions (USFWS 2004).

Waterfowl, Wading Birds, and Shorebirds

Waterfowl (geese, ducks, teal, etc.), wading birds (herons and cranes), and shorebirds (plovers, sandpipers, and similar birds) are found throughout the planning area. Within the region, migration routes for these birds are often associated with riparian corridors and wetland or lake stopover areas. Some notable areas in the state include lakes and reservoirs in the White Mountains, Cibola National Wildlife Refuge, Roosevelt Lake, Whitewater Draw Wildlife Area, Anderson Mesa wetlands, and areas on the Gila River (AGFD 2011b). Some waterfowl species are game species and are hunted throughout the planning area. Notable species of birds hunted in the planning area include sandhill crane (*Grus canadensis*), Canada goose (*Branta canadensis*), and mallard (*Anas platyrhynchos*), as well as numerous other duck and teal species.

Neotropical Migrants

Arizona is home to many species of neotropical migrants, bird species that breed in the U.S. and Canada and winter primarily from Mexico to South America. For many of these migrants, Arizona serves as a migration corridor between the northern breeding grounds and the southern wintering areas. In total, 237 neotropical migrant species have been documented in Arizona, of which 163 species have been documented as nesting in the state (AGFD 2011b).

Birds of Prey

Birds of prey include raptors, owls, and vultures, with raptors and owls being the premier avian predators in their respective ecosystems. Forty-four raptor species have been documented in Arizona, including various species of hawks, falcons, and kites as well as osprey (*Pandion haliaetus*), bald eagle (*Haliaeetus leucocephalus*), and golden eagle (*Aquila chrysaetos*). A total of 37 of the raptor species are known to breed in the state. Four species are federally listed as threatened or endangered (AGFD 2011b). Special status species are included in **Section 3.19**, Special Status Species. Raptors forage on a variety of prey, including small mammals, reptiles, other birds, fish, invertebrates, and, at times, carrion. Hunting and foraging varies significantly among species, with some being very active hunters, pursuing prey on the wing, and others foraging from a perch; all forage during the day.

Owls in Arizona are represented by 13 species, notably the burrowing owl (*Athene cunicularia*), ferruginous pygmy-owl (*Glaucidium brasilianum*), flammulated owl (*Otus flammeolus*), and Mexican spotted owl (*Strix occidentalis lucida*) (AGFD 2011b). These species are found throughout the planning area in a variety of ecosystems. Vultures are represented by three species: the endangered California condor (*Gymnogyps californianus*), black vulture (*Coragyps atratus*), and turkey vulture (*Cathartes aura*). These birds are large soaring scavengers that feed on carrion. The California condor has been reintroduced to the Vermilion Cliffs in northern Arizona under Section 10(j) of the Endangered Species Act (ESA) as an experimental non-essential population.

Special protection is provided for some birds of prey species. The Arizona population of bald eagles was removed from ESA listing in February 2010 (Federal Register 2010); however, bald and golden eagles are still protected under the Bald and Golden Eagle Protection Act (16 USC 668–668d, 54 Stat. 250, as amended), which prohibits the taking or possession of, or commerce in, bald and golden eagles, with limited exceptions for permitted scientific research and Native American religious purposes. The 1978 amendment authorizes the Secretary of the Interior to permit the taking of golden eagle nests that interfere with resource development or recovery operations. Recent guidance has also been developed to guide wind energy development. The Guidance for Reducing Impacts to Wildlife from Wind Energy Development (AGFD 2009) and USFWS Land-Based Wind Energy Guidelines (USFWS 2012) aim to help industry avoid and minimize impacts on federally protected migratory birds and bats and other impacted wildlife resulting from site selection, construction, operation, and maintenance of wind energy facilities. The Draft Eagle Conservation Plan Guidance (USFWS 2011b) provides information to aid in the evaluation of impacts from proposed wind energy projects to eagles protected by the Bald and Golden Eagle Protection Act and other federal laws. The BLM field or district offices also have specific management guidelines for raptors.

Upland Game Birds and Migratory Game Birds

Game birds that are native to the planning area include the blue grouse (*Dendragapus obscurus*), wild turkey (*Meleagris gallopavo*), Gambel's quail (*Callipepla gambelii*), scaled quail (*C. squamata*), and Mearns quail (*Cyrtonyx Montezuma*). Introduced species managed as game species include the ring-necked pheasant (*Phasianus colchicus*) and chukar (*Alectoris chukar*). All of the upland game bird species are year-round residents. Migratory game birds in Arizona include ducks, geese, swan, coots, gallinules, the sandhill crane, common snipe (*Gallinago gallinago*), mourning dove (*Zenaida macroura*), white-winged dove (*Z. asiatica*), and band-tailed pigeon (*Columba fasciata*) (AGFD 2011b). The determining factor controlling small game numbers in Arizona is the quality and quantity of habitats, which vary by location and season.

Declines in many bird populations in Arizona and across the nation have led to concern about the future of migratory and resident birds. The reasons for the declines are complex but include loss and fragmentation of the birds' habitat where they breed, winter, and migrate. Arizona Bird Conservation Initiative and other organizations are working with AGFD to monitor bird populations and create conservation initiatives to protect bird species (Arizona Partners in Flight 1999).

Mammals

A total of 134 native and 11 introduced mammals have been documented in Arizona (AGFD 2011b). Many nongame mammals in Arizona are poorly known; among those in need of additional information and field study are the water shrew (*Sorex palustris*), jumping mouse (*Zapus hudsonius*), and several species of

pocket mice. Thirty-four Arizona mammals are identified as Species of Greatest Conservation Need, and nine are also federally listed as endangered under the ESA. Further information is included in **Section 3.19**, Special Status Species. Most imperiled species have very small, local populations that face a variety of threats. Some species are tied to riparian or native grassland habitats.

The AGFD manages game mammals and establishes seasons, season dates, and permit numbers. They also define the times and methods of taking wildlife and the possession and bag limits. A number of the big game species make seasonal migrations when seasonal changes reduce food availability, or where local conditions are not suitable for calving or fawning. Large game mammals and trends for each species are discussed below, and important big game habitat as determined by AGFD is shown on **Figure 3-8**, Important Big Game Habitat.

Pronghorn

Pronghorn (*Antilocapra americana*) are native to the prairies of North America. In Arizona, pronghorn are found primarily in the northern plains. They also inhabit high elevation meadows between forested areas and semi-desert grasslands, and scattered herds are found in the grasslands of southeastern Arizona. The species is secure in Arizona (NatureServe 2011). The endangered Sonoran pronghorn occurs in Mexico and southwestern Arizona (AGFD 2011b). Pronghorn are found in mixed herds most of the year, except in the spring when the bucks are alone or in small groups. In the fall, bucks collect harems up to 20 does, which they then defend from other bucks. Pronghorn breed in August and September and the young are born in May and June. Preferred food includes grasses, weeds, cacti, juniper, winterfat, and chamise. In 1922, the state's pronghorn population was estimated to be less than 1,000 animals. Aided by a closed hunting season, government predator control programs, and the abandonment of numerous homesteads, pronghorn numbers steadily increased and hunting was opened in 1949. Today, due to loss of habitat from housing development, fragmentation by highways, and other land use changes, populations have declined and are maintained by relocation programs. Approximately 10 percent of the pronghorn harvest is in areas having reintroduced herds (AGFD 2011b).

Pronghorn summer range within the planning area is divided into the following density categories: 56,200 acres of very high density habitat; 162,100 acres of high density habitat; 907,400 acres of medium density habitat; 3,320,100 acres of low density habitat; 3,599,900 acres of sparse density habitat; and 2,407,400 acres of very sparse density habitat (AGFD 1988).

Black Bear

In Arizona, the black bear is found in most woodland habitats, including pinyon-juniper, oak woodland, coniferous forest, and chaparral, from approximately 4,000 to 10,000 feet. The species is considered secure in Arizona (NatureServe

Important Big Game Habitat

Important big game habitat was determined utilizing Arizona Game and Fish Department big game species density data. The data for the following species were determined as important: elk summer habitat, elk winter habitat, bighorn sheep, black bear, javelina, mountain lion high, mule deer summer and winter habitat, turkey summer and winter, and white-tailed deer.

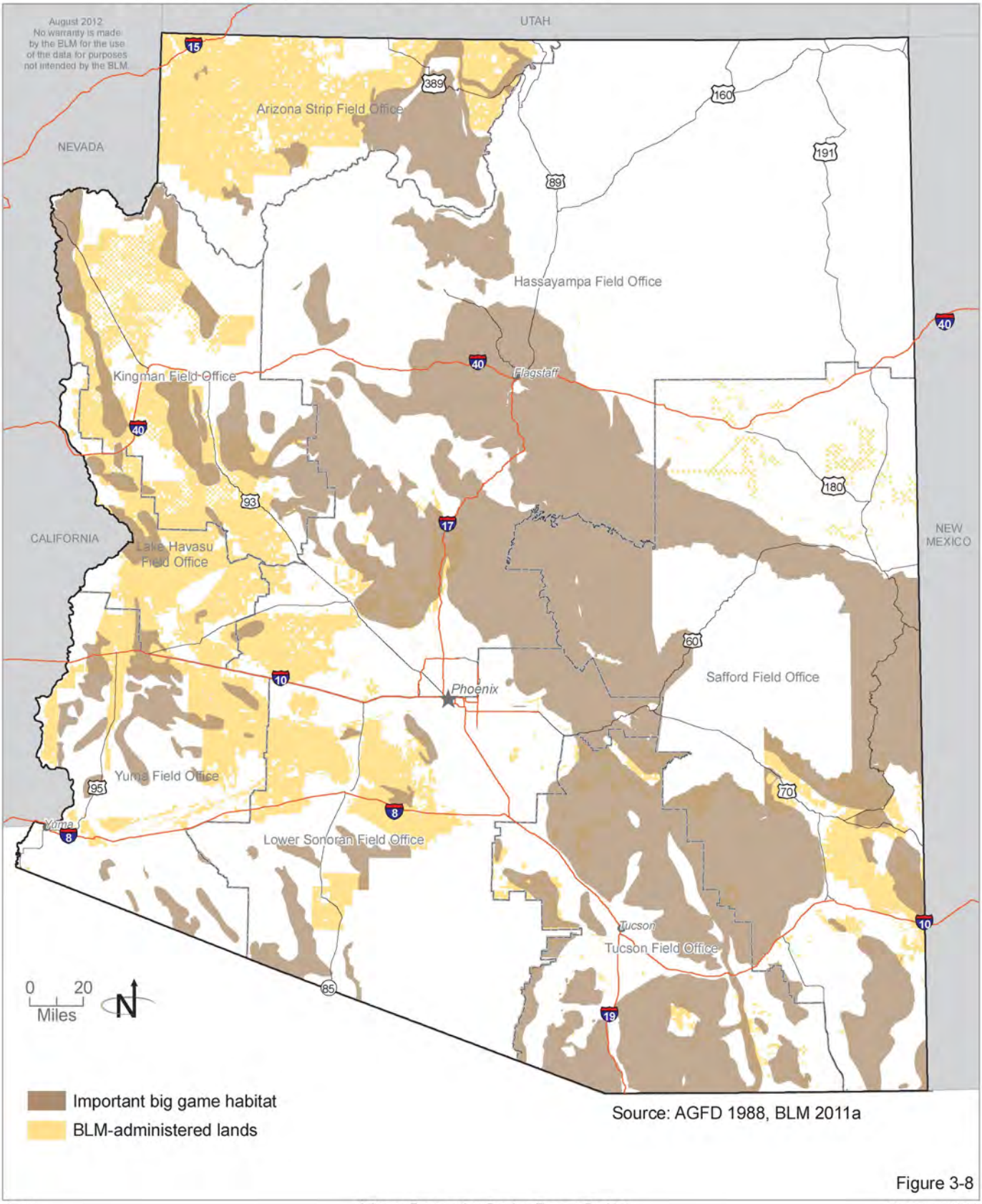


Figure 3-8

2011); however, there is no sizable population of black bears north of the Colorado River. Cubs are born during the winter and emerge from the den in April and stay with their mother through their first summer and fall. Normal reproductive cycles of Arizona black bears may be adversely affected by drought and resultant poor physiological condition. The low reproductive potential of this species is becoming an increasingly important management consideration. Concerns about the bear's relatively low reproductive rate have recently caused the AGFD to monitor the bear harvest more closely and implement additional regulations (AGFD 2011b).

Black bear habitat within the planning area is divided into the following density categories: 1,460,800 acres of high density habitat; 1,759,700 acres of medium density habitat; 3,853,200 acres of low density habitat; and 913,900 acres of sparse density habitat (AGFD 1988).

Bighorn Sheep

Arizona's bighorn sheep population, consisting of both desert and Rocky Mountain subspecies, is estimated at 6,000 animals, reduced from historic numbers due to competition with livestock for food and water and exposure to livestock-associated parasites and diseases. Bighorn sheep were not legal game in Arizona until 1953. Since then, permit numbers, the number of units open to hunting, the number of rams taken, and hunt success have gradually increased. Bighorn sheep are social animals. Mature rams stay in one group while the ewes, lambs, and young rams congregate separately. The groups join during the rut (mid-November through late December) and occasionally in the spring when plants are abundant. Bighorn eat native grasses and also feed heavily on jojoba. Pincushion and saguaro cactus provide moisture. Preferred plant species vary with habitat quality, locality, and species availability (NatureServe 2011).

Bighorn sheep habitat within the planning area is divided into the following density categories: 113,200 acres of high density habitat; 388,000 acres of medium density habitat; 1,043,300 acres of low density habitat; 1,543,600 acres of sparse density habitat; 2,035,800 acres of very sparse density habitat (AGFD 1988).

Elk

Elk were at one time the most widely distributed member of the deer family in North America, found everywhere except the Great Basin desert and the Southern coastal plains. Population threats have included hunting to supply commercial markets, as well as agriculture. Following population lows in the 1920s, herds from Yellowstone National Park were transplanted throughout the West. In February 1913, 83 elk were released in Cabin Draw near Chevelon Creek. From these transplants, the Arizona elk population has grown to nearly 35,000 animals (AGFD 2011b). Summer elk range is typically within a half mile of water in Arizona. Summer range varies in elevation from 7,000 feet in the mixed conifers to 10,000 feet in the spruce fir-subalpine belt. Winter range is often the

limiting factor for elk herds, as only about 10 percent of their total habitat is winter range. Winter range varies in elevation from 5,500 to 6,500 feet in Arizona, in the pinyon-juniper zone (NatureServe 2011).

Elk summer range within the planning area is divided into the following density categories: 837,600 acres of high density habitat; 1,249,200 acres of medium density habitat; 1,131,500 acres of low density habitat, 716,600 acres of sparse density habitat; and 1,018,600 acres of very sparse density habitat (AGFD 1988). Elk winter range within the planning area is divided into the following density categories: 471,300 acres of very high density habitat; 356,000 acres of high density habitat; 676,200 acres of medium density habitat; 938,700 acres of low density habitat; 533,000 acres of sparse density habitat; and 1,282,300 acres of very sparse density habitat (AGFD 1988).

Javelina

The collared peccary, or javelina, evolved in South America and migrated north, only recently arriving in Arizona. The species is found between 1,000 to 6,000 feet in elevation in desert, chaparral, and oak-grasslands. Javelina are herd animals. Territories are set up and defended. Territory size varies with the productivity of the habitat but averages about 750 acres (NatureServe 2011). Javelina were not legally designated as big game until 1929 in Arizona. Hunter interest has gradually increased, and javelina has become an important game animal in the past 50 years (AGFD 2011b).

Javelina habitat within the planning area is divided into the following density categories: 1,430,600 acres of high density habitat; 6,541,700 acres of medium density habitat; 6,031,900 acres of low density habitat; 4,813,800 acres of sparse density habitat; and 3,441,500 acres of very sparse density habitat (AGFD 1988).

Mountain Lion

In Arizona, mountain lions are absent only from the areas heavily impacted by human development. In general, the distribution of mountain lions in Arizona corresponds with the distribution of its major prey species, deer. Mountain lions are very specialized top predators and consequently do not normally exist in high concentrations. Preferred prey includes deer, elk, javelina, and bighorn sheep (NatureServe 2011). Lions were classified as a "predatory animal" and were subject to a statewide bounty until 1970 (AGFD 2011b).

Mountain lion habitat within the planning area is divided into the following density categories: 7,652,200 acres of high density habitat; 14,585,700 acres of medium density habitat; 14,944,100 acres of low density habitat; and 8,292,400 acres of sparse density habitat (AGFD 1988).

Mule Deer

The most abundant deer in Arizona is the Rocky Mountain mule deer. Mule deer are not limited to any one type of terrain, being found from sparse, low deserts to high forested mountains. Desert mule deer also occur in Arizona,

though in fewer numbers. It is slightly smaller, paler in color, and with a smaller rump patch. Today, mule deer comprise about 60 percent of the total deer harvested (AGFD 2011b). Population cycles are linked to variations in climate and precipitation. Recent years with above average winter precipitation have created improved conditions for mule deer. Deer feed on grasses and forbs in the spring and summer; however, they are primarily browsers. They eat such items as twigs, bark, buds, leaves, and nuts. Important plants in a mule deer's diet include mountain-mahogany, buckbrush, cliffrose, sagebrush, buckthorn, juniper, and oak (NatureServe 2011). Home range size may be 30 to 240 hectares or more and is directly correlated with availability of food, water, and cover. Desert mule deer have adapted to harsh conditions, such as extreme heat and cold, meager forage, scarce water, and lack of vegetative cover. In Arizona, predation on deer is mainly by coyotes, bobcats, and mountain lions.

Mule deer summer range within the planning area is divided into the following density categories: 1,345,300 acres of high density habitat; 7,899,300 acres of medium density habitat; 10,655,300 acres of low density habitat; 11,345,300 acres of sparse density habitat; and 5,843,000 acres of very sparse density habitat. For Kaibab mule deer summer range, there are 172,600 acres of high density habitat and 178,600 acres of medium density habitat (AGFD 1988). Mule deer winter range within the planning area is divided into the following density categories: 44,500 acres of very high density habitat; 430,100 acres of high density habitat; 544,900 acres of medium density habitat; 1,358,100 acres of low density habitat; 1,554,900 acres of sparse density habitat; and 1,905,900 acres of very sparse density habitat. For Kaibab mule deer winter range, there are 99,500 acres of high density habitat and 142,200 acres of medium density habitat (AGFD 1988).

Coues Deer

The Coues deer is a subspecies of the white-tailed deer. Coues deer are most common in Arizona's southeastern mountains but range up to the Mogollon Rim and into the White Mountains. They are most abundant in areas of predictable summer precipitation. White-tailed deer occur in two social groups: 1) adult females and young, and 2) adult and occasionally yearling males, although adult males are generally solitary during the breeding season except when with females (NatureServe 2011). The annual home range of sedentary populations can average as much as 1,285 acres, while some populations can undertake annual migrations of up to 31 miles. They prefer woodlands of chaparral, oak, and pine with interspersed clearings and eat weeds, shrubs, mast, grass, mistletoe, and cacti fruits in season (NatureServe 2011). The subspecies has become increasingly important in the harvest. Today, they comprise over 40 percent of total deer harvested (AGFD 2011b).

Reptiles/Amphibians

Arizona supports 107 species of native reptiles, including 6 turtle species, 49 lizard species, and 52 species of snakes (AGFD 2011b). Among the snakes are

13 species of rattlesnakes, which is just over one-third of the world's rattlesnakes. Eleven of the reptile species are protected in the state and are illegal to collect from the wild. In addition to the native reptiles, six nonnative species have become established in the state. Reptiles are found throughout the state, occurring in all of Arizona's vegetative communities.

A total of 25 species of native amphibians, including 24 species of frogs or toads and 1 salamander species (tiger salamander [*Ambystoma tigrinum*]) are found in Arizona (AGFD 2011b). Amphibians in the planning area are found not only in riparian and aquatic environments but also in desert ecosystems, where they spend much of their lives buried underground only to emerge briefly to breed and grow during the summer rains. Habitat changes due to demand for water in the state have led to increased pressure on many species. In addition to the 25 species of native amphibians, Arizona has 4 species of exotic amphibians: bullfrog (*Lithobates catesbeiana*), Rio Grande leopard frogs (*Lithobates berlandieri*), African clawed frogs (*Xenopus laevis*), and barred tiger salamanders (*Ambystoma mavortium*). Amphibian and reptile species that have special status listing are addressed in **Section 3.19**, Special Status Species.

3.6.2 Agua Caliente Solar Energy Zone Affected Environment

Fish and Wildlife

The proposed SEZ is within the Sonoran Basin and Range ecoregion, dominated by Lower Sonoran desert scrub vegetation. Wildlife in the proposed SEZ are likely typical of those species that use this habitat type. Common species within the Lower Sonoran desert scrub habitat include zebra-tailed lizard (*Callisaurus draconoides*), desert mule deer (*Odocoileus hemionus crooki*), round-tailed ground squirrel (*Spermophilus tereticaudus*), desert cottontail (*Sylvilagus auduboni*), pocket mouse (*Perognathus* spp.), red-tailed hawk (*Buteo jamaicensis*), turkey vulture (*Cathartes aura*), swallows (*Hirundo* spp.), rattlesnakes (*Crotalus* spp.), and desert iguana (*Dipsosaurus dorsalis*). AGFD conservation potential tiers are described above in **Section 3.6**, Fish and Wildlife. The proposed SEZ has lands characterized as AGFD conservation potential tiers 1 through 5, but the majority of the area is categorized as tier 1.

The proposed SEZ is within the Palomas Plain Wildlife Habitat Area (WHA) identified by the Yuma RMP. **Figure 3-9**, Important Resources in Proposed Agua Caliente SEZ, is a map of Palomas Plain WHA. This WHA is the largest unfragmented habitat in southwest Arizona for a myriad of wildlife, including bighorn sheep and mule deer. It contains braided channel floodplains and mixed cacti paloverde communities on rocky slopes and bajadas. The large, contiguous, unfragmented habitat is significant to the hunting community. This area is a potential reintroduction area for the endangered Sonoran pronghorn (BLM 2010g). The proposed SEZ also has small amounts of desert tortoise category 3 habitat; tortoises potentially migrate between the Palomas Mountains and Baragan Mountain.

Important Resources in Proposed Agua Caliente SEZ

The proposed Agua Caliente SEZ is scoured by braided series of washes and ephemeral streams. A small amount of Tortoise Category 3 is within the proposed SEZ. The proposed SEZ is within the Palomas Plain Wildlife Habitat Management Area. The proposed SEZ is mostly in AGFD conservation potential tier 1, the lowest tier of potential. The washes are conservation potential tier 4.

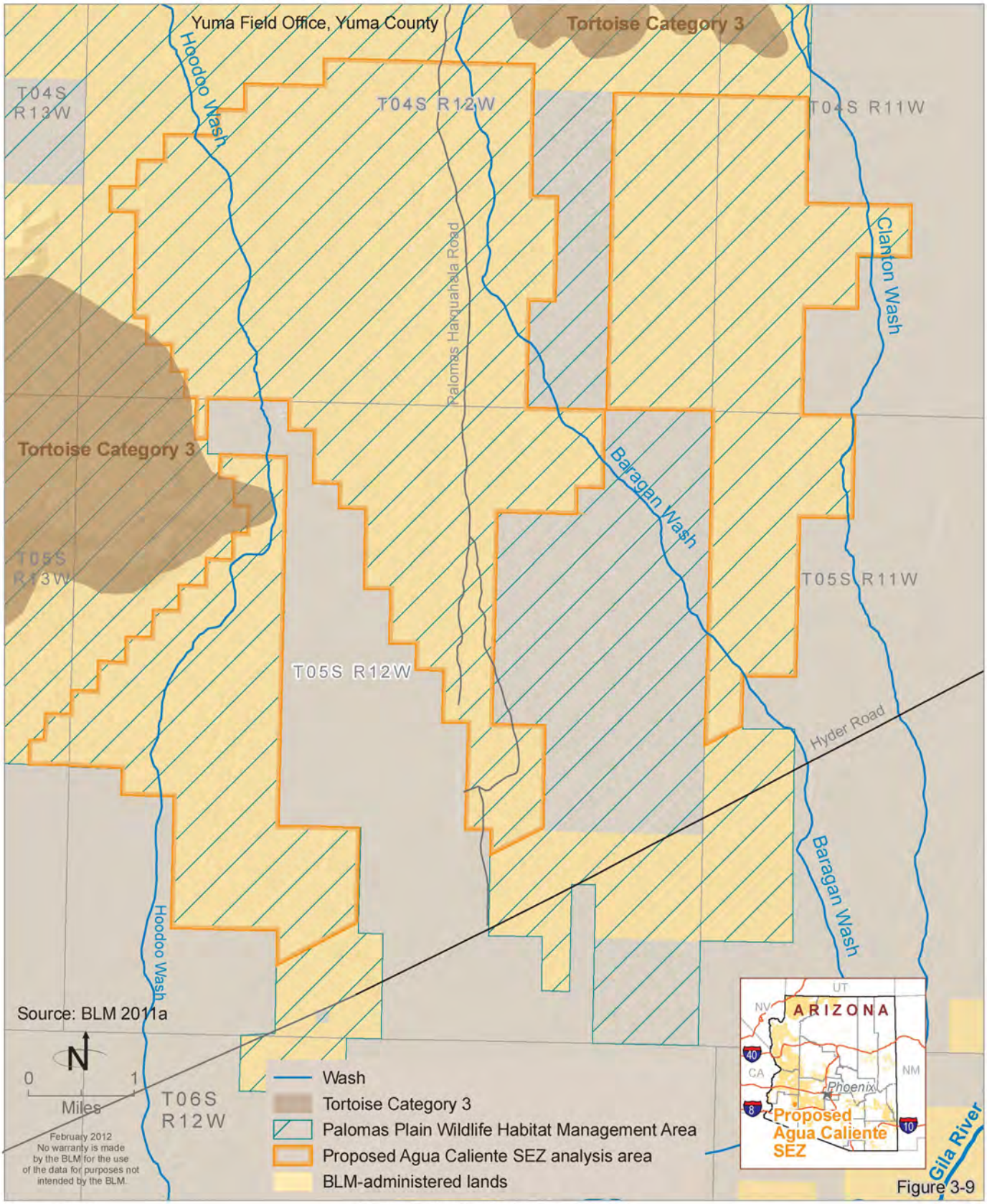


Figure 3-9

There are three major washes in the proposed SEZ: Hoodoo Wash, Baragan Wash, and Clanton Wash. There are no perennial aquatic systems within the proposed SEZ, and thus aquatic species are not present. However, seasonally wet areas are present as evidenced by the braided channels throughout the proposed SEZ, and many species may use these for water sources.

Big Game
Mule deer and mountain lions occur in the proposed SEZ and may use the washes for foraging, cover, and as movement corridors.

The Yuma RMP acknowledges that the federally endangered Sonoran pronghorn (*Antilocapra americana sonoriensis*) could use the proposed SEZ and surrounding area, which has been identified as a potential reintroduction area for the species. An experimental population has been reintroduced in the Kofa National Wildlife Refuge to the west of the site. Pronghorn have not been recorded onsite, but given their large territory size and mobility, could use the site if the population expands.

Migratory Birds
Migratory birds could utilize the shrubs and leguminous trees within the proposed SEZ, particularly within the washes where there is ample cover for nesting and foraging. Species observed on site include turkey vulture, northern harrier (*Circus cyaneus*), Gambel's quail (*Callipepla gambelii*), and white-winged dove (*Zenaida asiatica*). Thrashers, sparrows, and an owl were observed, though not identified to species.

Wildlife populations in the proposed SEZ are likely stable given the relatively rural and undisturbed nature of the site. The current adjacent solar development could be displacing or disturbing wildlife in and around that area, causing more wildlife to move away from the area, or to inhabit the proposed SEZ site for refuge. The proposed SEZ is a popular area for mule deer hunting.

3.7 GEOLOGY AND SEISMICITY

3.7.1 RDEP Affected Environment

Physiography
The planning area lies within three distinct physiographic provinces, the Basin and Range, the Transition Zone (also referred to as the Central Highlands), and the Colorado Plateau (see **Figure 3-10**, Physiographic Provinces).

The Basin and Range Physiographic Province of southwestern North America includes southern and western Arizona and is characterized by numerous mountain ranges and intervening Cenozoic basins. The geology of these mountains is generally complex and variable. The Basin and Range Physiographic Province is characterized by nearly parallel mountain ranges that trend north to

Figure 3-10 Physiographic Provinces

northwest and are separated by broad valleys filled with sediments. In Arizona, the Province is subdivided into a mountain region and a desert region occurring in the Sonoran Desert of southwest Arizona. The mountain region contains higher and wider mountains with less extensive alluvial valleys than does the desert region. The mountains of the Basin and Range Province represent blocks of rock bounded by near-vertical normal faults that were upthrown in late Tertiary times. The significance of relative age of each of these processes varies greatly from range to range (Spencer and Reynolds 1989). This area is characterized by irregular surfaces, northerly trending mountain ranges, sediment-filled basins, abundant igneous and metamorphic rock exposures, extensive faulting and folding, and widely exposed Precambrian rocks (see **Figure 3-11**, Surface Geology Age). The rocks consist mostly of Precambrian phyllites, schists, and gneisses; lower to mid-Paleozoic limestones and shales; and volcanic rocks from numerous ages, ranging from Precambrian through late Cenozoic. The geology of the valleys is poorly known because of their sediment cover.

The Basin and Range Province of Arizona is bounded on the north and east by what is called the Transition Zone (BLM 1991). This area separates the Basin and Range Province in the southwestern part of the state from the Colorado Plateau Physiographic Province in the northern and northeastern part of the state. The Transition Zone is a northwest-trending escarpment of mountainous terrain in central Arizona shaped by the intersection of the higher-level Colorado Plateau with the lower-level Basin and Range Province. The area is termed the Transition Zone because it is transitional between the two regions, with characteristics of both. The area consists of a series of rugged mountain ranges and valleys. Many of the mountains of the Transition Zone are part of the Mogollon Rim, a cliff, or a dramatic escarpment in places, which extends 115 miles from northern Yavapai County eastward to near the border with New Mexico. The mountain ranges of the Transition Zone include the Mazatzal, Santa Maria, Sierra Ancha, and White Mountain ranges.

Geologic faults in central Arizona are generally short, discontinuous, normal faults that date to the Quaternary Period, or the last two million years. The Verde Fault, a potentially active fault, is located 25 miles northeast of Prescott near the town of Jerome. The only areas of concern for earthquake hazard within the planning area are at the moderate to low level for the northern portions near Prescott. The remainder of the planning area is in the low hazard level. The last known earthquake in central Arizona occurred near Constellation, Arizona in 1930 (BLM 2008a).

Surface Geology Age

The Colorado Plateau Physiographic Province, shown in Figure 3-9, contains geologic units of a different age than those of the Basin and Range Physiographic Province.

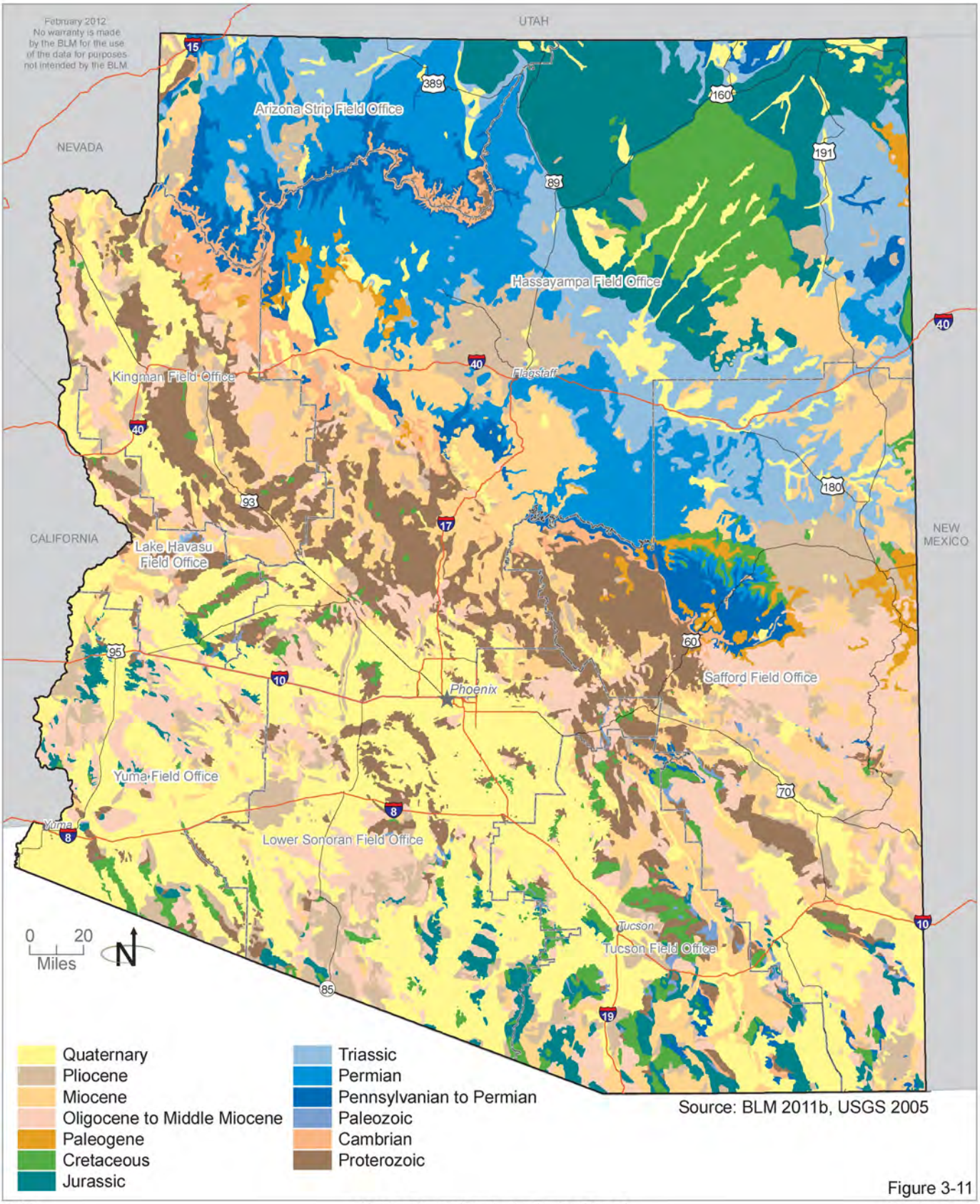


Figure 3-11

The Colorado Plateau of Arizona consists of a thick sequence of locally folded or faulted but generally flat-lying and undeformed, sedimentary rocks overlying a basement complex of granite and schist. Most of the rocks exposed are upper Paleozoic or Mesozoic age, predominantly sandstone or limestone (BLM 1995a, 2007a). The Grand Wash Cliffs Fault Zone east to Marble Canyon lies within the Colorado Plateau province. This province is characterized by predominantly sedimentary rock exposures; a regular, gently dipping surface; and plateau elevations exceeding 5,000 feet with subordinate plateaus exceeding 9,000 feet. The portion of the Colorado Plateau known as the Grand Canyon section is characterized by block plateaus over 7,000 feet in elevation, which have been cut up to 5,000-6,000 feet by the Colorado River and its tributaries.

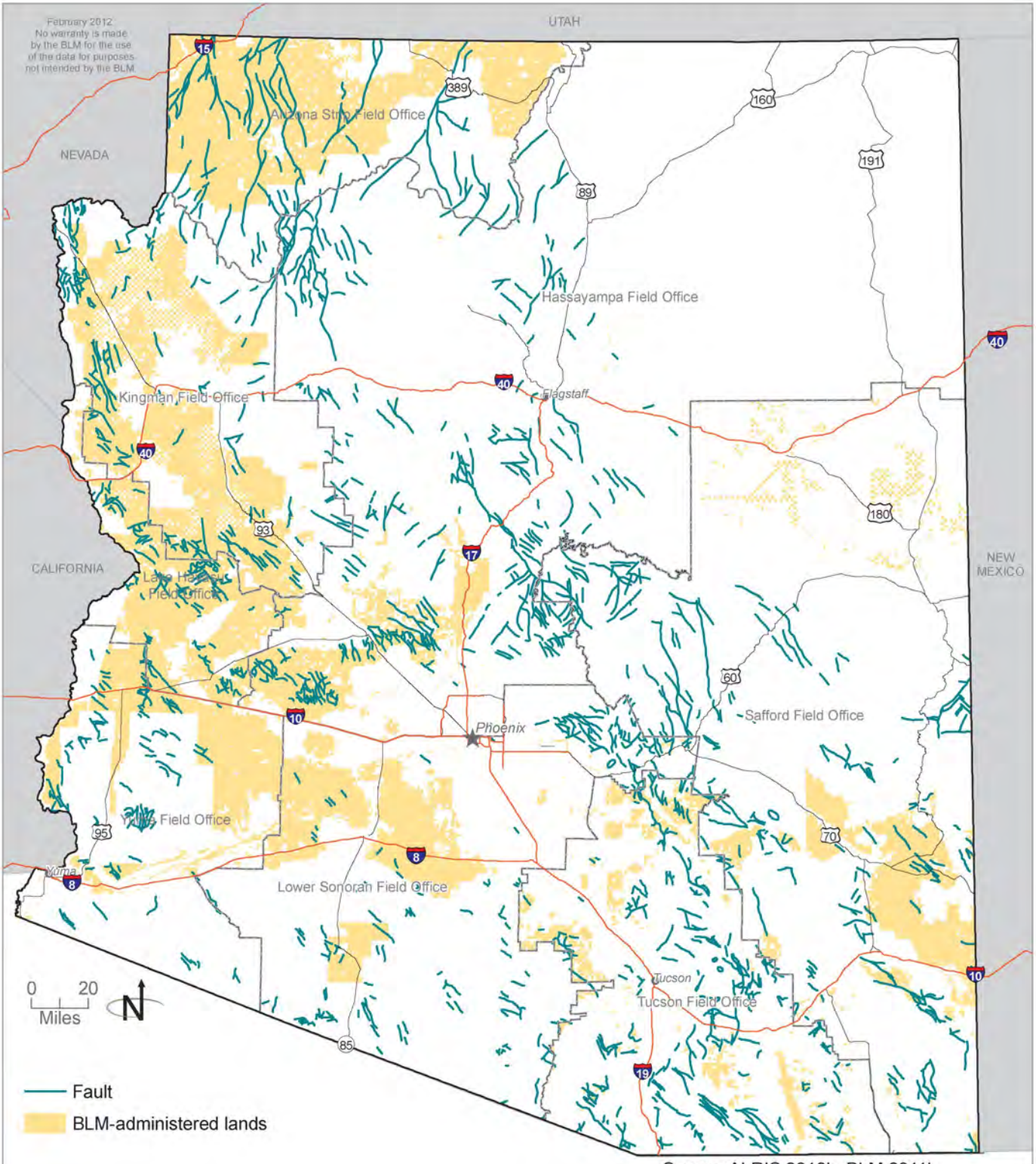
Major structures that occur include faults (e.g., Virgin, Grand Wash Cliffs, Mainstreet, Hurricane, Dellenbaugh, Toroweap, Sevier, and Muav Canyon Faults; see **Figure 3-12**, Major Arizona Faults); anticlines (Vermilion, Kaibab, and Echo anticlines); and monoclines (Kaibab and Echo Cliffs monoclines). In general, northerly trending normal faults, downthrown to the west, dominate the structural setting of the western two-thirds of the planning area. East of the Muav Canyon Fault Zone, anticlines and monoclines are the most common major structural types.

Several minor plateaus have been defined in the Colorado Plateau province, including the Kaibab Plateau, Kanab Plateau, and the Uinkaret Plateau (BLM 2007b). In northwestern Arizona, Paleozoic rocks unconformably overlie the Precambrian through lower Cenozoic sediments of both continental and marine origin. In addition, Tertiary and Quaternary volcanic features overlie these sediments in the western half of the planning area.

Grand Canyon-Parashant National Monument encompasses the lower portion of the Shivwits Plateau, which forms an important watershed for the Colorado River and Grand Canyon. The plateau is bounded on the west by the Grand Wash Cliffs and on the east by the Hurricane Cliffs. These cliffs, formed by large faults slicing north to south through the region, are the major topographic barriers. At the southern end of the Shivwits Plateau are several important tributaries, including the rugged Parashant, Andrus, and Whitmore Canyons. Volcanic rocks with an array of cinder cones cap the plateau and basalt flows and range in age from 9 million to 1,000 years old. Lava from the Whitmore and Toroweap areas has flowed into the Grand Canyon and dammed the river many times over the past several million years. The monument is pocketed with sinkholes and breccia pipes, structures associated with volcanism and the collapse of underlying rock layers through ground water dissolution. Parashant also contains portions of several active geologic faults in the area. These include the Dellenbaugh Fault, which cuts basalt flows dated 6 to 7 million years old; the Toroweap Fault, which has been active within the last 30,000 years; the Hurricane Fault, which forms the Hurricane Cliffs and extends over 150 miles

Major Arizona Faults

In general, northerly trending normal faults, down thrown to the west, dominate the structural setting of the western two-thirds of the planning area.



Source: ALRIS 2010b, BLM 2011b

Figure 3-12

across northern Arizona into Utah; and the Grand Wash Fault, which separates the Colorado Plateau and Basin and Range physiographic provinces (BLM 2007a).

Vermilion Cliffs National Monument is described in its proclamation as a geological resource worthy of protection. In the center of Vermilion sits the Paria Plateau, a terrace lying between the East Kaibab and the Echo Cliffs monoclines. The Vermilion Cliffs, which lie along the northern, eastern, and southern edge of the Paria Plateau, rise 3,000 feet in an escarpment capped with sandstone underlain by multicolored, actively eroding, dissected layers of shale and sandstone. The Paria River Canyon winds along the east side of the plateau to the Colorado River. Erosion of the sedimentary rocks in this 2,500-foot deep canyon has produced a variety of geologic objects and associated landscape features such as amphitheaters, arches, and massive sandstone walls (BLM 2007a).

In the northwest portion of the monument lies Coyote Buttes, an area where crossbeds of sandstone exhibit colorful banding in hues of yellow, orange, pink, and red caused by the precipitation of manganese, iron, and other oxides. Thin veins or fins of calcite cut across the sandstone, adding another dimension to the landscape.

The Vermilion Cliffs are composed of the Jurassic Moenave and Kayenta Formations. Directly at their base are the Chocolate Cliffs consisting of the Triassic Moenkopi Formation. The Paria Plateau and the Coyote Buttes are composed of Jurassic Navajo Sandstone, with scattered representations of Page Sandstone, Carmel Formation, and Entrada Sandstone, also from the Jurassic period (BLM 2007a).

3.7.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ is located within the Palomas Plain, which is bounded on the southwest by the Palomas Mountains. The Palomas Plain is a typical basin found in the Basin and Range Province of the western U.S. In this area, the mountain ranges bounding the basins are all oriented to the northwest. The Palomas Mountains are an isolated portion of the Kofa-Tank Mountains complex, and the range's bedrock is composed of granitic, metamorphic rocks and volcanic rocks (DOE 2010).

There are no known unique or significant geologic features within the proposed Agua Caliente SEZ boundary. The subsurface geology is underlain by recent alluvial sediments varying from 200 to 600 feet thick that overly a thick sequence of volcanic rocks that extend to a depth of at least 2,500 feet. The volcanic rocks are highly fractured and there is an irregular contact between the volcanic unit and the overlying recent alluvium. The seismic hazard potential for the Yuma region is Seismic Zone 4 (subject to ground shaking), but the earthquake hazard risk for the area has been determined to be low by the Arizona Geologic Survey (DOE 2010). Minor faults occur in the area, but no

significant faults that could generate major seismic activity or areas prone to liquefaction have been identified by Yuma County in their Comprehensive Plan in eastern Yuma County. The lack of significant faults results in the low earthquake risk for the area as determined by the Arizona Geological Survey (DOE 2010).

3.8 LAND USE AND REALTY

The primary goal of the Arizona Land Tenure Adjustment Strategy is to enhance the administration of public land ownership patterns through land tenure adjustments that acquire lands with high resource values and dispose of lands that are difficult and uneconomical to manage (BLM 2011f). To accomplish this objective, BLM Arizona will take action to provide the most effective configuration of lands and interests in land, consistent with land use plans developed through a full and open public involvement process, and to further the purposes of FLPMA. The land tenure program will support local community needs, further the public interest, secure exceptional natural values, and to the extent allowed by law, generate revenue from the enhanced management of the public land resources that remain in public ownership.

BLM adjustments to land tenure can occur via land exchanges and land sales. When in the public interest, it is the goal in land tenure adjustments to keep the surface and mineral estates together on both lands disposed of and acquired to benefit the future landowner's use and management of the land by avoiding the creation of split estate. Some lands identified for disposal in the RMPs may be leased under the Recreation and Public Purposes Act, such as a park or municipality, and, therefore, cannot be sold for another purpose until that lease is relinquished. Before disposal of public lands, any encumbrances, such as the type of lease mentioned above, would need to be identified. Public lands selected for disposal typically meet the following criteria:

- Isolated and fragmented from larger tracts of BLM-administered lands;
- Adjacent to urbanizing private and state lands subject to future development;
- Present an economic and management challenge to retain under public ownership;
- Not within designated wildlife corridors;
- Not occupied by species listed or proposed as threatened or endangered under the ESA;
- Not designated or proposed critical habitat for listed or proposed threatened or endangered species;
- Not supporting listed or proposed threatened or endangered species if such transfer would conflict with recovery of the listed or proposed species; and

- Not supporting federal candidate species if such action would contribute to the need to list the species as threatened or endangered.

Acquisitions

Lands or interests in lands may be acquired through purchase, easement, and donation or through a land exchange. Acquisitions must be consistent with the BLM mission and with applicable land use plans.

Exchanges

An exchange must be determined to be in the public interest and fully consider better federal land management and the needs of state and local people. It must be determined that the values and objectives of the lands being acquired will be greater than the values of the federal lands being conveyed.

Sales

Public lands must be identified for disposal in a land use plan before being offered for sale. Public lands that are classified withdrawn, reserved, or have special designations are not available for sale. Under the authority of FLPMA, the BLM can sell public lands through competitive sales and exchange lands with other land management agencies and private landowners. Federal lands can only be sold at fair market value; that is, at a price comparable to private land sales.

3.8.1 RDEP Affected Environment

Arizona contains an estimated 72.1 million acres, or approximately 112,657 square miles. The surface land ownership in Arizona can be classified into four basic categories: Federal, State, Tribal, and Private (BLM 2011a). **Table 3-6**, Arizona Land Status, presents the total acreage and percentage of acreage by ownership. **Figure 3-13**, Surface Administration, shows land ownership.

