I-11 and Intermountain West Corridor Study

Existing and Natural Built Environment Technical Memorandum

Prepared for

Nevada DOT and ADOT

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Executive Summary

Summary of Key Findings

- The I-11 and Intermountain Corridor Study is following Arizona Department of Transportation and Nevada Department of Transportation Planning and Environmental Linkages processes to provide a foundational description of the environmental setting, helping to streamline the environmental review process once this project progresses into the National Environmental Policy Act phase.
- Opportunities and constraints have been identified at a macro scale to reflect geographic areas that are (and are not) conducive to large-scale infrastructure development and/or placement; these are mapped by project segment in this technical memorandum and will provide the foundation for the subsequent alternatives development phase of the project.
- Leading constraints are related to land ownership and management patterns, topography, balancing impact versus support to existing population centers, and habitat clusters/areas of critical environmental concern.

This technical memorandum contains a preliminary investigation of the environmental resources in the Interstate 11 (I-11) Corridor study area that could be affected by a high-capacity, north-south transportation improvement. Data were collected from various sources, including the Arizona Department of Transportation (ADOT), Nevada Department of Transportation (NDOT), Bureau of Land Management (BLM), the U.S. Fish and Wildlife Service, and Arizona Game and Fish Department. The purpose of this technical memorandum is to provide an overview of the existing natural and built environmental settings and characterize the potential resource impacts on a macro scale.

The study area includes the entire states of Arizona and Nevada. Detailed planning will occur in the three Priority Sections (Las Vegas metropolitan area through the greater Phoenix metropolitan area), with higher-level visioning for the potential extensions beyond the metropolitan areas (southern Arizona and northern Nevada).

Planning and Environmental Linkages Process

The Federal Highway Administration has recently issued new guidance to assist transportation planners and environmental practitioners in the use of corridor and subarea planning to inform the National Environmental Policy Act (NEPA) review process. While this study phase will not include detailed environmental documentation such as an environmental impact statement, the results of this “pre-NEPA” effort will follow the Planning and Environmental Linkages (PEL) process, which includes a description of the environmental setting and an understanding of the existing infrastructure to make corridor use as efficient as possible through innovative solutions. Using the PEL process will help streamline the entire environmental review process, allowing this study to provide the foundation and minimize the need for re-evaluation as the project progresses into the environmental phase.

ADOT and NDOT have both worked with Federal Highway Administration to adapt the federal guidance into state-led processes, which include checklists to be completed throughout a study’s process. The PEL processes of the two states are similar and will be carried forth throughout this study to identify important issues early so that agencies, stakeholders, and the public can make informed and timely decisions.

This review of the existing environment is intended to be preliminary. Its intent is to identify fatal flaws and issues that will need to be considered as the project moves into the alternatives analysis phase. While this review supports both the ADOT and NDOT PEL processes, the full analysis of environmental impacts of project

implementation, pursuant to NEPA, has yet to begin. The intent of this PEL-supported work will assist in the scoping of that NEPA analysis.

Overview of Environmental Features

As part of the technical analysis conducted for this effort, several related studies and plans were reviewed to understand external planning implications to the I-11 Corridor study area. Full study summaries are in Appendix A of the I-11 and Intermountain West Corridor Study Corridor Justification Report. Summaries of the technical topic areas reviewed for the analysis of the existing natural and built environment that present issues and/or opportunities for corridor development follow. This technical memorandum contains detailed evaluations of analysis topics, including a discussion of other planning initiatives that were considered in the analysis of the natural and built environments but that do not necessarily relate geographically, or have minor implications to the corridor study effort (for example, broadband infrastructure, BLM land management planning, and renewable energy planning).

Natural Environmental Features

The analysis of natural environment features included a review of areas of critical environmental concern (ACECs), wilderness areas, national monuments, National Conservation Areas (NCAs), critical habitats, and other land management categories (for example, wildlife refuge areas).

- **ACECs:** Typically identified by the BLM in the agency's Resource Management Plans. ACEC designations highlight areas where special management attention is needed to protect resources and to prevent irreparable damage to important historic, cultural, and scenic values, fish or wildlife resources, or other natural systems or processes; or to protect human life and safety from natural hazards. The ACEC designation indicates that BLM recognizes that an area has significant value and has established special management measures to protect those values.
- **Wilderness Areas:** Activity on wilderness areas is coordinated by the National Wilderness Preservation System. Wilderness areas are managed by four federal land management agencies: the National Park Service, U.S. Forest Service, U.S. Fish and Wildlife Service, and BLM. The Wilderness Act of 1964 defines a wilderness area as "an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions."
- **NCAs and National Monuments:** NCAs are designated by Congress to conserve, protect, enhance, and manage public lands for the benefit and enjoyment of present and future generations. The Antiquities Act of 1906 grants the president authority to designate national monuments in order to protect "objects of historic or scientific interest." While most national monuments are established by the president, Congress has also occasionally established national monuments protecting natural or historic features. All national monuments are categorized as NCAs, but not all NCAs have national monument designations.
- **Critical Habitats:** Critical habitats are considered essential for the conservation of a listed species. Locations of critical habitat species have been inventoried and reported. In Arizona, the Arizona Game and Fish Department conducted a thorough critical habitat analysis through their HabiMap™ tool, which prioritizes conservation areas.
- **Other:** Throughout the I-11 Corridor, other natural environmental opportunities and constraints have been identified as appropriate, such as other federally or locally protected lands.

Topographic Features

Study area maps were created to illustrate steepness of slope along the I-11 Corridor. Generally, slopes greater than 12 percent are not conducive to the development of roads or other major infrastructure projects; this will be

a defining feature in understanding natural constraints, which range from relatively flat desert lands to more dominant mountain ranges, through the two-state area.

Major Drainage Features

Drainage features reviewed include major areas of surface water, rivers, reservoirs, wetlands, riparian areas, and Federal Emergency Management Agency flood hazard zones. While all of these features can be constraining factors to corridor development, many can be mitigated or accommodated (for example, bridge crossings), although they must be considered at the outset to understand any indirect impacts (for example, impact to habitat areas).

Major Land Ownership

Both Arizona and Nevada have varied land ownership patterns, with large portions of both states under federal and tribal ownership. These areas include 38 recognized Indian communities, 10 military installations, 41 national parks and forests, and 18 national wildlife refuges. In both states, private land is outnumbered by the percentage of federal land holdings. Arizona and Nevada both have portions of land under state control (Arizona State Land Department and Nevada Division of Lands), which both serve "real estate" purposes, but in different manners and supporting different beneficiaries. Table ES-1 shows the percentage of land in each state that belongs to each major landowner/management category.

TABLE ES-1
Land Ownership and Management

Land Management Category	Percentage Area	
	Arizona	Nevada
Bureau of Land Management	16.8	66.9
Bureau of Reclamation	0.1	0.6
Tribal Land	27.5	1.5
National Park Service	3.5	1.1
Local or State Parks	0.3	0.0
Military	3.8	6.0
Private	17.5	13.4
State Land	12.7	0.3
U.S. Fish and Wildlife	2.4	2.0
U.S. Forest Service	15.3	8.1
Total	**100.0**	**100.0**

Source: BLM 2012a

Utility and Energy

The U.S. Energy Information Administration maintains a comprehensive inventory of major utility features across the country, including electric transmission lines, interstate natural gas pipelines, and solar, coal, and natural gas power plants. These features were mapped for both states to understand where other major infrastructure corridors are located and to understand the possibilities of implementing shared corridors in the future. Based on stakeholder coordination activities, the potential for shared rights-of-way (and therefore, possible expedited environmental clearance processes) exists, and long-term flexibility for a common corridor is desired; however, this would likely be in response to a decision on the I-11 Corridor alignment because no long-range utility or energy expansion plans are within the Corridor.

Despite the lack of a long-range plan, both Arizona and Nevada rank high in terms of solar energy potential. The National Renewable Energy Laboratory ranks areas based on a range of low to high solar energy potential,

measured in the amount of solar radiation (kilowatt hours per square meter per day) that will fall on a solar array, on average, every day. Most of the study area falls within a very high solar potential range. This, combined with Arizona regulations that require electrical utilities to obtain 15 percent of their retail generated energy from renewable resources by 2025 (Arizona Corporation Commission 2006), Nevada to obtain 25 percent of its energy from renewable resources by 2025, with 6 percent to come from solar energy by 2016 (Natural Resources Defense Council 2013), and California to obtain 33 percent of its energy from renewable resources by 2020 (State of California 2011), could set the stage for increased commercial solar plant investments, and therefore transmission needs, in both states.

Opportunities and Constraints Analysis

Using the data and information acquired to conduct an analysis of the natural and built environment, maps were developed to illustrate constraint and opportunity areas for Corridor development. Figure ES-1 through ES-5 (at the end of this executive summary) show these areas, divided by segments for ease of reference. The blue areas on these maps show constraint areas, or portions of the environment that are generally not conducive to placement of or implementation of an I-11 Corridor. While this analysis presents these constraints on a macro scale, all areas shaded in blue on the maps do not necessarily reflect fatal flaws. Some contributing factors may be accommodated or mitigated as Corridor refinement evolves.

At a high level, the blue constraint areas reflect the following features:

- ACECs
- Wilderness areas
- National monuments
- NCAs
- Critical habitats
- Slopes in excess of 12 percent
- Rivers/scenic rivers
- Federal Emergency Management Agency 100-year flood zone
- Surface water
- Riparian areas
- Wetlands
- Tribal lands
- Military installations
- Local/state parks, National Park Service, U.S. Forest Service, U.S. Fish and Wildlife Service/national wildlife refuges

The white areas on the maps reflect opportunity areas for corridor development. Ranges of population densities are also shown. These areas represent developed communities with a population density threshold of more than 100 persons per square mile and all fall within the white opportunity areas. These areas are shown for reference purposes to understand where population clusters reside and, therefore, to understand the nodes or activity centers that people may be traveling between.

Additional opportunities exist to consider in corridor alignment planning; however, these are not necessarily geographic in nature and are therefore translational to the abovementioned maps. These considerations include:

- Potential shared corridors for broadband infrastructure deployment
- Coordination with BLM land management planning to better serve recreational areas and/or align with their travel management plans
- High potential for commercial-scale renewable energy generation throughout the study area (especially solar), which requires transport options for energy transmission, as well as facilitates industrial growth

- Potential for shared rights-of-way for other utility transmission

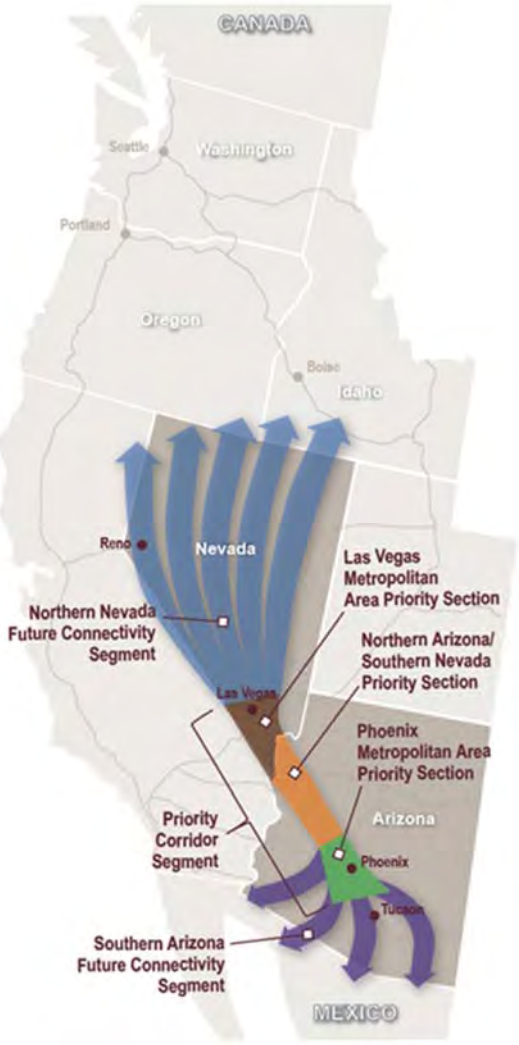
The sections below summarize the most prominent constraint elements for each study area segment (Figure ES-6).

Southern Arizona Future Connectivity Segment

The Southern Arizona Future Connectivity Segment includes the entire southern Arizona border with Mexico. Although the map includes portions of the Phoenix metropolitan area, the focus of this study portion spans from the international border to just north of the intersection of I-8 and I-10 (near Casa Grande). The breadth of the future connectivity study segment allows higher-level visioning for this potential extension south of the Phoenix metropolitan area.

Land ownership patterns are the leading constraint elements in this section (Figure ES-1). Much of the Southern Arizona Future Connectivity Segment is comprised of military and tribal lands, as well as state/local parks, national wildlife refuges, wilderness areas, national monuments, and forest lands. Compared to other parts of the state, very little private and State Trust land exists in this area, with the exception of areas along Interstate highways and within population clusters (for example, Yuma and Tucson). Several rivers with 100-year flood zone envelopes, including the Gila and Santa Cruz, flow through the segment. The Juan Bautista de Anza historic trail traverses the segment, generally following those two rivers. From an opportunity standpoint, this portion of the state is relatively flat, hosting much open desert and agricultural lands, with focused topographic constraints.

FIGURE ES-6
Study Area Segments



Priority Section 1: Phoenix Metropolitan Area

The principal goal of this project is to identify and establish feasible route(s) and transportation connections for the Priority Section (the study corridor between the Las Vegas and Phoenix metropolitan areas). Because of the length and varying characteristics of the priority corridor segment, the priority corridor is divided into three sections for in-depth study and analysis. The Phoenix Metropolitan Area Priority Section is one of these three Priority Section subdivisions. This segment includes the greater metropolitan Phoenix area, spanning from the northwest at Wickenburg to the southeast near Casa Grande.

Balancing placement of an alignment(s) that supports but does not greatly impact existing development will be key in this area, which includes the expansive Phoenix metropolitan area, as well as development in Pinal County communities such as Casa Grande and Maricopa. With much forest land to the east of the metropolitan area, the western portion of Maricopa County (Hassayampa and Hidden Valleys) provides greater opportunity for corridor consideration due to the flatter topography and availability of private lands (Figure ES-2). Key constraints in those areas include the Sonoran Desert National Monument, wilderness areas, Hassayampa and Gila Rivers and their floodplains, regional parks (including the future Vulture Mountains Cooperative Recreation Management Area), and pockets of areas of critical environmental concern (ACECs.) Topographical constraints exist north of the Wickenburg/US 93 corridor. Additionally, due to the national monument on the east, Gila River Indian Community to the north, and Tohono O'odham Indian Community and Barry M. Goldwater Air Force Range to the south, a

very limited geography is available to make a connection between Maricopa and Pinal Counties, and at that point, two small mountain ranges flank available private lands, leaving a small "slot" area for a corridor consideration option. Studies have already occurred in the western portion of this Priority Section to understand environmental constraints and preliminarily plan high-capacity transportation corridors for the build out of this area (Maricopa Association of Governments I-10/Hassayampa Valley and I-8 and I-10/Hidden Valley transportation framework studies) that can provide a foundation for the alternatives analyses process in the next phase of this study.

Priority Section 2: Northern Arizona/Southern Nevada

The Northern Arizona/Southern Nevada Priority Section is the second of the three Priority Section subdivisions. This segment includes the area from Wickenburg to Boulder City, generally centered on the US 93 corridor.

The greatest constraints in this section will be the topography, specifically south of I-40, and selecting a Colorado River crossing (Figure ES-3). US 93 currently traverses the mountains in the least steep areas in Arizona. While flatter lands do exist between the US 93 corridor and the Colorado River, this area includes ACECs, several wilderness areas, and drainage corridors, all of which must be considered. In Nevada, the southern portion of the state has a high degree of critical habitats, ACECs, and wilderness areas. Land ownership throughout this portion of northern Arizona/southern Nevada includes broad checkerboard patterns of the Arizona State Land Department, BLM, and private land holdings. The National Park Service owns most of the land along Arizona/Nevada border (the Colorado River) as part of the Lake Mead National Recreation Area. Crossing the Colorado River will be a key factor in corridor consideration here. Currently, the only crossings exist along US 93 (recently constructed Hoover Dam bypass bridge), State Route (SR) 68 (Laughlin/Bullhead City), I-40, and SR/US 95 near Parker.

Priority Section 3: Las Vegas Metropolitan Area

The Las Vegas Metropolitan Area Priority Section is the third of the three segments of the Priority Section. This segment includes the greater metropolitan Las Vegas area (Las Vegas Valley).

Similar to Priority Section 1, balancing placement of an alignment(s) that supports the existing economic base while not greatly impacting the natural environment is key. Las Vegas is in a valley, and topography will be the primary locational constraint, after considering existing development (Figure ES-4). Most of the mountain ranges include slopes greater than 24 percent, which is not conducive to infrastructure development. The Lake Mead National Recreation Area, as well as large ACECs and critical habitat areas, are located west and south of the metropolitan area. Several tribal communities and military installations are located to the north, spanned by the Desert National Wildlife Refuge. To the east of the Las Vegas Valley are wilderness areas and large expanses of NCAs. While much of the Las Vegas Valley surrounding existing development is colored blue on the maps, not all of these constraints are necessarily fatal flaws to corridor development. For example, while the Lake Mead National Recreational Area is managed by the National Park Service and is shown as a constraint due to its federal land status (and general desire not to disturb park lands), as a regional recreational asset, transport options to and from this facility are important. Focused gaps between such constraints have been studied before in several local transportation studies and should be considered in the next project phase. Studies such as the *Draft Southern Nevada Outerbelt Feasibility Study Part I: Initial Environmental Screening* (NDOT 2012c) have already occurred in this Priority Section to understand environmental constraints and preliminarily plan high-capacity transportation corridors for the build-out of the Las Vegas Valley. These studies can provide a foundation for the alternatives analyses process in the next study phase.

Northern Nevada Future Connectivity Segment

The Northern Nevada Future Connectivity Segment stretches from the northern edge of the Las Vegas metropolitan area, potentially all the way to the U.S./Canadian border. However, for the purposes of this technical memorandum, the segment is considered to terminate at the northern Nevada border with Oregon and Idaho. Although the maps include the Las Vegas metropolitan area, the focus of this study portion spans from

beyond the metropolitan area north to the northern edge of the state. The breadth of the future connectivity study segment allows higher-level visioning for this potential extension beyond the Las Vegas metropolitan area.

Topography and land ownership patterns will form the major corridor consideration constraints in the Northern Nevada Future Connectivity Segment, which comprises the majority of the state (Figure ES-5). Nevada contains many isolated mountain ranges separated by flatter basins. These ranges generally trend north-south and most are short and narrow with steep slopes (greater than 12 percent). The western side of the state includes portions of the Sierra Nevada (located primarily in California), as well as many lakes and reservoirs. From a land management standpoint, the Humboldt-Toiyabe National Forest comprises 6.3 million acres in Nevada (the largest national forest in the lower 48 states), split into more than 10 clusters of forest lands throughout the state. Military land holdings are large, specifically Nellis Air Force Base, located north of the Las Vegas metropolitan area. The area also has several state wildlife areas, wilderness areas, and tribal communities. Most ACECs and critical habitat areas are located in the southeastern and northwestern parts of Nevada. Population clusters are dispersed, with Reno-Sparks/Carson City being the primary population/employment center in northern Nevada.

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FIGURE ES-1

Opportunity and Constraint Areas: Southern Arizona Future Connectivity Segment

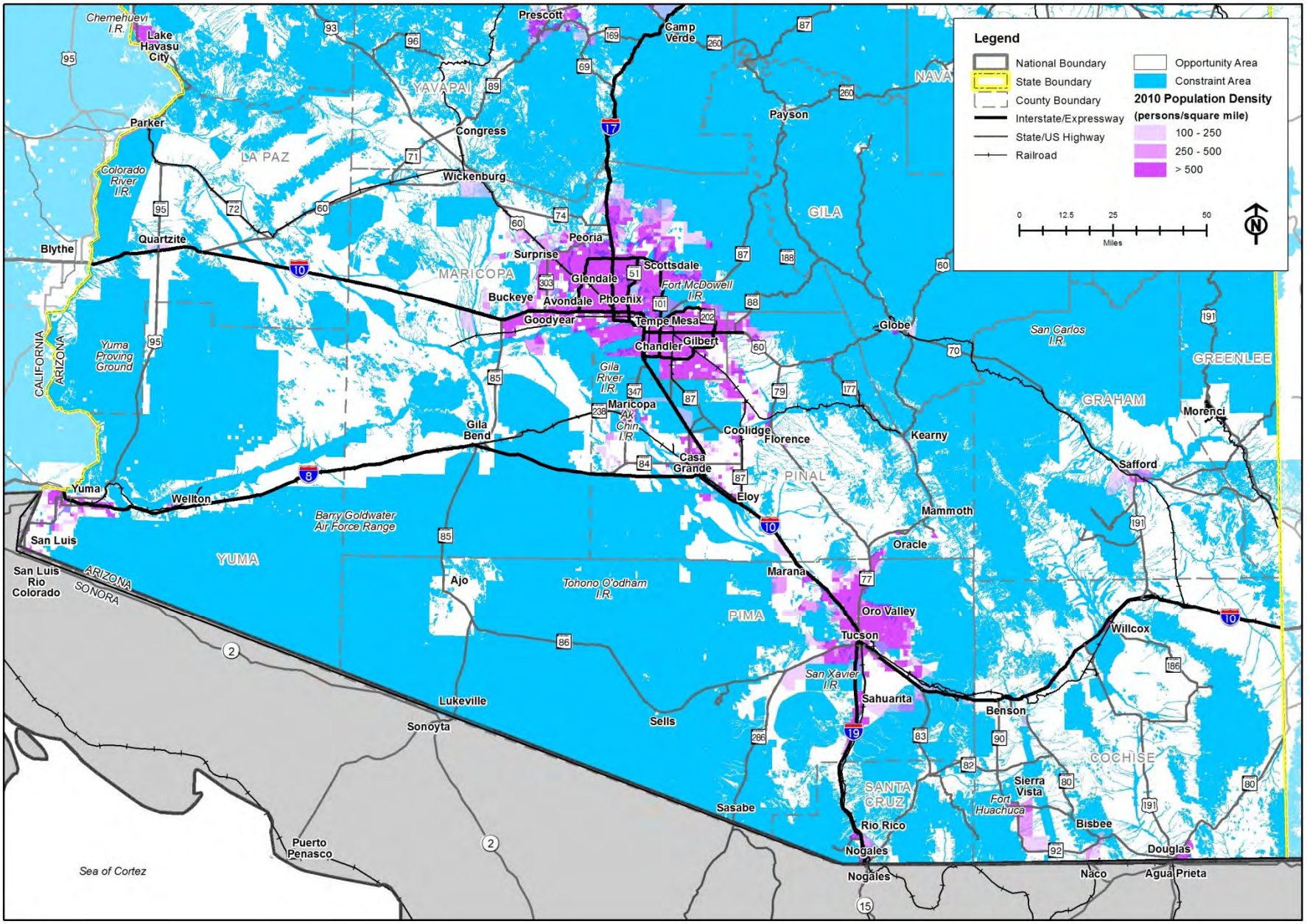


FIGURE ES-2

Opportunity and Constraint Areas: Priority Section 1 – Phoenix Metropolitan Area

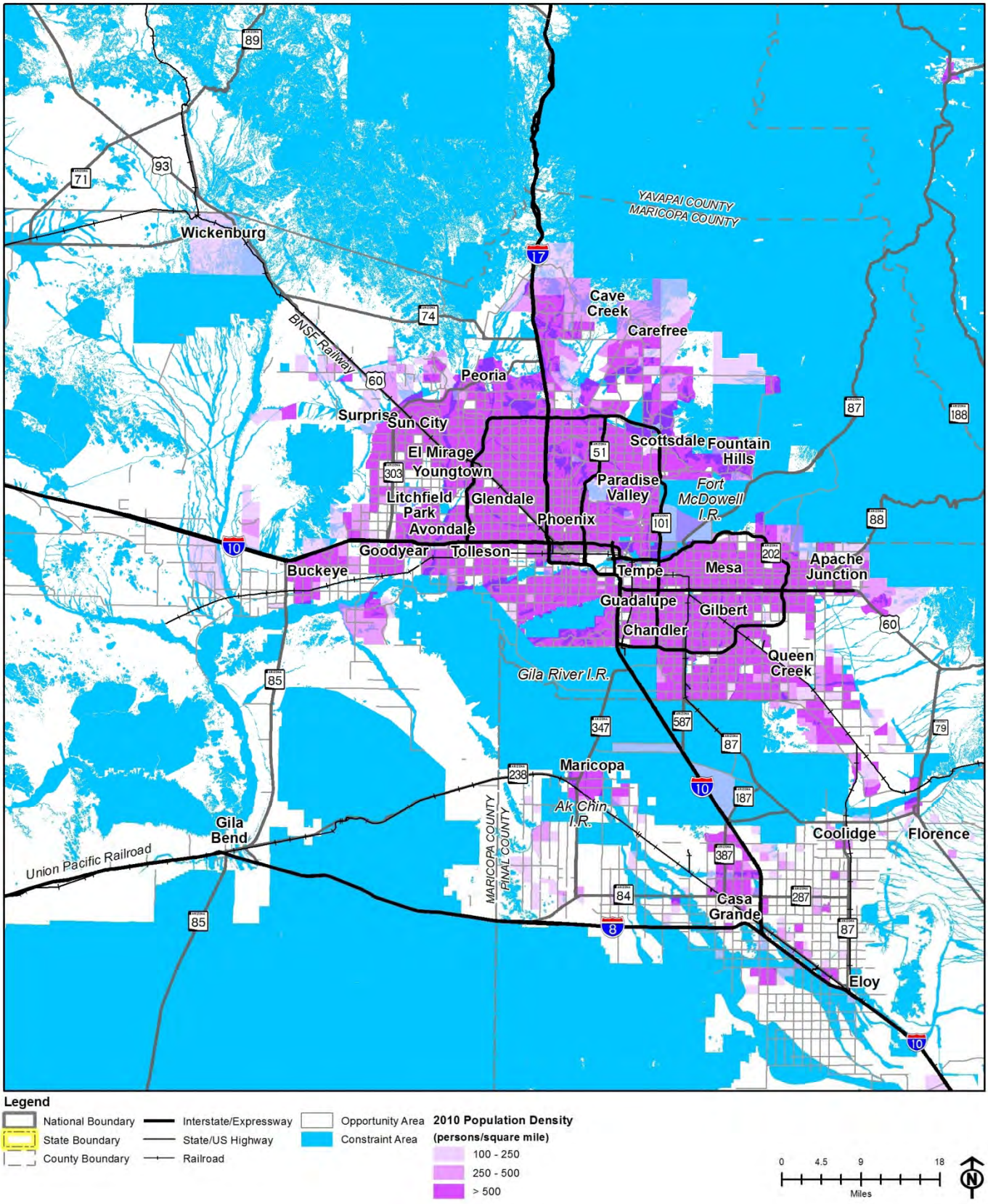


FIGURE ES-3

Opportunity and Constraint Areas: Priority Section 2 – Northern Arizona/Southern Nevada

