United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

IN REPLY REFER TO:
08EVEN-2013-F-0105

September 30, 2013

Memorandum

To: Field Manager, Needles Field Office, Bureau of Land Management, Needles, California

Assistant Field Manager, Las Vegas Field Office, Bureau of Land Management, Las Vegas, Nevada

From: Acting Field Supervisor, Ventura Fish and Wildlife Office, Ventura, California

Subject: Biological Opinion for the Stateline Solar and Silver State Solar South Projects, San Bernardino County, California, and Clark County, Nevada (Stateline: 2800(P), CACA-048669, CAD090.01; Silver State South: 6840 (NV-052)) (Stateline: 8-8-13-F-43; Silver State South: 84320-2010-F-0208-R003)

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the Bureau of Land Management's (Bureau) proposed issuance of right-of-way grants for the Stateline and Silver State South solar projects and their effects on the federally threatened desert tortoise (*Gopherus agassizii*), in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.). The proposed Stateline Solar Project involves the construction, operation, maintenance, and decommissioning of a 300-megawatt solar photovoltaic power plant and associated infrastructure and facilities on 1,685 acres of Bureau-managed lands; the applicant for the Stateline Solar Project is Desert Stateline, LLC (Stateline). The proposed Silver State South Project involves the construction, operation, maintenance, and decommissioning of a 250-megawatt solar photovoltaic power plant and associated infrastructure and facilities on 2,427 acres of Bureau-managed lands; the applicant for the Silver State South Project is Silver State Solar Power South, LLC (Silver State). We explain the rationale behind our consolidation of these two consultations in the Consultation History section of this biological opinion.

This biological opinion is based on information that accompanied your requests for consultation, including the biological assessments (Bureau 2013a, Bureau 2013c) and draft environmental impact statements (Bureau 2012a, Bureau 2012b); we also used information that the Bureau and the applicants provided during consultation and our files. The Service can make a complete record of this consultation available at the Ventura Fish and Wildlife Office and the Southern Nevada Field Office.

With one exception, the proposed actions would not occur within the boundaries of critical habitat of the desert tortoise or directly or indirectly affect the primary constituent elements of critical habitat. The one exception is that the Bureau and Silver State propose to use a portion of the Piute-Eldorado Critical Habitat Unit as an alternative site for translocation of desert tortoises, if needed. If the Bureau used this area, vehicles would remain on open routes and workers would access off-road sites on foot. Consequently, this activity is not likely to adversely affect critical habitat of the desert tortoise. Therefore, we do not address critical habitat in this biological opinion.

Consultation History

On September 16, 2010, the Service (2010a) issued a biological opinion encompassing three phases of the proposed 400 MW Silver State Solar Project. On October 12, 2010, the Bureau (2010a) issued a record of decision approving phase I and indicating that subsequent phases may require supplemental analysis under the National Environmental Policy Act. The Bureau incorporated the Service's biological opinion (Service 2010a) as a term and condition of the right-of-way grant for phase I, which is referred to as the Silver State Solar North Project and is owned by Silver State Solar Power North, LLC[1].

On January 2, 2013, the Bureau (2013c) requested initiation of formal consultation for the issuance of a right-of-way grant for the construction, operation, maintenance and decommissioning of the Stateline Project. On February 11, 2013, the Bureau (2013d) requested re-initiation of formal consultation for phases II and III of the Silver State Solar Project, which are collectively referred to as the Silver State South Project.

By memorandum dated March 4, 2013, the Service (2013a) requested that the Bureau consolidate the two consultation requests due to the proximity of the projects to each other, the timing of the consultations, the fact that the same parent company proposed both projects, the similarity between the effects of the projects, and the need to comprehensively address impacts to habitat and connectivity in the Eastern Mojave Recovery Unit of the desert tortoise. In the memorandum, the Service noted that conservation of the desert tortoise in Ivanpah Valley and the Eastern Mojave Recovery Unit was best addressed by analyzing the effects of these projects in a single document instead of approaching the requests for consultation separately.

The Bureau (2013e) agreed to consolidate the two consultations by memorandum dated March 12, 2013. Subsequently, the Bureau, the Applicants, and the Service engaged in a series of discussions regarding both project layouts to reduce the effects of the proposed actions on the

[1] This consultation does not address the Silver State Solar North Project (Phase I). Because the Silver State Solar North Project is encompassed by the 2010 biological opinion (Service 2010a), the conclusions and terms and conditions for the Silver State Solar North Project contained in the "Operation and Maintenance of Project Facilities" and "Restoration and Decommissioning of Facilities" provisions set forth in Sections A.3 and A.4 of the 2010 biological opinion remain in effect.

desert tortoise and a means of monitoring project impacts. Stateline reduced the overall acreage of the Stateline facility and shifted the entire project to the east, placing the eastern boundary of the facility in close proximity to Ivanpah Dry Lake. Silver State also moved phase II of the Silver State South facility to the west and removed phase III from the proposed project.

The Bureau provided the Service with revised biological assessments reflecting changes in the proposed projects for Silver State South (Bureau and Ironwood 2013c) on July 3, 2013 and for Stateline (Bureau 2013a) on July 5, 2013.

On September 11, 2013, the Service (2013f) provided the Bureau with a draft biological opinion. The Bureau shared the draft with First Solar and Southern California Edison. The Bureau (Cota 2013b, LaPre 2013b) provided comments on the draft biological opinion on September 18, 2013; we have incorporated the Bureau's comments into this biological opinion, as appropriate. The Bureau's comments included some changes to the proposed actions that we have incorporated into this final biological opinion.

DESCRIPTION OF THE PROPOSED ACTIONS

Introduction

The Bureau proposes to issue two separate right-of-way grants to the respective applicants for the proposed Stateline and Silver State South projects. The Bureau also proposes to issue a third right-of-way grant to Southern California Edison to operate the proposed Primm Substation and related facilities (loop-in lines, telecommunications site, fiber optic installation and separate access road on approximately 28 acres) that would be associated with and located near the Silver State South Project. The Silver State South Project and the Southern California Edison facilities would be constructed at the same time, use the same data sets with regard to the desert tortoise, and are located in close proximity to each other. For the sake of brevity, we will refer to the Silver State South Project and Southern California Edison facilities associated with that project throughout this biological opinion collectively as the Silver State South Project and to Silver State as the entity conducting work. However, because the Bureau is proposing to issue separate right-of-way grants to Silver State and Southern California Edison, we have included separate conclusions and incidental take statements for the right-of-way grants. We also included a separate conclusion and incidental take statement for the right-of-way grant for the Stateline Project.

We will refer to Silver State and Stateline collectively as the "Applicants" herein when the reference applies similarly, but individually, to both projects. However, each project and applicant is a separate legal entity and the conclusions and incidental take statements in this biological opinion apply to the applicant for each project individually.

Both solar projects generally include similar processes for construction, operation, maintenance and decommissioning of a photovoltaic facility and a generation-tie (gen-tie) transmission line.

The proposed Stateline and Silver State South projects would be located approximately 2 miles southwest and less than a mile east of Primm, respectively.

Unless otherwise noted, we summarized the following description of the proposed action from the biological assessments for Stateline and Silver State South projects (Bureau 2013a, Bureau and Ironwood 2013c).

Construction

Construction of the Stateline and Silver State South facilities would take 2 to 4 years from pre-construction surveys to operation. The combined monthly construction workforce for the projects would be approximately 700 to 900 people.

In the following paragraphs, we provide a description of the key components associated with development of the two projects. Based on similarities in the two solar facilities, we have merged features that are common to both projects. We will address features that are specific to Stateline and Silver State South separately. The following figures show the Stateline and Silver State South project foot prints and components.

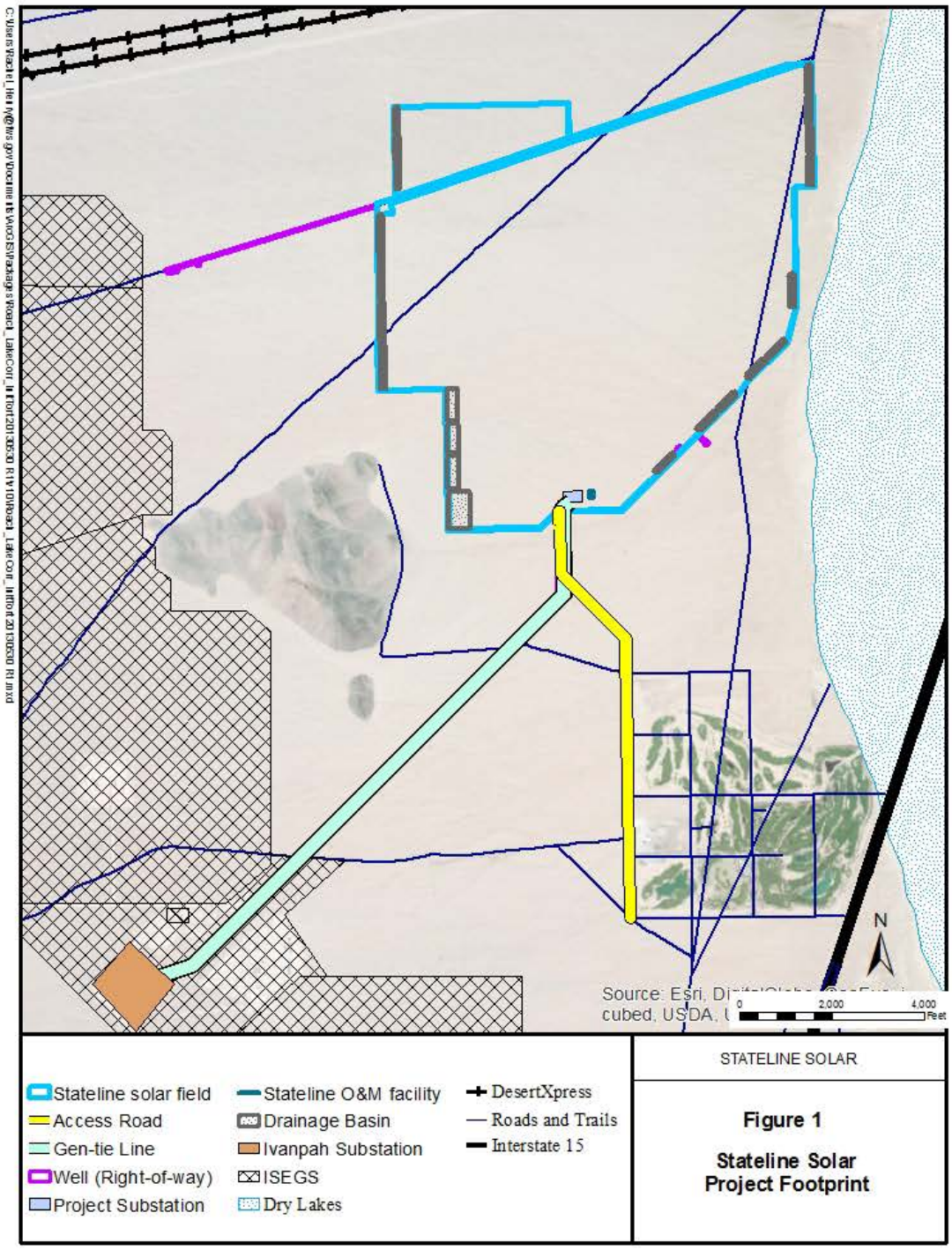
Features Common to Both Stateline and Silver State South

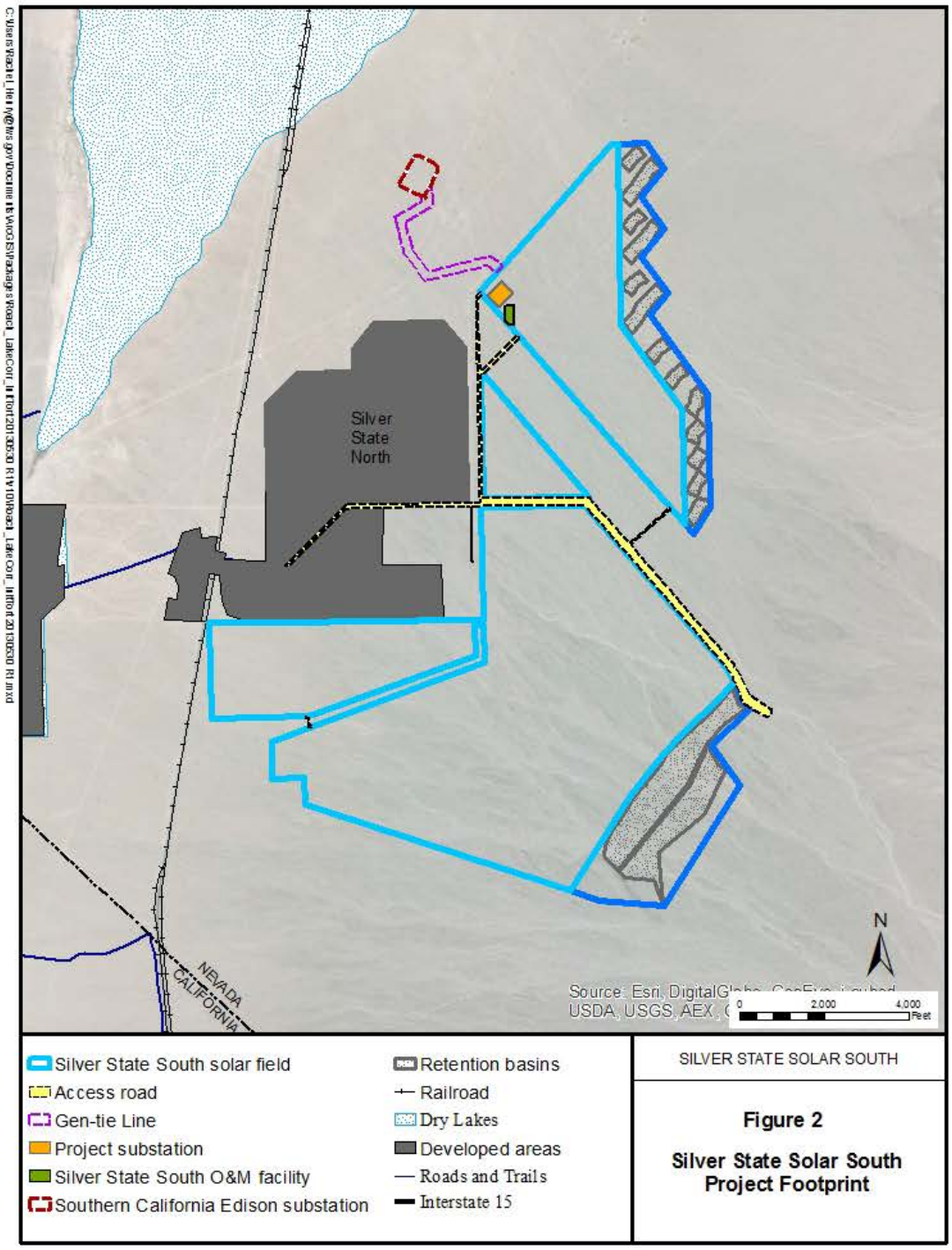
Prior to commencement of the construction process, the Applicants will conduct environmental clearance surveys along with the installation of desert tortoise fencing. Project construction would take place in two general phases: construction mobilization, which includes preconstruction surveys, construction of access roads, and installation of construction trailers, laydown areas, and materials storage areas; and construction and assembly of the solar fields and gen-tie lines.

The Applicants would remove vegetation from permanent facility sites, such as the operation and maintenance facilities, roads, and project substations. At other locations, such as within the solar array field and facility roadways, the site would be prepared with a combination of mowing, disking and rolling, and/or grading (Bureau 2012a, 2012b).

Temporary Construction Areas

Upon completion of the environmental clearance activities, the Applicants would develop temporary construction areas within the project footprints for laydown areas, offices, trailers, parking areas, and tool sheds. Temporary fencing would surround the staging and office areas while the sites' perimeter fences are under construction.


N
0
2,000
4,000
Feet
Stateline solar field
Access Road
Gen-tie Line
Well (Right-of-way)
Project Substation
Stateline O&M facility
Drainage Basin
Ivanpah Substation
ISEGS
Dry Lakes
DesertXpress
Roads and Trails
Interstate 15
STATELINE SOLAR
Figure 1
Stateline Solar
Project Footprint


Silver State North
NEVADA
CALIFORNIA
N
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, G
0 2,000 4,000 Feet
Silver State South solar field
Access road
Gen-tie Line
Project substation
Silver State South O&M facility
Southern California Edison substation
Retention basins
Railroad
Dry Lakes
Developed areas
Roads and Trails
Interstate 15
SILVER STATE SOLAR SOUTH
Figure 2
Silver State Solar South Project Footprint

Solar Panel Arrays

The Applicants would mount the photovoltaic modules on steel columns approximately 10 feet apart. The photovoltaic modules would be placed in linear arrays with positioning of the arrays based on various site constraints, including the location of other site facilities, topography, and biological concerns. When completed, the arrays would be approximately 6 to 8 feet high for fixed-tilt and 13 feet high for trackers and a minimum of 18 inches above the ground surface.

Substations

Each project would have a corresponding substation where voltage produced by the solar array fields would be centrally collected and transferred off-site. Stateline's substation would be centrally located within the project area north of the existing transmission lines. The substation for Silver State South would be located along the northernmost western edge of the project footprint.

Gen-tie Line

Electricity from each substation would be transferred by way of a 220-kilovolt above-ground gen-tie line. A fiber-optic communication line would be suspended on each gen-tie line and an additional fiber-optic communication line would be buried within the transmission rights-of-way.

The gen-tie line of the Stateline facility would exit the southern portion of the project site and would connect to the Ivanpah Substation approximately 2.7 miles to the southwest. The gen-tie line of the Silver State South facility would exit the northwest portion of the project site and connect to the Eldorado- Ivanpah Transmission Line by way of the Primm Substation, which will be constructed by Southern California Edison. Figures 1 and 2 depict the gen-tie line rights-of-way for both projects.

Operation and Maintenance Facility

The operations and maintenance facilities for both projects would be constructed next to the project's substation. The facilities would consist of a building designated for storage of maintenance equipment and replacement parts and would contain the plant power and security monitoring systems.

Fencing and Security

The Applicants would surround the solar facilities with a chain-link fence that is at least 6 feet tall. Silver State would surround the Primm Substation with an 8-foot-tall pre-fabricated concrete perimeter wall and the Primm Microwave Communication Site with a combination of an approximately 10-foot-tall barrier wall with a chain-link fence on top. Each component

would include desert tortoise exclusion fencing, as appropriate, to implement minimization measures.

The solar facilities' perimeters would not include lights to minimize the visual impact on surrounding receptors and roads. Exterior lights at the operations and maintenance facilities, substation, temporary construction areas, and power conversion station shelters would be shielded and focused downward and toward the interior of the site to minimize lighting impacts to neighboring areas.

Features Specific to the Stateline Project

We summarized the following information from the biological assessment for the Stateline Project (Bureau 2013a) and draft environmental impact statement (Bureau 2012a).

Geotechnical Investigation

The first step in the construction process would be the completion of geotechnical studies to gather the information necessary to determine soil stability and the required depths of footings for site structures. The investigations would occur throughout the proposed solar farm site, the gen-tie route, the on-site substation, and the access route. Testing would consist of test pile driving, test pits, and soil borings at 23 locations. Each test location would comprise an area of no more than 15 feet by 20 feet or 300 square feet. The total acreage affected by the testing would comprise less than 0.2 acre.

Groundwater Production and Monitoring Wells

The Stateline facility would include the construction and operation of up to two groundwater production wells and three groundwater monitoring wells. The primary production well would be located on the southeastern corner of the facility; a secondary well would be located approximately 4,577 feet from the western edge of the facility (see Figure 1). One monitoring well would be installed for the primary well and two for the secondary well. Water would be conveyed through a 6-inch-diameter buried pipeline to the Project site and then to 5 temporary water storage ponds spaced throughout the solar arrays.

Primary Access Road

Access to the Stateline Project would occur via the Yates Well Road exit from Interstate 15. Yates Well Road, which is equipped with fencing to exclude desert tortoises, terminates at Silverton Road. Silverton Road runs west of and adjacent to the Primm Valley Golf Club. The primary access to the project site would be from the terminus of Silverton Road at Saragossa Drive at the northwest corner of the Primm Valley Golf Club (Figure 1).

Debris and Sediment Basins

The upstream perimeter of the proposed facility would include debris basins. The downstream perimeter of the proposed facility would include sediment basins. The purpose of the debris and sediment basins would be to capture any stormwater flowing on or off the site, allowing any solid materials (debris, sediment, plant material, and any other material) to settle out and remain within the basin, and then releasing stormwater at a lower velocity. All of the basins would be located within the perimeter fence of the Stateline facility.

Features Specific to the Silver State South Project

We summarized the following information from the biological assessment for the Silver State South project (Bureau and Ironwood 2013c) and draft supplemental environmental impact statement (Bureau 2012b).

Drainage Control Features

Silver State proposes to install detention basins upstream of the project site to control drainage outside of the eastern edge of the perimeter fence. The detention basins would be large-volume facilities cut below existing grade to detain and discharge water at a lower flow rate, at or below historic conditions downstream of the project site. All of the basins would be located within the perimeter fence of the Silver State South facility.

Primary Access Road

Silver State would access the Silver State South Project from Primm Boulevard using a portion of the same access road constructed for the Silver State North Project. Silver State would extend that road further to access the project operations and maintenance building, other ancillary facilities within the project site, and the Primm Substation.

Operation and Maintenance

Activities would include road maintenance, vegetation management, scheduled maintenance of electrical equipment, and occasional replacement of equipment. With the exception of linear facilities, operation and maintenance activities associated with the solar facilities would occur within the fenced perimeter of the Stateline and Silver State South projects. The biological assessments (Bureau 2013a, Bureau and Ironwood 2013c) for the Stateline and Silver State South projects provide additional details on these activities.

Decommissioning

The projects would have anticipated economic lifespans of up to 30 years. Because site conditions and agency requirements may change over the course of the project lifespan, final

decommissioning plans would be developed prior to termination of the right-of-way authorizations and be approved by the Bureau, dependent on the future use of the sites. If a site would continue to be used for industrial or commercial purposes, certain facilities may be left in place under a new right-of-way authorization. If no further use as a developed site is planned, the site would be restored in accordance with the approved decommissioning plan.

In this biological opinion, we are consulting on the issuance of the Bureau's right-of-way grants for the projects, which the environmental impact statements describe as 30 years for the 2 solar facilities. We based our analysis on this assumption. If the Bureau determines that it wishes to extend the right-of-way grants beyond this time frame, this extension would constitute a modification of the agency action causing an effect to the listed species that we did not consider in this biological opinion ((50 Code of Federal Regulations 402.16) and necessitate re-initiation of consultation with the Service, pursuant to section 7(a)(2) of the Endangered Species Act.

Minimization Measures

General Protective Measures

To minimize adverse effects to the desert tortoise, the Bureau will ensure the Applicants implement the following protective measures during construction, operation, maintenance, and decommissioning activities. To some degree, we have collated protective measures from throughout the biological assessments and changed the wording of some measures to improve clarity, but we have not changed the substance of the measures that the Applicants and the Bureau have proposed. The biological assessments contain more detailed descriptions of the proposed protective measures.

1. The Applicants will employ authorized biologists, approved by the Service, and desert tortoise monitors to ensure compliance with protective measures for the desert tortoise. Use of authorized biologists and desert tortoise monitors will be in accordance with the most up-to-date Service guidance (2010b) and will be required for monitoring of any construction, operation, maintenance, or decommissioning activities that may wound or kill desert tortoises.

2. The Applicants will provide the credentials of all individuals seeking approval as authorized biologists to the appropriate jurisdictional office of the Bureau in California and Nevada. The Bureau will review these and provide the credentials of appropriate individuals to the Service for approval at least 30 days prior to the time they must be in the field.

3. The Applicants will designate a field contact representative who will oversee compliance with protective measures during construction, operation, maintenance, and decommissioning activities that may result in wounding or mortality of desert tortoises. If the field contact representative, authorized biologist, or desert tortoise monitor

identifies a violation of the desert tortoise protective measures, they will halt work until the violation is corrected.

4. Authorized biologists and qualified desert tortoise monitors will capture and handle desert tortoises in compliance with the most up-to-date guidance from the Service (2009a).

5. The Applicants will develop and implement an environmental awareness program for all workers (construction, operation, maintenance, and decommissioning) that will address the following: a) types of construction activities that may affect the desert tortoise, b) the required desert tortoise protective measures, c) desert tortoise life history and threats, d) legal protections and penalties, and e) reporting requirements.

6. The Applicants will permanently fence the boundaries of the project sites (i.e., the areas where the solar fields, drainage basins, and ancillary buildings are located) and clear these areas of all desert tortoises prior to construction. We have provided a description of the procedures for clearance, translocation, and monitoring of these animals below.

7. Desert tortoise guards will be placed at all road access points, where desert tortoise-proof fencing is interrupted, to exclude desert tortoises from the road and solar facilities. The Applicants will coordinate with the Service on placement and design of the guards and their connection with the fencing to ensure that the guards provide a functional barrier to desert tortoises. The Applicants will inspect the guards quarterly and maintain them to ensure they continue to function as a barrier.