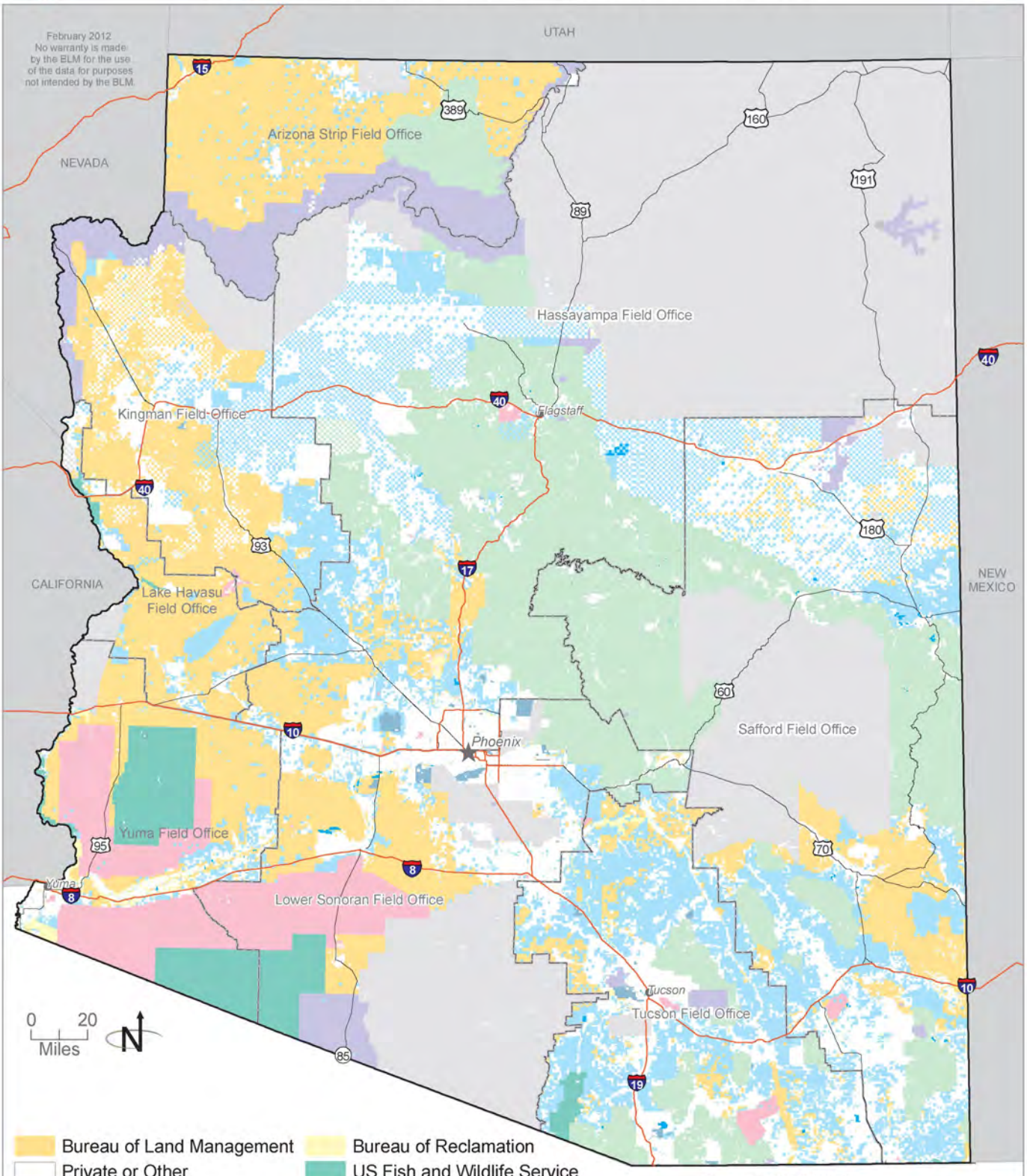
Table 3-6
Arizona Land Status

Landowner	Acres	Percentage of Arizona Land
BLM	12,171,000	17
Forest Service	11,165,300	15
DOD	2,753,900	4
NPS	2,585,200	4
USFWS	1,705,600	2
BOR	178,100	<1
Tribal Lands	20,114,000	28
State	9,285,100	13
State or Local Parks	148,700	<1
State Wildlife Area	41,500	<1
County	14,300	<1
Private	12,779,900	18
Other	800	<1
Total	**72,943,400**	**100**

Source: BLM 2011a

Surface Administration

Arizona is 72.9 million acres, with 12.1 million acres of BLM-administered lands.



Source: BLM 2011a

Figure 3-13

This section provides an overview of land ownership and uses and consideration of land use plans. Lands managed for conservation (National Scenic and Historic Trails, and Special Designations) are described in **Section 3.18**, Special Designations. Recreation use on federal, state, and local government agency lands is discussed in **Section 3.15**, Recreation. The acreage data used in this section were the currently available data at the time of assembly and are still generally representative.

Federal Uses of Land in Arizona

The federal government owns about 30.6 million acres (about 42 percent) of the 72.1 million acres of land in Arizona. The majority of federal land is administered by the BLM (12.2 million acres, or 40 percent of federal land in Arizona) and the Forest Service (11.2 million acres, or 37 percent) (BLM 2011a).

Each federal agency manages its lands and resources according to its mission and responsibilities. The BLM and Forest Service lands are managed for recreation, timber harvesting, livestock grazing, energy production, mining, wilderness protection, water and wildlife habitat, and other purposes. The U.S. Department of the Interior, National Park Service (NPS) manages lands for the conservation, preservation, protection, and interpretation of the nation's natural, cultural, and historic resources. The USFWS manages its lands for the conservation and protection of fish and wildlife and their habitats. The U.S. Department of Defense (DOD) manages its land to provide realistic test and training environments for military operations as required by Title 10 (Armed Forces) of the United States Code. The U.S. Department of the Interior, Bureau of Reclamation (BOR) manages its lands primarily for water development.

The designation of REDAs and land use plan amendments could affect land use on federal lands. The acreages and land uses that could be affected are discussed in **Section 4.2.8**, Land Use and Realty.

BLM

The BLM's multiple-use mission, set forth in FLPMA, mandates that the agency manage public land resources for a variety of uses, such as energy development, livestock grazing, recreation, mining, and timber harvesting, while protecting a wide array of natural, cultural, and historical resources, many of which are found in the BLM's 27-million-acre National Landscape Conservation System (NLCS). The BLM currently administers approximately 12.2 million acres of land in Arizona, about 17 percent of the land area. These lands are often intermingled with other federal or private lands. The BLM also administers the subsurface mineral resources on these federal lands if the subsurface is owned by the federal government. In conjunction with the Bureau of Indian Affairs, the BLM supervises leasable mineral operations on Indian trust lands.

The BLM administers a variety of lands within Arizona, including rangelands, forests, wetlands, lakes, high mountains, and deserts. Land uses include livestock grazing; fish and wildlife habitat development and utilization; mineral exploration

and development; renewable energy development; ROWs; outdoor recreation; and timber production. These uses are managed within a framework of numerous laws, the most comprehensive of which is FLPMA. FLPMA established the "multiple use" management framework for public lands, so that "public lands and their various resource values are utilized in the combination that will best meet the present and future needs of the American people" (from Section 103(c) of FLPMA). FLPMA ensures that there is no predominant or single use that overrides the multiple-use concept on any of the lands administered by the BLM. However, not all uses can occur on the land at the same time. Use of public lands shall be limited to areas where such use would not be inconsistent with land use plans or current uses. National monuments and other units of the NLCS system are managed with the intent of protecting the resources that are identified with these types of designated lands. Multiple uses of BLM-administered lands (and resources) are described as follows:

- Domestic Livestock Grazing. BLM Arizona issued 769 grazing permits and leases in 2010, primarily for cattle and sheep. It also issued permits for domestic horses, burros, and goats. Livestock grazing is managed on about 89 percent of the BLM-administered public lands in Arizona. Livestock grazing is discussed in detail in **Section 3.9**, Livestock Grazing.
- Fish and Wildlife Development and Utilization. Fish and wildlife habitat spans all of the lands and waterways managed by the BLM. The agency works with AGFD, which is responsible for managing fish and wildlife populations on state lands. BLM funds many fish- and wildlife-related projects annually and plays an important role in the development and implementation of conservation plans for at-risk species. Wildlife and aquatic species conditions are discussed in detail in **Section 3.6**, Fish and Wildlife.
- Mineral Exploration, Development, and Production. Energy and mineral resources have the highest economic production values among commercial uses for surface lands and subsurface estates administered by the BLM in Arizona. These economic production values include exploration, development, and production of oil, natural gas, and geothermal resources; ROWs for associated pipelines and transmission lines; and locatable, leasable, and salable solid minerals. Locatable minerals, defined under the General Mining Law of 1972, can be obtained by locating a mining claim; they include both metallic (e.g., gold, silver, and lead) and nonmetallic (e.g., gemstones, fluorspar, and mica) materials. Leasable minerals are subject to the Mining Leasing Act of 1920 and include energy (e.g., coal) and non-energy (e.g., sodium, phosphate) resources; leases to these resources are obtained through a competitive bidding process. Salable minerals include basic natural resources such as sand and gravel that the BLM sells to the public at fair

market value. The BLM may also grant free-use permits to states, counties, or other government entities for public projects. See **Section 3.5**, Energy and Minerals, for a detailed description of energy and mineral conditions.

- Rights-of-way. ROWs consist of an authorization to occupy, use, or traverse public lands. The BLM has been granted the authority to grant, issue, or renew ROWs for reservoirs, pipelines, renewable energy development, transmission lines, and transportation routes (e.g., roads, highways, trails, and railways).
- Outdoor Recreation. The vast majority of the American public's interaction with BLM-administered lands is through outdoor recreational activities. In 2005, more than 50 million visitors participated in activities such as rafting, hiking, biking, hunting, fishing, and camping on BLM lands throughout the U.S. Other activities include visits to heritage sites, national monuments, wild and scenic rivers, wilderness areas, national trails, and national conservation areas (BLM 2005a). Recreation use is discussed in **Section 3.15**, Recreation.
- Timber Production. About 1.7 million acres of BLM land in Arizona (14 percent) fall under the categories of forests and woodlands (DOE and BLM 2008). BLM defines forests as lands with 10 percent or greater stocking in tree species used in commercially processed wood products (e.g., lumber, plywood, and paper). Woodlands are lands with 10 percent or greater stocking in tree species not typically used in commercial wood products (such as pinyon pine, juniper, and black spruce). Timber production is just one aspect of the BLM's forest management program.

Other commercial uses also occur on these lands (e.g., guides and outfitters and special uses such as filming or competitions).

U.S. Forest Service

Congress established the U.S. Forest Service in 1905 to provide quality water and timber for the nation's benefit. Its mission is to sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations. Types of land managed by the U.S. Forest Service throughout the western U.S. include national grasslands, land utilization projects, purchase units, research and experimental areas, national preserves, and other miscellaneous lands. In Arizona, national forests are the only type of land managed by the U.S. Forest Service (approximately 11.2 million acres, 15 percent of land area) (BLM 2011a). National forests are units of land formally established and permanently set aside and reserved for national forest purposes (e.g., as rangeland, timberland, and recreation land).

The Forest Service uses a multiple-use land management approach based on the principles outlined in the Multiple Use Sustained Yield Act of 1960 (16 USC 528) to sustain healthy ecosystems, repair damaged ecosystems, and address the need for resources and commodities. Multiple uses include the following:

- Administering and managing recreation, wilderness, and heritage areas and other congressionally designated areas (e.g., wild and scenic rivers and national recreation areas);
- Restoring, recovering, conserving, and enhancing fish and wildlife and their habitats;
- Managing forest, rangeland, minerals, and water resources in a sustainable manner;
- Conducting resource inventories and assessments of National Forest System (NFS) lands; and
- Providing a safe environment for the public and for Forest Service employees (Forest Service 2003).

The agency authorizes and administers the use of public lands by individuals, companies, organized groups, other federal agencies, and state or local levels of government to protect natural resource values and public health and safety. The following are some of the land uses authorized by the Forest Service Lands and Realty Management Program related to infrastructure for generating and transmitting energy resources:

- Electricity transmission facilities;
- Oil and gas pipelines;
- Hydropower facilities; and
- Wind and solar facilities (Forest Service 2004).

NPS

The NPS was created in 1916 to protect the national parks and monuments managed by DOI. The approximately 2.8 million acres (four percent of total land area) managed by the NPS in Arizona includes one national historic park, two national historic sites, thirteen national monuments, one national memorial, three national parks, and two national recreation areas[2] (BLM 2011a).

USFWS

The USFWS was established in a 1940 reorganization plan when the DOI consolidated the Bureau of Fisheries and the Bureau of Biological Survey into one agency. The USFWS manages the 96.3-million-acre National Wildlife Refuge

[2] Acreage does not include Nevada portions of Lake Mead National Recreation Area (NRA), and Utah portions of Glen Canyon NRA.

System (NWRS), which encompasses 547 national wildlife refuges, thousands of small wetlands, and other special management areas throughout the U.S. The Bankhead-Jones Farm Tenant Act, passed in 1937, was the authority used for establishing a number of wildlife refuges across the U.S. The approximately 1.7 million acres (two percent of total land area) managed by USFWS in Arizona includes national wildlife refuges, coordination areas, national fish hatcheries, and administrative sites (BLM 2011a). These categories are defined by the USFWS as follows:

- National Wildlife Refuge. Any area of the NWRS, excluding coordination areas and waterfowl production areas. Includes wilderness areas (service land managed in accordance with the terms of the Wilderness Act of 1964) and migratory waterfowl refuges (service land managed for the benefit of migrating waterfowl and other wildlife under the Fish and Wildlife Coordination Act).
- Coordination Area. Any area administered as part of the NWRS and managed by the state under cooperative agreements between the USFWS and the state's fish and wildlife agency.
- National Fish Hatchery. A facility where fish are raised. Hatchery objectives are to replenish depleted stocks, mitigate federal water projects, assist with the management of fishery resources on federal (primarily USFWS) and tribal lands, and enhance recreational fisheries.
- Administrative Sites. Land used to support administrative programs, such as maintenance facilities or offices and off-site visitor centers.

DOD

The DOD owns and manages 3,748 sites, covering nearly 30 million acres worldwide, of which about 79 percent are located in the U.S. or in U.S. territories. The majority of land managed by DOD is used for military bases and bombing/firing ranges. Sites range in size from the very small, such as unoccupied locations supporting an Air Force navigational aid on less than one-half acre of land, to the very large, including the Army's White Sands Missile Range in New Mexico with more than 2.3 million acres. The majority of the land controlled by the DOD is government-owned or withdrawn public land (about 80 percent). The approximately 2.8 million acres (four percent of total land area) managed by DOD in Arizona include three Army bases (Camp Navajo, Flagstaff; Fort Huachuca, Cochise; and Yuma Proving Ground, Yuma County), three Air Force bases (Barry M. Goldwater Range, Phoenix; Davis-Monthan AFB, Tucson; and Luke AFB, Glendale), and one Marine Corps base (Marine Corps Air Station Yuma, Yuma) (BLM 2011a).

BOR

Established in 1902, the BOR is best known for the dams, power plants, and canals it constructed in the 17 western states. Today, it is the largest wholesaler

of water in the country and is also the second largest producer of hydroelectric power in the western United States. Arizona is part of the Lower Colorado Region administered by the BOR. The region encompasses southern Nevada, southern California, most of Arizona, a small corner of southwestern Utah, and a small section of west-central New Mexico. In Arizona, the BOR manages approximately178,000 acres (BLM 2011a).

Some of BOR's projects in Arizona include the Central Arizona Project; Imperial Diversion Dam and the Yuma Project in Arizona; and the Hoover Dam and the Colorado River. The BOR delivers water for irrigation and domestic needs, supplies electricity through hydroelectric power plants, and provides recreation opportunities on the reservoirs and river stretches (BOR 2009).

Nonfederal Uses of Land in Arizona

Nonfederal lands in Arizona include privately owned lands, tribal and Indian trust lands, and lands controlled by state and local governments.

Tribal Land

There are 22 federally recognized Indian tribes with reservation land in Arizona. This tribal land encompasses approximately 20.1 million acres or 28 percent of Arizona's land base. Tribal lands are administered for recreation, timber harvesting, livestock grazing, oil and gas production, mining, conservation, and functions vital to the culture and livelihood of the tribes.

State Trust Land

State trust lands are not public lands, but are instead the subject of a public trust created to support educational programs. The trust accomplishes this in a number of ways, including through its sale and lease of trust lands for grazing, agriculture, municipal, school site, residential, commercial and open space purposes. Currently, exchange of state trust lands is not allowed under the Arizona Constitution.

Arizona has approximately 9.28 million surface acres and 9 million subsurface acres of trust lands. Scattered throughout the state, the trust lands are extremely diverse in character, ranging from Sonoran Desert lands, desert grasslands, and riparian areas in the southern half of the state to the mountains, forests, and Colorado Plateau regions of northern Arizona. The majority of the trust lands are located in rural areas of the state with more than one million acres located within or adjacent to urbanized areas. The trust lands constitute approximately 13 percent of land ownership in Arizona (Arizona State Land Department 2011).

It should be noted that sites identified on State Trust land in no way implies Arizona State Land Department agreement with the nomination of these sites, that inclusion of sites on State Trust land does not create any obligation on the part of Arizona State Land Department to approve renewable energy developments on these sites, does not provide any entitlement to potential

applicants for the use of these sites, and does not mean that Arizona State Land Department is actively seeking applications for the disposal, or lease, of these sites for these types of projects.

State and Local Parks

There are approximately 148,700 acres of state and local parks in Arizona (BLM 2011a). The state park system in Arizona includes state parks and state historic parks, as well as other designations such as natural areas and recreation areas. Arizona currently has 30 state park units, which are managed wholly or partly by the Arizona State Parks government agency (Arizona State Parks 2011a). Local government parks also provide numerous recreation opportunities throughout the state.

State Wildlife Areas

The AGFD owns 41,500 acres of State Wildlife Areas (SWA) (BLM 2011a). Most wildlife areas are available for public use, generally including wildlife viewing, fishing, hunting, camping, hiking, and birding. All of the SWAs are located in the southern portion of the state (south of Interstate 40).

Aviation Considerations

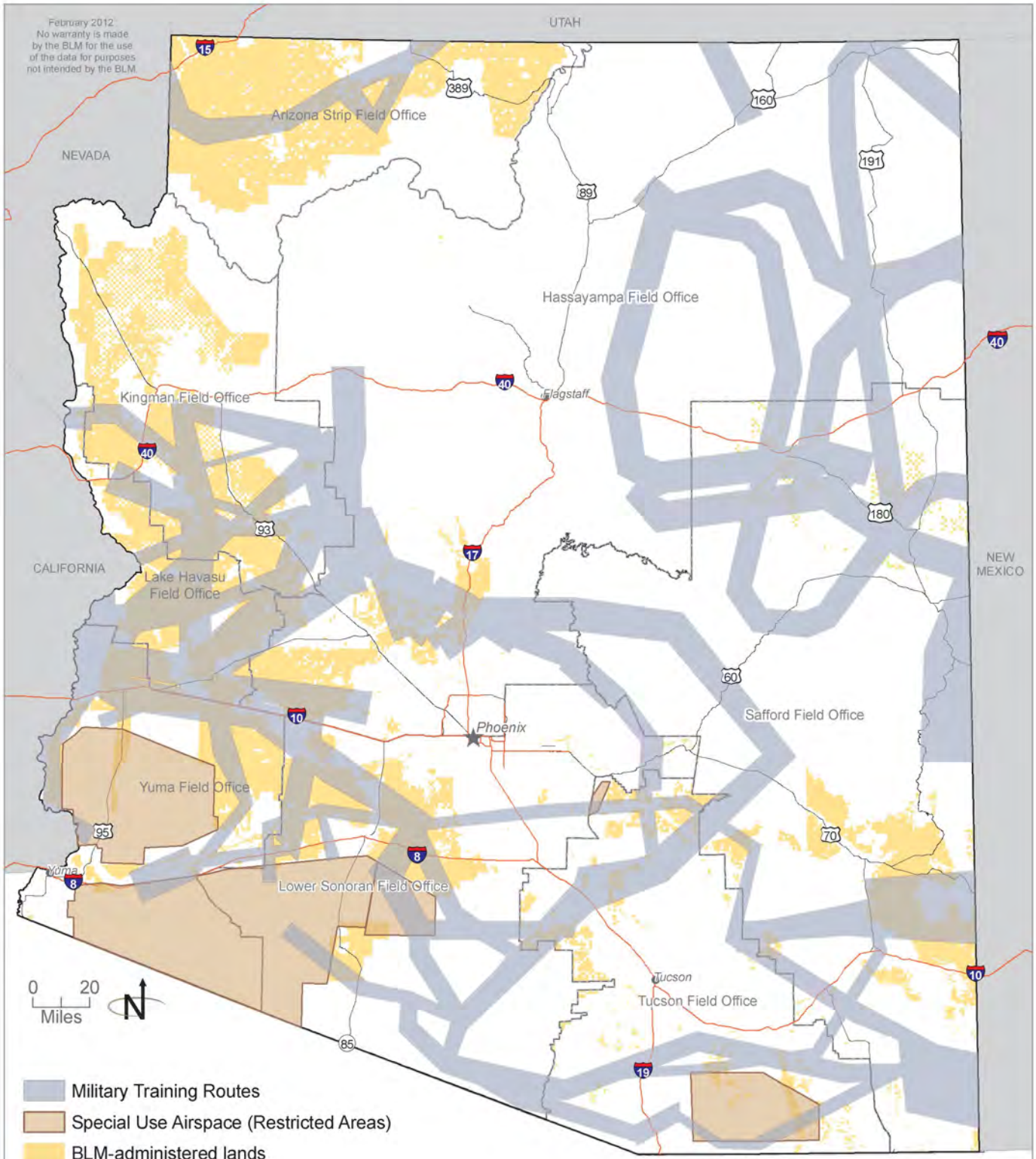
The US military uses airspace for its operations, some of which take place as low as 100 feet above ground level. For non-military aircraft operating below 10,000 feet above ground level, air speed is restricted by the Federal Aviation Administration (FAA) to 250 knots (288 mph). In order to support military training exercises and ensure the safety of military personnel and civilians, the DOD and FAA mutually developed and maintain a network of Military Training Routes (MTRs). Within MTRs, military aircraft are permitted to operate below 10,000 feet above ground level at speeds in excess of 250 knots. The DOD also designates Special Use Areas (SUA) where civilian aircraft are not authorized to fly without special permission. SUA and MTR airspace are shown in **Figure 3-14**, Military Restricted Airspace.

Specific locations and DOD operational needs must be considered when siting solar and wind energy facilities, and related transmission facilities. DOD publishes detailed information regarding SUAs and MTRs throughout the US, including those within the planning area. Descriptions of MTRs, for example, identify route widths, hours of operation, special operating procedures, and minimum training altitudes for each route segment (DOD 2008). Development within SUAs and MTRs would require consultation with the DOD during project planning to ensure projects do not conflict with DOD training activities.

The presence of civilian airports and their operational airspaces also must be considered when siting solar and wind energy facilities, and related transmission facilities. There are 314 public or private airports and other aviation facilities in Arizona (GlobalAir 2011).

Military Restricted Airspace

The US military uses airspace for its operations, some of which occur at low elevations (from 1,000 feet to as low as ground surface).



Source: BLM 2011b,
HQ, AF Bases, Ranges, & Airspace 2011

Figure 3-14

Another important consideration is the aircraft operations of BLM's National Office of Aviation and the Forest Service's Office of Fire and Aviation Management, which provide aircraft support for wildfire suppression and resource management missions on public lands.

Because of air navigation concerns associated with tall structures and structures built near airports, the locations of airports (and their related airspaces) and the flight patterns of various aircraft need to be taken into account when siting infrastructure (e.g., wind turbines and transmission towers). The FAA must be contacted for any proposed construction or alteration of objects within navigable airspace under the following categories:

- Proposed objects more than 200 feet above ground level at the structure's proposed location;
- Within 20,000 feet of an airport that has one runway longer than 3,200 feet, and the proposed object would exceed a slope of 100:1 horizontally from the closest point of the nearest runway;
- Within 10,000 feet of an airport or that does not have a runway more than 3,200 feet in length, and the proposed object would exceed a 50:1 horizontal slope from the closest point of the nearest runway; and
- Within 5,000 feet of a heliport, and the proposed object would exceed a 25:1 horizontal slope from the nearest landing and takeoff area of that heliport (FAA 2000).

The FAA could recommend marking and/or lighting a structure that does not exceed 200 feet above ground level, or that is not within the distances from airports or heliports mentioned above, because of its particular location (FAA 2000).

BLM Land Use Authorizations

The goals of the BLM lands and realty program are to manage public lands to support the goals and objectives of other resource programs, provide for uses of public lands in accordance with regulations and compatibility with other resources, and improve management of public lands through land ownership adjustments. The lands and realty program is a support program to all other resources to help ensure that BLM-administered public lands are managed to benefit the public.

BLM lands and realty actions include land use authorizations, which consist of ROWs, and other leases or permits. ROWs are authorized under FLPMA. Section 103(l) FLPMA identifies ROWs as one of the principal or major uses of the public lands. A ROW conveys an authorization to occupy, use, or traverse public lands. The BLM grants or renews ROWs on public lands for a variety of uses, including reservoirs; pipelines; electrical generation, transmission, and

distribution systems; and roads. Once granted, a ROW conveys a right to occupy public lands and, depending on the specific ROW grant, may provide a priority for use of the public land for the specified term of the ROW. ROWs are typically issued for 20 to 30 years, but some may be granted in perpetuity. Through the land use planning process, the BLM may identify areas that are available for various types of ROWs and, in some areas, may identify where ROWs are either to be avoided or excluded. The BLM has also initiated efforts to streamline the solar and wind energy application processing procedures (Instruction Memorandum Nos. 2011-59, 2011-60, and 2011-61).

Through its land use planning process, the BLM has identified and continues to identify transmission corridors that are intended to provide locations on federal lands for future siting of electrical lines and pipelines. These corridors would be available to provide for transmission facilities to support renewable energy developments (DOE and BLM 2008).

A lease is an authorization to possess and use BLM land for a fixed period of time. A lease is issued when there is going to be substantial construction, development, and improvement and there is investment of large amounts of capital that will be amortized over time. Permits are authorized when uses of public lands will be short term and involve little or no land improvement, construction, or investment. Permits and leases are subject to processing and monitoring fees and a fair market rental value.

Renewable Energy

Arizona has been classified as having a highly favorable renewable energy climate due to having key policies in place that include green pricing programs, green power aggregation, net metering, and, most importantly, an RPS (BLM and DOE 2003). It is expected that public and private lands will continue to be considered for renewable energy development to meet the Arizona RPS that requires 15 percent of energy produced in the state be from renewable sources by 2025. This will include utilizing previously disturbed lands owned by federal, state, and local government agencies to minimize impacts on undeveloped lands.

In February 2003, BLM, in partnership with the Energy Efficiency and Renewable Energy division of the DOE, published a report entitled *Assessing the Potential for Renewable Energy on Public Lands*. The report used GIS data to analyze and assess the potential for CSP, PV, wind, and biomass resources and technologies on public land. This report represented an important initial activity of BLM's proposed National Energy Policy Implementation Plan, which is to identify and evaluate renewable energy resources on public lands and any limitations on access to them. The BLM is using this information in prioritizing land use planning activities to increase industry's development and use of the renewable energy resources on public lands. These renewable resources include solar, biomass, geothermal, hydroelectric, and wind energy. Arizona BLM strategic goals include (BLM 2010b):

- Participating with landowners in the development of renewable energy strategies;
- Contributing to Arizona community power demands and state goals for development of renewable energy on public lands;
- Ensuring a full array of locations for solar and wind energy generation and transmission as part of statewide decisions about the footprint of renewable energy; and
- Focusing efforts on potential generation sites and transmission alignments that optimize natural resources on public lands together with technical and economic requirements.

Solar

The entire planning area has high enough solar intensity for development, with annualized Direct Normal Irradiance (DNI) levels of 6.5 or higher. Details and solar intensity maps are provided in the RFDS document produced for this project, included as **Appendix A**, Reasonably Foreseeably Development Scenario for Renewable Energy in Arizona.

Wind

Wind resource classes were examined within the planning area. Details and wind intensity maps are provided in the RFDS document produced for this project, included as **Appendix A**, Reasonably Foreseeably Development Scenario for Renewable Energy in Arizona. As shown in the following breakdown, the majority of the acreage identified as having wind potential occurs in the lowest commercially viable wind class, Class 3:

- Class 3 (Fair) – 885,941 acres
- Class 4 (Good) – 44,852 acres
- Class 5 (Excellent) – 10,801 acres
- Class 6 (Outstanding) – 3,591 acres
- Class 7 (Superb) – 396 acres

The acreage breakdown for BLM-administered lands by wind class is as follows:

- Class 3 (Fair) – 68,308 acres
- Class 4 (Good) – 3,746 acres
- Class 5 (Excellent) – 277 acres
- Class 6 (Outstanding) – 69 acres
- Class 7 (Superb) – 0 acres

With current wind development technologies, areas with slopes of 15 percent or greater are considered economically infeasible. The RFDS document,

included as **Appendix A**, Reasonably Foreseeably Development Scenario for Renewable Energy in Arizona, eliminates such areas from the wind resource potential maps. The remaining lands of less than 15 percent slopes are considered to be the wind potential area. Potential maps and additional details are provided in **Appendix A**, Reasonably Foreseeably Development Scenario for Renewable Energy in Arizona.

Biomass

In 2007, NREL produced a "Biomass Resource Assessments" for the state of Arizona (National Renewable Energy Lab 2007). This assessment quantified the existing or potential biomass material in the state. Biomass resources include agricultural crops and residues; dedicated energy crops; forestry products and residues; animal wastes; residues and byproducts from food, feed, fiber, wood, and materials processing plants; as well as post-consumer residues and wastes, such as municipal solid wastes and landfill gases. These biomass resources could be used to produce power, heat, transportation fuels, and various chemical products.

Most Arizona counties have the potential to produce less than 50,000 tonnes of biomass per year. Cochise and Yuma County have the potential to produce 50,000 to 100,000 tonnes of biomass per year; Pima County has the potential to produce 100,000 to 150,000 tonnes of biomass per year; Pinal and Navajo Counties have the potential to produce 150,000 to 250,000 tonnes of biomass per year; and Maricopa County has the potential to produce more than 500,000 tonnes of biomass per year (National Renewable Energy Lab 2007).

Summary

In 2007, new Arizona rules were adopted that expanded the state's RPS to 15 percent by 2025. This new standard will secure and likely expand the market of developing renewable energy resources across the state. It is anticipated that renewable energy development will take place in all regions of the state, and largely will be concentrated in rural areas. Arizona has been identified as the state with the best developable solar energy resource in the country. Its solar supply chain and green and renewable technology sectors have been growing rapidly, and this trend is expected to continue (Renewable Energy Focus 2010).

3.8.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ is located in Yuma County about 65 miles northeast of the city of Yuma, and 60 miles southwest of Buckeye. The proposed SEZ is bordered by BLM lands to the north and west, and state and private lands to the east and south. The area surrounding the proposed SEZ is agriculture to the west and south, and undeveloped desert to the north and east.

Palomas Road, a Yuma County road, passes just south of the proposed SEZ and provides access to the proposed SEZ. A previously disturbed agricultural private inholding surrounded on three sides by the proposed SEZ is being developed

for a 290-MW solar energy facility (Agua Caliente Solar Project). A large-capacity transmission line passes within approximately 0.5 mile of the proposed SEZ near the southern end of the area, and a new Palo Verde Hub to North Gila 500-kV transmission line is expected to be in service by 2014.

The proposed SEZ is primarily used for natural resource-based recreation opportunities, including hunting through motorized and nonmotorized means. Numerous transportation routes traverse the proposed SEZ, most heading north-south and crossing or originating/terminating on private and state land.

Renewable Energy

Solar

The proposed Agua Caliente SEZ has high enough solar intensity for development, with annualized DNI levels of 6.5 or higher. A 2,200-acre, privately owned area encompassed by the proposed Agua Caliente SEZ is under development by solar developer First Solar for a 290-MW photovoltaic project. Slopes within the proposed Agua Caliente SEZ are generally less than five percent, meeting slope requirements for the development of most solar technologies.

Wind

Wind resource classes were examined within the proposed Agua Caliente SEZ. The lowest commercially viable wind class is Class 3, and the proposed Agua Caliente SEZ has no acres rated as Class 3 or higher. Therefore, it has been determined that the proposed Agua Caliente SEZ has no developable wind potential.

Biomass

NREL's Biomass Resources Map for Arizona indicates that Yuma County has the potential to produce 50,000 to 100,000 tonnes of biomass per year. Yuma County is reported to be 5,189 square miles, or 3,352,000 acres in size. Because the proposed Agua Caliente SEZ is 20,600 acres (less than 1 percent of Yuma County) or less, a rough estimate can be made of how much biomass might be produced by the proposed SEZ in a given year, assuming that the proposed Agua Caliente SEZ represents a typical level of vegetation and rate of growth for Yuma County. Using this approach, it is estimated that the proposed Agua Caliente SEZ could produce a maximum of approximately 500 tonnes of biomass per year.

3.9 LIVESTOCK GRAZING

The primary laws that govern grazing on public lands are the Taylor Grazing Act of 1934, FLPMA, and Public Rangelands Improvement Act of 1978. Management direction is provided under 43 CFR Part 4100, BLM Handbooks 4100 to 4180, and BLM Manual H-4120-1.

The BLM provides for the following two types of authorized use for livestock grazing:

1. Grazing permits, which authorize use of the public lands within an established grazing district. Grazing districts are specific areas where public lands are administered in accordance with Section 3 of the Taylor Grazing Act; and
2. Grazing leases, which authorize use of public lands outside an established grazing district. Public lands outside grazing district boundaries are administered in accordance with Section 15 of the Taylor Grazing Act.

The terms and conditions for grazing on BLM-administered lands (such as stipulations on forage use and season of use) are set forth in the permits and leases issued by the BLM to public land ranchers. Under this management, ranchers may obtain a grazing permit for an allotment of public land on which a specified number of livestock may graze. An allotment is an area of land designated and managed for livestock grazing. The number of permitted livestock on a particular allotment on public land is determined by how many animal unit months (AUMs) that the forage resources will support. An AUM is the quantity of forage required by one mature cow and her calf (or the equivalent in sheep or horses) for one month.

3.9.1 RDEP Affected Environment

Approximately 10.9 million acres of BLM-administered lands are available for grazing in the planning area; this represents approximately 89 percent of the BLM-administered land in the state. A total of 1.3 million acres (11 percent) are unavailable for grazing. Recent land use plan amendments have increased the number of acres unavailable for grazing due to other resource concerns. As of 2010, the total number of grazing permits/leases on BLM-administered lands in the planning area was 769, of which 405 were authorized as Section 3 permits, and 364 were authorized as Section 15 leases. A total of 635,731 AUMs have active status as of 2011 (**Table 3-7**, Year 2010 Livestock Grazing Statistics for BLM-administered Lands in the Planning Area) (BLM 2011a).

The BLM manages Arizona rangelands in accordance with established rangeland health standards and guidelines. Livestock, fish and wildlife habitat, riparian, watersheds, and other resource values benefit from improving the vegetative habitat and rangeland health of BLM-administered lands.

The BLM conducts land health assessments and evaluations of grazed land, develops vegetation objectives and integrates weed management into the livestock grazing program. Some examples of rangeland improvements include vegetation projects and fencing and wildlife/livestock water developments. Projects are generally initiated within priority watersheds and riparian areas and

Table 3-7
Year 2010 Livestock Grazing Statistics for BLM-administered Lands in the Planning Area

Leases and Permits	769
Section 3 permits	405
Section 15 leases	364
Active AUMs	635,731
Suspended AUMs	103,382
Allotments	834
Acres available for grazing	10,858,500
Acres unavailable for grazing	1,341,600
Grazing permits	769

Source: BLM 2011a

BLM-administered lands not meeting management objectives are given particular emphasis.

Based on the most recent BLM-administered land statistics for monitored rangeland, resource conditions on 2.1 million acres in Arizona were determined to be improving, 3.6 million acres were determined to be static, and 640 thousand acres were determined to be declining on public grazing lands in Arizona (BLM 2010c).

3.9.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ is within the Palomas Grazing Allotment #03064, which consists of approximately 150,000 acres, including 110,000 acres of public lands. The allotment was authorized for ephemeral use only. Ephemeral rangelands produce a minor percentage of desirable perennial livestock forage but periodically provide annual vegetation suitable for grazing. Under the Yuma Field Office RMP updated January 2010, the Palomas Grazing Allotment was withdrawn from livestock grazing due to non-use. The private land (White Wing Ranch) is located within the White Wing Allotment #05006. This allotment is not active and has not been active for some years.

3.10 NATIONAL TRAILS

3.10.1 RDEP Affected Environment

National scenic trails are extended trails that provide maximum outdoor recreation potential and for the conservation and enjoyment of the various qualities—scenic, historical, natural, and cultural—of the areas through which they pass.

National historic trails are extended trails that closely follow a historic trail or route of travel of national significance. Designation identifies and protects historic routes, historic remnants, and artifacts for public use and enjoyment.

National historic trails must meet the following three criteria listed in Section 5(b)(11) of the National Trails System Act:

- They must follow actual documented route of historic use;
- They must be of national significance; and
- They must possess significant potential for public recreation and/or interpretation.

A "National Recreation Trail" designation is given to existing trails that contribute to health, conservation, and recreation goals in the U.S. While national scenic trails and national historic trails may only be designated by an act of Congress, national recreation trails may be designated by the Secretary of the Interior or the Secretary of Agriculture to recognize exemplary trails of local and regional significance in response to an application from the trail's managing agency or organization. Through designation, these trails are recognized as part of America's national system of trails.

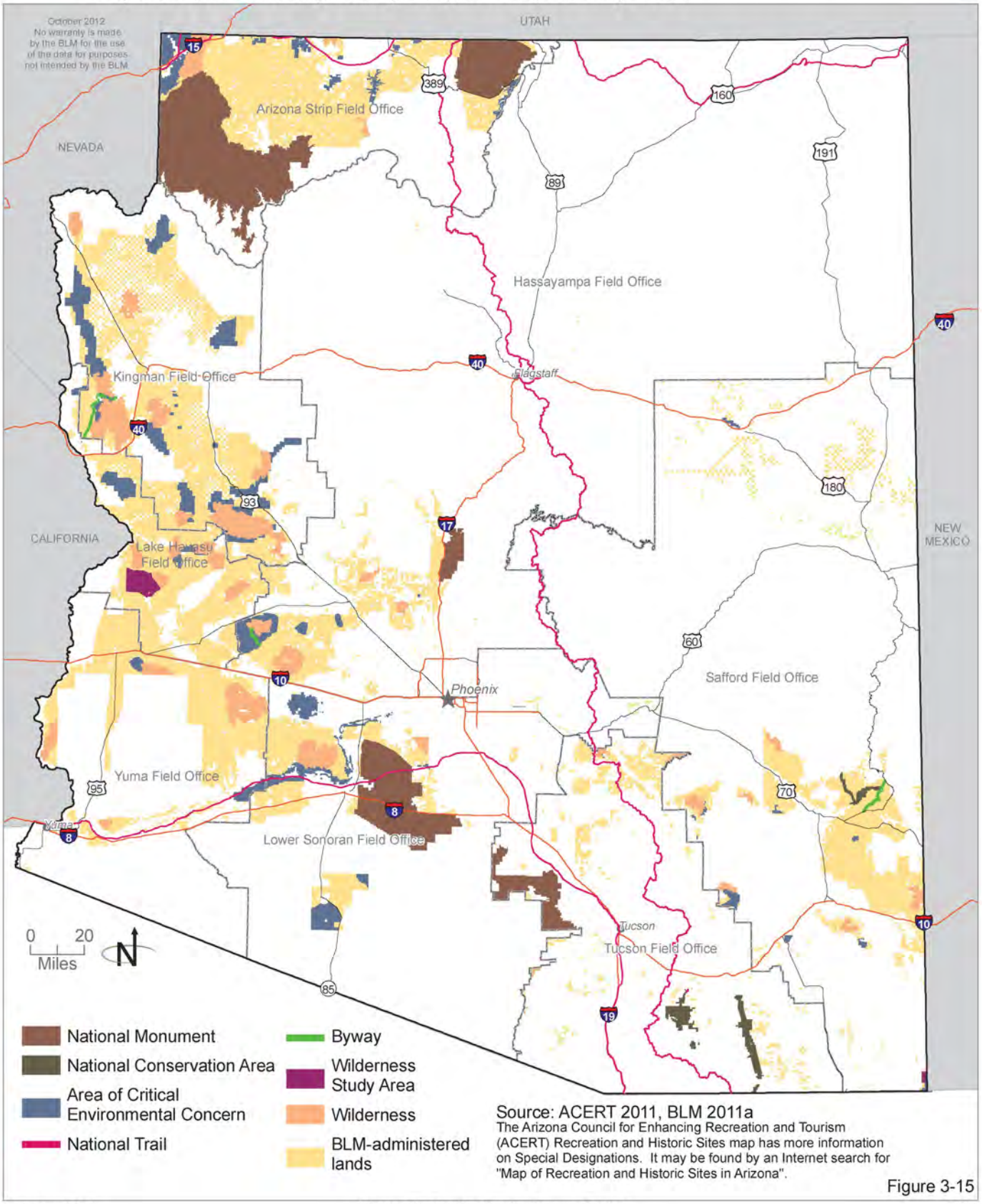
There are two national historic trails, the Juan Bautista de Anza National Historic Trail and the Old Spanish National Historic Trail, and one national scenic trail, the Arizona National Scenic Trail, in Arizona. The corridors of these trails total 34,400 acres on BLM-administered land in Arizona (**Figure 3-15**, Special Designations). Approximately 40 acres of private land of one nominated site overlaps the Juan Bautista de Anza National Historic Trail. Parts of these trails are affected by their proximity to urban areas, highways, utility corridors, or other modern developments. This proximity has impacted the viewsheds from the trails by introducing modern visual, aural, or atmospheric intrusion to their settings. For example, part of the Old Spanish National Historic Trail is underwater in Lake Mead. In addition, there are 34 national recreation trails in Arizona, two of which are managed by the BLM: Black Canyon Trail and Betty's Kitchen Interpretative Trail.

Juan Bautista de Anza National Historic Trail

The Juan Bautista de Anza National Historic Trail was designated on August 15, 1990, by the Juan Bautista de Anza National Historic Trail Act (Public Law 101-365). The trail comprises the overland route traveled by Captain Juan Bautista de Anza of Spain from Sonora, Mexico, to the vicinity of San Francisco, California during the years 1775 and 1776. The trail was used by Captain Juan Bautista de Anza to lead almost 100 people to California to establish the first permanent Alta California colony where followers were promised a better life (NPS undated). Other historic expeditions or travel routes, including the Butterfield Stage, Mormon Battalion, and pioneer travelers to the 1849 gold rush, followed portions of the Juan Bautista de Anza National Historic Trail.

Special Designations

Special designation areas protect unique characteristics that have been identified as scientifically, educationally, or recreationally important. BLM administers these areas with the intent to improve the manageability of the areas, allowing the agency to preserve, protect, and evaluate the significant components of national heritage. This figure depicts BLM special designations.



Source: ACERT 2011, BLM 2011a

The Arizona Council for Enhancing Recreation and Tourism (ACERT) Recreation and Historic Sites map has more information on Special Designations. It may be found by an Internet search for "Map of Recreation and Historic Sites in Arizona".

Figure 3-15

Old Spanish National Historic Trail

The Old Spanish National Historic Trail was designated on December 4, 2002, by the Old Spanish Trail Recognition Act of 2002 (Public Law 107-325). The Old Spanish National Historic Trail was a 2,700-mile trade route linking Santa Fe, New Mexico, and Los Angeles, California, passing through New Mexico, Colorado, Utah, Arizona, Nevada, and California. The trail had brief but heavy use between 1829 and 1848. During that period, Mexican and American traders took woolen goods west over the trail by mule train and returned eastward with California mules and horses for the eastern U.S. and Mexican markets (Old Spanish Trail Association 2011).

Spanish traffic on the trail was fairly constant between 1765 and 1821 to trade with the Ute Indians. Some trail users chose to trade with the Utes as far north as Salt Lake City, and followed a path now labeled the "North Branch," which led to Grand Junction, Colorado, before heading south to rejoin the other major route from Santa Fe via Green River, Utah. Mexican trader Antonio Armijo made the first commercial round-trip journey along a southern variant of the route in 1829 to 1830. William Wolfskill and George Yount's commercial pack train of 1830 to 1831 inaugurated consistent use of the entire route from 1830 to 1848. Use lapsed after the end of the Spanish American War in 1848, and by 1853, the Old Spanish National Historic Trail had been abandoned as a principal trade route (NPS 2001). The various historical routes together make up what is today known as the Old Spanish National Historic Trail.

Arizona National Scenic Trail

The Arizona National Scenic Trail was designated on March 30, 2009, by the Omnibus Public Land Management Act (Public Law 111-11). The Arizona National Scenic Trail is a more than 800-mile recreation trail from Mexico to Utah that connects mountain ranges, canyons, deserts, forests, wilderness areas, historic sites, trail systems, points of interest, communities, and people. It serves day hikers, backpackers, equestrians, mountain bicyclists, trail runners, nature enthusiasts, cross-country skiers, snowshoers, and mule and llama packers (Arizona Trail Association undated).

The many different features on and near the Arizona National Scenic Trail showcase many of Arizona's greatest attributes, including historic sites, diverse natural features and geologic wonders, quaint communities, and large remote wilderness areas. Prehistoric and historic sites dot the entire trail. These sites include the mining history at Kentucky Camp, the cliff dwellings at Tonto and Walnut Canyon National Monuments, the historic Roosevelt Dam, 1900 tourism era structures and trails of Grand Canyon National Park, the former railroad town of Patagonia, the former logging railroads near Mormon Lake, and the early Forest Service history of General Springs Cabin (Arizona Trail Association undated).

Notable natural features include the diverse life zones and elevation changes throughout the state, allowing a diversity of vegetation and wildlife. Some describe these various life zones as similar from going from Mexico to Canada, and are especially evident in southern Arizona's sky islands. These features include geologic wonders such as Grand Canyon National Park, Colossal Cave, and the White Canyon area (Arizona Trail Association undated).

3.10.2 Agua Caliente Solar Energy Zone Affected Environment

No national scenic, historic, or recreation trails occur within the proposed Agua Caliente SEZ. However, the Juan Bautista de Anza National Historic Trail corridor is located approximately five miles south of the proposed SEZ, and the proposed SEZ would be visible from the trail corridor.

3.11 NATIVE AMERICAN INTERESTS AND HERITAGE RESOURCES

Tribal interests include economic rights related to Indian trust assets and resource uses and access guaranteed by treaty rights. "Indian trust assets" means lands, natural resources, money, or other assets held by the federal government in trust or restricted against alienation for Indian tribes and individual Indians (Secretarial Order No. 3215, April 28, 2000).

The NHPA requires federal agencies to consider the effects of their actions on historic properties, including places of traditional religious and cultural importance to Indian tribes. Executive Order 13007, Indian Sacred Sites, was designed to accommodate access to sacred sites on federal land and to avoid harm to these sites "to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions."

Areas of cultural heritage importance to tribes may include archaeological sites; TCPs; traditional territories; areas used for traditional hunting, resource gathering, social events, or ceremonies; trails; graves and cemeteries; places associated with important events; or geographic features. The connections among places within a particular geographic landscape may also have cultural meaning.

Native American interests may also extend to the potential effects of renewable energy development on tribal economies and business ventures, public health and safety, traditionally important plants and animals, or other issues. Tribal consultation and coordination is essential to fully identify and analyze potential environmental and social consequences of development within the REDAs.