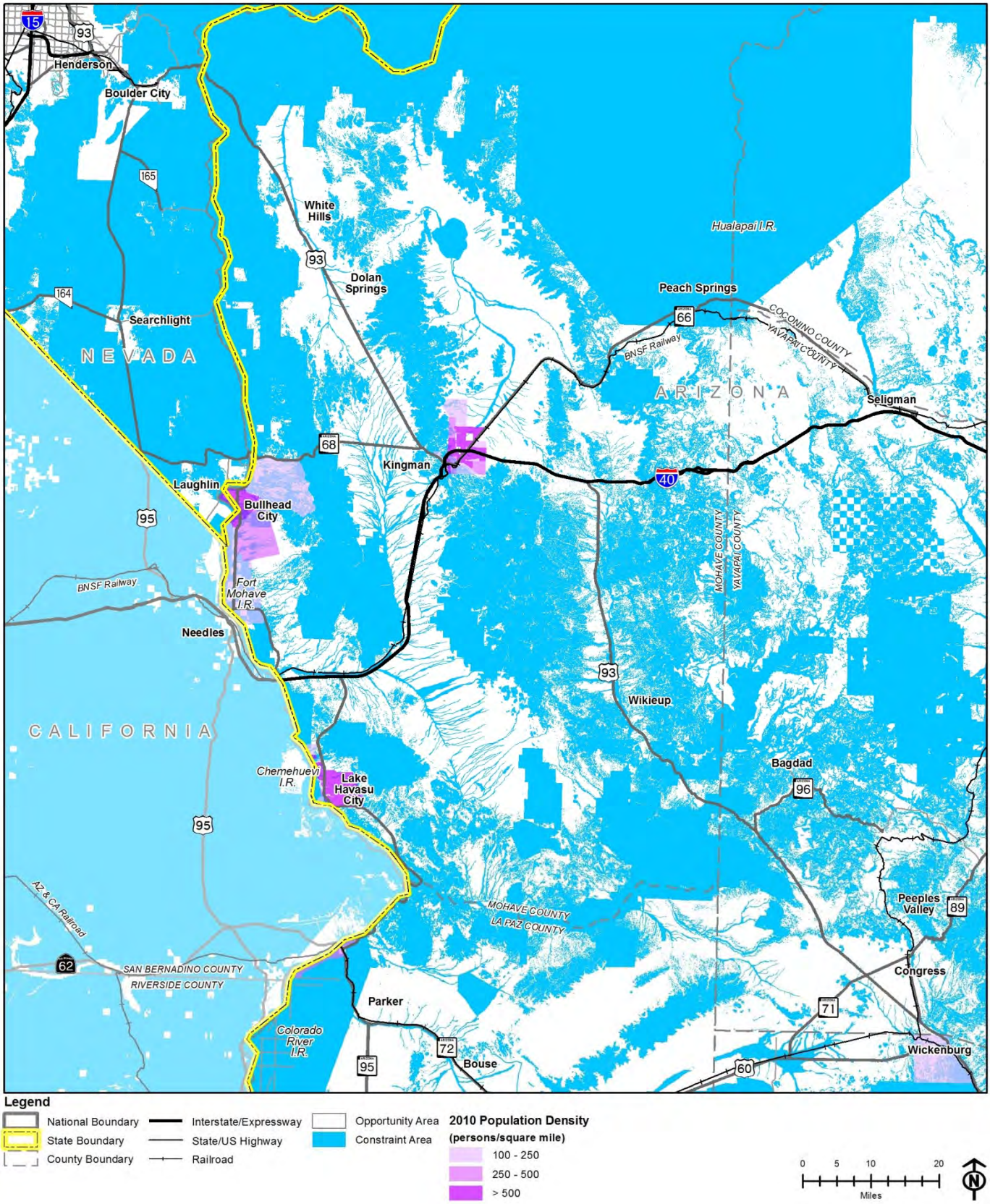


FIGURE ES-4

Opportunity and Constraint Areas: Priority Section 3 – Las Vegas Metropolitan Area

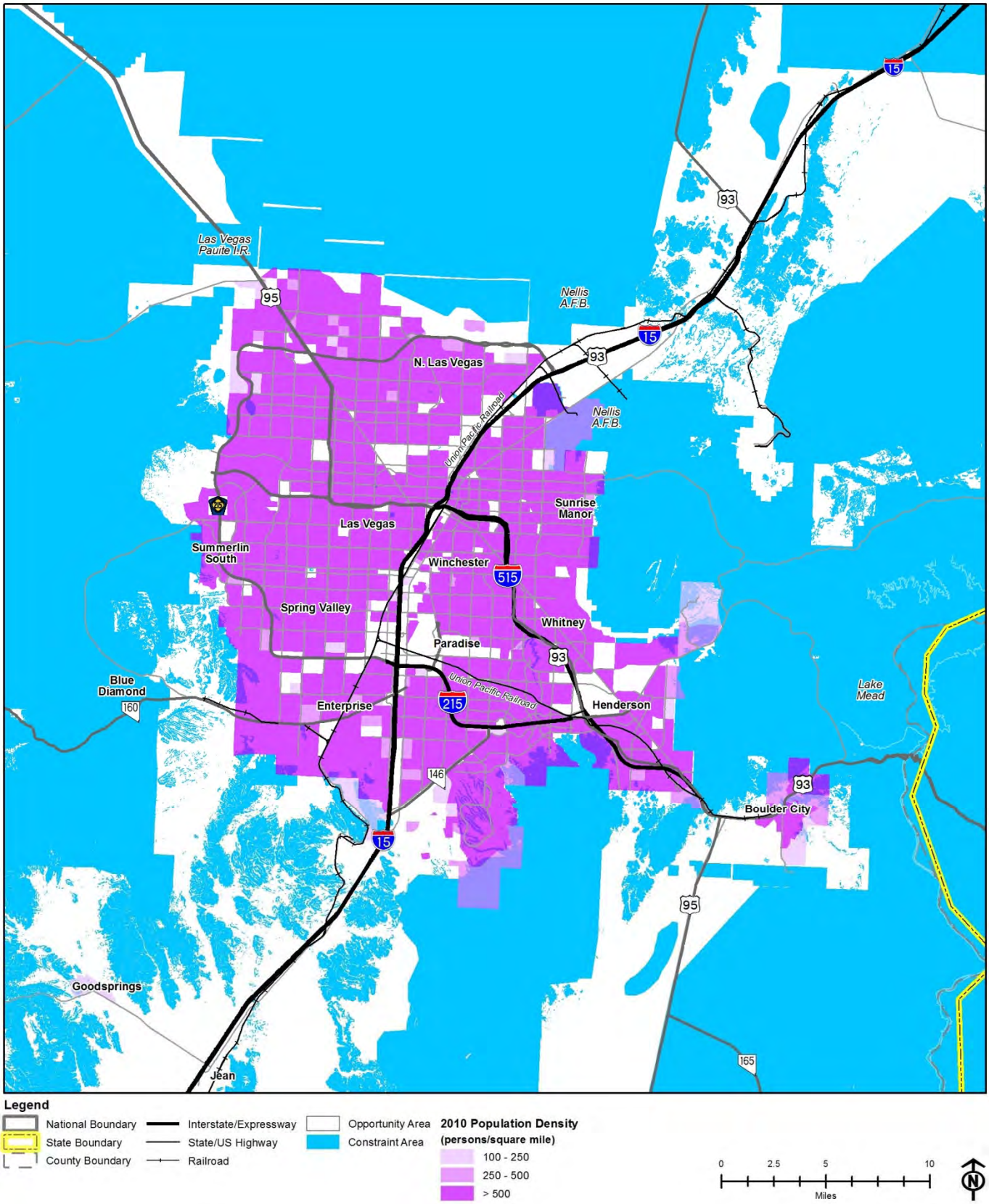
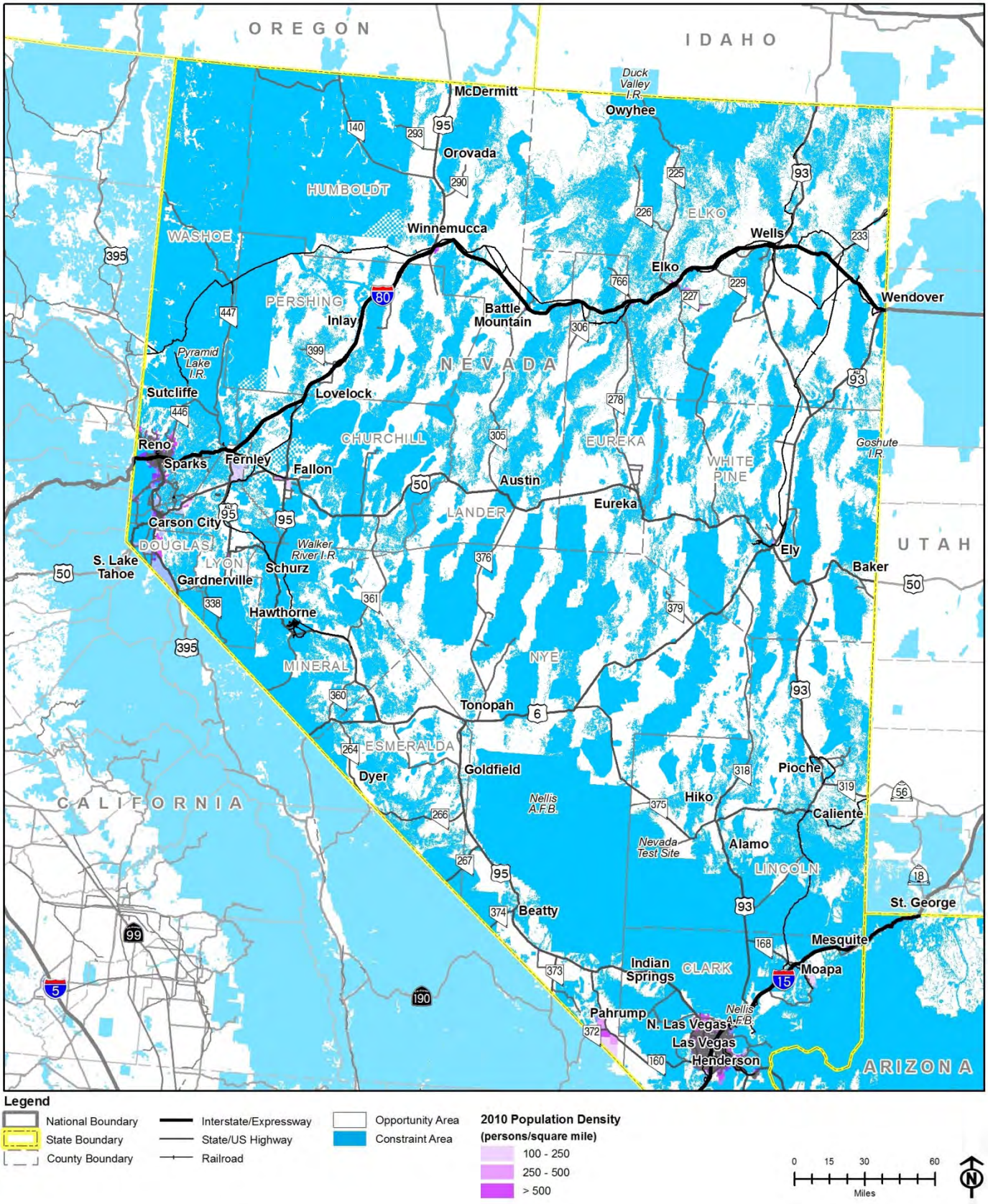


FIGURE ES-5

Opportunity and Constraint Areas: Northern Nevada Future Connectivity Segment



SECTION 1

1 Existing Natural and Built Environment

1.1 Introduction and Overview

1.1.1 The I-11 and Intermountain West Corridor

FIGURE 1-1
Intermountain West Corridor Influence Area

Phoenix, Arizona, and Las Vegas, Nevada, are the nation's two largest proximate metropolitan areas not directly linked by an Interstate. These two cities have a highway connection that is not expected to sustain future growth.

Interstate 11 (I-11) specifically refers to a possible Interstate connection between Phoenix and Las Vegas. The broader Intermountain West Corridor refers to a future high-capacity transportation network south of Phoenix to Mexico and north of Las Vegas to Canada. For ease of reading, the combined I -11 and Intermountain West Corridor is referred to as the Corridor.

In addition to the designation of the CANAMEX High Priority Corridor in 1995, recently enacted federal transportation legislation called Moving Ahead for Progress in the 21st Century (MAP-21) designates I-11 as a future Interstate between Phoenix and Las Vegas. In approving the I-11 designation, Congress recognized the need for, and importance of, an Interstate link between these two metropolitan areas.

For the purposes of this study, the Intermountain West is the geographic region of the western United States (U.S.) located between the Rocky Mountains on the east and the Cascade Range and Sierra Nevada on the west (Figure 1-1). This region is facing a rapidly growing population, expanding global trade, and an aging transportation infrastructure that is reaching capacity.

1.1.2 Why the Corridor is Needed

Investment in regional transportation infrastructure has not kept pace with population growth and changing economic trends. The population of the Intermountain West states (Arizona, Idaho, Montana, Nevada, Oregon, Utah, and Washington) is currently 25 million. Between 2000 and 2010, the rate of growth for the Intermountain West states was 19.6 percent—double that of the U.S. as a whole, which grew at a rate of 9.8 percent. Population and economic growth in Arizona and Nevada will continue to outpace the U.S. average.

Current global and regional trends are creating demands for new transportation links. It is now more cost effective to manufacture and import goods from Mexico than it is from Asia Pacific, increasing the need for high-capacity, north-south transportation infrastructure. The transportation network in the Intermountain West was developed decades ago to serve the economic, population, and mobility needs at that time—east-west movement of people and goods between Southern California and the rest of the country. The need is now shifting to north-south demand.

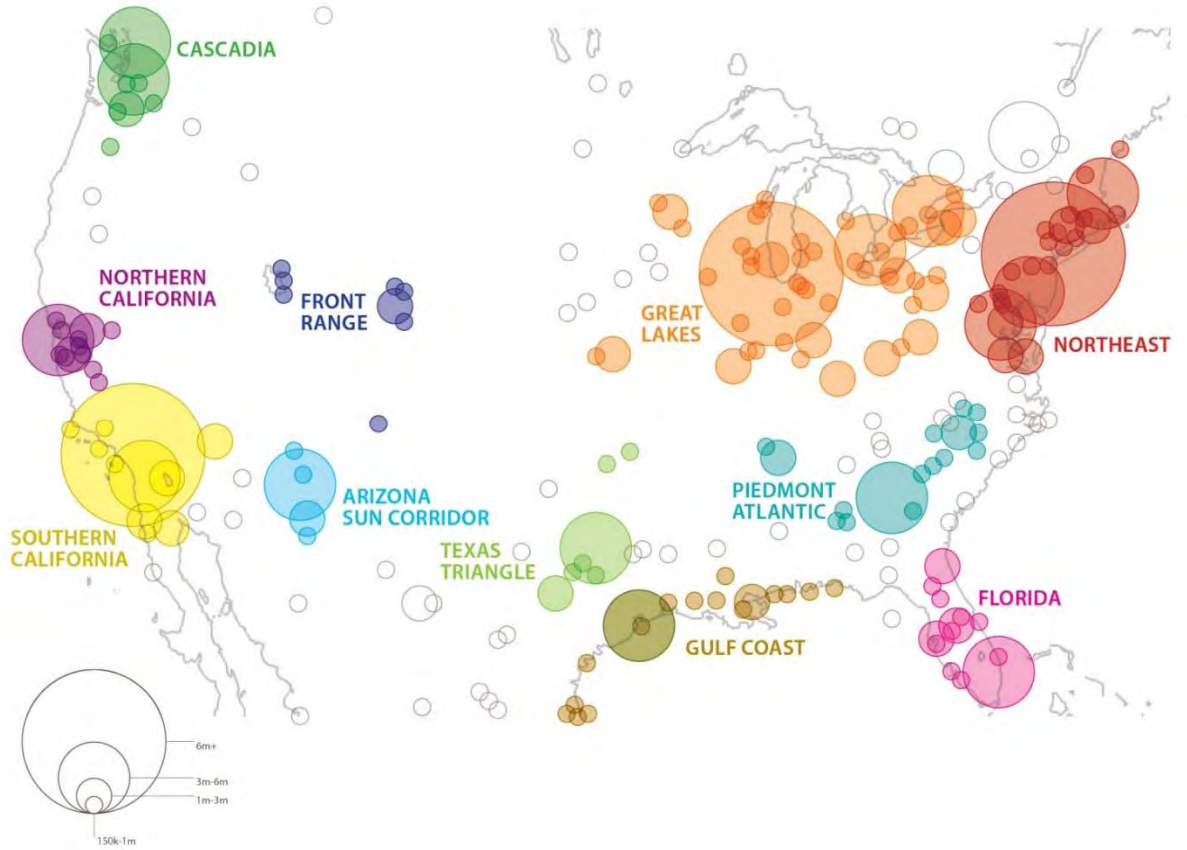
Manufacturing growth in Arizona and Nevada exceeded the U.S. average, indicating a strengthening economic sector that is strongly linked with transportation demand. State economic development departments are focused on diversifying the Arizona and Nevada economies to target industry clusters that rely heavily on interconnected and efficient transportation systems to both transport goods and facilitate business attraction/retention.

Without strategic improvements in transportation infrastructure, the region will lose the opportunity to capitalize on enhanced economic growth related to important trends in regional and national trade. Both states recognize that to be successful in their economic development endeavors, many simultaneous strategies, including developing the transportation systems that these industry clusters require, must be implemented.

The Brookings Institution, Regional Plan Association, and others have developed and furthered the concept of "megapolitans" as the key U.S. areas of integration with world trade (Regional Plan Association 2005) (Figure 1-2). A megapolitan, of which 11 have been designated in the U.S., can be defined as a conglomeration of two or more intertwined metropolitan areas with a combined population of 5 million or more. A megapolitan is characterized by interlocking economic systems, shared natural resources and ecosystems, and common transportation systems. The U.S. megapolitan areas contain most of the nation's major ports and international airports, and their assets give them a large presence in world trade.

Efficient mobility is a major competitive advantage in the global playing field, where time savings create value. Our competitors in Asia and Europe are creating Global Integration Zones by linking specialized economic functions across vast geographic areas and national boundaries with high-speed rail and dedicated goods movement systems. The increased mobility of workers, business travelers, and goods between the cities of these megapolitans enables greater collaboration, flexibility, and innovation.

FIGURE 1-2
Megapolitan Areas in the Continental United States and Southern Canada



Source: Regional Plan Association 2005

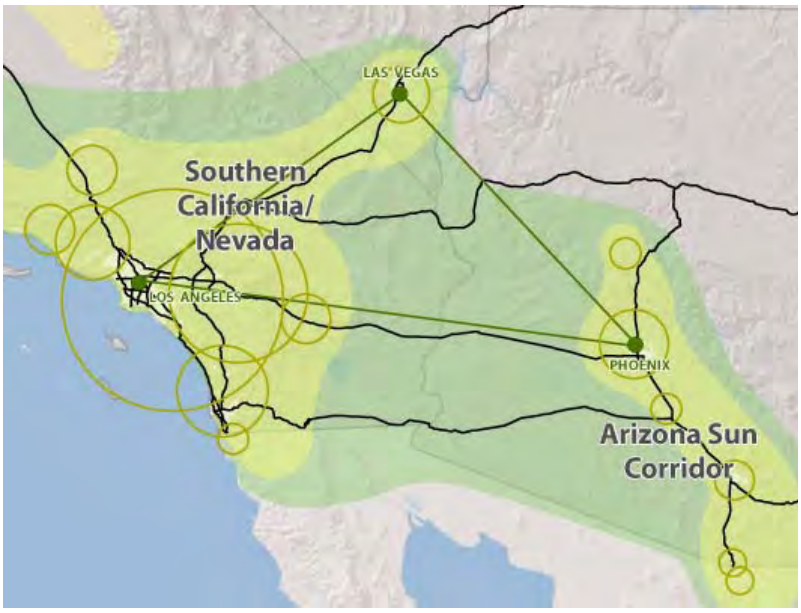
Improving and maintaining megapolitan infrastructure is an important national priority, especially for the Southwest, which seeks more trade and exports as a way to diversify its economy from consumption and real estate toward technology, innovation, and high-value manufacturing. The megapolitan capacity for trade is a key element in this economic transition. Failure to establish adequate infrastructure to move people and goods around the country and the region would significantly constrain future economic growth.

The old notion of urban rivalry among proximate cities and metropolitan areas is giving way to a new concept that such regions share significant business linkages and are now part of a larger economic system. Linking the economies of several large megapolitan areas is giving way to the emerging trend of megaregions, such as the Southwest Triangle Megaregion.

The Greater Southwestern U.S. consists of three main centers of growth. The largest cluster lies in Southern California, which includes more than 20 million residents from San Diego to Santa Barbara. The second leading cluster combines the Phoenix metropolitan area to create an urban corridor that is home to nearly 6 million. Finally, a cluster of development in the Greater Mojave Region centered on Las Vegas lies north of both Southern California and the Arizona Sun Corridor, which is the combined Phoenix metropolitan area and Tucson metropolitan area. This area of expanding megapolitans–a Southwest Triangle–maintains a population approaching 30 million (Figure 1-3).

This megaregion is linked by transportation, economy, and environment. Major international airports anchor each of the three subregions. Ground-based transportation includes several major Interstates but no passenger rail capacity. A proposed high-speed rail link that would connect Southern California to Las Vegas is under study.

FIGURE 1-3
Expanding Southwest Megapolitans



The major regions in this Southwest Triangle share numerous economic interdependencies in sectors such as logistics, healthcare, entertainment, tourism, and technology. Surrounded by deserts, Las Vegas and the Sun Corridor are actively engaged in wind and solar research and development, equipment manufacturing, and green energy production.

While the Southwest Triangle is emerging as a linked megaregion, it does not yet have the name recognition as other megaregions, such as the Texas Triangle (Dallas/Fort Worth-Houston-San Antonio-Austin). In many respects, the Southwest Triangle is larger than the Texas Triangle, in both area and population, yet it lacks an Interstate highway system and rail connecting all three legs.

The Southwest Triangle is on a trajectory to be the only American region that maintains linkages to the world's fastest emerging economies in Asia and Latin America.

For the last half century, Southern California has built America's most significant connections to Asia, displacing San Francisco as the nation's leading region for this trade. Southern California is now hyperlinked to Asia, and Las Vegas and the Sun Corridor are actively engaged in establishing new trade with Latin America.

The key issue now is to determine what infrastructure improvements would facilitate greater economic integration of this megaregion. This area already has one of the most densely linked air systems of any region in the country, with 2 of the 10 ten busiest air corridors (Los Angeles-Las Vegas and Los Angeles-Phoenix) (Brookings Institution 2009a).

This region also has the weakest ground-based transportation connectivity of any U.S. megapolitan cluster. The Southwest, especially Phoenix and Las Vegas, has an underdeveloped Interstate network that does not meet current demand. With no direct rail service between the two metropolitan areas, and only minimal intercity bus service, the region has not kept pace with evolving needs.

1.1.3 Purpose of the Corridor Study

The study area includes the entire states of Arizona and Nevada, although more detailed planning will occur in concentrated study segments. The principal project goal is to identify and establish feasible route(s) and transportation connections for the portion of the study corridor between Phoenix and Las Vegas, with options for extensions to the north and south. Because of its length and varying characteristics, this segment is divided into three sections. Two additional segments beyond the Phoenix and Las Vegas metropolitan areas will allow higher-level visioning for potential extensions (Figure 1-4).

FIGURE 1-4
Study Area Segments

The I-11 Corridor divisions are as follows:

- Southern Arizona Future Connectivity Segment: Mexico to Casa Grande
- Priority Corridor Section 1: Phoenix Metropolitan Area (Casa Grande to Wickenburg)
- Priority Corridor Section 2: Northern Arizona/Southern Nevada (Wickenburg to the Las Vegas Metropolitan Area)
- Priority Corridor Section 3: Las Vegas Metropolitan Area
- Northern Nevada Future Connectivity Segment: Beyond the Las Vegas Metropolitan Area

The study will include two levels of analysis over a 24-month schedule:

- Detailed planning for the high-priority I-11 segment between (and including) Las Vegas and Phoenix
- A high-level visioning approach to possible future connectivity segments from Las Vegas to Canada and from Phoenix to Mexico

The work program is presented in three phases. During the initial phase (discussed in this technical memorandum), a review and inventory of existing and future conditions was conducted to provide a foundation for further study, and the economic context for the Corridor was established.

A unique element of this study is the development of a Corridor Business Case to help determine the value of the project. In addition, benefits and costs of the proposed Corridor to different parties and stakeholders (for example, private investors, freight carriers and shippers, state and local governments, and residents) will be estimated using various assumptions about funding scenarios and planning options (such as alignment and project type). The Corridor Business Case will identify and describe projects and public policy initiatives impacting decisions, validate existing estimates of capital costs and other life cycle costs, and identify benefit and cost metrics based on a set of core objectives.

During the next phase, Corridor Concept Development, the data analysis presented in the Corridor Justification Report will be used to develop and evaluate alternatives for the separate Corridor segments and sections. This high-level evaluation will narrow the connectivity area options. A detailed feasibility assessment of the priority Corridor sections will then be conducted. The Corridor's final purpose and need will be developed, the Business Case finalized, and generalized implementation steps outlined.

A "corridor" implies the use of different modes of transportation. Depending on the purpose and need of each Corridor segment, different transportation modes or infrastructure facilities (for example, transfer of information

technology) may be recommended for implementation, either in the same right-of-way envelope or on different alignments.

For the future connectivity segments north of Las Vegas and south of Phoenix, a series of recommended alignments will be identified, evaluated, and prioritized, with potentially different trigger points that could allow the choice of one alignment or mode over another, dependent on external factors that might be unknown or undetermined at the conclusion of this study.

1.1.4 Purpose of the Technical Memorandum

This technical memorandum contains a preliminary investigation of the environmental resources in the I-11 Corridor study area that could be affected by a high-capacity, north-south transportation improvement. Data were collected from various sources, including the Arizona Department of Transportation (ADOT), Nevada Department of Transportation (NDOT), Bureau of Land Management (BLM), the U.S. Fish and Wildlife Service (USFWS), and Arizona Game and Fish Department (AGFD). The purpose of this technical memorandum is to provide an overview of the existing natural and built environmental settings and characterize the potential resource impacts on a macro scale, per the Planning and Environmental Linkages (PEL) process.

This memorandum culminates with a series of maps and discussions that illustrate the constraint and opportunity areas for corridor development that will provide one foundational aspect moving into the alternatives development and analysis process.

1.2 Planning and Environmental Linkages Process

The Federal Highway Administration has recently issued new guidance to assist transportation planners and environmental practitioners in the use of corridor and subarea planning to inform the National Environmental Policy Act (NEPA) review process. While this study phase will not include detailed environmental documentation such as an environmental impact statement, the results of this “pre-NEPA” effort will follow the PEL process, which includes a description of the environmental setting and an understanding of the existing infrastructure to make corridor use as efficient as possible through innovative solutions. The use of the PEL process will help streamline the entire environmental review process, allowing this study to provide the foundation and minimize the need for re-evaluation as the project progresses into the environmental phase.

ADOT and NDOT have both worked with the Federal Highway Administration to adapt the federal guidance into state-led processes, which include checklists to be completed throughout a study’s process. The PEL processes of the two states are similar and will be carried forth throughout this study to identify important issues early so that agencies, stakeholders, and the public can make informed and timely decisions.

This review of the existing environment is intended to be preliminary. Its intent is to identify fatal flaws and issues that will need to be considered as the project moves into the alternatives analysis phase. While this review supports both the ADOT and NDOT PEL processes, the full analysis of environmental impacts of project implementation, pursuant to NEPA, has yet to begin. The intent of this PEL-supported work will assist in the scoping of that NEPA analysis.

1.3 Background and Foundational Data Resources

As part of the technical analysis conducted for this work effort, several related studies and plans were reviewed to understand external planning implications to the I-11 Corridor study area. Full study summaries are in Appendix A of the Corridor Justification Report. Summaries for those initiatives relating to the technical review of the existing natural and built environment follow for reference purposes only. Planning initiatives that were considered in the analysis of the natural and built environment but that do not necessarily relate geographically, or have minor implications to the study effort, are presented in this section rather than being repetitiously referenced in each segment area.

1.3.1 Sensitive Species and Wildlife Linkage Planning

In support of the PEL process, the AGFD has developed a tool to assist planners in evaluating the impact of major infrastructure development on wildlife corridors and habitats in Arizona. HabiMap™ is an online mapping and data analysis tool that enables practitioners to visually explore how wildlife is distributed throughout the state and where conservation can have the greatest impact. This tool streamlines the data analysis process by assembling wildlife conservation data, maps, tools, and other information to help inform and guide project planners in a manner that maintains the quality of the state's landscapes and minimizes negative impacts to wildlife and its habitat. The ultimate goal of this effort is to balance the growth, diversity, and mobility of the human population with the sustainability, diversity, and mobility of the state's wildlife populations. From an urban development perspective, conservation of these sensitive lands supports a sustainable land use pattern by shaping future growth, clustering development into nodes connected by transportation routes. This tool will be used throughout subsequent discussions on environmental considerations in Arizona.

Both Arizona and Nevada have working groups devoted to analyzing and prioritizing wildlife linkage locations. The *Arizona Wildlife Linkages Assessment* is a collaborative effort of public and private sector organizations to address habitat fragmentation through a comprehensive, systematic approach that has identified large blocks of protected habitat, wildlife movement corridors between and through them, and factors threatening to disrupt the 152 linkage zones identified in Arizona. A series of follow-on studies, entitled *Arizona Missing Linkages*, identified and mapped high-priority linkage zones, or those with multi-species corridors, that need to be preserved to maintain wildlife movement between habitat blocks.