8. Authorized biologists will perform clearance surveys of unfenced work areas outside of the main project sites and construction logistics areas (e.g., utility rights-of way, etc.) immediately prior to the onset of construction, operation, or maintenance activities.

9. The Applicants will employ an appropriate number of authorized biologists and desert tortoise monitors to provide full coverage monitoring of construction, operation, maintenance, and decommissioning activities that occur in any unfenced work areas. Authorized biologists or desert tortoise monitors will flag all desert tortoise burrows for avoidance in areas adjacent to work areas.

10. The Applicants will confine all construction activities, project vehicles, and equipment within the delineated boundaries of areas that authorized biologists or designated desert tortoise monitors have identified and cleared of desert tortoises. The Applicants will confine all work areas to the smallest practical area, considering topography, placement of facilities, location of burrows, public health and safety, and other limiting factors. The Applicants will use previously disturbed areas to the extent feasible.

11. Any non-emergency expansion of activities into areas outside of the areas considered in this biological opinion will require the Bureau's approval and desert tortoise clearance surveys. These expanded activities may require re-initiation of consultation with the Service.

12. The Applicants will prohibit project personnel from driving off road or performing ground-disturbing activities outside of designated areas during construction, operation, maintenance, or decommissioning.

13. During operation and maintenance at the completed project sites, the Applicants will confine all vehicle parking, material stockpiles, and work-related equipment and materials to the permanently fenced project sites and logistics areas. However, under circumstances when space is limited, vehicles may be parked outside the walled Primm Substation where the undercarriage of all parked vehicles will be inspected for desert tortoise prior to continued operation.

14. The Applicants will confine project access to one major road for construction, operation, maintenance, and decommissioning of each facility.

    14a. At the Stateline facility, Stateline will confine project access to the road extending from the northwestern corner of the Primm Valley Golf Course for construction, operation, maintenance, and decommissioning activities. Stateline will install temporary fencing along this road during construction and decommissioning, when traffic volumes will be greater; it will also establish a 15-mile-per-hour speed limit for project-related travel when desert tortoises are active.

    14b. At the Silver State South facility, Silver State will confine project access to a road that would be constructed from the existing Silver State North Project maintenance road for construction, operation, maintenance, and decommissioning activities. This road would be located inside a permanent fence.

    14c. To reduce the potential for vehicle strikes of desert tortoises on unfenced access roads (i.e., gas line road, fiber optic right-of-way road, etc.), the Applicants will enforce a 15-mile-per-hour speed limit for project-related travel (i.e., construction, operation, maintenance, and decommissioning) in these areas when desert tortoises are active.

    The authorized biologist will inform Stateline when he or she is aware that desert tortoises are active. The Applicants will post speed limit signs along all access routes.

15. Project personnel who are working outside fenced areas will check under vehicles or equipment before moving them. If project personnel encounter a desert tortoise, they will contact an authorized biologist. The desert tortoise will be allowed to move a safe

distance away prior to moving the vehicle. Alternatively, an authorized biologist or desert tortoise monitor may move the desert tortoise to a safe location to allow for movement of the vehicle.

16. An authorized biologist or desert tortoise monitor will inspect all excavations that are not within desert tortoise exclusion fencing on a regular basis (several times per day) and immediately prior to filling of the excavation. If project personnel discover a desert tortoise in an open trench, an authorized biologist or desert tortoise monitor will move it to a safe location. The Applicants will cover or temporarily fence excavations that are outside of the permanently fenced project areas at the end of each day to prevent entrapment of desert tortoises during non-work hours.

17. The authorized biologist or desert tortoise monitor will check and repair all fencing (if necessary) on a daily basis during installation to ensure its integrity and identify any desert tortoises that may be fence-walking.

18. When outside of the fenced project areas, project personnel will not move construction pipes greater than 3 inches in diameter if they are stored less than 8 inches above the ground until they have inspected the pipes to determine whether desert tortoises are present. As an alternative, the Applicants may cap all such structures before storing them outside of fenced areas.

19. A biological resources monitor will be at each of the geotechnical test sites for all activities. This monitor will have the authority to micro-site the geotechnical test locations and stop work, if necessary, to avoid sensitive resources.

Management of Common Ravens

The Bureau will ensure the Applicants implement protective measures to reduce the adverse effects associated with predation of desert tortoises by common ravens (*Corvus corax*). In general, the Bureau and the Applicants propose to manage common ravens by designing facilities to discourage common raven use, minimizing or eliminating food and water subsidies, providing training to on-site personnel, monitoring the presence of common ravens and their use of subsidies, and developing educational materials regarding subsidies and predation on desert tortoises. The management plans for common ravens for the Stateline and Silver State South Projects (Ironwood 2012a, Bureau et al. 2013) contain more detailed information on these actions.

Weed Management

The Bureau will ensure that the Applicants implement weed management measures to reduce adverse effects to desert tortoises and their habitat during construction, operation, maintenance, and decommissioning of the solar facilities. A primary objective of the Applicants' weed

management plans is to ensure that the presence of weed populations on and adjacent to the projects do not increase due to the projects (Desert Stateline 2013, Ironwood 2013). In general, the Bureau and the Applicants propose to manage noxious weeds and control any potential infestations that may occur by identifying potential weed infestations at the facilities and prescribing treatment, limiting ground disturbance to the minimum necessary, monitoring construction sites, cleaning equipment, providing training to on-site personnel, and submitting a pesticide use proposal prior to beginning construction.

Translocation Strategy

To minimize impacts associated with the projects, the Applicants have proposed to translocate desert tortoises from within the proposed solar facilities and any other areas that would be fenced. The Bureau (2013f) and the Bureau and Ironwood (2013b) provided us with translocation plans for the Stateline and Silver State South projects, respectively, during development of the draft biological opinion. Discussions among the Service, Bureau, and Applicants resulted in several changes to these translocation plans; we based the following description on the Bureau (2013f) and the Bureau and Ironwood (2013b) translocation plans and these discussions.

To assist in preparing the translocation plans, the Applicants analyzed home range size, distribution, habitat use and selection, disease prevalence, and contaminant exposure of desert tortoises within the Ivanpah Valley. These data sets will inform translocation activities and provide baseline data for future monitoring as the study area encompasses the project sites and contiguous recipient sites. In 2012, the Applicants initiated research efforts to locate, attach transmitters to, and conduct health evaluations on desert tortoises in the Stateline and Silver State South project sites. To date, the Applicants have attached transmitters to approximately 34 and 80 desert tortoises in and around the Stateline and Silver State South project sites, respectively. The Applicants used these data to establish an activity area for each desert tortoise.

<u>Monitoring of Translocated Desert Tortoises</u>

BrightSource Energy is currently constructing the Ivanpah Solar Electric Generating System, which is located to the west of the proposed Stateline Solar Project. As a condition of the approval of that project, BrightSource Energy is monitoring translocated, resident, and control desert tortoises in the Ivanpah Valley. The Bureau will maintain a database that will allow it and the Service to determine mortality rates of these desert tortoises.

The Bureau and Applicants have proposed to use information from this database to compare the mortality rates of BrightSource Energy's control animals to assess whether translocation is affecting the survival rate of desert tortoises translocated from the sites of the Stateline Solar and Silver State South projects. Data from some of the resident animals that BrightSource Energy is monitoring may also serve as information regarding residents for the Stateline Solar Project. The Bureau proposed to use these data because the desert tortoises that BrightSource Energy is

monitoring are close enough in proximity that the same environmental factors (e.g., weather conditions, habitat quality, etc.) are likely to affect the recipient sites for the Stateline Solar and Silver State South projects and the control site. Currently, BrightSource Energy is monitoring 136 desert tortoises as controls (Davis 2013a).

The Bureau and Silver State have proposed to monitor the translocated and resident desert tortoises for 1 year after the initial translocation (Cota 2013b). The Bureau has determined that Stateline will conduct 5 years of post-translocation mortality monitoring of the desert tortoises, if it approves the Stateline Solar Project. During the course of this consultation, the Bureau, Service, and First Solar engaged in several discussions regarding reducing the duration of monitoring of translocated desert tortoises because of the results of studies on translocated animals. After agreeing that one year of post-translocation monitoring would be sufficient for the Silver State South and Stateline Solar projects, the California Department of Fish and Wildlife notified the Bureau and Stateline that it intended to require Stateline to monitor translocated desert tortoises for 5 years in its incidental take permit under the California Endangered Species Act. Consequently, although the Nevada and California offices of the Bureau are requiring one year of post-translocation monitoring, the Bureau in California recognizes that 4 additional years of monitoring will take place at Stateline because of the requirement of the California Department of Fish and Wildlife (LaPre 2013d).

If BrightSource Energy discontinues its monitoring of desert tortoises before Stateline's commitment ends, the Bureau will require Stateline to track an appropriate number of animals as controls and residents (Fesnock 2013a). At the end of 5 years, the agencies will determine if additional study is warranted (e.g., mortality rates are significantly different from resident or control populations) with regard to the desert tortoises translocated from the Stateline Solar Project or if the individuals could or should be incorporated in an existing regional study (Fesnock 2013b).

The Applicants have already attached transmitters to many desert tortoises at both sites. They will maintain these transmitters on animals after translocation and attach transmitters to any new desert tortoises discovered during pre-construction clearance surveys prior to being translocated (provided that it is large enough to support one). The details of translocation methodologies and frequency of monitoring are located in the translocation plans for the projects (Bureau 2013f, Bureau and Ironwood 2013b); the plans generally followed the most recent guidance for post-translocation monitoring (Service 2011a).

Recipient Sites

The Bureau based its selection criteria to identify recipient sites for each project on the Service's (2011a) translocation guidance. The Bureau selected areas within approximately 40 kilometers of the Stateline and Silver State South project sites that meet all or most of the criteria in the guidance. The Bureau evaluated recipient sites for suitability of both within-home-range translocation (for animals moved up to 500 meters from their original location) and outside-

home-range translocation (for animals moved greater than 500 meters from their original location).

The Bureau evaluated one within-home-range recipient site (Perimeter) and two outside-home-range recipient sites (North and East Lake) for the Stateline Project. (The Stateline translocation plan describes three outside-home-range recipient sites in the translocation plan but the Bureau deleted one during consultation (LaPre 2013c).) The Perimeter site is located immediately adjacent to the northern and western boundaries of the project site. Data on desert tortoises within the Perimeter site were derived from protocol surveys conducted in 2011 and 2012. Based on these surveys and the Service's translocation guidelines (2011a), the Perimeter site can hold approximately 35 additional large desert tortoises without exceeding a post-translocation density of 15 large individuals per square mile. (We define large desert tortoises as any animal that is 160 millimeters or greater in length and explain our use of this term, rather than "adult," in the Environmental Baseline - Status of the Desert Tortoise in the Action Area section of this biological opinion. We based the post-translocation density on one standard deviation of the mean density of desert tortoises in the Eastern Mojave Recovery Unit, which is 15 individuals per square mile (Service 2011a).) The North site is approximately 1.2 miles north of the Stateline Project site, extending up the alluvial fan towards the Stateline Pass. The site is contiguous with the Perimeter recipient site; however, because of its distance from the project, Stateline would use it for outside-home-range translocation.

The Bureau also evaluated East Lake as an additional recipient site for the Stateline Project. The East Lake recipient site is located along the east side of Ivanpah Dry Lake approximately 3.1 miles east of the project site. The Bureau is not proposing this site for use at this time because the Perimeter and North recipient sites should be sufficient to meet the objectives of the translocation plan. However, if the number of large desert tortoises found within the project site exceeds the capacity of the primary recipient sites, the Bureau would consider the East Lake site as an alternative recipient site.

The Bureau identified three proposed recipient sites for the Silver State South Project, referred to as the Corridor, Crescent and Rucker sites. The Corridor site lies to the east of the project, extends into the foothills of the Lucy Grey Mountains and includes the area immediately surrounding the project. The Bureau prefers this site for translocation because Silver State has extensive information on densities, disease status, and activity areas of its desert tortoises. Based on surveys it has conducted and the Service's translocation guidelines (2011a), Silver State could translocate approximately 100 large desert tortoises into the Corridor site without exceeding the post-translocation limit, which is 15 large individuals per square mile. The Crescent site is within the Piute-Eldorado Critical Habitat Unit and the Piute-Eldorado Valley Area of Critical Environmental Concern near the southern end of the Lucy Grey and McCullough mountains; it lies 8.7 miles southeast of the project area. The Rucker site is located approximately 7.5 miles northeast of the southern portion of the Silver State South Project. The Bureau would use these translocation areas if the number of large desert tortoises from the Silver State South Project site exceeds the capacity of the Corridor site.

Translocation Procedures

This section provides details of the steps that the Applicants would undertake to translocate desert tortoises. The installation of the exclusion fence would preclude desert tortoises that were outside the fence line at the time from re-entering the project sites. After the Applicants install the exclusion fence, it would translocate individuals with attached transmitters and then conduct clearance surveys to find and translocate any remaining individuals.

The Applicants will conduct health assessments to the extent possible on small desert tortoises, if their size allows. The Applicants have already completed health assessments on the individuals it has been tracking in the project areas. If these results are more than a year old at the time of translocation, the Applicants will reassess those desert tortoises and include this information in the disposition plan. The Applicants would use the Service's (2013d) guidelines for assessing the health of desert tortoises and transport any individuals showing severe injury or severe clinical signs of disease at the time of translocation to an agency-approved quarantine facility.

The biological assessments state that the Applicants would translocate desert tortoises in the spring or fall when rainfall has been "adequate." Because rainfall may not reach 40 millimeters, which the biological assessments describe as adequate, and research has demonstrated that the amount of rainfall does not affect the survival rates of translocated desert tortoises, the Bureau agreed on the following change to the proposed actions (Cota 2013a, LaPre 2013a).

The Applicants would translocate desert tortoises in the spring or fall, when animals are active. Individuals authorized by the Service to conduct health assessments as described in the Service's (2013d) health assessment procedures will evaluate the suitability of desert tortoises for translocation. Depending on environmental conditions and their perceived hydration state, the authorized biologists will provide supplemental hydrating fluids to desert tortoises within 12 hours of translocation. (In addition, all desert tortoises that void will be given hydrating fluids.) The authorized biologists will decide on the necessity of supplemental hydration in close coordination with the Service as part of the individual disposition plans for the desert tortoises.

The Applicants will conduct clearance surveys as described in the translocation plans (Bureau 2013f, Bureau and Ironwood 2013b) and in the Service's (2010c) current guidance. The Applicants will divide the area within the perimeter fence into subsections with interior fencing. Clearance surveys will continue in each subsection until at least two consecutive perpendicular passes are completed without a desert tortoise or new active sign (additional individuals, active burrows, recent scat, tracks, or mating rings) being found, at which time construction may commence in that unit. Desert tortoises found during clearance surveys will remain in situ until a disposition plan is approved; if an animal's health assessment is more than a year old, the Applicant will complete a new assessment for the disposition plan. All desert tortoise burrows within the cleared area will be completely and carefully excavated to seek out viable nests.

Each applicant will attempt to conduct clearance surveys only during the active season for desert tortoises; however, they may need to begin work in some areas (e.g., staging area) outside the active season. Construction of linear components of the projects may occur at any time of the year (Bureau 2013f). Any desert tortoises found during clearance of linear components will be moved out of harm's way to adjacent habitat following current clearance and handling procedures (Service 2009a). The Applicants will not attach transmitters to these individuals or track or test them for disease; they will conduct visual health assessments of these desert tortoises to determine if they exhibit clinical signs of disease.

Handling and Release of Translocated Desert Tortoises

The following description of the methodology for moving and releasing desert tortoises is from the translocation plan for the Stateline Solar Project (Bureau 2013f). The translocation plan for the Silver State South Project did not address this methodology; however, Silver State will follow procedures outlined in the Service's guidance similar to the Stateline Solar Project.

Only authorized biologists will handle desert tortoises during translocation. Desert tortoises will be hydrated according to the Service's (2011a) protocol; all desert tortoises that void their bladders will be hydrated according to the Service's protocols. Animals will be transported to their release sites in clean, ventilated protective containers. If these containers are re-used, they will be disinfected according to existing protocols. All individuals will be released at unoccupied shelter sites such as soil burrows, spaces within rock outcrops, caliche caves, or the shade of shrubs. Release locations will be identified ahead of time and specified in the disposition plan. Spatial distribution patterns between desert tortoises will be maintained as consistently as possible to those found on the project site. Releases will take place between 0700 and 1600 hours and will occur when temperatures range from 65 to 85°F and are not forecasted to exceed 90°F within 3 hours of release. The Applicants will not release desert tortoises if daily low temperatures are forecasted to be cooler than 50°F for one week post-release. Temperatures will be taken at approximately 2 inches above ground in a recently shaded area.

Handling of Desert Tortoise Nests

The Applicants will completely and carefully excavate all desert tortoise burrows within the cleared area to ensure that no viable nests remain. If the Applicants locate a viable nest, they will move it as described in the Desert Tortoise Field Manual (Service 2009a). Section 6.6 of the field manual recommends that relocated nests be monitored by an authorized biologist according to a monitoring program to be developed in consultation with the Service.

Monitoring of Demographic and Genetic Stability

The Applicants have separately agreed to fund a program, developed by the U.S. Geological Survey and the Bureau, to monitor regional desert tortoise populations for changes in demographic and genetic stability. Each project would separately begin its respective

monitoring as soon as November of 2013 and continue it for the term defined in Nussear et al. (2013). The monitoring study will address genetic and demographic connectivity, changes in health status of populations in response to habitat changes, and the effects of climate and between-site habitat suitability on connectivity between populations. We have summarized the following description of the monitoring strategy from Nussear et al. (2013).

The monitoring strategy is designed to examine connectivity among pre-selected study sites in the Ivanpah Valley by monitoring genetic connectivity using a multifaceted approach. The U.S. Geological Survey will assess genetic connectivity by using blood samples to provide baseline information on population genetics (i.e., genetic variation and genetic structure of the population). The U.S. Geological Survey will sample each of the 10 1-square-kilometer study sites approximately every 3 to 5 years; the time between samples is appropriate, given the long generation times of desert tortoises. The data will also provide estimates of differentiation among individuals and populations to assess whether developments and habitat barriers affect the genetic structure of the population in the valley. These samples will infer changes in genetic structure and the relative connectivity among these populations over time. If connectivity among sites is severed, genetic differentiation among sites would likely increase over time.

Because long periods of study may be required to detect changes in gene flow given the desert tortoise's slow reproduction and long generation times, monitoring programs may not be able to detect broken linkages with sufficient time to implement conservation decisions informed by genetic analyses alone. For this reason, the U.S. Geological Survey will also measure individual movement and fine-scale connectivity annually by using radio telemetry to measure the coincident locations of desert tortoises and subsequent overlap of home ranges at two of the study sites. The U.S. Geological Survey will then use micro-dataloggers attached to desert tortoises that will record contacts and relay the chain of connectivity through a corridor as individuals encounter one another on the landscape. This system will allow the U.S. Geological Survey to measure connectivity using the relay of contacts among desert tortoises throughout the corridor; the rates of contact will then be compared to rates of contact and connectivity in uncompromised habitats.

The U.S. Geological Survey will attach a radio transmitter to each new animal encountered within the study site (provided that it is large enough to carry a transmitter). Information from capture-recapture surveys will provide local estimates of density, immigration, and emigration; quantify demographic structure; facilitate the collection of new genetic material, disease and health status; quantify mortality estimates during the surveys; and potentially document demographic exchange of individuals among sites over time. The U.S. Geological Survey will also genotype desert tortoise scat as a second method of capture-recapture to increase the number of individuals that can be detected and sampled. Scat genotyping provides a non-invasive sampling technique for future genetic population monitoring. Nussear et al. (2013) contains additional information on the U.S. Geological Survey's methodologies.

Measures to Offset Adverse Effects

The Bureau will require the individual applicants to offset the loss of desert tortoise habitat in accordance with the relevant land use plans.

Stateline Project

The Bureau and Stateline have proposed several projects to offset the adverse effects of the Stateline Solar Project. First, Stateline will fund the retirement of 40,000-acres of the Clark Mountain Grazing Allotment, which occupies the area west of Interstate 15 between the Clark Mountains and the state line. Second, Stateline will fund restoration work along 20 acres of the Kern River Pipeline right-of-way located north of the project site and within a 6.4-acre area along the west side of Whiskey Pete's, located approximately 1.5 miles northeast of the proposed project site. Third, Stateline will restore 30 closed/unauthorized routes located within the Eastern Mojave Recovery Unit. Lastly, Stateline will fund fencing along 13 miles of Morningstar Mine Road, located within the Mojave National Preserve.

Stateline will also provide funding to the regional management for common ravens by paying a one-time fee of $105 per acre of disturbance for 1,685 acres of desert tortoise habitat that will be adversely affected by the project. The Service will use this funding to implement various management actions for common ravens, as described in the environmental assessment for the management of this species in the California desert (Service 2008).

Silver State South Project

The Bureau and Silver State have proposed actions to offset the adverse effects of the Silver State South Project. Silver State will fund the Bureau to perform health and genetic testing of desert tortoises in the Large-Scale Translocation Site to determine if connectivity can be restored by removing or reconfiguring the site's perimeter fence without additional management actions. The Bureau will, with technical assistance from the Service as needed, develop and implement appropriate adaptive management strategies to allow eventual removal or reconfiguration of the perimeter fence in appropriate locations to improve connectivity. If initial testing results or subsequent adaptive management strategies indicate that removal or reconfiguration of the perimeter fence is feasible, Silver State's funding will be used by the Bureau for the removal or reconfiguration of the perimeter fence, as appropriate, in consultation with the Service. If testing indicates that improving connectivity through the Large-Scale Translocation Site is not feasible for genetic, disease, or other reasons, the Bureau would instead fence portions of Highway 93 from where fencing exists to the north to reduce the mortality of desert tortoises.

Silver State will fund the Bureau to perform restoration work to ensure that areas important for connectivity adjacent to the project site are improved (e.g., restoring disturbed area, etc.); it will also fund law enforcement personnel for up to 3 years to ensure that land management regulations and protections enacted by the Bureau in these areas are enforced. Silver State will

fund the Bureau for a study to assess the effects of dust palliatives on the desert tortoise, if these substances are used at the project site.

Silver State and Southern California Edison will also provide the Bureau with the standard remuneration fee of $824 per acre of disturbance for their respective disturbances totaling 2,427 acres of desert tortoise habitat, in addition to the funds required to implement the projects described in this section. If Silver State's payment to the Bureau for improving connectivity though the Large-Scale Translocation Site is not sufficient, the Bureau would use funds from the standard remuneration fee to complete the work. The Bureau will use any remaining remuneration funds for other projects to promote the conservation of the desert tortoise in Nevada.

Changes in Land Use Plans

The Bureau has proposed related actions to create a new proposed area of critical environmental concern in Nevada (Bureau 2013g) in relation with the Silver State South Project approval, and to expand the Ivanpah Desert Wildlife Management Area in California (Bureau 2012a) in relation with the Stateline Project approval. The new proposed area of critical environmental concern would result in the addition of approximately 50 square miles to existing conservation areas; it would encompass most of the Lucy Gray Mountains and adjacent valley floors and extend north to the Sheep Mountains. The area of expansion of the Ivanpah Desert Wildlife Management Area would encompass the remaining desert tortoise habitat in California outside the footprints of the Stateline Solar Project, Ivanpah Solar Electric Generating System, and the Primm Valley Golf Course; this expansion would add approximately 37 square miles to this conservation area. The desert wildlife management area and proposed area of critical environmental concern would be contiguous at the state boundary east of Interstate 15 with approval of a land use plan amendment.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY DETERMINATION

Section 7(a)(2) of the Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 Code of Federal Regulations 402.02).

The jeopardy analysis in this biological opinion relies on four components in relation to the desert tortoise: (1) the *Status of the Desert Tortoise*, which describes the range-wide condition of the desert tortoise, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which analyzes the condition of the desert tortoise in the action area, the factors responsible for that condition, and the relationship of the action area to its survival and recovery; (3) the *Effects of the Action*, which determines the direct and indirect

impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the desert tortoise; and (4) the *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the desert tortoise.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the current status of the desert tortoise and, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both its survival and recovery in the wild.

STATUS OF THE DESERT TORTOISE

Section 4(c)(2) of the Act requires the Service to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review); these reviews, at the time of their completion, provide the most up-to-date information on the range-wide status of the species. For this reason, we are appending the 5-year review of the status of the desert tortoise (Appendix 1; Service 2010d) to this biological opinion and are incorporating it by reference to provide most of the information needed for this section of the biological opinion. The following paragraphs provide a summary of the relevant information in the 5-year review.

In the 5-year review, the Service discusses the status of the desert tortoise as a single distinct population segment and provides information on the Federal Register notices that resulted in its listing and the designation of critical habitat. The Service also describes the desert tortoise's ecology, life history, spatial distribution, abundance, habitats, and the threats that led to its listing (i.e., the 5-factor analysis required by section 4(a)(1) of the Act). In the 5-year review, the Service concluded by recommending that the status of the desert tortoise as a threatened species be maintained.