Tribal Consultation and Coordination

The BLM Arizona notified and initiated consultation with 23 federally recognized Native American tribes concerning the RDEP (see **Chapter 6**, Consultation and Coordination, for a summary of government-to-government consultation on the RDEP). The Native American tribes involved include the following:

- Hopi Tribe
- Pueblo of Zuni
- Navajo Nation
- Pascua Yaqui Tribe
- San Carlos Apache Tribe
- White Mountain Apache Tribe
- Tonto Apache Tribe
- Hualapai Tribe
- Havasupai Tribe
- Yavapai Prescott Indian Tribe
- Yavapai-Apache Nation
- Fort McDowell Yavapai Nation
- Salt River Pima Maricopa Indian Community
- Gila River Indian Community
- Ak-Chin Indian Community
- Tohono O'odham Nation
- Colorado River Indian Tribes
- Fort Mojave Tribe
- Fort Yuma-Quechan Tribe
- Cocopah Tribe
- San Juan Paiute Tribe
- Kaibab Paiute Tribe
- Chemehuevi Tribe

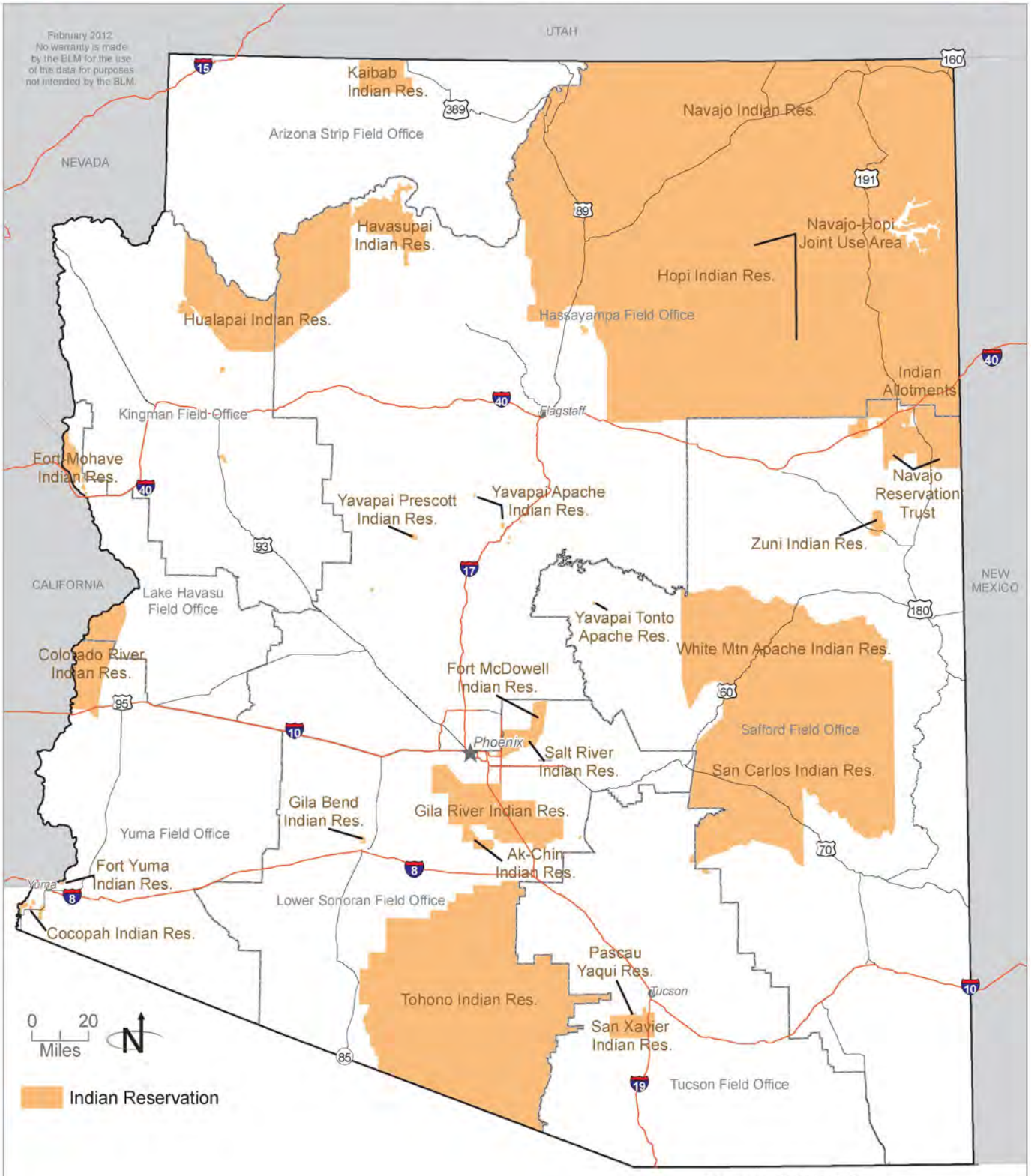
3.11.1 RDEP Affected Environment

Ethnographic History

As described in **Section 3.4**, Cultural Resources, the proposed REDAs cluster into eight geographic areas that are described in this EIS as cultural regions (see **Figure 3-4**, RDEP Cultural Regions, in **Section 3.4**, Cultural Resources). These regions are environmentally distinct areas that were associated with distinct groups of Indian tribes possessing shared languages, histories, and ways of life. **Figure 3-16**, Arizona Indian Reservations, shows the current locations of Arizona Indian reservations. Prior to the establishment of reservations, Indian tribes inhabited the entire state and many of their traditional territories far exceeded the boundaries of current tribal lands.

Arizona Indian Reservations

Indian Reservations in Arizona.



Source: BLM 2011b

Figure 3-16

The following discussion relates tribal territories and general ethnographic information to the eight cultural regions.

Lower Gila Cultural Region
Tribes who inhabited or used this region include the Cocopah, Quechan, Maricopa (Pee Posh), Tohono O'odham, Yavapai, and related peoples (Ortiz 1983). The former three tribes lived in settlements, some of which may have been seasonal, along the Colorado River and lower Gila River. They relied to a great degree on farming and fishing, but also ventured into the adjacent deserts and mountains for hunting, resource collection and processing, and other activities. Traditional use areas and trails were located both near and away from the rivers.

The Tohono O'odham resided in the desert south of the Gila River and tended to rely to a greater degree on wild plant and animal foods, though they also farmed. Some groups moved seasonally between desert and mountain camps. Hia'ced groups subsisted on hunting and gathering in the very arid western area of the Papagueria south of the Gila River. Western Yavapai groups lived near springs in the Castle Dome and Kofa mountain ranges north of the Gila River (Ortiz 1983).

Heritage resources of tribal concern include TCPs, springs, trails, intaglios and geoglyphs, graves or other features with human remains, petroglyphs and pictographs, and other traces of past activities. Some tribes have elaborate cultural geographies that define interconnections and relationships among important mountains, other geographic features, trails, and various types of archaeological sites. They have expressed concern about potential direct and indirect (visual, auditory, and access) impacts on these places from renewable energy development.

Southern Patayan Cultural Region
Tribes who inhabited or used this region include the Yavapai, Mohave, and Chemehuevi (Ortiz 1983). The Mohave lived along the Colorado River, where they relied on farming and fishing but frequently traveled into the deserts and mountains to hunt and gather wild resources. Mohave oral histories describe extensive travels throughout this area (Stone 1986).

The Yavapai subsisted primarily on wild resources and traveled seasonally to exploit important plant and animal foods. They also farmed where conditions permitted. Groups of the Western Yavapai inhabited camps in the Harquahala and Harcuvar mountain ranges, where springs were available (Ortiz 1983). The Chemehuevi lived primarily west of the Colorado River but ventured east of the river on hunting expeditions (D'Azevedo 1986). Some Chemehuevi also reside in the Colorado River Indian Tribes community near Parker.

Heritage resources of tribal concern are similar to those identified for the Lower Gila Cultural Region.

Northern Patayan Cultural Region

Tribes who inhabited or used this region include the Mohave, Hualapai, Havasupai, Yavapai, and Chemehuevi (Ortiz 1983). The Hualapai were grouped into a series of bands whose territories were centered on certain mountain ranges, canyons, and valleys. They generally relied on wild plant and animal foods and moved seasonally to take advantage of a wide range of food sources, although they also grew crops near water sources. They were closely related to the Havasupai, who inhabited parts of the Grand Canyon and adjacent Colorado Plateau. The Hualapai also maintained social and trade relations with the Mohave along the Colorado River.

Heritage resources of tribal concern are similar to those identified for the Lower Gila Cultural Region. Areas along the Colorado River that contain intaglios, geoglyphs, and trails are particularly sensitive. Another topic of concern is the impact on views from culturally important mountains and topographic features. In prior consultations with government agencies, the Hualapai have identified Red Lake and the surrounding area as one of special concern. This playa zone in the Hualapai Valley was an important area where many bands gathered to collect grass seeds that played a key role in subsistence, such that no single band laid claim to the area (Stone 1987).

Tusayan/Northern Plateau Cultural Region

Tribes who inhabited or used this region include the Southern Paiute, Hualapai, Havasupai, Hopi, and Navajo (Ortiz 1983; D'Azevedo 1986). Southern Paiute tribes inhabited areas north of the Grand Canyon and other parts of the Colorado Plateau in northern Arizona. They generally relied on wild plant and animal foods and moved seasonally to take advantage of a wide range of food sources, although they grew crops near water sources. Traditional Paiute territories are largely outside the proposed REDAs, except for areas that may have been used on a temporary basis for hunting or travel.

The Hualapai and Havasupai established seasonal camps south of the Grand Canyon to exploit pinyon nuts and other upland resources. All of the above mentioned tribes, as well as the Zuni, traveled to sites of traditional religious and cultural importance in and around the Grand Canyon. Long-distance trade routes also passed through this region.

Heritage resources of tribal concern include archaeological sites, trails, springs, petroglyphs and pictographs, the Colorado River, the Grand Canyon, the San Francisco Peaks, and Red Butte.

Little Colorado Cultural Region

Tribes who inhabited or used this region include the Hopi, Pueblo of Zuni, Navajo, and Western Apache (Ortiz 1979, 1983). The Hopi and Zuni, descendants of Ancestral Puebloan peoples, lived in pueblo villages and relied to a great degree on farming, but hunting and gathering provided additional sources of food and raw materials. Hopi territory is centered on the Colorado Plateau

in northeastern Arizona, but Hopi oral history describes a series of ancient migrations through many areas of Arizona. The Pueblo of Zuni is in western New Mexico, but Zuni territory extended into eastern Arizona. Both tribes ascribe cultural importance to a number of prehistoric pueblos and other ancestral sites throughout the Little Colorado region.

The Apache and Navajo speak the Apachean branch of Athapaskan native languages. Groups of the Western Apache lived in the highlands of eastern and central Arizona. They generally relied on wild plant and animal foods and moved seasonally to harvest a wide range of food sources, though they grew crops near water sources (Ortiz 1983). Much of the traditional Apache territory consists of rugged mountainous or forested areas where no REDAs have been proposed. Navajo traditional territory is on the Colorado Plateau. The Navajo originally relied on a diverse base of subsistence, including hunting, gathering, farming, and trading. After contact with the Spanish, sheep and other livestock became an important addition to the Navajo economy and engendered a pastoral way of life with a rich tradition of weaving (Ortiz 1979).

Heritage resources of tribal concern include ancestral pueblo sites such as those in Homolovi State Park, petroglyphs and pictographs, trails, other archaeological sites, Woodruff Butte near Holbrook, and the "Zuni Heaven" lands owned by the Pueblo of Zuni near Petrified Forest National Park.

Safford/San Simon Cultural Region

Tribes who inhabited or used this region include the Western and Chiricahua Apache and the Zuni (Ortiz 1979, 1983). The Hopi and O'odham tribes have ancestral connections to the region by virtue of their cultural ties to the prehistoric Ancestral Puebloan and Hohokam traditions. Archaeological and ethnographic evidence indicates that this was a region of cultural and adaptive diversity with territorial boundaries changing through the centuries. The Apache groups were more mobile, while the Puebloan and O'odham-related peoples were more settled and relied to a greater degree on farming.

Heritage resources of tribal concern include ancestral pueblo sites, petroglyphs and pictographs, other archaeological sites, traditional gathering areas for acorns and other important resources, and geographic landmarks such as Mount Graham near Safford.

Santa Cruz/Tucson Cultural Region

Tribes who inhabited or used this region include the O'odham and the Pascua Yaqui (Ortiz 1983). The O'odham tribes share a common Piman language and are linked to the prehistoric Hohokam and Sobaipuri cultural traditions. Various groups of the O'odham include the Akimel (Pima) and Tohono (Papago), who currently live in four reservations (Salt River Pima-Maricopa Indian Community, Ak-Chin Indian Community, Gila River Indian Community, and Tohono O'odham Nation). Their traditional territories covered large areas of central and southern Arizona. The Pascua Yaqui tribe moved within a large territory of

northern Mexico and southern Arizona and currently occupies a reservation near Tucson; there is another Yaqui community at the village of Guadalupe near Phoenix.

The Akimel groups lived along the Salt, Gila, and Santa Cruz Rivers and relied to a large degree on farming but ventured into the deserts and mountains to hunt and collect natural resources. The Tohono groups resided in the desert and tended to rely to a greater degree on wild plant and animal foods, though they also farmed. Some groups moved seasonally between desert and mountain camps.

Heritage resources of tribal concern include archaeological sites, petroglyphs and pictographs, pools and other water sources, historic sites and missions, and geographic landmarks such as Baboquivari Peak.

Phoenix Basin/Middle Gila Cultural Region
Tribes who inhabited or used this region include the O'odham tribes, Maricopa, and Yavapai (Ortiz 1983). O'odham settlements and farms were located along the middle Gila, Salt, and lower Santa Cruz Rivers. They traveled to the surrounding desert basins and mountains to hunt and collect wild resources to supplement their diet. The Maricopa (Pee Posh) people and related groups spoke a Yuman language and originally lived along the Colorado and lower Gila Rivers, but migrated eastward to settle in areas currently surrounding Gila Bend and Phoenix, where they lived near their allies the Akimel O'odham (Pima) (Spier 1933).

Various groups of the Yavapai also inhabited this region, particularly in the upper elevations west and north of present-day Phoenix. Most Yavapai groups traveled seasonally over an extensive territory to harvest wild plant foods, though they farmed at suitable locations near rivers, streams, and springs.

Heritage resources of tribal concern include archaeological sites, petroglyphs and pictographs, pools and other water sources, and natural features such as certain hills or mountain peaks.

In conclusion, these diverse tribes were connected to each other through long-distance interaction networks maintained through trade and social relationships, and their territories often overlapped. The tribes continue to regard many locations within their traditional territories, including types of archaeological sites, trails, and natural features, as places of traditional cultural importance. Effective tribal consultation is critical to identifying such areas of traditional use or importance potentially affected by renewable energy development (see **Chapter 6**, Consultation and Coordination, for additional information).

3.11.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ is in the Lower Gila cultural region, within or near the traditional territories of the Maricopa, Quechan, Cocopah, Western Yavapai, and Tohono O'odham.

Historically, the Kaveltcadom, a Yuman-speaking group related to the Maricopa, lived along the lower Gila River. Records indicate that several villages were located between Gila Bend and the Mohawk Mountains, the largest of which were near Gila Bend (Spier 1933). Dwellings were often widely dispersed along the river, rather than clustered at specific locations. The native people farmed along the river but also hunted in the nearby desert basins and mountains where they gathered mesquite beans, saguaro cactus fruits, and other wild foods.

Near the area of the proposed SEZ, there were settlements on the south side of the Gila River at Agua Caliente and Palomas, about ten miles west of Agua Caliente. The village near Agua Caliente was called "xakupi'nc" or "hot water" in reference to the nearby hot springs (Spier 1933, p. 24). Remnants and traces of the people's activities and movements, including trails, could be present as archaeological sites in the SEZ.

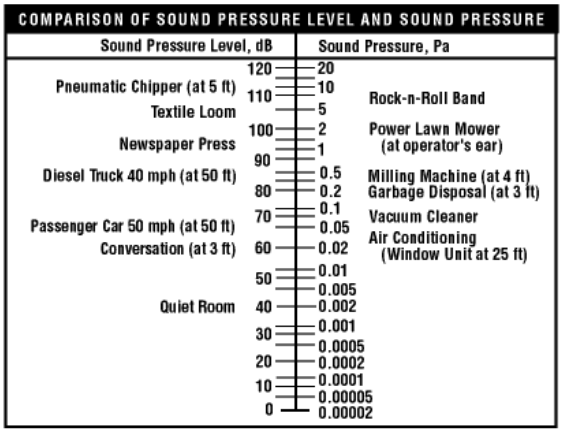
3.12 NOISE

This section describes environmental noise fundamentals, background noise levels, noise propagation, and noise standards and guidelines related to solar and wind development projects.

Fundamentals

Noise is defined as any undesirable sound that interferes with normal activities or in some way reduces the quality of the environment. Response to noise varies according to type, perceived importance, appropriateness in the setting, time of day, and the sensitivity of the individual receptor. Sound is any pressure variation that the ear can detect. Sound pressure levels are measured in units of decibels. Any time a sound level (or sound pressure level) is referred to, a decibel notation is implied.

Figure 3-17 Comparison of Sound Pressure Level and Sound Pressure



[1] dB = decibel

Source: Canada National Occupational Health and Safety Resource 2008

Audible sounds range from 0, considered the quietest sound that can be heard by an average person, called the "threshold of hearing," to about 130, which is considered so loud that it causes pain, and is called the "threshold of pain" (**Figure 3-17**, Comparison of Sound Pressure Level and Sound Pressure). The perceived pitch of a sound, which characterizes the sound as being high or low when heard, is determined by its frequency. Low-pitched or bass sounds have low frequencies, and high-pitched or treble sounds have high

frequencies. A healthy, young person can hear sounds with frequencies ranging from approximately 20 to 20,000 cycles per second (hertz). The sound of human speech is typically in the range of 300 to 3,000 hertz (Canada's National Occupational Health and Safety Resource 2008).

Sound measurement is further refined by using a decibel "A-weighted" sound level (dBA) scale that more closely describes how a person perceives sound. The A-weighted decibel scale estimates the range of human hearing by filtering out lower frequency noises, which are not as damaging as high frequencies. This scale is widely used in noise standards, guidelines, and ordinances, and is widely accepted in analyzing noise and its impacts on humans. **Table 3-8**, A-Weighted Decibel Scale and Example Noise Conditions provides the sound pressure levels associated with some familiar noise sources.

The EPA developed an index (threshold) to assess noise impacts from a variety of sources using residential receptors. Noise levels in a quiet rural area at night are typically between 32 and 35 dBA. Quiet urban nighttime noise levels range from 40 to 59 dBA. Noise levels during the day in a noisy urban area are frequently as high as 70 to 80 dBA. Noise levels above 110 dBA become intolerable and then painful; levels higher than 80 dBA over continuous periods can result in hearing loss. Constant noises tend to be less noticeable than irregular or periodic noises (EPA 1974). Although an A-weighted sound may adequately indicate the level of sound at a given instant, it does not account for the duration of the sound or variations in sound level over time. To assess these variations, two descriptors are often used, L_{dn} and L_{EQ}. The day-night average sound level (L_{DN} or DNL) is the average A-weighted sound level during a 24-hour period with 10 decibels added to nighttime levels (between 10:00 PM and 7:00 AM). This adjustment is added to account for the fact that human sensitivity increases during the nighttime hours when people are involved in more noise-sensitive activities (e.g., sleeping). The equivalent continuous sound pressure level (L_{eq}) is a sound level that, if maintained continuously during a specific time period, would contain the same total energy as sound that varied over that time.

Statistical values of noise levels are also frequently used to describe time-varying characteristics of environmental noise measured in A-weighted decibel scale. The L_{eq} values typically used are L_{10}, L_{50}, and L_{90}, representing noise levels that are exceeded at 10, 50, and 90 percent of the time, respectively. L_{10} represents a sound level considered intrusive, L_{50} is the median noise level, and L_{90} corresponds to background noise.

Noise effects on humans fall into three categories:

- Subjective effects such as annoyance, nuisance, and dissatisfaction;
- Interference with activities such as speech, sleep, and learning; and
- Physiological effects such as anxiety, tinnitus, or hearing loss.

Table 3-8
A-Weighted Decibel Scale and Example Noise Conditions

Characterization	dBA	Example Noise Condition or Event
Threshold of Hearing	0	---
Barely audible	5	---
	10	Audiometric testing booth
Very quiet	15	---
	20	Empty recording studio
	25	---
	30	Quiet rural area, winter night, no wind; whisper, quiet library
Quiet	35	---
	40	Quiet suburban area at night
	45	Typical rural area daytime background conditions
Moderately noisy	50	Typical daytime suburban background conditions
	55	Typical urban residential area away from major streets
	60	Typical daytime urban mixed use area conditions, background music, conversation in restaurant
	65	Typical daytime busy downtown background conditions
Noisy	70	Auto, 35 mph at 20 feet; 300 feet from busy 6-lane freeway
	75	Street sweeper at 30 feet; Idling locomotive, 50 feet
Very Noisy	80	2-axle commercial truck, 35 mph at 20 feet
	85	City bus at 30 feet
8-hour workplace limit	90	Heavy truck, 35 mph at 20 feet; leaf blower at 5 feet
Extremely noisy	95	Locomotive horn at 100 feet, subway train at 200 feet
Possible building damage	100	Outboard motor, jackhammer, snowmobile, motorcycle
	105	Emergency vehicle siren at 50 feet, power lawn mower at 3 feet
	110	Peak crowd noise, pro football game, open stadium
	115	F/A-18 aircraft takeoff with afterburner at 1,600 feet, loud rock concert
	120	Mach 1.1 sonic boom under aircraft at 12,000 feet
Threshold of pain	125	F/A-18 aircraft takeoff with afterburner at 470 feet, pneumatic riveter at 4 feet
	130	Surface detonation, 30 pounds of TNT at 1,000 feet

dB = decibel
Source: Data compiled from various published sources.

Determining if a noise is objectionable depends on the type of noise (tonal, broadband, low frequency, or impulsive), in addition to the circumstance and individual sensitivity of the person who hears it. Typically, the levels associated with environmental noise only produce effects in the first two categories. However, workers subjected to noise in environments such as industrial plants

or airports may experience noise effects similar to those described under the third category. **Table 3-9**, Subjective Response to Changes in Sound Level, illustrates how differences in sound magnitudes are perceived by humans.

Table 3-9
Subjective Response to Changes in Sound Level

Change in Sound Level	Perceived Change in Loudness
±1 decibel	Requires close attention to noise
±3 decibels	Barely perceptible
±5 decibels	Quite noticeable
±10 decibels	Dramatic; sounds nearly twice or half as loud
±20 decibels	Striking; fourfold change in loudness

Source: Berendt, Corliss, and Ojalvo 2000

Noise Propagation

Predicting the noise level at a receptor location depends on a complex combination of source characteristics and site-specific factors (Anderson and Kurze 1992), including the following:

- Source characteristics such as sound power, directivity, and configuration;
- Geometric spreading (geometric divergence) as the sound moves away from the source to the receptor;
- Atmospheric air absorption, which depends strongly on the sound frequency and relative humidity, less strongly on temperature, and slightly on pressure;
- Ground effects due to sound reflected by ground surfaces interfering with the sound propagating directly from the source to the receptor;
- The topography, structures, and other natural or human-made barriers between the source and the receptor; and
- Meteorological factors such as turbulence and variations in vertical wind speed and temperature.

The 'transmission path' or medium for sound or noise is most often the atmosphere (i.e., air). In order for the noise to be transmitted, the transmission path must support the free propagation of the small vibratory motions that make up the sound. Atmospheric conditions (e.g., wind speed and direction, temperature, humidity, precipitation) influence the attenuation of sound. Barriers and discontinuities that attenuate the flow of sound may compromise the path.

At short distances (less than 160 feet), the wind has a minor effect on the sound level. For locations at greater distances from a given source, wind can cause considerable differences in sound levels. Wind speed typically increases with height, and this variation focuses it in the downwind direction and creates a shadow in the upwind direction. Therefore, upwind sound levels will be lower, and downwind levels higher, than if there were no wind.

Changes in temperature with height also play a major role in sound propagation. During the day, air temperature decreases with height. In contrast, on a clear night, the temperature often increases with height (a condition known as a temperature inversion). The speed of sound varies with temperature so that generally sound bends (refract) upward during the day, leading to reduced sound levels on the ground, and bends downward during inversions, leading to higher sound levels on the ground. Such temperature effects are uniform in all directions, differing from those of wind that affect mostly upwind and downwind direction.

Noise Standards and Guidelines

The federal law that directly affects noise control is the Noise Control Act of 1972, as amended by the Quiet Communities Act of 1978 (42 USC 4901-4918). This act delegates to the states the authority to regulate environmental noise. It also directs government agencies to comply with local community noise statutes and regulations, and to conduct their programs to promote an environment free of any noise that could jeopardize public health or welfare.

3.12.1 RDEP Affected Environment

Background noise is the noise from all other sources than the source of interest (e.g., construction activities or wind turbines in operation). The background noise level can vary considerably depending on the location. There is currently no available information defining existing noise levels in the REDA, which would be recorded as background noise levels at any given project site. Natural soundscapes are an accumulation of all natural sounds that occur in the unpopulated places such as wilderness areas. Background noises expected to exist in such areas include agricultural activities, mining operations, traffic, recreation activities (including mechanized and motorized uses), weather, and aircraft overflights.

3.12.2 Agua Caliente Solar Energy Zone Affected Environment

There is no available information defining existing noise levels in the proposed Agua Caliente SEZ. Aside from some trails and a few dirt roads, the proposed SEZ is undeveloped. Palomas Road is approximately 0.6 mile from the southern edge of the proposed SEZ. Background noise within the proposed SEZ is expected to include vehicular movements on roads, possible off-highway vehicle uses, farm equipment from adjacent agricultural operations, weather, and construction activities from the construction of the First Solar Agua Caliente Solar Project.

From a review of aerial photography and field visits to the proposed SEZ areas, no sensitive receptors (e.g., hospitals, schools, or nursing homes) appear to exist within one mile of the proposed SEZ. The nearest obvious residence from the proposed SEZ boundary is about 1.5 miles to the northeast of the northeastern corner of the proposed SEZ. Other buildings that could potentially be residences exist within the privately owned agricultural lands enveloped by the proposed SEZ that are planned for the development of a solar project.

3.13 PALEONTOLOGICAL RESOURCES

Paleontological resources are any fossilized remains, traces, or imprints of organisms preserved in the Earth's crust. Fossils include bones, teeth, shells, leaves, wood, and tracks originally buried in sedimentary deposits. Paleontological resources include not only the actual fossils but the sedimentary deposits containing the fossils. Geological deposits provide context for the fossils, such as their age, habitat, and climate at the time of deposition. Paleontological resources are important to the understanding of Earth's history, as they make it possible to:

- Investigate the mechanisms behind evolution and the interrelationships of life through the history of Earth;
- Study patterns and processes of evolution, extinction, and speciation;
- Determine the nature and effects of previous climate change episodes and how they compare to ongoing climate change;
- Study the geographic distribution of organisms and tectonic movements of land masses and ocean basins through time;
- Reconstruct ancient environments, climate change, and paleoecological relationships;
- Use fossils to biostratigraphically link or differentiate geological units over wide geographic areas; and
- Provide a measure of relative geological dating, which forms the basis for biochronology and biostratigraphy.

Sensitivity levels are determined based on the Potential Fossil Yield Classification (PFYC) system used by the BLM. BLM uses the PFYC system to assess the potential of geological deposits to contain paleontological resources. The PFYC system uses a scale of 1 to 5 to classify geological units based on the known, or expected, relative abundance of vertebrate fossils and/or scientifically significant invertebrate and plant fossils.

Class 1 geological units have very low potential to contain recognizable fossil remains. Units of Precambrian age and most volcanic deposits have low potential.

Class 2 areas have low potential for fossil remains, except in rare circumstances. Examples include some types of sedimentary rocks, as well as deposits less than 10,000 years old.

Class 3 units typically are sedimentary deposits, commonly marine in origin, that have moderate or unknown potential to contain fossils. Such occurrences may be widely scattered within the geological unit.

Class 4 areas have a high potential for significant fossil resources, which have been documented but may vary in occurrence and predictability.

Class 5 units have a very high potential and predictably produce significant fossils that are at risk of human-caused adverse impacts or natural degradation.

Literature research, institutional record searches, and the PFYC provided the information necessary to assign a sensitivity level of high, low, or moderate/undetermined to the planning area. Any future provisions for mitigation of adverse impacts on significant paleontological resources exposed during construction-related activities are based upon these determinations of sensitivity level. The terms high sensitivity level, moderate/undetermined sensitivity level, and low sensitivity level are defined below:

- High Sensitivity Level: Geological units classified as high sensitivity have a high density of recorded fossil localities, have produced fossils in or near the vicinity of a project area, are very likely to yield additional fossils during construction, and contain significant paleontological resources. Areas identified as having a Class 4 or 5 in the PFYC system are considered to have a high sensitivity level.
- Moderate/Undetermined Sensitivity Level: Geological units classified as moderate/undetermined sensitivity level have limited exposure in a project area, are poorly studied, or contain no recorded paleontological resource localities. However, in other areas, the same or similar geological units may contain sufficient paleontological localities to suggest that exposures of the unit in a project area would have at least a moderate potential for yielding fossils. Areas with a Class 3 in the PFYC system are considered to have a moderate or undetermined sensitivity level.
- Low Sensitivity Level: Geological units classified as low sensitivity level contain no, or a very low, density of recorded fossil localities, have produced little or no fossils in the vicinity of a project, and are not likely to yield any fossils. Nevertheless, geological units with few or no prior recorded fossil localities can still prove fossiliferous during paleontological mitigation activities. Areas identified as having a Class 1 or 2 in the PFYC system are considered to have a low sensitivity level.

3.13.1 RDEP Affected Environment

Paleontological resources are present in all three physiographic provinces of Arizona: the Colorado Plateau, the Transition Zone, and the Basin and Range. Each of these provinces contains distinctive paleontological resources that reflect the geological and evolutionary history of Arizona. Potential for any area to contain paleontological resources depends upon the geologic formations found within an area and the paleontological sites found to date within the formation.

The Colorado Plateau Province in northern Arizona contains a number of the most fossiliferous geological units in Arizona. Paleontological resources from the Colorado Plateau Province are dominated by collections from Paleozoic and Mesozoic rocks. Permian fossils from the Hermit Shale and Coconino Sandstone include tracks and traces of reptiles and mammal-like reptiles (Hunt et al. 2005; Hunt and Santucci 1998). Lower to Middle Triassic fossils from the Moenkopi Formation include fossil fish (e.g., *Moenkopia wellesi* and *Taphrognathus bradyi*), amphibians (e.g., *Hadrokkasaurus bradyi*, *Vigilius wellesi*, *Eocyclotosaurus wellesi*, *Stanocephalus birdi*, and *Cosgriffus campi*), and reptiles (e.g., *Anisodontosaurus greeri*, *Ammorhynchus navajoi*, *Arizonasaurus babbitti*, and *Rhadalognathus boweni*) (Heckert et al. 2005; Nesbitt 2005). Triassic fossils from the Chinle Formation include petrified wood (*Araucarioxylon arizonicum*) and a diverse assemblage of reptiles and early dinosaurs that includes *Coelophysis sp.* and *Chindesaurus bryansmalli* (Parker 2005). Upper Triassic and Lower Jurassic fossils from the Glen Canyon Group include fossils of crocodylomorphs, mammal-like reptiles, and early dinosaurs. Trace fossils include tracks of crocodylomorphs and dinosaurs (Lucas et al. 2005a).

Paleontological resources from the Transition Zone Province in central Arizona are dominated by collections from Cenozoic rocks. The Prescott Local Fauna in the Milk Creek Formation contains canid, gomphothere, horse, camel, and pronghorn fossils (Honey and Taylor 1978). Fossils from the Verde Formation include fish, salamander, tortoise, turtle, lizard, snake, bird, bat, rabbit, ringtail, numerous rodents, gomphothere, horse, camel, and pronghorn (Morgan and White 2005; Czaplewski 1987a; Czaplewski 1987b; Lindsay and Tessman 1974).

Paleontological resources from the Basin and Range Province in southern and western Arizona are dominated by collections from Mesozoic and Cenozoic rocks. Cretaceous fossils have been collected from the Amole Arkose, Fort Crittenden Formation, and Bisbee Group. The fossils of the Amole Arkose include the Tucson Mountain Dinosaur (*Tenontosaurus* sp.) (Lucas et al. 2005b). Fossils from the Fort Crittenden Formation include a diverse assemblage of fish, lizards, and dinosaurs (McCord and Gillette 2005). Fossils from the Bisbee Group include fish, turtles, crocodiles, and dinosaurs that include *Sonorasaurus sp.*, *Acrocanthrosaurus sp.*, *Deinonychus sp.*, unnamed titanosaur, unnamed nodosaur, and *Tenontosaurus sp.* (McCord and Gillette 2005). Early Pleistocene fossils of the 111 Ranch Beds include ground sloth, glyptodont, bat, dog, weasel,

ringtail, bear, hyena, cat, rabbit, rodents, horse, tapir, camel, pronghorn, and gomphothere (Morgan and White 2005; Tomida 1987).

In summary, the planning area in the Colorado Plateau Province has the greatest potential for paleontological resources, with 1,047,642 acres containing geological units with a very high to moderate potential for paleontological resources. The portion of the planning area that falls within the Basin and Range Province has the next highest potential for paleontological resources, with 495,405 acres containing geological units with a high to moderate potential for paleontological resources. Most of this area in central and western Arizona does not have a high potential for paleontological resources. Areas with a higher paleontological potential are located in southeastern Arizona. The parts of the planning area that fall within the Transition Zone Province have the least potential for paleontological resources, with only 173,838 acres containing geological units with a high to moderate potential for paleontological resources.

Paleontological resources are affected by a number of factors directly and indirectly related to a project. These factors can include ground disturbance, erosion, and illegal collecting. Arizona is rich in paleontological resources, but as with other states, economic constraints often determine how much research is done. Arizona has a significant amount of federal and state lands managed by the BLM, Forest Service, and State of Arizona. The BLM and Forest Service provide guidelines for managing paleontological resources on federal lands. Paleontological resources are not regulated on private lands. Urban development has created the need for more electrical transmission lines, as well as oil and gas pipelines. These types of projects, along with construction of renewable energy projects, provide a greater opportunity to study the paleontological resources in Arizona. A large number of these projects are located on federal and state lands. Ongoing and future development of renewable energy projects are expected to have continued effects on paleontological resources.

3.13.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ is located within the Palomas Plain, which is bounded by the Palomas Mountains to the west and Baragan Mountain to the north. Both mountains are mapped as Tertiary volcanic rocks (Demsey 1990; Spencer 1995; Richard et al. 2000). The valley-fill deposits of the Palomas Plain include Quaternary surficial deposits and Tertiary alluvial-fan deposits (Richard et al. 2000). The Tertiary volcanic rocks have a very low potential (Potential Fossil Yield Classification of 1) for containing paleontological resources, because volcanic rocks do not preserve fossils. Quaternary surficial deposits have a low potential (Potential Fossil Yield Classification of 2) for containing paleontological resources, because of their young age. The Tertiary alluvial-fan deposits within the proposed SEZ have an unknown potential (Potential Fossil Yield Classification of 3) for containing paleontological resources, because these sediments are of an age and composition that may preserve fossils.

No known fossil localities occur within the proposed SEZ or within one-mile of the analysis area. However, fossil rodent, camel, and other land mammals ranging in age from the Miocene to the Quaternary have been collected to the west of the proposed SEZ along the Gila River near Wellton, Arizona (Sauter et al. 2011). Also, fossilized packrat middens, which scientists have used to reconstruct ancient environments, may occur in caves or other sheltered areas in either Tertiary or Quaternary geological units.

3.14 PUBLIC HEALTH AND SAFETY

This section describes health and safety concerns associated with solar and wind energy development and then describes the likelihood of existing soil and water contamination at the proposed Agua Caliente SEZ.

3.14.1 RDEP Affected Environment

Construction

Hazardous Materials Management. Fuels, oils, lubricants, and solvents are the primary hazardous and flammable materials typically on site during the construction and operation of solar and wind energy facilities; these substances are required for the operation of construction equipment. Small quantities of additional common hazardous materials are typically used on site during construction, including antifreeze and used coolant, latex and oil-based paint, paint thinners and other solvents, cleaning products, and herbicides. Substation construction requires mineral oil-based transformer oil to be transported to the site for use in step-up transformers. Some transformers can use non-toxic biodegradable vegetable oil (which contains no petroleum). Workers can also be exposed to residual pesticides and herbicides that may be present in soils at a project site through inhalation of contaminated dust or, if in direct contact with site soils, absorption through the skin.

Worker Safety. In addition to exposure to hazardous materials, typical worker hazards include electrocution, fires, and accidents (such as slips, trips, or falls). Hunting in the vicinity of project sites could also pose a risk of injury or death to construction workers.

Public Safety. Construction sites can pose a safety hazard for members of the general public if access is not restricted. Members of the public can fall into open pits, trenches, holes, or can be injured while climbing on large structures or equipment. Increased traffic on planning area roadways has the potential to increase the risk for traffic accidents, particularly during rainy periods and wet areas and periods with higher tourist traffic.

Exposure to Contaminated Sites. On-site soils may be contaminated with a variety of chemicals leftover from former land uses, or may have migrated into onsite soils via surface water or groundwater flow from nearby contaminated sites. Workers can be exposed to such contamination during project construction

through inhalation of dust from contaminated soils, or, if in direct contact with site soils, absorption through the skin.

Operation

Hazardous Materials Management. During operations and maintenance, it is typical for small quantities of hazardous materials to be periodically and routinely transported, used, and disposed of. These materials typically consist of minor amounts of petroleum products (fuels and lubricating oils) and a small to moderate amount of motor vehicle fuel. Small quantities of additional common hazardous materials are often used on project sites, including antifreeze and used coolant, latex and oil-based paint, paint thinners and other solvents, cleaning products, and herbicides. Minor hazardous materials releases can occur due to improper handling and storage practices during operation and maintenance activities.

Wildland Fires. Vegetation can be ignited from operation and maintenance activities such as welding sparks, fires from equipment failure, and other activities, including smoking by project personnel or guests. Such fires can pose a health and safety risk to personnel or nearby residences or businesses.

Electromagnetic Fields (EMF). EMFs are associated with electromagnetic radiation. Electric and magnetic fields are common throughout nature and are produced by all living organisms. Concern over EMF exposure, however, generally pertains to human-made sources of electromagnetism and the degree to which they may have adverse biological effects or interfere with other electromagnetic systems. Possible health effects associated with exposure to EMFs have been the subject of scientific investigation since the 1970s. Reviews of the scientific literature have consistently indicated insufficient evidence of an association between EMF exposure and adverse health effects in humans.

Hunting. Hunting in the vicinity of project sites could pose a risk of injury or death to operational personnel, could damage project components, and could trigger the release of hazardous materials into the environment.

3.14.2 Agua Caliente Solar Energy Zone Affected Environment

A search of federal and state records indicate no present or past contamination or presence of underground storage tanks at the site or within a quarter mile of its boundaries. No data on existing groundwater quality are available. The existing agricultural operations within the private lands largely surrounded by the southern portion of the proposed Agua Caliente SEZ may have contributed nitrates as well as other chemicals used as fertilizers, herbicides, and pesticides into groundwater beneath the proposed SEZ.

As described in **Section 3.4**, Cultural Resources, the proposed SEZ contains lands formerly used for at least three military ranges during World War II. These ranges consist of the East Artillery Range and two combat ranges used for .30-caliber small arms training. Topographic maps and aerial imagery reveal

the presence of at least two landing strips within the current planning area. Several buried crates containing grenades and rifles were found during planting operations at the White Wing Ranch following the Army's departure from the area. Local residents claim to have observed a number of exploded and unexploded ordnance in the area, including 20-mm projectiles and cartridges, 2.36-inch bazooka rockets, 81-mm mortars, 25-pound practice bombs, and .50-caliber bullets and cartridges. It is likely that the SEZ contains both exploded and unexploded ordnance.

3.15 RECREATION

3.15.1 RDEP Affected Environment

The diverse planning area offers multiple settings for a wide range of opportunities for recreation, most on public land requiring no permits and no or minimal fees.

Popular recreational activities include driving for pleasure, hiking, mountain biking, camping, hunting, fishing, off-highway vehicle (OHV) riding, horseback riding, rock climbing, skiing, visiting cultural sites, bird watching, viewing wildflowers, backpacking, and seasonal whitewater boating. Flying radio-controlled aircraft, rock crawling, parasailing, and geocaching are also growing in popularity in parts of the planning area.

Visitor use patterns within many parts of the planning area are seasonal. Due to extreme summer heat, some areas receive very little summer use but become popular destinations during winter months. In warmer parts of the planning area the winter season generally runs from late October through late March. Winter visitors are typically retired persons or seniors migrating to the area from relatively colder climates such as the Northwest and Midwest U.S. and Canada. Most winter visitors spend an extended period, usually 2 to 6 months, in these areas. Summer recreation in the hotter desert areas is virtually intolerable due to excessive heat. Winter use in these hot, lower-elevation and upland deserts is popular.

Water-based recreation is an important component of the Arizona recreation landscape. Boating, sport fishing, and water sports (e.g., waterskiing, wakeboarding, etc.) are popular on Arizona's lakes, reservoirs, and rivers.

Snow-based winter recreation, including downhill and cross-country skiing, is popular in higher elevation areas. The Arizona Snowbowl outside of Flagstaff and Sunrise Park Resort near Greer offer lift-assisted downhill skiing. Cross-country skiing and snowshoeing opportunities are available on public and private lands.

The majority of recreational opportunities on public lands are located on federal lands managed by the BLM, Forest Service, BOR, and other agencies.

Arizona's 12.1 million acres of BLM-administered lands offer a wide variety of recreational experiences, ranging from hiking, horseback riding, and mountain biking to motorcycle and OHV riding, boating, and more. Each BLM field office manages its own recreation program and social and environmental conditions, and facilities usually dictate the types of activities that occur in a given area.

Special Recreation Management Areas (SRMAs) were traditionally areas that had higher recreation use or required extra recreation investment or where more intensive recreation management was needed. SRMAs are areas identified in land use plans to direct recreation funding and personnel to fulfill commitments made to provide specific "structured" recreation opportunities (i.e., activity, experience, and benefit opportunities). SRMAs now must identify a distinct, primary recreation-tourism market (destination, community, or undeveloped), as well as a corresponding and distinguishing recreation management strategy. Recreation settings or natural resource settings are prescribed as part of the land-use allocation decision. Subsequent implementing actions, as identified in the activity planning framework, are proactive and address management, marketing and visitor information, and monitoring and administration. See **Figure 3-18**, Special Recreation Management Areas, for locations that have been designated SRMAs on BLM-administered lands.

Arizona's six national forests provide a variety of structured and unstructured recreation opportunities similar to BLM-administered lands.

There are 25 units of the National Park System in Arizona, including three national parks (Grand Canyon, Petrified Forest, and Saguaro National Parks) and two national recreation areas (Glen Canyon and Lake Mead National Recreation Areas). These areas provide a wide variety of automobile touring, developed and dispersed camping, and dispersed quiet recreation opportunities. Off-highway motorized vehicle recreation is generally more restrictive in NPS units (also see **Section 3.18**, Special Designations).

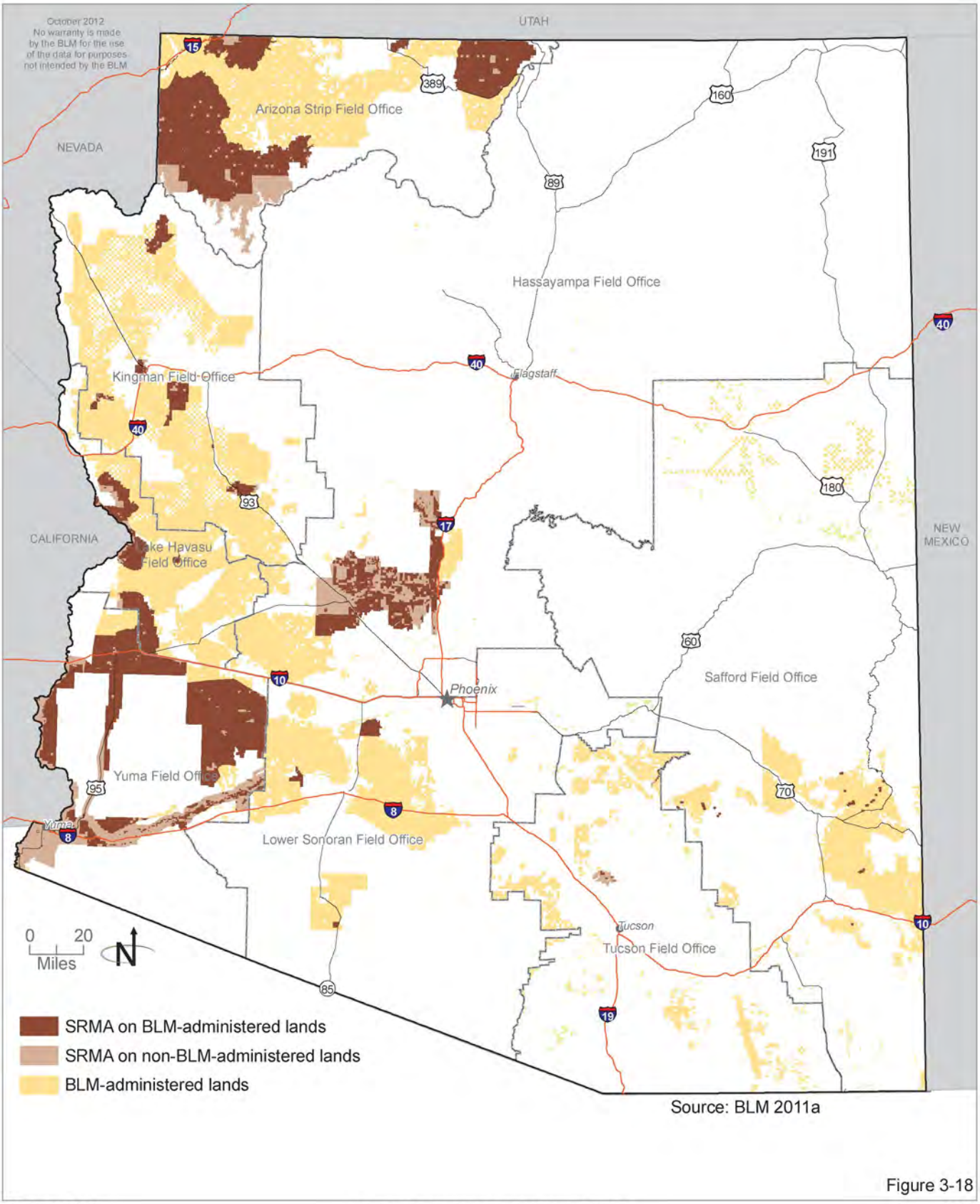
Arizona State Parks manages 29 state parks, natural areas, and state historic parks. Due to budget restrictions two parks are currently closed to the public and four other parks are open on a reduced schedule (Arizona State Parks 2011b). State parks charge an entrance fee for day use, and developed recreation opportunities such as camping also require a fee. Once in a state park, dispersed recreation is generally free of cost.

Some state trust lands are available for a variety of day-use activities. OHV riding, paintball, horseback riding, hiking, and mountain biking are some of the uses allowed on parcels of state trust lands where a right-of-way, permit, or authorization has been granted.

Non-government recreation providers also play an important role in producing recreation and tourism opportunities on public lands. Many local and regional

Special Recreation Management Areas

Special Recreation Management Areas (SRMAs) are administrative units with unique recreation values and where recreation is the prominent management focus.



Source: BLM 2011a

Figure 3-18

businesses provide for a variety of direct recreation opportunities on public and state lands that enable visitors to realize specific recreation experiences via numerous commercial and competitive activities or events.