In Nevada, the Nevada Wilderness Project has identified 20 places that are key "Linking Landscapes" priorities, places known to have significant wildlife populations that move great distances on the landscape. Using this information, the Nevada Department of Wildlife has drafted a Wildlife Action Plan that outlines conservation strategies and implementation and monitoring measures. An anticipated future action, once the Wildlife Action Plan is finalized, will be to gain permanent federal protection for important wildlife corridors and habitats.

While specific information about species and habitats is discussed throughout this section, planning for potential mitigation measures (for example, wildlife crossings) is not addressed because this topic will be considered and addressed during the design process. Coordination with the AGFD and the Nevada Department of Wildlife is ongoing and will continue throughout this study process to best understand and accommodate wildlife movement.

1.3.2 State Trust Lands – Arizona State Land Department

While serving as a major landowner in Arizona, the primary and continuing goal of the Arizona State Land Department (ASLD) is to increase revenue for the beneficiaries of the State Trust (Arizona's public school system and other public institutions) by enhancing value and optimizing economic return on the sale of State Trust lands for private development. This serves as an opportunity for the I-11 Corridor.

1.3.3 Utility and Energy Planning

Several reports and data resources are available regarding the viability of renewable energy resources in the U.S., as well as opportunities for future utility/energy corridors. Because actual locations for the implementation of such corridors and/or facilities are undetermined and rely on several variables (for example, demand for services), the following paragraphs discuss these opportunities at a high level, with no discussion within each segment area on geographic opportunity areas. Altogether, the pairing of utility and transportation rights-of-way could provide a benefit to both parties and is a real opportunity, but not one to be pursued this early in the planning process.

- The *West-Wide Energy Corridor Programmatic Environmental Impact Statement* (PEIS) evaluates potential impacts associated with the proposed action to designate corridors on federal land in 11 western states for oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities. Based on the recommendations of the PEIS, the agencies issuing it would amend their respective land use plans by designating a series of 3,500-foot energy corridors (to accommodate construction and operation of multiple

projects and their supporting infrastructure, thus providing flexibility to avoid important resources). This study makes no accommodation for the continuation of these corridors onto private lands.

- The Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy, and BLM (Department of the Interior) prepared the *Solar Energy PEIS* in 2012 to prioritize optimal locations for utility-scale solar energy development in six western states. This PEIS is intended to facilitate near-term, utility-scale solar energy development on public lands by minimizing negative environmental and social impacts and optimizing existing transmission infrastructure and corridors. Under the preferred alternative, the PEIS identifies categories of land to prioritize for development of solar energy zones (SEZs), lands to be excluded from utility-scale solar energy development, and lands that may be developed through a variance process. Several SEZs and commercial solar opportunity areas exist in both states. As of June 27, 2013, Public Land Order No. 7818 officially withdraws a series of public lands within Arizona, California, Colorado, Nevada, New Mexico, and Utah for protection and preservation of SEZs for future energy development, per the *Solar Energy PEIS* recommendations. In Arizona, this includes 3,343 acres of land in two SEZs. In Nevada, this includes 9,690 acres in five SEZs.
- The National Renewable Energy Laboratory (NREL) has gathered data over a 30-year period that provides information about the monthly solar radiation characteristics at hundreds of locations across the U.S. The NREL ranks lands based on their general suitability for solar energy potential; specifically, for utility concentrated solar power (CSP), which is a form of solar technology that uses the sun's thermal energy to heat a liquid that drives a generator to produce electricity (NREL 2012a). CSP technology is constructed at the megawatt (MW) or multi-MW scale, and electricity generated is typically exported to the power grid. This analysis has resulted in a series of maps that illustrate solar energy potential. Most areas of Arizona and Nevada are very conducive to commercial solar energy development.
- NREL, in coordination with the U.S. Department of Energy's Wind Powering America program, has created a dataset that illustrates annual average wind resources. This information gives a visual indication of the potential to use wind as an energy generation source. These data apply only to areas of low surface roughness (for example, grassy plains) and exclude areas with slopes greater than 20 percent. The data are characterized by wind power class, divided into seven classes ranging from 1 (poor) to 7 (superb). The range of 1 to 7 describes utility-scale energy use, or the potential for large wind farms, as opposed to residential or small commercial onsite energy use (NREL 2012b). Much of Arizona and Nevada is not conducive to commercial-scale wind energy generation, with the exception of portions of northern Nevada and northeastern Arizona. Because infrastructure development is not favorable on slopes greater than 12 percent, the Corridor would likely serve only feeder infrastructure for potential future wind farms.

1.3.4 Broadband Infrastructure Inventories

Arizona and Nevada are conducting thorough inventories of broadband infrastructure in both states. In the twenty-first century, telecommunications has joined transportation, water, energy, and sewer as critical infrastructure needed to sustain local economies. Internet access allows increased educational opportunities, opportunities for competitive entrepreneurs and small businesses, increased productivity and efficiency of businesses, greater availability of government services, and telework opportunities.

Wireless broadband networks eliminate boundaries, allowing communities to remain economically viable no matter their size or location. The Digital Arizona Program, housed in the Arizona Department of Administration, is conducting a comprehensive inventory of all telecommunications infrastructure in the state to identify what broadband infrastructure exists, what is planned, and where broadband gaps exist. Connect Nevada is mapping the availability (or lack thereof) of various broadband types across Nevada.

In both states, the metropolitan areas are generally well-served primarily by cable and some digital subscriber line and fixed wireless. Fiber access is limited throughout, even in metropolitan areas. Mobile wireless is available in some rural areas, but not all. Overall, the biggest gaps in connectivity exist in communities not proximate to a major metropolitan area.

A major issue in providing broadband access throughout the states is the process of digging up ground and installing cables, potentially disturbing other utilities and cultural artifacts. Similar to a transportation project, a telecommunications corridor must go through an environmental clearance process. Very high-capacity fiber-optic cables are required to connect each community to the global Internet at broadband speeds. These connections to communities are often referred to as "middle mile" connections. Laying fiber-optic lines along rural highways to bring broadband capacity to remote communities could make it much more economically attractive for broadband providers to serve or to expand telecommunication services.

The Digital Arizona Program worked for an executive order that implements a "dig once" policy, treating broadband infrastructure as a form of transportation and allowing broadband conduit to be installed on any federally funded highway or transportation project to more rapidly deploy broadband service. The federal executive order requires the U.S. Department of Transportation to provide guidance to states and to encourage their implementation of a "dig once" policy (Obama 2012). Adoption of the policy encourages the inclusion of "broadband conduit"—plastic pipes that house fiber-optic communications cable—during the construction of federal highways. The Federal Highway Administration estimates that it is 10 times more expensive to dig up and then repair an existing road to lay fiber than to dig a channel for it when the road is being built or repaired (Eschoo 2012). This policy was approved by the governor of Arizona as the Digital Arizona Highways Act of 2012 in April 2012 (State of Arizona 2012). The Digital Arizona Program and ADOT are working together to implement the "dig once" policy along future rural state highway construction projects. To date, a similar policy has not yet been adopted in Nevada.

1.3.5 Bureau of Land Management Land Management Planning

While the study efforts are not yet complete and specific data are not available for review and integration in this technical memorandum, the BLM is completing a series of Travel Management Plans and Rapid Ecological Assessments to prioritize their lands for conservation versus active recreational areas. For travel management planning, BLM has been designating all public lands in one of three off-highway vehicle designation categories. For Arizona, the state has 12.2 million acres of public lands; less than 1 percent is designated "open," 88 percent "limited," and 11 percent "closed" to off-highway vehicle use. BLM is being proactive in seeking travel management solutions that conserve natural resources while providing for ample recreation opportunities. Despite the federal land status, for those areas designated as "open," or active recreational areas, appropriate access should be provided to those lands, whereas planned transportation access points or activity center development near protected lands would not be in line with their planning strategies.

Conversely, the Rapid Ecological Assessments examine ecological values, conditions, and trends within ecoregions, which are large, connected areas that have similar environmental characteristics. An example of an ecoregion is the Sonoran Desert, which spans administrative boundaries and encompasses an area much larger than those managed by individual BLM field offices. Assessments of these larger areas identify regionally important habitats for fish, wildlife, and species of concern, and then gauge the potential of these habitats to be affected by four overarching environmental change agents: climate change, wildfires, invasive species, and development (both energy development and urban growth). These assessments will also help identify areas that do not provide essential habitat, those that are not ecologically intact or readily restorable, and those where development activities may be directed to minimize impacts to important ecosystem values.

1.4 Southern Arizona Future Connectivity Segment

The Southern Arizona Future Connectivity Segment includes the entire southern Arizona border with Mexico. Although the maps include portions of the Phoenix metropolitan area, the focus of this study portion spans from the international border to just north of the intersection of I-8 and I-10. The breadth of the future connectivity study segment allows higher-level visioning for this potential extension south of the Phoenix metropolitan area.

1.4.1 Environmental Features

Figure 1-5 shows the environmental features and biological resources in the southern Arizona segment. The environmental features are composed of ACECs, wilderness areas, national monuments, NCAs, critical habitats, and other land management categories.

Located in southern Arizona are 24 areas of critical concern (ACECs) identified by the BLM in the agency's Resource Management Plans. ACEC designations highlight areas where special management attention is needed to protect resources and to prevent irreparable damage to important historic, cultural, and scenic values, fish or wildlife resources, or other natural systems or processes, or to protect human life and safety from natural hazards. The ACEC designation indicates that BLM recognizes that an area has significant value and has established special management measures to protect those values. The identified ACECs are spread throughout southern Arizona, with the majority in the southeastern part of the state.

In addition to critical habitats and ACECs, southern Arizona has 17 federally designated wilderness areas. Activity on wilderness areas is coordinated by the National Wilderness Preservation System. Wilderness areas are managed by four federal land management agencies: the National Park Service (NPS), U.S. Forest Service (USFS), USFWS, and BLM. The Wilderness Act of 1964 defines a wilderness area as "an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions."

The BLM has also identified National Conservation Areas (NCAs) and national monuments, which protect these lands from unwanted development. All national monuments are categorized as NCAs, but not all NCAs have national monument designations. This segment area includes the Ironwood Forest National Monument, located between the Tohono O'odham Indian Community and the Town of Marana; the Organ Pipe Cactus National Monument, located near the Cabeza Prieta National Wildlife Refuge along the Arizona-Sonora border in Pima County west of Lukeville; and the Sonoran Desert National Monument, located east of Gila Bend. Numerous national monuments, national parks, and similar sites fall under the jurisdiction of the NPS. Three other NCAs are located in the southeastern part of the state.

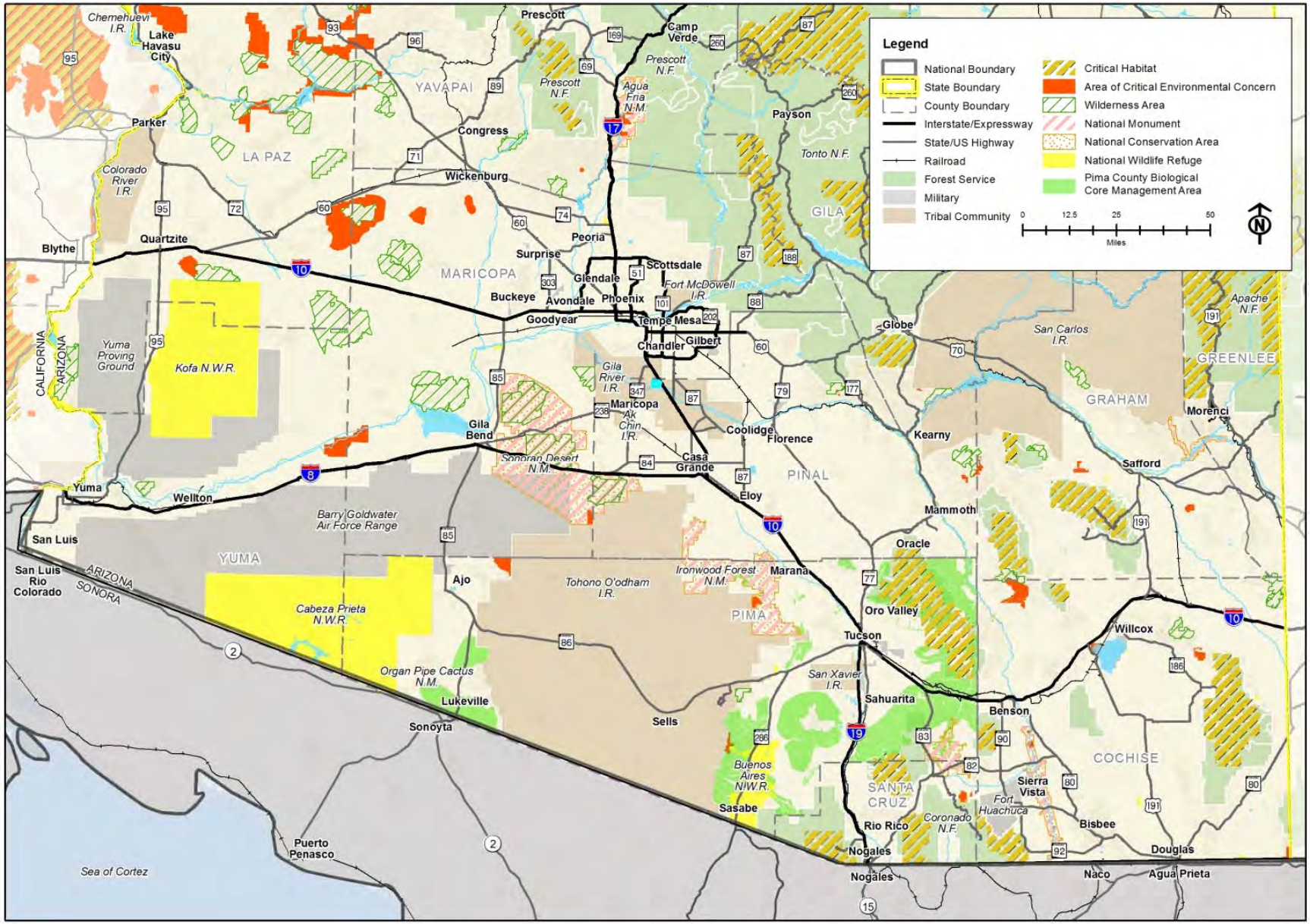
In addition to the BLM protected lands, the Tucson Mitigation Corridor is comprised of 2,514 acres in two tracts separated by the Central Arizona Project canal, connecting the Tucson Mountain Park and Tohono O'odham Indian Community. It is owned by the BLM (including the Central Arizona Project canal, which brings total acreage under BLM to 2,730) and managed by the Pima County Natural Resources, Parks and Recreation Department. The land was originally set aside by the Bureau of Reclamation to mitigate the effects the Central Arizona Project canal has on wildlife movement, with the purpose to prohibit future development in the area, other than existing or future wildlife improvements. Various recreational activities are allowed on the land.

The Tucson Mitigation Corridor and Tucson Mountain Park are just two elements of the Pima County Conservation Lands System, which categorizes and identifies locations of priority biological resources within Pima County and provides guidelines for the conservation of these resources. Resource categories include biological core management areas, multiple use management areas, important riparian areas, and agricultural inholdings. Figure 1-5 shows the biological core management areas. The Conservation Lands System document is just one of several guidance documents to steer growth and development in the region, most notably aimed at preserving and protecting open space in the vicinity of public preserves and creating ecologically sound transitions between the preserves and more urbanized development. Wildlife habitat and connectivity is a high priority in the region and is seen as an economic development so that visitors and residents can enjoy the open desert and all that it offers. Other guiding documents include:

- *Pima County Tucson Mountain Park Management Plan*
- *Pima County Sonoran Desert Conservation Plan*
- Pima County Buffer Overlay Zone (includes areas within 1 mile of major park areas to transition open space and urbanized areas)

FIGURE 1-5

Environmental Features – Southern Arizona



Sources: ADOT 2012j, Arizona Land Resource Information System (ALRIS) 2012, BLM 2012a

Critical habitats for 14 wildlife species can be found in southern Arizona (Table 1-1). Critical habitat areas are considered essential for the conservation of a listed species. The list provides notice to the public and land managers of the importance of these areas to the conservation of the species. Special protections and restrictions are possible in areas where federal funding, permits, licenses, authorizations, or actions occur or are required.

TABLE 1-1
Critical Habitat Species – Southern Arizona

No.	Common Name	Scientific Name
1	Bonytail chub	*Gila elegans*
2	Sonora chub	*Gila ditaenia*
3	Yaqui catfish	*Ictalurus pricei*
4	Yaqui chub	*Gila purpurea*
5	Desert pupfish	*Cyprinodon macularius*
6	Beautiful shiner	*Cyprinella formosa*
7	Little Colorado spinedace	*Lepidomeda vittata*
8	Razorback sucker	*Xyrauchen texanus*
9	Desert tortoise	*Gopherus agassizii*
10	Mount Graham red squirrel	*Tamiasciurus hudsonicus grahamensis*
11	Huachuca water-umbel	*Lilaeopsis schaffneriana* var. *recurva*
12	Mexican spotted owl	*Strix occidentalis lucida*
13	Gila chub	*Gila intermedia*
14	Southwestern willow flycatcher	*Empidonax traillii extimus*

Source: USFWS 2012

Figure 1-6 shows the areas identified by the AGFD for their conservation value, under the HabiMap™ "Species and Habitat Conservation Guide." The map presents conservation potential through six shades of blue, with deeper shades indicating higher-priority conservation areas. The majority of these high-priority areas are located in the southeastern part of the state, including the communities of Tucson and Nogales. Conservation potential on tribal lands is not presented due to the unavailability of comprehensive species information at this time.

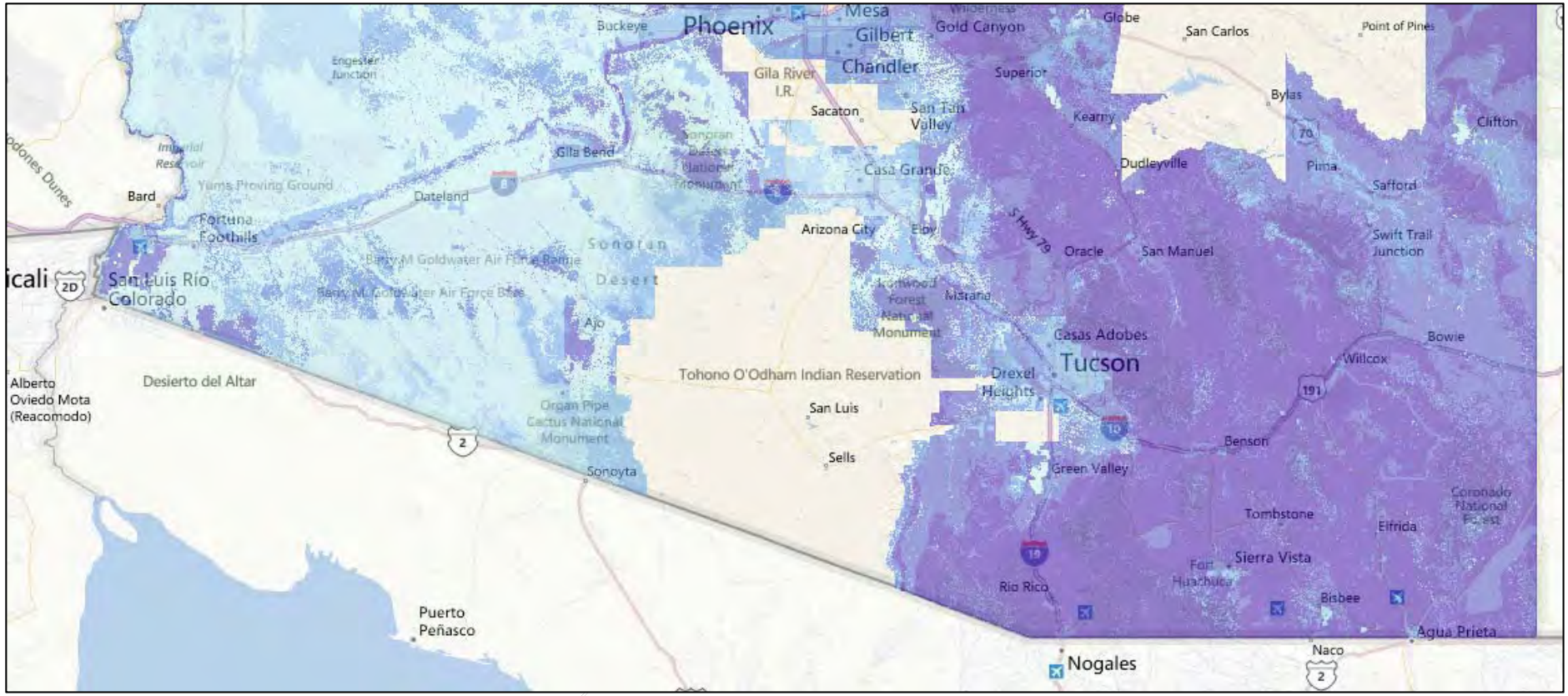
1.4.2 Topographic Features

Figure 1-7 shows the major topographic features of southern Arizona. The map is organized by steepness of slope, with the darker shades of brown representing slopes greater than 12 percent. Slopes greater than 12 percent are generally not conducive to development of roads or other infrastructure projects.

Southwestern Arizona is a relatively flat Sonoran desert landscape with predominant slopes of less than 6 percent. Throughout this region, small mountains and buttes are scattered, with localized slopes ranging up to 24 percent or more. This part of the state also contains its lowest point, 70 feet above sea level, on the Colorado River near Yuma.

Southeastern Arizona is part of the Mexican Highlands section of the Basin and Range physiographic province and includes a number of mountain ranges, including but not limited to, the Gila Bend Mountains in Maricopa County, the Catalina, Rincon, and Santa Rita Mountains in Pima County, and the Chiricahua, Dos Cabeza, and Pinaleno Mountains in Cochise County.

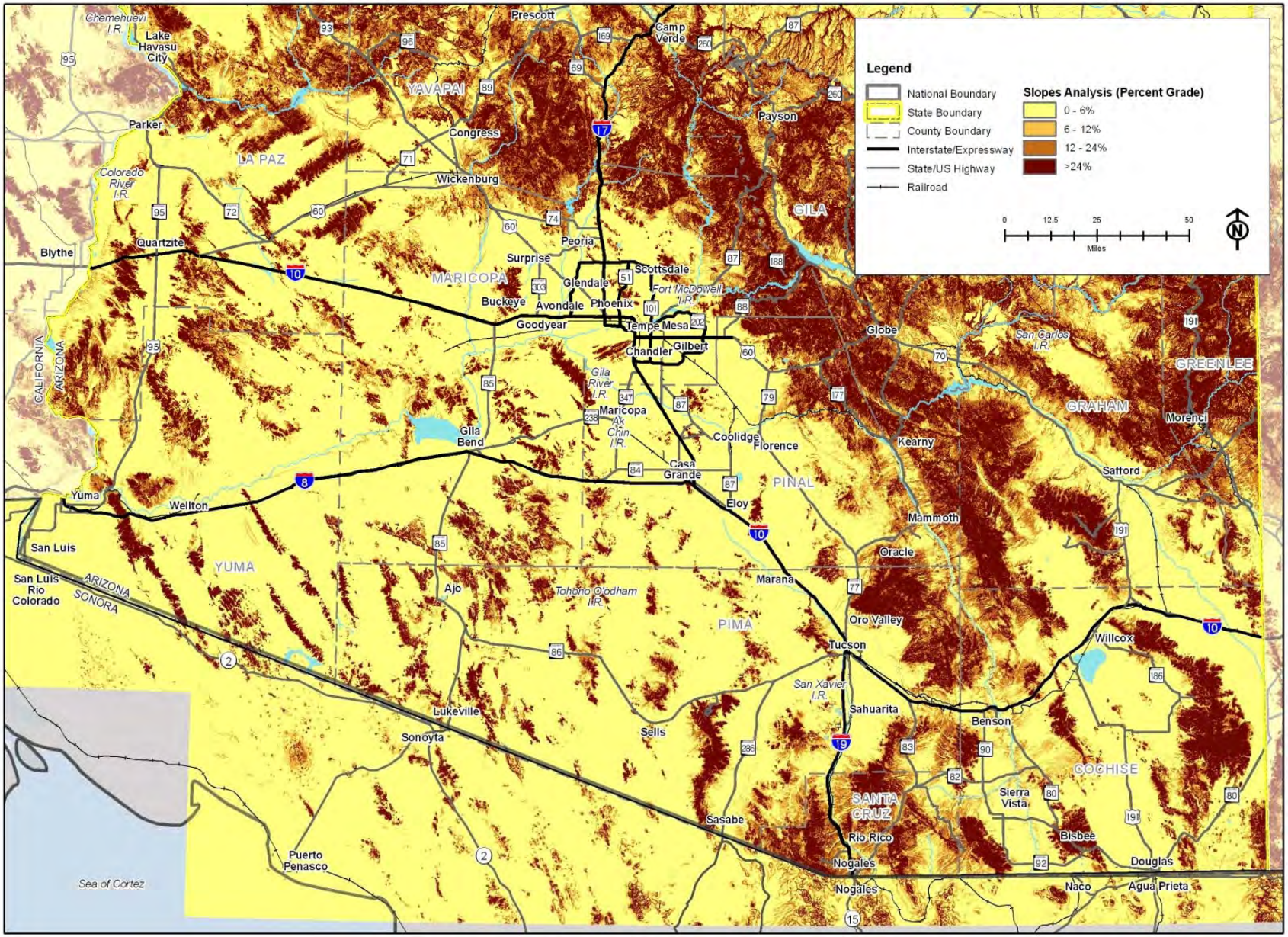
FIGURE 1-6
HabiMap™ – Southern Arizona



Source: AGFD 2012

FIGURE 1-7

Major Topographic Features – Southern Arizona



Sources: ADOT 2012j, ALRIS 2012

1.4.3 Major Drainage Features

Figure 1-8 shows the major drainage features in southern Arizona, including major surface water features, wetlands, riparian areas, and Federal Emergency Management Agency (FEMA) flood hazard zones. The figure also includes detailed riparian areas in Pima County, as defined in the Pima County Conservation Lands System guidance document.

The region is drained primarily by the Colorado River that flows north-south along Arizona's western border. The Gila River, which drains an arid watershed in Arizona and New Mexico, flows east-west across the state south of the Phoenix metropolitan area. It emerges from the mountains into the valley southeast of Phoenix, where it crosses the Gila River Indian Reservation as an intermittent stream due to large irrigation diversions. Well west of Phoenix, the river bends sharply southward along the Gila Bend Mountains. It flows generally westward through Yuma County and finally empties into the Colorado River near Yuma. The Gila River has several tributaries in the southeastern part of the state, including the San Carlos, Santa Cruz, San Francisco, San Pedro, and San Simon Rivers.