With regard to the status of the desert tortoise as a distinct population segment, the Service concluded in the 5-year review that the recovery units recognized in the original and revised recovery plans (Service 1994 and 2011b, respectively) do not qualify as distinct population segments under the Service's distinct population segment policy (61 Federal Register 4722; February 7, 1996). We reached this conclusion because individuals of the listed taxon occupy habitat that is relatively continuously distributed, exhibit genetic differentiation that is consistent with isolation-by-distance in a continuous-distribution model of gene flow, and likely vary in behavioral and physiological characteristics across the area they occupy as a result of the transitional nature of, or environmental gradations between, the described subdivisions of the Mojave and Colorado deserts.

In the 5-year review, the Service summarizes information with regard to the desert tortoise's ecology and life history. Of key importance to assessing threats to the species and to developing and implementing a strategy for recovery is that desert tortoises are long lived, require up to 20

years to reach sexual maturity, and have low reproductive rates during a long period of reproductive potential. The number of eggs that a female desert tortoise can produce in a season is dependent on a variety of factors including environment, habitat, availability of forage and drinking water, and physiological condition. Predation seems to play an important role in clutch failure. Predation and environmental factors also affect the survival of hatchlings.

In the 5-year review, the Service also discusses various means by which researchers have attempted to determine the abundance of desert tortoises and the strengths and weaknesses of those methods. Due to differences in area covered and especially to the non-representative nature of earlier sample sites, data gathered by the Service's current range-wide monitoring program cannot be reliably compared to information gathered through other means at this time.

The Service provides a summary table of the results of range-wide monitoring, initiated in 2001, in the 5-year review. This ongoing sampling effort is the first comprehensive attempt to determine the densities of desert tortoises across their range. Table 1 of the 5-year review provides a summary of data collected from 2001 through 2007; we summarize data from the 2008 through 2012 sampling efforts in subsequent reports (Service 2012a, 2012b, 2012e, 2012f).

Allison (2013b) analyzed long-term monitoring data for desert tortoise conservation areas to evaluate whether densities are changing across the range of the species. The data best fit a model in which densities are declining across the Western Mojave, Eastern Mojave, Colorado Desert, and Upper Virgin River recovery units and increasing across all conservation areas in the Northeastern Mojave Recovery Unit. The data do not support alternative models of stable population abundance. Trends in the Upper Virgin River and Northeastern Mojave recovery units are significant at the alpha = 0.10 level, but the rate of population change is not statistically significant elsewhere.

Allison (2013b) also evaluated changes in size distribution of desert tortoises since 2001. In the Western Mojave, Eastern Mojave, and Colorado Desert recovery units, the median size of large individuals has increased, indicating less recruitment of younger (therefore smaller) desert tortoises. In the Western Mojave and Colorado Desert recovery units, the relative number of smaller desert tortoises is about half what it was in 2001. Taken together, these trends suggest fewer small desert tortoises are reaching sexual maturity, which may be explained because they comprise a smaller proportion of the population or possibly because their survival rates are relatively lower than those of adults. Either possibility indicates that smaller size classes, like adults, are affected by ongoing threats; however, because most small desert tortoises die before reaching 180 millimeters in length, we do not know whether the reduced number of small animals has directly contributed to the observed declining trends in adults. For instance, a small increase in adult mortality would have a much larger effect on adult densities. None of these demographic rates have been measured in parallel with this study, so we cannot point to specific demographic rates that are associated with these overall population declines.

In the 5-year review, the Service provides a brief summary of habitat use by desert tortoises; more detailed information is available in the revised recovery plan (Service 2011b). In the absence of specific and recent information on the location of habitable areas of the Mojave Desert, especially at the outer edges of this area, the 5-year review also describes and relies heavily on a quantitative, spatial habitat model for the desert tortoise north and west of the Colorado River that incorporates environmental variables such as precipitation, geology, vegetation, and slope and is based on occurrence data of desert tortoises from sources spanning more than 80 years, including data from the 2001 to 2005 range-wide monitoring surveys (Nussear et al. 2009). The model predicts the probability that desert tortoises will be present in any given location; calculations of the amount of desert tortoise habitat in the 5-year review and in this biological opinion use a threshold of 0.5 or greater predicted value for potential desert tortoise habitat. The model does not account for anthropogenic effects to habitat and represents the potential for occupancy by desert tortoises absent these effects.

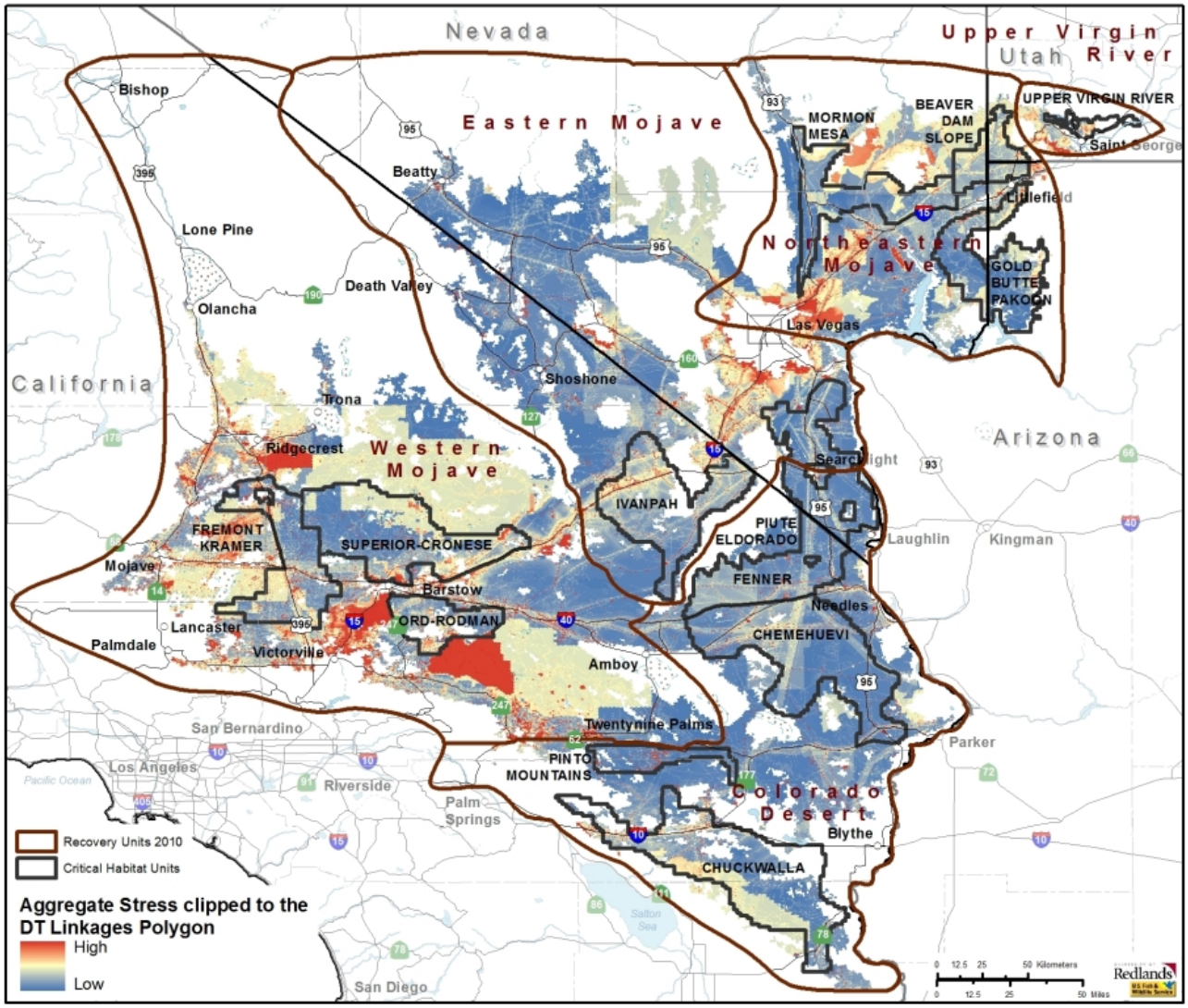
To begin integrating anthropogenic activities and the variable risk levels they bring to different parts of the Mojave and Colorado deserts, the Service completed an extensive review of the threats known to affect desert tortoises at the time of their listing and updated that information with more current findings in the 5-year review. The review follows the format of the five-factor analysis required by section 4(a)(1) of the Act. The Service described these threats as part of the process of its listing (55 Federal Register 12178; April 2, 1990), further discussed them in the original recovery plan (Service 1994), and reviewed them again in the revised recovery plan (Service 2011b).

To understand better the relationship of threats to populations of desert tortoises and the most effective manner to implement recovery actions, the Desert Tortoise Recovery Office is developing a spatial decision support system that models the interrelationships of threats to desert tortoises and how those threats affect population change. The spatial decision support system describes the numerous threats that desert tortoises face, explains how these threats interact to affect individual animals and habitat, and how these effects in turn bring about changes in populations. For example, we have long known that the construction of a transmission line can result in the death of desert tortoises and loss of habitat. We have also known that common ravens, known predators of desert tortoises, use the transmission line's pylons for nesting, roosting, and perching and that the access routes associated with transmission lines provide a vector for the introduction and spread of invasive weeds and facilitate increased human access into an area. Increased human access can accelerate illegal collection and release of desert tortoises and their deliberate maiming and killing, as well as facilitate the spread of other threats associated with human presence, such as vehicle use, garbage and dumping, and invasive plants (Service 2011b). Changes in the abundance of native plants because of invasive weeds can compromise the physiological health of desert tortoises, making them more vulnerable to drought, disease, and predation. The spatial decision support system allows us to map threats across the range of the desert tortoise and model the intensity of stresses that these multiple and combined threats place on desert tortoise populations.

The threats described in the listing rule and both recovery plans continue to affect the species. Indirect impacts to desert tortoise populations and habitat occur in accessible areas that interface with human activity. Most threats to the desert tortoise or its habitat are associated with human land uses; research since 1994 has clarified many mechanisms by which these threats act on desert tortoises. As stated earlier, increases in human access can accelerate illegal collection and release of desert tortoises and deliberate maiming and killing, as well as facilitate the spread of other threats associated with human presence, such as vehicle use, garbage and dumping, and invasive weeds.

Some of the most apparent threats to the desert tortoise are those that result in mortality and permanent habitat loss across large areas, such as urbanization and large-scale renewable energy projects, and those that fragment and degrade habitats, such as proliferation of roads and highways, off-highway vehicle activity, and habitat invasion by non-native invasive plant species. However, we remain unable to quantify how threats affect desert tortoise populations. The assessment of the original recovery plan emphasized the need for a better understanding of the implications of multiple, simultaneous threats facing desert tortoise populations and of the relative contribution of multiple threats on demographic factors (i.e., birth rate, survivorship, fecundity, and death rate; Tracy et al. 2004).

The following map that depicts the 12 critical habitat units of the desert tortoise and the aggregate stress that multiple, synergistic threats place on desert tortoise populations. The map also depicts linkages between conservation areas for the desert tortoise (which include designated critical habitat) recommended in the revised recovery plan (Service 2011b) that are based on an analysis of least-cost pathways (i.e., areas with the highest potential to support desert tortoises) between conservation areas for the desert tortoise. This map illustrates that areas under the highest level of conservation management remain subjected to numerous threats and stresses and that current conservation actions for the desert tortoise are not substantially reducing mortality sources across its range.



land within critical habitat and desert wildlife management areas and funding for the implementation of various actions that are intended to promote the recovery of the desert tortoise. Although most of these mitigation measures are consistent with recommendations in the recovery plans for the desert tortoise and the Service continues to support their implementation, we cannot assess how desert tortoise populations will respond because of the long generation time of the species.

The following table summarizes information regarding the proposed solar projects that have undergone formal consultation with regard to the desert tortoise. Data are from Service 2010a [Silver State North]; b [Genesis], c [Chevron Lucerne Valley]; d [Abengoa Harper Lake], e [Blythe], h [Palen], i [Desert Sunlight]; 2011c [BrightSource Ivanpah], d [Rice]; 2013b [Desert Harvest], 2013c [McCoy]; and Burroughs (2012, Nevada projects; 2013c, Moapa). Projects are in California, unless noted.

Project	Acres of Desert Tortoise Habitat	Estimated Number of Desert Tortoises Onsite*	Recovery Unit
BrightSource Ivanpah	3,582	1,136	Eastern Mojave
Silver State North - NV	685	37	Eastern Mojave
Amargosa Farm Road - NV	4,350	4	Eastern Mojave
Abengoa Harper Lake	Primarily in abandoned agricultural fields	4	Western Mojave
Chevron Lucerne Valley	516	10	Western Mojave
Nevada Solar One - NV	400	**	Northeastern Mojave
Copper Mountain North - NV	1,400	30 **	Northeastern Mojave
Copper Mountain - NV	380	**	Northeastern Mojave
Moapa K Road Solar - NV	2,152	157	Northeastern Mojave
Genesis	1,774	8	Colorado
Blythe	6,958	30	Colorado
Palen	1,698	18	Colorado
Desert Sunlight	4,004	56	Colorado
McCoy	4,533	15	Colorado
Desert Harvest	1,300	5	Colorado
Rice	1,368	18	Colorado
Total	35,100	1,529	

*The numbers in this column are not necessarily comparable because the methodologies for estimating the numbers of desert tortoises occasionally vary between projects.
** These projects occurred under the Clark County Multi-species Habitat Conservation Plan; we estimate that all three projects combined will affect fewer than 30 desert tortoises.
The Service completed consultation on the Calico project, located in the Western Mojave Recovery Unit; however, the applicant has abandoned the project and the Bureau has withdrawn the request for consultation (Bureau 2013b).

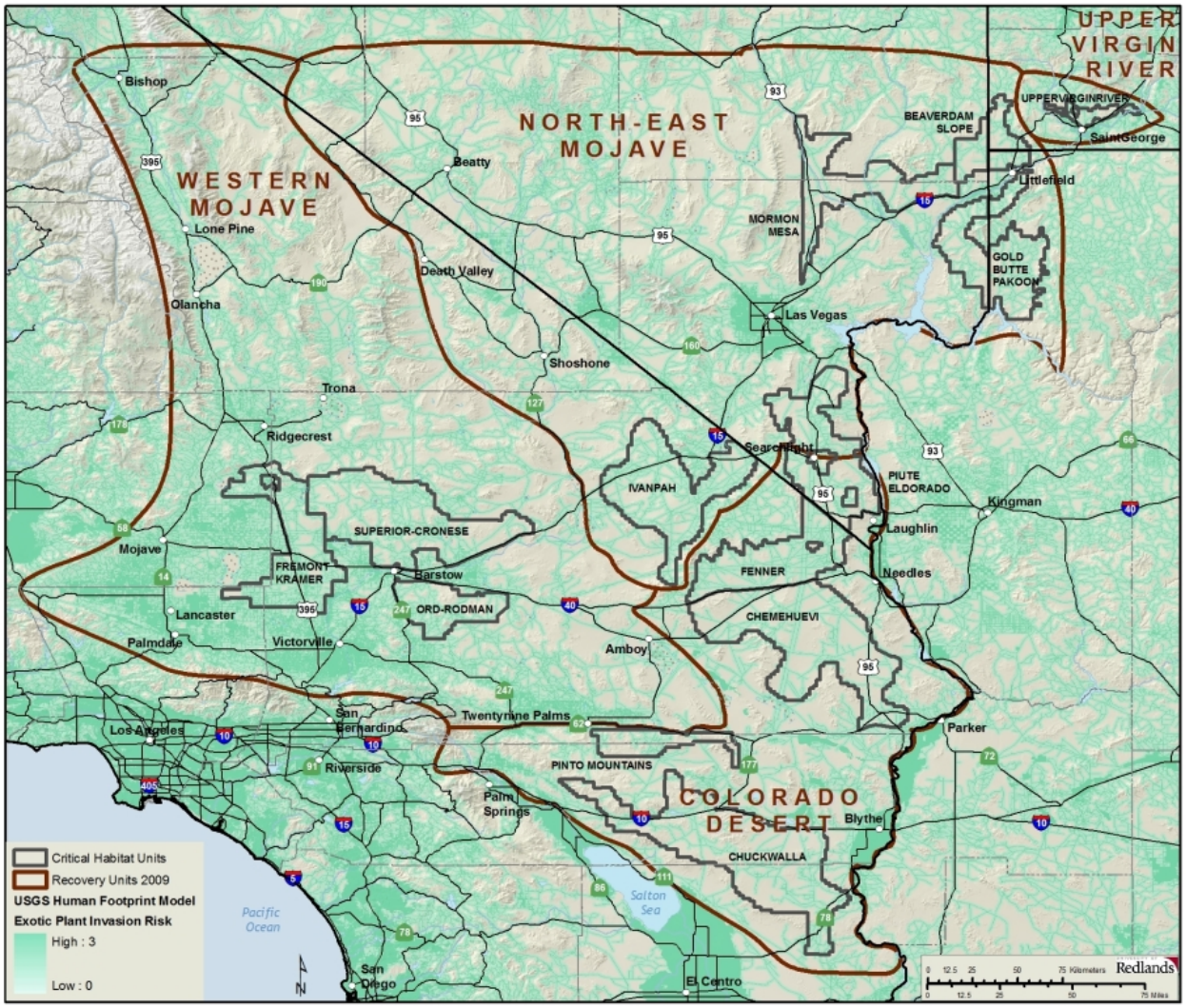
In addition to the biological opinions issued for solar development within the range of the desert tortoise, the Service (2012c) also issued a biological opinion to the Department of the Army for the use of additional training lands at Fort Irwin. As part of this proposed action, the Army removed approximately 650 desert tortoises from 18,197 acres of the southern area of Fort Irwin, which had been off-limits to training. The Army would also use an additional 48,629 acres that lie east of the former boundaries of Fort Irwin; much of this parcel is either too mountainous or too rocky and low in elevation to support numerous desert tortoises.

The Service also issued a biological opinion to the Marine Corps that considered the effects of the expansion of the Marine Corps Air Ground Combat Center at Twentynine Palms (Service

2012d). We concluded that the Marine Corps' proposed action, the use of approximately 167,971 acres for training, was not likely to jeopardize the continued existence of the desert tortoise. Most of the expansion area lies within the Johnson Valley Off-high Vehicle Management Area.

The incremental effect of the larger actions (i.e., solar development, the expansions of Fort Irwin, and the Marine Corps Air Ground Combat Center) on the desert tortoise is unlikely to be positive, despite the numerous conservation measures that have been (or will be) implemented as part of the actions. The acquisition of private lands as mitigation for most of these actions increases the level of protection afforded these lands; however, these acquisitions do not create new habitat and Federal, State, and privately managed lands remain subject to most of the threats and stresses we discussed previously in this section. Although land managers have been implementing measures to manage these threats, we have been unable, to date, to determine whether the measures have been successful, at least in part because of the low reproductive capacity of the desert tortoise. Therefore, the conversion of habitat into areas that are unsuitable for this species continues the trend of constricting the desert tortoise into a smaller portion of its range.

As the Service notes in the 5-year review (Service 2010d), "(t)he threats identified in the original listing rule continue to affect the (desert tortoise) today, with invasive species, wildfire, and renewable energy development coming to the forefront as important factors in habitat loss and conversion. The vast majority of threats to the desert tortoise or its habitat are associated with human land uses." Oftedal's work (2002 in Service 2010d) suggests that invasive weeds may adversely affect the physiological health of desert tortoises. Current information indicates that invasive species likely affect a large portion of the desert tortoise's range (see following map). Furthermore, high densities of weedy species increase the likelihood of wildfires; wildfires, in turn, destroy native species and further the spread of invasive weeds.



Global climate change is likely to affect the prospects for the long-term conservation of the desert tortoise. For example, predictions for climate change within the range of the desert tortoise suggest more frequent and/or prolonged droughts with an increase of the annual mean temperature by 3.5 to 4.0 degrees Celsius. The greatest increases will likely occur in summer (June-July-August mean increase of as much as 5 degrees Celsius [Christensen et al. 2007 in Service 2010d]). Precipitation will likely decrease by 5 to 15 percent annually in the region, with winter precipitation decreasing by up to 20 percent and summer precipitation increasing by 5 percent. Because germination of the desert tortoise's food plants is highly dependent on cool-season rains, the forage base could be reduced due to increasing temperatures and decreasing precipitation in winter. Although drought occurs routinely in the Mojave Desert, extended periods of drought have the potential to affect desert tortoises and their habitats through physiological effects to individuals (i.e., stress) and limited forage availability. To place the consequences of long-term drought in perspective, Longshore et al. (2003) demonstrated that even short-term drought could result in elevated levels of mortality of desert tortoises.

Therefore, long-term drought is likely to have even greater effects, particularly given that the current fragmented nature of desert tortoise habitat (e.g., urban and agricultural development, highways, freeways, military training areas, etc.) will make recolonization of extirpated areas difficult, if not impossible.

The Service notes in the 5-year review that the combination of the desert tortoise's late breeding age and a low reproductive rate challenges our ability to achieve recovery. When determining whether a proposed action is likely to jeopardize the continued existence of a species, we are required to consider whether the action would "reasonably be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 Code of Federal Regulations 402.02). Although the Service does not explicitly address these metrics in the 5-year review, we have used the information in that document to summarize the status of the desert tortoise with respect to its reproduction, numbers, and distribution.

In the 5-year review, the Service notes that desert tortoises increase their reproduction in high rainfall years; more rain provides desert tortoises with more high quality food (i.e., plants that are higher in water and protein), which, in turn, allows them to lay more eggs. Conversely, the physiological stress associated with foraging on food plants with insufficient water and nitrogen may leave desert tortoises vulnerable to disease (Oftedal 2002 in Service 2010d), and the reproductive rate of diseased desert tortoises is likely lower than that of healthy animals. Young desert tortoises also rely upon high-quality, low-fiber plants (e.g., native forbs) with nutrient levels not found in the invasive weeds that have increased in abundance across its range (Oftedal et al. 2002; Tracy et al. 2004). Compromised nutrition of young desert tortoises likely represents an effective reduction in reproduction by reducing the number that reaches adulthood. Consequently, although we do not have quantitative data that show a direct relationship, the abundance of weedy species within the range of the desert tortoise has the potential to negatively affect the reproduction of desert tortoises and recruitment into the adult population.

Data from long-term study plots, which were first established in 1976, cannot be extrapolated to provide an estimate of the number of desert tortoises on a range-wide basis; however, these data indicate, "appreciable declines at the local level in many areas, which coupled with other survey results, suggest that declines may have occurred more broadly" (Service 2010d). Other sources indicate that local declines are continuing to occur. For example, surveyors found "lots of dead [desert tortoises]" in the western expansion area of Fort Irwin (Western Mojave Recovery Unit) in 2008 (Fort Irwin Research Coordination Meeting 2008). After the onset of translocation, coyotes killed 105 desert tortoises in Fort Irwin's southern translocation area (Western Mojave Recovery Unit); other canids may have been responsible for some of these deaths. Other incidences of predation were recorded throughout the range of the desert tortoise during this time (Esque et al. 2010). Esque et al. (2010) hypothesized that this high rate of predation on desert tortoises was influenced by low population levels of typical prey for coyotes due to drought conditions in previous years. Recent surveys in the Ivanpah Valley (Eastern Mojave Recovery Unit) for a proposed solar facility detected 31 live desert tortoises and the carcasses of 25

individuals that had been dead less than 4 years (Ironwood 2011); this ratio of carcasses to live individuals over such a short period of time may indicate an abnormally high rate of mortality for a long-lived animal. In summary, the number of desert tortoises range-wide likely decreased substantially from 1976 through 1990 (i.e., when long-term study plots were initiated through the time the desert tortoise was listed as threatened), although we cannot quantify the amount of this decrease. Additionally, more recent data collected from various sources throughout the range of the desert tortoise suggest that local declines continue to occur (e.g., Bureau et al. 2005, Esque et al. 2010).

The distribution of the desert tortoise has not changed substantially since the publication of the original recovery plan in 1994 (Service 2010d) in terms of the overall extent of its range. Prior to 1994, desert tortoises were extirpated from large areas within their distributional limits by urban and agricultural development (e.g., the cities of Barstow, Lancaster, Las Vegas, St. George, etc.; agricultural areas south of Edwards Air Force Base and east of Barstow), military training (e.g., Fort Irwin, Leach Lake Gunnery Range), and off-road vehicle use (e.g., portions of off-road management areas managed by the Bureau and unauthorized use in areas such as east of California City). Since 1994, urban development around Las Vegas has likely been the largest contributor to habitat loss throughout the range. Desert tortoises have been essentially removed from the 18,197-acre southern expansion area at Fort Irwin (Service 2012c).

The following table depicts acreages of habitat (as modeled by Nussear et al. 2009) within various regions of the desert tortoise's range and of impervious surfaces as of 2006 (Xian et al. 2009). Impervious surfaces include paved and developed areas and other disturbed areas that have zero probability of supporting desert tortoises.