Stretching more than 800 miles from the Utah border to the Mexico border, the Arizona National Scenic Trail provides an unparalleled nonmotorized recreation experience for mountain bicyclists, hikers, equestrians, and more. Many sections of the trail were constructed by volunteers and the route itself crosses numerous local, state, and federal land parcels.

The Great Western Trail also traverses Arizona in a north-south manner on its way from Mexico to Canada. This route, comprised mainly of existing backcountry roads, is open to motorized and nonmotorized uses.

Rafting, kayaking, boating, fishing, and swimming are popular along the Colorado River as it winds through Arizona. The lower Colorado River attracts families and groups from metropolitan centers in southern California and Phoenix who come for water-based recreation activities from May to September.

Recreation use is expected to continue to grow throughout the planning area. Because of the tremendous population growth in Arizona and the surrounding region, day users will probably represent the fastest growing user group. In addition, the proximity of many recreation opportunities to the metropolitan areas of Phoenix, Las Vegas, and Southern California has dramatically increased recreational visitation within portions of the planning area and is expected to continue to do so.

3.15.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ is located within the Yuma Field Office's 526,900-acre Yuma East Undeveloped SRMA. The SRMA is split into two recreation management zones (RMZs), including the Dispersed Use RMZ in which the proposed SEZ is located. The primary management strategy for the SRMA is to target the demonstrated undeveloped tourism market. The area is a regional hunting destination, and the SRMA's exemplary wildlife habitat supports this activity. More specifically, the Dispersed Use RMZ is managed to continue to provide undeveloped and wildlife-based recreation opportunities through motorized and nonmotorized means. The RMZ's wildlife habitat and wildlife populations continue to provide local communities with access to natural resource-based recreation opportunities, and younger generations are provided with opportunities to develop hunting, camping, and outdoor skills. The RMZ is part of AGFD Game Management Unit 41 and also provides exemplary OHV riding, hiking, and wildlife and wildflower viewing opportunities (BLM 2010g).

Administrative actions for the RMZ include providing sustainable opportunities for hunting, camping, OHV riding, hiking, wildlife and wildflower viewing; promoting environmental education programs; and partnering with agencies and organizations to cooperatively and comprehensively manage the area.

3.16 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

The construction and operation of solar, wind, or other renewable power plants contributes to local, state, and national economies directly through the creation of jobs (particularly during the construction phase), generation of property taxes, and payments of revenues, and indirectly through the addition of employees' incomes into the local economy. The current and projected economic contributions of solar resources in particular have been examined in the state. Estimates of the direct contributions of solar energy in Arizona in 2010 are shown in **Table 3-10**, Solar Energy Direct and Indirect Economic Contributions. The contribution of renewable resources and solar energy in particular to the local and state economy is expected to increase over the next twenty years due to the higher cost of traditional energy sources, renewable portfolio standards requiring an increasing percentage of power from renewable sources, and increasingly competitive pricing for renewable resources. The following section contains an overview of current social and economic conditions in the planning area. Additional details are provided in the Socioeconomic Baseline Assessment Report prepared for this project (BLM 2012c).

Table 3-10
Solar Energy Direct and Indirect Economic Contributions[1]

Temporary Construction Jobs (direct only)	565
Temporary Construction Jobs (direct, indirect, and induced)	1,068
Temporary Construction Wages (direct, indirect, and induced)	$51 million
Permanent O&M Jobs (direct, indirect, and induced)	3
Permanent O&M Annual Wages (direct, indirect, and induced)	$200,000

[1]2010 estimates
O&M – Operations and Maintenance
Source: Frisvold et al. 2009

3.16.1 RDEP Affected Environment

The socioeconomic environment potentially affected by the development of renewable resources on federal land encompasses Arizona, irrespective of land ownership. Where available, socioeconomic information is provided for both Arizona and for the U.S. Measures of economic development and social indicators described in the following sections include employment, unemployment, personal income, population, sales tax revenues, and housing. For each indicator, the most recently available data are presented; forecasts are also presented as available. Data were collected from the U.S. Census Bureau, the U.S. Department of Labor, Bureau of Labor Statistics (BLS), and various state agencies. Information is also provided for current land uses on public lands within Arizona.

State Employment Levels and Projections

There were 2,855,660 jobs in Arizona in 2008. **Table 3-11**, Occupational Levels and Projections in Arizona (2008-2018), provides the 2008 employment

Table 3-11
Occupational Levels and Projections in Arizona (2008-2018)

SOC (Standard Occupation Classification)	Employment		10-Year Change (%)	
	2008 Estimated	2018 Projected	Number	Percent
Total, All Occupations	2,855,660	3,014,136	158,476	5.5%
Management	168,202	168,158	-44	0.0%
Business and Financial Operations	137,844	151,434	13,590	9.9%
Computer and Mathematical	63,180	67,675	4,495	7.1%
Architecture & Engineering	58,560	61,259	2,699	4.6%
Life, Physical, & Social Science	24,160	26,314	2,154	8.9%
Community & Social Services	34,688	38,078	3,390	9.8%
Legal	21,144	22,444	1,300	6.1%
Education, Training & Library	151,321	166,257	14,936	9.9%
Art, Design, Entertainment, Sports, & Media	40,443	42,014	1,571	3.9%
Healthcare Practitioners & Technical	132,114	159,025	26,911	20.4%
Healthcare Support Occupations	70,057	87,345	17,288	24.7%
Protective Service	79,141	84,668	5,527	7.0%
Food Preparation & Serving Related	229,663	256,898	27,235	11.9%
Building & Grounds / Cleaning & Maintenance	118,447	121,365	2,918	2.5%
Personal Care & Service	91,485	100,006	8,521	9.3%
Sales & Related	306,370	322,497	16,127	5.3%
Office & Administrative Support	508,978	537,339	28,361	5.6%
Farming, Fishing, & Forestry	16,984	17,120	136	0.8%
Construction & Extraction	203,889	187,362	-16,527	-8.1%
Installation, Maintenance, & Repair	112,242	114,314	2,072	1.8%
Production	128,628	123,825	-4,803	-3.7%
Transportation & Material Moving	158,120	158,739	619	0.4%

Total average annual openings are the sum of openings from growth plus openings from separations. Separations are vacancies caused by workers leaving the labor market or changing occupations. Thus, an occupation that is not growing or is in decline could still have openings due to separations.
Some occupations are suppressed due to confidentiality or base employment less than 50.
Source: AZ DOC & BLS 2010

levels and 2018 employment projections by Standard Occupation Classification (SOC), which were developed by the BLS. Office and administrative support represented the largest SOC in 2008, with 508,978 total estimated jobs. Other significant SOCs included sales and related occupations, with 306,370 total estimated jobs. SOCs of potential relevance to public lands include construction and extraction, which accounted for 203,889 jobs (10.7 percent), and farming, fishing, and forestry, which accounted for 16,948 jobs (0.6 percent) (AZ DOC [Arizona Department of Commerce] & BLS 2010). The projected increase for all SOCs between 2008 and 2018 is 158,476 jobs, an increase of 5.5 percent (AZ DOC & BLS 2010). Projections for some SOCs, are anticipated to decrease, notably construction and extraction (8.1 percent decrease).

State Unemployment

Between 2001 and 2011, the annual average number of jobs in Arizona ranged from a low of 2,589,800 in 2001 to a high of 3,179,503 in 2011. **Table 3-12,** Unemployment Levels in Arizona (2001-2011), provides total unemployment levels for Arizona between 2001 and 2011. Unemployment in Arizona has increased over the past five years, following national trends observed in the recent economic downturn. Unemployment levels have ranged from a low of 113,667 in 2007 to a high of 316,103 in 2010. It is important to consider that population has increased every year between 2001 and 2011; the overall number of unemployed people must be compared to the overall state population to provide adequate context (BLS 2011a). Arizona's lowest levels of

Table 3-12
Unemployment Levels in Arizona (2001-2011)

Year	AZ Labor Force (Annual Average)	AZ Unemployment (Annual Average)	AZ Unemployment Rate (Annual Average)
2001[1]	2,589,800	122,018	4.7%
2002[1]	2,671,546	160,574	6.0%
2003[1]	2,721,477	156,008	5.7%
2004[1]	2,780,643	138,622	5.0%
2005[1]	2,859,352	133,693	4.7%
2006[1]	2,957,468	121,533	4.1%
2007[1]	3,018,323	113,667	3.8%
2008[1]	3,117,136	183,711	5.9%
2009[1]	3,157,694	305,536	9.7%
2010[1]	3,175,724	316,103	9.9%
2011[2]	3,179,503	300,210	9.4%

Note: Unemployment rates are not seasonally adjusted.
[1]Reflects revised population controls, model re-estimation, and new seasonal adjustment
[2]Preliminary (through June 2011)
Source: BLS 2011a

unemployment between 2001 and 2011 were in 2006 (4.1 percent) and 2007 (3.8 percent). Arizona's highest levels of unemployment were in 2009, 2010, and 2011 (9.7 percent, 9.9 percent, and 9.4 percent, respectively) (BLS 2011a).

Personal Income

Personal income levels in Arizona are provided in **Table 3-13**, Labor and Non-Labor Income in Arizona (2009). Personal income for the state was over $222 billion in 2009, while the U.S. totals $12 trillion. In Arizona, $138 billion (62 percent) came from net income labor earnings, while $85 billion (38 percent) came from non-labor income sources, including dividends, interest, rent, personal transfer receipts, and other sources. These percentages are similar to those seen for the U.S. (Headwaters Economics 2011).

Table 3-13
Labor and Non-Labor Income in Arizona (2009)

Area	Personal Income Total (Thousands of 2010 $)	Labor Income (Net Earnings)		Non-Labor Income[1]	
		Thousands of $	Percent of Personal Income Total	Thousands of $	Percent of Personal Income Total
Arizona	222,618,742	137,616,413	61.8%	85,002,329	38.2%
U.S.	123,677,188,140	7,971,951,464	64.5%	4,395,767,376	35.5%

[1]Non-labor income includes dividends, interest, rent, and personal transfer receipts. Non-labor income and labor earnings may not add to total personal income because of adjustments made by the Bureau of Economic Analysis to account for contributions for social security, cross-county commuting, and other factors.
Source: Headwaters Economics 2011

Population

Arizona's population increased at a faster rate than the population of the U.S. during each decade between 1980 and 2010. **Table 3-14**, Arizona Population Totals (1980-2010), provides population data for Arizona and for the U.S.

Between 1980 and 1990, Arizona's population increased by nearly one million people, or almost 34 percent. Between 1990 and 2000, Arizona's population increased by 1.5 million people, or nearly 40 percent.

Table 3-14
Arizona Population Totals (1980–2010)

Location	1980	1990	1980–1990 Percent Change	2000	1990–2000 Percent Change	2010	2000–2010 Percent Change	1980–2010 Percent Change
Arizona	2,716,546	3,665,228	+34.9%	5,130,632	+40.0%	6,392,017	+24.6%	+135.3%
U.S.	226,548,632	248,709,873	+9.8%	281,424,906	+13.2%	308,745,538	+9.7%	+36.3%

Source: U.S. Census Bureau 1980, 2000a, 2000b, 2000c, 2010

From 2000 to 2010, Arizona's population increased at a smaller rate but still experienced an increase of almost 25 percent (about 1.3 million people). Between 1980 and 2010, the population of the state increased by 135 percent, while the population of the United States increased by 36 percent (U.S. Census Bureau 1980, 2000a, 2000b, 2000c, 2010). Increased population growth creates heightened demand for natural resources, increased use of public lands, and increased energy demand.

Sales Tax Revenue

Sales tax plays an important role by bringing in revenue to local governments. **Table 3-15**, Net Taxable Sales, Fiscal Year (FY) 2005 through FY 2009, examines the primary sources of sales tax in Arizona from FY 2005-06 to FY 2009-10. Compared with other forms of sales tax, retail sales tax provides the most revenue to the state. In FY 2006-07, retail sales tax provided $55 billion, or 48 percent of the overall sales tax for the state. In FY 2009-10, retail sales tax generated $43 billion, which is the lowest monetary value for all fiscal years (FY 2005-06 to FY 2009-10), but the highest percentage of overall sales tax (49 percent) (AZ [Arizona Department of Revenue] DOR 2010).The second most significant source of sales tax is the Contracting classification, which provided a low of 11 percent of the state's sales taxes in FY 2009-10, and high of 19 percent in FY 2006-07 (AZ DOR 2010).

Overall, sales taxes ranged from a high of $115 billion in FY 2006-07 to a low of $87 billion in FY 2009-10 (AZ DOR 2010).

Housing Data

Arizona experienced a housing boom in the past decade. Between 2000 and 2009, there was a 21.4 percent increase in the number of housing units (compared with 10.2 percent for the U.S.) (U.S. Census Bureau 2000a, 2009). Housing prices in the state were dramatically increasing and peaked in 2006. Because of the recent economic downturn, however, prices are now at or below 2000 levels for many metropolitan areas (Zillow 2011).

Median home value, according to 2009 estimates, was $218,400, which was higher than the U.S. average of $185,400. The vacancy rate for Arizona houses in 2009 was 15.4 percent, which was higher than the U.S. average of 11.8 percent. Refer to **Table 3-16**, Arizona Household Characteristics (2000 to 2005-2009 Comparison).

Current Land Uses

Current significant uses of public land in the planning area include recreation, mineral and energy development, and grazing.

Recreation

Recreation on public lands in the planning area consists of a large variety of activities, including off OHV use, biking, and hiking. Additional details for

Table 3-15
Net Taxable Sales, Fiscal Year 2005 through Fiscal Year 2009

Classification	FY 2005-06 (Total Dollar Amount / %Total)	FY 2006-07 (Total Dollar Amount / %Total)	FY 2007-08 (Total Dollar Amount / %Total)	FY 2008-09 (Total Dollar Amount / %Total)	FY 2009-2010 (Total Dollar Amount / %Total)
Mining Severance	$1.22 billion 1.12%	$1.74 billion 1.51%	$1.75 billion 1.56%	$729 million 0.76%	$1.16 billion 1.33%
Utilities	$7.68 billion 7.06%	$8.61 billion 7.47%	$9.24 billion 8.23%	$9.24 billion 9.59%	$9.35 billion 10.70%
Communications	$3.22 billion 2.96%	$3.51 billion 3.05%	$3.67 billion 3.27%	$2.93 billion 3.04%	$3.62 billion 4.14%
Restaurants and Bars	$8.94 billion 8.22%	$9.62 billion 8.34%	$9.66 billion 8.61%	$9.09 billion 9.44%	$9.02 billion 10.32%
Amusements	$999 million 0.92%	$1.09 billion 0.94%	$1.15 billion 1.02%	$1.05 billion 1.09%	$1.05 billion 1.20%
Personal Property Rentals	$3.63 billion 3.34%	$3.93 billion 3.41%	$4.00 billion 3.56%	$3.55 billion 3.69%	$3.13 billion 3.58%
Contracting	$20.5 billion 18.85%	$22.4 billion 19.44%	$20.2 billion 17.95%	$14.9 billion 15.45%	$9.31 billion 10.65%
Retail	$53.1 billion 48.89%	$55.0 billion 47.72%	$52.6 billion 46.86%	$46.2 billion 47.94%	$42.9 billion 49.08%
Hotel/Motel	$2.27 billion 2.09%	$2.41 billion 2.09%	$2.41 billion 2.14%	$2.12 billion 2.20%	$1.95 billion 2.23%
Use Tax	$6.16 billion 5.66%	$6.09 billion 5.28%	$6.84 billion 6.09%	$5.88 billion 6.11%	$5.46 billion 6.25%
Other[1]	~$968 million 0.89%	~$865 million 0.75%	~$797 million 0.71%	~$665 million 0.69%	~$455 million 0.52%
State Total[2]	*$109 billion* *100%*	*$115 billion* *100%*	*$112 billion* *100%*	*$96.3 billion* *100%*	*$87.4 billion* *100%*

[1]Other sources of sales tax that are not listed include Transporting, Mining (Oil & Gas), Private Car and Pipelines, Publishing, Job Printing, Commercial Lease, Rental Occupancy Tax, Use Tax-Utilities, and Membership Camping. These sources of sales tax are below 1% of state total sales taxes for each fiscal year, and their combined monetary values for each fiscal year are approximate, as they are calculated as (% of Total) multiplied by (State Total).
[2]Figures may not add to total due to rounding.
Source: AZ DOR 2010

Table 3-16
Arizona Household Characteristics (2000 to 2005-2009 Comparison)

		State of Arizona	United States
Average Household Size (persons)	2000	2.64	2.59
	2009[1]	2.76	2.60
Total Housing Units	2000	2,189,189	115,904,641
	2009[1]	2,657,551	127,699,712
Housing Units % Change 2000–2009[1]		21.4%	10.2%
Occupied Housing Units	2000	1,901,327	105,480,101
	2009[1]	2,248,170	112,611,029
Vacant Housing Units	2000	287,862	10,424,540
	% Vacant 2000	13.1	9.0%
	2009[1]	409,381	15,088,683
	% Vacant 2009*	15.4%	11.8%
Median Value (Owner-occupied Homes)[2]	2000	$121,300	$119,600
	2009[1]	$218,400	$185,400

[1]Data for 2009 represent 2005–2009 estimates
[2]Number represents median value of single-family owner-occupied homes
Source: U.S. Census Bureau 2000a, 2009

recreation are included in **Section 3.15**, Recreation. Recreation on public lands provides funds directly through recreation permit fees, and indirectly through money spent by visitors in the local communities. Public lands attract visitors from within the state and from around the world. In 2009, Arizona hosted 35.3 million domestic and international overnight visitors, equal to roughly 97,000 visitors per day (Arizona Office of Tourism 2009). In 2009, residents from other states (21.2 million visitors) made up the largest share of overnight visitors (60 percent) to Arizona, while nearly 5 million international visitors represented about 14 percent of Arizona's overnight visitation. Travel is an important contributor to the vitality of both state and local economies. In 2009, total direct travel spending in Arizona was $16.6 billion, which generated 157,200 direct jobs, paying $4.7 billion in earnings (Arizona Office of Tourism 2009). Additional indirect spending is generated from income brought into the local economies due to travel spending.

Mineral and Energy Development

Arizona ranked first in nonfuel mineral production in the U.S. In addition to leading the U.S. in copper, Arizona ranks in the top five in molybdenum, sand and gravel, gemstones, perlite, silver, zeolites, and pumice (Singh 2008). In 2008, total value of mineral resources was approximately $7.58 trillion. Additional details are provided in **Section 3.5**, Energy and Minerals. Renewable energy on public lands in Arizona represents a growing contribution to the state economy.

Grazing

Grazing represents a traditional use of land in the West, with some contribution to the state economy in the present day. Grazing on BLM lands has direct effects in terms of employment and income, as well as induced effects in the local economy such as the activities of other businesses required to support ranching operations and the local effects of spending the additional income derived from grazing on public lands. Approximately 100 direct jobs and a total of 191 direct, indirect, and induced jobs were provided by BLM-managed grazing activities in Arizona in 2010 (DOI 2011). Total economic output for grazing on BLM lands was estimated at 14.3 million dollars in direct contributions and 27.4 million dollars in direct, indirect, and induced funds (DOI 2011).

Environmental Justice

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," formally requires federal agencies to incorporate environmental justice as part of their missions. Specifically, it directs them to address, as appropriate, any disproportionately high and adverse human health or environmental effects of their actions, programs, or policies on minority and low-income populations.

Guidance for evaluating environmental justice populations is included in the BLM planning handbook (BLM 2005c). Environmental justice refers to the fair treatment and meaningful involvement of people of all races, cultures, and incomes with respect to the development, implementation, and enforcement of environmental laws, regulations, programs, and policies. It focuses on environmental hazards and human health to avoid disproportionately high and adverse human health or environmental effects on minority and low-income populations.

The evaluation of impacts on environmental justice populations has three steps: 1) describing the geographic distribution of low-income and minority populations in the affected area; 2) assessing whether the impacts of construction and operation would produce impacts that are high and adverse; and 3) if impacts are high and adverse, determining whether these impacts disproportionately affect minority and low-income populations.

Low-income populations are defined as persons living below the poverty level based on total income of $11,136 for an individual and $22,314 for a family household of four for 2010, based on preliminary data (U.S. Census Bureau 2010). Black/African American, Hispanic, Asian and Pacific Islander, American Indian, Eskimo, Aleut, and other non-White persons are defined as minority populations.

Table 3-17, Population by Race/Ethnicity, shows the ethnic composition of the total population in Arizona based on 2000 census data, 2010 U.S. Census Bureau estimates, and CEQ guidelines. Individuals identifying themselves as

Table 3-17
Population by Race/Ethnicity

Population	Arizona 2000	Arizona 2010	U.S. 2010
Hispanic or Latino ethnicity of any race	25.3%	29.6%	16.3 %
White	77.9%	73.0%	72.4%
Black or African American	3.6%	4.1%	12.6%
American Indian or Alaskan Native	5.7%	4.6%	0.9%
Asian	2.3%	2.8%	4.8%
Native Hawaiian and Other Pacific Islander	0.3%	0.2%	0.2%

Note: The sum of the five race groups adds up to more than the total population because individuals may report more than one race.
Source: U.S. Census Bureau 2000a, 2011

Hispanic or Latino are included in the table as a separate entry. However, because Hispanics can be of any race, this number includes individuals also identifying themselves as being part of one or more of the population groups listed in the table.

Approximately 41 percent of the population in Arizona is classified as minority; the state percentage of minority individuals does not exceed the national average by 20 percentage points or more or 50 percent of the total population, meaning that the state does not have a minority population according to CEQ guidelines. Likewise, the proportion of low-income individuals does not exceed the national average by 20 percentage points and does not exceed 50 percent of the total population, meaning that there is not a low-income population, according to CEQ guidelines (**Table 3-18**, Poverty Level (2000 to 2005-2009 Comparison). Location-specific analysis would be conducted prior to project-specific permitting and development. Additional data for project area minority and low-income populations are included in the Socioeconomic Baseline Assessment Report prepared for this project (BLM 2012c).

Table 3-18
Poverty Level (2000 to 2005-2009 Comparison)

Income		Arizona	US
Families Below Poverty Level	2000[1]	9.9%	9.2 %
	2009	11.6%	11.1 %

Data from 2000 census in 1999 dollars
[1]Data for 2009 represents 2009 estimates
Source: U.S. Census Bureau 2000a, 2010

3.16.2 Agua Caliente Solar Energy Zone Affected Environment

Renewable Energy Socioeconomic Overview

The proposed Agua Caliente SEZ is in Yuma County. Yuma County is home to some of the highest incidences of solar radiation in the U.S., and the county has

already attracted significant interest in the development of solar energy. One example of an existing solar facility and the scale of its economic impacts is First Solar's Agua Caliente solar facility. The development of this facility is providing a substantial source of employment and associated revenue to the state and local economy. This 290-MW photovoltaic facility provided 534 direct jobs in July 2011 during the construction phase of the project. Of these jobs, 435 were Arizona residents, and 260 live in Yuma County (First Solar 2011).

Socioeconomic Conditions

The proposed Agua Caliente SEZ is located in the eastern portion of Yuma County in an area that is sparsely populated with limited economic development opportunities. Yuma County refers to this portion of the county as the Dateland / East County planning area. Dateland is the largest community in the planning area and is located at the interchange of Avenue 64E and Interstate-8. While some impacts of development would be likely to be distributed throughout neighboring counties and the state as a whole, details are provided for Yuma County and for the Dateland area in particular.

Yuma County Employment and Unemployment Levels

The labor force of Yuma County increased every year between 2001 and 2010. Refer to **Table 3-19**, Employment Levels in Yuma County (2001-2010). The total labor force of Yuma County had an increase of 41.3 percent (from almost 65,000 workers to nearly 92,000 workers) between 2001 and 2010. Yuma County experienced its highest level of unemployment in 2010, with over 25 percent of the workforce (23,166 people) unemployed. Between 2001 and 2005, the unemployment rate remained relatively consistent. The lowest year of unemployment occurred in 2007, at 13.8 percent.

Table 3-19
Employment Levels in Yuma County (2001-2010)

			Unemployed	
Year	**Labor Force**	**Employed**	**Level**	**Rate**
2001	64,884	54,163	10,721	16.5
2002	68,906	57,330	11,576	16.8
2003	72,634	60,426	12,208	16.8
2004	73,477	61,995	11,482	15.6
2005	75,478	63,459	12,019	15.9
2006	76,651	65,489	11,162	14,6
2007	78,263	67,453	10,810	13.8
2008	84,146	69,287	14,859	17.7
2009	88,268	68,423	19,845	22.5
2010	91,707	68,541	23,166	25.3
2001-2010 % Increase	41.3%	n/a*	n/a*	n/a*

Estimates use Local Area Unemployment Statistics (LAUS) Methodology. The LAUS program is a Federal-State cooperative effort in which monthly estimates of total employment and unemployment are prepared for approximately 7,300 areas.
Source: BLS 2011b

Yuma County Employment by Industry

Table 3-20, Yuma County Occupational Levels (May 2010), provides data regarding estimated 2010 occupation levels, as classified by the U.S. Department of Labor, Bureau of Labor Statistics, SOC system. In May 2010, there were 55,720 jobs in Yuma County. The office and administrative support sector provided the largest number of jobs (8,110 total estimated jobs, or 14.6 percent of the employed). Other sectors with significant levels include farming, fishing, and forestry (13.3 percent of the employed); sales and related (9.6 percent of the employed); and food preparation and serving related (7.9 percent of the employed) (BLS 2011c, 2011d). It should be noted that the SOC data in **Table 3-20**, Yuma County Occupational Levels (May 2010), excludes military-specific

Table 3-20
Yuma County Occupational Levels (May 2010)

SOC (Standard Occupation Classification)	Employment	
	May 2010 Estimated[1]	Percentage
Total, All Occupations	55,720	100%
Management	2,010	3.6%
Business and Financial Operations	1,750	3.1%
Computer and Mathematical	650	1.2%
Architecture & Engineering	1,280	2.3%
Life, Physical, & Social Science	320	0.6%
Community & Social Services	990	1.8%
Legal	180	0.3%
Education, Training, & Library	3,530	6.3%
Art, Design, Entertainment, Sports, & Media	630	1.3%
Healthcare Practitioners & Technical	2,180	3.9%
Healthcare Support Occupations	1,320	2.4%
Protective Service	2,970	5.3%
Food Preparation & Serving Related	4,380	7.9%
Building & Grounds / Cleaning & Maintenance	1,850	3.3%
Personal Care & Service	1,120	2.0%
Sales & Related	5,350	9.6%
Office & Administrative Support	8,110	14.6%
Farming, Fishing, & Forestry	7,380	13.3%
Construction & Extraction	2,160	3.9%
Installation, Maintenance, & Repair	2,500	4.5%
Production	2,020	3.6%
Transportation & Material Moving	3,060	5.5%

The Occupational Employment Statistics (OES) table above excludes Military-Specific Occupations, as well the majority of the agricultural sector, with the exception of logging (NAICS 113310), support activities for crop production (NAICS 1151), and support activities for animal production (NAICS 1152). Total average annual openings are the sum of openings from growth plus openings from separations. Separations are vacancies caused by workers leaving the labor market or changing occupations. Thus an occupation that is not growing or is in decline could still have openings due to separations. Some occupations suppressed due to confidentiality or base employment less than 50.

[1]Estimates for detailed occupations do not sum to the totals because the totals include occupations not shown separately. Estimates do not include self-employed workers.

Source: BLS 2011c, 2011d

occupations as well as the majority of the agricultural sector, with the exception of logging, support activities for crop production, and support activities for animal production.

The agricultural sector drives the economy in the Dateland/East County planning area; jobs in other industries are largely created to support workers in the agricultural sector, based on 2000 census data.

Military Presence in Yuma County: Employment Levels and Economics

The military is a significant source of employment in Yuma County. For every 1,000 civilian jobs in the county in 2010, there were 66 military jobs. In contrast, for every 1,000 civilian jobs in the state in 2008, there were 9 military jobs (Yuma County 2010).

The U.S. Army Yuma Proving Ground (YPG) serves as a major test range specializing in tank-automotive, munitions and weapons, aircraft armament, air delivery systems, and desert environmental. The YPG employs nearly 3,000 military, civilian, and contract employees, as well as people who come to the proving ground for training. The YPG is a major employer in Yuma County and plays an important role in the economic stability of the area. Annual payroll is about $164 million. In addition, YPG commands about $164 million in private contracts.

The Marine Corps Air Station (MCAS) Yuma has approximately 5,500 marines and sailors on any given day. There are several hundred permanent civilian employees and contract employee at MCAS. The economic impact of MCAS on the local community (2002) was $265.7 million (Yuma County Chamber of Commerce 2009).

Yuma County Income Distribution and Poverty Levels

In 2000, the median household income in Yuma County, at $32,182, was below the median household income for Arizona ($40,558) and for the U.S. ($41,994). **Table 3-21**, Yuma County Income Distribution Comparison (2000 to 2005-2009), conveys data regarding income distribution and poverty levels. In 2000, per capita income in Yuma County ($14,802) fell below the levels for the state ($20,275) and for the U.S. ($21,587). In 2000, 15.5 percent of families and 19.2 percent of all people in Yuma County were below the poverty level. The poverty levels for Yuma County were higher than those for Arizona and for the U.S. by at least 5 percent (U.S. Census Bureau 2000a, 2009, 2011).

In 2009, Yuma County's income distribution and poverty levels were similar to 2000 levels, which reflect an overall trend that indicates Yuma County is poorer than the state and the U.S.

Table 3-21
Yuma County Income Distribution Comparison (2000 to 2005-2009)

Income		Yuma County	Arizona	U.S.
Median Household Income	2000	$32,182	$40,558	$41,994
	2009[1]	$38,854	$50,296	$50,221
Per Capita Income	2000	$14,802	$20,275	$21,587
	2009[1]	$18,244	$25,203	$27,041
Persons Below Poverty Level	2000	19.2%	13.9%	12.4%
	2009[1]	19.9%	14.7%	14.3%
Families Below Poverty Level	2000	15.5%	9.9%	9.2%
	2009[1]	16.8%	10.5%	9.9%

Data from 2000 census in 1999 dollars
[1]Data for 2009 represents 2005–2009 estimates in 2009 inflation adjusted dollars
Source: U.S. Census Bureau 2000a, 2009, 2011

Yuma County had a median household income of $38,854 in 2009, whereas the state had a median household income of $50,296 and the U.S. had a median household income of $50,221. Yuma County's per capita income in 2009 ($18,244) was also below that of the state ($25,203) and the U.S. ($27,041). The number of people below the poverty level in Yuma County increased between 2000 and 2009, for families (by 1.3 percent) and for all people (0.7 percent) (U.S. Census Bureau 2000a, 2011).

Yuma County Population and Projected Population

Yuma County's population grew from 160,026 in 2000 to 195,751 in 2010, a 22.3 percent increase. Arizona's population increased from about 5.1 million to nearly 6.4 million people between 2000 and 2010, a 24.6 percent increase (slightly higher than Yuma County's percent increase). Both Arizona and Yuma County experienced more relative population growth in comparison to the U.S., which increased in population from 281 million in 2000 to nearly 308 million in 2010 (U.S. Census Bureau 2011). For more details, refer to **Table 3-22**, Population Total Comparison (2000-2010). The Dateland / East County planning area is a relatively large area of 861 square miles but only had a population of 1,137 in 2000 (U.S. Census 2000a). Contrary to the county as a whole, this reflects a population drop between 1990 and 2000. More recent data are not available for the area; however, it is likely that this local trend has continued.

Table 3-23, Population Projection Comparison (2015-2050), provides population projections for Yuma County, Arizona, and the U.S. from 2015 to 2050. Yuma County and Arizona are projected to experience population growth at similar rates, with continual population growth at decreasing rates through 2050. Between 2015 and 2050, Yuma County is projected to experience a 53.5 percent population increase (U.S. Census Bureau 2011).

Table 3-22
Population Total Comparison (2000-2010)

Area	2000	2010	2000-2010 Percent Increase
Yuma County	160,026	195,751	22.3%
Arizona	5,130,607	6,392,017	24.6%
United States	281,424,602	308,745,538	9.7%

Source: U.S. Census Bureau 2011

Table 3-23
Population Projection Comparison (2015-2050)

Year	Yuma County		Arizona		U.S.	
	Projected Population	Percent Increase	Projected Population	Percent Increase	Projected Population	Percent Increase
2015	246,260	--	7,915,629	--	325,539,790	--
2020	271,361	+10.2%	8,779,567	+10.9%	341,386,665	4.9%
2025	294,666	+8.6%	9,588,745	+9.2%	357,451,620	4.7%
2030	316,158	+7.3%	10,347,543	+7.9%	373,503,674	4.5%
2035	335,246	+6.0%	11,049,577	+6.8%	389,531,156	4.3%
2040	351,299	+4.8%	11,693,553	+5.8%	405,655,295	4.1%
2045	364,991	+3.9%	12,284,395	+5.1%	422,058,629	4.0%
2050	377,598	+3.4%	12,830,829	+4.4%	439,010,253	4.0%
2015-2050	131,338	+53.3%	4,915,200	+62.1%	113,470,463	34.9%

Source: Arizona State Demographers Office 2006; U.S. Census Bureau 2008

Yuma County Housing Characteristics

Table 3-24, Yuma County Household Characteristic Comparison (2000 to 2005-2009), provides data regarding household size, number of housing units, percent changes in housing units, vacant housing units, and the median value of owner-occupied homes. Between 2000 and 2009, the total number of housing units increased by 17.1 percent in Yuma County, which is a greater rate of increase than the U.S. (10.2 percent) in the same time period, but a lesser increase than Arizona, which experienced a 21.4 percent increase in the total number of housing units (U.S. Census Bureau 2000a, 2009).

The number of occupied housing units increased for Yuma County, Arizona, and the U.S. from 2000 to 2009; in both 2000 and 2009, Yuma County had the highest percentage of vacant housing units. Over 27 percent of housing units in Yuma County were vacant in 2000, whereas just 13.1 percent and 9.0 percent of housing units were classified as vacant in the state of Arizona, and the U.S.,

Table 3-24
Yuma County Household Characteristic Comparison
(2000 to 2005-2009)

		Yuma County	Arizona	U.S.
Average Household Size (persons)	2000	2.86	2.64	2.59
	2009[1]	2.61	2.76	2.60
Total Housing Units	2000	74,140	2,189,189	115,904,641
	2009*	86,878	2,657,551	127,699,712
Housing Units % Change 2000–2009[1]		17.1%	21.4%	10.2%
Occupied Housing Units	2000	53,848	1,901,327	105,480,101
	2009[1]	70,289	2,248,170	112,611,029
Vacant Housing Units	2000	20,292	287,862	10,424,540
	% Vacant 2000	27.4%	13.1%	9.0%
	2009[1]	16,589	409,381	15,088,683
	% Vacant 2009[1]	19.1%	15.4%	11.8%
Median Value (Owner-occupied Homes)	2000	$85,100[2]	$121,300[2]	$119,600
	2009[1]	$132,300	$218,400	$185,400

[1]Data for 2009 represent 2005–2009 estimates
[2]Number represents median value of single-family owner-occupied homes
Source: U.S. Census Bureau 2000a, 2009

respectively, in the same year. In 2009, 16,589 housing units, or 19.1 percent of the housing units in Yuma County, were vacant. In contrast, 15.4 percent of homes in Arizona and 11.8 percent of homes in the U.S. were vacant (U.S. Census Bureau 2000a, 2009).

The median value of owner-occupied homes was lower for Yuma County in 2000 and in 2009 as compared to Arizona and the U.S. In 2000, the median value of an owner-occupied home in Yuma County was $85,100, which is nearly 30 percent less than the median value of an owner-occupied home in Arizona in the same year. In 2009, Yuma County's median value of an owner-occupied home was $132,300, which is 39.4 percent less than the median value of an owner-occupied home for Arizona and 28.6 percent less than the median value of an owner-occupied home for the U.S. (U.S. Census Bureau 2000a, 2009).

Yuma County Educational Trends

Yuma County has high pupil/teacher ratio compared to other counties in Arizona. In the 2000-01 school year, Yuma County averaged 20.70 pupils per each teacher, exceeded only by three other counties in the state (Mohave County had 22.80 pupils per teacher; Navajo County had 21.20 pupils per teacher; and Santa Cruz County had 22.20 pupils per teacher). Yuma County's

pupil-to-teacher ratio was the highest of all 15 counties in Arizona during the 2009-10 school year, with 23.65 pupils per teacher (IES 2011). See **Table 3-25**, Yuma County Data for Pupil/Teacher Ratio (2000-01 to 2009-10).

Table 3-25
Yuma County Data for Pupil/Teacher Ratio (2000-01 to 2009-10)

County	Pupil/Teacher Ratio (School) [2000-01]	Pupil/Teacher Ratio (School) [2005-06]	Pupil/Teacher Ratio (School) [2009-10]
Yuma	20.70	20.80	23.65

Source: IES 2011

Of the approximately 197,000 people living in Yuma County, Arizona, about 68 percent (33,450) are 18 years and older. Of that number, about 29 percent (38,114) lack a high school credential. Of the population 18 and over representing child-bearing and employment ages in Yuma County, 14 percent (18,659) have only an elementary education. Additionally, 12 percent of individuals 18 years and older (15,881) live in "linguistically isolated" households, which means that all members of the household 14 years and older have at least some degree of difficulty with the English language (Arizona Department of Education 2010). Additional strains on the Yuma County educational system could exacerbate strains on the education system within the county.

Yuma County Crime Statistics

Table 3-26, Crime Statistic Comparison (2010), compares crime statistics for Yuma County with crime statistics for Arizona. The 2010 crime rate for Yuma County (2,488 crimes per 100,000 population) was significantly lower than the 2010 crime rate for Arizona (3,910 crimes per 100,000 population). However, violent crimes accounted for a higher percentage of total crimes (13.2 percent violent crimes) than for Arizona (9.5 percent violent crimes).

Table 3-26
Crime Statistic Comparison (2010)

Location	Crime Rate 2010 (Crimes per 100,000 Population)	Violent Crimes as a Total % of the Crime Index[2]
State of AZ	3,910.2[1]	9.5%
Yuma County	2,487.9	13.2%

[1]The 2010 crime rate for Arizona was 3,910.2 crimes per 100,000 population based on an estimated population of 6,401,758.
[2]The remaining percentage of crimes (90.5%) was for property crimes in 2010.
Source: Arizona Department of Public Safety 2010

Environmental Justice

The county and census tracts (small, relatively permanent statistical subdivisions of a county) surrounding the proposed Agua Caliente SEZ were examined for percentage of low-income and minority populations per CEQ guidelines. Both

Yuma County and two census tracts (Census Tract 121 in Yuma County and Census Tract 7233.02 in Maricopa County) have a significant (over 50 percent) minority population predominantly comprised of Hispanic or Latino persons (**Table 3-27**, Population by Race/Ethnicity Comparison). The population therefore meets the CEQ classifications as a minority population that may be impacted by the proposed action.

The proposed Agua Caliente SEZ area poverty level was also examined (**Table 3-28**, Poverty Level Comparison). Based on 2009 data, Yuma County has 16.8 percent of families below the poverty level. Census tracts within a 25-mile radius of the SEZ were examined. Data are not available for census tracts for 2010. However, 5-year estimates for 2006-2010 indicate that 30.7 percent of families in Census Tract 121 were below the poverty level. While higher than the county and national level, this population does not meet CEQ classifications for a low-income population.

Table 3-27
Population by Race/Ethnicity Comparison

Geography	Population					
	Hispanic or Latino ethnicity of any race	White	Black or African American	American Indian or Alaskan Native	Asian	Native Hawaiian and Other Pacific Islander
Census Tract 201 La Paz County	25.4%	84.3%	1.0%	2.6%	0.6%	0.1%
Census Tract 205.01 La Paz County	8.1%	94.4%	1.2%	2.2%	0.4%	0.0%
Census Tract 205.02 La Paz County	6.6%	94.5%	0.7%	3.2%	0.4%	0.0%
Census Tract 7233.02 Maricopa County	60.2%	50.1%	1.5%	20.0%	0.7%	0.0%
Census Tract 506.03 Maricopa County	36.1%	73.4%	2.4%	2.7%	0.7%	0.3%
Census Tract 121 Yuma County	53%	76%	4.0%	3.1%	3.3%	.8%
Census Tract 112.02 Yuma County	47.3%	79.2%	1.0%	1.9%	0.7%	0.2%
Yuma County	59.7%	73.8%	2.6%	2.3%	1.9%	0.30%
Arizona	29.6%	73.0%	4.1%	4.6%	2.8%	.20%

Note: The sum of the five race groups adds to more than the total population because individuals may report more than one race.
Source: US Census Bureau 2010, 2011

Table 3-28
Poverty Level Comparison

Geography	Families Below Poverty Level
Census Tract 201 La Paz County	15.3%
Census Tract 205.01 La Paz County	8.2%
Census Tract 205.02 La Paz County	4.6%
Census Tract 7233.02 Maricopa County	14.2%
Census Tract 506.03 Maricopa County[1]	18.3%
Census Tract 121 Yuma County	30.7%
Census Tract 112.02 Yuma County	7.9%
Census Tract 9800.01 Yuma County	NA
Yuma County	16.8%
Arizona[1]	11.6 %

2006-2010 estimate, exceptions noted
[2]2009, [1]2000 (2006-2010 data not available)
Note that Census Tract 9800.01 in Yuma County has a population of zero.
Source: US Census Bureau 2009

3.17 SOIL RESOURCES

3.17.1 RDEP Affected Environment

Soil Taxonomy

Soil formation results from the complex interactions between geologic material, climate, topography, vegetation, organisms, and time. The classification of soils is based on their degree of development into distinct layers or horizons and their dominant physical and chemical properties. Due to the large size of the planning area, soils are described in terms of their soil order, the highest order of classification used by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS). Further soil classification includes suborder, great group, subgroup, family, and series. These classifications are based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Additional site-specific information would be provided for project-specific locations prior to site development.

Soil orders that are likely to occur in the planning area, as described by NRCS (NRCS 2011a), are presented below in the general declining order of occurrence in the planning area.

Aridisols

Aridisols are light in color and low in organic material. These soils are characterized by an extreme water deficiency. They may have subsurface accumulations of soluble materials, such as calcium carbonate, silica, gypsum, soluble salts, and exchangeable sodium. Vegetation on these soils includes scattered desert shrubs and short bunchgrasses, which are important forage for livestock. Aridisols are generally not very productive without irrigation and may

be prone to salinity buildup. Subsurface accumulations of soluble materials like calcium carbonate, silica, gypsum, soluble salts, and exchangeable sodium result in hardpans that impede water infiltration. Aridisols in the planning area are found throughout the state in arid and semiarid areas, with the largest concentration in the Sonoran Desert in the southwest as well as on the Colorado Plateau in the northeast (NRCS 2011b). BLM-administered lands in the planning area are dominated by Aridisols, particularly in the Kingman, Lake Havasu, Yuma, and Lower Sonoran Field Offices.

Entisols

Entisols, common in lower elevation arid and semiarid environments, are young, weakly developed mineral soils showing little or no horizon development. These soils include recent alluvium, sands, soils on steep slopes, and shallow soils. Entisols are also formed in recently deposited sediments on floodplains, dunes, fans, and deltas along rivers and small streams. These soils support wildlife habitat and pasture or rangeland, and may support trees in areas of relatively high precipitation. All soils that do not fit into one of the other 11 orders are Entisols. Thus, they are characterized by great diversity, both in environmental setting and land use. Entisols are found throughout the planning area. Concentrations of this soil are seen most dominantly in the Colorado Plateau in the northern and northeastern part of the state as well as scattered throughout the Sonoran Desert and the mountains surrounding the Phoenix area (NRCS 2011b). Entisols on BLM-administered lands are on small patches throughout the planning area, and more dominantly, in the Arizona Strip Field Office.

Alfisols

Alfisols occur in semiarid to moist areas and are characterized by subsurface clay accumulations leached from surface layer and nutrient-rich subsoils. Alfisols are formed under forest or mixed vegetation cover in which clays have accumulated. These soils can support cropland and commercial timberland and have relatively high native fertility. Alfisols are generally found in forested or wooded regions of the planning area, including the Kaibab Plateau in the north and in the mountains along the San Francisco Plateau in the north-central portion of the state (NRCS 2011b). Some Alfisols are found on BLM-administered lands in the Hassayampa Field Office, though Alfisols are not a significant presence on other BLM-administered lands in the planning area.

Mollisols

Mollisols are commonly dark-colored, organic-rich, mineral soils. Mollisols are the soils of grassland ecosystems. They are characterized by a thick, dark surface horizon. This fertile surface horizon, known as a mollic epipedon, results from the long-term addition of organic materials derived from plant roots. The soil is base-rich throughout and highly fertile. These soils support cropland and pasture or rangeland. Mollisols in the planning are predominantly in the Gila Mountains and Nantanes Plateau in the southeast as well as on the San Francisco

Plateau west of Williams. Mollisols are also found on some BLM-administered land in the Safford Field Office (NRCS 2011b).

Inceptisols

Inceptisols occur in a wide range of climates, from semiarid to humid and are generally young mineral soils showing only moderate degrees of soil development and weathering (more than Entisols). Inceptisols develop where the native vegetation is grass, and may occasionally support trees. They are often found on fairly steep slopes, young geomorphic surfaces, and on resistant parent materials. Land use varies considerably; a sizable percentage is found in mountainous areas and support forest growth. In the planning area, Inceptisols are found in sub-humid regions, notably in the San Francisco Peaks near Flagstaff, the Juniper Mountains and Bradshaw Mountains surrounding Prescott, the Sierra Ancha and the Mazatzal Mountains east of Phoenix, and the Pinaleno, Santa Catalina, Galiuro, Chiricahua, and Santa Rita Mountains in the south (NRCS 2011b). Some Inceptisols are located on BLM-administered lands in the Tucson Field Office.

Vertisols

Vertisols are clay-rich soils that shrink and swell with changes in moisture content. During dry periods, the soil volume shrinks, and deep, wide cracks form. Soil from upper portions of the soil profile falls into the cracks, causing a churning effect. The soil volume then expands as it absorbs moisture. These shrink/swell and churning actions create serious engineering problems and generally prevent formation of distinct, well-developed horizons in these soils. Areas dominated by Vertisols are associated primarily with volcanic (basalt) rocks in Arizona. They are generally limited to the Antelope Flats near San Carlos in Gila and Graham Counties, as well as areas in the Mohan Mountains in Mohave and Yavapai Counties east of Kingman (NRCS 2011b). Vertisols are not a significant presence on BLM-administered lands in the planning area.

Sensitive Soils

For the purposes of this assessment, sensitive soils include soils with a high potential for supporting biological soil crust, desert pavement, and soils prone to erosion by wind or water. Soil type, the local climate, landscape position, land uses, and vegetation cover all contribute to impacts on sensitive soils.