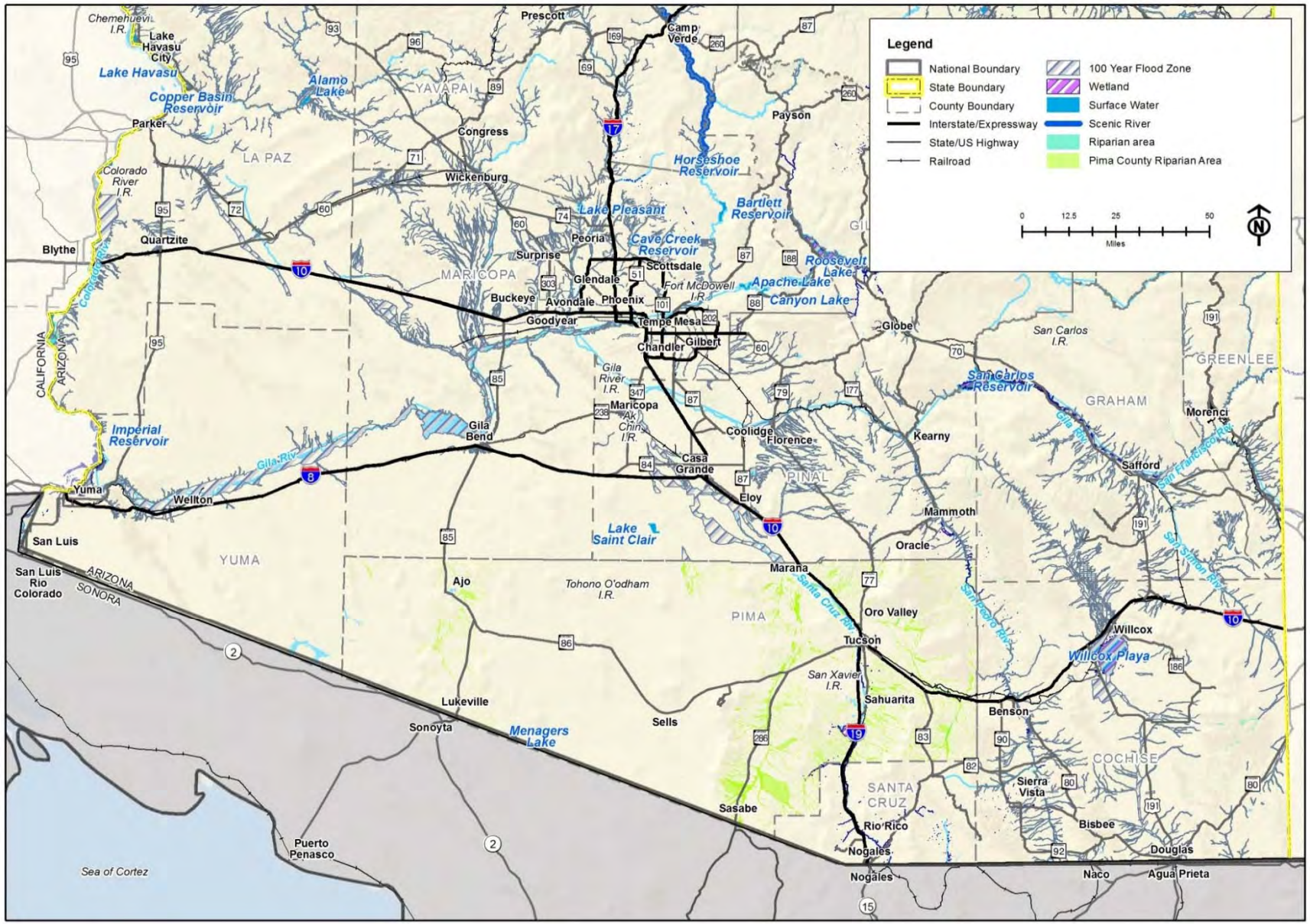
Three reservoirs are located in this area of the state: the Imperial Reservoir in Yuma County, and the Picacho and San Carlos Reservoirs in southeastern Arizona. Wetlands are located primarily along the smaller rivers in southeastern Arizona and along the Colorado River in Yuma County. FEMA has identified 100-year flood hazard zones throughout southern Arizona along major river channels. Major flood hazard zones are located along the Gila River and in southeastern parts of the state.

1.4.4 Major Land Ownership

Figure 1-9 shows the major land ownership patterns in southern Arizona. Military installations in southwestern Arizona occupy a large part of Yuma County and a portion of Maricopa County. These installations include the Yuma Proving Ground and the Barry M. Goldwater Air Force Range. Tohono O'odham Nation is the third largest tribal community in Arizona, located south of Casa Grande and west of Tucson in Pima County, extending all the way to Arizona's border with Sonora, Mexico. The Kofa National Wildlife Refuge, Cabeza Prieta National Wildlife Refuge, and Organ Pipe Cactus National Monument occupy other large portions of land in Yuma and Pima Counties. Additionally, southern Arizona includes several national parks, recreation areas, and historic sites owned and operated by the National Park Service, such as the Saguaro National Park or Yuma Crossing National Heritage Center.

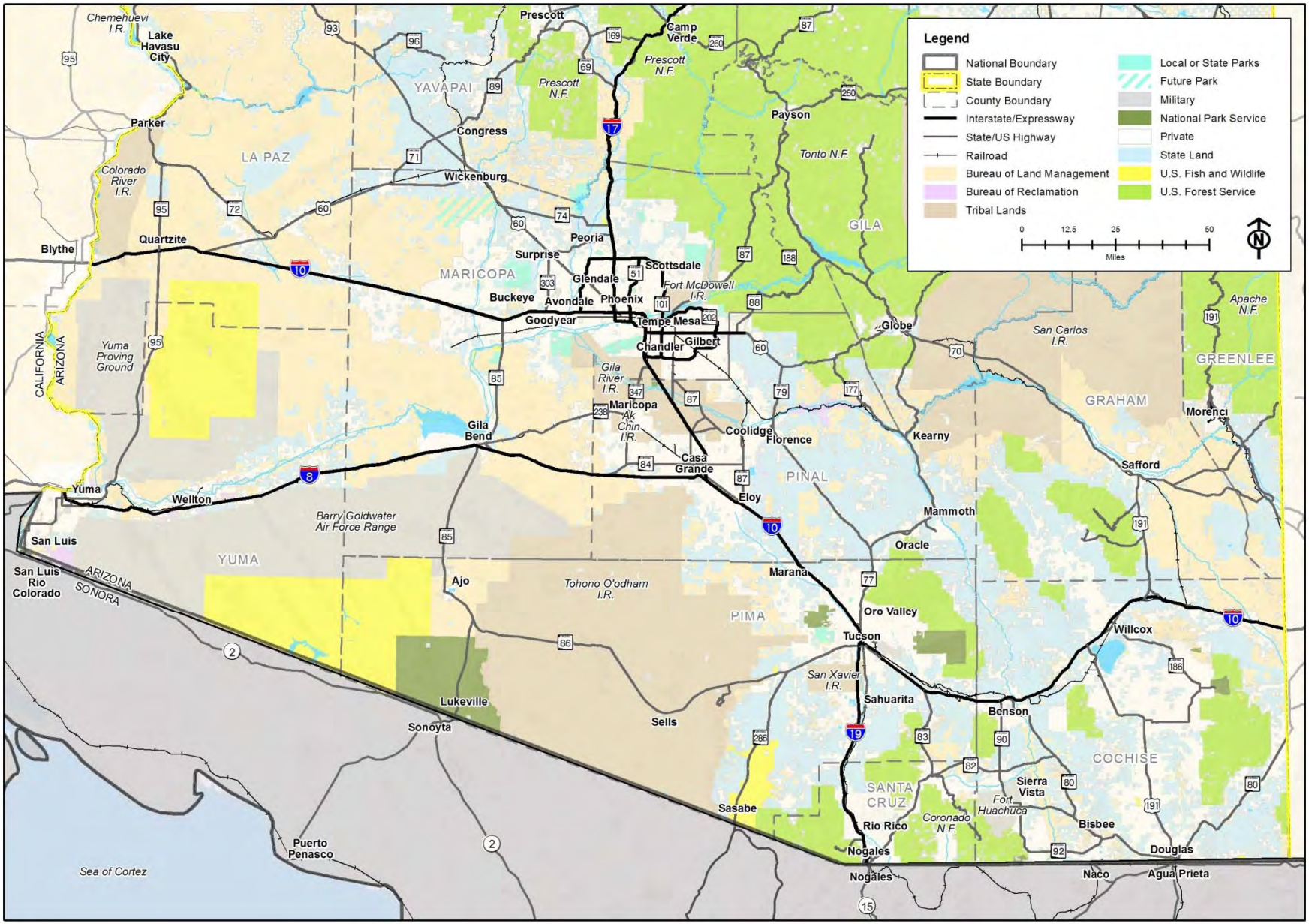
The BLM, ASLD, and USFS own the majority of land in southeastern Arizona, which includes all or part of Cochise, Graham, Greenlee, Pima, Pinal, and Santa Cruz Counties. Privately owned lands form the majority of the urbanized areas in Tucson, Casa Grande, Maricopa, Eloy, Marana, Nogales, and other smaller communities.

FIGURE 1-8
Drainage Features – Southern Arizona



Sources: ADOT 2012j, ALRIS 2012

FIGURE 1-9
Major Land Ownership – Southern Arizona



Sources: ADOT 2012j, ALRIS 2012, BLM 2012a

1.4.5 Utility and Energy

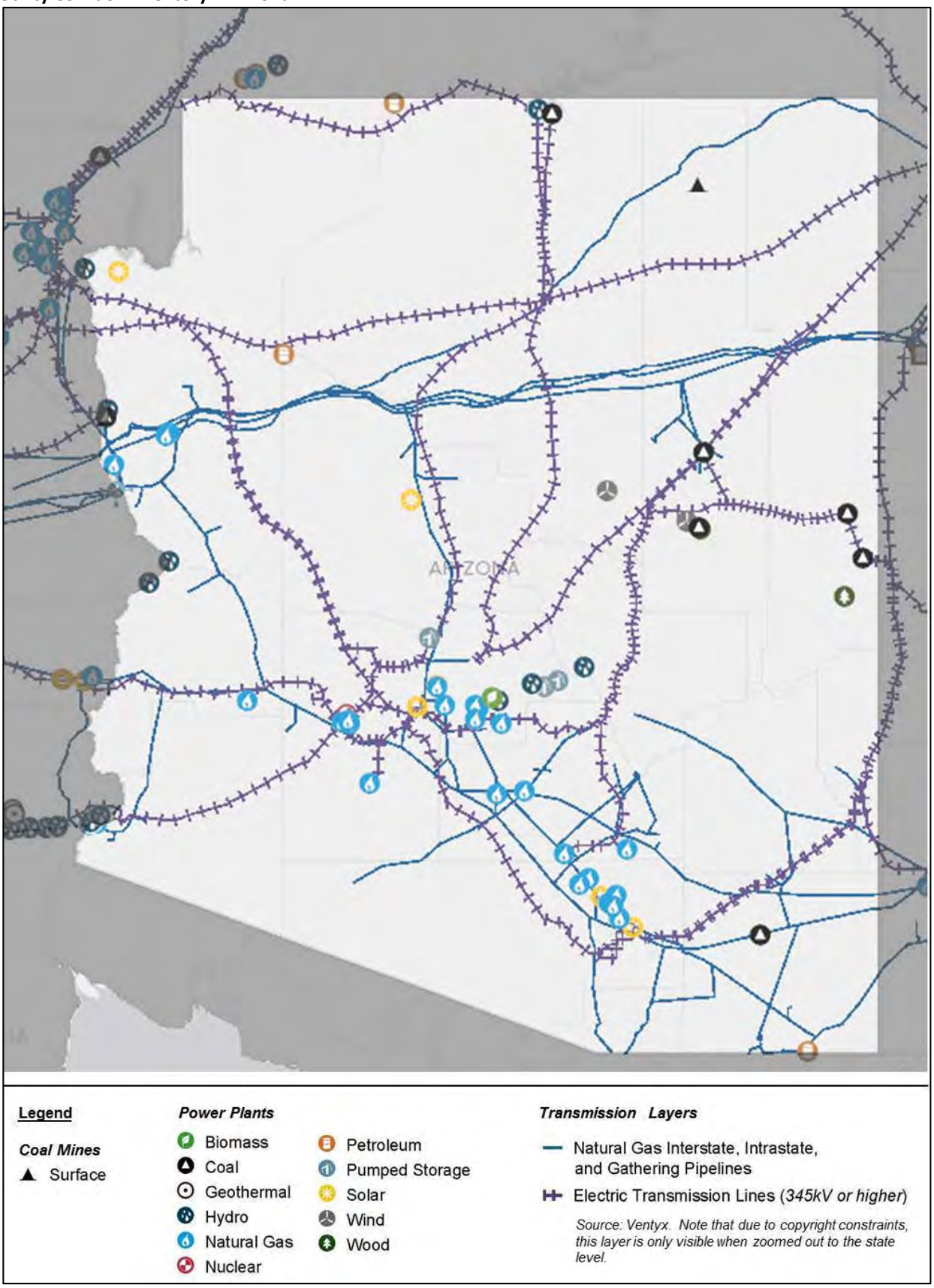
Major Utility Corridors

The U.S. Energy Information Administration (EIA) maintains a comprehensive inventory of major utility features across the country. In the Southern Arizona Future Connectivity Segment, there are a series of electric transmission lines, interstate natural gas pipelines, and solar, coal, and natural gas power plants (Figure 1-10) (EIA 2012a). These corridors include the Kinder Morgan-El Paso Natural Gas Line and Transwestern Pipeline, which deliver supplies to three major intrastate natural gas pipelines operating in Southern California.

A series of private transmission corridor proposals are in this segment area:

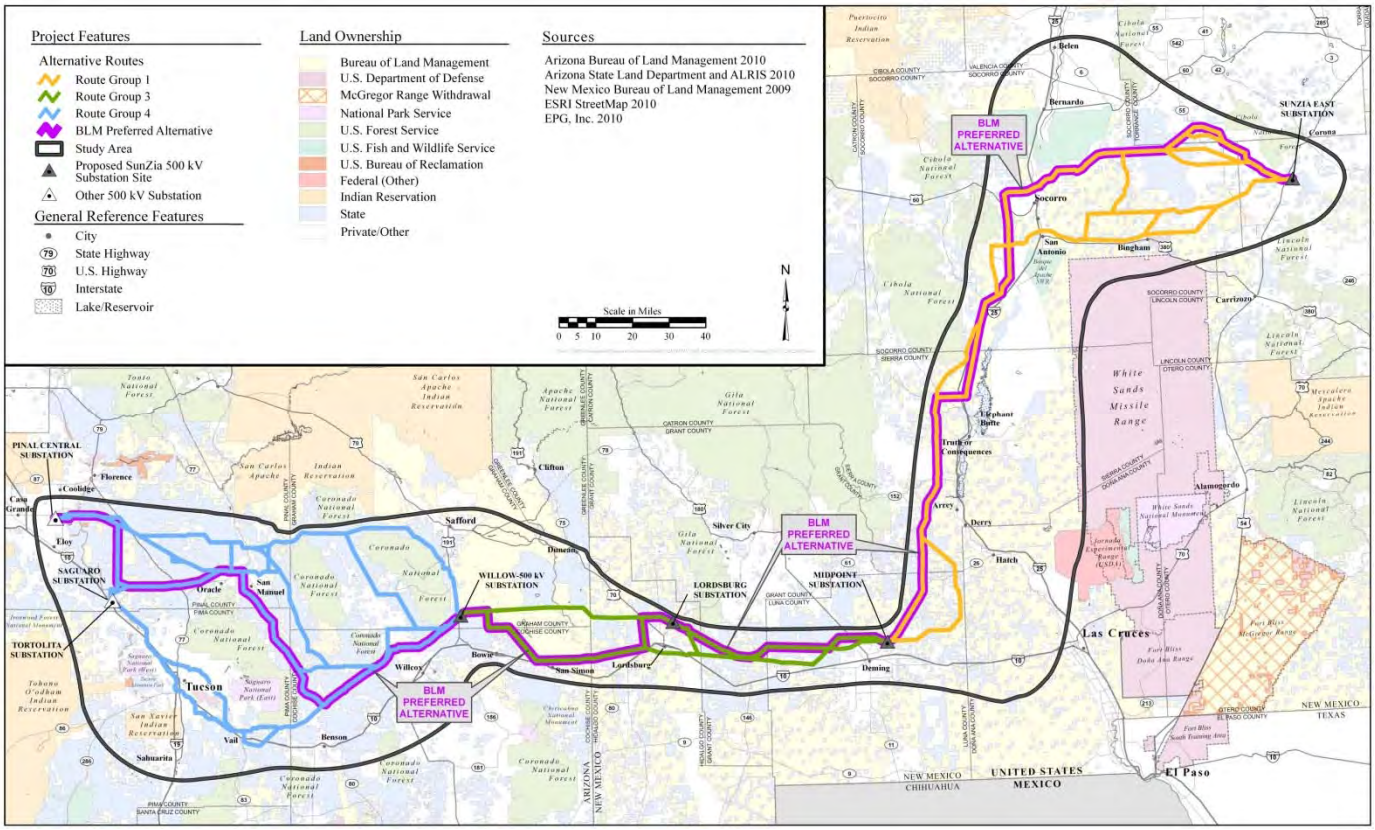
- The **SunZia Southwest Transmission Project** is planned to be approximately 500 miles of two 500-kilovolt (kV) transmission lines and associated substations that interconnect SunZia with numerous 345-kV lines in Arizona and New Mexico (BLM 2012b). SunZia will connect and deliver electricity generated in Arizona and New Mexico to population centers in the Desert Southwest. The preferred alternative identified by the BLM in the Draft Environmental Impact Statement is approximately 530 miles and is comprised of 191 miles of federal lands, 226 miles of state lands, and 113 miles of private or other lands in Arizona and New Mexico. The BLM's final determination on SunZia's alignment has not been made, and alternate routes are still under consideration (Figure 1-11). Right-of-way corridors for both lines may be up to 1,000 feet, depending on terrain conditions. Typical right-of-way corridor width is 200 feet per 500-kV circuit, 130-foot lattice steel towers are characteristic, and access to line and towers will use existing roadways where available.
- The **Centennial West Clean Line** will transport clean power via an approximately 900-mile overhead, high-voltage direct current transmission line, traversing New Mexico, Arizona, and California. The route is currently undetermined. The project is in the public outreach, siting, permitting, and regulatory approval stage through 2014 (Clean Line Energy Partners 2012).
- The **Southline Transmission Project** is a proposed transmission line designed to collect and transmit electricity across southern New Mexico and southern Arizona, including a "new build" section for approximately 240 miles from Las Cruces, New Mexico, to the existing Apache Substation, south of Willcox, Arizona (Southline 2012). The "upgrade section" would consist of double-circuit 230-kV lines connecting the Apache Substation to the existing Saguaro Substation northwest of Tucson (Figure 1-12). The upgrade section would rebuild approximately 120 miles of existing single-circuit 115-kV transmission lines, currently owned by the Western Area Power Administration, providing up to 1,000 MW of transmission capacity between these substations. The upgrade would interconnect with more than 10 existing substations along the route.

FIGURE 1-10
Utility Corridor Inventory – Arizona



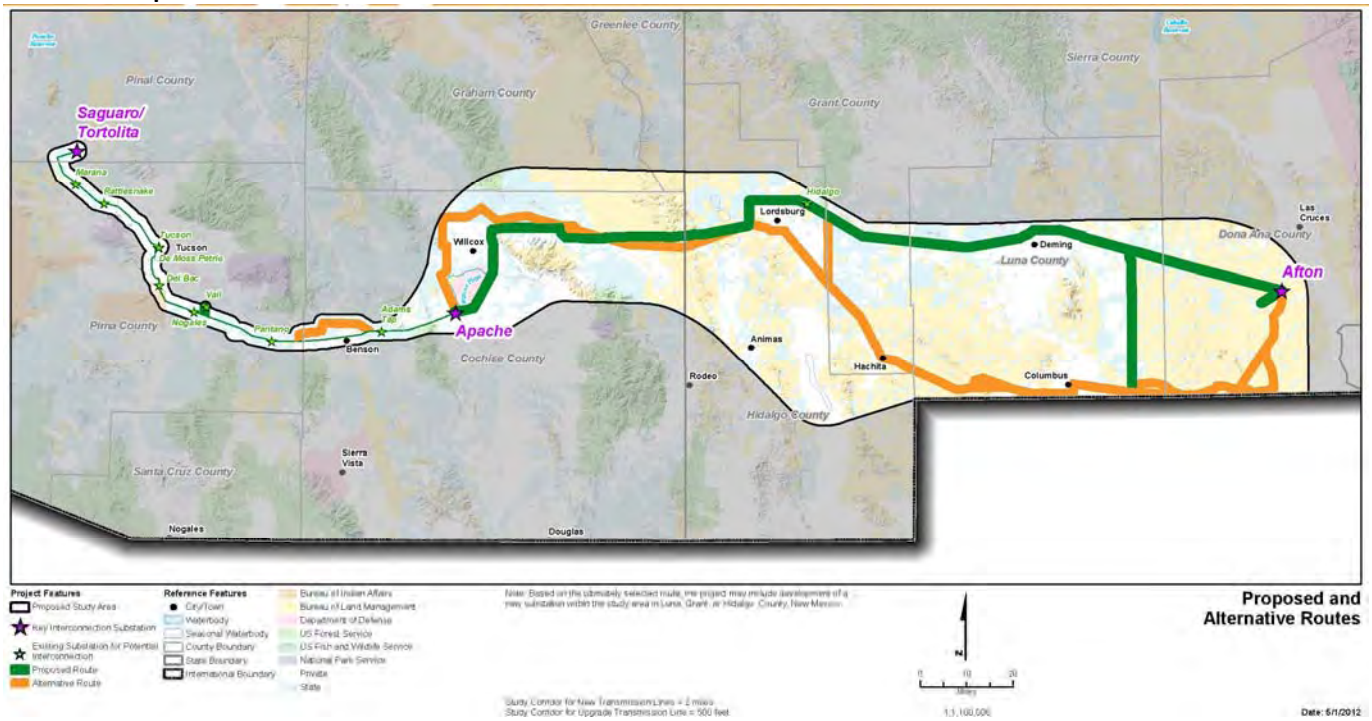
Source: EIA 2012a

FIGURE 1-11
SunZia Southwest Transmission Project Alternate Routes



Source: BLM 2012b

FIGURE 1-12
Southline Proposed and Alternate Transmission Routes



Source: Southline 2012

Solar Energy Potential

As of January 2012, Arizona ranked third in the nation in solar photovoltaic installations increasing in capacity from 63 MW in 2010 to 273 MW in 2011 (EIA 2012a). Three solar energy generation facilities are in this segment area. Arizona Public Service (APS), one of the state's major energy utility providers, is the purchaser of the power output of two of these plants. Beginning in 2006, the Arizona Renewable Energy Standard and Tariff rule required all regulated electrical utilities to obtain 15 percent of their retail generated energy from renewable resources by 2025 (Arizona Corporation Commission 2006).

The three solar energy generation facilities in this segment area are:

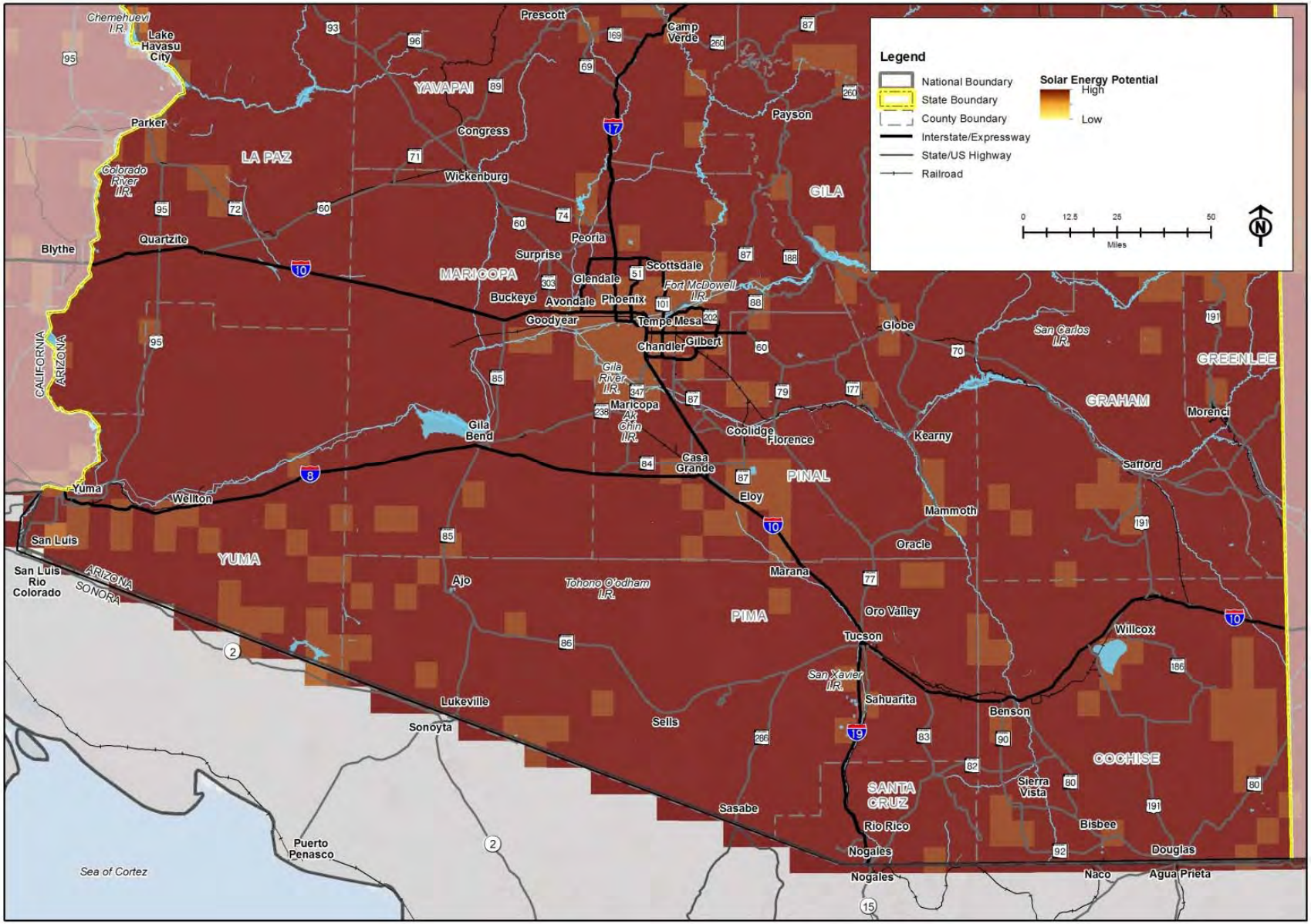
- **Agua Caliente Solar Power Plant:** This 2,400-acre photovoltaic solar plant, under construction by First Solar, is located in Yuma County, approximately 65 miles east of Yuma on the former White Wing Ranch (north of I-8 near Dateland). Expected to begin operation in 2014, this plant has a generating capacity of 290 MW (First Solar 2012). The power produced will be sold to Pacific Gas & Electric in California in a 25-year power purchase agreement.
- **Solana Generating Plant Solar:** This 1,900-acre CSP plant, under construction by Abengoa Solar, is located in Maricopa County, west of Gila Bend and north of I-8. Expected to begin operation in 2013, this plant has a generating capacity of 280 MW. APS has contracted to purchase the power output (CSP World 2012).
- **Saguaro Solar Power Plant:** This 14-acre CSP plant by Solargenix is located in Pinal County, near Red Rock and north of I-10. Constructed in 2006, this was the first CSP plant to become operational in the U.S. since 1988. It has a generating capacity of 1 MW. Power is purchased by APS (NREL 2009).

Using NREL data to understand monthly solar radiation characteristics, Figure 1-13 shows the solar energy potential of this study segment. The study area is shaded based on a range of low to high solar energy potential, measured in the amount of solar radiation (kilowatt hours per square meter per day, or kWh/m^2/day) that will fall on a solar array, on average, every day. The solar energy potential maps range from low (less than 4.0 kWh/m^2/day) to high (more than 7.5 kWh/m^2/day) solar energy generation potential. Photovoltaic technology reaches a "high potential" threshold at 5 kWh/m^2/day. (NREL 2012a)

As Figure 1-13 shows, the majority of the Southern Arizona Future Connectivity Segment falls within a very high solar potential range. In developing commercial solar energy facilities, however, other factors that must be considered include distance to transmission lines, slopes (ideally less than 1 percent), acreage available, areas falling within environmentally sensitive federal lands, and distance to graded roads (NREL 2012a).

Supporting these findings, the Restoration Design Energy Project (RDEP) is a BLM Arizona initiative to identify lands across Arizona that may be suitable for the development of renewable energy. The RDEP Record of Decision and approved Resource Management Plan Amendments have been released, which establish 192,100 acres of renewable energy development areas on BLM land throughout Arizona (BLM 2012c) (Figure 1-14). The renewable energy development areas are near transmission lines or designated corridors, close to population centers or industrial areas, and in areas where impacts on water usage would be moderate. These lands also have few known resource impacts or have been previously disturbed, such as retired agriculture properties. Renewable energy development areas are available for solar or wind energy development. The Record of Decision establishes the Agua Caliente SEZ on 2,550 acres near Dateland in western Arizona. The *Solar Energy PEIS* Record of Decision established the concept of SEZs as potential sites for utility-scale solar development. The BLM has amended eight land use plans across Arizona to identify areas that are considered to be most suitable for renewable energy projects. While these amendments apply only to BLM-managed lands, the RDEP examined all lands in Arizona and serves as a resource to the public, policy makers, and energy planners. The RDEP does not eliminate the need for further environmental review of individual sites. Proposed renewable energy projects outside of a Renewable Energy Development Area or a SEZ will also be considered on a case-by-case basis.