Regions[1]	**Modeled Habitat (acres)**	**Impervious Surfaces within Modeled Habitat**	**Percent of Modeled Habitat that is now Impervious**
Western Mojave	7,582,092	1,864,214	25
Colorado Desert	4,948,900	494,981	10
Northeast Mojave	7,776,934	1,173,025	15
Upper Virgin River	232,320	80,853	35
Total	20,540,246	3,613,052	18

[1]The regions do not correspond to recovery unit boundaries; we used a more general separation of the range for this illustration.

On an annual basis, the Service produces a report that provides an up-to-date summary of the factors that were responsible for the listing of the species, describes other threats of which we are aware, describes the current population trend of the species, and includes comments of the year's findings. The Service's (2011e) recovery data call report describes the desert tortoise's status as 'declining,' and notes that "(a)nnual range-wide monitoring continues, but the life history of the desert tortoise makes it impossible to detect annual population increases (continued monitoring

will provide estimates of moderate- to long-term population trends). Data from the monitoring program do not indicate that numbers of desert tortoises have increased since 2001. The fact that most threats appear to be continuing at generally the same levels suggests that populations are still in decline. Information remains unavailable on whether mitigation of particular threats has been successful."

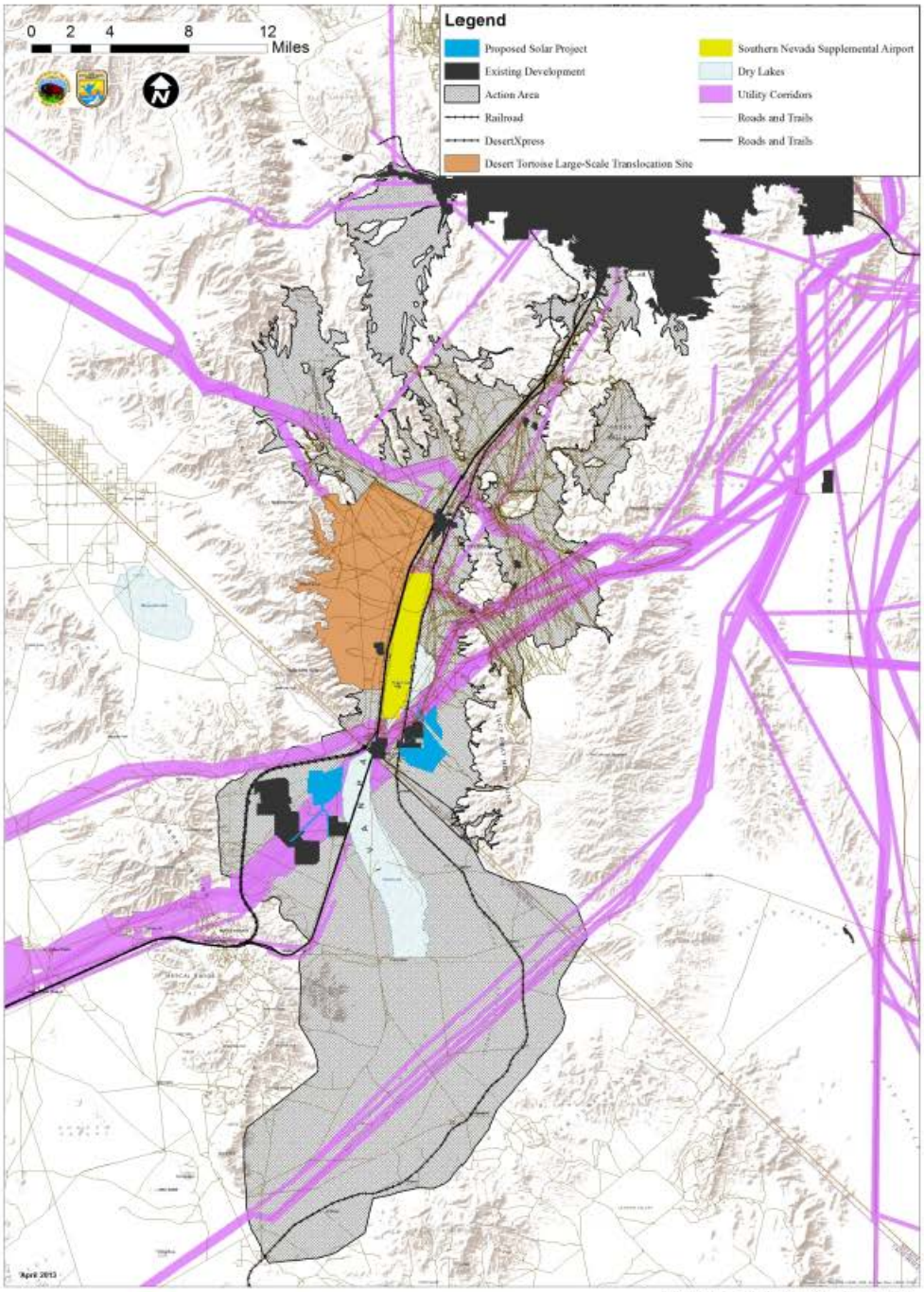
In conclusion, we have used the 5-year review (Service 2010d), revised recovery plan (Service 2011b), and additional information that has become available since these publications to review the reproduction, numbers, and distribution of the desert tortoise. The reproductive capacity of the desert tortoise may be compromised to some degree by the abundance and distribution of invasive weeds across its range; the continued increase in human access across the desert likely continues to facilitate the spread of weeds and further affect the reproductive capacity of the species. Prior to its listing, the number of desert tortoises likely declined range-wide, although we cannot quantify the extent of the decline; since the time of listing, data suggest that declines continue to occur throughout most of the range, although recent information suggests that densities may have increased slightly in the Northeastern Mojave Recovery Unit. The continued increase in human access across the desert continues to expose more desert tortoises to the potential of being killed by human activities. The distributional limits of the desert tortoise's range have not changed substantially since the issuance of the original recovery plan in 1994; however, desert tortoises have been extirpated from large areas within their range (e.g., Las Vegas, other desert cities). The species' low reproductive rate, the extended time required for young animals to reach breeding age, and the multitude of threats that continue to confront desert tortoises combine to render its recovery a substantial challenge.

ENVIRONMENTAL BASELINE

Action Area

The implementing regulations for section 7(a)(2) of the Act define the "action area" as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 Code of Federal Regulations 402.02). For the purposes of this biological opinion, we consider the action area to include the entire Ivanpah Valley in California and Nevada. We have defined the action area in this manner because of the potential effects of the Stateline and Silver State South projects on connectivity for the desert tortoise within the entire valley.

By including all contiguous desert tortoise habitat within the Ivanpah Valley, we are accounting for all areas that desert tortoises could move to following translocation based on the presence of movement barriers and the post-translocation distances observed in previous studies (Berry 1986, Field et al. 2007, Nussear 2004) and areas that would be potentially vulnerable to fragmentation of the local population. The action area defined for this biological opinion is approximately 328,640 acres (Darst 2013). This acreage does not include dry lake beds and developed areas, such as the town of Primm.


0 2 4 8 12
Miles
Legend
Proposed Solar Project
Existing Development
Action Area
Railroad
DesertXpress
Desert Tortoise Large-Scale Translocation Site
Southern Nevada Supplemental Airport
Dry Lakes
Utility Corridors
Roads and Trails
Roads and Trails
April 2013

Habitat Characteristics of the Action Area

The following information provides a summary of the discussion of habitat characteristics from the biological assessments (Bureau 2013a, Bureau and Ironwood 2013c) and draft environmental impact statements for Stateline and Silver State South (Bureau 2012a, 2012b). The Ivanpah Valley is bounded by the Ivanpah Mountains, Mescal Range, and Clark Mountain to the west; the Spring Mountain Range and Stateline Hills to the north; the Lucy Gray Range, Sheep Mountain and McCullough Mountains to the east; and the New York Mountains and the Mid Hills to the south. The action area is characterized by two broad alluvial fans, one spreading eastward from the Clark Mountains and one spreading westward from the Lucy Gray Mountains at a 0 to 5 percent grade. The alluvial fans drain into both the Ivanpah Dry Lake running through the Ivanpah Valley, and to the Roach Dry Lake to the northwest. Elevations within the action area range from approximately 2,600 to 3,700 feet above mean sea level.

The Stateline project site supports two primary vegetation communities. The majority of the site supports a creosote bush-white bursage series. The eastern extent of the site borders Ivanpah Dry Lake and supports mixed saltbush series. This community is situated within a relatively narrow band around the western edge of the unvegetated dry lake.

The Silver State South project site comprises three primary vegetation communities. Mojave yucca series is found at higher elevations along the alluvial fan; habitat then transitions to a creosote bush-white bursage series in the mid-elevation range, with a mixed saltbush series occurring along the eastern edge of the unvegetated dry lake.

All portions of the action area contain habitat features that the U.S. Geological Survey has mapped as conducive to desert tortoise occupancy (Nussear et al. 2009).

Existing Conditions in the Action Area

In this section, we discuss the anthropogenic and natural conditions in the action area as they relate to desert tortoises and their habitat. Unless we have noted otherwise by citing a biological opinion, the anthropogenic conditions present in the action area were constructed or instituted prior to the listing of the desert tortoise. Various factors within areas that contain barriers have the potential to influence desert tortoise movement; these factors include, but are not limited to: culvert dimensions, road width, height of boundary fence, and complexity of the vegetation along the route (Yanes et al. 1995). For the purpose of analyzing the various types of barriers impeding upon desert tortoise movement within the action area, we classify the barriers based on "permeability." We consider linear barriers equipped with culverts that allow desert tortoise passage and aid in connectivity to be semi-permeable barriers; large developments, most of which remove large expanses of desert tortoise habitat with no means of connectivity, are considered impermeable barriers to movement.

Land Management

The Federal government owns most of the land in the action area. A few sections of the Ivanpah Valley are owned by the State of California and State of Nevada and a few small areas are privately owned. The Primm Valley Golf Course and the communities of Nipton, California, and Primm, Jean, and Goodsprings, Nevada, are the main areas of privately owned land in the Ivanpah Valley. Habitat for desert tortoises has been removed from the areas of the golf course and the communities. In addition to the habitat that has been directly disturbed as a result of the development of these areas, we expect that desert tortoise habitat immediately adjacent to these areas is somewhat degraded.

The National Park Service manages the southernmost portion of the Ivanpah Valley, from the southern end of the valley where it begins at Cima Dome to the south side of Nipton Road. The Service issued a biological opinion regarding the effects of the management of Mojave National Preserve on the desert tortoise and its critical habitat on July 6, 2001 (Service 2001); in this biological opinion, we concluded that the proposed management was not likely to jeopardize the continued existence of the desert tortoise because most of the proposed actions would improve the condition of habitat within the Mojave National Preserve and reduce the level or mortality of desert tortoises. We concluded that relatively few desert tortoises were likely to be killed or wounded on an annual basis as a result of the ongoing casual use of the Mojave National Preserve.

With the exception of the National Park Service, state, and private lands mentioned above, the Bureau manages the remainder of the land within the Ivanpah Valley. The Service (2005) issued a biological opinion to the Bureau regarding its amendment to the California Desert Conservation Area Plan for the Northern and Eastern Mojave Desert planning area, which encompasses the California portion of the action area for this consultation. We concluded that the proposed amendment to the California Desert Conservation Area Plan was not likely to jeopardize the continued existence of the desert tortoise because all of the management direction that the Bureau proposed would either retain the current management direction or provide new direction that was intended to contribute to the recovery of the desert tortoise. New management direction included restrictions on casual off-road vehicle use, designations of desert wildlife management areas, reducing the number of burros in herd management areas, and addition of a disturbance cap for new development on public lands. The biological opinion addressed management direction for future actions that would require additional consultation if the Bureau proposed a specific action and numerous ongoing activities, such as casual use with regard to mining and recreation, burro gathers (the active removal of burros from public land), and cattle grazing. A portion of the lands in California north of the Mojave National Preserve and south and east of Interstate 15 lies within the Ivanpah Desert Wildlife Management Area; the Bureau manages these lands for conservation of desert tortoises. We concluded that relatively few desert tortoises were likely to be killed or injured on an annual basis as a result of the ongoing casual use of these lands.

In California, the Bureau does not manage the remainder of its lands in the valley specifically to ensure the long-term conservation of the desert tortoise. In general, the public's ability to conduct casual use with regard to mining and recreation in these areas is greater than in the desert wildlife management area; additionally, the Bureau will entertain proposals for larger scale projects, such as renewable energy projects, in such areas. Consequently, the desert tortoises are generally at higher risk of injury or mortality in these areas.

In Nevada, most of the Bureau's lands in the action area are within the Jean-Roach Special Recreation Management Area. The Service (1998) issued a programmatic biological opinion to the Bureau regarding the Las Vegas District's proposed resource management plan, which encompasses the Nevada action area for this consultation. We concluded that approval and implementation of the plan was not likely to jeopardize the continued existence of the desert tortoise. Our conclusion was based on our analysis of programmatic-level actions proposed in the resource management plan and management actions contributing to the recovery of the desert tortoise. The resource management plan includes restrictions on casual and competitive off-highway vehicle use, designations of areas of critical environmental concern for the desert tortoise that primarily overlap designated critical habitat, management of wild horses and burros for zero appropriate management level in areas of critical environmental concerns, closure of grazing allotments in areas of critical environmental concerns, reduction of the number of burros in herd management areas, reducing the size of off-highway vehicle events, and a disturbance cap by program of activity.

In 2013, the Service (2013g) issued a programmatic biological opinion for future actions in the area that the Bureau's Southern Nevada District Office manages. The 1998 resource management plan remains in effect but the 2013 programmatic biological opinion replaces our 1998 document, which covered a 10-year period. The action area includes all land managed by the Bureau in Clark and southern Nye counties excluding Red Rock Canyon National Conservation Area and Sloan Canyon National Recreation Area. The biological opinion established a disturbance cap of 13,005 acres for land disposals, leases, rights-of way, mining, recreation, fuel breaks, and vegetation and resource management. We concluded that approval and implementation of the plan was not likely to jeopardize the continued existence of the desert tortoise and 15 other threatened or endangered species.

The Bureau issues special use permits for organized high-speed racing events in this area that may include up to hundreds of racing and spectator vehicles per event (Bureau 1998, Service 2010f). We expect that these events likely result in the death or injury of desert tortoises on occasion; we do not have definitive information on their effect of the regional density of desert tortoises but expect that they have led to an overall decrease in the number of individuals in this area. Beginning in 2009, the Bureau prohibited high-speed events in the area during the months of April, May, September, and October, when desert tortoises are most active, in an attempt to reduce the number of mortalities (Burroughs 2013a).

On August 5, 1995, the Service issued an incidental take permit, pursuant to section 10(a)(1)(B) of the Endangered Species Act, to Clark County; subsequent to the issuance of this permit, the Service issued a multi-species incidental take permit to Clark County, the cities within the county, and the Nevada Department of Transportation that addressed impacts to the desert tortoise, several other federally listed species, numerous unlisted species (RECON 2000). The county-wide incidental take permit allows the incidental take of covered species for various development activities for 30 years on 145,000 acres of non-Federal land in Clark County and within the Nevada Department of Transportation rights-of-way, south of the 38th parallel in Nevada; we issued the incidental take permit on January 9, 2001. The habitat conservation plan associated with the permit provides details on the proposed measures to minimize, mitigate, and monitor the effects of covered activities (RECON 2000).

As part of the incidental take permits issued to Clark County, participants in the plan developed the Large-Scale Translocation Site, which is located between Jean and Primm (RECON 2000). The site is bounded by State Route 161 on the north, which is fenced to exclude desert tortoises; the similarly fenced Interstate 15 on the east; the high elevation of the Spring Mountains on the west; and a desert tortoise-proof fence approximately 3 miles north of the California state line on the south. The Large-Scale Translocation Site encompasses approximately 28,000 acres of public land managed by the Bureau; it will not entertain proposals for utility-scale renewable energy projects within this area. Over 8,000 desert tortoises have been released into the Large-Scale Translocation Site since 1997.

The Service has issued two biological opinions for the construction and operation of two photovoltaic solar facilities located within the action area. The Ivanpah Solar Electric Generating System is located approximately 4.5 miles southwest of Primm and includes 3 solar electric generating plants and associated facilities, covering approximately 3,582 acres (Service 2011c). Although the Service concluded that the proposed action was not likely to jeopardize the continued existence of the desert tortoise, we expressed concern that this solar facility would impede connectivity within this portion of Ivanpah Valley. During project clearance surveys, BrightSource found 173 desert tortoises inside the project area. BrightSource has translocated the larger animals to habitat offsite. Approximately 110 desert tortoises smaller than 120 millimeters remain in the holding pens (Bransfield 2013); these animals will be released when they reach 120 millimeters in length or at the end of 5 years (Service 2011c). BrightSource will monitor translocated, resident, and control desert tortoises for 5 years. To date, 25 desert tortoises have died but no significant difference exists among control, resident, and translocated animals (Service 2013e; see following table); most of the deaths resulted from predation. Two deaths can be attributed to project activities. We expect that at least a few additional animals died during construction and were not detected.

Cause of Death	Treatment of Desert Tortoises				Total
	Control	Resident	Translocated	Holding Pen	
Canid Predation	2	5	4	-	11
Hyperthermia[1]	2	2	1	-	5
Vehicle Strike	1	1	-	-	2
Livestock Trampling	-	-	1	-	1
Unknown	2	1	1	1	5
Total	7	9	7	1	24

[1] All but one of the animals that died of hyperthermia were found on their backs. We do not know why they were on their backs but the potential exists that they could have been overturned during a fight with another desert tortoise. Desert tortoises with hyperthermia have abnormally elevated body temperatures as a result of overexposure to heat.

A 0.5-mile-wide constriction point exists between the southern unit of this facility and the Primm Valley Golf Course. North of the constriction point, Colosseum Road runs perpendicularly across this linkage and is lined by fencing to exclude desert tortoises. BrightSource will install three corrugated pipe culverts under Colosseum Road in the future to reduce habitat and population fragmentation (Bureau and Ironwood 2013a). Currently, this fenced road prevents connectivity. Interstate 15 is an additional barrier to the movement of desert tortoises; it lies 0.8 mile to the east of the Ivanpah Solar Electric Generating Station System; approximately 1.1 miles separates the northern unit of the Ivanpah Solar Electric Generating Station System from the mountains to the north.

The Service (2010g) issued a biological opinion for the 3,796-acre Silver State Solar Project, located approximately 0.9 mile east of Primm. The Bureau (2010a) issued a record of decision for only the 618-acre first phase of the project, known as the Silver State North Solar Project. This facility has been built and is currently operating. Silver State North translocated four desert tortoises from this site into surrounding habitat (Cota 2013b). Although the Service concluded that the proposed action was not likely to jeopardize the continued existence of the desert tortoise, we expressed concern that this solar facility would impede connectivity between the northern and southern portions of the Ivanpah Valley. We expect that at least a few additional animals died during construction and were not detected.

To the east of Interstate 15 in Nevada, the connectivity of desert tortoise habitat is naturally constrained between the steep Lucy Gray Mountains and unvegetated Roach Lake. This constriction is further reduced by the Silver State North Project, the Walter M. Higgins Generating Station, an existing railroad, and the portion of Primm that lies east of the freeway.

The Jean Airport is located immediately southeast of Jean to the east of Interstate 15 and west of a rail line. East of the rail line, approximately 0.4 mile from the western edge of Sheep Mountain, is Jean Conservation Camp. This concentration of development in and around Jean

has removed a large portion of desert tortoise habitat between Interstate 15 and Sheep Mountain, creating a constriction point in the habitat connectivity to the north and south.

The site of the proposed Southern Nevada Supplemental Airport is north of Primm, east of Interstate 15, and west of the Union Pacific Railroad. The southern boundary of the site is within approximately 1 mile of the northern portion of the Silver State South Project. In 2000, Congress enacted legislation to authorize the sale of approximately 6,000 acres of lands managed by the Bureau to Clark County for the proposed airport (Christ 2013). This sale has already occurred; therefore, we consider the sale to be part of the environmental baseline for this consultation. The 6,000-acre parcel largely covers Roach Dry Lake; see figure 3.5-1of the final supplemental environmental impact statement for the Silver State South Project (Bureau 2013g). Although desert tortoises may occasionally cross a dry lake bed, they do not reside in such areas because the substrate is not suitable for burrowing and these areas lack the annual plants and shrubs that provide food and shelter. Because of the fine (and occasionally saline) substrate at the edge of dry lakes, desert tortoises also are generally scarce in such areas. For these reasons, development on this parcel would not result in the loss of a substantial amount of desert tortoise habitat, based on the information we have available to us at this time. If any desert tortoises are located within this 6,000-acre parcel, they would be addressed under the authority of Clark County's incidental take permit, which we discussed previously in this section. Additionally, because the 6,000-acre parcel is situated between Interstate 15 and the Union Pacific Railroad and is not located on the alluvial fan that extends to the Lucy Gray Mountains to the east, we do not expect that its development would have a measurable effect on connectivity in the Ivanpah Valley.

Congress also enacted legislation that identified a 17,000-acre noise overlay district for transfer to Clark County. This transfer would not occur until the Federal Aviation Administration and Bureau complete compliance with the National Environmental Policy Act and sign a record of decision (Christ 2013). The lands to be transferred would surround the 6,000-acre parcel discussed in the previous paragraph. The Bureau and the Federal Aviation Administration were preparing an environmental impact statement for a proposed Southern Nevada Supplemental Airport in Clark County, Nevada; however, the agencies have suspended work on the environmental impact statement and do not know when work on it will resume.

As of August 2013, Clark County has submitted right-of-way applications to the Bureau for necessary storm water, flood control, and materials transport facilities associated with the Southern Nevada Supplemental Airport. Three modified retention facilities, one of which falls within the proposed area of critical environmental concern, are proposed. In addition, Clark County has proposed a temporary conveyor system to transport mineral materials for use in construction of the airport. A section of the conveyor belt route falls within the proposed area of critical environmental concern. Any roadway, utility or other infrastructure associated with the Southern Nevada Supplemental Airport would be subject to an approved final environmental impact statement and record of decision and subject to compliance with the Endangered Species Act.

We acknowledge the existence of these potential actions but are not including them as part of the environmental baseline for the Silver State South and Stateline projects under consideration in this biological opinion because the actual transfer of the noise overlay district and other activities related to development of the proposed Southern Nevada Supplemental Airport that may occur on Bureau lands are future Federal actions that are subject to the consultation requirements of section 7(a)(2) of the Endangered Species Act (50 Code of Federal Regulations 402.02). According to the Congressional legislation, the 17,000 acres of the noise overlay district would not be transferred to Clark County and the 6,000 acres already transferred to Clark County would revert to the Bureau if the Federal Aviation Administration and Bureau do not approve the airport in the record of decision.

Use by Feral and Domestic Livestock

Grazing by cattle and burros affects desert tortoises in several ways. Desert tortoises can be killed or injured during the construction, maintenance, and use of range improvements. Cattle and burros have trampled desert tortoises and also damage or destroy their burrows. Predators, such as common ravens, can be attracted to livestock waters, carcasses of livestock, and some range improvements; predators attracted to these features could feed on desert tortoises and the subsidies that common ravens derive from the livestock and range improvements can contribute to increasing their reproductive capacity. Cattle and burros affect the habitat of desert tortoises by disturbing substrates and their crusts, grazing and trampling of shrubs and annual plants, and introducing and spreading weeds. Effects to desert tortoises and their habitat are most pronounced near range improvements (e.g., corrals, water tanks, etc.).

The action area contains several grazing allotments. The Clark Mountain and Jean Lake allotments are located in California. The Clark Mountain Allotment occupies the area west of Interstate 15 between the Clark Mountains and the state line. It is authorized through September 30, 2013, and may be re-authorized through a Congressional extension. Up to 124 head of cattle can graze year round, depending on the availability of forage (Bureau 2012a). In California, the Jean lake Allotment extends from the state line partially into the valley. Although it is considered an active allotment, it has been in non-use status for many years. All allotments in the portion of the Ivanpah Valley within the Mojave National Preserve have been retired.

The Nevada portion of the action area comprises four cattle grazing allotments: Jean Lake (a different allotment from the one in California), Roach Lake, Table Mountain and Hidden Valley. The Jean Lake Allotment, covering the portion of the Ivanpah Valley east of the railroad line, extends from the state line partially into the valley. The Roach Lake Allotment is located immediately east of the Jean Lake Allotment. Currently, both allotments are closed to grazing (Bureau 2012b). The Jean Lake Allotment closed in 2006 and the Roach Lake Allotment closed in 2000. The Hidden Valley allotment is open and extends east of Interstate 15 and south of the Las Vegas Valley. Only the southernmost portion of the Hidden Valley allotment lies within the action area. The Table Mountain allotment occurs between Interstate 15 to the east and

Amargosa Valley to the west; it was closed in the Bureau's 1998 resource management plan (Bureau 1998).

In California, the action area includes the Clark Mountain Herd Management Area; the Bureau designates these areas for the management of burros. The Northern and Eastern Mojave Plan Amendment (Bureau 2002 in Bureau 2012a) reduced the animal management level in this herd management area to 0. The purpose of this amendment was to reduce grazing and assist the recovery of the desert tortoise. The Bureau has removed nearly 100 burros from this area; however, burros continue to persist here (Bureau 2012a). The Nevada portion of the action area does not contain any herd management areas.