Biological Soil Crusts

Biological soil crusts, also known as cryptogamic, cryptobiotic, microbiotic, or microphytic soil crusts, are composed of complex communities of cyanobacteria, green algae, bryophytes, lichens, mosses, microfungi, and other bacteria. The filaments produced by these organisms weave through the top few millimeters of soil, forming a matrix that stabilizes and protects soil surfaces from wind and water erosion and retains soil moisture. Biological soil crusts are commonly found in semiarid and arid environments where vascular plant cover is sparse (Belnap et al. 2001). Biological crusts in many regions are best

developed in interspaces between shrubs. Invasive exotic plants generally decrease the biological crust cover in most ecosystems (Belnap et al. 2001). In general, more stable, fine-textured soils (such as silty loams) support greater crustal cover than less stable, coarse-textured soils (Belnap et al. 2001). Biological soil crusts are well adapted to severe growing conditions but are influenced by physical disturbances, fire, and application of herbicides, especially in sandy soils. Disturbance of biological crusts results in decreased soil organism diversity, nutrients, stability, and organic matter. In areas where biological soil crusts are abundant, these changes may increase the rate of soil loss due to surface runoff or wind erosion. Biological soil crusts are found in arid and semi-arid environments. These crusts are common and scattered throughout the planning area in the Sonoran Desert and on the Colorado Plateau (USGS 2011a).

Desert Pavement

Desert pavement consists of a single layer of tightly packed pebbles and small stones, the surface of which is covered with a dark varnish. Extremely fine-grained soils of silt- and clay-sized particles are found beneath the pavement surface. The abundance of coarse particles on desert pavements is thought to be the result of deflation, a process whereby fine sediments are eroded from alluvium by wind or water and/or the upward movement of larger clasts through the alluvial matrix (by cycles of shrinking and swelling and/or freezing and thawing) until they reach the surface (McFadden et al. 1987). Desert pavements form in the most arid parts of the Sonoran Desert, where annual rainfall is less than eight inches on average. Desert pavement is also found in the Mojave Desert. Perennial plants are often absent from these surfaces; instead, the pavements support a sparse seasonal cover of ephemeral species (Turner and Brown 1994). The tightly packed surface of desert pavement inhibits infiltration of precipitation and promotes runoff, which funnels water into the adjacent rills. Desert pavements may play a key role in hydrologic function by funneling surface runoff to nearby wash channels that support trees and other vegetation (Turner and Brown 1994). Desert pavements are less susceptible to disturbance than biological soil crusts, but once they are disturbed, desert pavements lose their armoring function, increasing the likelihood of soil loss due to surface runoff or wind erosion. Desert pavement is found in arid environments. Some of the most extensive and well-developed areas of desert pavements occur on stony alluvial fan deposits flanking the rugged, low mountains in the extremely arid lower Colorado River Valley (Arizona Sonoran Desert Museum 2011).

Erodible Soils

The quantity of soil lost by water or wind erosion is influenced by climate, topography, soil properties, vegetative cover, and land use. Erosion occurs when wind or water forces exceed the ability of stabilizing factors to hold the fine-grained components of soil in place. Factors that function to stabilize soils include vegetation cover, biological soil crust cover, rock cover, high salt or calcium carbonate content, high clay and silt content, physical crusts, and desert

pavement. While erosion occurs under natural conditions, rates of soil loss may be accelerated by human activity. Soil stabilizing factors can be compromised by compaction created by vehicles, livestock, and humans, and the loss of fine soil particles reduces the soil's productivity (Belnap et al. 2001).

Soils vary in their susceptibility to erosion. The soil erodibility factor K is a measure of water erodibility for a standard condition. Fine-textured soils high in clay have low K values, about 0.02 to 0.15, because they are resistant to detachment. Coarse texture soils, such as sandy soils, have low K values, about 0.05 to 0.2, because of low runoff even though these soils are easily detached. Medium-textured soils, such as silt loam soils, have moderate K values, about 0.25 to 0.40, because they are moderately susceptible to detachment and they produce moderate runoff. Soils having a high silt content are the most erodible of all soils. They are easily detached and they tend to crust and produce large amounts and rates of runoff. Values of K for these soils tend to be greater than 0.4. In practical terms, the soil erodibility factor is the average long-term soil and response to the erosive powers of rain and wind; that is, the soil erodibility factor is a lumped parameter that represents an average annual value of the soil reaction to a large number of erosion and hydrologic processes. Although a K factor was selected to represent a soil in its natural condition, past management or misuse of a soil by intensive cropping or other factors can increase a soil's erodibility (NRCS 2011c).

The wind erodibility index is a measure of soil (in tons) eroded by wind from an acre of exposed land over a one-year period based on the amount of fine particles in the soil, and ranges from 0 to 310 tons per acre. A wind erodibility group consists of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The soil texture class most vulnerable to wind erosion is sand (very fine sand, fine sand, sand, or coarse sand), a common constituent of exposed sediments in the alluvial basins found in desert ecosystems in the planning area. Wind erosion is also increased in arid and semiarid regions where lack of soil moisture greatly reduces soil's adhesive capability (USGS 2011b). There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction (NRCS 2011c).

Soil particles (soil fines) eroded by wind (as fugitive dust) are a nonpoint source of air pollution with potentially significant health effects and environmental impacts. Likewise, water-eroded soils can impact water quality and negatively impact aquatic habitats. Due to the slow process of replacing soil, the best mitigation to reduce soil loss by erosion is to follow practices that avoid soil disturbance to the maximum extent possible.

Sensitive soils are a concern in the planning area, and on BLM-administered lands in particular, due to the susceptibility of arid soils to contain one or more sensitive soil features. A large portion of BLM lands in the planning area is located within the Sonoran Desert on arid lands, predominated by the Aridisols soil order. These arid soils have the potential to support biological soil crusts and desert pavement as well as have higher susceptibility to wind erosion than other soil orders.

With increased use of public lands in areas with sensitive or otherwise fragile soils, wind and water-driven erosion is increased. As discussed under sensitive soils, above, compaction of soils by recreation, livestock grazing, or other land use also disrupts protective soil crusts and makes soils susceptible to erosion. As recreation use increases in the planning area due to population growth, the potential for soil crust disturbance and erosion is also likely to increase.

Prime and Unique Farmland

The purpose of the Farmland Protection Policy Act (Public Law 97-98, 7 USC 4201) is to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses, and to assure that federal programs are administered in a manner that, to the extent practicable, will be compatible with state and local government and private programs and policies to protect farmland. The term "farmland" includes all land defined as follows:

- Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion, as determined by the Secretary of Agriculture. Prime farmland includes land that possesses the above characteristics but is being used to produce livestock and timber. It does not include land already in or committed to urban development or water storage;
- Unique farmland is land other than prime farmland that is used for production of specific high-value food and fiber crops, as determined by the Secretary of Agriculture. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality or high yields of specific crops when treated and managed according to acceptable farming methods; and
- Farmland, other than prime or unique farmland, that is of statewide or local importance for the production of food, feed, fiber, forage, or oilseed crops, as determined by the appropriate state or unit of local government agency or agencies, and that the Secretary of Agriculture determines should be considered as farmland for the purposes of the Farmland Protection Policy Act. Cropland of

statewide importance is land, in addition to prime farmlands, that is of statewide importance for the production of food, feed, fiber, forage, and oilseed crops. Criteria for defining and delineating this land are to be determined by the appropriate state agency or agencies. Generally, additional farmlands of statewide importance include those that are nearly prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods.

The majority of farmland within the planning area is prime or unique farmland. Specific locations of prime and unique farmlands, as well as farmlands of statewide importance, would be discussed for specific lease sites, as farmlands soils are generally identified and managed by local soil conservation districts. As of 1997, there were approximately 675,000 acres of prime farmland in the planning area, primarily located along the Gila River (NRCS 2001).

As development in the planning area has continued to increase, prime farmland acres have decreased. Between 1982 and 2002, approximately 200,000 acres of prime agricultural land was converted to developed land. This trend is expected to continue (Farmland Information Center 2010).

3.17.2 Agua Caliente Solar Energy Zone Affected Environment

The soils in the proposed Agua Caliente SEZ consist of a gravely loam found in an alluvial sediment fan. Soils are dominated by Ligurta-Cristobal complex, 2 to 6 percent slopes, Carrizo very gravelly sand, and Harqua-Tremant Complex with pockets of Cherioni-Rock outcrop complex, 25 to 70 percent slope (**Table 3-29**, Soil Series and Soils Properties in the Proposed Agua Caliente SEZ, and **Figure 3-19**, Soil Series in Proposed Agua Caliente SEZ). Portions of the proposed SEZ located on the Cherioni-Rock outcrop complex have a moderate susceptibility to water erosion due to soil type and slope.

Table 3-29
Soil Series and Soil Properties in the Proposed Agua Caliente SEZ

Soil Name	Potential for Water Erodibility (K Factor Rating)	Potential for Wind Erodibility Group/Index (Tons/Acre/Year)	Acres in Proposed SEZ[1]
Carrizo very gravelly sand	.10	Group 7 / Index 38	2,470
Cherioni-Rock outcrop complex, 25 to 70 percent slopes	.32	Group 8 / Index 0	10
Harqua-Tremant complex	.28	Group 4L / Index 86	3,680
Ligurta-Cristobal complex, 2 to 6 percent slopes	.28	Group 8 / Index 0	14,430

Source: NRCS 2011c, [1]NRCS 2011d

Soil Series in Proposed Agua Caliente SEZ

Soils in the proposed Agua Caliente SEZ are dominated by Ligurta-Cristobal complex, 2 to 6 percent slopes, Carrizo very gravelly sand, and Harqua-Tremant Complex, with pockets of Cherioni-Rock outcrop complex, 25 to 70 percent slopes.

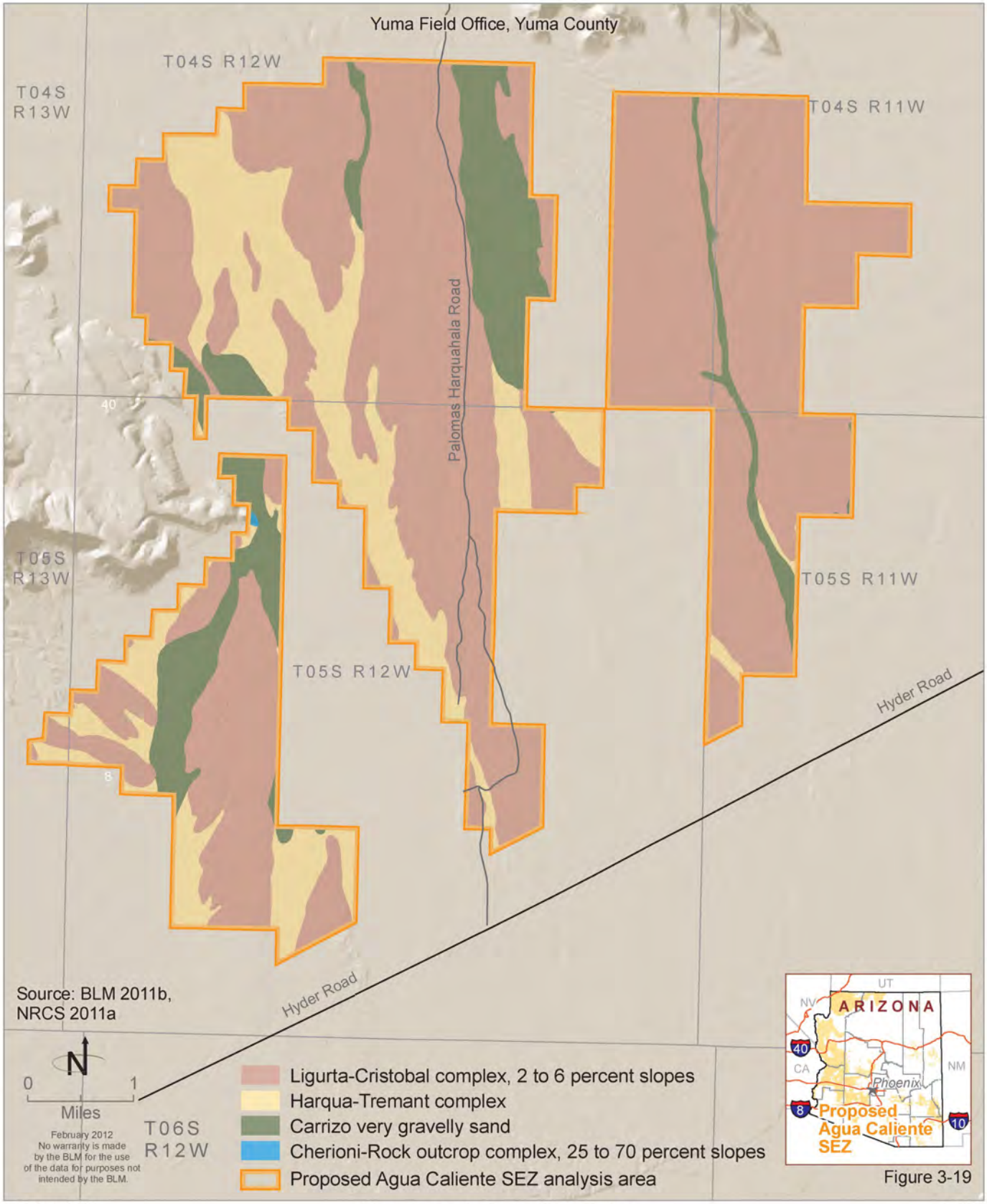


Figure 3-19

Wind erosion susceptibly for the dominant soil types is low to moderate. Soils with potential for wind erosion include Carrizo very gravelly sand (38 tons/acre/year) and Harqua-Tremant complex (86 tons/acre/year). The proposed SEZ is not classified as prime or unique farmland (NRCS 2011c).

3.18 SPECIAL DESIGNATIONS

3.18.1 RDEP Affected Environment

The following section describes special designation areas in the planning area, including ACECs, designated wilderness, wilderness study areas (WSAs), streams eligible or suitable for inclusion in the National Wild and Scenic River System, designated wild and scenic rivers, national conservation areas, national monuments, national parks (also see **Section 3.15**, Recreation), backcountry byways, Forest Service roadless areas, and other Forest Service special designation areas (i.e., research natural areas, protection areas, botanical areas, recreation management areas, and wildlife management areas). These special areas have been identified to protect unique characteristics and contain resources that have been identified as scientifically, educationally, or recreationally important.

Special management areas are administered with the intent to improve the manageability of the areas, allowing the managing agency to preserve, protect, and evaluate these significant components of national heritage. Special area designations on public lands can be established by Congress, presidential proclamation, or administratively. The BLM and Forest Service have the authority to identify special management areas through RMP or Forest Plan amendments or revisions.

Congressional designations include Wilderness, National Conservation Areas, rivers in the National Wild and Scenic Rivers System, National Scenic and Historic Trails (discussed in **Section 3.10**, National Trails), and National Parks. National Monuments are designated by presidential proclamation or, less commonly, by congressional designation. In instances where designations occur by an act of Congress or presidential proclamation, the law or order designating each area provides specific objectives and guidelines for that area's management.

At their discretion, both the BLM and Forest Service may apply administrative designations in areas requiring special management. Administrative designations are not legislative. Special areas that are designated administratively by the BLM include ACECs, streams eligible or suitable for inclusion in the National Wild and Scenic River System, and Backcountry Byways. Special areas designated by the Forest Service include Roadless Areas, Research Natural Areas, protection areas, botanical areas, recreation management areas, and wildlife management areas. In addition, for the purposes of analysis in this document, WSAs are also evaluated under administrative designation; however, only Congress can provide additional direction for these areas. Uses are permitted in the administratively

designated areas to the extent that the uses are in harmony with the purpose for which the area was designated. The type and number of each special designation area are shown on **Figure 3-15**, Special Designations, and listed below in **Table 3-30**, Special Designation Areas in the Planning Area.

Table 3-30
Special Designations in the Planning Area

Special Designation Area	BLM		Forest Service		NPS	
	Number	Acres	Number	Acres	Number	Acres
ACECs[1]	63	986,800	N/A	N/A	N/A	N/A
Wilderness	47	1,391,200	46	2,459,100	0	0
WSAs	2	63,800	N/A	N/A	N/A	N/A
Streams Suitable for Inclusion in the National Wild and Scenic River System	14	268 miles	Unknown	Unknown	Unknown	Unknown
Designated Wild and Scenic Rivers	0	0	2	57.3 miles	0	0
National Conservation Areas	3	121,100	N/A	N/A	N/A	N/A
National Monuments	5	1,775,200	0	0	16	585,800
National Parks	N/A	N/A	N/A	N/A	24	2,587,200
BLM Byways	5	32,300	N/A	N/A	N/A	N/A
Roadless Areas	N/A	N/A	Unknown	3,174,300	N/A	N/A
Other Forest Service Special Designation Areas[2]	N/A	N/A	Unknown	2,392,800	N/A	N/A

[1]Does not include two ACECs managed by BLM Arizona Field Offices but occurring in California.
[2]Other Forest Service Special Designation Areas include Research Natural Areas, protection areas, botanical areas, recreation management areas, and wildlife management areas.
Notes:
N/A denotes type of special designation area is not designated by agency.
Unknown denotes GIS does not specify a number of areas, only a total GIS acreage.
Sources: BLM 2012a, 1997

3.18.2 Agua Caliente Solar Energy Zone Affected Environment

There are no special designation areas within the proposed Agua Caliente SEZ. The Juan Bautista de Anza National Historic Trail is between four and five miles from the proposed Agua Caliente SEZ (see **Section 3.10**, National Trails), and the Sears Point ACEC is 5 and 10 miles from the proposed Agua Caliente SEZ. The nearest wilderness area, Eagletail Mountains Wilderness, is about 15 miles away from the proposed Agua Caliente SEZ.

3.19 SPECIAL STATUS SPECIES

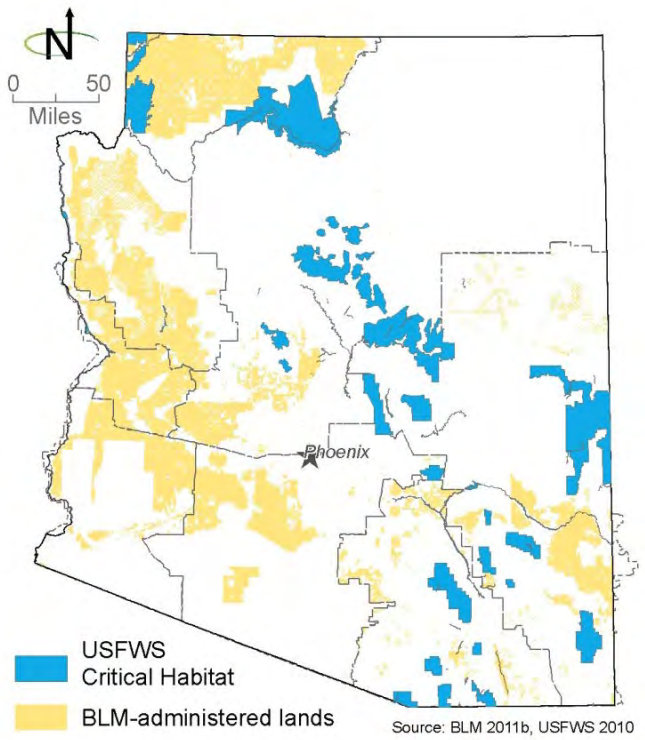
Special status plant and wildlife species are subject to regulations under the authority of federal and state agencies. Descriptions for each category are included below.

3.19.1 RDEP Affected Environment

Federally Listed Species

Federally listed species include those listed by the USFWS as endangered, threatened, proposed, or candidate species under the ESA, Section 4, as amended. Endangered species are those species in danger of extinction throughout all or a significant portion of their range. Threatened species are those species identified by USFWS as likely to become endangered in the foreseeable future. Proposed species are those species recommended for listing under Section 4 of the ESA. Candidate species are those species for which the USFWS has sufficient information on their biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a proposed listing regulation is precluded by other higher priority listing activities. Candidate species are not protected under the ESA.

Figure 3-20 Critical Habitat



Federally listed species with the potential to occur in the planning area are included in **Table 3-31**, Special Status Animal Species with the Potential to Occur in the Planning Area, and **Table 3-32**, Special Status Plant Species with the Potential to Occur in the Planning Area. In the planning area, 55 animal species and 22 plant species are federally listed as threatened or endangered, proposed for listing, or candidates for listing under the ESA.

Critical habitat for federally listed species is defined under the ESA as specific geographic area(s) essential for the conservation of a threatened or endangered species and that may require special management and protection. Critical habitat may include an area that is not currently occupied by the species but that will be needed for its recovery. There are approximately 306,000 acres of designated critical habitat on public lands in the planning area. Critical habitat in the planning area is shown on **Figure 3-20**, Critical Habitat.

Table 3-31
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Birds				
American peregrine falcon	*Falco peregrinus anatum*	BLM S, WSC, G4	Open areas with large trees and/or cliffs for nesting sites	Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai
American redstart	*Setophaga ruticilla*	WSC, G5	Mature and second-growth wooded habitats	Apache, Yavapai
Arizona Botteri's sparrow	*Peucaea botterii arizonae*	BLM S, G4	Healthy grasslands with interspersed shrubs and trees. Prefers tall grasses for nesting sites	Cochise
Arizona grasshopper sparrow	*Ammodramus savannarum ammolegus*	BLM S, G5	Open desert grassland and Sonoran desert scrub between 3,800 and 5,300 feet	Cochise, Pima, Santa Cruz
Baird's sparrow	*Ammodramus bairdii*	WSC, G4	Grasslands	Cochise, Pima, Santa Cruz
Bald eagle	*Haliaeetus leucocephalus*	BLM S, WSC[2], G5,	Large trees or cliffs near water (reservoirs, rivers, and streams) with abundant prey	Apache[3], Cochise[3], Coconino[3], Gila, Graham, Greenlee[3],La Paz, Maricopa, Mohave, Navajo[3],Pinal, Santa Cruz[3], Yavapai, Yuma
Belted kingfisher	*Megaceryle alcyon*	WSC, G5	Nests in burrows near water	Apache, Coconino, Gila, Graham, Maricopa, Pinal Yavapai
Black-bellied whistling duck	*Dendrocygna autumnalis*	WSC, G5	Riparian areas and near ponds and streams	Cochise, Maricopa, Pima, Pinal, Santa Cruz
Black-billed magpie	*Pica hudsonia*	WSC, G5	Forages in open country; nests in bushes or trees	Apache
Black-capped gnatcatcher	*Polioptila nigriceps*	WSC, G5	Riparian woodland and associated brushy areas, especially mesquite	Cochise, Pima, Santa Cruz
Bobolink	*Dolichonyx oryzivorus*	WSC, G5	Tall grass, flooded meadows, prairie, and agricultural areas	Apache, Gila
Cactus ferruginous pygmy-owl	*Glaucidium brasilianum cactorum*	BLM S, WSC, G5	Dense Sonoran scrub washes	Graham, Maricopa, Pima, Pinal, Santa Cruz, Yuma
California black rail	*Laterallus jamaicensis coturniculus*	BLM S, G4	Marshes along the Colorado River	La Paz, Mohave, Yuma
California condor	*Gymnogyps californianus*	E, G1	High desert canyons and plateaus	Apache, Coconino, Mohave, Navajo, Yavapai
California least tern	*Sterna antillarum browni*	E, G4	Open, bare or sparsely vegetated sand, sandbars, gravel pits, or exposed flats along shorelines of inland rivers, lakes, reservoirs, or drainage systems	Maricopa, Mohave, Pima
Clark's grebe	*Aechmophorus clarkia*	WSC, G4	Herbaceous wetlands and riparian areas, nests in tall plants along bodies of water	La Paz, Mohave

Table 3-31 *(continued)*
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Birds (continued)				
Common black-hawk	*Buteo gallus anthracinus*	WSC, G4	Riparian areas	Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai
Crested caracara	*Caracara cheriway*	WSC, G5	Paloverde-Saguaro deserts, frequently found near stock tanks.	Pima
Desert purple martin	*Progne subis hesperia*	BLM S, G5	Saguaro cacti	No data
Elegant trogon	*Trogon elegans*	WSC, G5	Open or scrubby woodland, often in pine-oak forest	Cochise, Graham, Pima, Santa Cruz
Ferruginous hawk (breeding population only)	*Buteo regalis*	BLM S, WSC, G5	Healthy grasslands	Coconino, Mohave, Navajo, Yavapai
Gilded flicker	*Colaptes chrysoides*	BLM S, G5	Saguaro cacti	Maricopa, Pinal, Yavapai
Golden eagle	*Aquila chrysaetos*	BLM S, G5	Significant cliffs, large undeveloped areas	Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma
Gray catbird	*Dumetella carolinensis*	WSC, G5	Thickets, dense brushy and shrubby areas	Apache, Cochise
Great egret	*Ardea alba*	WSC, G5	Lakes, rivers, ponds as well as nearby fields and meadows	La Paz, Maricopa, Pinal, Yuma
Least bittern	*Ixobrychus exilis*	WSC, G5	Freshwater marshes with dense, tall growths of aquatic or semi-aquatic vegetation interspersed with clumps of woody vegetation and open water	La Paz, Maricopa, Pinal, Yuma
Le Conte's thrasher	*Toxostoma lecontei*	BLM S, G4	Remote creosote scrub	La Paz, Maricopa, Mohave, Pinal, Pima, Yuma
Masked bobwhite	*Colinus virginianus ridgewayi*	E, WSC, G5	Desert grasslands with diversity of dense native grasses, forbs, and brush	Pima
Mexican spotted owl	*Strix occidentalis lucida*	T, WSC, G3	Nests in canyons and dense forests with multilayered foliage structure	Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai
Mississippi kite	*Ictinia mississippiensis*	WSC, G5	A variety of wooded and open areas	Cochise, Graham, Maricopa, Pinal,
Northern Aplomado falcon	*Falco femoralis septentrionalis*	E, WSC, G4	Grassland and savannah	Currently extirpated from AZ with unconfirmed sightings occasionally reported in Cochise County
Northern buff-breasted flycatcher	*Empidonax fulvifrons pygmaeus*	WSC, G4	Pine-oak and riparian areas	Cochise, Pima, Santa Cruz
Northern goshawk	*Accipiter gentilis atricapillus*	BLM S, WSC, G5	Mature or old-growth forests, particularly ponderosa pine	Apache, Cochise, Coconino, Gila, Graham, Greenlee, Mohave, Navajo, Pima, Santa Cruz, Yavapai

Table 3-31 *(continued)*
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Birds (continued)				
Northern gray hawk	*Buteo nitidus maxima*	WSC, G5	Riparian woodlands near open areas	Cochise, Gila, Graham, Pima, Pinal, Santa Cruz
Osprey	*Pandion haliaetus*	WSC, G5	Nests in trees near water	Apache, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Pima, Santa Cruz
Pine grosbeak	*Pinicola enucleator*	WSC, G5	Open coniferous forest	Apache, Coconino, Yavapai
Pinyon jay	*Gymnorhinus cyanocephalus*	BLM S, G5	Healthy pinyon pine forests	No data
Rose-throated becard	*Pachyramphus aglaiae*	WSC, G4	Sycamore dominant riparian areas of south-central Arizona	Pima, Santa Cruz
Snowy egret	*Egretta thula*	WSC, G5	Marshes, lakes, ponds, lagoons	Maricopa, Yuma
Southwestern willow flycatcher	*Empidonax traillii extimus*	E, WSC, G5	Cottonwood/willow and tamarisk vegetation communities along rivers and streams	Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma
Sprague's pipit	*Anthus spragueii*	WSC, G4	Grasslands	Cochise, Santa Cruz
Thick-billed kingbird	*Tyrannus crassirostris*	WSC, G5	Arid scrub, riparian woodland, and open habitats	Cochise, Pima, Pinal, Santa Cruz
Tropical kingbird	*Tyrannus melancholicus*	WSC, G5	Lowlands near water; often nests in cottonwoods	Cochise, Pima, Pinal, Santa Cruz
Veery	*Catharus fuscescens*	WSC, G5	Forests with shrubby understory, nests on the ground at the base of shrubs near water	Apache
Violet-crowned hummingbird	*Amazilia violiceps*	WSC, G5	Scrub, open woodland, and riparian areas	Cochise, Graham, Santa Cruz
Western burrowing owl	*Athene cunicularia hypugaea*	BLM S, G4	Grasslands, undeveloped valley bottoms	Apache, Cochise, Coconino, Graham, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma
Western snowy plover	*Charadrius alexandrinus nivosus*	WSC, G4	Shores of salt ponds, alkaline lakes and sandy playas	Maricopa
Yellow-billed cuckoo (Western US DPS)	*Coccyzus americanus*	C, WSC, G5	Large blocks of riparian woodlands (cottonwood, willow, or tamarisk galleries)	Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma
Yuma clapper rail	*Rallus longirostris yumanensis*	E, WSC, G5	Fresh water and brackish marshes	Gila, La Paz, Maricopa, Mohave, Pinal, Yuma
Mammals				
Allen's big-eared bat	*Idionycteris phyllotis*	BLM S, G4	Caves, mines	Apache, Cochise, Coconino, Gila, Graham, Mohave, Navajo, Yavapai
American water shrew	*Sorex palustris*	WSC, G5	Near streams with thick overhanging riparian growth	Apache
Arizona myotis	*Myotis occultus*	BLM S, G4	Caves, mines	Apache, Cochise, Coconino, Gila, Greenlee, Mohave, Navajo, Pima, Yavapai

Table 3-31 *(continued)*
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Mammals (continued)				
Arizona shrew	*Sorex arizonae*	WSC, G3	Conifer forest and oak-pine woodland with thick understory vegetation	Cochise, Santa Cruz
Banner-tailed kangaroo Rat	*Dipodomys spectabilis*	BLM S, G5	Desert grasslands with scattered shrubs, mesquite, or junipers and hard soil to support their deep burrow system	Apache
Black-footed ferret	*Mustela nigripes*	E, WSC, G1	Grassland plains generally found in association with prairie dogs	Apache, Coconino, Navajo, Yavapai
Black-tailed prairie dog	*Cynomys ludovicianus*	BLM S, WSC, G4	Dry, flat, open plains and desert grasslands	Pima
California leaf-nosed bat	*Macrotus californicus*	BLM S, WSC, G4	Caves, mines; lowland desertscrub	Gila, Graham, La Paz, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai, Yuma
Camp Verde cotton Rat	*Sigmodon arizonae arizonae*	WSC, G5	Desert areas, usually found within 10 miles of a river, stream or waterway	Yavapai
Cave myotis	*Myotis velifer*	BLM S, G5	Caves, mines	Cochise, Coconino, Gila, Graham, La Paz, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai
Great western mastiff bat	*Eumops perotis californicus*	BLM S, G5	Caves, mines; rocky canyon country	Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Pima, Pinal, Yuma
Gunnison's Prairie Dog	*Cynomys gunnisoni*	BLM S, G5	High mountain valleys and plateaus at elevations of 6,000 - 12,000 feet; open or slightly brushy country, scattered junipers and pines	Apache, Navajo
Houserock Valley chisel-toothed kangaroo rat	*Dipodomys microps leucotis*	BLM S, G5	Atriplex scrub	Coconino
Hualapai Mexican vole	*Microtus mexicanus hualpaiensis*	E, WSC, G5	Moist, grass/sedge habitats along permanent or semi-permanent waters (springs or seeps)	Coconino, Mohave, Yavapai
Jaguar	*Panthera onca*	E, G3	Found in Sonoran desert scrub up through subalpine conifer forest	Cochise, Pima, Santa Cruz
Lesser long-nosed bat	*Leptonycteris curasoae yerbabuenae*	E, G4	Desert scrub habitat with agave and columnar cacti present as food plants	Cochise, Gila, Graham, Greenlee, Maricopa, Pima, Pinal, Santa Cruz, Yuma
Mexican gray wolf	*Canis lupus baileyi*	E, G4	Chaparral, woodland, and forested areas. May cross desert areas	Apache, Gila, Greenlee, Navajo
Mexican long-tongued bat	*Choeronycteris mexicana*	BLM S, WSC, G4	Caves, mines	Cochise, Coconino, Graham, Pima, Pinal, Santa Cruz
Mount Graham red squirrel	*Tamiasciurus hudsonicus grahamensis*	E, G5	Montane conifer forests from spruce-fir to mixed conifer	Graham

Table 3-31 *(continued)*
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Mammals (continued)				
Navajo Mexican vole	*Microtus mexicanus navaho*	WSC, G4	Shrub thickets and grassy areas	Apache, Coconino, Navajo
New Mexico meadow jumping mouse	*Zapus hudsonius luteus*	C, WSC, G5	Nests in dry soils but also uses moist, streamside, dense riparian/wetland vegetation	Apache, Greenlee
Ocelot	*Leopardus (=Felis) pardalis*	E, G4	Desert scrub in Arizona. Humid tropical and subtropical forests, and savannahs in areas south of the US.	Cochise, Pima, Santa Cruz
Sonoran pronghorn	*Antilocapra Americana sonoriensis*	E, WSC, G5	Broad intermountain alluvial valleys with creosote-bursage and palo verde-mixed cacti associations	Maricopa, Pima, Yuma
Spotted bat	*Euderma maculatum*	BLM S, WSC, G4	Caves, mines; forages in various habitats, from desert to forested areas	Apache, Coconino, Mohave, Yavapai, Yuma
Townsend's big-eared bat	*Corynorhinus (=Plecotus) townsendii*	BLM S, G4	Caves, mines; forages in desert scrub, oak woodland, pinyon-juniper, and conifer forest habitats	Apache, Cochise, Coconino, Gila, Graham, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma
Western red bat	*Lasiurus blossevillii*	WSC, G5	Riparian areas	Cochise, Coconino, Gila, Graham, La Paz, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai
Western yellow bat	*Lasiurus xanthinus*	WSC, G5	Roosts in trees in riparian areas	Cochise, Graham, La Paz, Maricopa, Pima, Pinal, Yuma
Reptiles/Amphibians				
Arizona ridge-nosed rattlesnake	*Crotalus willardi willardi*	WSC, G5	Montane woodlands and canyons, often near streams	Cochise, Santa Cruz
Arizona skink	*Plestiodon "gilberti" arizonensis*	WSC, G5	In and near permanent or semi-permanent streams, in habitats ranging from mesquite riparian drainages up through oak and into pine woodlands	Maricopa, Yavapai
Arizona Striped Whiptail	*Aspidoscelis arizonae*	BLM S, G2	Herbaceous grassland and chaparral shrubland, north end of Wilcox Playa	Cochise, Graham
Arizona treefrog (Huachuca/Canelo DPS)	*Hyla wrightorum*	C, G4	Madrean oak woodlands, savannah, pine-oak woodlands, and mixed conifer forests	Cochise, Santa Cruz
Brown vinesnake	*Oxybelis aeneus*	WSC, G5	Brush covered hillsides, canyons and stream bottoms with sycamore, oak, walnut and wild grape	Pima, Santa Cruz
Chiricahua leopard frog	*Lithobates chiricahuensis*	T, WSC, G3	Pine-oak and oak woodlands and semi-desert grassland with permanent water available	Apache, Cochise, Coconino, Gila, Graham, Greenlee, Navajo, Pima, Santa Cruz, Yavapai

Table 3-31 *(continued)*
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Reptiles/Amphibians (continued)				
Desert massasauga	*Sistrurus catenatus edwardsii*	WSC, G3	Grassy wetland, rocky hillsides, mesquite/scrub plains, thornbrush, oak-grass, dry prairie, and desert grassland	Cochise
Desert ornate box turtle	*Terrapene ornata*	BLM S, G5	Grassland and herbaceous habitats; also shrubland and chaparral	Cochise, Graham, Pinal, Santa Cruz
Desert tortoise, Mojave or Sonoran population	*Gopherus agassizii*[4]	Mojave Population: T, G4	Mojave Population: Mohave desert scrub (north and west of the Colorado River) in basins and bajadas but also found on rocky slopes	Mojave Population: Mohave
		Sonoran Population: C, WSC, G4	Sonoran Population: Upper bajadas and steep slopes in the Sonoran Desert	Sonoran Population: Cochise, Gila, Graham, La Paz, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai, Yuma
Flat-tailed horned lizard	*Phrynosoma mcallii*	WSC, G3	Closely associated with creosote-white bursage series of Sonoran Desert, sandy flats or areas with gentle slopes where galleta grass is common	Yuma
Great Plains narrow-mouthed toad	*Gastrophryne olivacea*	BLM S, G5	From mesquite semi-desert grassland to oak woodland, in the vicinity of streams, springs and rain pools	Maricopa, Pima, Pinal, Santa Cruz
Lowland burrowing treefrog	*Smilisca fodiens*	BLM S, WSC, G4	Xeric environments, where it lives in burrows in low open mesquite grasslands	Maricopa, Pima
Lowland leopard frog	*Lithobates yavapaiensis*	BLM S, WSC, G4	Rocky streams in canyons surrounded by conifer forests	Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai, Yuma
Mohave fringe-toed lizard	*Uma scoparia*	BLM S, WSC, G3G4	Sand habitats	La Paz
Narrow-headed garter snake	*Thamnophis rufipunctatus*	WSC, G3G4	Rocky streams with abundant riparian vegetation	Apache, Coconino, Gila, Graham, Greenlee, Navajo, Yavapai
New Mexico ridge-nosed rattlesnake	*Crotalus willardi obscurus*	T, G5	Primarily canyon bottoms in pine-oak communities	Cochise
Northern leopard frog	*Lithobates pipiens*	BLM S, WSC, G5	Near permanent water with rooted aquatic vegetation	Apache, Coconino, Greenlee, Mohave, Navajo, Yavapai
Northern Mexican gartersnake	*Thamnophis eques megalops*	C, G4	Cienegas, stock tanks, large-river riparian woodlands and forests, streamside gallery forests	Apache, Cochise, Coconino, Gila, Graham, Navajo, Pima, Pinal, Santa Cruz, Yavapai

Table 3-31 *(continued)*
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Reptiles/Amphibians (continued)				
Plains leopard frog	*Lithobates blairi*	BLM S, WSC, G5	In or near water in grassland and oak-pine woodland habitats	Cochise
Relict leopard frog	*Lithobates (Rana) onca*	C, WSC, G1G2	Permanent streams, springs, and spring-fed wetlands with open shorelines and available pools	Mohave
Slevin's bunchgrass lizard	*Sceloporus slevini*	BLM S, G4	Coniferous forest up to 10,000 feet elevation, and rarely desert grassland.	Pima, Santa Cruz
Sonoran Green Toad	*Bufo retiformis*	BLM S, G4	Rain pools, wash bottoms, and areas near water in semi-arid mesquite-grassland, creosotebush desert, and upland saguaro-paloverde desert scrub	Pima, Pinal
Sonoran tiger salamander	*Ambystoma mavortium stebbinsi*	E, WSC, G5 T1	Stock tanks and impounded cienegas; rodent burrows, rotted logs, and other moist cover sites	Cochise, Santa Cruz
Sonoran mud turtle	*Kinosternon sonoriense sonoriense*	BLM S, G4	Riparian habitats	Cochise, Graham, Greenlee, Pima, Pinal
Sonoyta mud turtle	*Kinosternon sonoriense longifemorale*	C, G4	Ponds and streams	Pima
Tarahumara frog	*Lithobates tarahumarae*	WSC, G3	Intermittent rivers and arroyos	Santa Cruz
Tucson shovelnosed snake	*Chionactis occipitalis klauberi*	C, G5	Sonoran desert scrub; associated with soft, sandy soils having sparse gravel	Maricopa, Pima, Pinal
Western barking Frog	*Craugastor augusti cactorum*	WSC, G5	Rocky areas in oak woodland	Cochise, Gila, Pima, Santa Cruz
Western narrow-mouthed toad	*Gastrophryne olivacea*	WSC, G5	Semi-arid and arid lowlands such as mesquite and shrublands	Maricopa, Pima, Pinal, Santa Cruz
Yuman desert fringe-toed lizard	*Uma rufopunctata*	BLM S, WSC, G3	Sand habitats	Pima, Yuma
Aquatic Species				
Apache (Arizona) trout	*Oncorhynchus gilae apache*	T, WSC, G3	Streams and rivers generally above 6,000 ft. elevation with adequate streamflow and shading; temperatures below 77 degrees F; and substrate composed of boulders, rocks, gravel and some sand and silt	Apache, Coconino, Gila, Graham, Greenlee, Navajo
Beautiful shiner	*Cyprinella formosa*	T, G3	Small to medium sized streams and ponds with sand, gravel, and rock bottoms	Cochise
Bluehead sucker	*Catostomus discobolus*	BLM S, G4	Large rivers and mountain streams	Apache, Coconino

Table 3-31 *(continued)*
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Aquatic Species (continued)				
Bonytail chub	*Gila elegans*	E, G1	Warm, swift, turbid mainstem rivers of the Colorado River basin, reservoirs in lower basin	La Paz, Mohave
Colorado pikeminnow	*Ptychocheilus lucius*	E, WSC, G1	Warm, swift, turbid mainstem rivers. Prefers eddies and pools	Gila, Maricopa, Yavapai
Desert pupfish	*Cyprinodon macularius*	E, G1	Shallow springs, small streams, and marshes. Tolerates saline and warm water	Cochise, Graham, La Paz, Maricopa, Pima, Pinal, Santa Cruz, Yavapai
Desert sucker	*Catostomus clarki*	BLM S, G3G4	Small to moderately large streams with pools and riffles	Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai
Flannelmouth sucker	*Catostomus latipinnis*	BLM S, G3G4	Moderate to large rivers with pools and riffles	Coconino, Mojave
Gila chub	*Gila intermedia*	E, WSC, G2	Pools, springs, cienegas, and streams	Cochise, Gila, Graham, Greenlee, Pima, Pinal, Santa Cruz, Yavapai
Gila topminnow	*Poeciliopsis occidentalis occidentalis*	E, WSC, G3	Small streams, springs, and cienegas vegetated shallows	Cochise, Gila, Graham, La Paz, Maricopa, Pima, Santa Cruz, Yavapai
Gila trout	*Oncorhynchus gilae gilae*	T, G3	Small high mountain streams	Greenlee
Headwater chub	*Gila nigra*	C, G2	Medium-sized streams in large, deep pools often associated with cover such as undercut banks or deep places created by trees or rocks	Gila, Graham, Yavapai
Humpback chub	*Gila cypha*	E, WSC, G2	Large, warm turbid rivers especially canyon areas with deep fast water	Coconino, Mohave
Little Colorado spinedace	*Lepidomeda vittata*	T, WSC, G1G2	Moderate to small streams; found in pools and riffles with water flowing over fine gravel and silt substrate	Apache, Coconino, Navajo
Little Colorado sucker	*Catostomus sp.*	BLM S, WSC, G1G2	Rocky pools and riffles of creeks and small to medium-sized rivers	Apache, Coconino, Navajo
Loach minnow	*Tiaroga cobitis*	E, WSC, G1G2	Benthic species of small to large perennial streams with swift shallow water over cobble and gravel. Recurrent flooding and natural hydrograph important	Apache, Cochise, Gila, Graham, Greenlee, Navajo, Pinal
Longfin dace	*Agosia chrysogaster*	BLM S, G4	Shallow sandy and rocky runs in small to medium-sized rivers	Cochise, Gila, Graham, Greenlee, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai

Table 3-31 *(continued)*
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Aquatic Species (continued)				
Mexican stoneroller	*Campostoma ornatum*	WSC, G3G4	Shallow riffles, runs, and pools in small to medium creeks	Cochise
Quitobaquito pupfish	*Cyprinodon eremus*	WSC, G1	Small ponds and streams	Pima
Razorback sucker	*Xyrauchen texanus*	E, WSC, G1	Riverine and lacustrine areas, generally not in fast moving water and may use backwaters	Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Pinal, Yavapai, Yuma
Roundtail chub	*Gila robusta*	C, WSC, G1	Cool to warm waters of rivers and streams, often occupy the deepest pools and eddies of large streams	Apache, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pinal, Yavapai
Sonora chub	*Gila ditaenia*	T, WSC, G2	Perennial and intermittent, small to moderate sized streams with boulders and cliffs	Santa Cruz
Sonora sucker	*Catostomus insignis*	BLM S, G3G4	Gravelly or rocky pools of creeks and rivers	Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Pinal, Santa Cruz, Yavapai
Speckled dace	*Rhinichthys osculus*	BLM S, G5	Creeks, rivers, springs and streams	Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Navajo, Pinal, Santa Cruz, Yavapai
Spikedace	*Meda fulgida*	E, WSC, G2	Medium to large perennial streams with moderate to swift velocity waters over cobble and gravel substrate. Recurrent flooding and natural hydrograph important to withstand invading exotic species	Cochise, Gila, Graham, Greenlee, Pinal, Yavapai
Virgin River chub	*Gila seminuda*	E, WSC, G1	Deep swift waters but not turbulent, occurs over sand and gravel substrates in water less than 86 degrees F. Tolerant of high salinity and turbidity	Mohave
Virgin spinedace	*Lepidomeda mollispinis mollispinis*	BLM S, G1G2	Creeks and small rivers with cool water and pools, runs, and riffles	Mohave
Woundfin	*Plagopterus argentissimus*	E, WSC, G1	Inhabits shallow, warm, turbid, fast-flowing water. Tolerates high salinity	Maricopa, Mohave
Yaqui catfish	*Ictalurus pricei*	T, G2	Moderate to large streams with slow current over sand and rock bottoms	Cochise
Yaqui chub	*Gila purpurea*	E, G1	Deep pools of small streams near undercut banks and debris; pools associated with springheads, and artificial ponds	Cochise

Table 3-31 *(continued)*
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Aquatic Species (continued)				
Yaqui topminnow	*Poeciliopsis occidentalis sonoriensis*	E, G3	Small to moderate sized streams, springs, and cienegas. Generally found in shallow areas with aquatic vegetation or debris. Tolerates relatively high water temperature and low dissolved oxygen	Cochise
Zuni bluehead sucker	*Catostomus discorbolus yarrowi*	C, G4	Small streams in low velocity, moderate deep pools, and pool-runs with seasonal dense algae Young prefer quieter shallow areas near shoreline	Apache
Invertebrates				
Arizona cave amphipod	*Stygobromus arizonensis*	BLM S, G1	Aquatic habitats in subterranean caves and mine tunnels	Cochise, Santa Cruz
Bylas springsnail	*Pyrgulopsis arizonae*	BLM S, G2	Three springs on the north bank of the Gila River, most common on firm substratum in the springbrooks, on dead wood, gravel, and pebbles	Graham
Desert springsnail	*Pyrgulopsis deserta*	BLM S, G2	Small springs along Lower Virgin River	Mohave
Gila tryonia	*Tryonia gilae*	BLM S, G1	Dead wood, leaves, or stones in springs	No data
Huachuca springsnail	*Pyrgulopsis thompsoni*	C, G2	Aquatic areas, small springs with vegetation and slow to moderate flow	Cochise, Santa Cruz
Hydrobiid spring snails	All species in genus *Pyrgulopsis*	BLM S, G1	Springs	No data
Kanab ambersnail	*Oxyloma haydeni kanabensis*	E, G3	Travertine seeps and springs in Grand Canyon National Park	Coconino
Kingman springsnail	*Pyrgulopsis conica*	BLM, S, G1	Burns, Dripping, and Cool Springs in the Black Mountains near Kingman,	Mohave
Page springsnail	*Pyrgulopsis morrisoni*	C, G1	Permanently saturated cienegas, firm substrate like cobble, gravel, woody debris, and aquatic vegetation	Yavapai
San Bernardino springsnail	*Pyrgulopsis bernardina*	C, G1	Springs with firm substrate composed of cobble, gravel, woody debris, and aquatic vegetation	Cochise
Stephan's riffle beetle	*Heterelmis stephani*	C, G1	Free-flowing springs and seeps, commonly referred to as rheocrenes	Santa Cruz
Succineid snails	All species in family *Succineidae*	BLM S, G2	Springs	No data

Table 3-31 *(continued)*
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Invertebrates (continued)				
Three Forks springsnail	*Pyrgulopsis trivialis*	C, G1	Rheocrene springs, seeps, marshes, spring pools, outflows and diverse lotic waters commonly referred to as cienegas	Apache