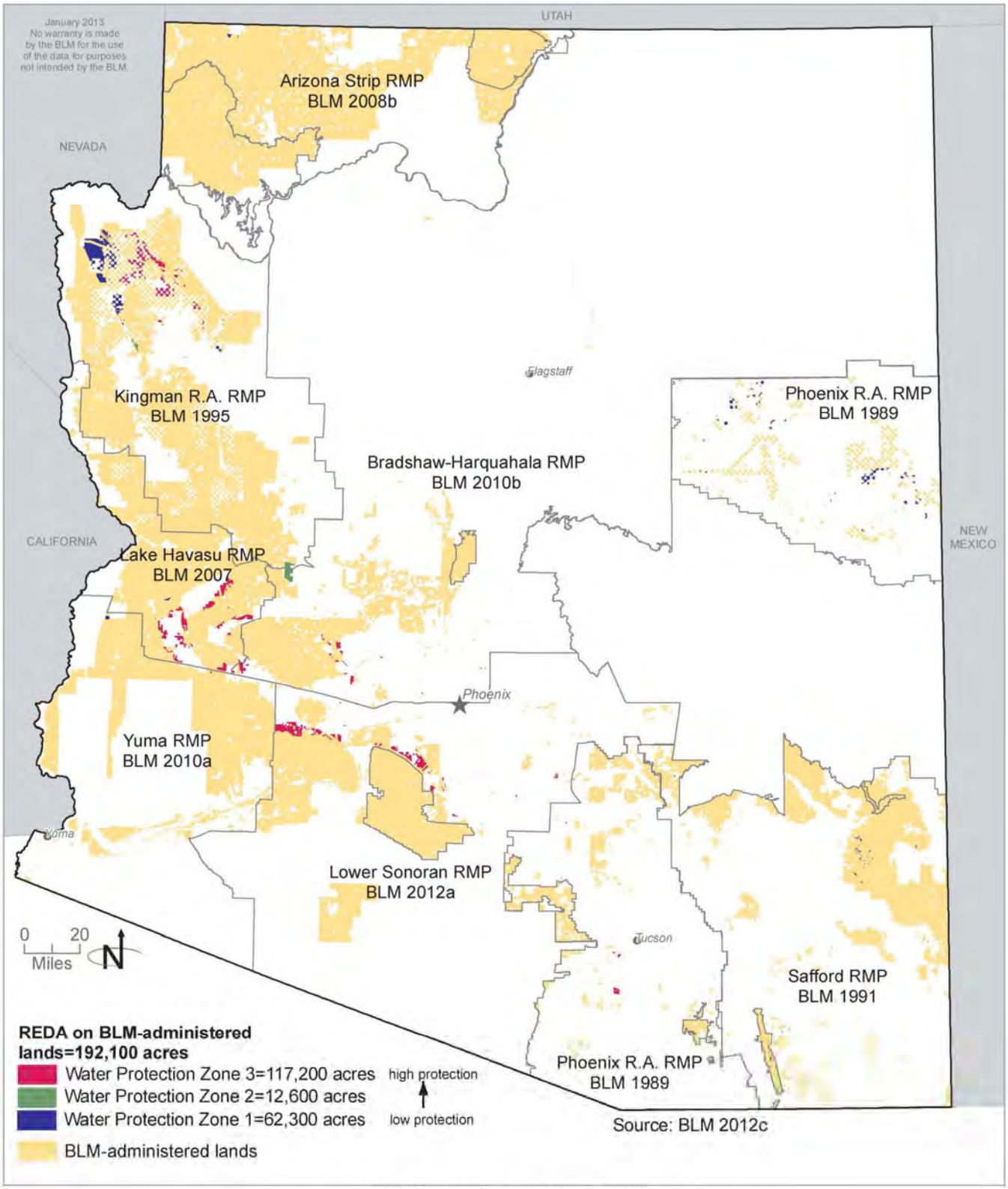
FIGURE 1-13
Solar Energy Potential – Southern Arizona



Sources: ADOT 2012j, NREL 2012a

FIGURE 1-14

Renewable Energy Development Areas on Bureau of Land Management Land



Arizona Restoration Design Energy Project
Record of Decision and Approved Resource Management Plan Amendments

Source: BLM 2012c

1.5 Priority Section 1: Phoenix Metropolitan Area

The principal goal of this project is to identify and establish feasible route(s) and transportation connections for the Priority Section (the study corridor between the Phoenix and Las Vegas metropolitan areas). Because of the length and varying characteristics of the priority corridor segment, the priority corridor is divided into three sections for in-depth study and analysis. The Phoenix Metropolitan Area Priority Section is one of these three Priority Section subdivisions. This segment includes the greater metropolitan Phoenix area, spanning from the northwest at Wickenburg to the southeast near Casa Grande.

1.5.1 Environmental Features

Figure 1-11 shows the environmental features and biological resources in the Phoenix metropolitan area. The environmental features are composed of ACECs, wilderness areas, national monuments, NCAs, critical habitats, and other land management categories.

Seventeen ACECs are located in this study segment, as identified by BLM. The identified ACECs are located primarily northwest of Phoenix near Wickenburg and along the US 93 corridor.

In addition to critical habitats and ACECs, the greater Phoenix metropolitan area is home to 18 federally designated wilderness areas, which are primarily located west of the metropolitan area between I-8 and I-10 and to the northwest between I-10 and US 93. The Arrastra Mountain, Tres Alamos, and Burro Creek Wilderness Areas are located along the US 93 corridor.

The BLM has also identified NCAs and national monuments on its lands. The Sonoran Desert National Monument is located east of Gila Bend, and the Agua Fria National Monument is located north of Phoenix along I-17. NPS properties include the Casa Grande Ruins and Tonto National Monument.

Critical habitats for five wildlife species are located in the Phoenix metropolitan area. Table 1-2 lists the common and scientific names of these species.

TABLE 1-2
Critical Habitat Species – Phoenix Metropolitan Area

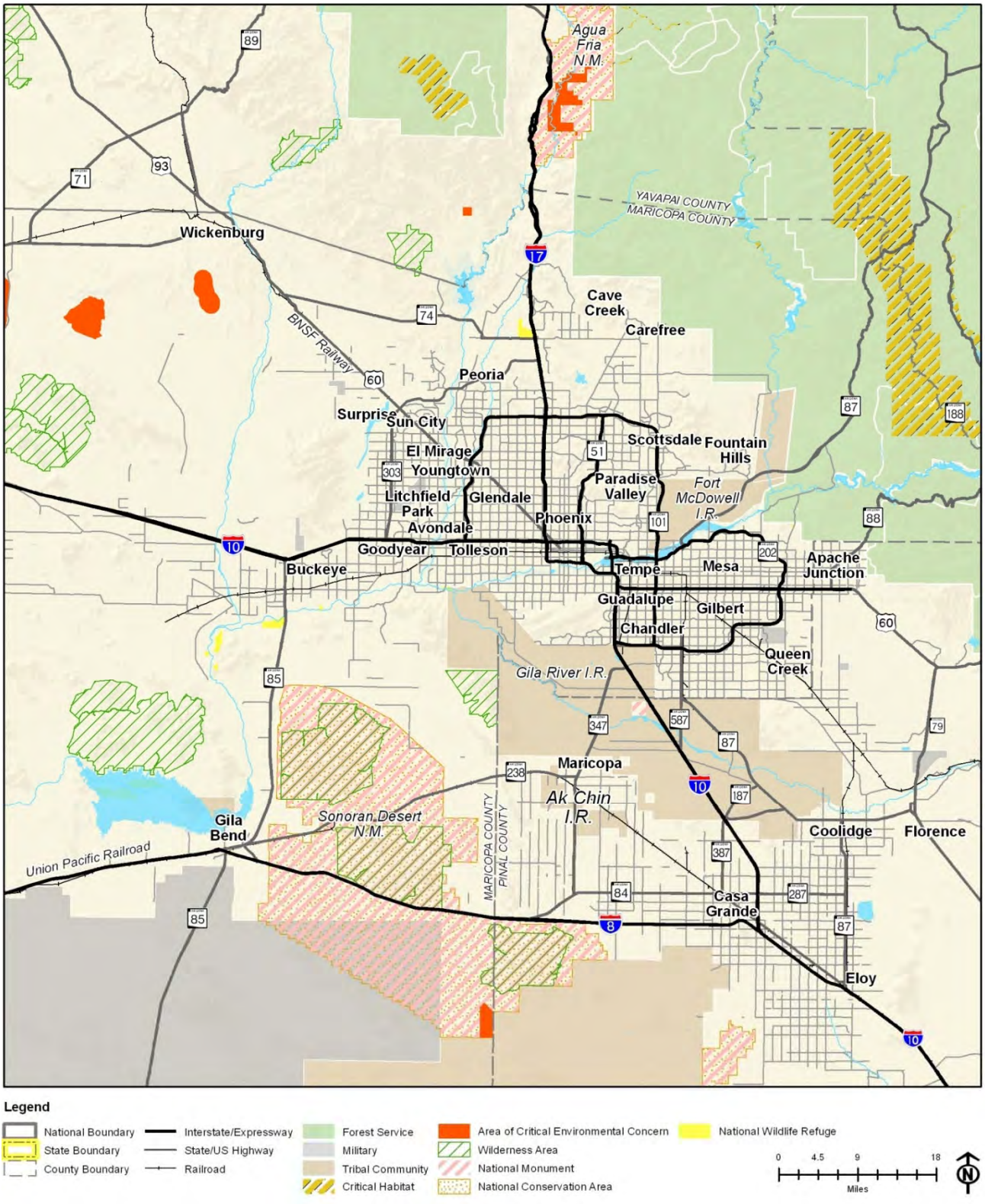
No.	Common Name	Scientific Name
1	Little Colorado spinedace	*Lepidomeda vittata*
2	Razorback sucker	*Xyrauchen texanus*
3	Mexican spotted owl	*Strix occidentalis lucida*
4	Gila chub	*Gila intermedia*
5	Southwestern willow flycatcher	*Empidonax traillii extimus*

Source: USFWS 2012

Figure 1-16 shows the areas identified by the AGFD for their conservation value, under the HabiMap™ "Species and Habitat Conservation Guide." The figure shows conservation potential through six shades of blue, with deeper shades indicating higher-priority conservation areas. The majority of these high-priority areas are located in the northern and northeastern portions of the area and near Wickenburg. Conservation potential on tribal lands is not presented due to the unavailability of comprehensive species information at this time.

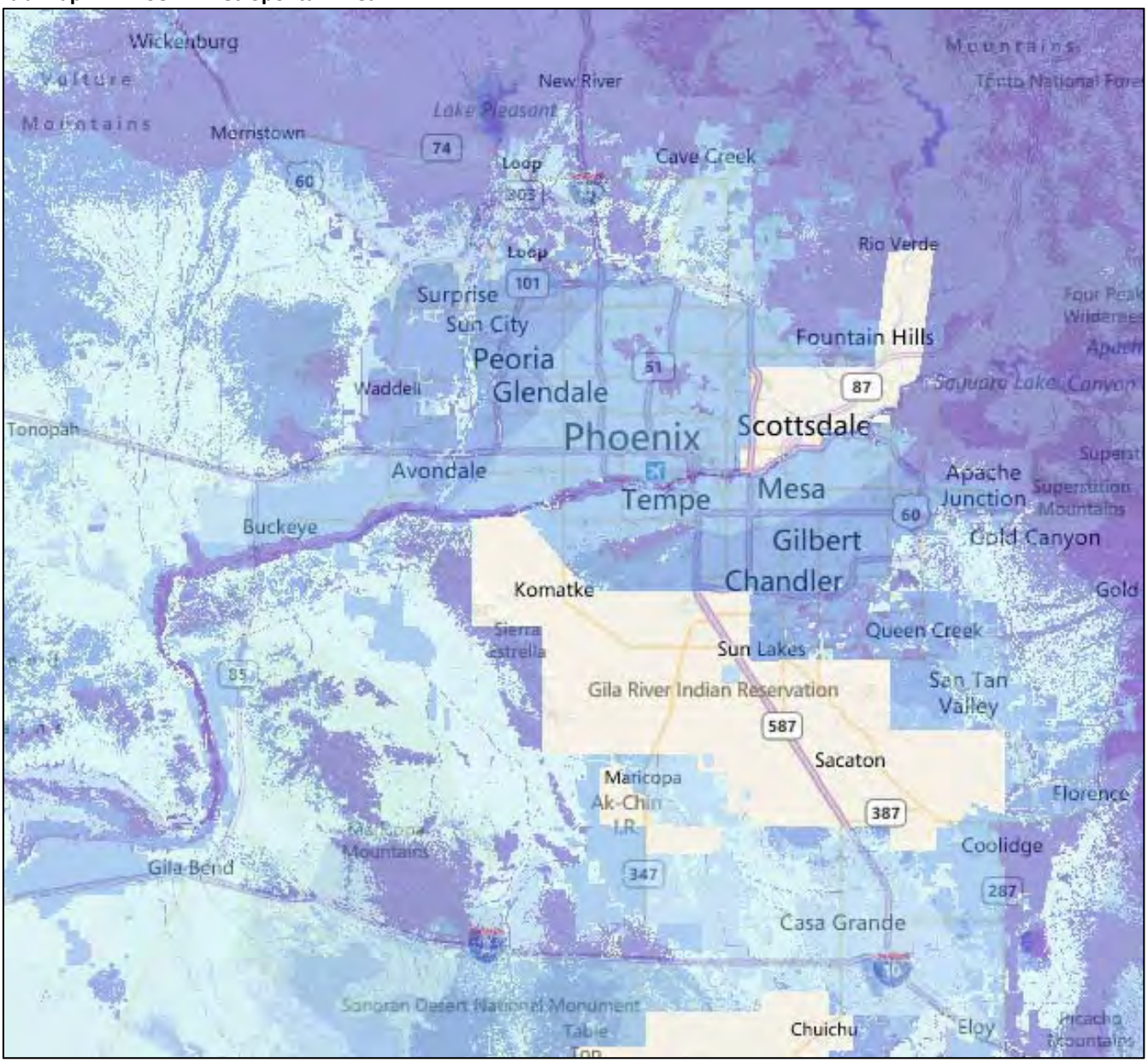
FIGURE 1-15

Environmental Features – Phoenix Metropolitan Area



Sources: ADOT 2012j, ALRIS 2012, BLM 2012a

FIGURE 1-16
HabiMap™ – Phoenix Metropolitan Area



Source: AGFD 2012

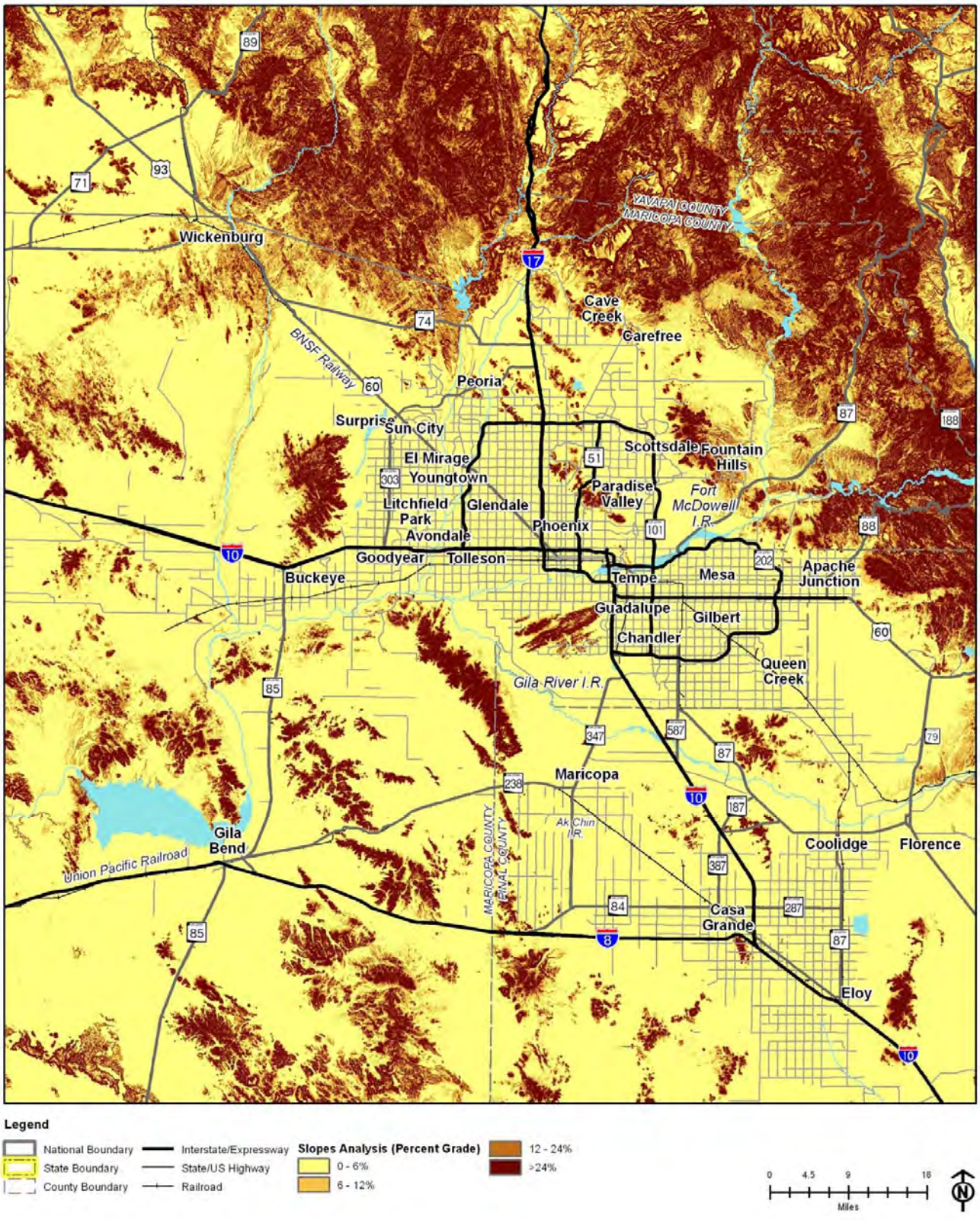
1.5.2 Topographic Features

Figure 1-17 shows the major topographic features in the greater Phoenix metropolitan area. Metropolitan Phoenix is located in the Salt River Valley, surrounded by mountains. To the north lie the New River Mountains in Yavapai and Maricopa Counties, and to the northeast are the Mazatzal Mountains that extend from southeast Yavapai County to west Gila County, through northern Maricopa County. To the west are the White Tank Mountains, and to the southwest the Sierra Estrellas. Closer to Phoenix, the McDowell Mountains are located on the east side of Scottsdale and South Mountain at the southern edge of Phoenix.

Because of the terrain in southeastern Maricopa County and western Pinal County, and the location of the Sonoran Desert National Monument, Sierra Estrella Wilderness Area, and the Gila River Indian Community, only a small slot of land is available (near Mobile) for major infrastructure development. Here, several previous studies have proposed a transportation connection (for example, the proposed Hassayampa Freeway) looping around the

southern and western portions of the Phoenix metropolitan area adjacent to several existing and proposed electrical transmission lines and underground natural gas lines.

FIGURE 1-17
Major Topographic Features – Phoenix Metropolitan Area



Sources: ADOT 2012j, ALRIS 2012

1.5.3 Major Drainage Features

Figure 1-18 shows the major drainage features in the vicinity of metropolitan Phoenix, including major surface water features, wetlands, riparian areas, and FEMA flood hazard zones. The Gila River and its tributary the Salt River are the most prominent streams. A number of artificial lakes and reservoirs are located primarily in the northeast part of the metropolitan area, along the Salt and Verde Rivers. Lake Pleasant is located northwest of the urbanized area.

Roosevelt Lake is the largest of several lakes formed by damming the Salt River for irrigation and flood control. It is located northeast of Phoenix along SR 88 in the Tonto National Forest. Wetlands are located primarily within the Tonto National Forest around Roosevelt Lake and near washes that drain into the lake. FEMA has identified 100-year flood hazard zones throughout the area along the Gila River and other smaller rivers and washes. A flood hazard zone has been identified along a wash close to the US 60 corridor in Wickenburg.

1.5.4 Major Land Ownership

Figure 1-19 shows major land ownership patterns in the Phoenix study segment. Developed land in the metropolitan area is largely privately held and falls under the jurisdiction of approximately two dozen municipalities, as well as unincorporated Maricopa County.

BLM and ASLD own the majority of land in northwest and southeast portions of this segment, which include parts of Yavapai, Pinal, and Pima Counties. The Salt River Pima-Maricopa, Fort McDowell, and Gila River Indian communities are located immediately east, northeast, and south of the urbanized limits. The USFS has jurisdiction of the Tonto National Forest to the north and east.

Additionally, and as illustrated on Figure 1-19, the planned Vulture Mountain Cooperative Recreation Management Area is recognized in northwest Maricopa County. This is a joint effort between the Maricopa County Parks Department and the BLM to develop a new regional park with recreational amenities, as well as the protection of natural, cultural, historical, and wildlife resources.

1.5.5 Utility and Energy

Major Utility Corridors

The U.S. EIA maintains a comprehensive inventory of major utility features across the country. The Phoenix metropolitan area project segment has a series of electric transmission lines; interstate natural gas pipelines; and biomass, hydro, nuclear, solar, natural gas, and pumped storage power plants (Figure 1-10) (EIA 2012a). Such corridors include the Kinder Morgan-El Paso Natural Gas Line and Transwestern Pipeline, which deliver supplies to three major intrastate natural gas pipelines operating in Southern California.

No private transmission corridor proposals are known in this segment area.

Solar Energy Potential

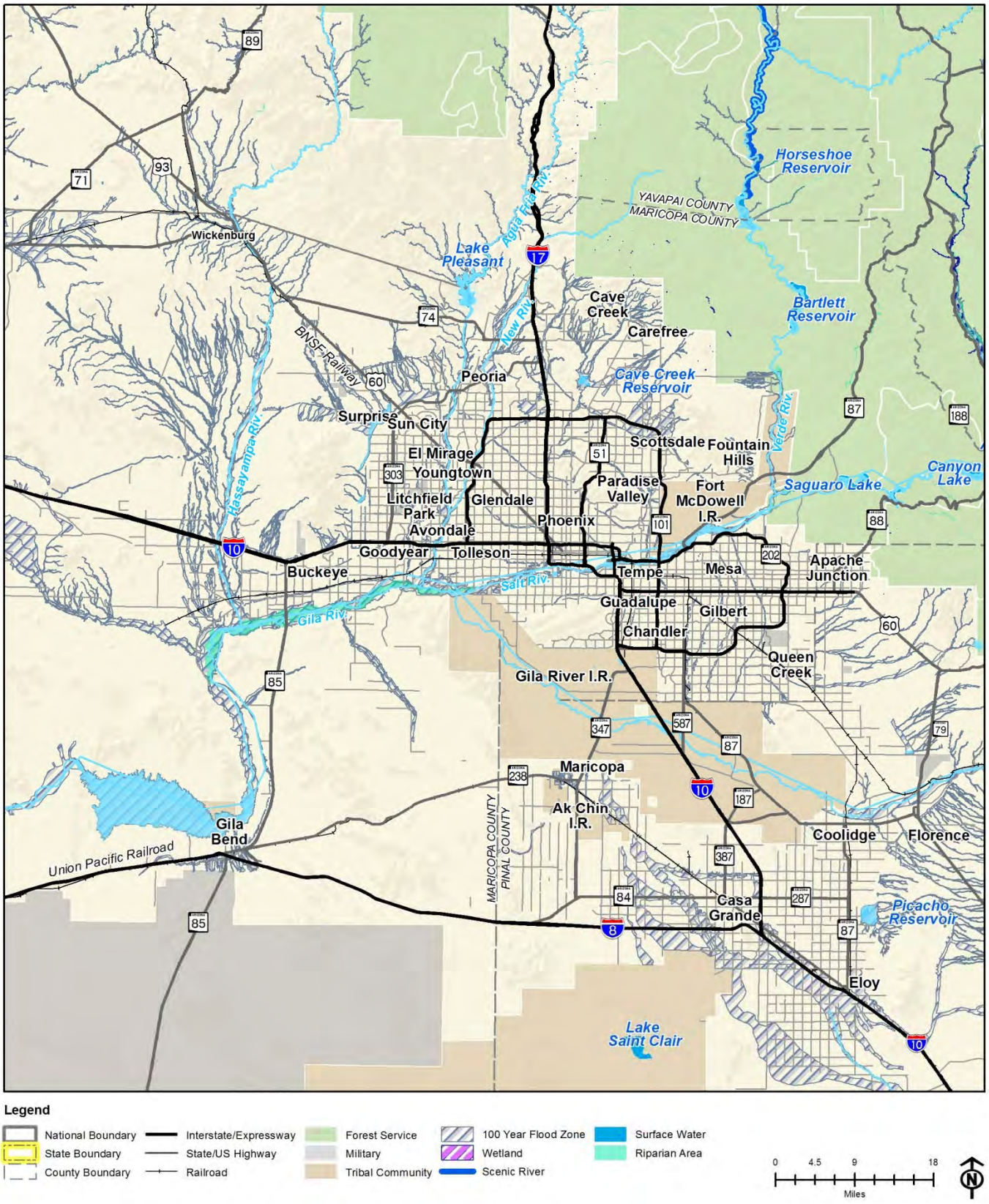
Using NREL data to understand monthly solar radiation characteristics, Figure 1-20 shows the solar potential of this study segment. As Figure 1-20 shows, the majority of the Phoenix metropolitan segment area falls within a very high solar potential range (NREL 2012a). In developing commercial solar energy facilities, however, other factors must be considered: distance to transmission lines, slopes (less than 1 percent is ideal), acreage available, areas falling within environmentally sensitive federal lands, and distance to graded roads.

One solar energy generation facility is planned in this segment area:

- **Mesquite Solar project:** Sempra Generation is building this 4,000-acre photovoltaic solar plant in Maricopa County, approximately 40 miles west of Phoenix (just west of SR 85 between I-10 and the Gila River). It is expected to begin operation in 2013. Phase I has a capacity of about 150 MW, with 42 MW already operational, and an ultimate capacity of up to 700 MW. Sempra has an agreement with Pacific Gas and Electric Company for power output purchasing (Sempra 2012).