The effects of cattle grazing and the presence of wild burros on desert tortoises and their habitat varies with the intensity of grazing, the time since an area was last grazed, weather conditions, and the type of habitat. We do not have quantitative information on the condition of habitat in the action area with relation to past grazing and the presence of wild burros; however, even in areas where grazing by cattle and burros has not occurred for decades, non-native plants persist and heavily used areas near range improvements often exhibit visible disturbance.

Non-native Species

During surveys of the project site, Ironwood Consulting identified numerous non-native plant species including: Sahara mustard (*Brassica tournefortii*), salt cedar (*Tamarix ramosissima*), red brome (*Bromus madritensis ssp. rubens*), cheatgrass (*Bromus tectorum*), red-stemmed filaree (*Erodium cicutarium*), foxtail barley (*Hordeum murinum*), Russian thistle (*Salsola tragus*), and common Mediterranean grass (*Schismus barbatus*) (Bureau 2013a, Bureau and Ironwood 2013b). These species likely occur throughout the remainder of the action area; however, we expect the abundance of these species to be lower in portions of the action area that have not experienced cattle grazing in recent years. The abundance and diversity of non-native species in any area vary in relation to the seasonal weather; consequently, the composition of the non-native plant flora may be substantially different from year to year. An overabundance of weedy species likely compromises the nutritional status of desert tortoises, as we discussed in the Status of the Species section of this biological opinion. We do not have specific information on the distribution of non-native species nor on their specific effects on desert tortoises in the action area.

Paved and Unpaved Roads

Interstate 15 roughly bisects the northern portion of the action area, from the area just south of Clark Mountain to its northern terminus. The construction of Interstate 15 resulted in the loss of hundreds of acres of habitat and the likely degradation of additional areas as sheet flow across the valley's alluvial fans was disrupted. We also expect that desert tortoise densities adjacent to the freeway are depressed, as discussed by Hoff and Marlow (2002), but we are not aware of surveys that quantify this effect.

Due to the size and heavy traffic, Interstate 15 is mostly an impermeable barrier to movement of desert tortoises; we anticipate that at least a few desert tortoises are killed on this road annually. Interstate 15 in Nevada is fenced with desert tortoise exclusion fencing that only allows passage of individuals at a few culverts and bridges; however, due to the proximity of these culverts near the development of Primm and near Roach Dry Lake (just to the north of Primm), desert tortoises may not use them frequently. In California, the west side of Interstate 15 is equipped with fencing to exclude desert tortoises from the freeway; exclusionary fencing will be installed along the eastern portion of Interstate 15 (Service 2006a, 2011c). In California, two bridges over washes south of the Primm Valley Golf Course allow desert tortoises to cross underneath the freeway.

To the southeast of Interstate 15, in California, three paved roads traverse the action area. Morning Star Mine Road runs the length of the valley at the base of the Ivanpah Mountains. This road does not constitute an impermeable barrier; desert tortoises are routinely killed on this road by motorists traveling to Las Vegas at high speeds (National Park Service 2009). We expect that desert tortoise densities in this portion of the valley are likely depressed adjacent to the road, as discussed by Hoff and Marlow (2002).

Morning Star Mine Road terminates at Ivanpah Road, approximately 3 miles southwest of Nipton Road. Nipton Road bisects the valley, roughly from Interstate 15 in the west, through the town of Nipton, and into Nevada in the east. Ivanpah Road extends from Nipton Road to the south, where it leaves Ivanpah Valley. The National Park Service has informed us of desert tortoises being killed on Ivanpah Road. We are not aware of desert tortoises being killed on Nipton Road; the lack of reports may be due more to the fact that Nipton Road is outside of the boundaries of the Mojave National Preserve than lack of mortalities.

To the northwest of Interstate 15 in California, Yates Well Road exits from the freeway and intersects Colosseum Road, which extends from the Primm Valley Golf Club into the Clark Mountains. These roads are fenced to reduce injury and mortality to desert tortoises associated with its use as the access to the Ivanpah Solar Electric Generating System. To reduce habitat and population fragmentation associated with this barrier, BrightSource will install three culverts under Colosseum Road to allow movement of desert tortoises under the road.

To the north of Primm in Nevada, three paved roads cross the action area. State Route 604 (Las Vegas Boulevard) enters the action area from the north running south from Las Vegas parallel to Interstate 15. State Route 604 comes to an end approximately 5 miles south of Jean. An unnamed paved road extends to the south from Prison Road in Jean and turns east to a sand and gravel mine located at the north end of the Lucy Gray Mountains. State Route 161 (Goodsprings Road) traverses the northwest part of the action area extending to the west from Jean to Goodsprings. These three paved roads are unfenced. We expect traffic along these roads likely results in the death or injury of desert tortoises.

In addition to the paved roads within the Ivanpah Valley, unpaved roads traverse the action area within the Mojave National Preserve and on Bureau and non-federal lands in both states. Most of these roads are used in association with various utility facilities and recreational off-highway vehicle use; we expect that most use is for recreation. These unpaved roads are not a barrier to movement, but their use results in occasional injuries to and mortalities of desert tortoises (National Park Service 2009).

Utilities

Three transmission lines, travelling adjacent to and parallel to one another, cross the southern portion of the valley from Cima Dome in the south to where they leave the valley east of the town of Nipton. To the north and east of Primm, approximately nine large (230 to 500 kilovolt) transmission lines tie either into the Walter M. Higgins Electrical Substation and substation or continue to the southwest where they cross the State Line Hills and enter California.

Four transmission lines pass into California to the north of the Stateline facility. These lines lie within the Boulder Corridor. Two other transmission lines run across Ivanpah Dry Lake into California immediately south of the proposed Stateline site and the Ivanpah Solar Electric Generating System. Another transmission line, which crosses Interstate 15 approximately 2.5 miles south of Jean, borders the community of Jean in the northern portion of the action area. Networks of smaller, interconnecting distribution lines also traverse the action area.

Southern California Edison completed the Eldorado–Ivanpah Transmission Project in June 2013 (Bureau 2013a). The Service's (2011f) biological opinion for this project concluded that it was not likely to jeopardize the continued existence of the desert tortoise. The 36-mile-long transmission line extends from the existing Eldorado Substation to the existing Ivanpah Substation.

The construction of the numerous tower sites for the transmission lines disturbed or destroyed habitat. Unpaved roads generally run parallel to the power lines and provide access to utility company workers and the public; spur roads extend from these roads to each tower. The main and spur roads have likely caused more habitat loss than the tower sites. The use of these access roads for the utility transmission lines (both electric and gas) by workers and the public results in the ongoing injury and death of desert tortoises. On April 13, 2013, a desert tortoise that had been struck by a utility vehicle was found along the El Dorado to Ivanpah transmission line route in Nevada. In one case in the western Mojave Desert near Daggett, a desert tortoise bearing a radio transmitter was buried alive by a utility company maintaining the access road. In the spring of 2011, at least two desert tortoises were crushed by vehicles using utility line access roads; based on the use patterns of the utility company at the time, these desert tortoises seem to have been killed by casual users of the access roads. Most of deaths that result from use of the access roads for utility lines are likely not detected; however, these instances demonstrate that access roads within utility corridors pose an ongoing threat to desert tortoises.

A substantial ongoing effect of electrical transmission lines is their use by common ravens for perching and nesting. The presence of this additional nesting substrate, which allows common ravens to nest far above the reach of ground-dwelling predators, likely contributes substantially to the increase in the number of common ravens in the desert. As previously discussed, common ravens prey on desert tortoises and are likely detrimental to the recovery of the desert tortoise.

The Boulder Corridor also supports two gas lines, constructed and maintained by the Kern River Gas Transmission Company, and a fiber optic line. The installation of the first Kern River gas line resulted in the disturbance of hundreds of acres of habitat. Construction of the first gas pipeline in 1991 resulted in the deaths of approximately 23 desert tortoises. (We do not have information regarding how many of these deaths occurred in the action area for this consultation. Additionally, a portion of the mortalities occurred on another pipeline that was addressed in the same consultation.) The Service (2002) issued a non-jeopardy biological opinion to the Federal Energy Regulatory Commission for the construction and operation of the second gas pipeline. In June 2011, the Bureau and the Service agreed that the requirement for re-initiation of consultation had been triggered for operation and maintenance activities due to a desert tortoise mortality that occurred, and additional effects to the desert tortoise due to a large-scale translocation project in the action area (Service 2011g).

The Kern River Gas Transmission Company also built a distribution pipeline that emanates from the Boulder Corridor, travels west of the Ivanpah Solar Electric Generating System, and terminates at the Molycorp Mountain Pass Mine, which lies outside of the action area of this consultation, just north of Interstate 15. The Service concluded that this proposed pipeline was not likely to jeopardize the continued existence of the desert tortoise (Service 2012g); one desert tortoise died during construction activities after being struck by a worker's truck.

The Molycorp wastewater pipeline, which traverses the area to the east of Interstate 15 from the Mountain Pass Mine, terminates on the Ivanpah Dry lake bed. This pipeline has been the subject of several consultations (Service 1997a, 1997b, 2006b). Maintenance of the pipeline and clean-up of spills of hazardous materials from the line cause minor amounts of habitat disturbance along its route.

The disturbance caused by the pipelines remains evident and, on occasion, repair and inspection work result in new disturbances in the right-of-way. Access roads along most of these lines allow for recreational vehicle use. We are aware of desert tortoises that have been killed by utility company and recreational vehicles.

Rail Lines

A rail line traverses the alluvial fan to the northwest of the New York Mountains, turns north across the valley and passes through the town of Nipton, then turns northwest and north to pass along the west side of the Silver State South Project. From this point, it travels parallel to Interstate 15. This rail line forms a semi-permeable barrier to desert tortoises because they can

use culverts under the tracks. Desert tortoises have been known to attempt to cross rail lines and to become entrapped between the rails, where they die of exposure to temperature extremes. The rail line is protected from flood flows by a series of dikes that have been constructed on its uphill side; these dikes have, at least in some cases, created differences in the washes and perennial vegetation above and below the rail line. We cannot, at this time, determine the specific manner in which the rail line and dikes have affected desert tortoises. Because the dikes seem to be concentrating the sheet flow of water that would normally flow across the alluvial fan into defined washes, the potential exists that the decrease in water availability to upland areas has compromised the plant community in upland areas; conversely, the increased flow in the washes may have enhanced habitat suitability for desert tortoises in the washes. The potential also exists that an increased flow of water and debris in washes may increase the number of desert tortoises that are killed or injured during storm events.

The Service and Federal Railroad Administration have completed formal consultation for a high-speed rail line, the DesertXpress, which would enter Ivanpah Valley near the southeastern slope of the Clark Mountains, turn north along the upper alluvial fan, turn east along the northern side of the Stateline Project in California, and then enter Nevada just to the north of Primm. In Nevada, the line would be located either adjacent to or within the median of Interstate 15. The components of the rail alignment would include a 75-foot-wide permanent right-of-way, concrete barriers, overhead electrical distribution and transmission lines, fencing, and access and maintenance areas. This rail line would cross some washes in the action area with bridges; the design plan also includes numerous culverts to allow other washes to pass under the rail line. We anticipate that the proposed rail line would fragment desert tortoise habitat in the valley, but not result in an impermeable barrier.

Miscellaneous Facilities

To the south of the Primm Valley Golf Course, the California Department of Transportation and Service have completed consultation on the development of a joint port of entry (Service 2006a). We concluded that the proposed action was not likely to jeopardize the continued existence of the desert tortoise. This new facility will be located on the northwest side of southbound Interstate 15 between the Yates Well Road Interchange and the Nipton Road Interchange, and occupy approximately 80 acres along approximately 4 miles of the freeway. Construction of this facility has not yet begun. BrightSource fenced the port-of-entry project site and removed three desert tortoises from the area as a courtesy to the California Department of Transportation during the course of implementing mitigation measures for the Ivanpah Solar Electric Generating System (Davis 2013b).

Status of the Desert Tortoise in the Action Area

The Service's (2010c) protocol is effective at detecting desert tortoises larger than 160 millimeters in length. We have determined, through work conducted during range-wide sampling, that field workers detect desert tortoises that are 160 millimeters in length or longer

more readily than they do small individuals. For the purposes of the analysis in this biological opinion, we will refer to desert tortoises 160 millimeters and greater in length to be large animals and desert tortoises less than 160 millimeters in length to be small animals.

Desert tortoises reach reproductive age (i.e., become adults) at different sizes in different parts of their range. The likelihood of being detected during surveys is a function of size and not reproductive capacity; therefore, we will not use the terms “adult” and “subadult” in this biological opinion unless we are discussing reproduction.

Population Estimates for the Action Area

To estimate the number of large desert tortoises in the action area, we used different methods for California and Nevada because of differences in the best available information. First, we assumed that the density derived from range-wide sampling within the Ivanpah Critical Habitat Unit was applicable for the California portion of the action area; we then multiplied this density by the acreage of modeled desert tortoise habitat in this portion of the action area. Within the Mojave Desert, previous assessments from the Service have used a threshold of 0.5 or greater as the predicted value that corresponds with potential desert tortoise habitat (Bureau and Ironwood 2013a, Service 2010d). For the purpose of maintaining consistency in this assessment, a model value of 0.5 or greater has been used to represent desert tortoise habitat. Second, we estimated the number of individuals in the Nevada portion of the action area by multiplying the estimated density extrapolated from past surveys conducted in the northern part (Ironwood 2012b) of the valley by the acreage of modeled desert tortoise habitat in that portion of the action area. We then added the estimated number of large desert tortoises in California to that in Nevada to obtain an overall estimate for the action area. Appendix 2 contains these calculations. Based on these calculations, we estimate that approximately 4,572 large desert tortoises occur within the action area. Due to the large number of assumptions needed to calculate the number of small desert tortoises or eggs and thus leading to a high level of uncertainty, we did not attempt to estimate the total number of small desert tortoises or eggs in the action area.

Estimates for Stateline and Silver State South Project Sites - Desert Tortoises Larger than 160 Millimeters

We summarized the following information from the Stateline and Silver State South biological assessments (Bureau 2013a, Bureau and Ironwood 2013c) and supplemental information provided by Blandford (2013a, 2013b). Ironwood Consulting conducted desert tortoise surveys in 2012 on the Stateline site and in 2011 and 2012 for the Silver State South site based on the Service’s (2010c) field survey protocol.

The Bureau (2013a) and Blandford (2013a) used the equation contained in the Service’s protocol (2010c) to derive estimates of the number of large desert tortoises within the project site and the lower and upper 95 percent confidence intervals for the Stateline and Silver State South facilities, respectively. Blandford (2013b) noted that the survey area covered only 2,265 acres of

the 2,427-acre Silver State South facility. We did not extrapolate the number of large desert tortoises to cover the entire 2,427 acres of the project footprint for several reasons. First, the difference in the acreages (162 acres) is relatively minor. Second, desert tortoises are not uniformly distributed across the landscape; therefore, a straight-forward extrapolation would not necessarily be appropriate. Last, our use of the upper 95 percent confidence interval for the number of desert tortoises within the project area provides for a conservative estimate of the number of large individuals predicted within the actual project area. The Bureau (2013a) and Blandford (2013a, 2013c) did not take into account the incidental sightings of large desert tortoises within the action area; we agree with this methodology because at least some of these animals may have been repeated sightings of the large desert tortoises observed during the surveys and the equation in our protocol accounts for individuals that are missed during surveys. We will use the upper 95 percent confidence intervals from the following table as a basis upon which to conduct the analysis of effects in this biological opinion because it is the maximum number of desert tortoises likely to be present; units are numbers of large desert tortoises.

Project	Detected During Surveys	Point Estimates	95 Percent Confidence Intervals
Stateline	14	35	13 to 94
Silver State South	20*	44	17 to 115

*This number includes observations of large desert tortoises from the 2011 and 2012 protocol surveys.

At the Stateline site, most observations of desert tortoises and their sign occurred at higher elevations within the study areas within areas of rocky and gravelly substrates of the stabilized alluvial fan. No live desert tortoises or active burrows were found within 1,300 meters of the western edge of Ivanpah Dry Lake.

Based on the information in figure 5 in the biological resources technical report for Silver State South (Ironwood 2012b), desert tortoises do not seem to be distributed differently in relation to their location on the alluvial fan; that is, they seem to occupy all elevation across the alluvial fan. Figure 5 seems to indicate, though, that desert tortoises are not distributed evenly across the project site; some portions of the site are devoid of observations.

Estimates for Stateline and Silver State South Project Sites - Eggs and Desert Tortoises Smaller than 160 Millimeters

Desert tortoises less than 160 millimeters in length (including hatchlings) are difficult to detect because of their small size and their cryptic nature. Hatchlings may also have emerged from a nest on the site since the time of the survey; this scenario could also increase the overall number of individuals on the site.

The Bureau and the Applicants used the Service's general methodology for estimating the number of small desert tortoises and eggs in the project areas. The table below summarizes the upper 95 percent confidence intervals for the estimates of the number of desert tortoises in the Stateline and Silver State South Project areas. We will use these numbers as a basis upon which to conduct the analysis of effects in this biological opinion; all units are numbers of individuals.

Project	Hatchling and Eggs	49.7 to 120 millimeters	120 to 160 millimeters	>160 millimeters
Stateline	286	523	44	94
Silver State South	353	646	54	115

The methodology is based on several assumptions. The assumptions are that female desert tortoises greater than 160 millimeters in length are reproductive, the ratio of males to females is one to one, the life table developed by Turner et al. (1987) is applicable, and that desert tortoises produce an average number of eggs every year. (Turner et al. developed a life table based on work they conducted near Goffs, California, which is located approximately 60 miles south of the action area.) We emphasize that, although the estimate of the number of desert tortoises and eggs on the project site is based on the best available information, the overall number of animals and eggs may be different. The demographic structure of the desert tortoise population on the Goffs study site may have been different in the early 1980s than that currently on either project site, because of the declines that have occurred since that time; consequently, use of the Goffs data may overestimate the actual number of smaller desert tortoises within the project area. Furthermore, we recognize that the survey data used for these estimates represent a single point in time and the number of individuals in these areas may change by the onset of project actives, environmental conditions and other anthropogenic and natural processes.

Disease Prevalence within and adjacent to the Stateline and Silver State South Project Sites

The Applicants have collected blood and performed health assessments on all of the animals located, to date, within and adjacent to the Stateline and Silver State South Project sites. These health evaluations provided a baseline status of the *Mycoplasma agassizii* and *M. testudenium* prevalence in this region. The translocation plans included tables that depicted the results of disease testing on desert tortoises in the project area (Bureau 2013f, Bureau and Ironwood 2013b).

The University of Florida, which analyzes the blood samples using an enzyme-linked immunosorbent assay (ELISA) to determine whether antibodies are present, recently suggested that the positive and suspect findings for *Mycoplasma testudinium* correspond to enzyme titers of 128 and 64 (Field 2013). We used the data from the biological assessments and the new information from the University of Florida to construct the following table.

Project	Number of Desert Tortoises Sampled	*Mycoplasma agassizii* ELISA titer				*Mycoplasma testudinium* ELISA titer			
		<32	32	64	128	<32	32	64	128
Stateline	34	33	1	0	0	15	12	5	2
Silver State South	71	68	3	0	0	45	18	7	1

Currently, researchers understand the presence of antibodies to be an indication of past exposure to the pathogens; it does not necessarily confer immunity or relate to the current health of an individual (Field 2013). The results indicate that prevalence of these two diseases in the area is likely to be low.

Connectivity within and outside of the Ivanpah Valley

Lowe and Allendorf (2010) define demographic connectivity as the degree to which population growth and vital rates are affected by dispersal and genetic connectivity as the degree to which gene flow affects evolutionary processes within populations. To further explain demographic connectivity, we have included this excerpt from Lowe and Allendorf (2010, although we did not include their citations or references to figures):

> Demographically connected populations are those in which population growth rates (λ, r) or specific vital rates (survival and birth rates) are affected by immigration or emigration. Demographic connectivity is generally thought to promote population stability (e.g. $\lambda \geq 1.0$) and this stabilizing effect can occur at two different scales. In individual populations, demographic connectivity can promote stability by providing an immigrant subsidy that compensates for low survival or birth rates of residents [i.e. low local recruitment]. Demographic connectivity can also promote the stability of metapopulations by increasing colonization of unoccupied patches (i.e. discrete subpopulations), even when the extinction rate of occupied patches is high.

They also note that "The importance of demographic connectivity is clear when the elimination of immigration results in a shift from stable or positive population growth to negative population growth." Demographic connectivity is equally important if negative population growth results from anthropogenic factors.

Genetic connectivity is the flow of genetic material between two populations. Genetic connectivity can occur if a few individuals occasionally make long-distance movements between populations; the amount of genetic connectivity is a function of the numbers of individuals in the two populations and of how many individuals move between those populations. For example, if two populations have a high degree of demographic connectivity, they would also exhibit a high degree of genetic connectivity.

In the following paragraphs, we explain the factors affecting connectivity within and outside of Ivanpah Valley. We will also describe how this connectivity relates to the Eastern Mojave Recovery Unit and desert tortoise as a listed taxon.

Three main areas contain the highest quality habitat and most of the desert tortoises within the Eastern Mojave Recovery Unit. In the western portion of the recovery unit, the first area extends roughly from Interstate 15 between Kelbaker and Cima roads to the south, along the southern edge of Cima Dome. This area supports high quality habitat and numerous desert tortoises; it lies mostly within the Mojave National Preserve. As we discussed previously in this biological opinion, this area is largely isolated from the southern end of Ivanpah Valley by a relatively high elevation pass from the southeastern edge of Cima Dome. Data collected during range-wide sampling from 2007 through 2010 seem to show lower relative abundance of desert tortoises in this area, thereby indicating that this connection may be tenuous (Service 2009b, 2012a, 2012b). Morningstar Mine Road (a heavily used, high-speed road along which several desert tortoises are killed by vehicles every year) and a rail line likely contribute, at least in part, to the low density of desert tortoises in this area.

Moving from west to east, Ivanpah Valley is the second important area of the Eastern Mojave Recovery Unit because it continues to support a relatively large number of desert tortoises across a range of habitat types (Hagerty et al. 2010). In an undisturbed state, desert tortoises would likely maintain long-term population stability and connectivity throughout Ivanpah Valley. Existing disturbance and development that was present when the desert tortoise was listed, has already undergone consultation, or has been approved legislatively (current: Interstate 15, an existing rail line, existing solar and fossil fuel plants, Primm, golf course; future: high-speed rail, joint port of entry) fragment habitat in the Ivanpah Valley. Existing disturbance has probably contributed to a decline in the overall number of desert tortoises in Ivanpah Valley and certainly caused the loss and degradation of habitat in the valley; off-highway vehicle recreation within the valley has contributed to these effects. With regard to connectivity within Ivanpah Valley, a large portion of this disturbance and development occurs (or will occur) within or near the naturally narrow band of desert tortoise habitat between Roach and Ivanpah dry lakes, near the state line and has likely affected the connectivity of desert tortoises between the northern and southern portions of the valley.

The Ivanpah Valley is bounded by geographic features that greatly restrict potential for demographic connectivity outside the valley. These natural barriers include the Clark and Spring Mountains to the west; Bird Spring Range to the northwest; Northern McCullough Range to the northeast; McCullough, Lucy Gray and New York Mountains to the east; and Cima Dome to the south. These mountain ranges (and Cima Dome) represent major geographic barriers that largely separate desert tortoises and gene flow within the Ivanpah Valley from individuals outside of the valley.

Ivanpah Valley connects to Eldorado Valley, the third important habitat area for desert tortoises within the Eastern Mojave Recovery Unit, near the northernmost points of both valleys. The

transition from Ivanpah Valley to Eldorado Valley is likely the primary genetic and demographic pathway between these two areas of important desert tortoise habitat. The genetic similarity in desert tortoises that reside in the Ivanpah and Eldorado valleys, as delineated by Hagerty and Tracy (2010), infers at least historical high levels of population connectivity. Historically, genetic connectivity was likely possible through southern Las Vegas Valley, north of the McCullough Range, and into Eldorado Valley (Bureau and Ironwood 2013a). These linkages have likely been compromised by development associated with Las Vegas. If the primary historical connection between these valleys was through the southern Las Vegas Valley, the genetic separation between the desert tortoise populations in Ivanpah and Eldorado valleys would likely become more pronounced over time. The linkage through McCullough Pass and other less-obvious linkages through the McCullough Range likely support lower levels of genetic connectivity. We can only indirectly infer the exact measurements of gene flow through these linkages at this time.

We acknowledge that desert tortoises may also occasionally move through Stateline Pass, which lies directly north of the proposed Stateline Solar Project. These animals, however, would pass through a narrow canyon that is unlikely to support a population of desert tortoises in the long term; therefore, we do not expect that this canyon provides a demographic connection between Ivanpah Valley and desert tortoises that reside outside the valley. Genetic separation caused by the Clark and Spring mountains, which divide Ivanpah Valley from Mesquite and Pahrump valleys to the north as delineated by Hagerty and Tracy (2010), infers that demographic connectivity is naturally limited across these geographic features (Bureau and Ironwood 2013a). Additionally, the northern end of this pass does not connect directly to another area that we consider important for the recovery of the desert tortoise because of generally lower densities and more diffuse patches of suitable habitat.