[1]Status
E- Federally Endangered
T- Federally Threatened
P – Proposed Threatened
C- Candidate for federal listing
BLM S- BLM AZ sensitive species
WSC - Wildlife of Special Concern in Arizona
G1- Critically imperiled
G2- Imperiled
G3- Vunerable
G4- Apparently Secure
G5- Secure
[2] Wintering and Sonoran Desert populations
[3] Location of wintering population
[4] The Sonoran Desert population of desert tortoise is now recognized as *Gopherus morafkai*.
Sources: NatureServe 2011; AGFD 2011b

Table 3-32
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Acuna cactus	*Echinomastus erectocentrus var. acunensis*	C, HS, G3T1T2Q	Well drained knolls and gravel ridges in Sonoran desert scrub	Maricopa, Pima, Pinal
Ajo rock daisy	*Perityle ajoensis*	SR, G1	Bare rock crevices between 2,600-4,800 feet elevation	Pima
Aquarius milkvetch	*Astragalus newberryi* var. *aquarii*	BLM S, G5T1	Narrow range; on limestone deposits in the Burro Creek area	Mohave, Yavapai
American frog orchid	*Coeloglossum viride* var. *virescens*	SR, G5T5	Found in Hannagan Meadow in mixed aspen and fir forest among ferns between 9,000-10,000 feet elevation	Greenlee
Aravaipa sage	*Salvia amissa*	BLM S, G2	Narrow range; on floodplain terraces in shady canyons	Cochise, Gila, Graham, Pinal
Aravaipa woodfern	*Thelypteris puberula* var. *sonorensis*	BLM S, G5T3	Few scattered springs	Coconino, Graham, Mohave, Pima, Pinal, Yavapai
Arizona agave	*Agave arizonica*	HS, G1Q	Open, rocky slopes and mesas in Sonoran desert scrub, chaparral, or juniper grassland between 3,600-5,800 feet elevation	Gila, Maricopa, Yavapai

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Arizona bugbane	*Cimicifuga arizonica*	HS, G2	The ecotone between coniferous forest and riparian habitat between 4,700-8,800 feet elevation	Coconino, Gila
Arizona cliff rose	*Purshia subintegra*	E, HS, GNA	White limestone soils derived from tertiary lakebed deposits	Graham, Maricopa, Mohave, Yavapai
Arizona crested coralroot	*Hexalectris spicata* var. *arizonica*	SR, G5T2T4	In oak and conifer woodlands between 3,500-7,000 feet elevation	Cochise, Santa Cruz
Arizona hedgehog cactus	*Echinocereus triglochidiatus* var. *arizonicus*	E, HS, G5T2	Ecotone between interior chaparral and madrean evergreen woodland	Gila, Pinal
Arizona Sonoran rosewood	*Vauquelinia californica* ssp. *sonorensis*	BLM S, G4T1	Relict species in shady canyons	Maricopa, Pima
Arizona willow	*Salix arizonica*	HS, G2G3	Wet areas within subalpine coniferous forest between 7,500-11,700 feet elevation	Apache
Atwood wild-buckwheat	*Eriogonum thompsoniae* var. *atwoodii*	SR, G4T1	Great Basin desert scrub, usually along small drainages between 4,400-4,700 feet elevation	Mohave
Bartram stonecrop	*Graptopetalum bartramii*	BLM S, SR	Narrow range; rocky outcrops in canyons in Madrean Woodland	Cochise, Pima, Santa Cruz
Bigelow onion	*Allium bigelovii*	SR, G3	Grassland, open chaparral, and desert scrub communities between 2,000-5,000 feet elevation	Coconino, Graham, Greenlee, Maricopa, Mohave, Yavapai
Blue diamond cholla	*Opuntia whipplei* var. *multigeniculata*	SR, G4	Flats, valleys, plains, and gentle slopes in grasslands	Mohave
Blue sand lily	*Triteleiopsis palmeri*	BLM S, SR, G3	Sand dunes and sandy soils	Pima, Yuma
Blumer's dock	*Rumex orthoneurus*	HS, G3	Near perennial springs between 6,500-9,000 feet elevation	Apache, Cochise, Coconino, Gila, Graham, Greenlee
Boreal bog orchid	*Platanthera hyperborea*	SR, G5	Wet habitats, almost always associated with skunk cabbage and marsh marigold	Apache, Graham, Greenlee
Brady pincushion cactus	*Pediocactus bradyi*	E, HS, G1	Areas with sparse vegetation characterized by scattered low shrubs and grasses between3,400 - 5,200 feet elevation	Coconino
Broadleaf twayblade	*Listera convallarioides*	SR, G5	In pine and fir forests between 7,000 - 8,600 feet elevation	Coconino, Pima
Button cactus	*Epithelantha micromeris*	SR, G4	Desert scrub and grasslands	Cochise
Cactus apple	*Opuntia engelmannii* var. *flavispina*	SR, G5	Flats, washes, and hillsides in the desert	Maricopa, Pima
California fan palm	*Washingtonia filifera*	SR, G4	Moist areas in desert communities	Yavapai, Yuma
California flannelbush	*Fremontodendron californicum*	BLM S, G4	Relict populations in shady canyons	Gila, Maricopa, Mohave, Pinal, Yavapai
Canelo Hills ladies' tresses	*Spiranthes delitescens*	E, G1	Finely grained, highly organic, saturated soils of cienegas	Cochise, Santa Cruz
Carpet foxtail cactus	*Coryphantha sneedii*	SR, G2	Chihuahuan desert scrub	Cochise

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Catalina beardtongue	*Penstemon discolor*	HS, G2	Openings in pine forests, pine-oak woodlands, and oak woodlands between 4,400-7,200 feet elevation	Cochise, Graham, Pima, Pinal, Santa Cruz
Cerbat beardtongue	*Penstemon bicolor* ssp. *roseus*	SR, G3	Gravel washes and disturbed roadsides to outwash fans and plains between 1,970-5,480 feet elevation	Mohave
Chihuahua breadroot	*Pediomelum pentaphyllum*	BLM S, G1	Open areas in grasslands with burrograss and mesquite	Cochise, Graham
Chiricahua fleabane	*Erigeron kuschei*	SR, G1	Shady, mossy areas around 9,500 feet elevation	Cochise
Chiricahua rock flower	*Apacheria chiricahuensis*	SR, G2	Montane conifer forest and pinyon-juniper woodland	Cochise
Cliff milkvetch	*Astragalus cremnophylax* var. *myriorrhaphis*	SR, G1	On rim-rock benches, cliff ledges and flat-topped pinnacles at the canyon Edge between 6,200-7,900 feet elevation	Coconino
Clifton rock daisy	*Perityle ambrosiifolia*	BLM S, SR, G1	Narrow range; on cliff faces of the Gila Conglomerate	Greenlee
Clustered barrel cactus	*Echinocactus polycephalus* var. *polycephalus*	SR, G3G4	Rocky and gravelly areas in the Sonoran and Mohave deserts between 230-2,787 feet elevation	Coconino, Mohave, Yuma
Cochise pincushion cactus	*Coryphantha robbinsorum*	T, HS, G1	Chihuahuan desert scrub and semidesert grassland between 4,200-4,650 feet elevation	Cochise
Coppermine milkvetch	*Astragalus cobrensis* var. *maguirei*	SR, G4T2	Pinyon-juniper woodland up to 7,000 feet elevation	Cochise
Counter clockwise fishhook cactus	*Mammillaria mainiae*	SR, G3	Sonoran Desert, grasslands, bajadas, valleys, washes, and alluvial fans between 2,000-4,000 feet elevation	Pima
Crested coralroot	*Hexalectris spicata*	SR, G5	In oak and conifer woodlands between 3,500-7,000 feet elevation	Cochise, Pima, Santa Cruz, Yavapai
Dahlia rooted cereus	*Peniocereus striatus*	SR, G4	Flats and small hills in the Sonoran Desert between 0-2,500 feet elevation	Pima
Dalhouse spleenwort	*Asplenium (=Ceterach) dalhousiae*	BLM S, GNR	Cliff face seeps in the Mule Mountains	Cochise, Pima
Desert barrel cactus	*Ferocactus cylindraceus*	SR, G5	Gravelly or rocky areas in the Mohave and Sonoran Deserts between 200-2,900 feet elevation	Coconino, Gila, Maricopa, Pima, Pinal, Yavapai, Yuma
Desert night-blooming cereus	*Peniocereus greggii* var. *transmontanus*	SR, G3G4T3T4	Desert flats and washes between 1,000-4,900 feet elevation	Pima
Diamond Butte milkvetch	*Astragalus toanus* var. *scidulus*	BLM S, G4G5T1T3	Narrow range; in the Moenkopi Formation badlands with red soils	Mohave

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Emory's barrel cactus	*Ferocactus emoryi*	SR, G4	Rocky hills and sandy or rocky flats in desert habitats mostly between 1,400-3,000 feet elevation	Maricopa, Pima
Fallen ladies'-tresses	*Schiedeella arizonica*	SR, GNR	Dry coniferous forest, hillsides, creek canyons between 4,900-13,000 feet elevation	Cochise, Graham, Greenlee, Pima, Santa Cruz
Fickeisen Plains cactus	*Pediocactus peeblesianus var. fickeiseniae*	C, HS, G1G2T1T2	Shallow soils derived from exposed layers of Kaibab limestone. Found on canyon margins, well-drained hills in Navajo Desert, or Great Plains grassland	Coconino, Mohave
Fish Creek fleabane	*Erigeron piscaticus*	BLM S, SR, G1	Narrow range; floodplain terraces in shady canyons	Graham, Maricopa
Flagstaff false pennyroyal	*Hedeoma diffusa*	SR, G3	Rock pavement, cliff, limestone and sandstone break habitats in ponderosa pine between 4,500-7,140 feet elevation	Coconino, Yavapai
Flannel bush	*Fremontodendron californicum*	SR, G4	On dry slopes in canyons between 3,500-6,500 feet elevation	Gila, Maricopa, Mohave, Pinal, Yavapai
Gentry indigo bush	*Dalea tentaculoides*	BLM S, HS, G1	Narrow range; floodplain terraces in shady canyons	Pima, Santa Cruz
Giant sedge	*Carex spissa* var. *ultra*	BLM S, G3	Springs	Cochise, Graham
Gierisch mallow	*Sphaeralcea gierischii*	C, G1	Found only on gypsum outcrops associated with Harrisburg member of Kaibab Formation	Mohave
Gila groundsel	*Senecio quaerens*	SR, G3	Riparian areas in spruce-fir and ponderosa pine forests between 7,500 – 9,200 feet elevation	Apache, Greenlee
Gladiator milkvetch	*Astragalus xiphoides*	SR, G3	High sandstone mesas and clay bluffs at 4,900-6,000 feet elevation	Apache, Coconino, Navajo
Goodding onion	*Allium gooddingii*	HS, G4	Moist, shaded canyon bottoms in conifer forest and mountain meadows around 8,000 feet elevation	Apache, Greenlee, Pima
Grand Canyon beavertail cactus	*Opuntia basilaris* var. *longiareolata*	SR, G5T2	Rocky soils at bases of talus slopes in the desert at 1,950 feet elevation	Coconino, Mohave
Grand Canyon cottontop cactus	*Echinocactus polycephalus* var. *xeranthemoides*	SR, G3G4T1T3	Rocky hills, slopes, and ledges of canyons in Great Basin and Mohave Desert scrub between 1,803-6,479 feet elevation	Coconino, Mohave
Grand Canyon century plant	*Agave phillipsiana*	HS, G1	Sandy to gravelly places with desert scrub between 2,300-3,600 feet elevation	Coconino

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Grand Canyon flaveria	*Flaveria mcdougallii*	SR, G2	Hanging gardens or terrace ledges in perennial alkaline or saline seeps between 1,750-4,000 feet elevation	Coconino, Mohave
Grand Canyon primrose	*Primula specuicola*	SR, G4	Moist sites from hanging gardens or alcoves from 1,250-7,600 feet elevation	Coconino
Grand Canyon rose	*Rosa stellata* var. *abyssa*	BLM S, SR, G4T2	Narrow range; limestone cliff rims	Coconino, Mohave
Green death camas	*Zigadenus virescens*	SR, G4	Montane coniferous forest between 3,300-10,500 feet elevation	Apache, Cochise, Coconino, Greenlee
Hedgehog cactus	*Echinocereus pseudopectinatus*	SR, G4	Semidesert grasslands between 4,000-4,600 feet elevation	Cochise
Holmgren (Paradox) milk vetch	*Astragalus holmgreniorum*	E, HS, G1	Just under limestone ridges and along draws in gravelly clay hills	Mohave
Hohokam agave	*Agave murpheyi*	HS, G2	Sonoran desert scrub between 1,300-3,200 feet elevation	Gila, Maricopa, Pinal, Yavapai
House Rock fishhook cactus	*Sclerocactus sileri*	SR, G1	Found in the House Rock Valley and Paria Plateau in pinyon-juniper mesa tops between 4,200-7,000 feet elevation	Coconino
Huachuca golden aster	*Heterotheca rutteri*	BLM S, G2	Narrow range; Plains Grassland, LCNCA	Cochise, Pima, Santa Cruz
Huachuca groundsel	*Senecio multidentatus* var. *huachucanus*	HS, G2G4	Steep, rocky high elevation mountain slopes and in canyon bottoms within pine-oak or mixed-conifer dominated forests between 7,000 - 9,500 feet elevation	Cochise, Santa Cruz
Huachuca milkvetch	*Astragalus hypoxylus*	BLM S, SR, G1	Narrow range; open, rocky clearings in woodland at approximately 5,500 feet elevation	Cochise, Santa Cruz
Huachuca water umbel	*Lilaeopsis schaffneriana* ssp. *recurva*	E, HS, G4	Marshy wetlands between 2,000-7,100 feet elevation	Cochise, Pima, Pinal, Santa Cruz
Intermediate fishhook cactus	*Sclerocactus parviflorus* ssp. *intermedius*	SR, G4T3?	In desert grasslands or saltbush, sagebrush, rabbitbrush, and blackbrush communities, pinyon-juniper woodlands between 3,300-6,900 feet elevation	Coconino, Mohave
Jones' cycladenia	*Cycladenia humilis* var. *jonesii*	T, HS, G3G4T2	Mixed desert scrub, juniper, or wild buckwheat-mormon tea	Mohave
Kaibab pincushion (plains) cactus	*Pediocactus paradinei*	BLM S, HS, G2	Narrow range; open pinyon-juniper woodlands and sagebrush valleys	Coconino
Kearney sumac	*Rhus kearneyi* ssp. *kearneyi*	BLM S, SR, G4	Relict species in shady canyons	Yuma

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Kearney's blue star	*Amsonia kearneyana*	E, WSC, G1	West-facing drainages in the Baboquivari Mountains	Pima
Kelvin cholla	*Cylindropuntia x kelvinensis*	SR, GNA	Sonoran desert scrub, edges of grasslands, rocky flats and slopes, and rolling hills between 1,650-3,300 feet elevation	Pima
Kingman's prickly-pear	*Opuntia superbospina*	SR, GHQ	Relatively flat areas of the Mojave desert floor between 2,500-4,400 feet elevation	Mohave
Kofa Mountain barberry	*Berberis harrisoniana*	BLM S, G1G2	Relict species in shady canyons	Maricopa, Pima, Yuma
Las Vegas bearpoppy	*Arctomecon californica*	SR, G3	Mohave desert scrub between 1,200-4,000 feet elevation	Mohave
Leafy lobelia	*Lobelia fenestralis*	SR, G4	Moist meadows, swales, and grasslands between 3,500-6,000 feet elevation	Cochise, Santa Cruz
Lemmon fleabane	*Erigeron lemmonii*	C, G1	Grows in dense clumps in crevices, ledges, and boulders in canyon bottoms in pine-oak woodland	Cochise
Lemmon lily	*Lilium parryi*	SR, G3	Montane conifer forest between 5,500-7,800 feet elevation	Cochise, Pima, Santa Cruz
Lesser rattlesnake plantain	*Goodyera repens*	SR, G5	Coniferous forest	Apache, Greenlee
Limestone Arizona rosewood	*Vauquelinia californica ssp. pauciflora*	SR, G4T3	Dry limestone ridges and hills and rhyolite	Cochise
Littleleaf false tamarind	*Lysiloma watsonii*	SR, G4?	Rocky hillsides and slopes of creeks and tributaries in the Rincon Mountains	Pima
Madrean adders mouth	*Malaxis corymbosa*	SR, G4	Shaded mountain canyons around 6,500 feet elevation	Cochise, Santa Cruz
Madrean ladies tresses	*Spiranthes delitescens*	HS, G1	Marshy wetland or cienega intermixed with tall grasses and sedges between 4,585-4,970 feet elevation	Cochise, Santa Cruz
Magenta-flower Hedgehog-cactus	*Echinocereus fasciculatus*	SR, G4G5T4T5	Canyons in desert scrub, semidesert grasslands, and chaparral between 1,800-5,600 feet elevation	Greenlee, Pima
Maguire's penstemon	*Penstemon linarioides* ssp. *maguirei*	SR, G5T1	Found in the Gila River Valley in conifer woodlands between 6,000-6,500 feet elevation	Greenlee
Marble Canyon indigo bush	*Psorothamnus arborescens* var. *pubescens*	BLM S, G5T2	Narrow range; red soils of Moenkopi Formation Marble Canyon	Coconino, Mohave
Marble Canyon milkvetch	*Astragalus cremnophylax* var. *hevronii*	BLM S, G1T1	Narrow range; limestone cliff rims in Marble Canyon	Coconino
Mazatzal triteleia	*Triteleia lemmoniae*	SR, G3	Pine woodlands between 3,200-7,700 feet elevation	Coconino, Gila, Yavapai

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Mckelvey's agave	*Agave mckelveyana*	SR, G4	Desert scrub, chaparral, and pinyon-juniper woodlands between 2,600-7,200 feet elevation	Yavapai
Mexican lobelia	*Lobelia laxiflora*	SR, G4	Woodland habitats	Santa Cruz
Michoacan ladies tresses	*Stenorrhynchos michuacanum*	SR, G4	Open grassy slopes, sand pine-oak woodlands between 6,200-7,200 feet elevation	Cochise, Santa Cruz
Missouri corycactus	*Coryphantha missouriensis*	SR, G5T4	Desert edge, grasslands, lower mountains	Coconino, Mohave
Mogollon columbine	*Aquilegia desertorum*	SR, G4	Grows on ledges and bluffs in ponderosa pine	Coconino
Mogollon thistle	*Cirsium parryi* ssp. *mogollonicum*	SR, G4T1	The shaded riparian understory of perennial streams around 7,200 feet elevation	Coconino,
Morton wild-buckwheat	*Eriogonum mortonianum*	SR, G1	Great Basin desert scrub, usually along small drainages around 4,650 feet elevation	Mohave
Mount Tumbull beardtongue	*Penstemon distans*	BLM S, SR, G2	Narrow range; moist, cool microhabitats on canyon slopes	Mohave
Murphey agave	*Agave murpheyi*	BLM S, G2	Low numbers; in the desert foothills of central Arizona	Gila, Maricopa, Pinal, Yavapai
Navajo bridge cactus	*Opuntia nicholii*	SR, G4Q	Gravelly soils of flats and low ridges in the desert	Coconino, Mohave
Navajo sedge	*Carex specuicola*	T, HS, G2	Found within pinyon-juniper woodland between 4,600-7,200 feet elevation	Apache, Coconino, Navajo
Needle-spined pineapple cactus	*Echinomastus erectocentrus* var. *erectocentrus*	SR, G4T2	Desert grasslands between 2,900-4,900 feet elevation	Cochise, Pima, Pinal
Nichol Turk's head cactus	*Echinocactus Horizonthalonius* var. *nicholii*	E, HS, G4T2	Sonoran desert scrub	Pima, Pinal
Night-blooming cereus	*Peniocereus greggii* var. *greggii*	SR, G3G4T2	Gravelly flats and washes in desert shrublands or shrub-invaded grasslands	Cochise
Nutrioso milkvetch	*Astragalus nutriosensis*	SR, G3?	Mesa tops at approximately 7,500 feet elevation in open grassland or pinyon-juniper	Apache
Organ pipe cactus	*Stenocereus thurberi*	SR, G5	Sonoran desert scrub between 1,400-3,000 feet elevation	Maricopa, Pima, Pinal
Our lords candle	*Yucca whipplei*	SR, G4G5	Dry, stony slopes, chaparral and mountains between 1,000-4,000 feet elevation	Coconino, Mohave
Paper-spined cactus	*Pediocactus papyracanthus*	SR, G4	Open flats in grasslands and pinyon-juniper woodlands between 5,000-7,300 feet elevation	Apache, Navajo
Paria plateau fishhook cactus	*Sclerocactus sileri*	BLM S, G1	Narrow range; sandy soils on the Paria Plateau	Coconino
Parish alkali grass	*Puccinellia parishii*	HS, G2G3	Wet habitats	Apache, Coconino, Yavapai

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Parish phacelia	*Phacelia parishii*	BLM S, G2G3	Narrow range; limestone deposits in the Burro Creek area, dry lake beds in Red Lake	Mohave
Parish wild onion	*Allium parishii*	BLM S, SR, G3	Narrow range; higher elevation desert mountains, such as the Mohave Mountains	Yuma
Peebles Navajo cactus	*Pediocactus peeblesianus var. peeblesianus*	E, HS, G1G2T1	Gravely soils of the Shinarump conglomerate of the Chinle Formation	Navajo
Pima Indian mallow	*Abutilon parishii*	BLM S, SR, G2	Rocky slopes, good condition desert mountains	Gila, Graham, Maricopa, Pima, Pinal, Santa Cruz, Yavapai
Pima pineapple cactus	*Coryphantha scheeri* var. *robustispina*	E, HS, G4T2	Sonoran desert scrub or semi-desert grassland communities	Pima, Santa Cruz
Pinaleno hedgehog cactus	*Echinocereus ledingii*	SR, G4G5	Rocky outcrops between 4,000 – 7,400 feet elevation	Cochise, Graham
Pinos Altos flame flower	*Talinum humile*	SR, G2	Rocky slopes at about 7,000 feet elevation, interior chaparral and Great Basin conifer woodland	Santa Cruz
Pinto beardtongue	*Penstemon bicolor*	BLM S, G3?	Narrow range; desert washes in the Black Mountains	Mohave
Playa spider plant	*Cleome multicaulis*	SR, G2G3	Moist, alkaline grasslands	Cochise
Plummer onion	*Allium plummerae*	SR, G4	Wet meadows, stream banks, and rocky slopes between 4,800-9,000 feet elevation	Cochise, Pima
Purple adder's mouth	*Malaxis porphyrea*	SR, G4	Mixed conifer forest between 7,000 – 9,200 feet elevation	Apache, Cochise, Coconino, Greenlee, Santa Cruz
Purple-spike coralroot	*Hexalectris warnockii*	BLM S, G2G3	Few populations; leaf litter under Madrean woodland	Cochise
Redflower onion	*Allium rhizomatum*	SR, G4	Grassy areas in juniper-oak woodland between 4,000-7,000 feet elevation	Cochise, Santa Cruz
Ripley wild buckwheat	*Eriogonum ripleyi*	SR, G2	On well-drained powdery soils derived from limestone, sandstone, or volcanic tuffs and ashes between 2,000-6,000 feet elevation	Coconino, Maricopa, Yavapai
Rocky Mountain bristlecone pine	*Pinus aristata*	SR, G3	Cold, dry subalpine habitats between 8,200-12,000 feet elevation	Coconino
Round-leaf broom	*Errazurizia rotundata*	BLM S, SR, G2	Narrow range; Shinarump Hills, Holbrook area	Coconino, Navajo
Roundleaf errazurizia	*Errazurizia rotundata*	SR, G2	Rocky hilltops and ledges between4,620-5,200 feet elevation	Coconino, Navajo
Saiya	*Amoreuxia gonzalezii*	HS, G1	Rocky limestone hillsides between 4,200-4,600 feet elevation	Pima, Santa Cruz
San Carlos wild-buckwheat	*Eriogonum capillare*	SR, G4	Wash bottoms, road cuts, and berms between 1,980-4,650 feet elevation	Cochise, Gila, Graham, Greenlee, Pima, Pinal
Sand food	*Pholisma sonorae*	BLM S, G2	Sand dunes near Yuma	Yuma

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
San Francisco Peaks groundsel	*Packera franciscana*	T, HS, G1	Found on talus slopes on the San Francisco Peaks, between 11,000-12,300 feet elevation	Coconino
San Pedro River wild buckwheat	*Eriogonum terrenatum*	BLM S, G1	Narrow range; limestone and clay soils of the St. David Formation in the SPRNCA	Cochise, Pima
Santa Cruz beehive cactus	*Coryphantha recurvata*	HS, G3	Valleys, mesas, and foothills in grassland and oak belts at 4,000-5,900 feet	Santa Cruz
Santa Cruz striped agave	*Agave parviflora* ssp. *parviflora*	HS, G3T2	Slopes and ridges in desert grassland and oak woodland between 3,600-4,600 feet elevation	Pima, Santa Cruz
Scaly sand food	*Pholisma arenaria*	BLM S, HS, G3	Sand dunes on the Cactus Plain	La Paz
Schott wire-lettuce	*Stephanomeria schottii*	BLM S, G2	Sand dunes and sandy soils in the Yuma area	Yuma
Senita	*Lophocereus schottii*	SR, G4	Heavy or sandy soils of valleys and plains in the desert	Pima, Yuma
Sentry milk vetch	*Astragalus cremnophylax* var. *cremnophylax*	E, HS, G1T1	In the pinyon-juniper-cliffrose plant community above 4,000 feet elevation	Coconino
September 11 stickleaf	*Mentzelia memorabalis*	BLM S, G1	Narrow range; gypsum soils of Harrisburg Formation	Mohave
Siler pincushion cactus	*Pediocactus sileri*	T, HS, G3	Desert scrub transitional areas of Navajo, sagebrush and Mohave Deserts	Coconino, Mohave
Silverleaf sunray	*Enceliopsis argophylla*	BLM S, G2G3	Narrow range; gypsum soils of Moenkopi Formation	Mohave
Simpson plains cactus	*Pediocactus simpsonii*	SR, G4	On rocky soils of high valleys, mountainsides, and grasslands	Coconino
Slender adders mouth	*Malaxis tenuis*	SR, G4	Meadows and shady, rocky hills up to 10,000 feet elevation	Cochise, Pima
Slender bog orchid	*Platanthera purpurascens*	SR, G5	Wet habitats between 8,200-10,800 feet elevation	Apache, Graham, Greenlee
Slender evening-primrose	*Camissonia exilis*	SR, G1	Warm desert shrub communities, apparently in association with subsurface seepage between 3,500-5,000 feet elevation	Coconino, Mohave
Slender needle corycactus	*Coryphantha scheeri* var. *valida*	SR, G4T4	Grasslands and deserts around 4,000 feet elevation	Cochise
Smallflower fishhook cactus	*Sclerocactus parviflorus* ssp. *parviflorus*	SR, G4	Gravelly or sandy soils in desert or woodland	Coconino
Smooth catseye	*Cryptantha semiglabra*	BLM S, G1?	Narrow range; mixed desert shrub, sagebrush, and pinyon-juniper communities	Coconino, Mohave
Staghorn cholla	*Opuntia versicolor*	SR, G4	Deeper soils of canyons, washes, and well watered areas in the desert	Pima, Pinal, Santa Cruz
Sticky wild buckwheat	*Eriogonum viscidulum*	BLM S, G2	Narrow range; sandy loam soils in the Virgin River Valley	Mohave

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Straw-top cholla	*Opuntia echinocarpa*	SR, G3G4Q	On benches, slopes, mesas, flats and washes in desert habitats between 1,000-6,700 feet elevation	La Paz, Maricopa, Mohave, Yuma
Sunset Crater beardtongue	*Penstemon clutei*	SR, G2	Cinder fields that are devoid of a soil covering and where other herbaceous vegetation is sparse between 6,100 - 8,500 feet elevation	Coconino
Supine bean	*Macroptilium supinum*	SR, G2	Semi desert grassland or grassy openings in oak-juniper woodland between 3,600-4,900 feet elevation	Santa Cruz
Tepic flame flower	*Talinum marginatum*	SR, G2	Mountainous areas with pine-oak woodland and areas of low rolling hills between 5,000-7,000 feet elevation	Cochise, Santa Cruz
Texas purple spike	*Hexalectris warnockii*	HS, G2G3	Along streambeds in oak-mixed conifer habitats between 5,000-7,000 feet elevation	Cochise
Thornber fishhook cactus	*Mammillaria thornberi*	SR, G4	Deep, gravelly soils on floodplains, alluvial fans, and deeply dissected uplands between 780-2,400 feet elevation	Pima, Pinal
Three-cornered milkvetch	*Astragalus geyeri* var. *triquetrus*	BLM S, G4T2T3	Narrow range; sandy loam soils in the Virgin River Valley	Mohave
Thurber's bog orchid	*Platanthera limosa*	SR, G4	Open to lightly forested springy marshes, seeps, stream banks between 5,900-8,200 feet elevation	Cochise, Pima
Thurber Indian mallow	*Abutilon thurberi*	SR, G2?	Near the mouths of canyons in the Baboquivari Mountains around 3,450 feet elevation	Pima
Trelease agave	*Agave schottii* var. *treleasei*	HS, G5T1Q	Desert scrub, grasslands, juniper, and oak woodlands in the Santa Catalina Mountains between 3,600-6,560 feet elevation	Pima, Pinal, Cochise
Tonto Basin agave	*Agave delamateri*	HS, G2	Upper Sonoran desert scrub between 2,200-5,100 feet elevation	Gila, Maricopa, Yavapai
Toumey agave	*Agave toumeyana* var. *bella*	SR, G3T3	Rocky slopes in chaparral between 4,000-5,000 feet elevation	Gila, Maricopa, Pinal, Yavapai
Tumamoc globeberry	*Tumamoca macdougalii*	BLM S, SR, G4	Few populations; Sonoran Desert plains	Maricopa, Pima, Pinal
Tusayan flame flower	*Talinum validulum*	SR, G3	Open mountain meadows and shallow basins at the rims of canyons and flat ridgetops between 5,600-7,700 feet elevation	Coconino, Yavapai

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Utah solitaire lily	*Eremocrinum albomarginatum*	SR, G3	Deep sandy areas in salt desert shrub; sand dunes	Apache
Varied fishhook cactus	*Mammillaria viridiflora*	SR, G4	Oak woodland and forest edges between 4,900-6,900 feet elevation	Cochise, Gila, Graham, La Paz, Maricopa, Mohave, Pima, Pinal, Yavapai
Verde Valley sage	*Salvia dorrii* ssp. *mearnsii*	SR, G5T3	Gypseous limestone at elevations of 3,100-5,100 feet	Yavapai
Viviparous foxtail cactus	*Escobaria vivipara* var. *rosea*	SR, G5T3	Near Peach Springs on rocky and gravelly slopes in woodland or desert mountains between 4,900-9,000 feet elevation	Mohave, Yavapai
Welsh's milkweed	*Asclepias welshii*	T, HS, G1	Open, sparsely vegetated sand dunes in sagebrush, juniper, pine and oak communities of the Great Basin desert scrub between 5,550-6,250 feet elevation	Coconino, Navajo
Western fairy slipper	*Calypso bulbosa*	SR, G5	Dry coniferous slopes	Apache, Coconino, Greenlee
Whipple cholla	*Opuntia whipplei* var. *whipplei*	SR G4?	Flats, valleys, plains, and gentle slopes in grasslands	Mohave
Whisk fern	*Psilotum nudum*	HS, G5	In rock crevices, on trees, and on the ground up to 4,000 feet elevation	Pima, Santa Cruz
White Mandarin twisted stalk	*Streptopus amplexifolius*	SR, G5	Coniferous and deciduous forests up to 9,200 feet elevation	Apache
White-margined penstemon	*Penstemon albomarginatus*	BLM S, SR, G2	Narrow range; sandy loam soils at Dutch Flat	Mohave
White Mountains paintbrush	*Castilleja mogollonica*	SR, G5?	Grassy meadows associated with creeks between 8,500 – 9,500 feet elevation	Apache
Wilcox fishhook cactus	*Mammillaria wrightii* var. *wilcoxii*	SR, G4T4	Grassland or along the edges of woodlands	Cochise, Graham, Santa Cruz
Wislizeni gentian	*Gentianella wislizeni*	SR, G2	Open meadows or shaded slopes between 6,500-8,000 feet elevation	Cochise, Greenlee
Woodland spurge	*Euphorbia macropus*	SR, G4	Pine-oak woodland between 2,100-7,400 feet elevation	Cochise, Santa Cruz
Wright fishhook cactus	*Mammillaria wrightii* var. *wrightii*	SR, G4T3	Grassland and woodland habitats between 4,900-7,900 feet elevation	Apache
Yellow beavertail	*Opuntia basilaris* var. *aurea*	SR, G5	Pinyon-juniper woodlands between 4,900-5,900 feet elevation	Coconino, Mohave
Yellow lady's-slipper	*Cypripedium parviflorum* var. *Pubescens*	HS, G5T5	Damp woods, near rivers, and in wet meadows	Apache, Greenlee

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Zuni fleabane	*Erigeron rhizomatus*	T, HS, G2	Selenium-rich red or gray detrital clay soils derived from the Chinle and Baca formations	Apache

[1]Status
T- Federally Threatened
E- Federally Endangered
C- Candidate for federal listing
BLM S- BLM AZ sensitive species
WSC – Wildlife of Special Concern in Arizona
HS- AZ Highly Safeguarded plant.
SR- AZ Salvage Restricted plant.
Sources: NatureServe 2011; AGFD 2011b; Source of the taxonomy is the AGFD Heritage Data Management System.

Other Special Status Species

Special status species related to the planning area include those species that are listed as Arizona BLM Sensitive Species; AGFD Wildlife Species of Special Concern; or are protected under the Arizona Native Plant List (ANPL) as Highly Safeguarded or Salvage-Restricted Native Plants by the Arizona Department of Agriculture (AZDA). Descriptions are included below.

Criteria for BLM Sensitive Species (BLM Manual Section 6840) include those that are:

1. Under status review by the USFWS/National Marine Fisheries Service; or
2. Whose numbers are declining so rapidly that federal listing may become necessary; or
3. With typically small and widely dispersed populations; or
4. Those inhabiting ecological refugia or other specialized or unique habitats (BLM 2008e).

BLM policy, as specified in BLM Manual 6840, is "to provide policy and guidance for the conservation of BLM special status species and the ecosystems upon which they depend on BLM-administered lands." Objectives of the BLM special status species policy are to 1) conserve and/or recover ESA-listed species and the ecosystems on which they depend so that ESA protections are no longer needed for these species; and 2) initiate proactive conservation measures that reduce or eliminate threats to BLM sensitive species to minimize the likelihood of and need for listing of these species under the ESA.

The BLM Arizona State Director maintains a list of sensitive species, and impacts on these species would have to be considered in project-specific

assessments developed before approval of any activity that would affect listed or proposed species or critical habitat. An updated list of sensitive species was published in December 2010.

AGFD Wildlife of Special Concern are those species whose occurrence in Arizona is or may be in jeopardy, or with known or perceived threats or population declines, as described by the AGFD's listing of Wildlife of Special Concern in Arizona (AGFD in prep).

AZDA Highly Safeguarded or Salvage Restricted Native Plants are special status plants protected under the ANPL and fall into the following categories: Highly Safeguarded (collection allowed only with permit for scientific purposes or for noncommercial salvage when the plant's existence is threatened); Salvage Restricted (collection allowed only with permit); Export Restricted (transport out of State prohibited); Salvage Assessed (permits required to remove live trees); and Harvest Restricted (permits required to remove plant byproducts).

Special status species with the potential to occur in the planning area are included in **Table 3-31**, Special Status Animal Species with the Potential to Occur in the Planning Area, and **Table 3-32**, Special Status Plant Species with the Potential to Occur in the Planning Area, above.

The USFWS has published a list of proposed, candidate, threatened, and endangered species occurring by county in Arizona (USFWS 2011). In addition, the AGFD has published a list of special status species occurring by county in Arizona (AGFD 2011b). These lists were consulted to provide a basis for special status species that might be present in the planning area and are included in the table below. Habitat information for each species and counties of occurrence are included below. Site-specific assessment, including literature and field review to determine the likelihood of occurrence of specific special status species and their habitats, would be conducted prior to site permitting and development.

3.19.2 Agua Caliente Solar Energy Zone Affected Environment

The AGFD has identified 36 species of greatest conservation need (SGCN) that have the potential to occur within the Agua Caliente SEZ based on habitat availability and species range. These species are identified in the Comprehensive Wildlife Conservation Strategy and are all listed as Tier 1a and 1b, which are the species in most immediate need of conservation (AGFD 2006). In addition, 17 BLM sensitive species could occur on lands within the BLM Yuma Field Office. All identified sensitive species are identified in **Table 3-33**, Special Status Species with Potential to Occur in the Proposed Agua Caliente SEZ, below.

A field survey was conducted in August 2011 by a qualified field biologist to identify any potential habitat for special status species on or near the site. The potential for occurrence is based on the site visit and the habitat information presented in **Table 3-31**, Special Status Animal Species with Potential to Occur

Table 3-33
Special Status Species with Potential to Occur in the Proposed Agua Caliente SEZ

Common name	Scientific Name	Status[1]	Potential for occurrence[2]
Birds			
Abert's towhee	*Melozone aberti*	SGCN	P
American bittern	*Botaurus lentiginosus*	BLM S, WSC, SGCN	U
Arizona Bell's vireo	*Vireo bellii arizonae*	SGCN	U
Bald eagle – wintering population	*Haliaeetus leucocephalus*	BLM S, WSC, SGCN	U
Cactus ferruginous pygmy-owl	*Glaucidium brasilianum cactorum*	BLM S, WSC	P
California black rail	*Laterallus jamaicensis coturniculus*	BLM S	U
Ferruginous hawk	*Buteo regalis*	BLM S, WSC, SGCN	P
Gila woodpecker	*Melanerpes uropygialis*	SGCN	P
Gilded flicker	*Colaptes chrysoides*	SGCN	P
Golden eagle	*Aquila chrysaetos*	BLM S, SGCN	P
Le Conte's thrasher	*Toxostoma lecontei*	BLM S, SGCN	P
Lincoln's sparrow	*Melospiza lincolnii*	SGCN	U
Mountain plover	*Charadrius montanus*	SGCN	P
Pacific wren	*Troglodytes pacificus*	SGCN	U
Savannah sparrow	*Passerculus sandwichensis*	SGCN	U
Sprague's pipit	*Anthus spragueii*	C, WSC, SGCN	U
Western burrowing owl	*Athene cunicularia hypugaea*	BLM S, SGCN	P
Wood duck	*Aix sponsa*	SGCN	U
Mammals			
American beaver	*Castor canadensis*	SGCN	U
Arizona pocket mouse	*Perognathus amplus*	SGCN	P
California leaf-nosed bat	*Macrotus californicus*	BLM S, WSC, SGCN	P
Cave myotis	*Myots velifer*	SGCN	P
Desert bighorn sheep	*Ovis canadensis mexicana*	SGCN	U
Greater western mastiff bat	*Eumops perotis californicus*	BLM S, SGCN	P
Harquahala southern pocket gopher	*Thomomys bottae subsimilis*	SGCN	P
Harris' antelope squirrel	*Ammospermophilus harrisii*	SGCN	P
Kit fox	*Vulpes macrotis*	SGCN	P
Little pocket mouse	*Perognathus longimembris*	SGCN	P
Mexican free-tailed bat	*Tadrida brasiliensis*	SGCN	P
Pale Townsend's big-eared bat	*Corynorhinus townsendii pallescens*	BLM S, SGCN	P
Pocketed free-tailed bat	*Nyctinomops femorosaccus*	SGCN	P
Sonoran pronghorn	*Antilocapra americana sonoriensis*	E, WSC	P
Western yellow bat	*Lasiurus xanthinus*	WSC, SGCN	P
Yuma myotis	*Myotis yumanensis*	SGCN	P
Amphibians/Reptiles			
Flat-tailed horned lizard	*Phrynosoma mcallii*	WSC	P
Gila monster	*Heloderma suspectum*	SGCN	U
Lowland leopard frog	*Lithobates yavapaiensis*	BLM S, WSC, SGCN	U
Sonoran Desert toad	*Bufo alvarius*	SGCN	U
Sonoran Desert tortoise	*Gopherus agassizii (Sonoran population)*	WSC, SGCN	U
Yuman desert fringe-toed lizard	*Uma rufopunctata*	BLM S, WSC	U
Plants			
Blue sand lily	*Triteleiopsis palmeri*	BLM S	P
Kearney sumac	*Rhus kearneyi*	BLM S	U
Kofa Mountain barberry	*Berberis harrisoniana*	BLM S	U
Parish onion	*Allium parishii*	BLM S	U
Sand food	*Pholisma sonorae*	BLM S	U
Schott wire lettuce	*Stephanomeria schottii*	BLM S	P

Table 3-33 *(continued)*
Special Status Species with Potential to Occur in the Proposed Agua Caliente SEZ

Common name	Scientific Name	Status[1]	Potential for occurrence[2]

[1]Status
E- Federally Endangered
P – Proposed Threatened
C- Candidate for federal listing
BLM S – BLM Sensitive
WSC – Wildlife of Special Concern in Arizona
SGCN – Species of Greatest Conservation Need
[2] Potential for Occurrence
P – Potential to occur
U – Unlikely to occur
Sources: NatureServe 2011; AGFD 2012a

in the Planning Area and **Table 3-32**, Special Status Plant Species with Potential to Occur in the Planning Area, above. The results of the AGFD, SGCN, and BLM sensitive lists and field survey are included in **Table 3-33**, Special Status Species with Potential to Occur in the Proposed Agua Caliente SEZ, above.

The proposed SEZ may provide potential habitat for several special status species, although no known species-specific special status species surveys have been conducted on-site. There is potential habitat for burrowing owls in certain locations that have suitable soils and erosional features, such as caliche caves. There is no golden eagle nesting habitat on site, though the area could provide foraging habitat, and golden eagle prey (e.g., lagomorphs) were observed on site.

Several special status bird and bat species could utilize the habitats within the proposed SEZ, including both the riparian areas and the desert scrub. There is Category 3 desert tortoise habitat to the west and north of the proposed SEZ, although since the site is relatively flat and does not have rocky, steep habitat, it is unlikely to provide potential habitat. The northern portion of the proposed SEZ may serve as a movement corridor for desert tortoise. As described in **Section 3.6**, Fish and Wildlife, the area within and around the SEZ has been identified as a potential reintroduction area for Sonoran pronghorn.

Special status species populations in the proposed SEZ are likely stable given the relatively rural and undisturbed nature of the site. The current adjacent solar development could be displacing or disturbing wildlife in and around that area, causing more wildlife to inhabit the proposed SEZ site for refuge.

3.20 TRAVEL MANAGEMENT

3.20.1 RDEP Affected Environment

Arizona is served by an extensive network of state and interstate highway systems. The National Highway System provides access to major metropolitan centers of Phoenix and Tucson, and smaller cities like Flagstaff and Yuma. Other

national and state highways connect multiple municipalities and provide access to destinations like Grand Canyon National Park.

Over the past 10 years, federal land management agencies have instituted policies to provide networks of roads and trails for motorized access. 43 CFR 8230 requires the BLM to designate all BLM-administered lands as open, limited, or closed to OHV travel. This policy has resulted in the implementation of a system of designated roads and trails, whereby cross-country travel is only allowed in specified areas, and motorized vehicles must stay on those routes designated for motorized travel.

In response to 36 CFR 212, Subpart B, the Forest Service has instituted a similar policy for motorized travel, requiring each national forest to produce a Motor Vehicle Use Map that depicts the routes on which motorized vehicles are allowed to travel. In Arizona, the Prescott National Forest has published its Motor Vehicle Use Map (Forest Service 2009). The Apache-Sitgreaves, Coconino, Coronado, Kaibab, and Tonto National Forests are currently preparing their Motor Vehicle Use Map (Forest Service 2010d).

OHV use is prohibited in many NPS units, though driving for pleasure on paved roads is a popular activity.

On BLM, Forest Service, and NPS-administered lands, cross-country nonmotorized travel remains largely permissible outside of some special designation areas. Mountain bicycle use is allowed on some designated routes within the National Parks System, such as the Cactus Forest Trail in Saguaro National Park.

Demand for public access is expected to continue to grow as the Southwest's population grows and motorized vehicles make previously remote areas more accessible. Travel management has become a prominent planning issue for land management agencies and will continue to be a high-profile issue.

3.20.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ is located within the Dispersed Recreation RMZ of the 526,900-acre Yuma East Undeveloped SRMA. Motorized travel within the entire RMZ is managed as "limited to designated routes," meaning vehicles can only travel on existing inventoried routes appearing on the Yuma Field Office route inventory maps that were published with the Yuma Field Office RMP (BLM 2010g). Nonmotorized uses are allowed to travel cross-country, though limitations can be put in place for competitive and permitted events.

Numerous routes traverse the proposed SEZ, most heading north-south and crossing or originating/terminating on private and state land. These routes receive heavy use during hunting season and are inventoried as "digital linear features" (i.e., linear features appearing on aerial photos that need to be field-

checked and may not exist) or "nonmotorized routes" by the Yuma Field Office RMP (BLM 2010g).

3.21 VEGETATION

This section addresses the vegetation communities within the planning area. A vegetation community is an assemblage of individual plant species that grow together in the same general geographic location. Special status plant species are addressed in **Section 3.19**, Special Status Species.

The Federal Noxious Weed Act of 1974 provides for the control and management of nonindigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health. The act prohibits importing or moving any noxious weeds identified by the regulation and allows for inspection and quarantine to prevent the spread of noxious weeds.

Signed in 1999, Executive Order 13112, Invasive Species directs federal agencies to prevent the introduction of invasive species, provide for their control, and minimize the economic, ecological, and human health impacts that invasive species cause. To accomplish this, the Executive Order established the National Invasive Species Council; currently there are 13 departments and agencies represented on the council.

3.21.1 RDEP Affected Environment

This discussion includes ecoregions in Arizona per the Draft Arizona Comprehensive Wildlife Conservation Strategy (AGFD 2006) and vegetation communities per the Southwest Regional GAP Analysis Project (SWReGAP) (USGS National Gap Analysis Program 2004). GIS was used where possible to quantify acreages of vegetation communities. Comprehensive biological surveys were not conducted within the entire planning area.

Ecoregions

Ecoregions are defined as "areas–on the scale of tens of millions of acres–that are characterized by phenomena that influence the character of specific habitat types. These large-scale phenomena include environmental conditions such as climate and landforms, as well as regional human activities and population centers" (AGFD 2006). Arizona is composed of the following ecoregions: Colorado Plateau, Arizona/New Mexico Plateau, Arizona/New Mexico Mountains, Madrean Archipelago, Mojave Basin and Range, Chihuahuan Desert, and Sonoran Basin and Range (see **Table 3-34**, Level III Ecoregions in Arizona, and **Figure 3-21**, Level III Ecoregions) (EPA 2011b).

Colorado Plateau

The Colorado Plateau ecoregion is an uplifted, eroded, and deeply dissected tableland. Its benches, mesas, buttes, salt valleys, cliffs, and canyons are formed in and underlain by thick layers of sedimentary rock. Precipitous side-walls mark

Level III Ecoregions

Ecoregions are large scale areas characterized by environmental conditions such as climate, landforms, and human activities that influence the character of specific habitat types.