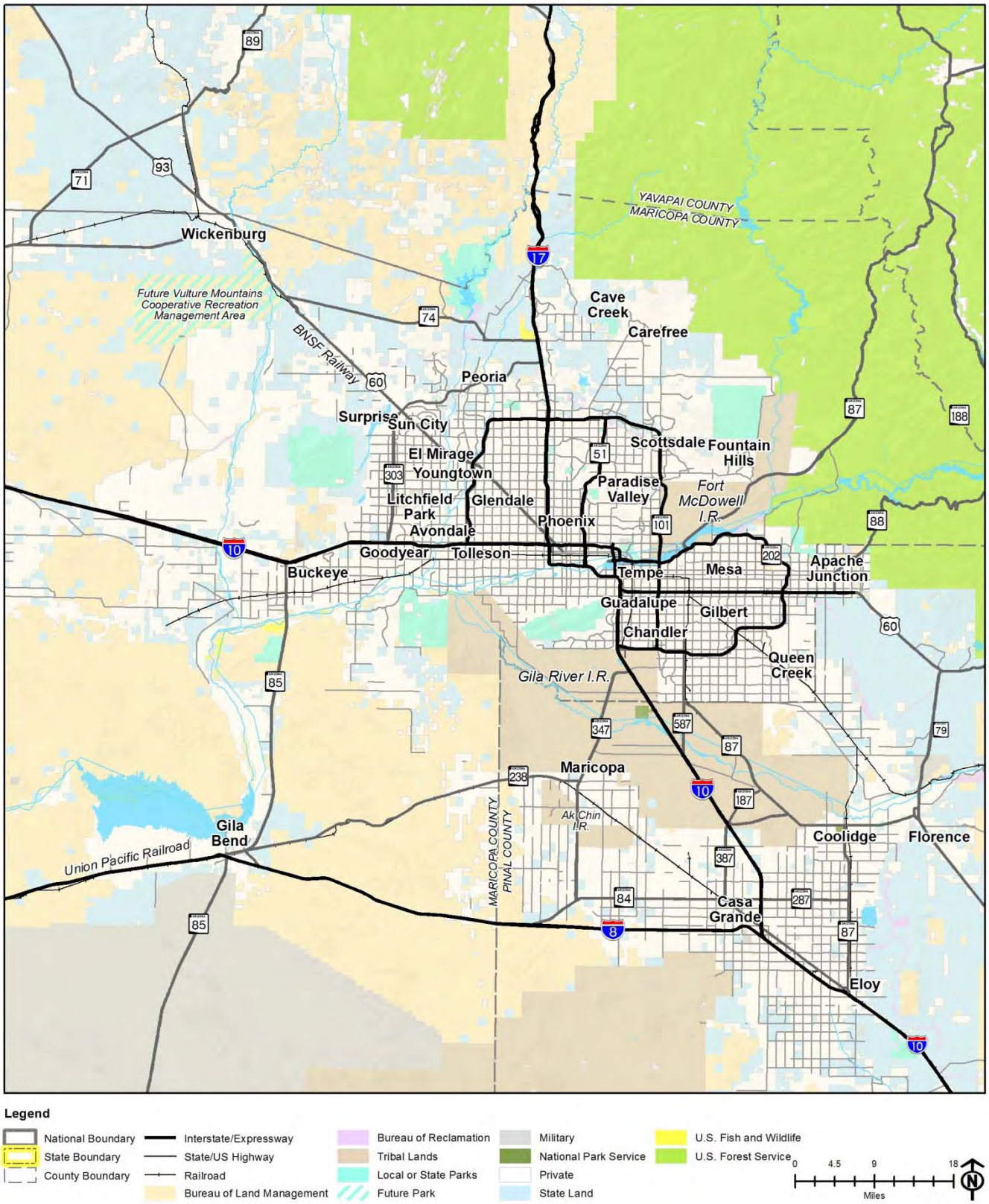
FIGURE 1-18

Drainage Features – Phoenix Metropolitan Area



Sources: ADOT 2012j, ALRIS 2012

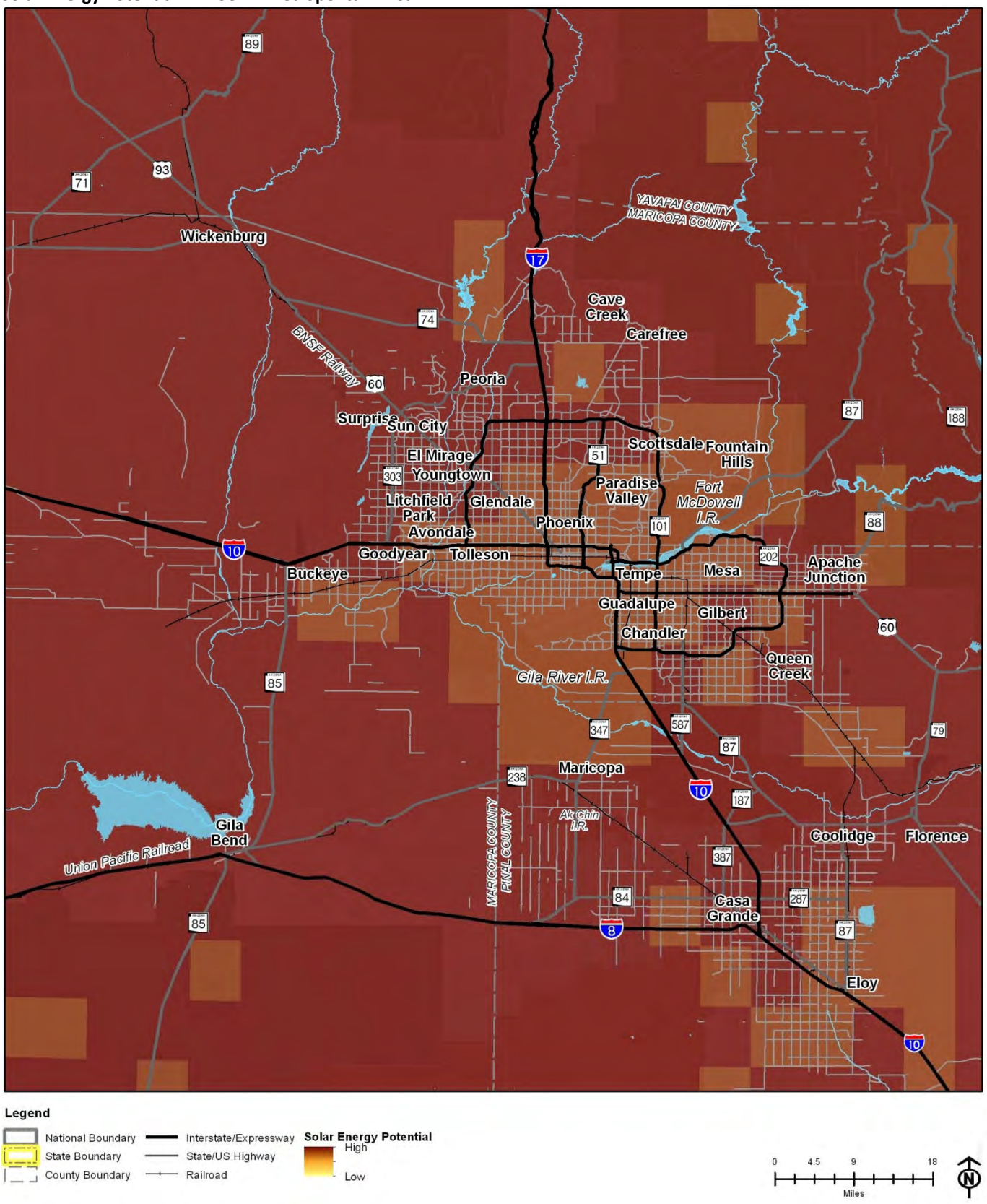
FIGURE 1-19
Major Land Ownership – Phoenix Metropolitan Area



Sources: ADOT 2012j, ALRIS 2012, BLM 2012a

FIGURE 1-20

Solar Energy Potential – Phoenix Metropolitan Area



Sources: ADOT 2012j, NREL 2012a

1.6 Priority Section 2: Northern Arizona/Southern Nevada

The priority corridor is divided into three sections for in-depth study and analysis. The Northern Arizona/Southern Nevada Priority Section is the second of these three Priority Section subdivisions. This segment includes the area from Wickenburg to Boulder City, generally centered on the US 93 corridor.

1.6.1 Environmental Features

Figure 1-21 shows the environmental features and biological resources in northern Arizona/southern Nevada. The environmental features are composed of ACECs, wilderness areas, national monuments, NCAs, critical habitats, and other land management categories.

Located in this region are 19 ACECs, as identified by BLM. In Arizona, these ACECs are primarily located in Mohave County, specifically along the US 93 corridor near the Yavapai/Mohave county line, where US 93 passes through the Burro Creek and Poachie ACECs (habitats of the bald eagle and desert tortoise). In southern Nevada, these ACECs span the US 95 corridor between the Nevada-California state line to just south of Boulder City as well as north of US 93 west of Lake Mead.

This segment also contains 19 federally designated wilderness areas, located in Mohave and Yavapai Counties (Arizona) west of US 93. The Mount Wilson, Mount Tipton, Arrastra Mountain, Tres Alamos, and Burro Creek Wilderness Areas are located along the US 93 corridor. The El Dorado, Ireteba Peaks, and the North and South McCullough Mountains Wilderness Areas are located in southern Nevada.

The BLM has identified NCAs and national monuments on its lands. The Grand Canyon-Parashant National Monument, the only national monument in northern Arizona, is located far north and east of US 93. The Grand Canyon National Park is located in northern Arizona and extends east-west from the eastern end of the canyon to the Lake Mead National Recreation Area (NRA) on the west.

Critical habitats for six wildlife species are located in northern Arizona/southern Nevada. Table 1-3 lists the common and scientific names of these species.

TABLE 1-3
Critical Habitat Species – Northern Arizona/Southern Nevada

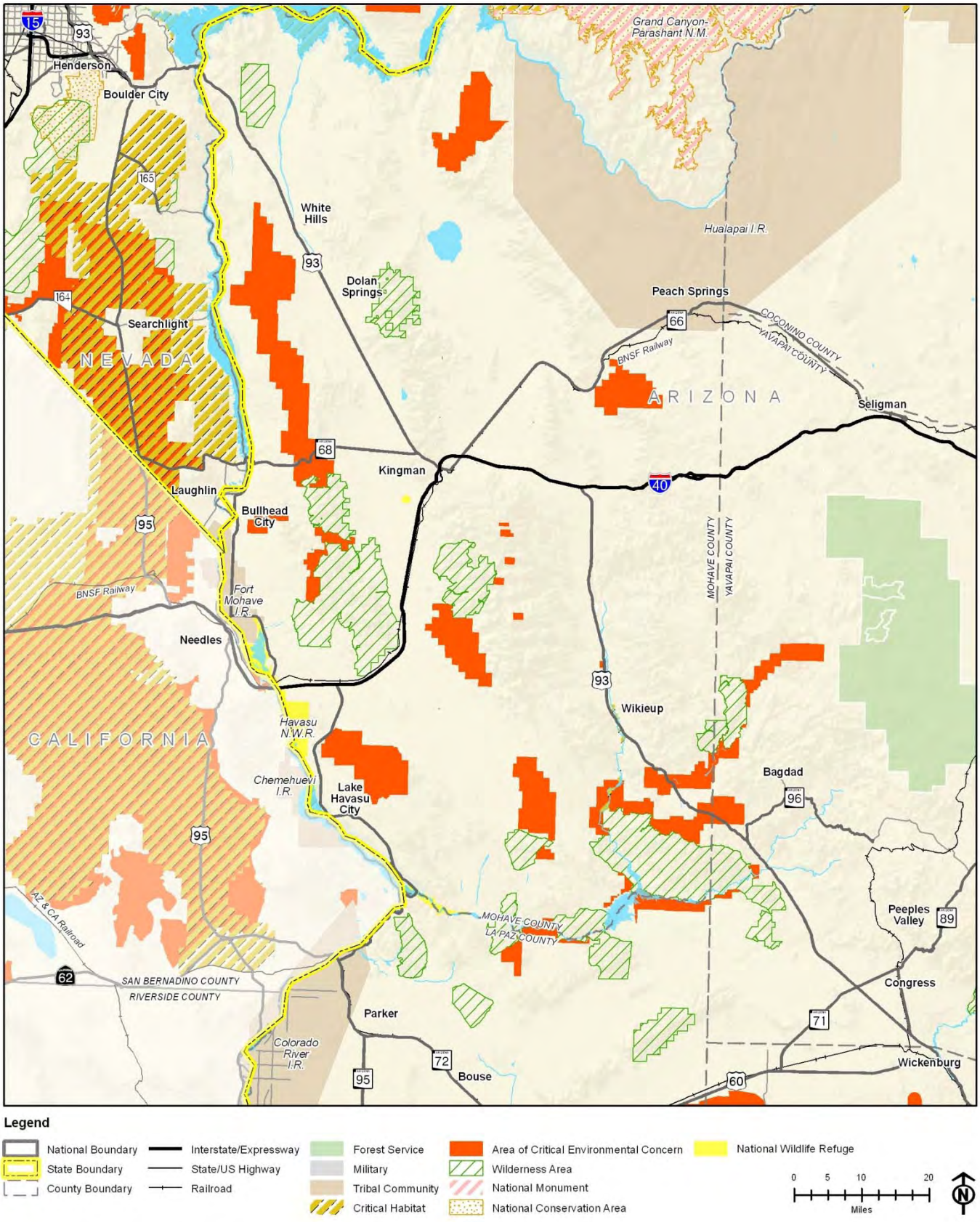
No.	Common Name	Scientific Name
1	Bonytail chub	*Gila elegans*
2	Desert tortoise	*Gopherus agassizii*
3	Humpback chub	*Gila cypha*
4	Mexican spotted owl	*Strix occidentalis lucida*
5	Razorback sucker	*Xyrauchen texanus*
6	Southwestern willow flycatcher	*Empidonax traillii extimus*

Source: USFWS 2012

Figure 1-22 shows the areas identified by the AGFD by their conservation value under the HabiMap™ "Species and Habitat Conservation Guide" (Arizona only). The figure shows conservation potential through six shades of blue, with deeper shades indicating higher-priority conservation areas. The majority of these high-priority areas are located in the northern and northwestern part of the state, east of US 93. Most other areas in northern Arizona along US 93 have low to medium conservation potential. Conservation potential on tribal lands is not presented due to the unavailability of comprehensive species information at this time.

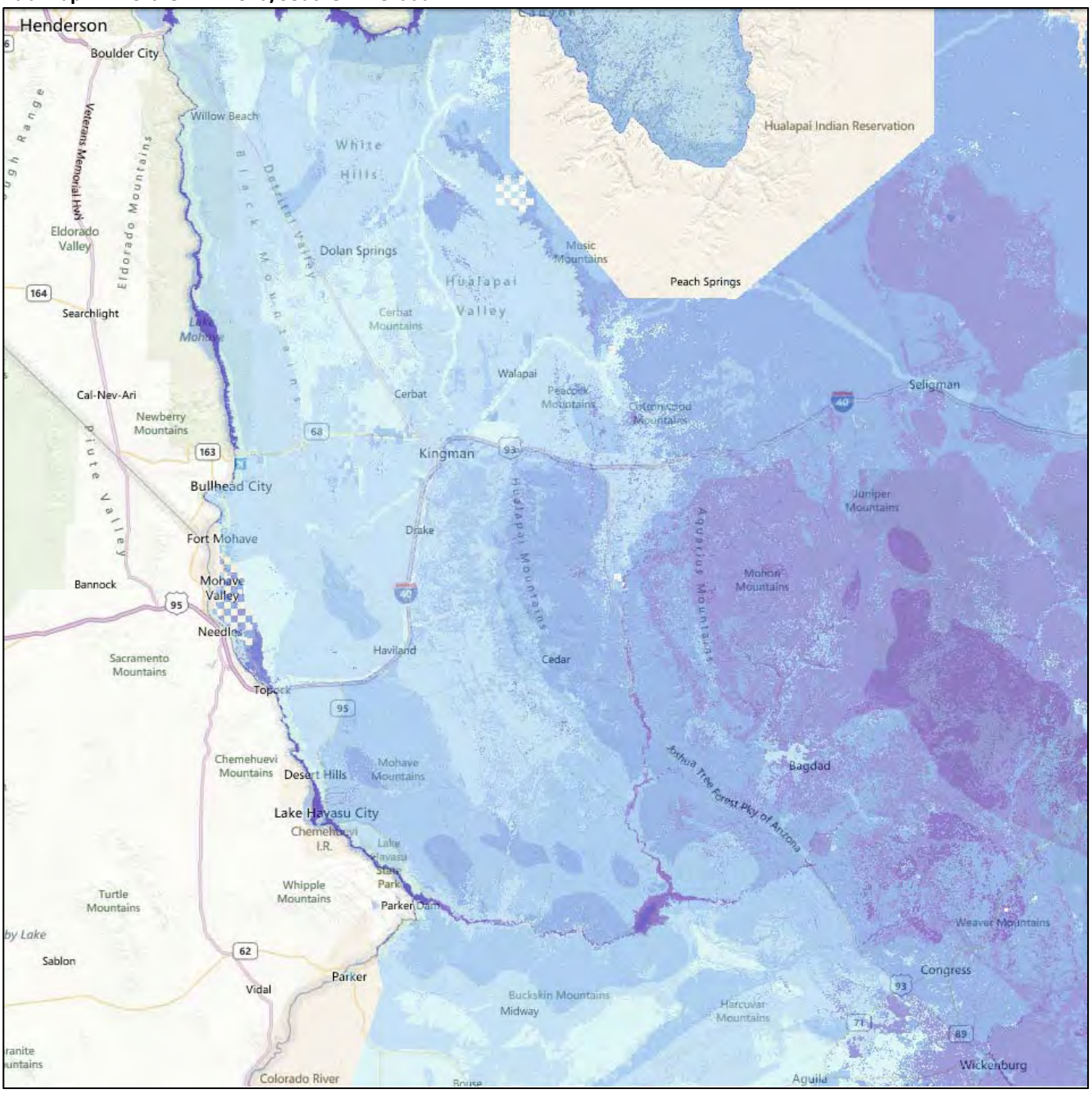
FIGURE 1-21

Environmental Features – Northern Arizona/Southern Nevada



Sources: ADOT 2012j, ALRIS 2012, BLM 2012a

FIGURE 1-22
HabiMap™ – Northern Arizona/Southern Nevada



Source: AGFD 2012

Improvements along US 93 in Arizona continue to consider and integrate wildlife crossing infrastructure where allowable. In the segment between the Mike O'Callaghan-Pat Tillman Memorial Bridge and I-40, three specially designed wildlife overpasses have been implemented to protect motorists on US 93 and also to protect the bighorn sheep that are native in the Lake Mead NRA within the Black Mountains. The overpasses are the first of their kind in Arizona.

1.6.2 Topographic Features

Figure 1-23 shows the major topographic features in this segment. The largest topographical feature is the Grand Canyon, which spans almost half the width of the state. The canyon was formed by the flow of the Colorado River over millions of years.

Northern Arizona has various dispersed mountain ranges that include the Beaver Dam Mountains northeast of Lake Mead in Mohave County, the Black Mountains south of Lake Mead along the Arizona-California border, the Hualapai Mountains near Kingman, and the Artillery Mountains northwest of Wickenburg. Existing US 93 extends around the Hualapai and Artillery Mountains before it connects with I-40 in Kingman.

1.6.3 Major Drainage Features

Figure 1-24 shows the major drainage features in northern Arizona/southern Nevada, including major surface water features, wetlands, riparian areas, and FEMA flood hazard zones.

Lake Mead on the Arizona/Nevada border and the Colorado River along the Arizona/California border are the two most prominent surface water features in this segment. The Colorado River travels east-west in northern Arizona through the Grand Canyon until it reaches Lake Mead, formed by the Hoover Dam. It then turns south and flows along the Arizona-California border. Lake Havasu, Lake Mohave, and the Alamo Lake are the other large water features.

The Copper Basin and Gene Wash reservoirs are located in Mohave County, south of Lake Havasu City. Wetlands are located primarily along the Colorado River and around Lake Mead. FEMA has identified 100-year flood hazard zones throughout northern Arizona along the smaller rivers and washes. A flood hazard zone has been identified along an unnamed wash close to the US 93 corridor.

1.6.4 Major Land Ownership

Figure 1-25 shows the major land ownership patterns in this segment. The BLM and the ASLD own the majority of the land. Grand Canyon National Park and Lake Mead NRA are managed by the NPS. The Hualapai Indian Reservation is located immediately south of Grand Canyon National Park. The Fort Mojave Indian Tribe is located at the Arizona/California border, north of I-40 near Needles. Prescott National Forest falls under the jurisdiction of the USFS.

1.6.5 Utility and Energy

Major Utility Corridors

The U.S. EIA maintains a comprehensive inventory of major utility features across the country. In the Northern Arizona/Southern Nevada Priority Segment, there are a series of electric transmission lines; interstate natural gas pipelines; and solar, natural gas, coal, petroleum, and pumped storage power plants (Figure 1-10) (EIA 2012a).

Solar Energy Potential

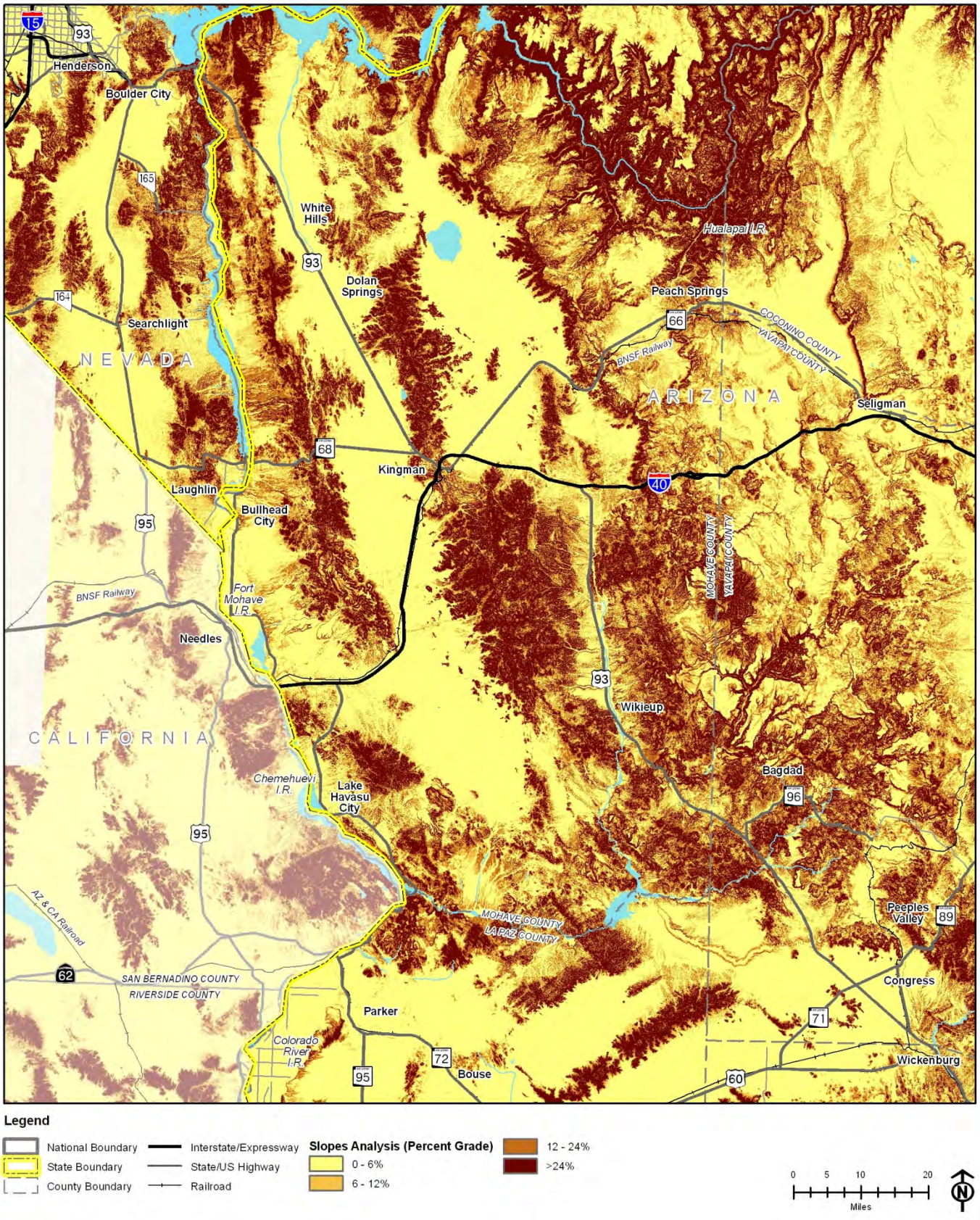
Using NREL data to understand monthly solar radiation characteristics, Figure 1-26 shows the solar potential of this study segment. As Figure 1-26 shows, the majority of the Northern Arizona/Southern Nevada Priority Segment area falls within a very high solar potential range (NREL 2012a). In developing commercial solar energy facilities, however, other factors must be considered: distance to transmission lines, slopes (ideally less than 1 percent), acreage available, areas falling within environmentally sensitive federal lands, and distance to graded roads.

One solar energy generation facility is in the vicinity of this segment area:

- **Prescott Airport Solar Plant:** This 55-acre photovoltaic solar plant, operated by APS, is located in Yavapai County, near the Prescott Regional Airport. The plant currently produces 3.5 MW, but has a potential capacity of 5 MW (APS 2006).

FIGURE 1-23

Major Topographic Features – Northern Arizona/Southern Nevada



Sources: ADOT 2012j, ALRIS 2012

FIGURE 1-24

Drainage Features – Northern Arizona/Southern Nevada

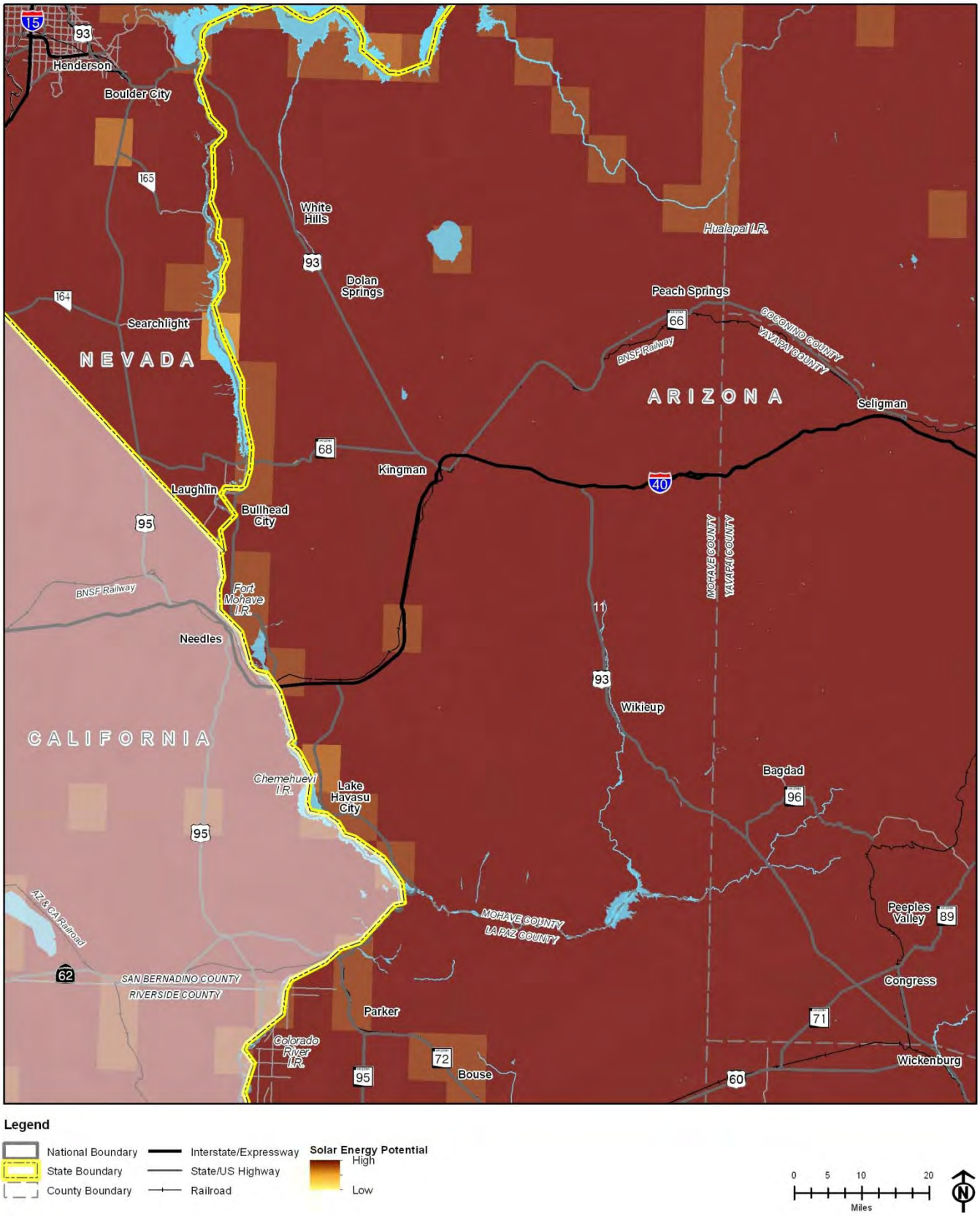
Sources: ADOT 2012j, ALRIS 2012

FIGURE 1-25
Major Land Ownership – Northern Arizona/Southern Nevada

Sources: ADOT 2012j, ALRIS 2012, BLM 2012a

FIGURE 1-26

Solar Energy Potential – Northern Arizona/Southern Nevada



Sources: ADOT 2012j, NREL 2012a

1.7 Priority Section 3: Las Vegas Metropolitan Area

The Las Vegas Metropolitan Area Priority Section is the third of the three Priority Section subdivisions. This segment includes the greater metropolitan Las Vegas area including cities such as Boulder City, Henderson, Paradise, and North Las Vegas.

1.7.1 Environmental Features

Figure 1-27 shows the environmental features and biological resources in the Las Vegas metropolitan area. Major environmental features include ACECs, wilderness areas, national monuments, NCAs, critical habitats, and other land management categories.

Six ACECs are located in this study segment, as identified by BLM. The Coyote Springs Valley and Hidden Valley ACECs are located northeast of the metropolitan area. The Rainbow Gardens and River Mountains ACECs are located east of Las Vegas, and the Bird Springs and Arden ACECs are located south and southwest of the Las Vegas metropolitan area.