Maintaining the genetic variability of the desert tortoise and sufficient ecological heterogeneity within and among populations are factors that are integral to recovery of the species (Murphy et al. 2007 and Hagerty and Tracy 2010 in Service 2011b). This variation is necessary to allow desert tortoises to adapt to changes in the environment over time (Service 1994). Additionally, because desert tortoises occupy large home ranges, the long-term persistence of extensive, unfragmented habitat is essential for the survival of the species (Service 1994). Extensive, unfragmented habitat is necessary to support sufficient numbers of desert tortoises to allow for periodic and local declines in densities that can result from various natural factors (e.g., drought, excessive predation, etc.) and for subsequent recolonization from adjacent areas that were not affected by such declines. The loss or degradation of suitable habitat because of urbanization, large-scale wildfire, or other landscape-modifying activities places desert tortoises at increased risk of extirpation in local areas; repetition of these activities over its range places the desert tortoise at risk of extinction. In short, absent the conservation of large areas of suitable habitat within each recovery unit, we cannot conserve all of the genetic and morphological variations and differences in behavior and ecology that comprise the desert tortoise as a species.

Maintaining "self-sustaining populations of desert tortoises within each recovery unit into the future" is a primary objective for recovery of the species (Service 1994, 2011b). The Service (2011b) uses recovery units as tools to identify geographic units that are individually necessary to conserve the diversity necessary for long-term sustainability of the entire listed taxon. Maintaining a robust population of desert tortoises within the Eastern Mojave Recovery Unit is important to ensure the long-term persistence of the species and the ability to recover the species throughout its range.

Individual desert tortoises can make long-distance movements, which can contribute to gene flow (Berry 1986, Edwards et al. 2004), but we do not know the extent to which individuals will traverse long narrow corridors of relatively intact habitat. Given this uncertainty, reliable genetic connectivity of populations depends upon the existence of enough suitable and occupied habitat to maintain sustainable populations. Consequently, the long-term viability of linkages depends on the ability of the habitat in these linkages to sustain populations into the future and the absence of substantial barriers to dispersal.

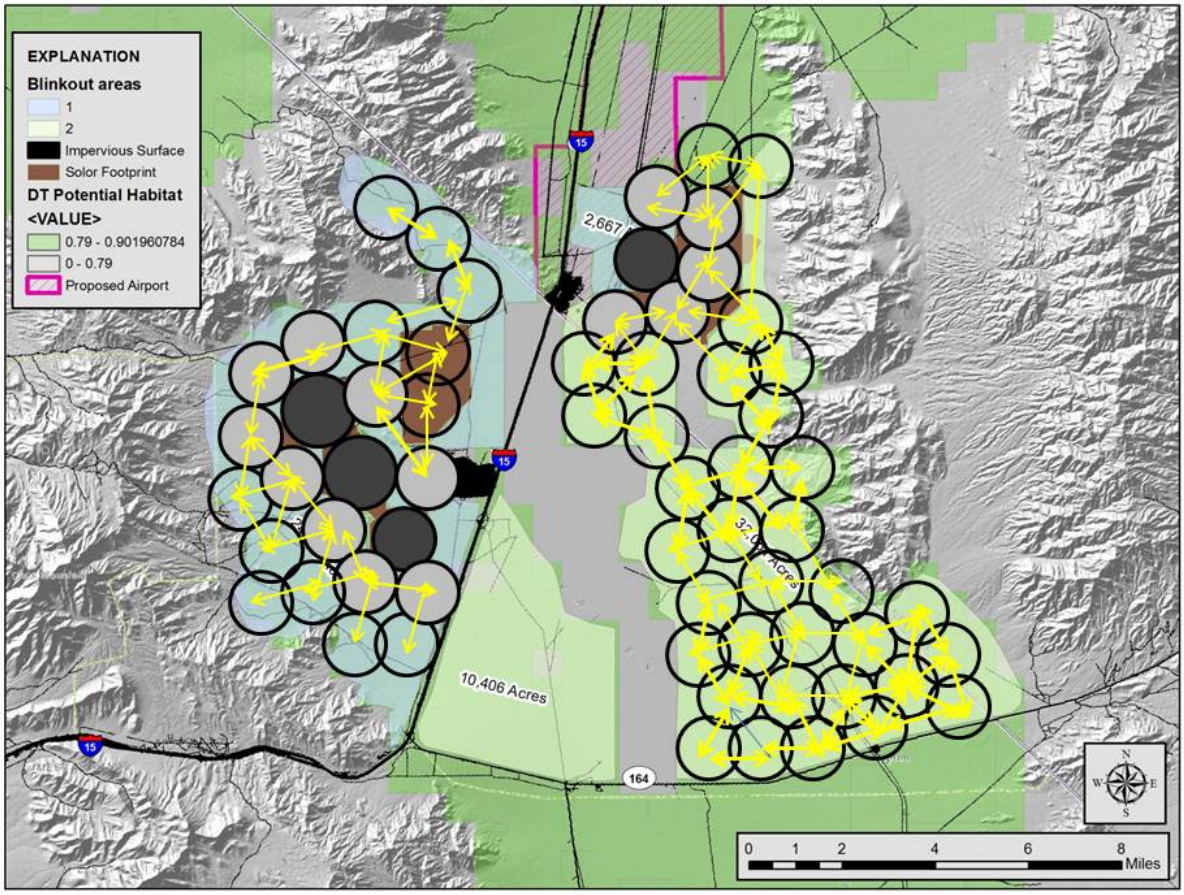
To define the area required to maintain populations within the linkages, we considered desert tortoise home range size, resource availability, and the magnitude of edge effects. Turner et al. (1981 in Berry 1986) documented home ranges of desert tortoises in the Ivanpah Valley to be as large as 220 acres. However, a desert tortoise's home range can expand and contract over the course of its life as it responds to year-to-year variability in resource availability. Over their lifetime, individual desert tortoises may use 1.5 square miles of habitat in adjusting their home ranges to address this variability (Service 1994). Therefore, we assess the viability of the linkages based on the ability of those linkages to maintain the lifetime desert tortoise utilization area of 1.5 square miles or the ability of utilization areas of this size to connect to one another through a relatively short linkage (e.g. a pinch point versus a long narrow corridor of desert tortoise habitat). Because the lifetime utilization area considers the expansion and contraction of an individual's home range size over time, it allows us to consider whether the linkage could remain viable in a year where decreased resource availability results in a smaller population of individuals requiring larger home ranges.

In assessing the lifetime utilization area, the Service (1994) assumed a circular configuration of this area when using it in the population viability assessment. We based this assumption on the fidelity that desert tortoises exhibit towards an overwintering burrow year after year. Consequently, the overwintering burrow serves as an anchor point from which the lifetime utilization area radiates (Service 1994). Using a circular lifetime utilization area of 1.5 square miles for a desert tortoise, we estimate that a linkage would need to be at least 1.4 miles wide to accommodate the width of a single desert tortoise's lifetime utilization area.

The existing conditions of demographic connectivity in the valley have been restricted from their historic condition by anthropogenic features in the region that act as barriers. Although we cannot quantify the overall effect on the viability of the population of desert tortoises in the Ivanpah Valley, these developments and their associated activities function as semi-permeable

and non-permeable barriers, affecting genetic and demographic connectivity through the valley. Interstate 15 is the most significant anthropogenic feature that has resulted in a demographic separation of subpopulations within the valley. Other features that have restricted demographic connectivity in the valley include, but are not limited to, the Ivanpah Solar Electric Generating System, Silver State North Project, the railroad, and larger developments such as the communities and commercial developments associated with the towns of Primm, Jean, and Goodsprings.

Interstate 15 bisects the Ivanpah Valley by forming a slightly permeable barrier; culverts and underpasses, north of Primm and between Yates Well Road and Nipton Road, offer some minor potential for population connectivity through this area. We anticipate that dispersal of desert tortoises through these underpasses does not likely contribute substantially to population connectivity. Based on the figure below showing circular 1.5-square-mile areas around the proposed projects sites in relation to Interstate 15 (Averill-Murray 2013), 3 potential linkages, in their existing state, are of sufficient width to accommodate the diameter of a single desert tortoise lifetime utilization area. Although this figure provides a means for characterizing the potential minimum width of a linkage, the actual linkage-width needed will be highly dependent on the actual site-specific configuration and size of desert tortoise home ranges in that area, the terrain within the linkage, and the degree to which threats, other constrictions, and edge effect will disrupt the linkage.



The first linkage exists to the north of the Stateline Project and serves as the only existing linkage along the west side of Interstate 15. This linkage has already experienced habitat loss and fragmentation due to the Kern River Gas Transmission Lines, several large transmission lines, urban development along both sides of Interstate 15, and access roads along these utilities. This linkage is also the proposed location of the DesertXpress rail line; that project would introduce a substantial amount of habitat loss and disturbance and fragment habitat. The Large-Scale Translocation Site virtually severs the linkage north of Primm because of the intersection of its southern boundary fence and Interstate 15. We anticipate that connectivity through this linkage is likely almost severed at the current time; removal of the fences at the Large-Scale Translocation Site and restoration of habitat quality in and around the Stateline Hills may improve the functionality of this linkage.

The other two linkages in the area occur east of Interstate 15. The linkage between Primm and the Silver State North Project is narrow (approximately 0.75 mile), heavily disturbed by human activity, and fairly close to Roach Dry Lake, where we expect the substrate would be less suitable for desert tortoises. Additionally, a rail line forms the eastern edge of this area for some distance. This linkage likely no longer supports a reliable level of connectivity.

The other linkage to the east of Interstate 15 lies east of the Silver State North Project, between the existing solar plant and the Lucy Gray Mountains. This linkage has the lowest level of existing habitat degradation and is wider (approximately 2 miles in the vicinity of the existing solar project). This linkage likely provides the most reliable potential for continued population connectivity throughout the Ivanpah Valley.

EFFECTS OF THE ACTION

We conducted the analysis in the following sections based on the current conditions in the action area as we described in the Environmental Baseline section of this biological opinion. Several aspects of the proposed actions may affect desert tortoises within the action area. These aspects are the capture and relocation of any desert tortoises, the installation of the fences to exclude desert tortoises from roads and construction areas, killing or injuring of individuals and crushing of their burrows and eggs during construction, loss of habitat, population fragmentation resulting from loss of connectivity, and other miscellaneous effects.

In this section of the biological opinion, we will analyze how these various aspects of the proposed actions affect desert tortoises and their habitat in a qualitative manner. In the Conclusions section of this biological opinion, we will integrate this general analysis with the best available information with regard to the numbers of desert tortoises and amount of habitat in the project areas, action area, and recovery unit to determine whether the proposed actions are likely to jeopardize the continued existence of the desert tortoise.

Effects Associated with Capture and Translocation of Desert Tortoises

The first step in the translocation of desert tortoises involves their capture. In some cases, the authorized biologists may find the animals above ground or near the mouths of their burrows. In such cases, the authorized biologist can easily pick up the desert tortoise and transfer it to a container for transport. If desert tortoises are deeper in their burrows, the authorized biologists would excavate the burrows; we expect that excavating desert tortoises from deep in their burrows is likely more stressful for them than being captured on the surface of the ground.

The capture and holding of desert tortoises can subject them to stress; stressed desert tortoises occasionally void their bladders. Desert tortoises store water in their bladders; this water is important to desert tortoises, particularly during times of low rainfall, in maintaining their life functions. Consequently, desert tortoises that void their bladders are at an increased risk of dying after their release. To mitigate this impact, the Bureau and the Applicants have proposed to hydrate desert tortoises prior to their release according to the Service's protocol. Because the Bureau and the Applicants would employ qualified biologists, we expect that the capture and transport of desert tortoises is unlikely to kill or wound any individuals.

We acknowledge that, in every phase of implementation of the proposed actions, desert tortoises are at risk of being killed or wounded when workers (including authorized biologists and

biological monitors) drive outside of areas that have been fenced and desert tortoises removed. As in many cases, small desert tortoises are at greater risk than larger animals. We are aware of desert tortoises that have been crushed by the vehicles of biologists working on translocations; both resident and translocated animals are vulnerable.

Boarman (2002), in a review of literature on threats to the desert tortoise, stated that the adverse effects of translocation include increased risk of mortality, spread of disease, and reduced reproductive success. The tendency for translocated desert tortoises to spend more time above ground, moving through their environment, than animals within their home ranges exacerbates at least some of these threats. Recent research, using comparisons among resident desert tortoises (animals within their home ranges with translocated individuals nearby) and control desert tortoises (animals within their home ranges with no translocated individuals nearby), has provided substantial information on this issue. We will evaluate the potential effects of translocation on desert tortoises in the following paragraphs.

Field et al. (2007), Nussear (2004), and Nussear et al. (2012) have found that translocated animals seem to reduce movement distances following their first post-translocation hibernation to a level that is not significantly different from resident populations. As time increases from the date of translocation, most desert tortoises change their movement patterns from dispersed, random patterns to more constrained patterns, which indicate an adoption of a new home range (Nussear 2004). Walde et al. (2011) found that movement patterns of desert tortoises translocated from Fort Irwin differed from those of animals studied elsewhere but describe their results as “apparent trends” because they have not completed analyses to determine if these trends were statistically significant. Translocated animals moved greater distances than residents and controls through the 4 years of their study. Desert tortoises that were translocated short distances moved much shorter distances than those that were translocated long distances. The movements of resident desert tortoises were similar to those of controls.

The Applicants will implement short distance translocations as much as possible; therefore, we expect that translocated desert tortoises are likely to exhibit more limited movement patterns; desert tortoises that spend less time above ground are less vulnerable to predation and environmental extremes. Regardless of the distance desert tortoises would be moved, we expect that translocated animals would spend more time moving, at least during the first year, which means they would be more vulnerable to predators, adverse interactions with other desert tortoises, and weather conditions than resident or control animals. For example, in spring 2013, biologists translocated 108 large and 49 small desert tortoises from approximately 2,000 acres of the KRoad Moapa Solar Project on the Moapa River Indian Reservation northeast of Las Vegas; they also monitored 18 large desert tortoises as controls or residents. Extremely high temperatures during the summer may have killed two or more large translocated desert tortoises. Predators likely killed eight small translocated desert tortoises. No resident or control desert tortoises have died during monitoring (Burroughs 2013b). During this first year of increased movement, desert tortoises would also be more likely to engage in fence pacing behavior, which can lead to hyperthermia and death.

As with other translocations (Nussear 2004, Field et al. 2007), we anticipate that predation is likely to be the primary source of post-translocation mortality. The level of winter rainfall may dictate the amount of predation observed in desert tortoises (Drake et al. 2010, Esque et al. 2010). Drake et al. (2010) documented a statistically significant relationship between decreased precipitation and increased predation of translocated desert tortoises at Fort Irwin. Additionally, the numbers of translocated, resident, and control desert tortoises that have died since the onset of work at the Ivanpah Solar Electric Generating System are roughly equal (see table in the Environmental Baseline – Existing Conditions in the Action Area – Land Management section of this biological opinion), which seems to indicate that translocation is not a factor in these mortalities.

Drought conditions seem to affect translocated and resident desert tortoises similarly. Field et al. (2007) monitored translocated and resident desert tortoises during drought conditions and found no significant difference between resident and translocated animals. Field et al. (2007) noted that most of the translocated desert tortoises "quickly became adept at life in the wild," despite the harsh conditions. Consequently, we have concluded that the amount of rainfall preceding translocation is not likely to decrease the survival rate of desert tortoises that would be moved from within the area of the proposed solar facilities. Additionally, the Bureau's proposal to assess the condition of desert tortoises prior to translocation and to hydrate individuals prior to release would decrease the likelihood that conditions at the time of release could depress survival rates.

Nussear et al. (2012) investigated the effects of translocation on reproduction in 120 desert tortoises. They found that, in the first year since translocation, the mean reproductive effort for translocated desert tortoises was slightly less than that of residents. Nussear et al. (2012) noted that the translocated animals may have benefited from being fed while in the pre-translocation holding facility; the food provided in the facility may have increased their production of eggs in the first year after translocation. In the second and third years after translocation, the mean number of eggs was not different between resident and translocated desert tortoises.

Translocating desert tortoises may also adversely affect resident desert tortoises within the action area due to local increases in density. Increased densities may result in increased incidence of aggressive interactions between individuals, increased competition for available resources, increased incidence of predation that may not have occurred in the absence of translocation, and increased spread of upper respiratory tract disease or other diseases.

We anticipate that density-dependent effects on resident populations are likely to be minor for the following reasons. First, current densities in the recipient sites are low enough to support additional desert tortoises (Bureau 2013f, Bureau and Ironwood 2013b). Second, the Applicants will restrict the number of large desert tortoises released in translocation areas to 15 individuals per square mile, which is one standard deviation of the mean density of desert tortoises in the Eastern Mojave Recovery Unit (Service 2011a). Third, the recipient sites are not a confined space, so released individuals would be able to disperse into other areas. Fourth, during the

translocation work at Fort Irwin, researchers tested over 200 desert tortoises for differences in the levels of corticosterone, which is a hormone commonly associated with stress responses in reptiles; Drake et al. (2012) "did not observe a measurable physiological stress response (as measured by [corticosterone]) within the first two years after translocation." The researchers found no difference in stress hormone levels among resident, control, and translocated desert tortoises. Finally Saethre et al. (2003) evaluated the effects of density on desert tortoises in nine semi-natural enclosures at the Desert Tortoise Conservation Center in Nevada. The enclosures housed from approximately 289 to 2,890 desert tortoises per square mile. Saethre et al. (2003) observed a greater incidence of fighting during the first year of the experiment but did not detect any trends in body condition index, reproduction, or presence of the symptoms of upper respiratory tract disease among the enclosures. Body condition index and reproduction are important indicators of how translocation may affect resident desert tortoises; generally, stress suppresses body condition index and reproduction in desert tortoises. For these reasons, we conclude that the addition of translocated desert tortoises to the recipient areas at densities that are slightly higher than the mean density of large individuals in the Eastern Mojave Recovery Unit would not result in detrimental effects to translocated or resident animals.

The upper limit for translocating desert tortoises is based on the density of large animals. We do not recommend limiting the density of small desert tortoises during translocation for several reasons. Natural mortality rates of smaller desert tortoises are greater than those of larger tortoises. In general, we expect that healthy populations have a large number of desert tortoises smaller than 160 millimeters (Turner et al. 1987), but have limited information on how many that might be. Additionally, small desert tortoises use resources differently than do large ones (Wilson et al. 1999) and we expect that juveniles (small animals) and adults (large animals) interact much less frequently than do adults. Due to differences in habitat use, caused by both physical and physiological differences in large and small desert tortoises, we expect overlapping of ranges while the small desert tortoises are growing and dispersing. Consequently, we do not expect translocating small desert tortoises at higher densities than large animals would result in any density-dependent adverse effects.

Upper respiratory tract disease and other pathogens are spread by direct contact between desert tortoises. Consequently, increasing the density of desert tortoises in the translocation areas has the potential to exacerbate the spread of diseases because, presumably, animals that occur in higher densities would have more opportunity to contact one another. Based on the results of the testing that the Applicants have conducted at the projects sites, disease prevalence in the area seems to be low; see the Environmental Baseline - Status of the Desert Tortoise in the Action Area - Disease Prevalence within and adjacent to the Stateline and Silver State South Project Sites section of this biological opinion. We cannot predict, at this time, whether animals that tested as suspect or positive for *Mycoplasma* would be placed in proximity of other desert tortoises. Overall, however, because the overall prevalence of disease in the area is low, the slightly greater densities of desert tortoises that would result from translocation would not cause an appreciable alteration.

Recently, we have become aware of new information with regard to disease in desert tortoises in the Mojave Desert (Jones 2013). Biologists have detected an undescribed *Mycoplasma* and a new beta herpes virus in desert tortoises; additionally, a Russian tortoise (*Testudo horsfieldi*) found at Fort Irwin had a strain of herpes that has not been found in desert tortoises. We have no other information on these diseases at this time.

Several circumstances are likely to reduce the magnitude of the threat of disease prevalence being exacerbated by translocation. First, the Applicants will use experienced biologists and approved handling techniques that are unlikely to result in substantially elevated stress levels in translocated animals; animals are less likely to succumb to disease when they are not stressed. Second, desert tortoises on the project site are currently part of a continuous population with the resident populations of the recipient sites and are likely to share similar pathogens and immunities. Third, the Applicants will move many of the translocated desert tortoises a relatively short distance into the within-home-range recipient site, which is likely to reduce post-translocation stress associated with long-distance movements. Fourth, density-dependent stress is unlikely to occur for the reasons discussed previously in this section. Finally, Service-trained biologists will perform health assessments using Service-approved protocols and will not translocate any desert tortoise showing severe clinical signs of disease, but rather will transport the animal to an agency-approved quarantine, which is described in the projects' translocation plans.

We recognize that, if the DesertXpress rail line is constructed, some desert tortoises that were translocated from the Stateline Solar Project would need to be moved again. We are unaware of any research regarding the effects of sequential translocations. We expect that desert tortoises would react as they have as a result of other translocations but that the potential adverse effects of the increased movement in the first year after translocation would be exacerbated if the two translocations occurred over a short period of time. We cannot, at this time, predict how many desert tortoises the rail line would affect.

Based on this information, we anticipate that post-translocation survival rates will not significantly differ from that of animals that have not been translocated. We expect that translocated desert tortoises would be at greatest risk during the time they are spending more time above ground than resident or control animals. We cannot precisely predict the level of post-translocation mortality because regional factors that we cannot control or predict (e.g., drought, predation related to a decreased prey base during drought, etc.) would likely exert the strongest influence on the rate of mortality.

Effects Associated with Construction of the Stateline and Silver State South Projects

The Applicants will install desert tortoise exclusion fencing and security fencing around the projects and remove all desert tortoises that it can locate on the proposed project sites prior to ground disturbance. During construction of the perimeter fencing and during other ground-disturbing activities that are outside of the fenced facilities (i.e., fiber optic line, access roads,

gen-tie line, and water wells), the Applicants will perform pre-activity clearance surveys and employ monitors to move desert tortoises out of harm's way if they re-enter work areas. For these reasons, we anticipate that construction is likely to kill few, if any, individuals larger than 160 millimeters. Some potential always exists that surveyors may miss desert tortoises during clearance surveys and construction monitoring. We cannot predict how many of these large desert tortoises that clearance surveys and construction monitoring would miss. However, because the Applicants will use qualified biologists, authorized by the Service for clearance surveys, we anticipate that the number is likely to be small. Weather conditions can also affect the number of animals detected during surveys; warm weather after average or above-average rainfall would lead to more activity in desert tortoises, which would facilitate their detection.

In some cases, desert tortoises that have been fenced out of their home territories make repeated efforts to return and follow fence lines for long periods. Desert tortoises would die when exposed to harsh conditions (i.e., cold or hot temperatures) while pacing fences. We expect that desert tortoises whose home territories have been reduced by the projects would be the animals most likely to pace fences.

The installation of fencing may also reduce the home range size of some individuals that inhabit areas immediately adjacent to the fence alignments. This reduction could result in future injury or mortality of these individuals as they expand their home range into adjacent areas where unknown threats may occur or where adverse social or competitive interactions may occur with neighboring desert tortoises. Based on the desert tortoise translocation plan for Silver State South (Bureau and Ironwood 2013b), approximately 43 desert tortoises have home ranges that fence alignments may affect. We do not have the same information for the Stateline Project and therefore cannot predict the number of desert tortoise home ranges that fence alignments may affect.

The Applicants have proposed to check newly installed fences on a daily basis to "identify any tortoises that may be fence-walking." The biological assessments do not provide any information on the actions the Applicants would undertake if they finds desert tortoises engaging in this behavior. Additionally, desert tortoises can overheat quickly when pacing fences; periodically checking the fence would likely be inadequate to prevent mortalities.

Desert tortoises are known to construct their nests at the entrance to their burrows (Ennen et al. 2012). Because the Applicants will excavate all desert tortoise burrows that are found within the construction footprint prior to the onset of ground disturbance (Bureau 2013f, Bureau and Ironwood 2013b), the biologists may detect at least some of the nests and eggs. Overall, we anticipate that detection of eggs is unlikely because the buried nests are difficult to find. Because hatchlings can take shelter in burrows of all sizes and are difficult to see due to their cryptic nature and their small size, surveyors are less likely to detect them than they are larger desert tortoises. Consequently, we expect that most of the hatching and eggs are likely to remain in the work areas during construction. The Applicants are likely to kill these desert tortoises during construction. Because construction activities for both projects would occur year round,

we cannot predict whether these activities would affect the hatchling or egg stage. Consequently, we have combined these stages in our estimation of effects.

We cannot predict precisely how many desert tortoises may be injured or killed because of the numerous variables involved. For example, we do not know the precise number of desert tortoises onsite, the size of those individuals, whether eggs will be present at the time of construction, the time of year that construction occurs, and the weather before or during construction. Regardless of these factors, we expect that relatively few large desert tortoises are likely to be killed or injured during construction because the Applicants have proposed to implement measures that have proven effective in the past in reducing mortality and injury.