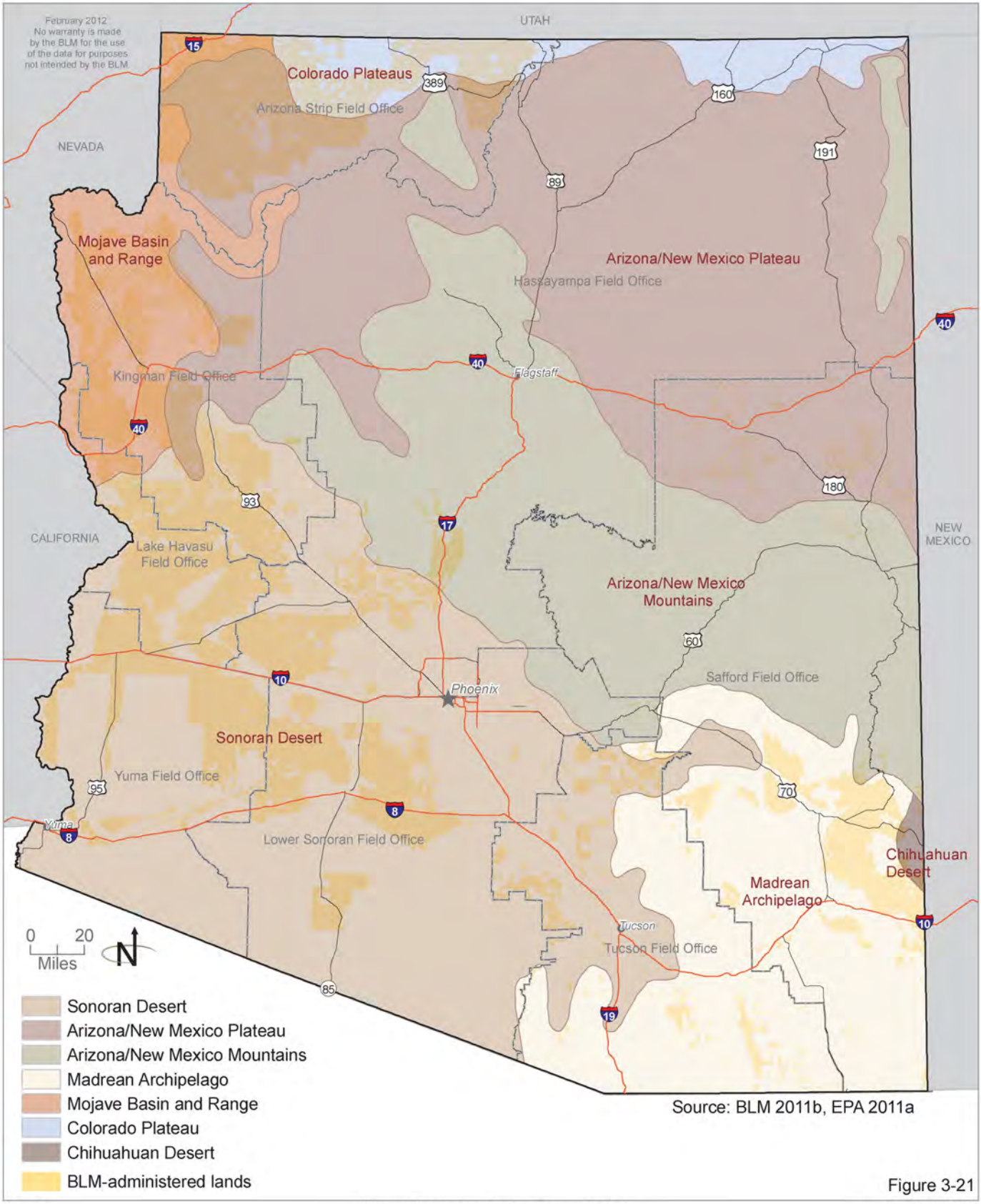


Figure 3-21

Table 3-34
Level III Ecoregions in Arizona

Ecoregion	Acres in Arizona
Colorado Plateau	1,188,100
Arizona/New Mexico Plateau	8,852,500
Arizona/New Mexico Mountains	12,283,300
Madrean Archipelago	8,644,100
Mojave Basin and Range	3,604,300
Chihuahuan Desert	158,700
Sonoran Basin and Range	18,113,000

Source: EPA 2011b

abrupt changes in local relief, often from 1,000 to 2,000 feet. The region contains a greater extent of pinyon-juniper and Gambel oak woodlands than the Wyoming Basin to the north. There are also large low-lying areas containing saltbrush-greasewood (typical of hotter drier areas), which are generally not found in the higher Arizona/New Mexico Plateau to the south where grasslands are common. Summer moisture from thunderstorms support warm season grasses not found in the Central Basin and Range to the west. Many endemic plants occur, and species diversity is greater than in the Central Basin and Range (EPA 2010b).

Arizona-New Mexico Plateau

The Arizona/New Mexico Plateau represents a large transitional region between the semiarid grasslands and low relief tablelands of the Southwestern Tablelands in the east, the drier shrublands and woodland-covered higher relief tablelands of the Colorado Plateau in the north, and the lower, hotter, less-vegetated Mojave Basin and Range in the west and Chihuahuan Desert in the southeast. Higher forest-covered mountainous ecoregions border the region on the northeast (Southern Rockies ecoregion) and south (Arizona/New Mexico Mountains ecoregion). Local relief in the region varies from a few feet on plains and mesa tops to well over 1,000 feet along tableland side slopes (EPA 2010b).

Arizona/New Mexico Mountains

The Arizona/New Mexico Mountains are distinguished from neighboring mountainous ecoregions by their lower elevations and associated vegetation indicative of drier, warmer environments, which is due in part to the region's more southerly location. Forests of spruce, fir, and Douglas-fir, which are common in the Southern Rockies and the Uinta and Wasatch Mountains, are only found in a few high-elevation parts of this region. Chaparral is common on the lower elevations, pinyon-juniper and oak woodlands are found on lower and middle elevations, and the higher elevations are mostly covered with open to dense ponderosa pine forests. These mountains are the northern extent of some Mexican plant and animal species (EPA 2010b).

Madrean Archipelago
Also known as the Sky Islands in the United States, this is a region of basins and ranges with medium to high local relief, typically 3,000 to 5,000 feet. Native vegetation in the region is mostly grama-tobosa shrubsteppe in the basins and oak-juniper woodlands on the ranges, except at higher elevations where ponderosa pine is predominant. The region has ecological significance as both a barrier and a bridge between two major cordilleras of North America, the Rocky Mountains and the Sierra Madre Occidental (EPA 2010b).

Mojave Basin and Range
This ecoregion contains broad basins and scattered mountains that are generally lower, warmer, and drier than those of the Central Basin and Range. Its creosote bush-dominated shrub community is distinct from the saltbush–greasewood and sagebrush–grass associations that occur to the north in the Central Basin and Range and Northern Basin and Range; it also differs from the paloverde–cactus shrub and saguaro cactus that occur in the Sonoran Basin and Range to the south (EPA 2010b).

Chihuahuan Desert
This desert ecoregion extends from the Madrean Archipelago in southeastern Arizona to the Edwards Plateau in south-central Texas. The physiography is generally a continuation of basin and range terrain that is typical of the Mojave Basin and Range and the Central Basin and Range to the west and northwest, although the patterns of alternating mountains and valleys is not as pronounced as in the Mojave Basin and Range and the Central Basin and Range. Vegetative cover is predominantly desert grassland and shrubland, except on the higher mountains where oak, juniper, and pinyon woodlands occur. The extent of desert shrubland is increasing across lowlands and mountain foothills due to the gradual desertification caused in part by historical grazing pressure (EPA 2010b).

Sonoran Basin and Range
Similar in topography to the Mojave Basin and Range to the north, this ecoregion contains scattered low mountains and has large tracts of federally owned land, a large portion of which is used for military training. However, the Sonoran Basin and Range is slightly hotter than the Mojave and contains large areas of palo verde-cactus shrub and giant saguaro cactus, whereas the potential natural vegetation in the Mojave is largely creosote bush. Winter rainfall decreases from west to east, while summer rainfall decreases from east to west (EPA 2010b).

Vegetative Communities
Vegetative communities within Arizona, based on the SWReGAP, are presented in **Appendix F**, Southwest Regional GAP Analysis Project Landcover Types and Descriptions for Arizona (USGS National Gap Analysis Program 2004).

Riparian Communities

Riparian areas are the zones along water bodies that serve as interfaces between terrestrial and aquatic ecosystems. Riparian areas are most commonly associated with river and stream corridors, though riparian vegetation can also be found in marshes, wetlands, seeps, and springs, and along lakesides. They support a disproportionate amount of wildlife and vegetation and provide shade, wildlife cover, migratory corridors, foraging and nesting habitat, pollutant and sediment filtration, flood control, and stream bank stabilization. Riparian areas in the Sonoran Desert are considered to have among the richest breeding bird diversity and productivity in North America (AGFD 2006).

Riparian vegetation within Arizona varies according to elevation, with three general groupings: below 3,500 feet; between 3,500 and 7,000 feet; and between 7,000 and 10,000 feet. Below 3,500 feet, ephemeral streams are common and support deep-rooted trees and shrubs, such as mesquite (*Prosopis* spp.), acacia (*Acacia* spp.), salt cedar (*Tamarix* spp.), palo verde (*Parkinsonia* spp.), cottonwood (*Populus* spp.), willow (*Salix* spp.), and sycamore (*Platanus* spp.). Between 3,500 and 7,000 feet elevation, riparian vegetation is the most diverse and has the greatest canopy cover. Common species include cottonwood, willow, sycamore, ash (*Fraxinus* spp.), and walnut (*Juglans* spp.). Above 7,000 feet, vegetation representative of montane riparian communities is present, such as willow, chokecherry (*Prunus virginiana*), boxelder (*Acer negundo*), Rocky Mountain maple (*Acer glabrum*), and various conifer tree species (Hendricks 1985).

Drought, livestock grazing, and the spread of nonnative species are the major causes of negative impacts on riparian areas in Arizona (AGFD 2006). Other sources of impacts are pollution, OHV use, diversions and impoundments, fire, and increasing population. Ponderosa pine encroachment is an issue in the Apache Highlands North ecoregion. Drought, diversions, and increasing populations reduce water availability for riparian vegetation, potentially making the vegetation more susceptible to disease or nonnative species invasion. Livestock may congregate in riparian areas, as they provide water and shade, and can therefore compact the soil, overbrowse seedlings, and trample vegetation. Nonnative species such as tamarisk (*Tamarix* spp.) and giant salvinia (*Salvinia molesta*) compete with native vegetation and remove water from the system. Polluted runoff may affect vegetation health, and OHV use compacts the soil and can destroy vegetation. Ash and silt resulting from upland fires can run off into riparian areas and create siltation problems (AGFD 2006).

Rare Plant Communities

Rare plant communities occur within Arizona and may be either inherently rare or rare because of habitat alteration or degradation. The majority of inherently rare plant communities are relatively small patches of plants in unique combinations, often due to the presence of equally rare soil conditions. These patch communities occur within a matrix of more common, widespread community types and often serve as important biological niches. Often, the rare

plant communities have been eliminated from REDA consideration because they occur in areas with known sensitive resources (**Table 2-1**, Area with Known Sensitive Resources (Eliminated from REDA Consideration)). However, it is likely that not all rare plant communities have been eliminated from REDA consideration. To protect these communities, site-specific evaluation would be conducted on a project-level basis, and vegetation management plans would be developed and implemented.

Invasive Species and Noxious Weeds

Invasive species are non-native species whose introduction does or is likely to cause economic or environmental harm or harm to human health. Noxious weeds are a subgroup of invasive species. The Arizona Department of Agriculture regulates noxious weeds, which are defined as "any species of plant that is, or is liable to be, detrimental or destructive and difficult to control or eradicate and shall include any species that the director [of the plant services division of the Arizona Department of Agriculture], after investigation and hearing, shall determine to be a noxious weed" (ARS 3-201[4]). There are three categories of noxious weeds: 1) prohibited – species which are prohibited from entering the state, 2) regulated – species which may be controlled or quarantined to prevent further infestation or contamination, and 3) restricted – species which shall be quarantined to prevent further infestation or contamination (Arizona Department of Agriculture 2011). There are 55 prohibited species, 9 regulated species, and 16 restricted species, for a total of 80 noxious weeds (**Appendix E**, Arizona Department of Agriculture List of Prohibited, Regulated, and Restricted Noxious Weeds). In addition, there are over 100 federal noxious weeds that BLM must manage for in accordance with the regulations listed in the beginning of this section and numerous other organizations that track weeds, such as the Weed Science Society of America.

Surface-disturbing activities such as development or poorly managed livestock grazing can remove or damage native vegetation and facilitate the spread of invasive species. Thus, as surface-disturbing activities have increased in Arizona, so have weed spread and invasion. Large, catastrophic fires have destroyed native vegetation, and where left barren, weeds have often spread and taken over. In addition, overgrazed areas have damaged or removed native vegetation and are more susceptible to weed invasion, especially since weeds may be transported by livestock. State regulations and BLM policy have worked to reduce and prevent weed spread with varying degrees of success. Patch treatment has removed weeds in localized areas, but large-scale removal of weeds is likely infeasible. Site-specific surveys are conducted on a project-level basis, and vegetation management plans and integrated weed management plans are developed. Together, these methods help to document and control weed populations.

3.21.2 Agua Caliente Solar Energy Zone Affected Environment

Vegetation within the proposed Agua Caliente SEZ is described using the same ecoregion and vegetation classifications as above. In addition, a biological reconnaissance site visit was conducted on August 2 and 3, 2011, within the proposed Agua Caliente SEZ.

The proposed Agua Caliente SEZ is within the Sonoran Basin and Range ecoregion and is dominated by Sonora-Mojave Creosotebush-White Bursage Desert Scrub (see **Table 3-35**, Vegetation Types in the Proposed Agua Caliente SEZ). Elevations range from 150 to 220 feet. Species observed on-site during the site reconnaissance include creosotebush (*Larrea tridentata*), white bursage (*Ambrosia dumosa*), saguaro (*Carnegiea gigantea*), ocotillo (*Fouquieria splendens*), ironwood (*Olneya tesota*), ratany (*Krameria* spp.), brittlebush (*Encelia farinosa*), pencil cholla (*Opuntia arbuscula*), palo verde, fishhook barrel cactus (*Ferocactus wislizenii*), desert mistletoe (*Phoradendron macrophyllum*), and silver cholla (*Opuntia imbricata* var. *argentea*).

Table 3-35
Vegetation Types in the Proposed Agua Caliente SEZ

Vegetation Type	Acres
Agriculture	20
Invasive Southwest Riparian Woodland and Shrubland	240
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	20,270
Barren Lands, Non-Specific	0
North American Warm Desert Wash	0
Sonora-Mojave Mixed Salt Desert Scrub	0
Sonoran Paloverde-Mixed Cacti Desert Scrub	70
Total	*20,600*

Source: SWReGAP 2011

The proposed Agua Caliente SEZ has a network of braided ephemeral washes onsite, running north to south (see **Section 3.23**, Water Resources). Riparian vegetation, such as leguminous trees, is most abundant in three of these washes, Hoodoo Wash, Baragan Wash, and Clanton Wash. In addition, numerous small washes and braided channels occur throughout the proposed SEZ, particularly in the northern portion of the site.

Site-specific noxious weed and invasive species surveys were not conducted within the proposed SEZ. During the site visit, Russian thistle (*Salsola kali*), an unknown thistle, and one tamarisk (*Tamarix* sp.) shrub were observed. The tamarisk shrub was observed within Hoodoo Wash. No state-listed noxious weeds were observed, but potentially occurring noxious weeds include field bindweed (*Convolvulus arvensis*), puncturevine (*Tribulus terrestris*), and red star-thistle (*Centaurea calcitrapa*), as these species have been recorded within Yuma County (NRCS 2011g).

3.22 VISUAL RESOURCES

This section describes visual resources in the planning area as well as regulations associated with visual resource management.

General Visual Setting

The planning area encompasses a wide variety of landscape types that can be categorized into ecological regions (or ecoregions). Attributes used to characterize an ecoregion include geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology, all of which influence visual resources (EPA 2011b). Visual resources are generally homogenous within an ecoregion. Arizona is comprised of the following ecoregions: Colorado Plateaus, Arizona/New Mexico Plateau, Arizona/New Mexico Mountains, Madrean Archipelago, Mojave Basin and Range, Chihuahuan Desert, and Sonoran Basin and Range (see **Figure 3-21**, Level III Ecoregions) (EPA 2011b). See **Section 3.21**, Vegetation, for a description of each ecoregion.

Although the population is not evenly distributed across the planning area, human influences have altered much of the visual landscape, especially with respect to land use and land cover. In some places, intensive human activities, such as mineral extraction and energy development, have significantly altered the natural visual landscape. Large, fast-growing cities also contain heavily altered landscapes, with urban sprawl spreading into what were recently relatively undisturbed landscapes.

Visual Resource Management System

In accordance with FLPMA, the BLM is entrusted with the multiple-use management of natural resources on BLM-administered land, which contain many outstanding qualities, including scenic landscapes. The BLM's Visual Resource Management (VRM) system guides visual resources management on BLM-administered lands. Visual resources are defined as the visible physical features on a landscape (e.g., land, water, vegetation, animals, structures, and other features). There are three stages of the VRM system: inventory (visual resource inventory), assigning VRM management classes, and analysis (visual resource contrast rating).

The visual resource inventory process provides BLM managers with a means for determining visual values. The process involves a scenic quality evaluation, sensitivity level analysis, and a delineation of distance zones. The process is described in detail in BLM Handbook H-8410-1, Visual Resource Inventory (BLM 1986a). Based on these three factors, BLM-administered lands are placed into one of four visual resource inventory classes. These inventory classes represent the relative value of the visual resources, Classes I and II being the most valued, Class III representing a moderate value, and Class IV being of least value. The inventory classes provide the basis for considering visual values in the RMP process. VRM classes are established through the RMP process for all BLM-

administered lands. During the RMP process, the class boundaries are adjusted as necessary to reflect the resource allocation decisions made in RMPs.

Table 3-36, Acres of Arizona BLM Land by Visual Resource Inventory [VRI] Components, displays the acres of BLM land broken down into each of the four VRI components (i.e., scenic quality, sensitivity, distance zones, and VRI classification). Note that data for the Tucson Field Office are unavailable. Additionally, the methodology for inventorying visual resources varied, data for different field offices were provided in a variety of digital formats, some data were missing, and some data overlapped other data. As such, the total acres calculated for each of the VRI components is different from the total acres of BLM land in Arizona and also may be different from each other. This information is also displayed on **Figure 3-22**, Visual Resource Quality Rating, **Figure 3-23**, Visual Resource Sensitivity Levels, **Figure 3-24**, Visual Resource Distance Zones, and **Figure 3-25**, Visual Resource Inventory Class.

Table 3-36
Acres of Arizona BLM Land by Visual Resource Inventory Components

Scenic Quality		Sensitivity		Distance Zones		VRI Classification	
Category	**Acres**	**Category**	**Acres**	**Zone**	**Acres**	**VRI Class**	**Acres**
A	2,294,000	High	6,031,800	Foreground/ Middleground	7,145,500	Class I	1,134,000
B	4,458,200	Medium	2,993,200	Background	2,202,200	Class II	2,961,300
C	4,512,800	Low	2,292,100	Seldom Seen	2,125,200	Class III	2,933,400
Not Rated	421,700	Not Rated	421,700			Class IV	4,538,500
No Data	4,600	No Data	4,600			No Data	200
Total	*11,691,300*	*Total*	*11,743,400*	*Total*	*11,472,900*	*Total*	*11,567,400*

Source: BLM 2011a

Visual management objectives are predefined for each VRM class. The objectives for visual resources management classes on public lands are as follows:

- Class I. The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
- Class II. The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
- Class III. The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer.

Visual Resource Quality Rating

Scenic Quality Evaluation measures the visual appeal of a landscape. Lands are rated as Class A, Class B, or Class C based on the apparent scenic quality. Scenic quality is determined by reviewing and rating lands using seven key factors (landform, vegetation, water, color, influence of adjacent scenery, and scarcity), and the total score determines the scenic quality rating.

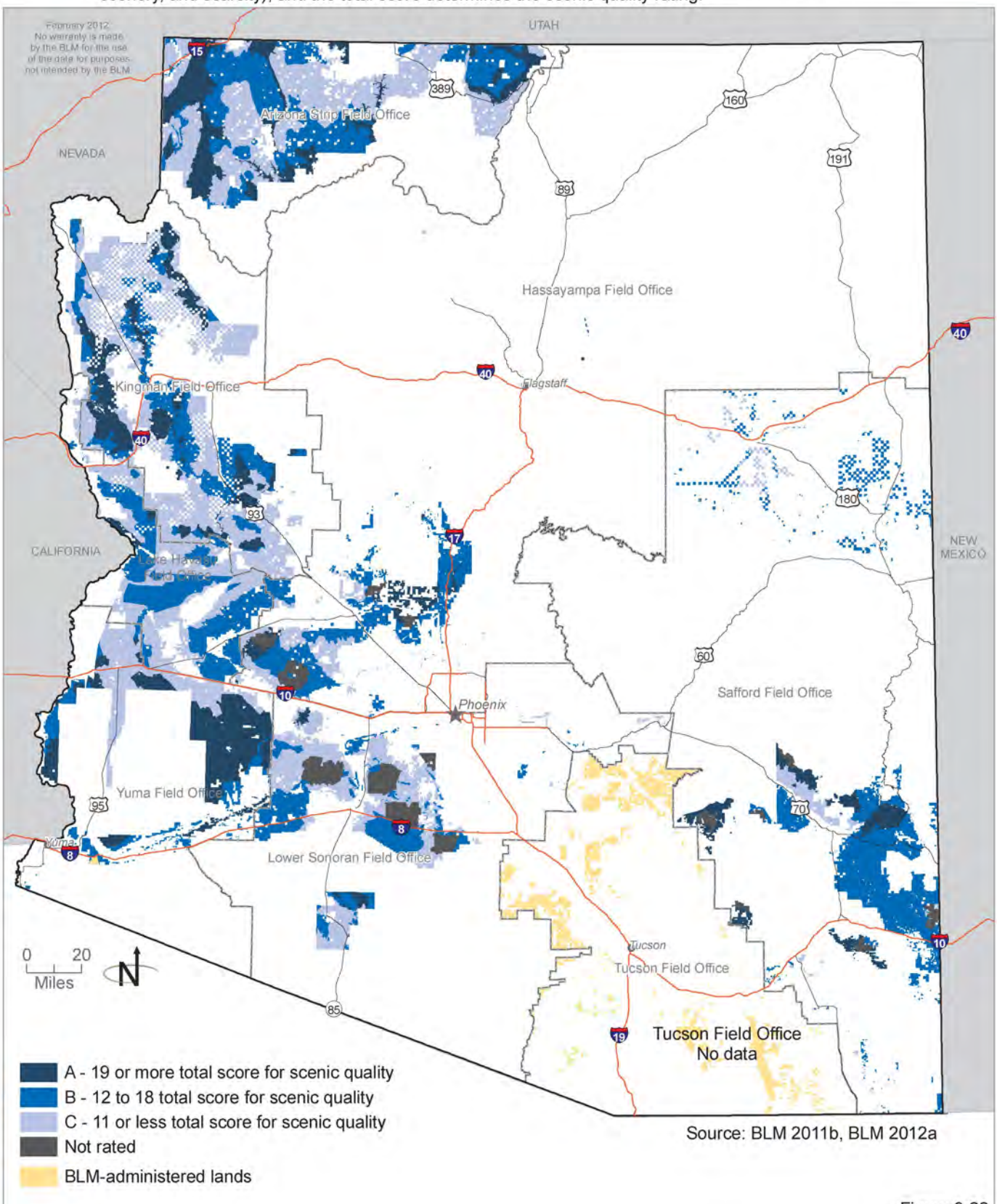


Figure 3-22

Visual Resource Sensitivity Levels

Sensitivity levels are a measure of public concern for scenic quality. Lands are assigned high, medium, or low sensitivity levels based on consideration of the following: types of users, amount of use, public interest, adjacent land uses, special areas, and other. The overall rating is not quantified; instead, the evaluators make a professional judgment about how the overall ratings valued.

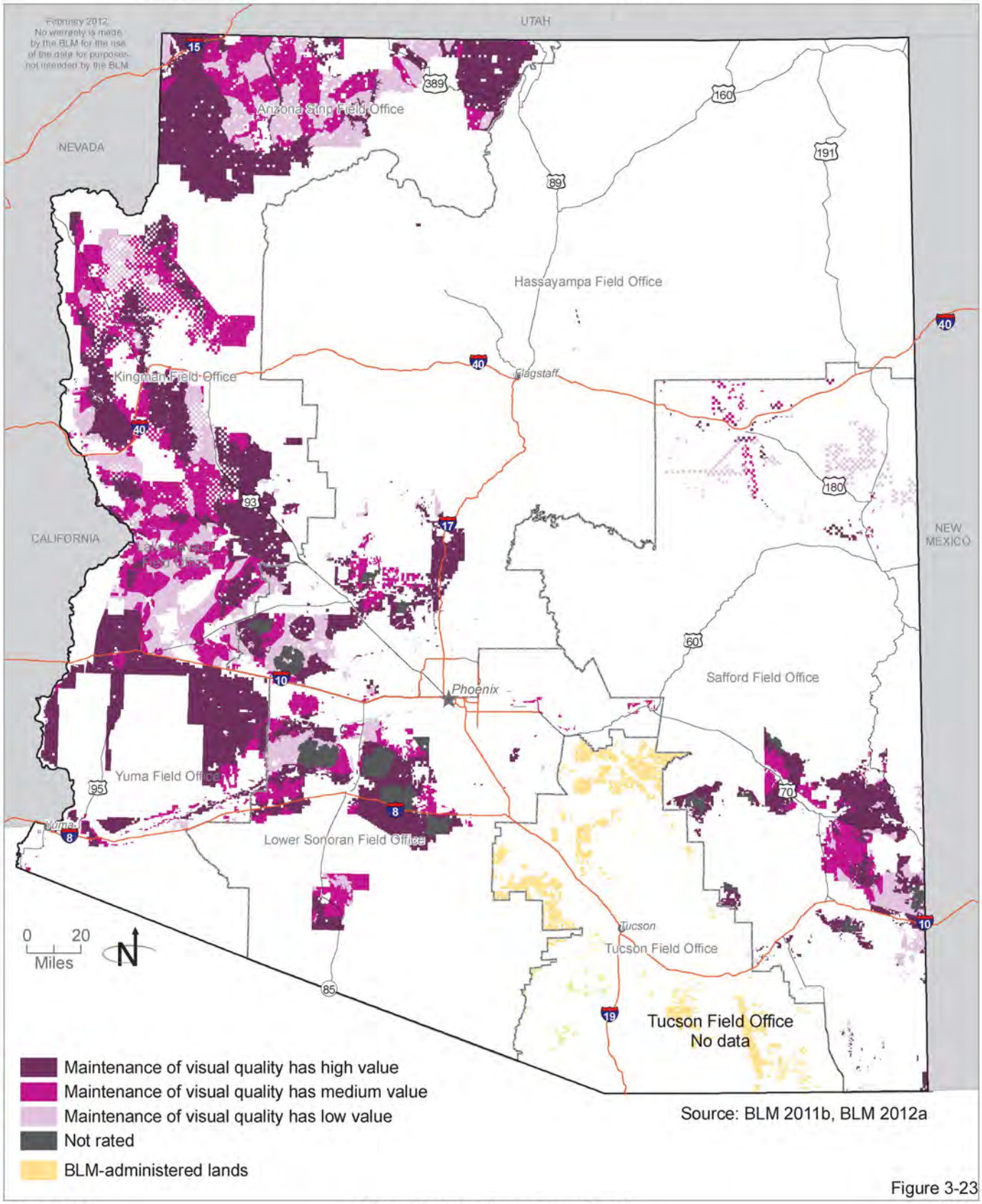


Figure 3-23

Visual Resource Distance Zones

Landscapes are divided into three distance zones: foreground, middleground, background, and seldom seen. The distance zones are based on relative visibility from travel routes or observation points. Details are more visible to the viewer in the foreground-middleground and are less visible in the seldom seen zone. Lands within the foreground/middleground may therefore be more sensitive to landscape changes.

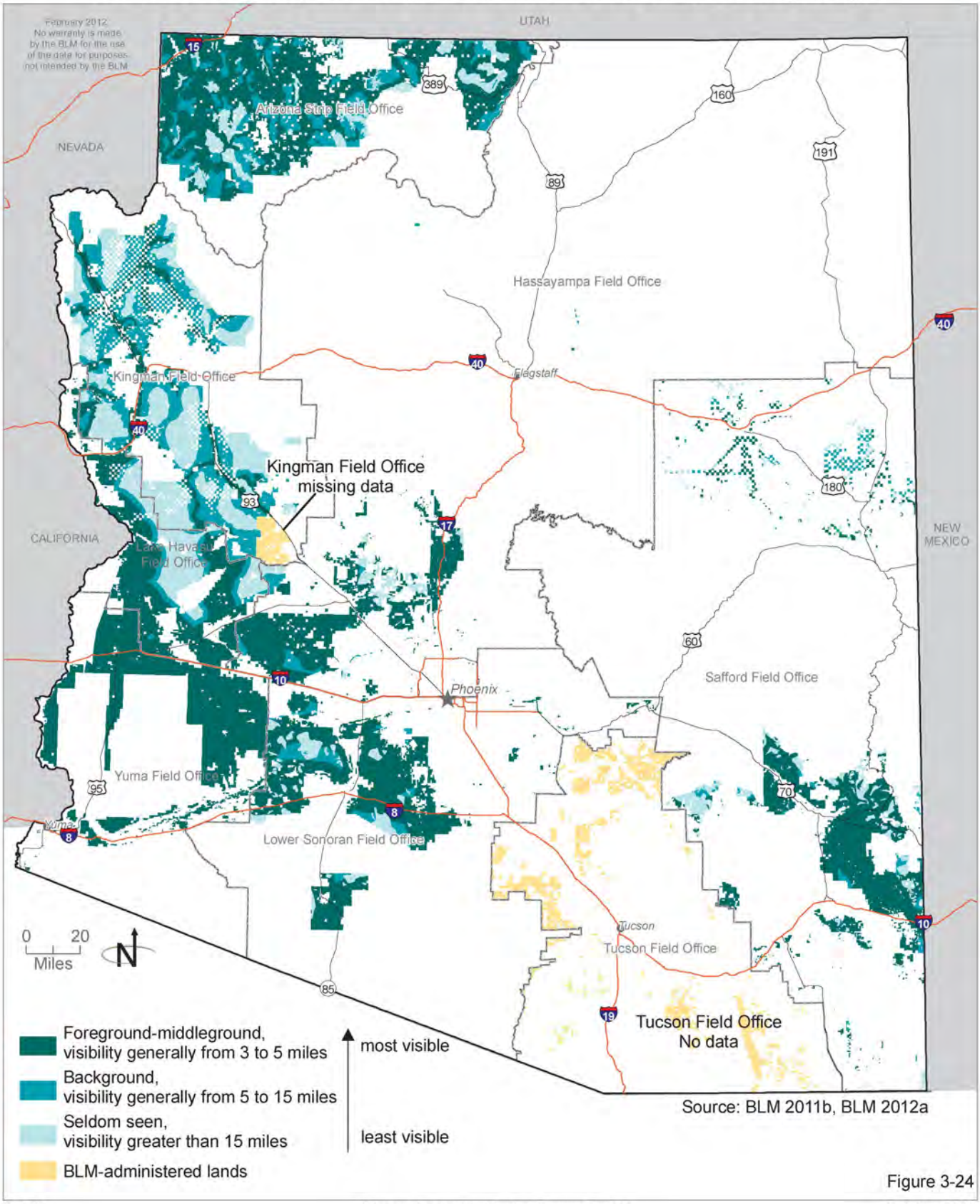
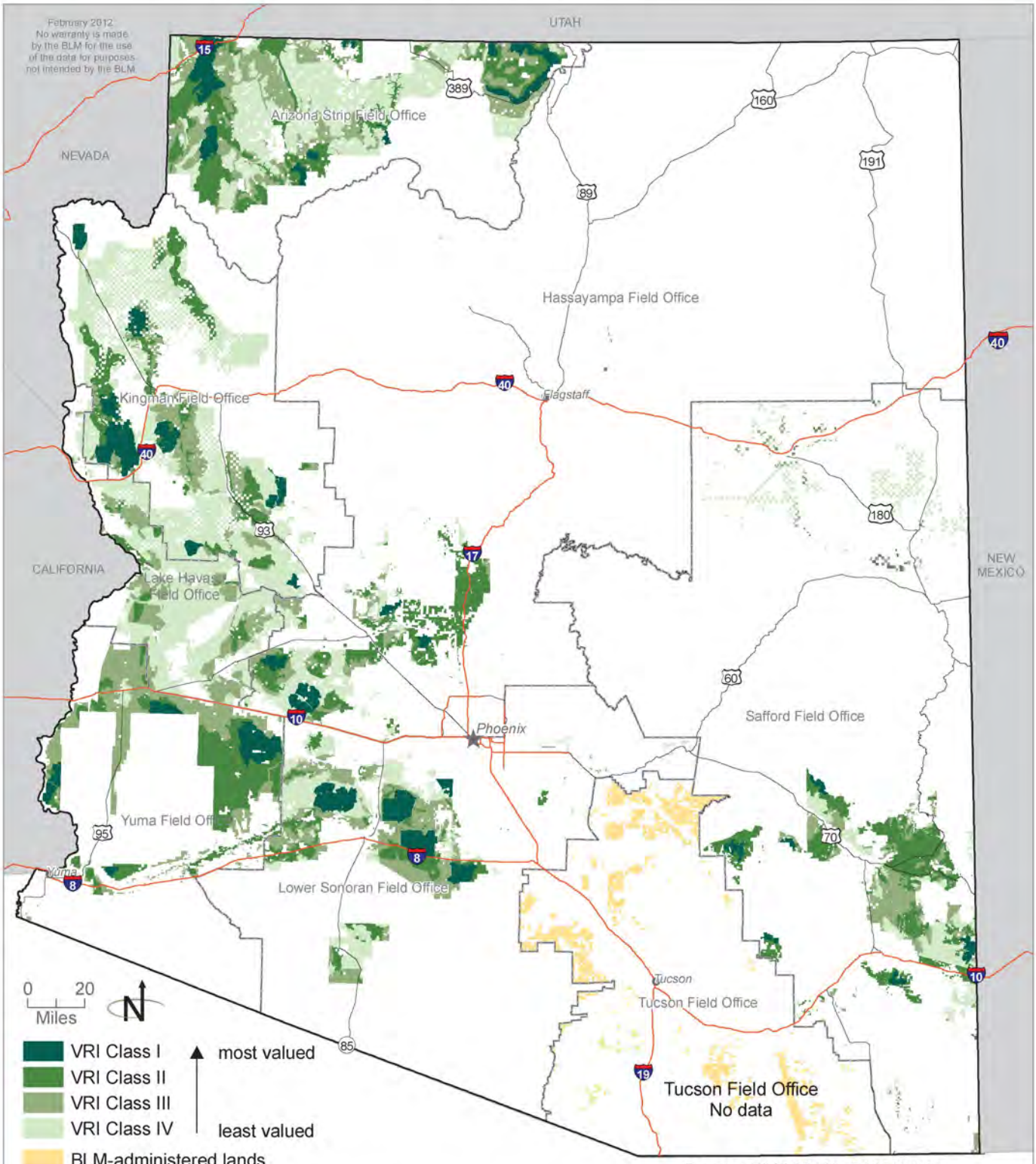


Figure 3-24

Visual Resource Inventory Class

Visual Resource Inventory Classes represent the relative value of the visual resources. Lands are placed into one of four classes based upon the results of visual resource contrast rating, sensitivity levels, and distance zones.



Source: BLM 2011b, BLM 2012a

VRI Class I is generally assigned to special areas such as national wilderness and other congressionally and administratively designated areas where decisions have been made to preserve a natural landscape.

Figure 3-25

Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

- Class IV. The objective of this class is to provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

The analysis stage (visual resource contrast rating) involves determining whether the potential visual impacts from proposed surface-disturbing activities or developments will meet the management objectives established for the area, or whether design adjustments will be required. A visual contrast rating process is used for this analysis, which involves comparing the project features with the major features in the existing landscape using the basic design elements of form, line, color, and texture. The analysis is also influenced by the number of and proximity of receptors sensitive to visual resources. This process is described in BLM Handbook H-8431-1, Visual Resource Contrast Rating (BLM 1986b). The analysis can then be used as a guide for resolving visual impacts.

3.22.1 RDEP Affected Environment

Figure 3-26, Visual Resource Management, and **Table 3-37**, Visual Resource Management, display the acres of each VRM Class on BLM-administered land in the planning area. Furthermore, approximately 1,650 acres in 8 nominated sites are managed as VRM Class II, and approximately 20,850 acres in 21 nominated sites are managed as VRM Class III.

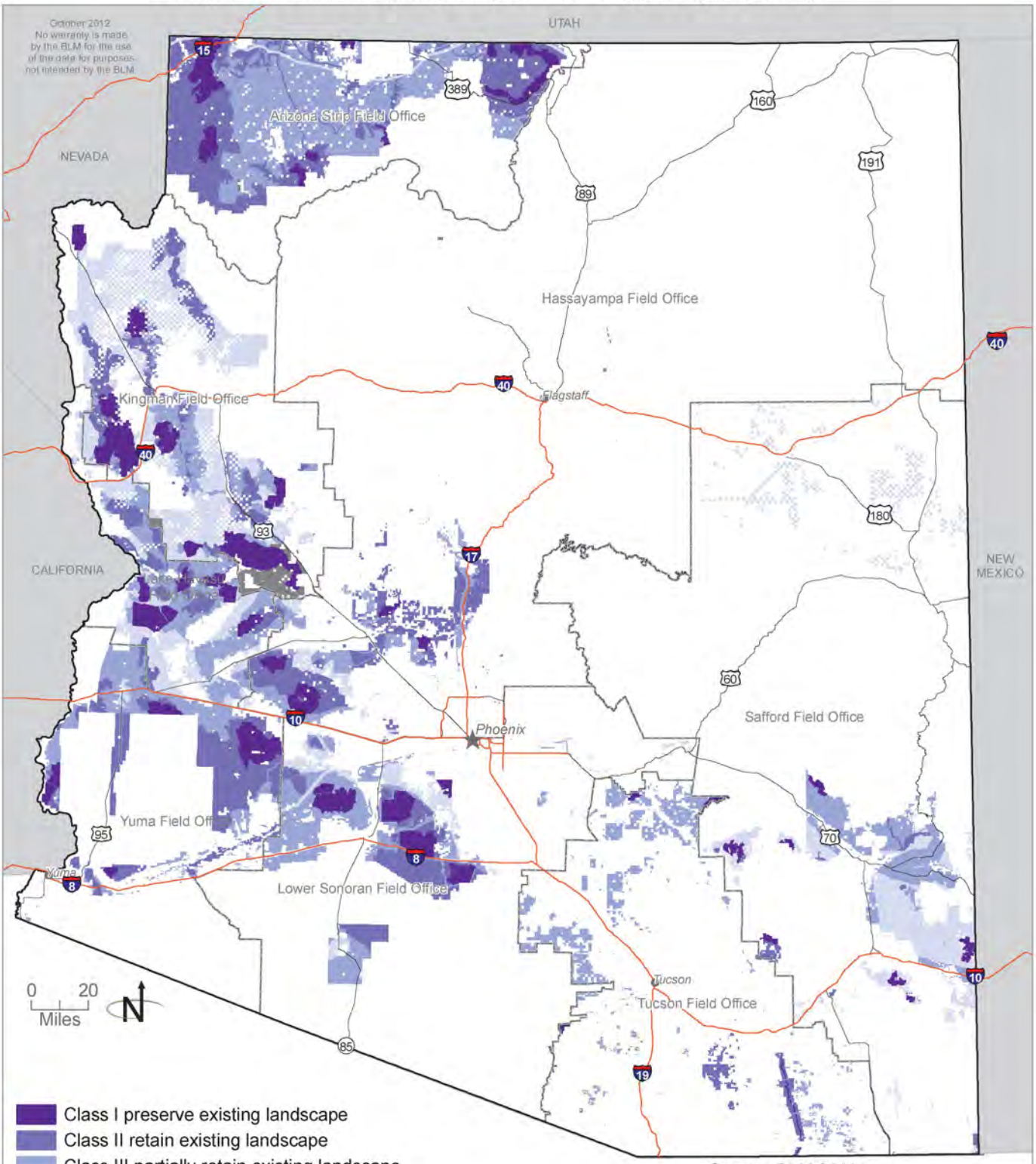
Table 3-37
Visual Resource Management

Class	Acres	Percentage of BLM-administered Lands
I	1,496,100	12%
II	3,323,100	27%
III	4,473,500	37%
IV	2,848,000	23%
Undesignated or No Data	30,000	0%

Source: BLM 2011a

Visual Resource Management

Visual resources are defined as the visible physical features on a landscape (e.g., land, water, vegetation, animals, structures, and other features). A Visual Resource Inventory determines the quality of the visual resources and Visual Resource Management manages visual resources by categorizing them into management types (classes).



Source: BLM 2011a

Figure 3-26

3.22.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ study area inventoried at Class III. It has a scenic quality rating of B, a sensitivity rating of medium, and is located in the foreground/middleground distance zone. During the RMP phase, it was decided that the area would be managed as VRM Class III (see **Figure 3-27**, Visual Resources in Proposed Agua Caliente SEZ). The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

The area immediately adjacent to the proposed Agua Caliente SEZ is managed as VRM Class II. The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

3.23 WATER RESOURCES

The following section describes water resources in the planning area. The majority of Arizona lies within the Lower Colorado River hydrologic region, with the exception of a small portion of the northeast corner of the state, north of Lees Ferry, which falls within the Upper Colorado hydrologic region.

Major Laws and Regulations

The Clean Water Act (CWA) established the basic structure for regulating discharges of pollutants into waters of the U.S., including setting water quality standards for all contaminants in surface waters. Under Sections 301 and 402, the CWA prohibits the discharge of any pollutant from a point source into navigable waters of the U.S. without a National Pollutant Discharge Elimination System (NPDES) permit issued by EPA, a state, or, where authorized, a tribal government on an Indian reservation. Permits under Section 402 are generally issued by the state in which the discharge originates. For discharge of dredged or fill material into Waters of the U.S., including wetlands, a Section 404 permit from the U.S. Army Corps of Engineers (USACE) is required. Under Section 401, the CWA requires the state to issue water quality certifications for discharges of fill and dredged material to waters of the state, including wetlands, headwaters, and riparian areas.

Executive Order 11990, Protection of Wetlands directs federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial value of wetlands in carrying out programs affecting land use.

Visual Resources in Proposed Agua Caliente SEZ

The proposed Agua Caliente SEZ study area inventoried at Class III. It has a scenic quality rating of B, has a sensitivity rating of medium, and is located in the foreground/middleground distance zone. During RMP planning, it was decided that the area would be managed as VRM Class III.

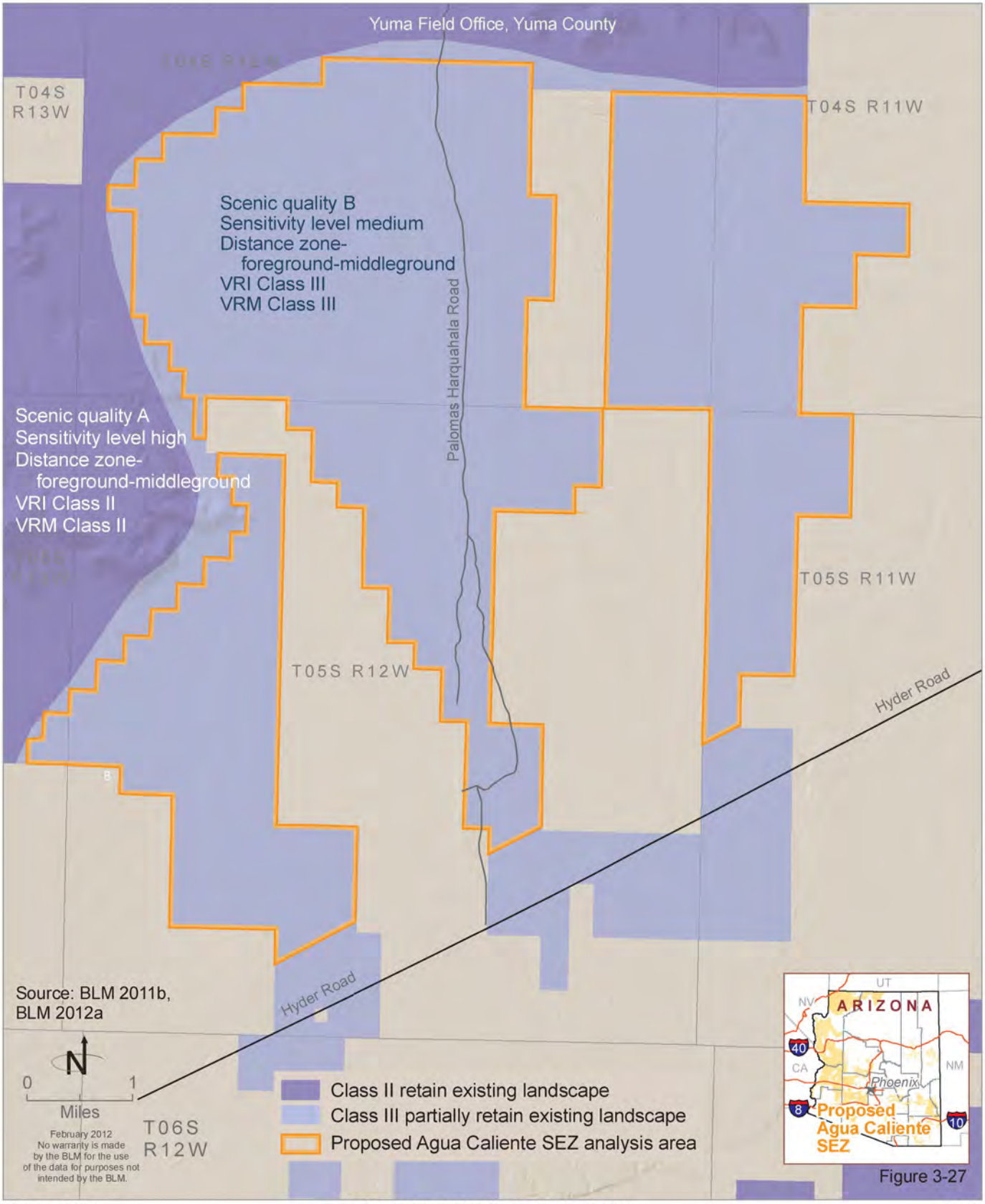


Figure 3-27

Executive Order 11988, Floodplain Management, as amended by Executive Order 12148, directs each federal agency to take action to avoid the long- and short-term adverse impacts associated with the occupancy and modification of floodplains. Agencies are further required to avoid direct or indirect support of floodplain development whenever there is a practicable alternative.

Under the Safe Drinking Water Act (SDWA), the EPA sets drinking water standards referred to as the National Primary Drinking Water Regulations, 40 CFR Part 141, and the National Secondary Drinking Water Regulations, 40 CFR Part 143. These regulations set maximum contaminant levels (MCLs) for substances in drinking water and apply to groundwater if the groundwater is a source of potable water. Groundwater rights may be subject to federal regulation where a hydrologic connection exists with a federal reserved water right.