The greater Las Vegas metropolitan area is surrounded by eight federally designated wilderness areas. The Nellis A, B, and C Wilderness Study Areas are located north of Las Vegas west of Nellis Air Force Base. The Spring Mountains (Mt. Charleston, La Madre Mountain, and Rainbow Mountain) Wilderness Areas are located to the west of the metropolitan area between SR 160 and US 95. The North McCullough Wilderness Area is south of Las Vegas between I-15 and US 95. The Muddy Mountain Wilderness Area is northwest of the metropolitan area north of the Lake Mead NRA.

The BLM has also identified NCAs on its lands. The Red Rock Canyon NCA is located west of Las Vegas with a portion along the US 95 corridor. The Sloan Canyon NCA is south of the metropolitan area between I-15 and US 95. No national monuments are in the Las Vegas metropolitan area. NPS properties include the Lake Mead NRA.

Critical habitats for six wildlife species are located in the Las Vegas metropolitan area. Table 1-4 lists the common and scientific names of these species. One critical habitat area lies northeast of the Las Vegas metropolitan area (Desert National Wildlife Refuge Area).

TABLE 1-4
Critical Habitat Species – Las Vegas Metropolitan Area

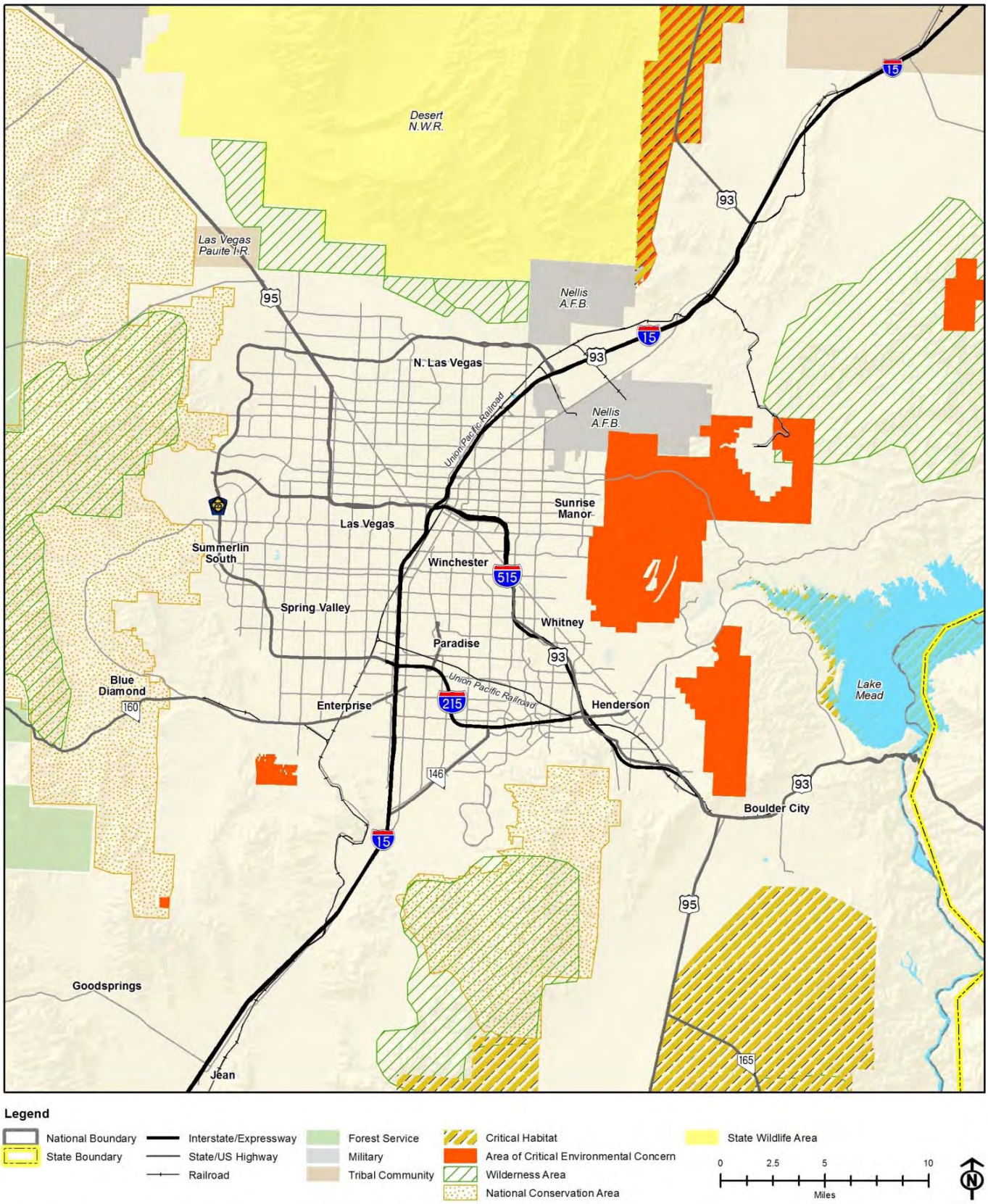
No.	Common Name	Scientific Name
1	Bonytail chub	*Gila elegans*
2	Desert tortoise	*Gopherus agassizii*
3	Virgin River chub	*Gila seminuda*
4	Woundfin	*Plagopterus argentissimus*
5	Razorback sucker	*Xyrauchen texanus*
6	Southwestern willow flycatcher	*Empidonax traillii extimus*

Source: USFWS 2012

1.7.2 Topographic Features

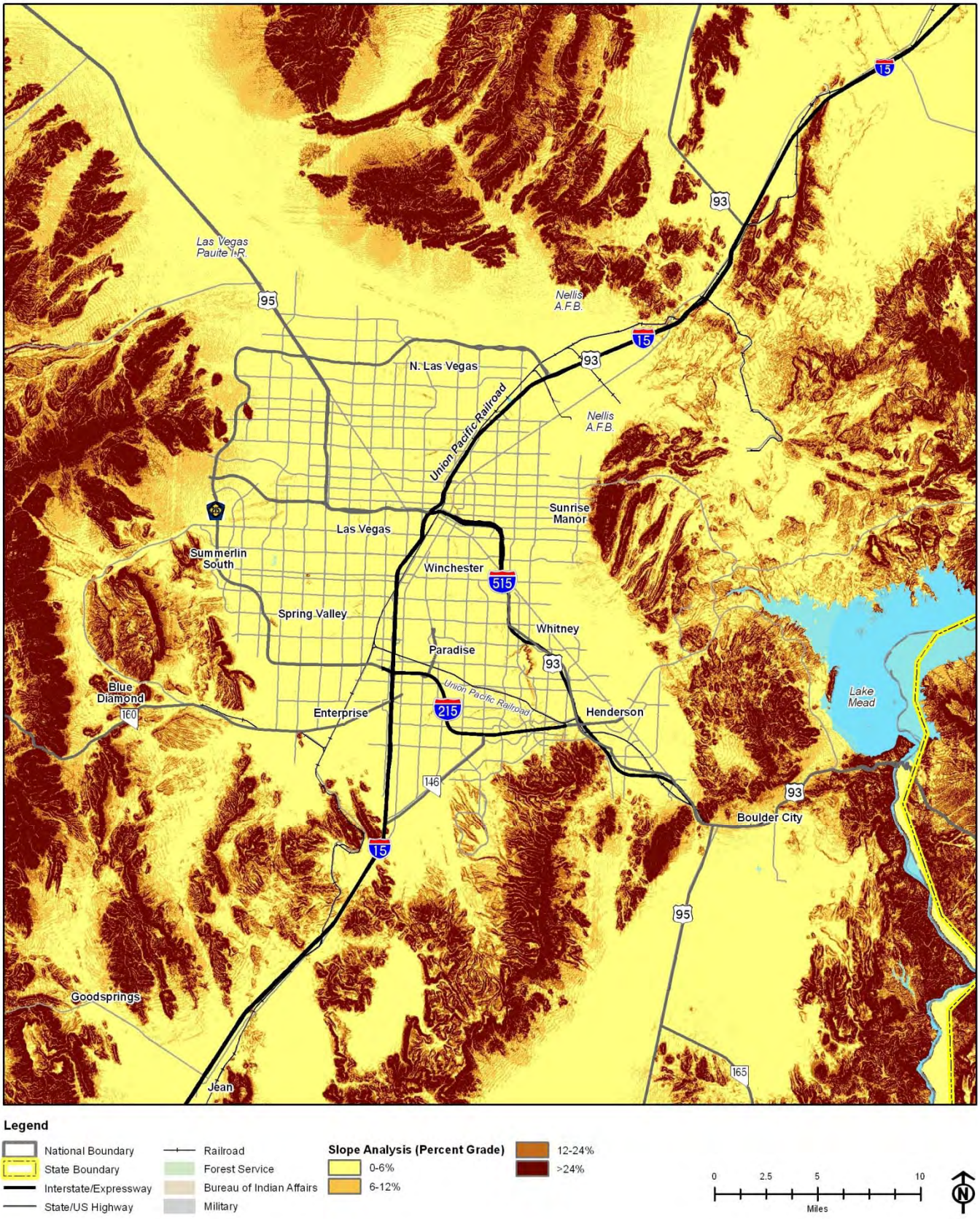
Figure 1-28 shows the major topographic features in the greater Las Vegas metropolitan area. The Las Vegas Valley is surrounded by the Spring Mountains to the west, Sheep Mountains to the north, Muddy and River Mountains to the east, and the McCullough and Eldorado Mountains to the south.

FIGURE 1-27
Environmental Features – Las Vegas Metropolitan Area



Sources: BLM 2012a, NDOT 2012e

FIGURE 1-28
Major Topographic Features – Las Vegas Metropolitan Area



Source: NDOT 2012e

1.7.3 Major Drainage Features

Figure 1-29 shows the major drainage features in the vicinity of the Las Vegas metropolitan area, including major surface water features, wetlands, and FEMA flood hazard zones. The mountainous areas surrounding the Las Vegas Valley feature rough terrain with steep slopes, high ridgelines, and deep natural washes. There are no prominent surface water features in the metropolitan area. The Las Vegas Wash drains all stormwater in the Las Vegas Valley into Lake Mead and the Colorado River system. Tributaries to the Las Vegas Wash include Las Vegas Creek, Red Rock Wash, Flamingo Wash, Pittman Wash (which drains into Duck Creek), Sloan Channel, and Monson Channel.

FEMA has identified 100-year flood hazard zones throughout the area along smaller rivers and washes. Flood hazard zones have been identified near the US 93/US 95 interchange in the southeast part of the area and near the US 95 corridor in the northwest part of the Las Vegas metropolitan area.

1.7.4 Major Land Ownership

Figure 1-30 shows major land ownership patterns in the Las Vegas metropolitan area study segment. Developed land in the metropolitan area is largely privately held and falls under the jurisdiction of four municipalities, as well as unincorporated Clark County.

BLM, NPS, and USFWS own the majority of land. NPS has jurisdiction of the Lake Mead NRA, and east of Las Vegas the USFWS has jurisdiction of the Desert National Wildlife Range north of Las Vegas. Nellis Air Force Base is located northeast of Las Vegas.

1.7.5 Utility and Energy

Major Utility Corridors

The U.S. EIA maintains a comprehensive inventory of major utility features across the country. In the Las Vegas metropolitan area study segment, there are a series of electric transmission lines; interstate natural gas pipelines; and natural gas power plants (Figure 1-31).

Solar Energy Potential

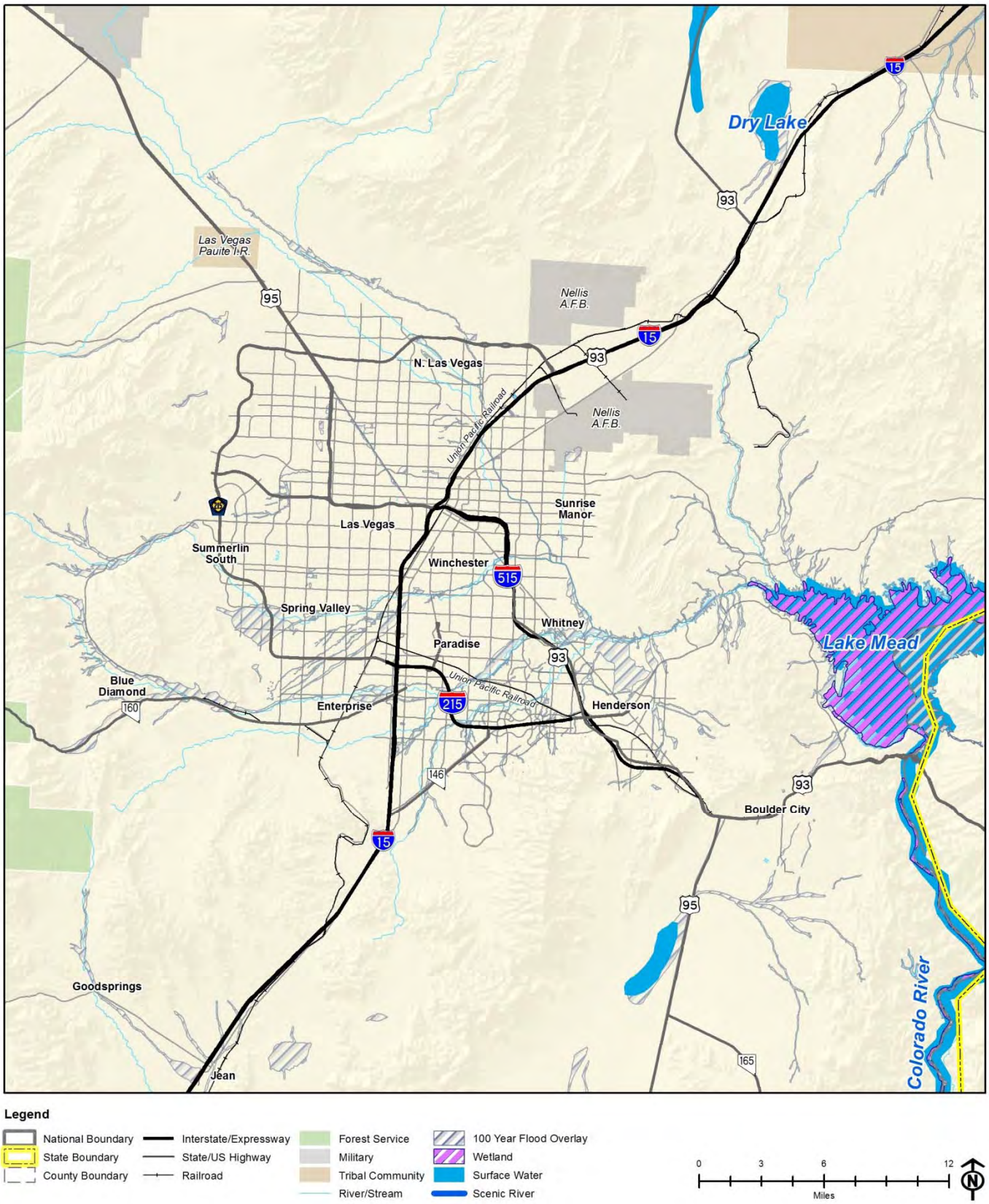
Using NREL data to understand monthly solar radiation characteristics, Figure 1-32 shows the solar potential of this study segment. As Figure 1-32 shows, the majority of the Las Vegas metropolitan segment area falls within a very high solar potential range. In developing commercial solar energy facilities, other factors that must be considered include distance to transmission lines, slopes (less than 1 percent), acreage available, areas falling within environmentally sensitive federal lands, and distance to graded roads.

Two planned solar energy generation facilities are in this segment area:

- **Silver State projects:** The Silver State South project is a 2,348-acre, 340-MW solar energy plant near Primm. The Draft Supplemental Environmental Impact Statement was completed in October 2012. The public comment period ended in January 2013, and the notice of availability and Final Supplemental Environmental Impact Statement are still pending. The Silver State North 618-acre, 60-MW solar energy plant has received approval. The projects would include photovoltaic panels and related facilities, including a substation and switchyard facilities (BLM 2011).
- **Moapa Solar Energy Center:** The Moapa Solar Energy Center is a 1,000-acre, 200-MW solar energy facility on the Moapa River Indian Reservation. The Bureau of Indian Affairs, Department of Interior filed its notice of intent to prepare an environmental impact statement in August 2012 (Bureau of Indian Affairs 2012).

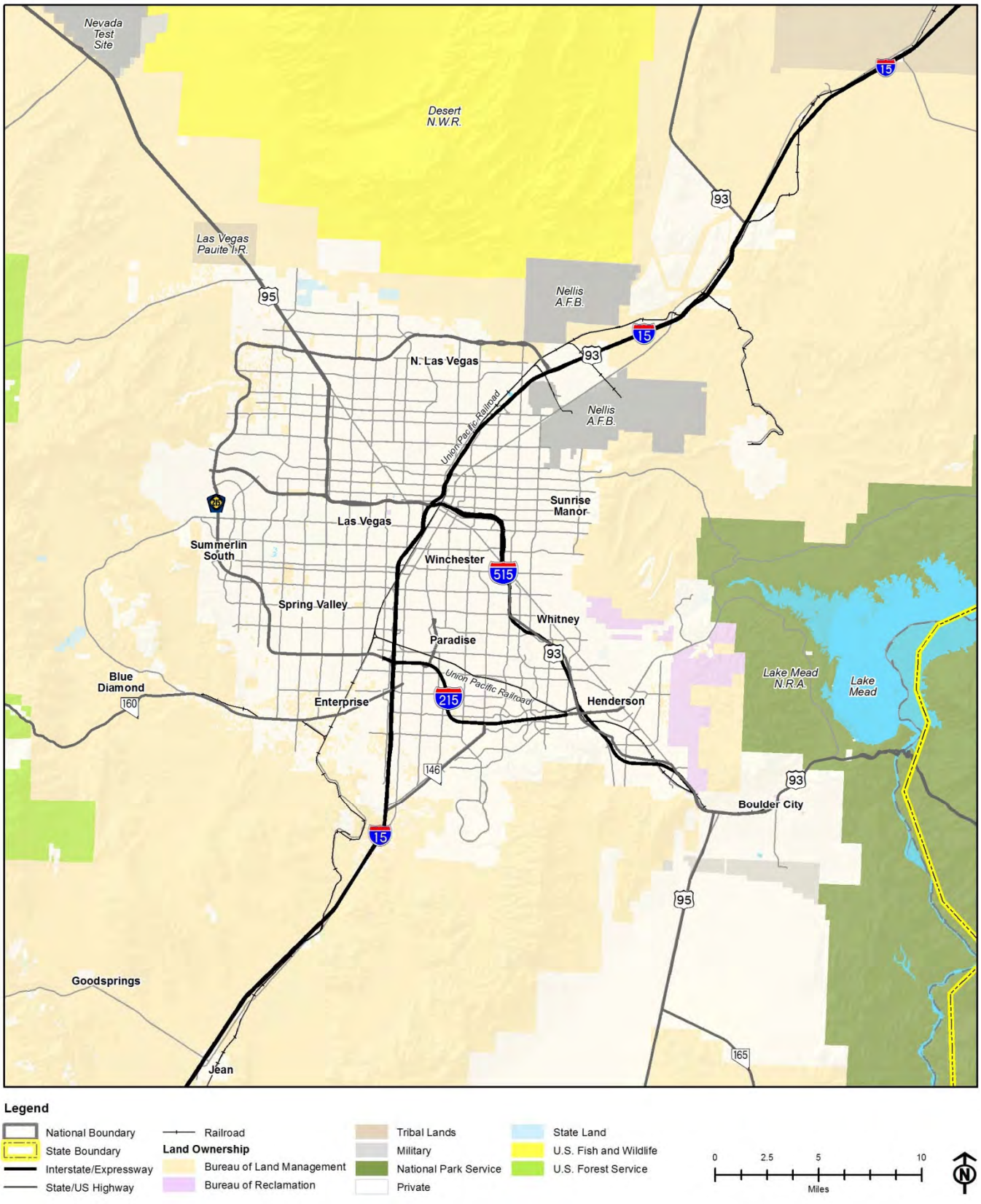
Figure 1-33 shows additional solar energy projects in the Las Vegas area, as well as other renewable energy sources provided by NV Energy.