Effects Associated with Construction of Linear Facilities

Linear facilities have different effects on desert tortoises relative to construction on large blocks of habitat. Construction of linear facilities (e.g., access road, gen-tie line, water lines, and installation of the fence along the main access road) would take place outside of the permanent perimeter fencing. We have analyzed these effects here rather than grouping them with our analysis of the overall effects of construction of the solar fields. The following table presents the overall habitat disturbance associated with the construction of linear activities proposed in the projects' biological assessments.

Project Components (outside permanent perimeter fence)	**Acreage of Disturbance**	
	Permanent	**Temporary**
Stateline		
Roads and re-routed pipelines	14	-
Access roads and gen-tie line	26	4
Western wells and access right-of-way	2	1
Total		**47**
Silver State South		
Drainage features	374	-
Access roads and gen-tie line	86	7
Southern California Edison components	2	4
Total		**473**

During construction of linear components, the Applicants would move desert tortoises out of harm's way into adjacent habitat. An approved recipient site will not be required for desert tortoises encountered within linear components. Based on the amount of surface disturbance that we expect from the construction of linear facilities (i.e., 520 acres), we anticipate that the Applicants would move few desert tortoises. Because of the relatively limited amount of activity associated with the construction of linear facilities and numerous protective measures that the Applicants have proposed, we expect the number of desert tortoises that would be wounded or killed to be small.

Installation of the temporary fence along the main access road for the Stateline Solar Project would affect prevent most desert tortoises from being killed on the road during construction. It would also affect desert tortoises with regard to fence pacing behavior and fragmenting of home territories during construction of the solar facility. As we discussed previously in this biological opinion, desert tortoises that pace fences may become overheated and die. We cannot assess how many animals are likely to engage in this behavior because that number is a function of how many desert tortoises are active and encounter the fence and their behavioral response to it.

If desert tortoises breached the temporary fencing, the 15-mile-per-hour speed limit for project-related travel would reduce the likelihood that large individuals would be killed along the main access road during construction. Smaller desert tortoises may be more likely to move through the temporary fence and less likely to be detected by drivers, even at 15 mile per hour. Consequently, these individuals are at greater risk.

The temporary fence would be in place for the duration of construction, which the Bureau expects to last between 2 to 4 years. During this time, the temporary fence would fragment habitat in this area because desert tortoises would be unable to cross the road. Figure 4 of the biological assessment (Bureau 2013a) indicates that desert tortoises seem to be absent from the area to the east of the main access road; no desert tortoises were found in that area during surveys. The lack of desert tortoises in this area is consistent with the results found on the Stateline solar facility; desert tortoises are generally absent from the area around Ivanpah Dry Lake. Because desert tortoises seem to be scarce in this section of the valley, we expect that fencing pacing behavior would be infrequent; however, any desert tortoises that pace the fence would be at risk of hyperthermia. Because of the low density of animals and the fact that the fence would be in place temporarily, we do not expect that it would affect connectivity to a measurable degree.

Construction of the Stateline Project would include the installation of two groundwater production wells and associated waterlines. The primary well will be located inside the perimeter fence; consequently, Stateline would implement the protective measures applicable for construction of the solar field during installation of this well and associated water lines.

The secondary well and its two associated monitoring wells would be located outside the perimeter fence and an aboveground pipeline would convey water to the solar field. Desert tortoises could be crushed by the equipment being used to install the water lines and wells; workers could also trample desert tortoises. Small desert tortoises would be at greatest risk because they are more difficult to see. If trenches or holes are left uncovered, desert tortoises could become entrapped and die of exposure or be killed by predators. Stateline has proposed several measures to protect desert tortoises during activities that would occur outside the fenced solar facility. These measures include installing temporary fencing around work areas, checking excavations, and assigning monitors to project sites. With these measures, we expect that few desert tortoises are likely to be wounded or killed. We cannot quantify the number of desert tortoises the pipeline and wells may affect because we do not know how many animals would be

wounded or killed because we do not know how many animals will cross this primarily linear work area during construction; also, we expect that monitors would be able to detect and protect most desert tortoises. The monitoring wells would result in a long-term loss of a small amount of habitat; the trench for the water line would result in the temporary loss of slightly more habitat. Neither the wells nor the pipeline would fragment habitat to a measurable degree.

Effects Associated with Geotechnical Investigations

Stateline would need to conduct geotechnical investigations at 23 sites, each of which would require the disturbance of an area of approximately 300 square feet; some of these facilities are likely to occur outside of areas that have been fenced and cleared of desert tortoises. As with the linear facilities, desert tortoises, particularly small individuals, would be at risk of being killed or wounded during this work by vehicles and workers. Stateline would implement standard measures to avoid killing or wounding desert tortoises during this work. Additionally, monitors at each site will have the authority to site test sites to avoid desert tortoises, if necessary. Given the small area involved with each site, the small area of cumulative disturbance (approximately 0.2 acre), and the proposed implementation of standardized avoidance measures, we expect that few, if any, desert tortoises are likely to be killed or wounded during these activities. Most risk to desert tortoises as a result of the geotechnical testing would likely stem from workers traveling to the sites along unpaved roads; Stateline would abide by its standard protective measures when driving to and from these sites outside of areas that have been fenced and cleared of desert tortoises.

The disturbance caused by the geotechnical testing would not result in the long-term loss of habitat to the extent that it has a measurable effect on desert tortoises in the area of the Stateline Solar Project. The temporary disturbance of approximately 300 square feet would not lead to additional fragmentation of habitat.

Effects Associated with Operations and Maintenance

We are aware of occasions where desert tortoises have been able to enter fenced facilities, such as a pump station for a gas pipeline and an operating solar plant; they entered through gaps under the fencing or open gates. Floods can damage fences to the point where desert tortoises may be able to enter the facilities. Once inside the fencing, desert tortoises would be at risk of being killed or injured by operations or maintenance. In general, we expect that operation and maintenance within permanently fenced areas are likely to injure or kill few desert tortoises; however, if fences are poorly maintained, the degree of risk to desert tortoises would likely increase.

Over the 30-year life of the projects, the Applicants may conduct some ground-disturbing maintenance activities outside of fenced areas. These activities have the potential to injure or kill desert tortoises primarily by vehicle strikes, as workers travel to and from work sites outside of the fenced areas; a limited possibility exists that desert tortoises could be injured or killed by

equipment or workers moving around a work site. Because typical maintenance activities would not result in surface disturbance or loss of habitat and the Applicants propose to implement protective measures to reduce the potential effects, maintenance activities would kill few, if any, desert tortoises.

Maintenance activities associated with repair of desert tortoise exclusion fencing would likely kill or injure few, if any, desert tortoises for the following reasons. First, fence repairs are likely to result in minimal ground disturbance in localized areas. Second, at least a portion of the work area would be on disturbed areas within the fenced project site. Third, perimeter roads would exist that would allow access to most repair locations with minimal off-road travel. Finally, the Applicants would implement numerous protective measures to reduce the potential for injury or mortality of desert tortoises.

Operation and maintenance of the transmission corridors may affect desert tortoises. The transmission corridor would not be fenced; therefore, desert tortoises may use the habitat in this corridor and be present during maintenance activities. Vehicles and workers conducting this work could kill or injure desert tortoises in the same manner as during construction. The Applicants would implement numerous protective measures to reduce the potential for injury or mortality of desert tortoises during this work.

Use of the unfenced main access road for the Stateline Solar Project poses some risk of vehicle strikes to desert tortoises. This risk would remain low if desert tortoises do not reoccupy the area to the east of the road; given habitat conditions in that area, we do not expect large numbers of desert tortoises to use that area. Stateline's proposal to maintain a 15-mile-per-hour speed limit when desert tortoises are active should be protective of larger animals; small animals would be at greater risk because they are more difficult to see. We expect few desert tortoises to be killed or wounded along the main access road because of the low density of desert tortoises in this area.

Effects of Decommissioning

Work associated with decommissioning of the sites within the fenced project areas is unlikely to result in injury to or mortality of desert tortoises because desert tortoises would not be present. The effects of use of the main access road for the Stateline project would be similar to those associated with construction and described previously in this biological opinion. If the sites are restored to pre-project conditions, they would likely be available for use by desert tortoises at some point after removal of the facilities. We cannot predict how soon desert tortoises would reoccupy the sites after decommissioning because of the many variables involved. These variables would include the amount of degree to which substrates and shrubs have been disturbed on the sites, weather conditions, and the restoration methodologies; additionally, different portions of the sites may return to functional habitat at different rates. We anticipate that the Bureau will informally consult with the Service as the time for decommissioning approaches, if some aspect of decommissioning and restoration may affect desert tortoises differently than we

have anticipated in this biological opinion, the Bureau would need to re-initiate formal consultation, pursuant to section 7(a)(2) of the Endangered Species Act.

Both biological assessments note that some potential exists for continued use of the project areas for industrial or commercial purposes (Bureau 2013a, Bureau and Ironwood 2013c). In such a case, re-initiation of consultation, pursuant to section 7(a)(2) of the Endangered Species Act may be necessary if long-term monitoring detected changes that present concern for tortoises in regards to demographic or genetic connectivity within Ivanpah Valley.

Effects of Loss of Habitat

The following analysis provides a detailed assessment of the effects that the habitat loss associated with the proposed projects would have on desert tortoises in the Ivanpah Valley and within the recovery unit. The following table summarizes the final acreages of the rights-of-way for each project as presented in the biological assessments (Bureau 2013a, Bureau and Ironwood 2013c).

Project	Acreage of Disturbance		
	Permanent	Temporary	Total
Stateline	1,651	5	1,685*
Silver State South/Southern California Edison	2,388	39	2,427

* The final right-of-way requirement is larger than the area of permanent disturbance because the transmission and access road corridors have a minimum width within which the facilities would be constructed.

Construction of the proposed Stateline and Silver State South projects would result in the direct, long-term loss of 4,039 acres of habitat that will not be available to desert tortoises for foraging, breeding, or sheltering for the life of the projects. Following extensive disturbance and compaction, Mojave Desert substrates can take between 92 and 124 years to recover in the absence of active restoration (Webb 2002). In addition, recovery of plant cover and biomass in the Mojave Desert can require 50 to 300 years in the absence of restoration efforts (Lovich and Bainbridge 1999). Although active restoration, including decompaction, seeding, and planting, can reduce the time required to restore desert ecosystems, success is varied and dependent on numerous variables. Based on this information, the 4,039 acres currently characterized as permanent disturbance are likely to remain unsuitable as habitat for several decades following decommissioning of the facilities and commencement of restoration work. The potential exists that they may be permanently lost if restoration efforts are not successful.

For the Stateline Project, the Bureau and Stateline have proposed to mow vegetation in the portion of the site that is closest to Ivanpah Dry Lake, disk and roll the middle portion of the site, and grade the upper third (Bureau 2013a). The area to be mowed is likely to return to pre-

disturbance conditions in the shortest time because the roots of most shrubs would be retained for the life of the project and the surface of the ground would be less disturbed. If cryptogamic crusts are present, mowing may cause less disturbance. (Cryptogamic crusts are a mixture of algae and soil fungi that occur in the upper millimeters of the substrate. They assist in retaining soil moisture and some can incorporate atmospheric nitrogen into substrates; these attributes are beneficial for the establishment and growth of native annual plant species.) Retaining cryptogamic crusts may inhibit the invasion of non-native plant species to some degree and allow for the persistence of native annual plants. Currently, desert tortoises do not occupy this area, likely because of its proximity to Ivanpah Dry Lake and the unsuitability of the substrate; we do not expect mowing to alter its suitability for desert tortoises.

The area to be graded may require the longest time to recover. Some potential exists that the root crowns of shrubs may persist after grading, if the grading removes only a small amount of substrate. Grading of the entire surface area would also remove most of the cryptogamic crusts, which is likely to delay the re-establishment of native annual plants and increase the potential for the establishment of weeds.

Disking and rolling are likely to disturb the roots of many shrubs and severely disturb the ground's surface; we expect that it would destroy at least some portion of the shrubs and potentially alter the substrate and destroy cryptogamic crusts in a manner that may exacerbate the spread of weeds. We do not expect that disking and rolling are likely to reduce the amount of time required to return disturbed areas to habitat suitable for desert tortoises as compared to grading the entire surface area.

Effects of Population Fragmentation

All recent genetic studies of the desert tortoise characterize its population structure as isolation-by-distance (Britten et al. 1997, Edwards et al. 2004, Murphy et al. 2007, Hagerty and Tracy 2010). In addition, the historic distribution of desert tortoises was relatively continuous across the species' range, broken only by major topographic barriers (Germano et al. 1994, Nussear et al. 2009). Genetic analysis also suggests that, historically, levels of gene flow among subpopulations of desert tortoises were likely high, corresponding to high levels of habitat connectivity (Murphy et al. 2007). All of this information suggests that gene flow in desert tortoises generally occurs according to a continuous-distribution model (Allendorf et al. 2007), as opposed to a metapopulation or stepping-stone model where individuals move from one patch of suitable habitat to another, across less suitable habitat.

Hagerty et al. (2010) concluded that geographic distance and the presence of geographic barriers provide the most reliable predictors for population structure in the desert tortoise; they used these predictors to model how these variables historically affected population connectivity on a landscape scale. This modeling indicates that historic population connectivity in the Eastern Mojave Recovery Unit and Ivanpah Valley was constrained through geographic and topographic bottlenecks. Because of these constrictions, the following analysis focuses on how the Stateline

and Silver State South solar facilities, in combination with other barriers in the action area, will affect dispersal, gene flow, demographic connectivity, and population viability in the Ivanpah Valley. In addition, we address the relative contribution of the Stateline and Silver State South solar facilities to these effects in context with the other existing and approved developments within the valley.

Long-term Viability of the Ivanpah Valley Population of Desert Tortoises

The loss of connectivity between the northern and southern ends of Ivanpah Valley would have far-reaching implications because of the confined nature of the desert tortoise population in the valley. Most of the Ivanpah Valley in California is isolated from adjacent desert tortoise habitat by mountain ranges; only the southern part of the valley is broadly connected to adjacent non-mountainous areas. Hagerty et al. (2010) showed that historic connectivity through the southern end of Ivanpah Valley near Cima is constrained by topographic barriers (i.e., the mountains on either side of the pass between Ivanpah Valley and Cima Dome). This constriction is sufficient to contain the width of multiple desert tortoise lifetime utilization areas. However, Nussear et al. (2009) identified the area of the Cima-Ivanpah junction as having a lower probability to support desert tortoises based on habitat attributes; it is higher in elevation than most desert tortoise habitat. Considering the low habitat potential and existing habitat impacts and degradation within the linkage (i.e., the Union Pacific Rail Road line, Morningstar Mine Road, unpaved roads, past cattle grazing, etc.), existing population connectivity through the southern end of Ivanpah Valley is likely severely constrained. Consequently, the southern portion of Ivanpah Valley is primarily connected to other desert tortoise habitat in the vicinity of Primm. To the north of Primm, Ivanpah Valley is largely isolated from adjacent desert tortoise habitat by mountains and the cities of Las Vegas and Boulder City.

Because desert tortoise habitat in the northern and southern portions of Ivanpah Valley is largely isolated from the remainder of the eastern Mojave Recovery Unit, the maintenance of connectivity within the valley is important. Based on a population viability analysis, the Service (1994) concluded that the minimum viable density for a population of desert tortoises was 10 adults per square mile; below this density, demographic stochasticity and genetic deterioration likely diminish the potential for population growth. This analysis concluded that recovery areas required a minimum reserve area of 1,000 square miles to maintain evolutionary potential at a minimum viable density of 10 adults per square mile due to the patchy distribution of desert tortoises across the landscape. The Service (1994) also concluded that the time to extinction for small populations was strongly related to population size (i.e., smaller populations would go extinct faster) and that lambda (i.e., population growth rate) needed to remain above one to avoid becoming extremely vulnerable to extinction.

Loss of population connectivity between the northern and southern portions of Ivanpah Valley would create a nearly closed population of desert tortoises within a 258-square-mile area in its southern portion. (Darst [2013] calculated the area of habitat with a potential [Nussear et al. 2009] of 0.5 or greater and then subtracted the amount of impervious surfaces.) The most recent

6-year average density of desert tortoises in the Ivanpah Critical Habitat Unit, which contains the southern portion of the Ivanpah Valley, is approximately 9.7 adult desert tortoises per square mile (Service 2009b, 2012a, 2012b, 2012e, 2012f). This density is based on the sampled areas of the entire Ivanpah Critical Habitat Unit and may not reflect conditions in this smaller area. Although the estimated density of desert tortoises for the southern portion of the valley is close to the recommended 10 adults per square mile, the amount of habitat is less than a third of the recommended reserve size of 1,000 square miles. Given the small size of the southern portion of the valley, the relatively small population that currently occupies it (2,503 large desert tortoises: 9.7 large desert tortoises per square mile multiplied by 258 square miles), the ongoing sources of mortality in this area that we discussed in the Environmental Baseline section of this biological opinion, and the existing conditions in the Ivanpah Valley, this population, if isolated, would likely experience the demographic and genetic effects discussed in the population viability assessment.

The loss of connectivity between the northern and southern portions of Ivanpah Valley would also create a nearly closed population within the 255-square-mile area of the northern portion of the valley. The cities of Las Vegas and Boulder City disrupt connectivity to adjacent habitat in the Eldorado Valley. The best available information regarding the density of desert tortoises in this area is from the surveys Silver State conducted in the area around the site of the proposed Silver State South Project; which estimated a density of 8.1 desert tortoises per square mile (Darst 2013). Again, the density of 8.1 desert tortoises per square mile and the size of the area do not meet the recommendations of the population viability analysis needed to maintain a viable population over time (2,066 large desert tortoises: 8.1 large desert tortoises per square mile multiplied by 255 square miles). As we discussed for the southern portion of the valley, this population, if isolated, would likely experience the deleterious demographic and genetic effects discussed in the population viability assessment.

Failure to maintain a viable population of desert tortoises in the Ivanpah Valley would have negative implications for the population in the Eldorado Valley of Nevada. The desert tortoise population in Eldorado Valley lies within the “South Las Vegas” genetic cluster with the Ivanpah Valley population (Hagerty and Tracy 2010). Even though agencies often consider the Eldorado and Piute valleys together for management purposes, the Piute Valley population is aligned with desert tortoise populations in the “Northern Colorado” genetic cluster to the south (Hagerty and Tracy 2010). (The Piute Valley lies to the south of the Eldorado Valley.) The cities of Las Vegas and Boulder City have already compromised the linkage between the Eldorado Valley and desert tortoise populations to the north; the Eldorado Valley has likely experienced population declines. If development in the Ivanpah Valley near Primm severs connectivity, it would essentially isolate the Eldorado Valley population from the rest of the recovery unit.

Effects of the Silver State South Project on Population Connectivity

As previously discussed, the linkage between Primm and the Silver State North Project will not likely provide any reliable level of population connectivity because of its narrowness and the

current levels of human impacts within and adjacent to it. The Primm Substation would be located at the northern end of this linkage; available desert tortoise habitat at this point in the linkage is approximately a mile wide, between the edge of Roach Dry Lake and the Silver State North Project. We estimate that the Primm Substation would occupy approximately 0.2 mile of this width; the access road from the substation to the Silver State North Project, which would run perpendicular to the linkage, would introduce another source of mortality to desert tortoises in the area.

Figure 9 of the biological assessment for the Silver State South Project (Bureau and Ironwood 2013c) indicates that desert tortoises currently occupy the area between the existing solar field and the lake bed in the area proposed for the substation. The presence of the Primm Substation (and temporary disturbance for construction of the Southern California Edison transmission line and laydown area) is likely to disrupt the use of the general area by these animals; given the numerous transmission lines and access roads in this area, the loss of 16 acres of habitat for the substation and additional vehicle travel on another road may render this less likely to support desert tortoises. The loss of habitat and increase in mortality source as a result of the construction and operation of the Primm Substation is unlikely to affect the linkage between Primm and the Silver State North Project because of its distance from the central portion of the linkage and its already degraded condition. Its primary effect is likely to be a minor degradation of the stability of the desert tortoise population that occurs at the northern end of the linkage to the east of the Silver State South Project.

The linkage east of the proposed Silver State South Project has the lowest level of existing habitat degradation and likely provides the most reliable potential for continued population connectivity. After construction, the linkage between habitat to the north and south would be approximately 3.65 miles long and between 1.39 and 2 miles wide. (See figure 10 in Bureau 2013c.) This width would likely accommodate a single lifetime desert tortoise utilization area throughout the length of the corridor. Beier et al. (2008) recommend that corridors between habitat patches for corridor-dwelling species like the desert tortoise accommodate multiple home ranges. To the east of the site of the Silver State South Project, the corridor that would remain after construction of the proposed project would vary from approximately the width of a single desert tortoise lifetime utilization area (i.e., 1.4 miles) to slightly more than that area. Horskins et al. (2006 in Beier et al. 2008) note that strongly territorial species require a minimum corridor width that is substantially larger than the width of a home range; in a narrow corridor, an occupied home range that spans the corridor could impede movement by other individuals through the corridor. Although desert tortoises are territorial and will fight among themselves, their territories also frequently overlap. Consequently, although the width of the remaining corridor would be narrower than optimal, territorial desert tortoises are unlikely to block the movement of other desert tortoises through the corridor.

Beier et al. (2008) note that wide linkages are beneficial because, among other attributes that are less relevant to desert tortoises, they reduce edge effects due to invasive species, provide an opportunity to conserve ecological processes, and help the biota respond to climate change. The

Environmental Law Institute (2003 in Beier et al. 2008) found that "Negative edge effects are biologically significant at distances of up to 300 (meters) in terrestrial systems…." Consequently, the effective width of the corridor to the east of the project site is likely less than the measured distance; we acknowledge that the edge effects of a solar plant likely extend less into adjacent habitat than those of a residential development and that edge effects likely do not emanate from the Lucy Gray Mountains.

The width of the corridor affects the functionality of linkages in that narrower linkages provide less certainty of desert tortoises persisting during years of low resource availability or surviving stochastic events; they may die or move to other areas. The converse is also true. Desert tortoises are more likely to persist in wider linkages because these areas support more habitat of different types, at varying elevations, and with varying weather patterns over time; desert tortoises can more easily recolonize areas where extirpations have occurred if the linkage is larger and source populations are closer (the larger areas to the north and south of the project site support the source populations for this linkage). In short, longer, narrower linkages are less likely to allow for recolonization of areas where extirpations have occurred. The rise in temperatures that we expect because of climate change is likely to exacerbate the potential effect of narrower linkages; the effects of climate change on rainfall are less predictable at this time.

An overall rise in temperature would increase the environmental variability that desert tortoises face and increase the likelihood that a small number of desert tortoises within the narrow linkages would perish in any given year from catastrophic events or other sources of mortality associated with edge effect. Desert tortoises occupying these linkages would also be vulnerable to periodic loss from stochastic events (i.e., the few desert tortoises occupying the linkages are more likely to die out due to random chance) that effectively sever connectivity. An increase in environmental variability would likely lower the overall survival rate of desert tortoises because they may be less likely to survive the wide variation between good and poor years in terms of resource availability. Preserving connectivity may allow species to adapt to or allow for natural range shifts in response to changing environmental conditions (Averill-Murray et al. 2013).

Under such conditions, desert tortoises occupying this narrow linkage area, which would also continue to be affected by the anthropogenic effects occurring in these areas that we described in the Environmental Baseline - Existing Conditions in the Action Area section of this biological opinion, may be more susceptible to local extirpation than individuals that reside in a larger area of habitat. With the overall number of desert tortoises in the area reduced because of the stochastic event, individuals may be less likely to find mates, reproduce, and recolonize the linkage areas, particularly if desert tortoises in these areas are subject to ongoing causes of mortality.

Effects of the Stateline Project on Population Connectivity

The Clark Mountains separate the portion of the Ivanpah Valley west of Interstate 15 and south of Primm (i.e., the location of the proposed Stateline Project) from adjacent desert tortoise

habitat to the north and west. To the north of the valley, the easternmost portion of the Stateline Hills allows for some level of connectivity for desert tortoises to the north of Primm; we are aware of desert tortoise burrows in these hills. Ivanpah Dry Lake is essentially an impermeable barrier directly south of Primm; although desert tortoises can and do occasionally cross dry lakebeds, dry lakes would never serve as an area that could support a source population of desert tortoises. South of the dry lake, Interstate 15 functions as a semi-permeable barrier between desert tortoises on either side of the freeway. The two underpasses on Interstate 15, between Yates Well Road and Nipton Road, offer some small potential for population connectivity to this area; however, we have concluded that dispersal of desert tortoises through these underpasses does not likely contribute substantially to population connectivity. This lack of connectivity has nearly isolated desert tortoises west of Interstate 15 from the remainder of the population in Ivanpah Valley.

Within this area west of Interstate 15, the joint port of entry, Ivanpah Solar Electric Generating System, Primm Valley Golf Course, and DesertXpress have caused or will cause the loss of thousands of acres of habitat. Other actions, such as those occurring in the Boulder Corridor and the Mountain Pass lateral pipeline have degraded additional habitat. This loss and degradation of habitat renders this area less able to support a stable population of desert tortoises and more vulnerable to stochastic events. The isolated population west of Interstate 15 is substantially smaller than the minimum viable population size identified in the original recovery plan for the desert tortoise (Service 1994), indicating that it is highly vulnerable to demographic stochasticity and genetic deterioration.