3.23.1 RDEP Affected Environment

Surface Water

The Lower Colorado hydrologic region is comprised of the lower reaches of the Colorado River in the desert southwest of Arizona. The climate is arid, and precipitation is limited to the winter months and periods of heavy storms in the summer. Most precipitation during summer evaporates before it can infiltrate into the desert sands (BLM and Forest Service 2008).

Surface water flow in the arid basins of the Southwest is ephemeral to nonexistent most of the year. Spring snowmelt and periods of heavy winter rain result in surface water flow in the mountainous areas and along the intervening basins' mountain fronts. During the rest of the year, surface water flow is absent except after major storms, where flash floods are common along mountain fronts. Only major rivers draining the Colorado Plateau or the Mogollon Rim, such as the Gila, Salt, and Bill Williams Rivers, have perennial flow (BLM and Forest Service 2008).

Surface water resources that occur in the planning area include perennial, intermittent, and ephemeral streams; human created reservoirs; wetlands; and broad ephemeral washes. Surface water resources are shown on **Figure 3-28**, Surface Waters.

Wetlands are often associated with perennial water sources such as springs, perennial segments of streams, lakes, or ponds. Wetlands are considered a valuable ecological resource because of their important roles in providing fish and wildlife habitat, maintaining water quality, and controlling floods. Total wetland area present based on estimates from 1980 is 600,000 acres in Arizona, accounting for 0.8 percent of the state's surface area. As throughout the U.S., wetlands in the western states have experienced a major decline in abundance because of human disturbance; however, data show a recent net gain in wetland acreage (BLM and Forest Service 2008). Wetlands occur in the planning area.

Surface Waters

Surface waters in Arizona include perennial, intermittent, and ephemeral streams, human-created reservoirs, wetlands, and broad ephemeral washes.

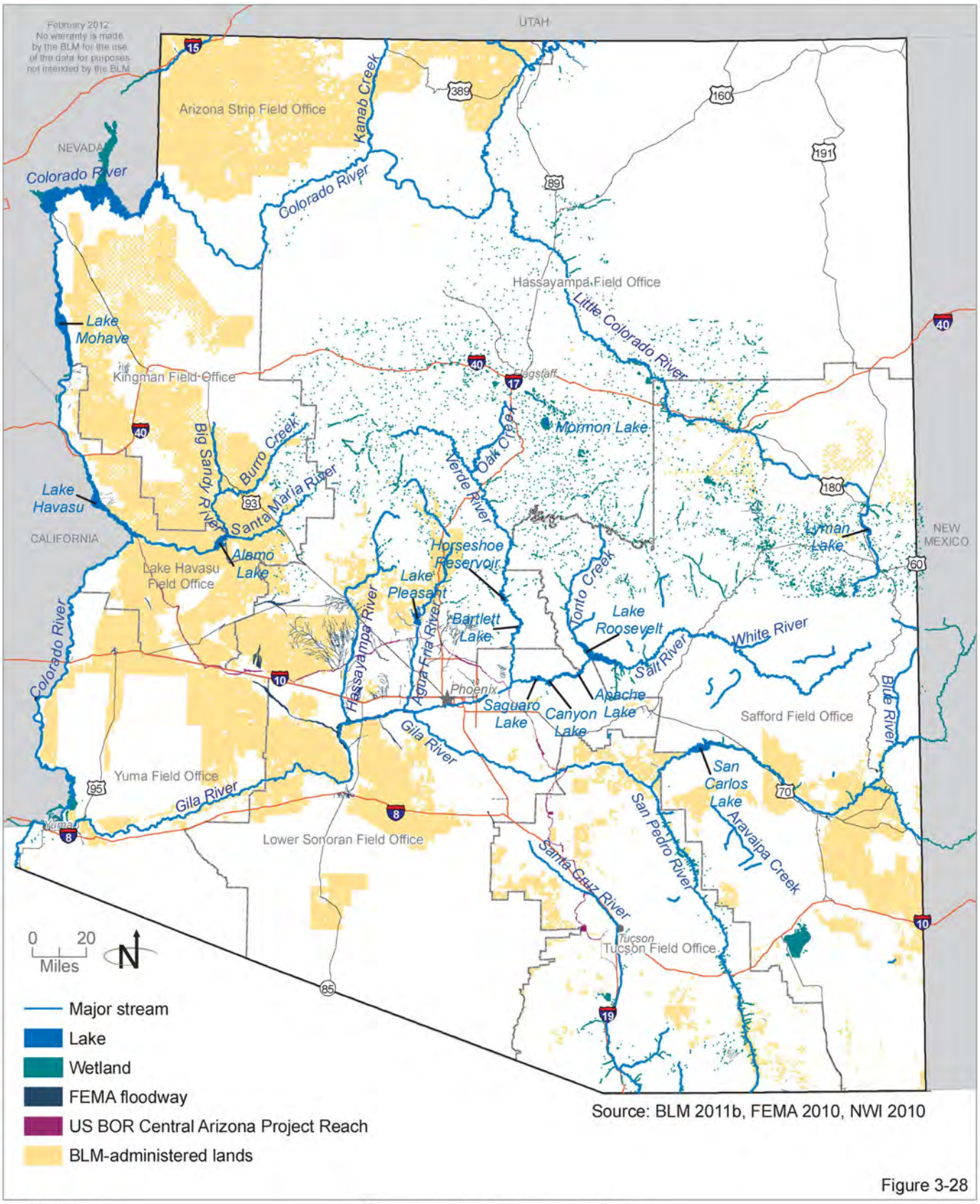


Figure 3-28

BLM Priority Watersheds

BLM Arizona developed a water strategy to identify risks to water quality, water quantity, groundwater-dependent ecosystems, and riparian areas for maintaining properly functioning watershed conditions. These risks contribute to declines in the ability to sustain the living rivers in Arizona.

BLM Arizona conducted a statewide assessment using interagency data and expertise to identify priority streams based on trends, including water quality, water quantity, anthropogenic threats, and condition of water-dependent resources such as riparian wildlife and aquatic species. Based on this assessment, the BLM Arizona water strategy established ten priority watersheds on BLM-administered lands (BLM 2011g). The priority watersheds, shown on **Figure 3-29**, Priority Watersheds, Sole Source Aquifers, and Irrigation Non-expansion Areas, include the Upper San Pedro, Bill Williams, Lower San Pedro, Agua Fria, Lower Colorado, Upper Gila, Big Sandy, Hassayampa, Santa Maria, and Kanab watersheds.

The priority watershed program is an effort by the BLM to provide leadership to engage local watershed organizations, communities, conservation interests and natural resource agencies to ensure active development and implementation of protection and restoration efforts for priority watersheds (BLM 2011i).

Groundwater

Groundwater is recharged by precipitation in the mountains and infiltration of streamflow along the base of the mountains. Groundwater aquifers are used extensively for irrigation and domestic consumption. Cultural uses (agriculture, industry, and municipal) have substantially lowered the water levels in the groundwater aquifers of the Arizona basins (BLM and Forest Service 2008).

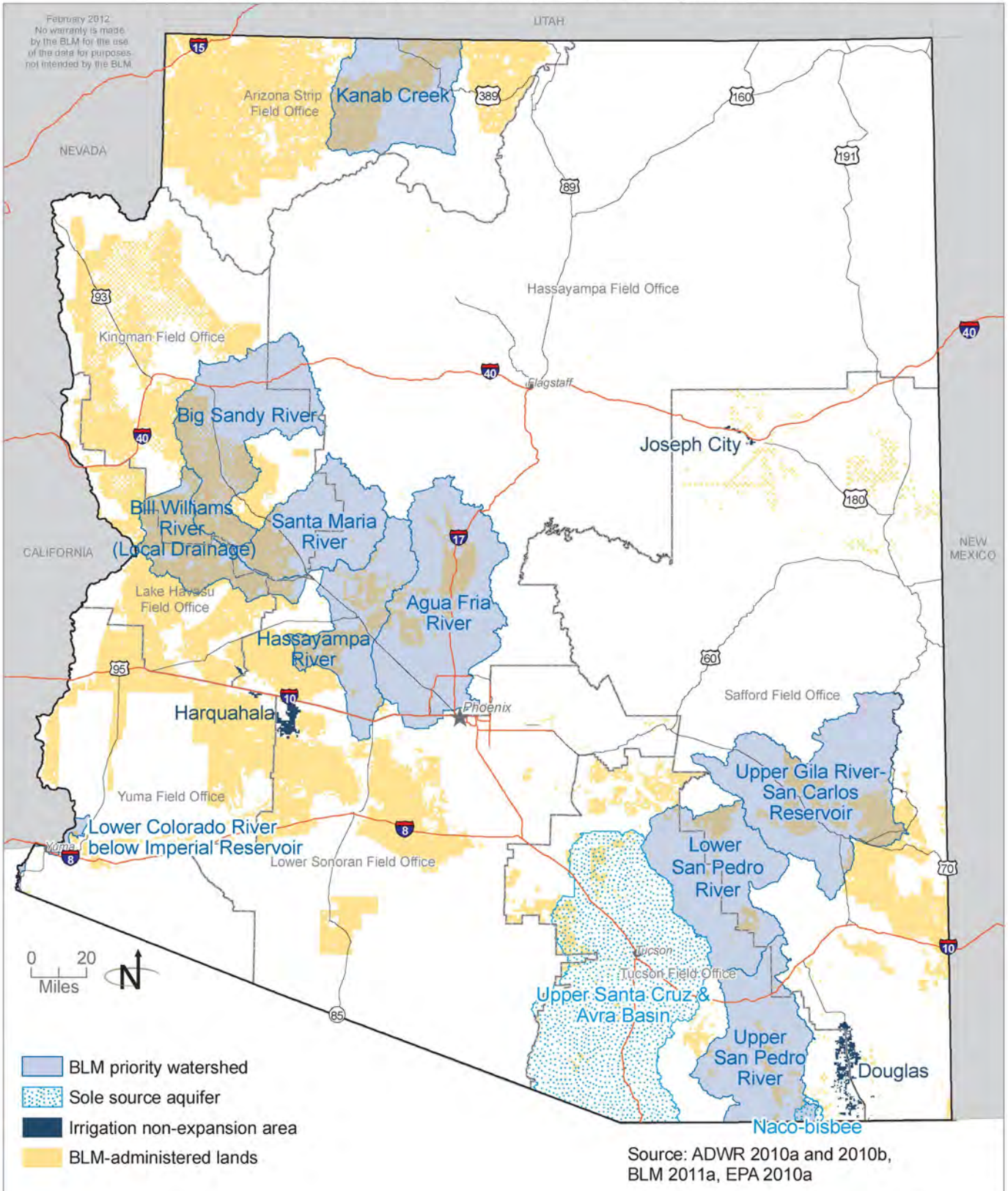
The water levels and direction of groundwater movement in a basin are determined by the geometry of the bedrock surrounding the basin and by the location and quantity of recharge and discharge within the basin. Although groundwater flows through the basin-fill aquifers from areas of recharge to areas of discharge, the complex and partly interconnected network of aquifers in the basins causes groundwater to flow in many different directions, and the hydrology of each basin is unique (USGS 1995).

Groundwater Basins

A majority of Arizona is within the Basin and Range aquifers, which occupy approximately 200,000 square miles of the southwestern U.S. and underlie most of Nevada, southeastern California, southeastern Oregon, southeastern Idaho, western Utah, southeastern Arizona, and southwestern New Mexico (USGS 1995).

Priority Watersheds, Sole Source Aquifers, and Irrigation Non-Expansion Areas

The Arizona BLM Water Strategy established 10 priority watersheds that are at risk. A sole source aquifer supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. Irrigation non-expansion areas have restrictions on increasing the number of irrigated acres in the area.



Source: ADWR 2010a and 2010b, BLM 2011a, EPA 2010a

Figure 3-29

Arizona is organized into 7 planning areas containing 51 groundwater basins (**Figure 3-30**, Arizona DWR Planning Areas and Groundwater Basins). The planning areas and the groundwater basins within those planning areas are as follows:

- Active Management Areas (AMAs): Phoenix, Pinal, Prescott, Santa Cruz, and Tucson AMAs;
- Central Highlands: Agua Fria, Salt River, Tonto Creek, Upper Hassayampa, and Verde River;
- Eastern Plateau: Little Colorado River;
- Lower Colorado River: Butler Valley, Gila Bend, Harquahala, Lower Gila, McMullen Valley, Parker, Ranegras Plain, San Simon Wash, Tiger Wash, Western Mexican Drainage, and Yuma;
- Southeastern Arizona: Aravaipa Canyon, Bonita Creek, Cienega Creek, Donnelly Wash, Douglas Basin, Dripping Springs Wash, Duncan Valley, Lower San Pedro, Morenci, Safford, San Bernardino Valley, San Rafael, Upper San Pedro, and Wilcox;
- Upper Colorado River: Big Sandy, Bill Williams, Detrital Valley, Hualapai Valley, Lake Havasu, Lake Mojave, Meadview, Peach Springs, and Sacramento Valley;
- Western Plateau: Coconino Plateau, Grand Wash, Kanab Plateau, Paria, Shivwitz Plateau, and Virgin River.

Sole Source Aquifers

The EPA defines a sole or principal source aquifer as an aquifer that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. These areas may have no alternative drinking water source(s) that could physically, legally, and economically supply all those who depend on the aquifer for drinking water. For convenience, all designated sole or principal source aquifers are referred to as "sole source aquifers" (SSA) (EPA 2011f).

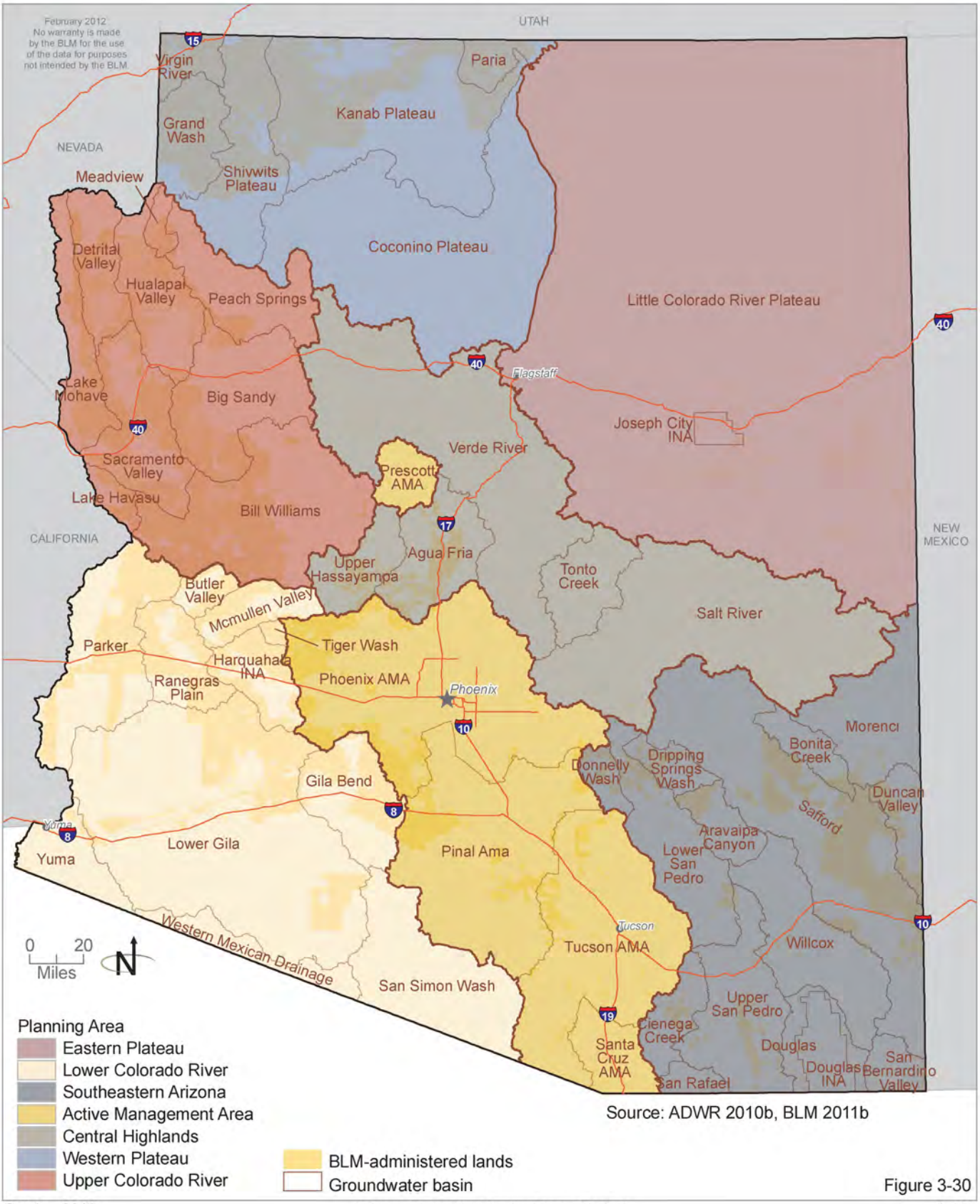
- There are two sole source aquifers in Arizona: the Upper Santa Cruz and Avra Basin, and the Bisbee-Naco Aquifer. The Upper Santa Cruz and Avra Basin was designated in 1984, and the Bisbee-Naco Aquifer was designated in 1988 (EPA 2011f). These two sole source aquifers are shown on **Figure 3-29**, Priority Watersheds, Sole Source Aquifers, and Irrigation Non-expansion Areas.

Active Management Areas

The 1980 Arizona Groundwater Management Code recognized the need to aggressively manage the state's finite groundwater resources to support the growing economy. Areas with heavy reliance on mined groundwater were identified and designated as AMAs. There are five AMAs: Prescott, Phoenix,

Arizona DWR Planning Areas and Groundwater Basins

Arizona is organized into seven water planning areas and 51 groundwater basins.



Source: ADWR 2010b, BLM 2011b

Figure 3-30

Pinal, Tucson, and Santa Cruz. These areas are subject to regulation pursuant to the Groundwater Code. Each AMA carries out its programs in a manner consistent with these goals, while considering and incorporating the unique character of each AMA and its water users (ADWR 2011). The five AMAs are located in the southern and central parts of Arizona and are shown on **Figure 3-31**, Active Management Areas.

In the Phoenix, Prescott, and Tucson AMAs, the primary management goal is safe-yield by the year 2025 by natural or artificial means. Safe-yield is accomplished when no more groundwater is being withdrawn than is being annually replaced.

In the Pinal AMA, where the economy is primarily agricultural, the management goal is to preserve that economy for as long as feasible, while considering the need to preserve groundwater for future non-irrigation uses.

In the Santa Cruz AMA, the management goal is to maintain a safe-yield condition in the AMA and to prevent local water tables from experiencing long-term declines (ADWR 2011).

Irrigation Non-Expansion Areas

The 1980 Arizona Groundwater Management Code initially established two Irrigation Non-expansion Areas (INA): Joseph City and Douglas. Since the law was passed, the Harquahala area has also been designated as an INA. When an area is designated as an INA, a restriction is placed on increasing the number of irrigated acres in the area (ADWR 2011). The INAs in Arizona are shown on **Figure 3-29**, Priority Watersheds, Sole Source Aquifers, and Irrigation Non-expansion Areas.

Groundwater Quality

The most common contaminants found in Arizona groundwater in concentrations above health-based drinking water standards are arsenic, fluoride, radioactive elements, and nitrate (Arizona Cooperative Extension 2009). Nitrate is one of the most common pollutants in Arizona's groundwater and is associated with both natural and human activities such as percolation of nitrate-laden water from irrigation, septic tanks, wastewater treatment plants, and concentrated feedlots (Rahman and Uhlman 2009).

In general, Arizona groundwater quality is influenced by the nature of the bedrock, elevated levels of total dissolved solids and salinity in alluvium or in areas with Late Tertiary sedimentary bedrock, and elevated metals in groundwater in mining areas. Good water quality occurs in deep, carbonate aquifers (BLM and DOE 2010).

Active Management Areas

Areas with heavy reliance on mined groundwater were identified and designated as Active Management Areas by the 1980 Arizona Groundwater Code and are subject to restrictions.

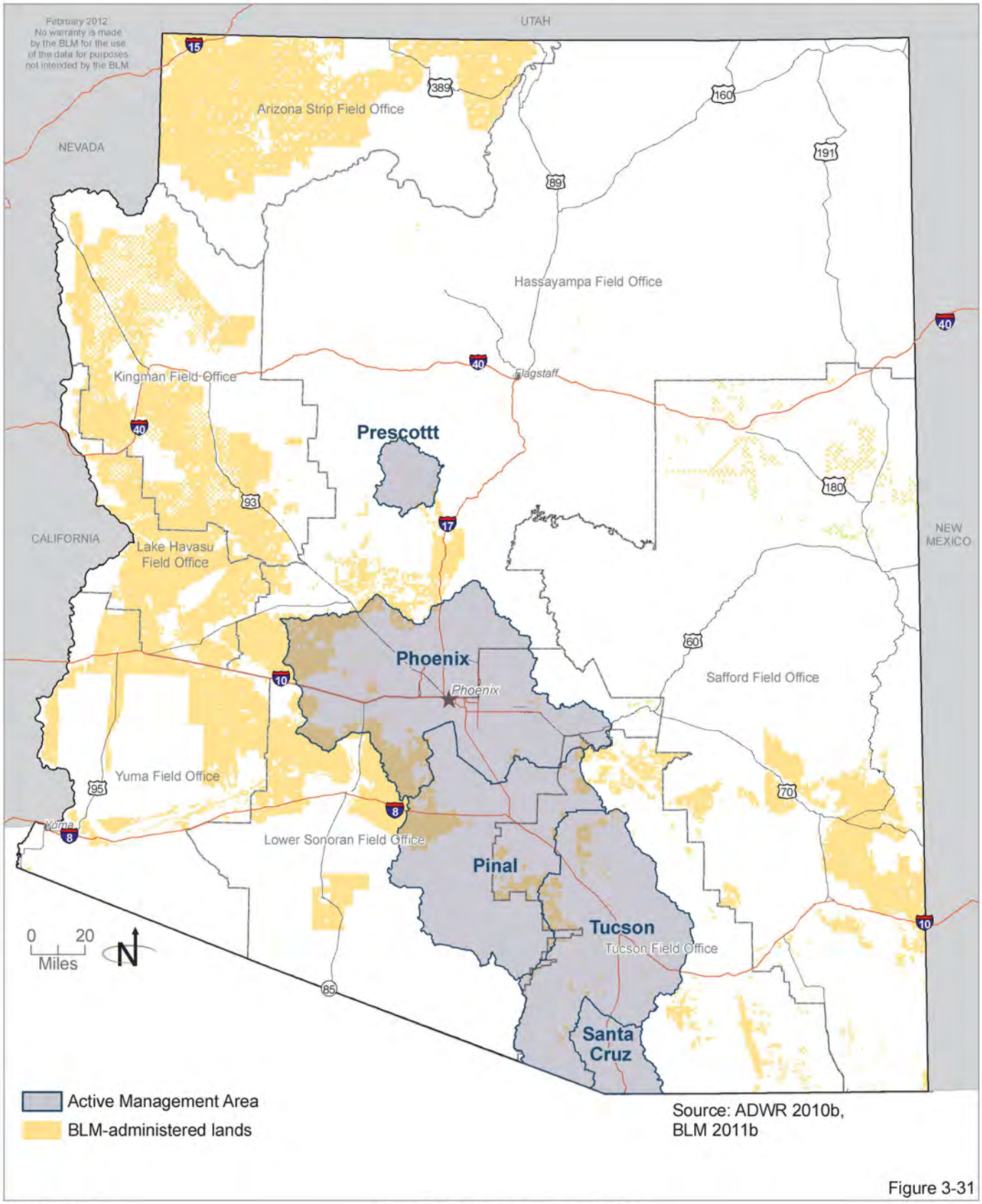


Figure 3-31

3.23.2 Agua Caliente Solar Energy Zone Affected Environment

The Agua Caliente SEZ is within the Basin and Range physiographic province. The hydrology within the proposed SEZ is complex and limited hydrologic information is available for the area. As a result, this section is limited to a general analysis of prominent surface and subsurface hydrology features and the influences of historic agricultural use on the area's surface and groundwater resources.

The proposed SEZ is situated on a south-facing hillslope landform atop alluvial fan features associated with the Palomas Mountains and Baragan Mountain. The proposed SEZ land surface includes a series of braided series of washes and channels created by ephemeral streams. Ephemeral surface water flows in a southerly direction through the washes and channels in the proposed SEZ and out the southern analysis boundary, eventually discharging to the Gila River.

Surface Water

The Agua Caliente SEZ has a network of braided channels and washes containing ephemeral streams that discharge into the nearby Gila River. There are three primary ephemeral surface water washes: Hoodoo Wash, Baragan Wash, and Clanton Wash. These washes cover 300 acres of the Agua Caliente SEZ. (See **Figure 3-9**, Important Resources in Proposed Agua Caliente SEZ). National Wetland Inventory maps do not identify mapped wetlands within the proposed SEZ analysis area. The analysis area may contain jurisdictional ephemeral waters of the US due to the drainage patterns observed on aerial photographs and area USGS topographic maps. Riparian areas, which are indicative of surface or near-surface water, cover 240 acres of the Agua Caliente SEZ and are located in each of the three major washes.

Surface water traveling through washes in the SEZ may also serve as an intermittent irrigation source for the 20 acres of agricultural land in the analysis area. However, these agricultural uses likely rely mostly on local groundwater supplies for irrigation.

The proposed Agua Caliente SEZ is outside all identified BLM priority watersheds (shown on **Figure 3-29**, Priority Watersheds, Sole Source Aquifers, and Irrigation Non-expansion Areas).

Groundwater

Based on the proposed SEZ analysis area's topography and aerial photographs, the direction of groundwater flow is to the south, towards the Gila River. The proposed SEZ analysis area is in the Lower Colorado Planning Area in the Lower Gila groundwater basin. Groundwater occurs in both recent stream alluvium and basin fill. Groundwater development in the eastern part of the Lower Gila Basin is in the broad alluvial plains that border the Gila River, where the main aquifer is the upper sandy unit in the basin fill. Groundwater is primarily unconfined.

Prior to development, groundwater flow was from north and southeast toward the Gila River and then downstream to the southwest. Historically, cones of depression occurred in irrigated areas north of Hyder, east of Dateland, and in the Palomas Plain west of Hyder. Infiltration of irrigation water in the western part of the basin has created groundwater mounds in the floodplain aquifer that also affect groundwater flow. Groundwater recharge is primarily from infiltration of runoff in washes and the Gila River floodplain, located in the western part of the basin. Underflow from the Painted Rock Dam on the eastern basin boundary, as well as releases from the dam during floods, also contributes to groundwater recharge.

Groundwater is likely the main source of irrigation water for the 20 acres of agricultural area found within the Agua Caliente SEZ. Agriculture land uses are more extensive along the Gila River to the south of the analysis area. Groundwater levels in the Gila River floodplain historically ranged from 10 to 20 feet below land surface. The streambed alluvium was the primary source of groundwater. As irrigation activity increased in the 1930s, groundwater levels declined and salinity increased.

Historic groundwater level declines were as much as 15 feet per year in irrigated areas north and west of Hyder and east of Dateland. Few water level change measurements are available for the period 1990-1991 to 2004-2005, but several measured wells in the western part of the basin show relatively stable water level conditions. A lack of groundwater data specific to the Agua Caliente SEZ analysis area prevents more specific analysis.

Groundwater quality varies in the eastern part of the basin, with elevated fluoride concentrations measured in a number of wells. In the western part of the basin, the quality of groundwater in the Gila River floodplain is unsuitable for most uses, with elevated total dissolved solids concentrations common, as well as fluoride and arsenic (ADWR 2009).

Water Rights and Supply

Potential water supply sources at the proposed Agua Caliente SEZ include surface water and groundwater. Renewable energy developers must apply for and obtain the appropriate state permits and approvals to pump groundwater or appropriate surface water. ADWR records indicate the existence of surface water rights in proximity to the Agua Caliente SEZ that are primarily for irrigation use. Other listed uses include domestic and stockwatering. There are also two inactive public drinking water supply wells located outside of the proposed SEZ (ADWR# 55-602947 and 55-602948). Any proposed groundwater wells or surface water diversions would be subject to review and approval by ADWR.

3.24 WILD HORSES AND BURROS

The Wild Free-Roaming Horses and Burros Act (United States Code, Title 16, Section 1331 et seq. [16 USC 1331 et seq.]) of 1971 gave the BLM and other federal land management agencies the responsibility to protect, manage, and control wild horses and burros.

The general management objectives for wild horses and burros are to 1) protect, maintain, and control viable, healthy herds with diverse age structures while retaining their free-roaming nature; 2) provide adequate habitat through the principles of multiple use and environmental protection; 3) maintain a thriving natural ecological balance with other resources; 4) provide opportunities for the public to view wild horses and burros; and 5) protect wild horses and burros from unauthorized capture, branding, harassment, or death.

The areas that were in use as habitat by wild horses or burros at the time the 1971 Wild Free-Roaming Horses and Burros Act was passed as known as herd areas (HAs). A subset of these areas have been determined suitable for long-term management of wild horses and burros and are known as herd management areas (HMAs). Horses and burros within HMAs are managed with the goal of maintaining a thriving natural ecological balance on public lands. Both HAs and HMAs can include private or state lands, but BLM has management authority only over public lands (BLM 2011e). HAs and HMAs in the planning area are shown on **Figure 3-32**, Wild Horse and Burros.

3.24.1 RDEP Affected Environment

In Arizona, the BLM manages two wild horse herds totaling approximately 430 head in the Cerbat Mountains (within Cerbat and Cibola-Trigo HMAs), located between Interstate-8 and Interstate-10, including Yuma Proving Ground north of the city of Yuma. In addition, the BLM manages around 2,800 head of wild burros roaming public lands in seven HMAs and three HAs. The appropriate management level (i.e., the maximum number of animals sustainable on a year-long basis) is, however, only 1,676 animals (BLM 2011e). **Table 3-38**, Wild Horse and Burro Statistics, shows the HAs, HMAs, and populations for wild horses and burros in the planning area.

Table 3-38
Wild Horse and Burro Statistics

Herd Area Acres (FY 2009)	
BLM	2,019,932
Herd Management Area Acres (FY 2009)	
BLM	1,756,086
Population (2011)	
Horses	434
Burros	2,761
Total	3,195
Total AML	1,676

Source: BLM 2010i, BLM 2011e

Wild Horse and Burros

Wild horse and burros are managed within herd management areas (HMAs) with the goal of maintaining the natural ecological balance of public lands as well as the ability to support multiple herds. HMAs can include private or state lands, but the BLM has management authority only over BLM-administered lands.

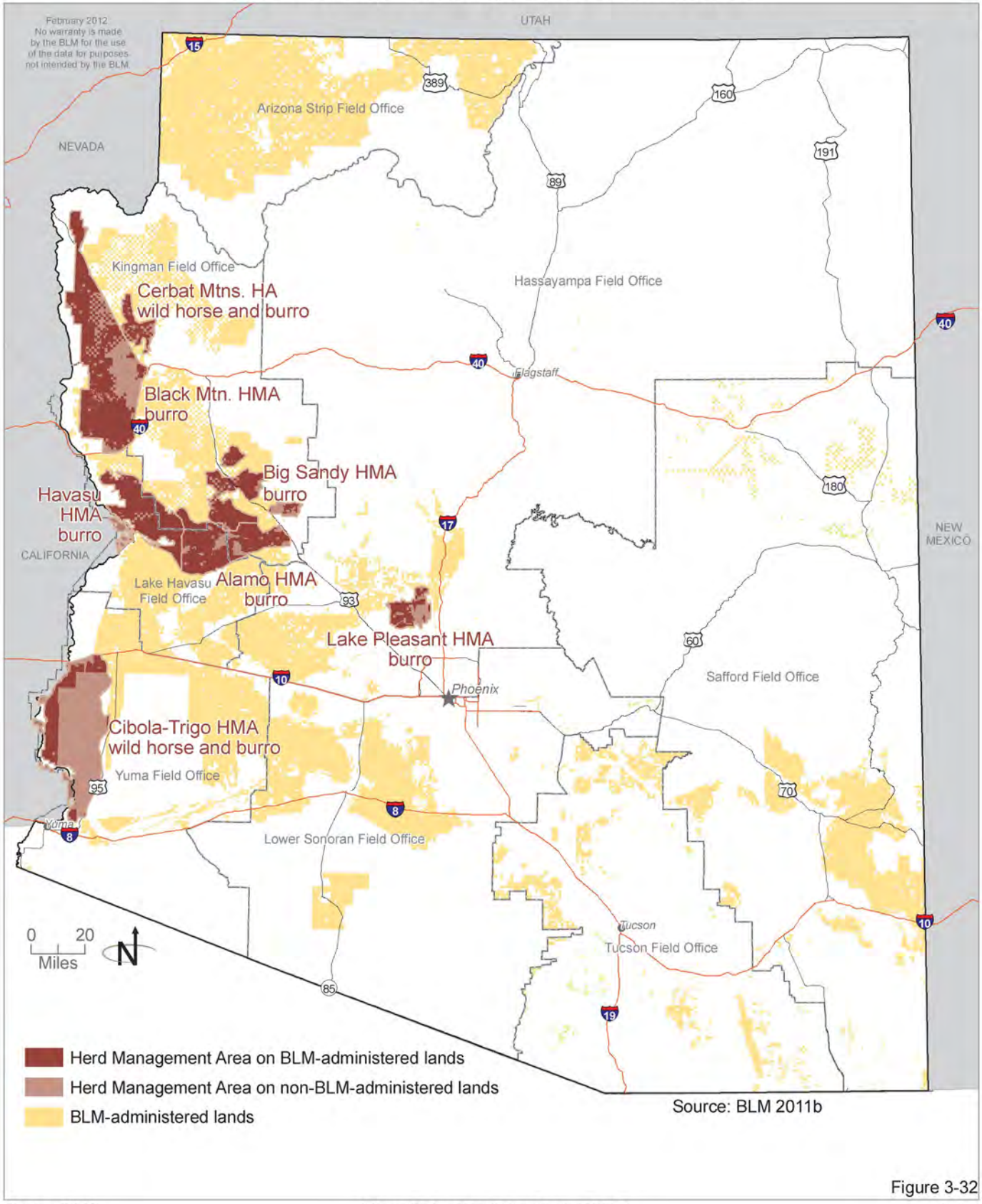


Figure 3-32

Due to a lack of predators, in the absence of management action, wild horse and burro populations will continue to increase in size (BLM 2011a). Data collected from Yuma, Arizona, however, indicates a lower rate of increase. The ecosystems of public rangelands are not able to withstand the impacts from overpopulated herds, which include soil erosion, sedimentation of streams, and damage to wildlife habitat.

As a result, the agency must remove animals from the range each year to short-term corrals, long-term pastures, and through the adoption program in order to control herd sizes. Additionally, the BLM is investigating the use of contraceptives and other population suppression techniques to control population sizes. Arizona, however, removes very few wild horses; only about 75 have been removed from the range in the last 10 years. The BLM is in the process of developing a comprehensive long-term plan and policy for management of wild horses and burros. The aim for this plan is to promote sustainable management of wild horse and burro populations (BLM 2010i).

3.24.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ is not within a current HMA or HA. Wild horses and burros would not be impacted by the proposed SEZ.

3.25 WILDERNESS CHARACTERISTICS

Section 201 of the FLPMA requires the BLM to maintain an inventory of BLM-administered lands that contain wilderness characteristics and to consider such information during land use planning. Through the RMP process, the BLM has discretion to determine which portions of BLM-administered lands with wilderness characteristics would be protected under special management. However, the BLM cannot manage these areas according to the nonimpairment standard described in BLM Manual 6330, Management of Wilderness Study Areas (BLM 2012f), which applies only to WSAs.

The process, outlined in BLM Manual 6310, Conducting Wilderness Characteristics Inventory on BLM Lands (BLM 2012e), entails the identification of wilderness inventory units, an inventory of roads and wilderness characteristics, and a determination of whether or not the area meets the overall criteria for wilderness character, including size, naturalness, outstanding opportunities for solitude or a primitive and unconfined type of recreation, and other supplemental values (e.g., ecological, geological, or other features of scientific, educational, scenic, or historical value). Citizens' wilderness proposals are evaluated and determinations of wilderness characteristics are made as part of the inventory process. Units found to possess such character are evaluated during the land use planning process to address future management. The BLM may decide to either protect the areas to maintain the wilderness characteristics or to consider the wilderness characteristics during implementation-level planning but not place primary management emphasis on their protection.

Wilderness characteristics inventories have been updated for the Arizona Strip District and the Hassayampa, Lake Havasu, Yuma, and Lower Sonoran Field Offices as part of recent RMP revision efforts. The Kingman, Safford, and Tucson Field Offices have not yet undergone RMP revisions. As such, the most recent field office-wide wilderness characteristics inventories for these field offices date back to 1980 when a BLM-wide inventory was performed. All areas identified as having wilderness characteristics during that inventory became WSAs. Subsequent legislation designated 47 Wilderness areas on BLM-administered land in Arizona and also released all but 2 WSAs from Wilderness consideration (PL 98-406 and PL 101-628).

Lands released from Wilderness consideration may still contain wilderness characteristics; the findings are reflected in the updated inventories for the Arizona Strip District and the Hassayampa, Lake Havasu, Yuma, and Lower Sonoran Field Offices. However, these lands may not have been reinventoried if they are within the Kingman, Safford, and Tucson Field Offices. These field offices will perform field office-wide inventory updates as part of future RMP revisions. Some wilderness characteristics inventories have been performed in the Kingman, Safford, and Tucson Field Offices in response to project proposals. Such inventories are localized to the project area.

Because of limited data for the Kingman, Safford, and Tucson Field Offices, the acres reported below and used in the impacts analysis are only for the Arizona Strip District and the Hassayampa, Lake Havasu, Yuma, and Lower Sonoran Field Offices. As the inventories are updated, RMPs will be amended accordingly.

3.25.1 RDEP Affected Environment

In the planning area, 1,8711,600 acres of BLM-administered land outside of existing Wilderness and WSAs have been inventoried and found to have wilderness characteristics. Of those, 623,600 acres are managed to maintain the wilderness characteristics (see **Figure 3-33**, Lands with Wilderness Characteristics).

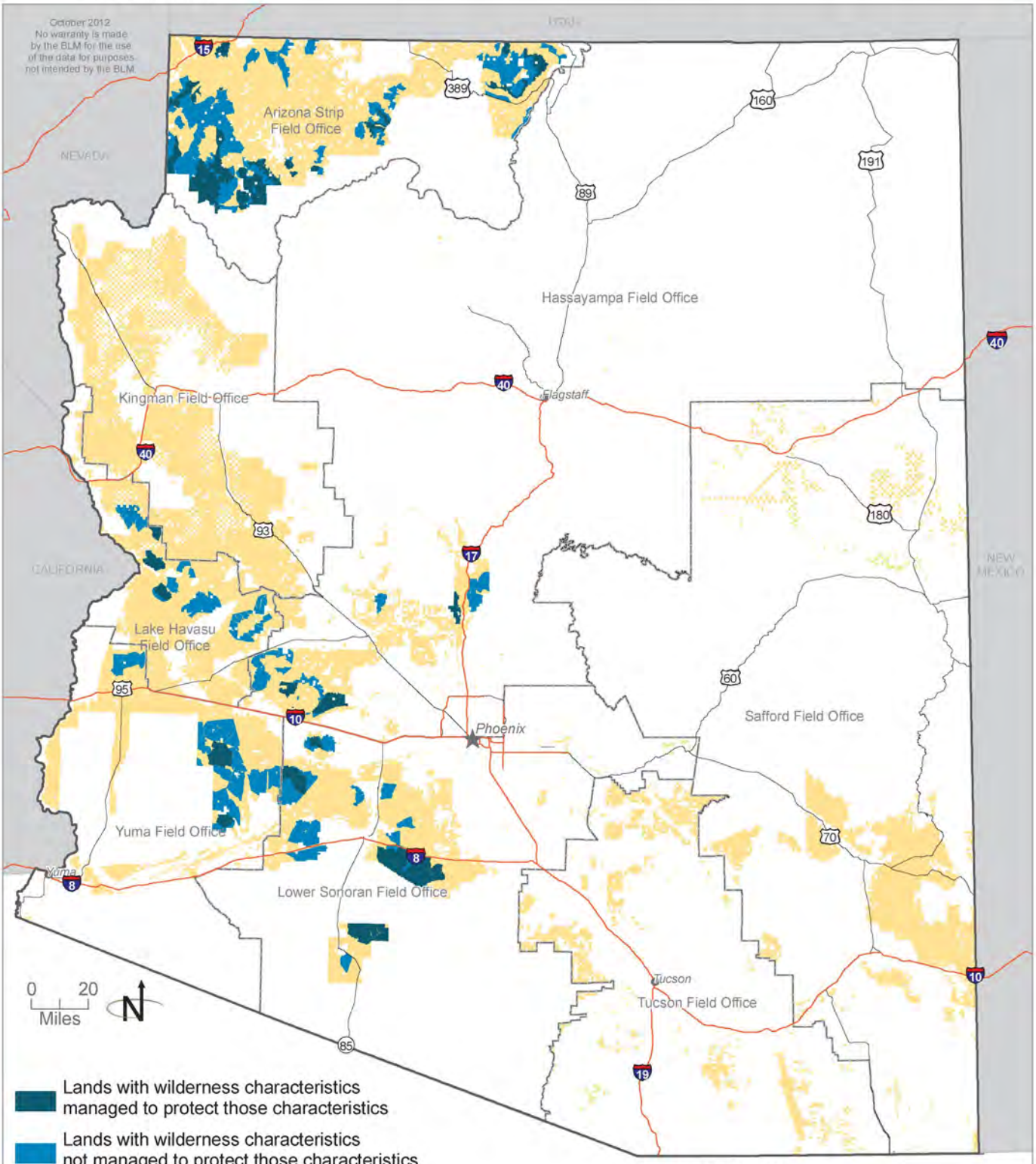
To date there are 2,240,600 acres of citizens' proposed wilderness for BLM-administered land in Arizona. Some of these lands include WSAs, ACECs, national monuments, and other special desgination areas. Of the citizens' proposed wilderness on BLM-administered land, 1,679,000 acres have been found to have wilderness characteristics, and 396,500 acres are managed to maintain those characteristics.

3.25.2 Agua Caliente Solar Energy Zone Affected Environment

There are 9,400 acres of lands that have been inventoried and found to have wilderness characteristics within the proposed Agua Caliente SEZ. This includes the citizens' proposed wilderness lands found to have wilderness characteristics during the inventory. None of the lands are managed for wilderness

Lands with Wilderness Characteristics

Lands with wilderness characteristics are lands outside of existing Wilderness and WSAs that have been inventoried by the BLM and found to contain wilderness characteristics. During the BLM RMP process, the BLM decided to maintain wilderness characteristics on some lands containing wilderness characteristics and not others.



Source: BLM 2011a

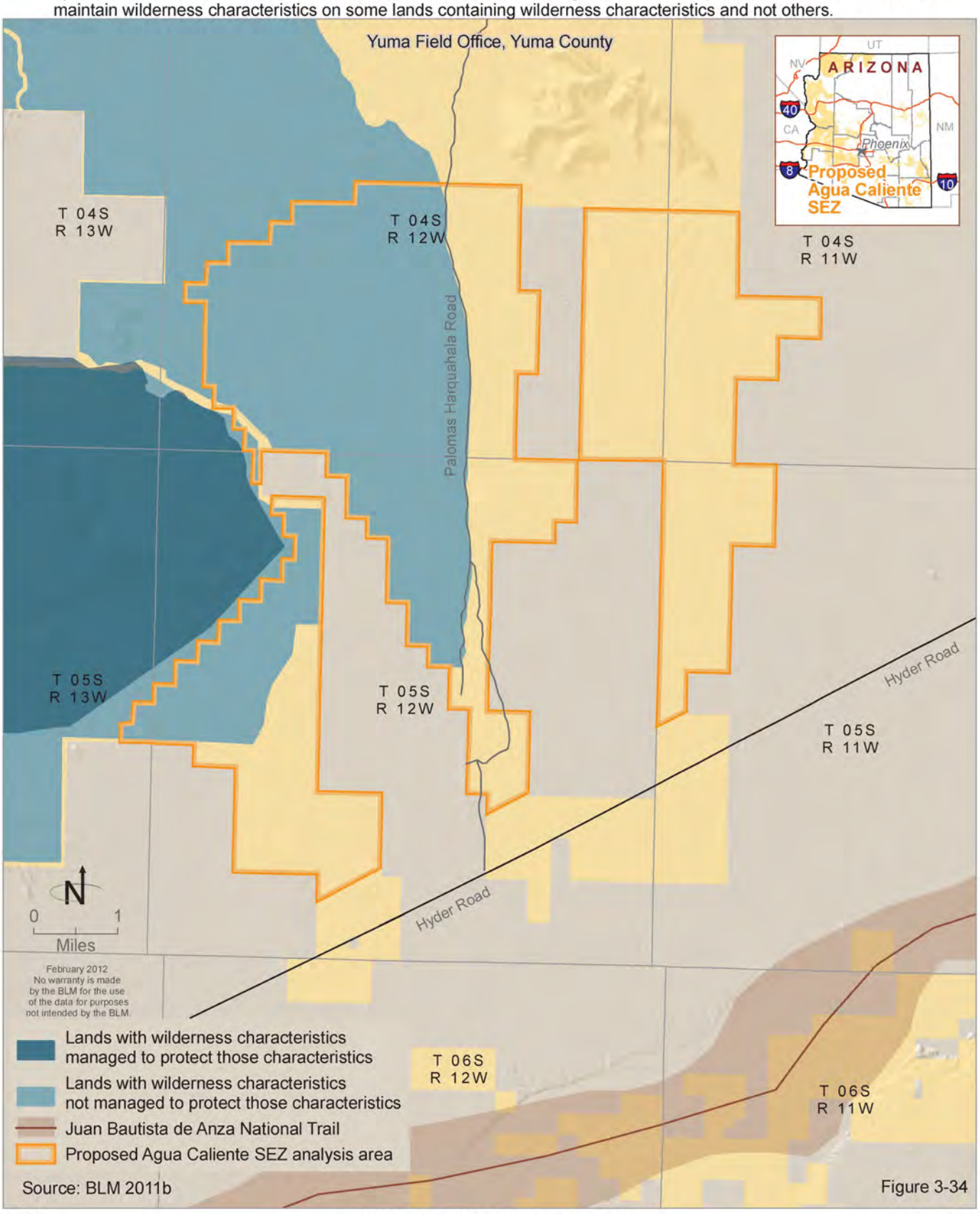
Figure 3-33

characteristics protection according to the Yuma Field Office RMP (see **Figure 3-34**, Lands with Wilderness Characteristics and the Juan Bautista de Anza National Historic Trail in Proposed Agua Caliente SEZ).

As described in **Section 3.8**, Lands and Realty, a county road, a large-capacity transmission line, and the Agua Caliente Solar Project are all visible from the lands with wilderness characteristics unit.

Lands with Wilderness Characteristics and the Juan Bautista de Anza National Trail in Proposed Agua Caliente SEZ

Lands with wilderness characteristics are lands outside of existing Wilderness and WSAs that have been inventoried by the BLM and found to contain wilderness characteristics. During the BLM RMP process, the BLM decided to maintain wilderness characteristics on some lands containing wilderness characteristics and not others.



Source: BLM 2011b

Figure 3-34