FIGURE 1-29
Drainage Features – Las Vegas Metropolitan Area



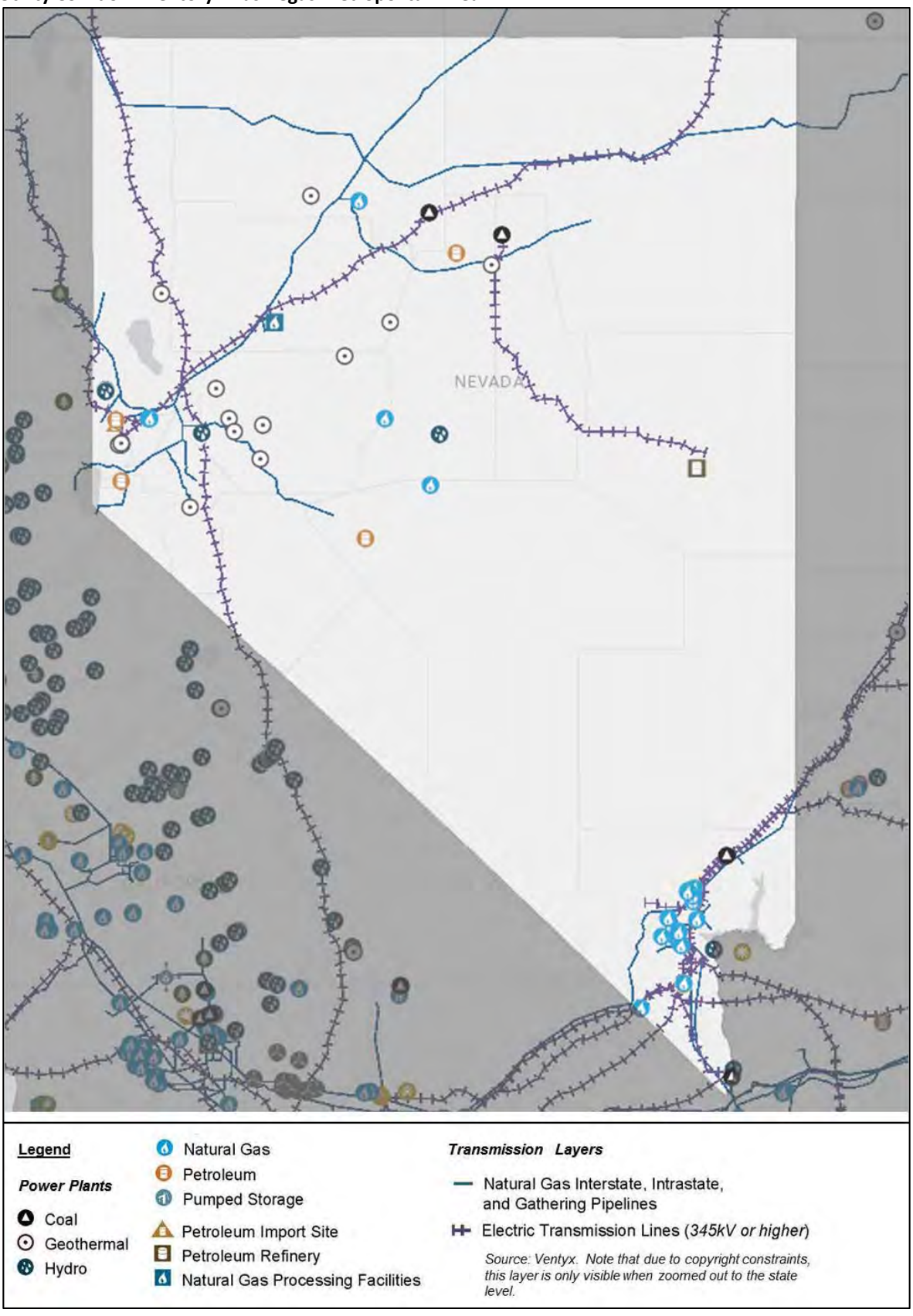
Source: NDOT 2012e

FIGURE 1-30
Major Land Ownership – Las Vegas Metropolitan Area



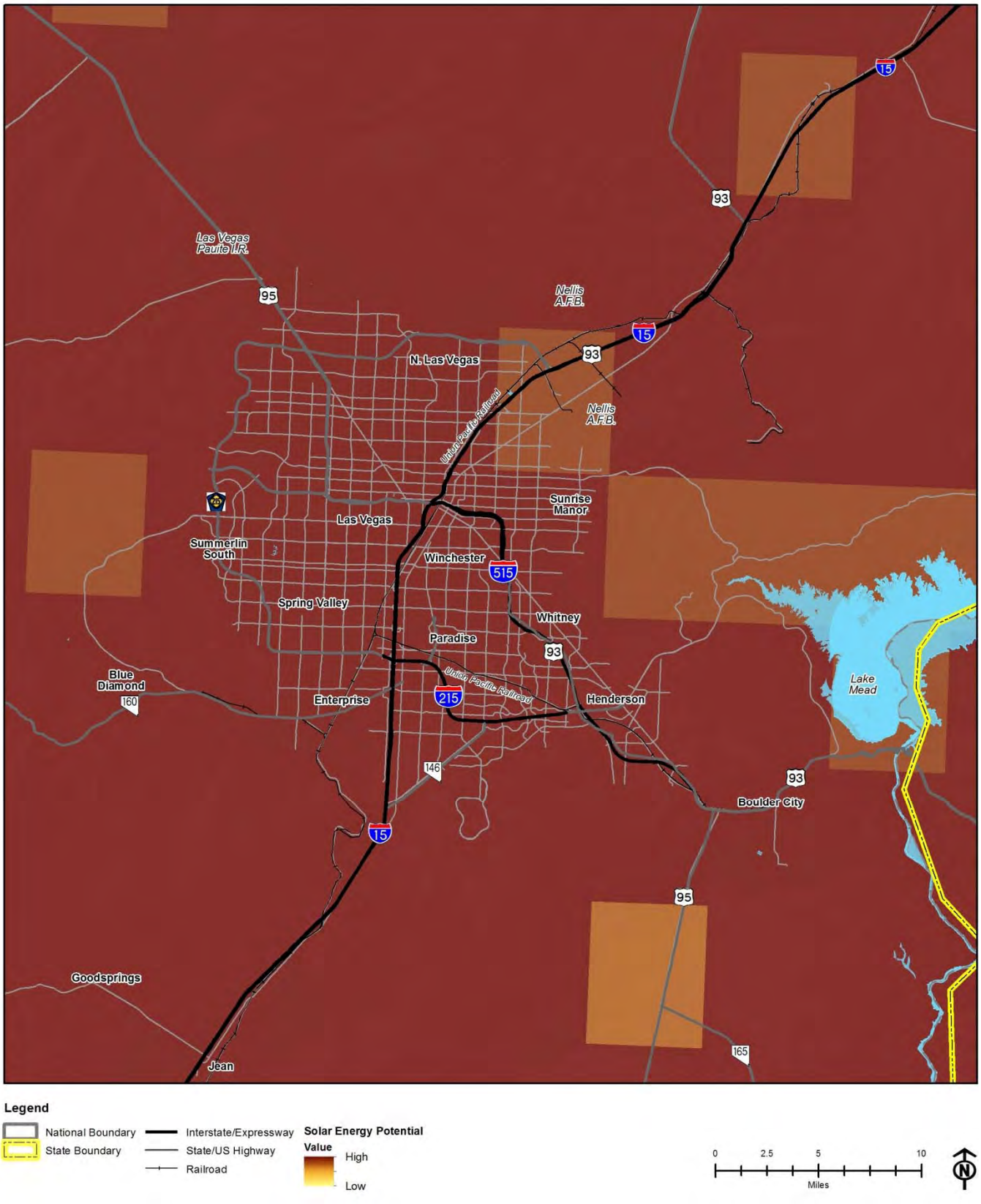
Sources: BLM 2012a, NDOT 2012e

FIGURE 1-31
Utility Corridor Inventory – Las Vegas Metropolitan Area



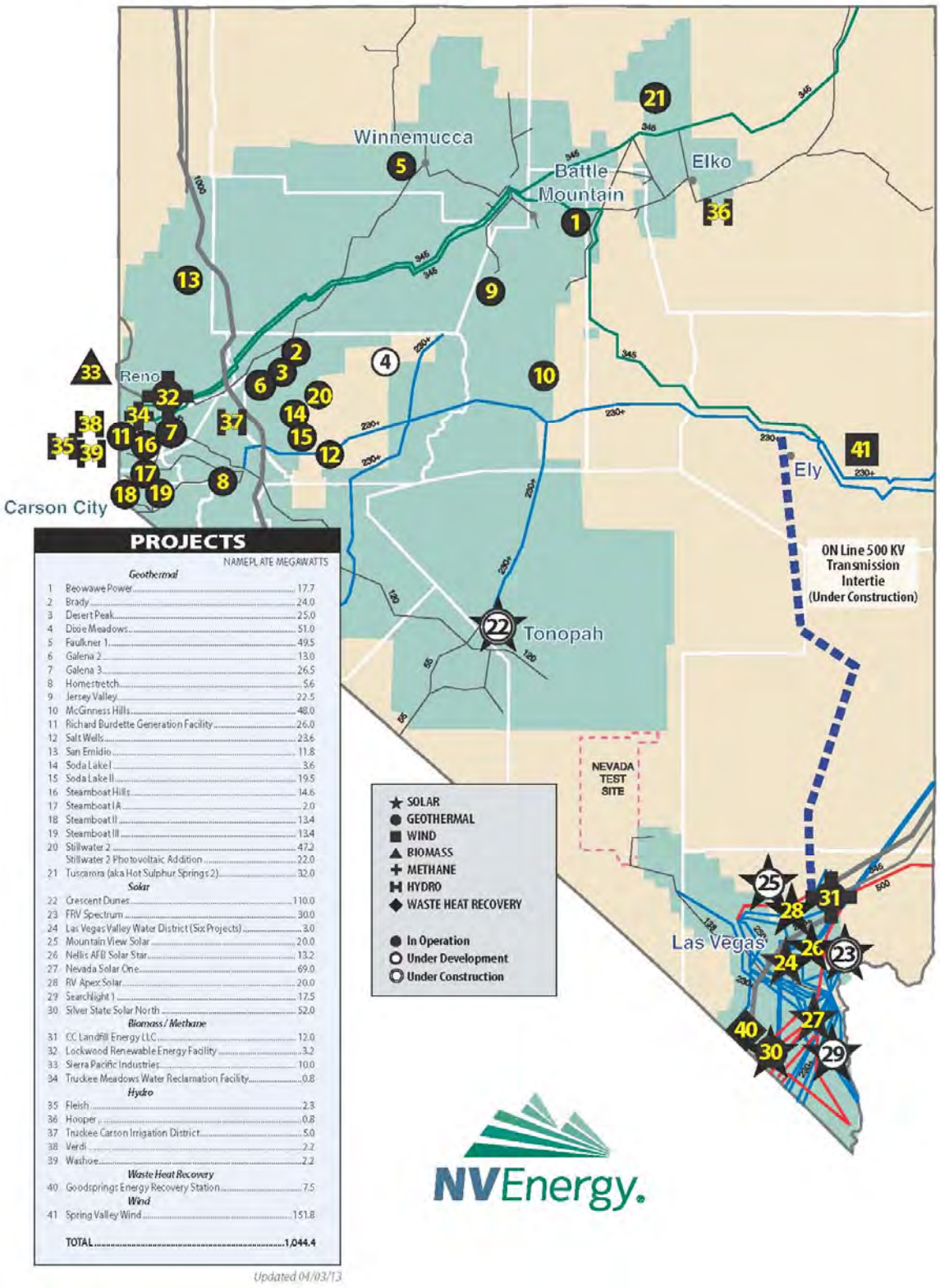
Source: EIA 2012b

FIGURE 1-32
Solar Energy Potential – Las Vegas Metropolitan Area



Sources: ADOT 2012j, NREL 2012a

FIGURE 1-33
Renewable Energy Resources – Las Vegas Metropolitan Area



Source: NV Energy 2013

1.8 Northern Nevada Future Connectivity Segment

The Northern Nevada Future Connectivity Segment stretches from the northern edge of the Las Vegas metropolitan area, potentially all the way to the U.S./Canadian border. However, for this technical memorandum, the segment is considered to terminate at the northern Nevada border with Oregon and Idaho. Once potential corridor alternatives are identified, this information will be gathered along those corridors for high-level evaluation. Although the maps include the Las Vegas metropolitan area, the focus of this study portion spans from beyond the metropolitan area north to the northern edge of the state. The breadth of the future connectivity study segment allows higher-level visioning for this potential extension beyond the Las Vegas metropolitan area.

1.8.1 Environmental Features

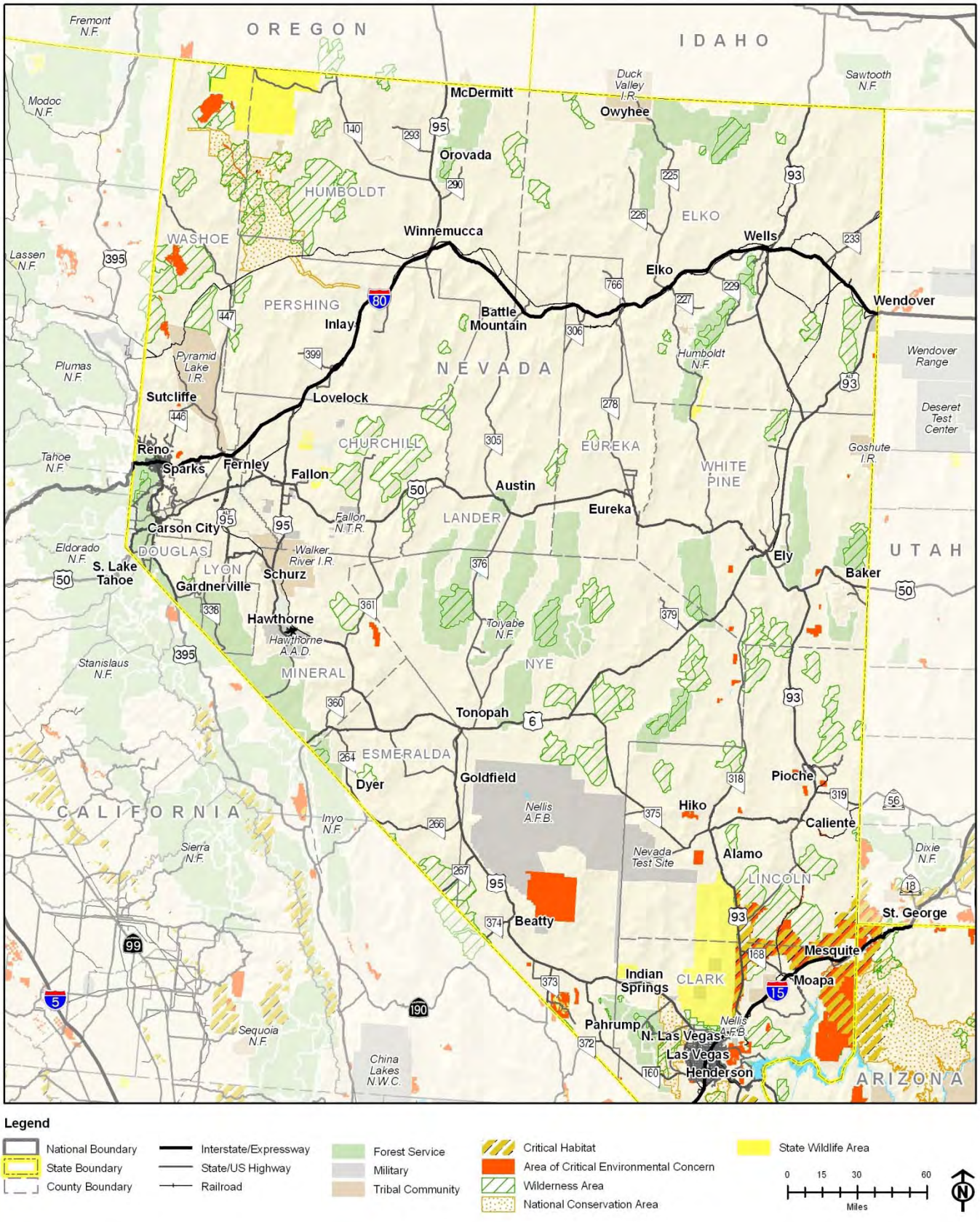
Figure 1-34 shows the environmental features and biological resources in northern Nevada. The environmental features are composed of ACECs, wilderness areas, national monuments, an NCA, critical habitats, and other land management categories.

Located in this region are 46 ACECs, as identified by BLM. The ACECs are primarily located in Lincoln, Nye, and Washoe Counties. In Lincoln and Nye Counties, there are ACECs all along US 93 and SR 318 south of US 50, and the Timber Mountain Caldera ACEC is located along the US 95 corridor in Nye County.

This segment contains 96 federally designated wilderness areas, located in almost every county in northern Nevada. Several wilderness areas are located along the US 93 corridor through Lincoln, White Pine, and Elko Counties including Delamar Mountains, Meadow Valley Range, Arrow Canyon, Parsnip Peak, Fortification Range, Mount Grafton, Becky Peak, and Goshute Canyon. The BLM has identified NCAs and national monuments on its lands. The Black Rock Desert-High Rock Canyon Emigrant Trails NCA is the only one in northern Nevada and is located in the northwest part of the state far west of US 95 in Washoe, Humboldt, and Pershing Counties. No national monuments are in Nevada. The Great Basin National Park and Death Valley National Park are located in northern Nevada. Great Basin National Park is located in White Pine County near the Nevada/Utah border, and Death Valley National Park extends between California and Nevada in the southwestern part of Nevada.

Critical habitats for 18 wildlife species are located in northern Nevada. Table 1-5 lists the common and scientific names of these species.

FIGURE 1-34
Environmental Features – Northern Nevada



Sources: BLM 2012a, NDOT 2012e

TABLE 1-5
Critical Habitat Species – Northern Nevada

No.	Common Name	Scientific Name
1	Ash Meadows blazingstar	*Mentzelia leucophylla*
2	Spring-Loving centaury	*Centaurium namophilum*
3	Ash Meadows speckled dace	*Rhinichthys osculus nevadensis*
4	Desert dace	*Eremichthys acros*
5	Ash Meadows gumplant	*Grindelia fraxino-pratensis*
6	Ash Meadows ivesia	*Ivesia kingii* var. *eremica*
7	Ash Meadows milk-vetch	*Astragalus phoenix*
8	Ash Meadows naucorid	*Ambrysus amargosus*
9	Ash Meadows Amargosa pupfish	*Cyprinodon nevadensis mionectes*
10	Big Spring spinedace	*Lepidomeda mollispinis pratensis*
11	White River spinedace	*Lepidomeda albivallis*
12	Hiko White River springfish	*Crenichthys baileyi grandis*
13	Railroad Valley springfish	*Crenichthys nevadae*
14	White River springfish	*Crenichthys baileyi*
15	Warner sucker	*Catostomus warnerensis*
16	Ash Meadows sunray	*Enceliopsis nudicaulis* var. *corrugata*
17	Desert tortoise	*Gopherus agassizii*
18	Bull trout	*Salvelinus confluentus*

Source: USFWS 2012

1.8.2 Topographic Features

Figure 1-35 shows the major topographic features in northern Nevada. Northern Nevada has various dispersed mountain ranges across the entire state. With more than 150 mountain ranges statewide, the major ranges in northern Nevada include the Battle, Monitor, Ruby, Santa Rosa, Schell Creek, Sierra Nevada, Snake, and Toiyabe ranges. The Ruby range runs along US 93 near I-80 and the Schell Creek and Snake ranges are along the east side of US 93 near US 50. The Sierra Nevada range runs along the Nevada/California border south of Carson City west of the US 95 corridor. The Santa Rosa range runs along the east side of US 95 north of I-80 to the Nevada/ Oregon border.

1.8.3 Major Drainage Features

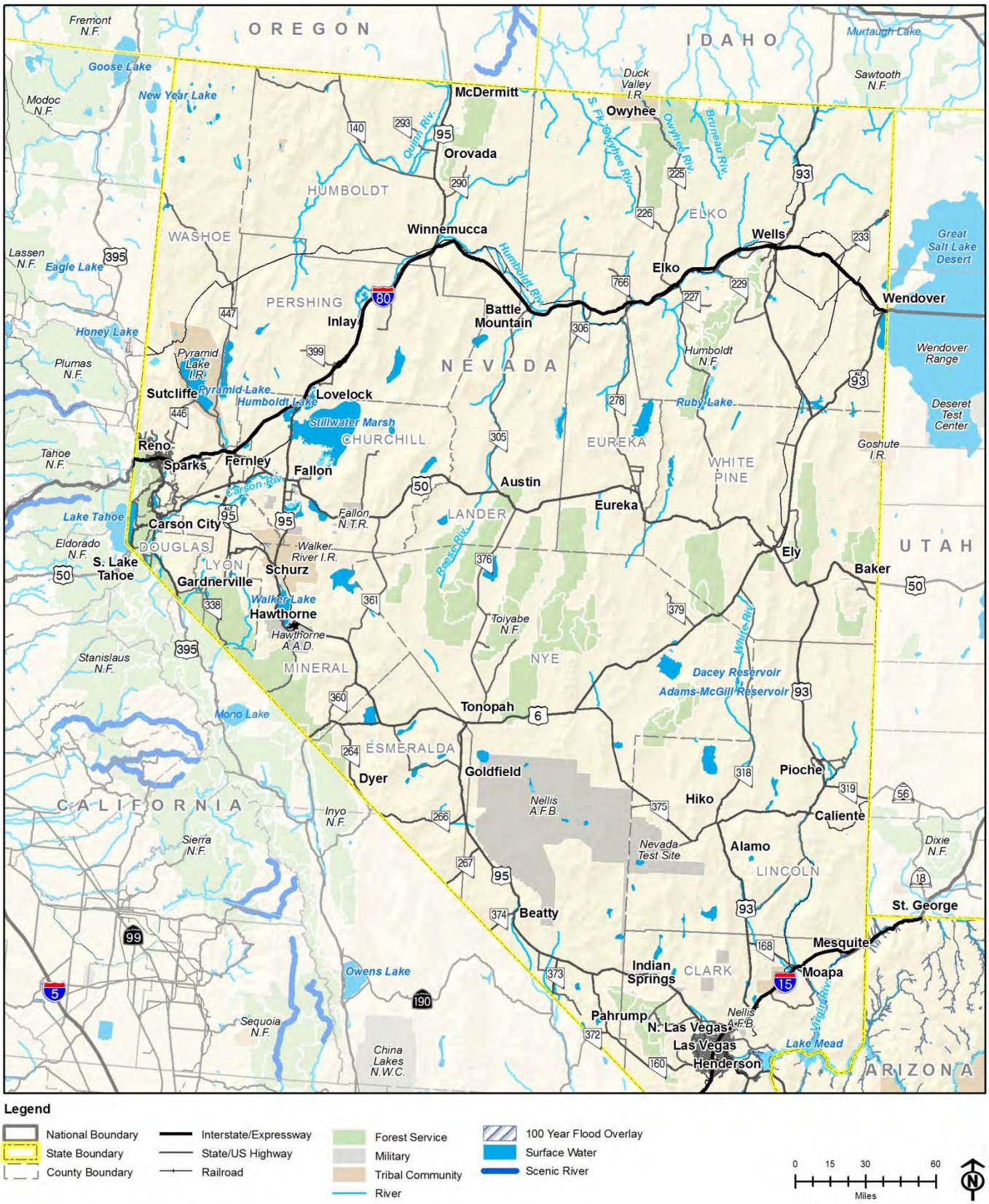
Figure 1-36 shows the major drainage features in northern Nevada, including major surface water features, wetlands, and FEMA flood hazard zones.

Some of the most prominent surface water features in northern Nevada are Lake Tahoe on the Nevada/California border, Pyramid Lake northeast of Reno, Walker Lake southeast of Reno, Humboldt Lake northeast of Reno near US 95/I-80, and the Humboldt River, which is the longest river in the state. The Humboldt River runs along the northern half of the state into the Humboldt Sink near US 95/I-80. The Walker, Truckee, and Carson Rivers drain the western part of Nevada. The Truckee River feeds into Pyramid Lake, one of the largest natural lakes in Nevada.

FIGURE 1-35
Major Topographic Features – Northern Nevada

Source: NDOT 2012e

FIGURE 1-36
Major Drainage Features – Northern Nevada



Source: NDOT 2012e

Reservoirs in northwest Nevada include the Squaw Valley reservoir in Washoe County, Lake Lahontan on the Carson River between Fallon and Carson City in Lyon/Churchill Counties, Rye Patch reservoir on the Humboldt River in Pershing County, and Topaz Lake reservoir on the Nevada/California border in Douglas County. FEMA has identified 100-year flood hazard zones throughout northern Nevada along the smaller rivers and washes.

1.8.4 Major Land Ownership

Figure 1-37 shows major land ownership patterns in the northern Nevada study segment. Developed land in the urban areas is largely privately held. BLM, followed by USFS and Nellis Air Force Base, owns the majority of land. Major national forests and parks outside of the Las Vegas metropolitan area are Humboldt-Toiyabe and Inyo National Forests and Death Valley and Great Basin National Parks. Several Indian reservations are located throughout Nevada. Larger reservations are Moapa River northeast of Las Vegas; Pyramid Lake, Washoe Ranches, and Walker River near Reno-Carson City; and Goshute and Duck Valley (U.S. Environmental Protection Agency 2012).

1.8.5 Utility and Energy

Major Utility Corridors

The U.S. EIA maintains a comprehensive inventory of major utility features across the country. In the northern Nevada project segment, there are a series of electric transmission lines; interstate natural gas pipelines; and natural gas, coal, geothermal, hydro, and petroleum power plants; a petroleum refinery; and a natural gas processing facility (Figure 1-31).

The *Transmission Initiative Routing Study* (Energy Source et al. 2012) prepared for the Nevada Energy Assistance Corporation used the renewable energy zones established in the Nevada *Renewable Energy Transmission Access Advisory Committee Phase II Report* (State of Nevada Governor's Office 2009) to identify three new transmission line projects. These high-voltage transmission line export projects would provide transmission access to the north, east, and south, improving transmission corridors into California and Utah (Figure 1-38).

Solar Energy Potential

Using NREL data to understand monthly solar radiation characteristics, Figure 1-39 shows the solar potential of this study segment. As Figure 1-38 shows, the majority of the Northern Nevada Future Connectivity Segment area falls within a medium to very high solar potential range. In developing commercial solar energy facilities, other factors that must be considered include distance to transmission lines, slopes (less than 1 percent), acreage available, areas falling within environmentally sensitive federal lands, and distance to graded roads.

Two solar energy generation facilities are planned in this segment area:

- **Amargosa Farm Road:** Amargosa Farm Road is a 6,320-acre, 460-MW solar energy plant east of Amargosa. The project would supply energy to the Valley Electric transmission line (BLM 2011).
- **Crescent Dunes:** Crescent Dunes is a 1,600-acre, 180-MW solar energy plant 13 miles northwest of Tonopah. The bulk of the electric power produced by the facility would be transmitted to the electric grid under the control of the Sierra Pacific Power Company, doing business as NV Energy, and delivered to the Anaconda 230-kV substation, located about 8 miles north of the site. A high-voltage overhead transmission line would be constructed to deliver power from the plant switchyard to the Anaconda substation. It is proposed that the new transmission line would parallel an existing transmission line that crosses the northwest corner of the site (BLM 2011).

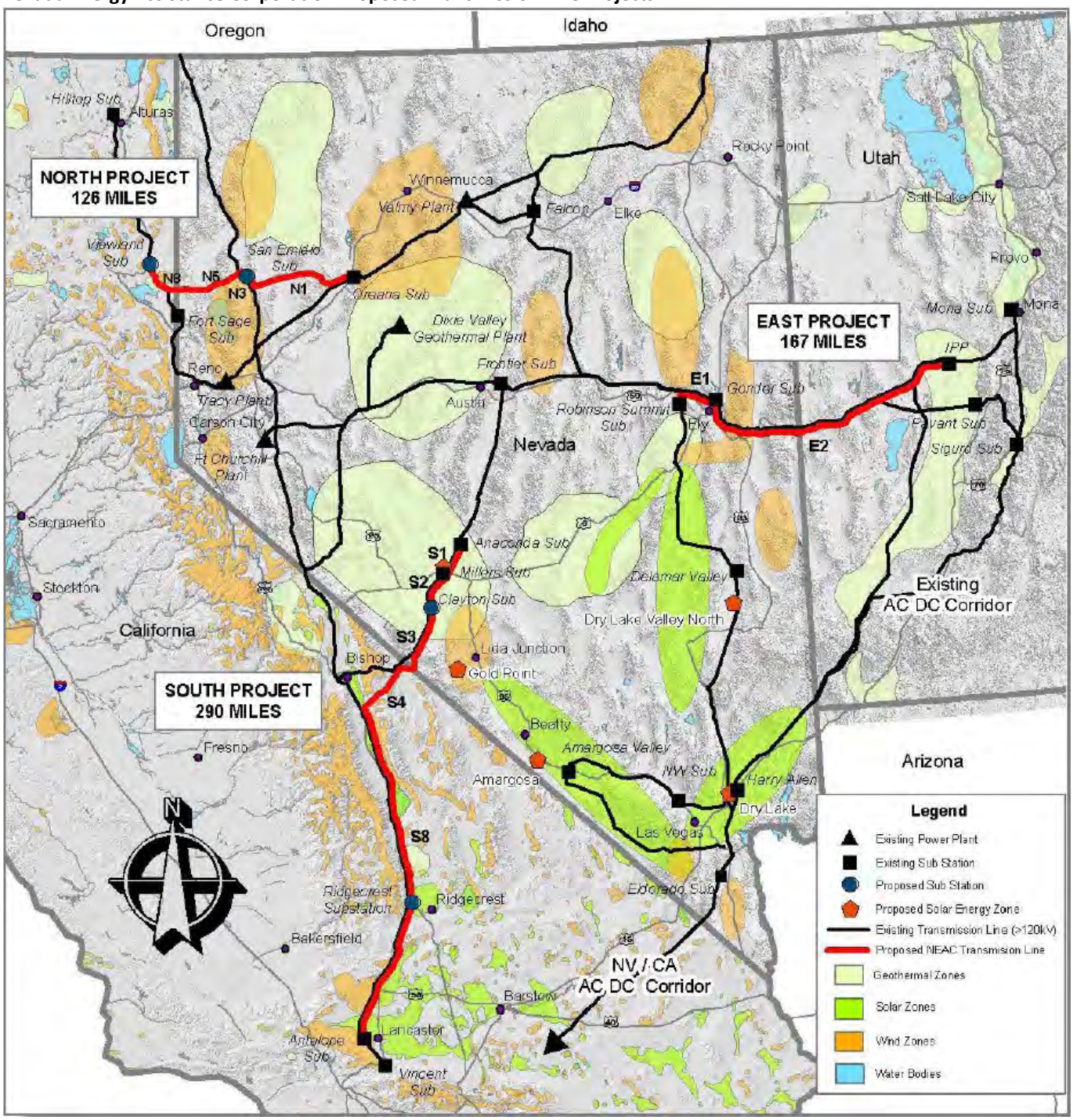
As referenced in the previous section, Figure 1-33 shows additional solar energy projects in Northern Nevada, as well as other renewable energy sources provided by NV Energy.

FIGURE 1-37
Major Land Ownership – Northern Nevada

Sources: ALRIS 2012, BLM 2012a, NDOT 2012e

FIGURE 1-38

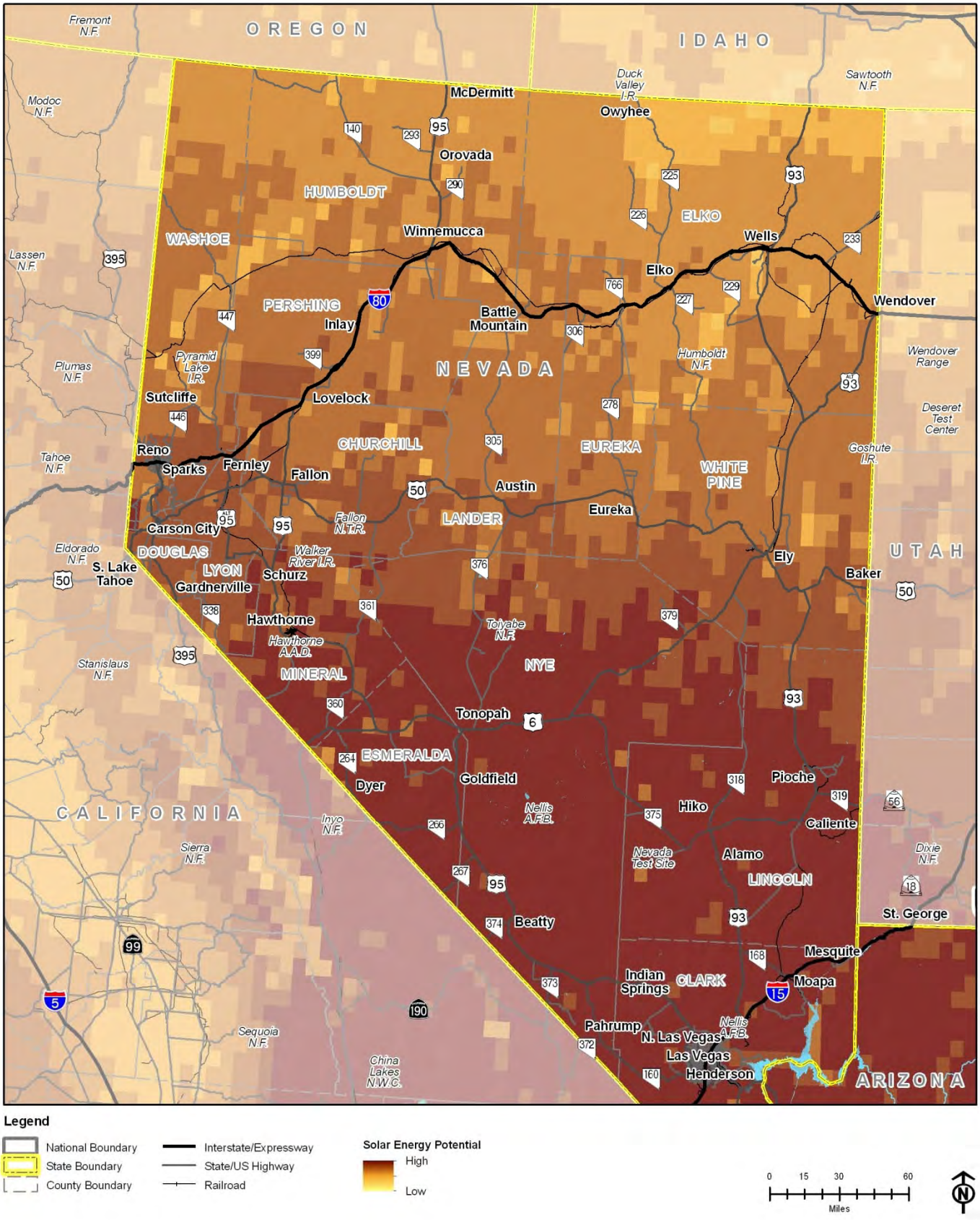
Nevada Energy Assistance Corporation Proposed Transmission Line Projects



Source: Energy Source et al. 2012

FIGURE 1-39

Solar Energy Potential – Northern Nevada



Sources: NDOT 2012e, NREL 2012a

2 Acronyms and Abbreviations

ACEC	area of critical environmental concern
ADOT	Arizona Department of Transportation
AGFD	Arizona Game and Fish Department
ALRIS	Arizona Land Resource Information System
APS	Arizona Public Service
ASLD	Arizona State Land Department
BLM	Bureau of Land Management
CSP	concentrated solar power
EIA	U.S. Energy Information Administration
FEMA	Federal Emergency Management Agency
I	Interstate
kV	kilovolt
kWh/m^2/day	kilowatt hours per square meter per day
MW	megawatt
NCA	National Conservation Area
NDOT	Nevada Department of Transportation
NEPA	National Environmental Policy Act
NPS	National Park Service
NRA	National Recreation Area
NREL	National Renewable Energy Laboratory
PEIS	programmatic environmental impact statement
PEL	Planning and Environmental Linkages
RDEP	Restoration Design Energy Project
SEZ	solar energy zone
SR	State Route
U.S.	United States
USFWS	U.S. Fish and Wildlife Service
USFS	U.S. Forest Service

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