Development of the Stateline facility in the area occupied by this isolated population is likely to promote or exacerbate these effects by reducing the area available to this population and introducing additional mortality sources that may reduce population recruitment or create demographic imbalances. The potential mortality of juvenile desert tortoises on the Stateline project site will also likely affect, to some degree, recruitment (i.e., individuals reaching reproductive age). In addition to exacerbating demographic and genetic effects within this small population, the Stateline facility would further fragment the small population west of Interstate 15 by constraining, to a limited degree, connectivity between populations east and west of the facility.

The northern edge of the Stateline Project would be located approximately 0.9 mile from the southernmost point of the eastern arm of the Clark Mountains. The resulting linkage between the Stateline facility and the Clark Mountains would connect desert tortoises to the northeast of the project with animals to the west, in the remaining habitat west of Interstate 15. Although this width is less than a single desert tortoise lifetime utilization area (i.e., 1.4 miles), the linkage will likely remain functional because its length is very short; the southernmost extension of the Clark Mountains is shaped like a peninsula and the linkage becomes wider immediately to the east and west of the narrowest point. Additionally, even without the proposed project, the width of the area where Stateline detected desert tortoises south of the “peninsula” is less than 1.4 miles

because the substrate becomes silt-like as the alluvial fan levels out and approaches Ivanpah Dry Lake.

To summarize, the population west of Interstate 15 is nearly isolated from the remainder of desert tortoises in Ivanpah Valley and therefore is more vulnerable to extirpation and genetic deterioration because of existing barriers that greatly reduce the potential for movement. The construction of the Stateline Solar Project would further inhibit, to a limited degree, connectivity in this portion of the valley. Given the existing extensive loss of habitat in this portion of the valley, the overall decrease in the amount of suitable habitat that would result from the proposed action is likely more detrimental to desert tortoises in this area than the reduced connectivity.

Effects Associated with Climate Change

Increases in atmospheric carbon are responsible for changes in climate. As we discussed in the Status of the Desert Tortoise section of this biological opinion, climate change is likely to cause frequent and/or prolonged droughts with an increase of the annual mean temperature. Increased temperatures would likely adversely affect desert tortoises by decreasing the range of temperatures at which desert tortoises would be active; decreased rainfall would likely result in fewer annual plants on which desert tortoises feed.

Plant communities in arid lands sequester carbon by incorporating it into their tissues. Plants also respire carbon into the substrate, where it combines with calcium to form calcium carbonate; calcium carbonate also sequesters carbon (Allen and McHughen 2011). The removal of plant life from approximately 4,039 acres within the action area is likely to reduce the amount of carbon that natural processes can sequester. We acknowledge that a portion of the area of the Stateline Project would be mowed and that regrowth of shrubs in that area may lessen, to some degree, the loss of carbon-sequestering plants; we do not have the ability to quantify the difference the mowing would cause.

The proposed action is unlikely to affect desert tortoises in a measurable manner with regard to carbon sequestration for several reasons. First, the amount of carbon sequestration that would be lost would be minor because the proposed action would affect a small portion of the desert. Second, some researchers have questioned the amount of carbon sequestration that occurs in arid areas; Schlesinger et al. (2009) contend that previous high estimates of carbon sequestration in the Mojave Desert bear re-examination. Finally, the reduction in the use of fossil fuels because of the solar facilities would prevent more carbon from entering the atmosphere than would occur by the vegetation that is currently present within the areas to be disturbed by construction. For example, Fernandes et al. (2010) report that thin film photovoltaic technology reduces overall atmospheric carbon by 4 million grams of carbon per acre per year and that, by contrast, the amount of annual carbon uptake by desert land is approximately 429,000 grams of carbon per acre per year. Additionally, any changes in the level of carbon production or sequestration would be dispersed far beyond the boundaries of the action area of this biological opinion;

consequently, we could not link any such changes to any specific impacts to desert tortoises within or outside the action area of this consultation.

The proposed actions are also unlikely to alter the surface albedo of the action area to the degree that it affects local climatic conditions. (Albedo is the amount of light reflected by an object. An object that reflects more light is heated less. The opposite is also true; an object that reflects less light is heated more.) Millstein and Menon (2011) found that large-scale photovoltaic plants in the desert could lead to significant local temperature increases (0.4^{o} Celcius) and regional changes in wind patterns because the solar plants are less reflective than many substrates in the desert. As we discussed above, increases in temperatures would likely impair the activity patterns of desert tortoises.

The proposed action is unlikely to affect desert tortoises in a measurable manner with regard to changes in the albedo of the action area because Millstein and Menon's (2011) prediction was based on a model that analyzed the effects of a 1-terawatt solar facility. (A terawatt is 1,000,000,000,000 watts; by comparison, the proposed solar fields would produce a maximum of 550 megawatts.) Consequently, the proposed actions, even when combined with the albedo produced by the Silver State North and Ivanpah Solar Electric Generating System (a combined 430 megawatts; Bureau 2010a, b) are unlikely to change local temperatures or regional wind patterns.

Miscellaneous Effects

Indirect effects associated with construction, operation, maintenance, and decommissioning of the Stateline and Silver State South solar projects may injure or kill desert tortoises. These effects include increased predation by common ravens that are attracted to the area because of increased human activity and modification of the habitat and diet of desert tortoises due to the spread of non-native plant species.

Ivanpah Valley currently supports numerous facilities that attract common ravens (e.g., water sources, trash, road-killed animals, nest and roost sites, etc.). These facilities are associated with established communities (i.e., Primm and Nipton), golf courses, an interstate highway, solar facilities, and utility lines that are likely to elevate the level of predation of desert tortoises by common ravens within the action area. Construction and operation of the Stateline and Silver State South facilities have the potential to attract additional common ravens and increase predation in the action area.

The Applicants have proposed numerous measures in the management plans for the projects (Ironwood 2012a, Bureau et al. 2013) to address predation by common ravens associated with the project sites. These measures include control of attractants, monitoring and reporting programs, and implementing adaptive management techniques such as devices to discourage roosting or nesting on project-related structures. To address the indirect and net effects of the Stateline Project with regard to common ravens, Stateline will participate in the regional

management and monitoring program for common ravens. The Service developed this program, in coordination with the Desert Managers Group, which is a consortium of land management agencies and other stakeholders in California, and the Renewable Energy Action Team, which is composed of the Service, Bureau, California Energy Commission, and California Department of Fish and Wildlife. The management and monitoring program for common ravens does not apply to Nevada.

We cannot reasonably predict the amount of predation by common ravens that construction and operation of the projects are likely to add to baseline levels within the action area, but we anticipate that measures proposed by the Applicants are likely to be effective in eliminating some, but not all, common raven use of the project sites. Depending on the location of specific control actions, funding of regional management of common ravens may also aid in reducing the amount of common raven predation on desert tortoises within the California portion of the action area.

Non-native species can occur in densities that can increase the risk of fires, which may result in future habitat loss. Non-native plant species currently occur on the proposed project site and are likely to occur in other portions of the action area at varying densities. Within the Ivanpah Valley, numerous features serve as vectors for infestation of the action area by non-native plant species (e.g., highways, unpaved roads, cattle allotments). Construction and operation of the Stateline and Silver State South facilities have the potential to increase the distribution and abundance of non-native species within the action area due to ground-disturbing activities that favor the establishment of non-native species. In addition, access to the project sites and other project features by construction and operations personnel could increase the volume and distribution of non-native seed carried into the action area. The Applicants have proposed numerous measures to address control of non-native plant species within the project sites. We cannot predict the degree to which non-native species would proliferate within or spread beyond the boundaries of the solar facilities for several reasons. For example, above-average rainfall immediately after construction may encourage the spread of weeds whereas drought may have the opposite effect. We cannot predict whether project equipment would introduce new species or whether such new species would be able to germinate, grow, and reproduce onsite. Because the objective of the Applicants' weed management plans is to ensure that the presence of weed populations on and adjacent to the projects does not increase due to the Projects and because available technology, consistently and persistently applied, can achieve this objective, we predict that the proposed projects would not lead to an increase in the number or amount of non-native species within or outside the boundaries of the solar facilities. If the Applicants' objective is not met, we would consider this new information regarding the effects of the action that may affect desert tortoise and its habitat in a manner or to an extent not considered in this biological opinion. Consequently, the Bureau would be required to re-initiate formal consultation, pursuant to 50 Code of Federal Regulations 402.16.

Field work associated with the monitoring of demographic and genetic stability, proposed by the Bureau and U.S. Geological Survey, has to potential to kill or wound desert tortoises simply

because the researchers would be using roads in the desert to access study sites and could strike desert tortoises with their vehicles. Because experienced researchers would be conducting this work, we expect that they are likely to strike a limited number of desert tortoises. The information provided by the study would likely improve our ability to manage desert tortoises in the future.

Effects of the Proposed Compensatory Mitigation

The Bureau and the Applicants have proposed a set of measures, discussed below, to offset at least a portion of the adverse effects of the proposed solar power facilities. For the Silver State South Project, the Bureau, with funding from Silver State, proposes to determine whether the fence around the Large-Scale Translocation Site can be removed or realigned to improve connectivity or, alternatively, to fence Highway 93 (if the fence around the Large-Scale Translocation Site cannot be removed or realigned), restore habitat near the site of the Silver State South Project, and fund law enforcement personnel to enhance protection of desert tortoise habitat.

The Bureau, with funding from Silver State, proposes to assess disease and the genetic status of desert tortoises within the Large-Scale Translocation Site and remove or realign the fence unless prohibited by disease or genetic issues. The Large-Scale Translocation Site encompasses approximately 28,000 acres of desert tortoise habitat. This measure, if implemented, would allow for some degree of increased connectivity; because it would allow more desert tortoises to approach the Stateline Hills to the south of the Large-Scale Translocation Site, it would enhance connectivity more along the west side of the freeway where the Stateline Solar Project would be located than to the Silver State South side of the freeway.

The increased connectivity west of Interstate 15 may alleviate, to a small degree, the reduction in the width of the linkage to the east of the freeway that the Silver State South Project would cause. Because of existing development in Primm and the Stateline Hills, increasing connectivity on the west side of the freeway could not completely offset the reduction east of the Silver State South Project.

If removal or realignment of the Large-Scale Translocation Site fence is not possible, Silver State would fund fencing of Highway 93. This project would not directly improve connectivity but would remove a mortality source for desert tortoises. This project would not directly improve connectivity but would remove a mortality source for desert tortoises. A reduction in mortality would likely lead to higher densities in desert tortoises over time; higher densities of desert tortoises would improve the overall capacity of the area to support demographic connectivity.

Silver State will also fund work to restore habitat near the site of the Silver State South Project. Habitat that has been restored after being damaged by recreational and other uses is likely to

support more desert tortoises; increasing the density of desert tortoises adjacent to and within a linkage area would be important to maintain connection through the linkage.

Silver State would also fund law enforcement personnel to ensure that recreational users follow the proposed management actions within the new area of critical environmental concern. The presence of law enforcement personnel is likely to add to the overall conservation of desert tortoises within the area because it would reduce habitat damage and deaths of desert tortoises from unauthorized use.

For the Stateline Solar Project, the Bureau proposes to remove cattle grazing from part of the action area, restore habitat along the Kern River Pipeline right-of-way and adjacent to Whiskey Pete's, and restore 30 closed and unauthorized routes located within the Eastern Mojave Recovery Unit. Lastly, Stateline will fund fencing of Morningstar Mine Road, which is located within the Mojave National Preserve.

The removal of cattle from 40,000 acres of the Clark Mountain Grazing Allotment would benefit desert tortoises adjacent to the Stateline Project because it would reduce competition for forage, habitat disturbance, and direct mortality of individuals and allow for the restoration of native plant species and soil crust. Studies in the eastern Mojave Desert on foraging behavior and food preferences of range cattle and desert tortoises show that a dietary overlap (spatial and temporal) exists and that this overlap is greatest in the spring when annual plants are at their peak biomass and densities (Service 2010d). A reduction in competition for forage would improve nutrition and may lower the susceptibility of desert tortoises to upper respiratory tract and shell diseases (Bureau 2002). Grazing also facilitates the proliferation of invasive species, increases soil compaction, and decreases infiltration rate (Boarman 2002). Eliminating such impacts to vegetation would increase the abundance and distribution of plant species that are preferred by the desert tortoise (Oftedal et al. 2002). Removal of grazing would also reduce the potential for desert tortoises or their burrows to be trampled by cattle.

Second, Stateline will fund restoration work along 20 acres of the Kern River Pipeline right-of-way located north of the project site and within an 6.4-acre area along the west side of Whiskey Pete's, located approximately 1.5 miles northeast of the proposed project site. Restoration of these sites should increase in the quality of desert tortoise habitat; if this increased habitat quality allows more desert tortoises to inhabit the area, overall connectivity near the Stateline Project would improve to a small degree. If the restoration results in less use of the area by off-road vehicles and, consequently, a reduction in mortality levels along unpaved roads in the area, this aspect may provide an even greater benefit to desert tortoises than the improved habitat quality.

The restoration of 30 unauthorized routes within the Eastern Mojave Recovery Unit would involve the active restoration of enough of the route to make it difficult for recreationists to see; this restoration could involve moving rocks onto the route, planting container plants, reseeding the route, and "vertical mulching," which is inserting branches from nearby shrubs into the ground or otherwise placing pieces of plants or rocks into disturbed areas so they do not look like

routes of travel. The Bureau would then allow plants to recolonize the remaining portion of the route. This action would not immediately restore habitat value to the route, in terms of native annual plants for forage or appropriate substrates for burrowing; those values would require a long time. It would, however, remove use of the route by vehicles as a threat to desert tortoises and thereby contribute to increased survivorship of animals in areas were the routes are closed.

Finally, Stateline will fund fencing of Morningstar Mine Road, located within the Mojave National Preserve. Fencing of Morningstar Mine Road will reduce the number of desert tortoises that are killed or injured along this road. As we stated in the Environmental Baseline - Existing Conditions in the Action Area section of this biological opinion, motorists use the paved Morningstar Mine Road at high speeds, which is responsible for the death of several desert tortoises a year (National Park Service 2011). The installation of fencing along Morningstar Mine Road could also increase habitat fragmentation by preventing the movement of desert tortoises across the road. To at least some extent, Morningstar Mine Road already serves as a semi-permeable barrier to the movement of desert tortoises. As Hoff and Marlow (2002) have described, the density of desert tortoises is lower adjacent to roads; this lowered density is itself a barrier to interaction among desert tortoises from opposite sides of the road; additionally, desert tortoises that attempt to cross the road are at risk of death or injury. In sum, reducing injury and mortality associated with Morningstar Mine Road would promote increased survivorship in the Eastern Mojave Recovery Unit and recovery of the desert tortoise, even though it may slightly reduce connectivity in this particular region.

Generally, the proposed actions are consistent with recommendations for recovery of the desert tortoise. Some of the actions would affect immediate benefits to desert tortoises. For example, fencing of Morningstar Mine Road (and Highway 93, if the Bureau pursues that option) would immediately reduce the mortality rate of desert tortoises in a large area of critical habitat; however, because of the desert tortoise's low reproductive rate, another benefit of the fencing, as measured by an increased density of desert tortoises in the area, is unlikely to be evident for many years. The removal of cattle, closing of roads, and restoration of habitat would likewise have some immediate benefit (e.g., reduction in competition, reduction in the number of desert tortoises crushed by off-highway vehicles and cattle) but increases in habitat quality and the number of desert tortoises will take much more time. The effects of efforts to improve connectivity, such as removal or realignment of the fence around the Large-Scale Translocation Site, will be more difficult to measure.

Effects of Changes in Land Use Plans

The Bureau (2013g) has proposed to create a new 50-square-mile area of critical environmental concern in Nevada. The Bureau would manage lands within the proposed area of critical environmental concern in Nevada in a manner consistent with its multiple-use mandate. However, the designation alters the Bureau's goals and objectives to ensure that conservation of habitat for desert tortoises is a primary purpose of land use in the area. For example, the Bureau would retain all lands within the area of critical environmental concern in Federal ownership;

allow (on a case-by-case basis) Bureau facilities that provide resource protection, enhancement of relevance and importance values and/or address human health and safety; restore areas that are temporarily disturbed to meet its standard restoration standards; consider land use authorizations and site-type right-of-ways of 5 acres or less on a case-by-case basis; close the area to solid leasable mineral resources; allow, on a case-by-case basis, salable mineral disposals that provide resource protection, enhancement of relevance and importance values and/or address human health and safety; close the area to livestock grazing; limit recreation facility development to those necessary for resource protection; limit off-highway vehicle use to existing routes; require permitted non-speed recreation activities have a desert tortoise monitor during the active season; and prohibit military maneuvers.

The Bureau would also designate the area of critical environmental concern as a linear right-of-way avoidance area. Rights-of-way for construction and operation of the Southern Nevada Supplemental Airport and associated facilities are allowed in the area of critical environmental concern, subject to an approved final environmental impact statement and record of decision for the airport and to compliance with the Endangered Species Act. The Bureau would also exclude large site-type rights-of-way (greater than 5 acres). Rights-of-way for construction and operation of the Southern Nevada Supplemental Airport and associated facilities are allowed in the area of critical environmental concern, subject to an approved final environmental impact statement and record of decision for the airport and to compliance with the Endangered Species Act (Cota 2013b).

The Bureau would expand the Ivanpah Desert Wildlife Management Area by approximately 37 square miles and manage these lands according to the multiple-use guidance contained in its final environmental impact statement for the Northern and Eastern Mojave amendment to the California Desert Conservation Area Plan (Bureau 2002). Under the plan, the Bureau would include specific design features to minimize potential impacts to desert tortoises and their habitat if projects would lead to new surface disturbance; require reclamation, to as close to pre-disturbance condition as practicable, for activities that result in loss or degradation of desert tortoise habitat within the area; limit cumulative new surface disturbance on public lands administered by the Bureau to no more than one percent of public lands; and require compensation for disturbances of public lands at the rate of 5 acres for each acre disturbed.

The area of critical environmental concern in Nevada and expansion of the desert wildlife management area in California would contribute to the protection of desert tortoises within this portion of the Ivanpah Valley. These designations are likely to reduce the amount of human disturbance in these areas; the reduced disturbance is likely to benefit desert tortoises by reducing the number of animals that are killed and the amount of habitat that is lost or degraded. In particular, the Bureau's prohibition of site-type rights-of-way larger than 5 acres in Nevada and the high compensation requirement and limit on cumulative disturbance in California would serve to prevent (in Nevada) or strongly discourage (in California) the loss of large areas of habitat.

As with most measures that are intended to protect desert tortoises and their habitat, we cannot precisely quantify how these measures would benefit individuals, populations, or habitat. To some degree, the benefit is a function of the activities that the management measures would prevent or discourage. For example, the mere presence of the increased level of management may discourage some development proposals from being brought forward or cause recreational users to go elsewhere; in such cases, we would not know that the direction had provided a benefit. In all cases of restoration, the degree to which desert tortoises and their habitat respond to the removal of sources of mortality and the restoration of disturbed areas is a function of rainfall. Adequate amounts of rainfall would improve the likelihood of survival of desert tortoises of all size classes and hasten the degree to which habitat restoration would occur.

Effects on Recovery

Given the relatively small number of large desert tortoises that we expect the Stateline Solar and Silver State South projects to kill, the proposed actions are unlikely to appreciably diminish the ability of the desert tortoise to reach stable or increasing population trends in the future. Several of the Bureau and the Applicants' proposals to offset the adverse effects of the proposed solar facilities (e.g., fencing of Morningstar Mine Road, removal of cattle grazing, reduction in the number of unauthorized vehicle routes) would remove sources of mortality of desert tortoises in the action area. These measures would promote the recovery of the desert tortoise and, over time, are likely to prevent more individuals from being killed than the Applicants is likely to kill during construction, operation, and maintenance of the solar facilities.

Connectivity among populations is essential to the conservation of the desert tortoise. Ivanpah Valley is almost completely isolated from adjacent important habitat for desert tortoises in the Kelbaker/Cima area and Eldorado Valley. Consequently, stochastic events (e.g., drought, wild fires) pose a greater degree of threat to desert tortoises in Ivanpah Valley than if the valley were more widely connected to adjacent habitat from which individuals could recolonize over time.

Connectivity within Ivanpah Valley is currently constrained in the area of the state line by existing development. The loss of habitat as a result of the Stateline Solar Project is likely to reduce connectivity in this portion of Ivanpah Valley to some degree. A portion of the area proposed for the project would occur in unoccupied habitat (i.e., the area close to Ivanpah Dry Lake), the corridor between the project and the adjacent mountains is short, and existing (and previously consulted upon) development has largely isolated the habitat west of Interstate 15 from the remainder of Ivanpah Valley. For these reasons, the Stateline Solar Project is not likely to measurably affect connectivity within Ivanpah Valley.

The habitat to the east of the Silver State South Project currently provides the greatest degree of connectivity between the northern and southern portions of Ivanpah Valley. The loss of habitat to east of the Silver State South Project is likely to reduce this connectivity; edge effects may reduce the effective connectivity to less than the measured distance between the project site and the Lucy Gray Mountains.

If the Bureau is able to remove or realign the fence around the Large-Scale Translocation Site, the improved connectivity on the west side of Interstate 15 would not completely compensate for decreased connectivity to the east of the Silver State South Project, primarily because Primm and the Stateline Hills comprise impermeable and semi-permeable barriers, respectively, to movement of desert tortoises through this area. The Bureau's proposal to restore routes and increase the degree of conservation management adjacent to the Silver State South Project would, over time, likely improve habitat quality and thereby increase the number of desert tortoises in this area; an increased number of desert tortoises adjacent to the corridor would likely provide a source population in the event of decreased densities within it.

For the reasons discussed in the preceding paragraphs, the Silver State South Project is likely to reduce connectivity within Ivanpah Valley. Consequently, the proposed project is likely to impede recovery of the desert tortoise, at least temporarily. The loss of habitat and reduction in connectivity would occur over a short period of time. The measures proposed to offset the loss of connectivity would require years to result in an increased number of desert tortoises and improved habitat quality; they also cannot replace the lost habitat and reduced width of the corridor.

Although the loss of habitat would occur in a relatively short time and be clearly visible, loss or degradation of connectivity would likely not occur for several years and be more difficult to detect. However, the monitoring of demographic and genetic stability by the U.S. Geological Survey should be able to detect such changes over time. The initial work by the U.S. Geological Survey would establish baseline conditions; that is, the first sampling would provide information on genotype, differentiation of populations, genetic diversity (allelic richness, heterozygosity), effective population size, relatedness among individuals, and genetic connectivity among collection location. Subsequent sampling would allow the U.S. Geological Survey to determine changes in these measurements of demographic and genetic stability over time and to provide information, based on the location of the monitoring plots, on whether changes in demographic and genetic stability were related to the proposed solar projects. Changes in any of the sampled metrics over time and among sites that rise to the level of significance (alpha = 0.05) would likely indicate changes in demographic and genetic stability. Comparisons between sites would suggest that connectivity between those sites has been altered. If this comprises new information with regard to the effects of the Silver State South or Stateline Solar Projects on connectivity, the Bureau would be required to re-initiate formal consultation, pursuant to section 7(a)(2) of the Endangered Species Act. At that time, the Service and Bureau would assess the available information to determine an appropriate course of action.

We conclude that construction of the Silver State South Project is not likely to appreciably diminish the likelihood of recovery of the desert tortoises for several reasons. First, at least one desert tortoise's lifetime utilization area would remain in the corridor after construction of the project. This corridor, combined with the increased level of management proposed by the Bureau within the new proposed area of critical environmental concern, has the potential to increase the density of desert tortoises in the region to a degree that may mitigate the loss of

habitat. Second, the monitoring to be conducted by the U.S. Geological Survey should detect changes in demographic and genetic stability. Third, the long generation time of desert tortoises provides the Bureau an opportunity to implement additional management measures, if needed. Finally, the re-initiation requirements of section 7(a)(2) of the Endangered Species Act will provide for additional review of the proposed action, both during and after the 30-year life of the right-of-way grant.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. We do not consider future Federal actions, including future actions on federal land by non-federal entities, that are unrelated to the proposed actions in this section because they require separate consultation pursuant to section 7(a)(2) of the Act.

The Bureau and the National Park Service manage the majority of the land in the action area. Future non-federal actions in the action area within Nevada are subject to the requirements of the Clark County Multi-species Habitat Conservation Plan. We are not aware of any proposed, non-federal actions within the action area in California.

CONCLUSIONS

As we stated previously in the biological opinion, “jeopardize the continued existence of” means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 Code of Federal Regulations 402.02). This regulatory definition focuses on how the proposed action would affect the reproduction, numbers, or distribution of the species under consideration in the biological opinion. For that reason, we have used those aspects of the desert tortoise’s status as the basis to assess the overall effect of the proposed actions on the species.

Additionally, we determine whether a proposed action is likely “to jeopardize the continued existence of the species” through an analysis of how a proposed action affects the listed taxon within the action area in relation to the range of the entire listed taxon. For the desert tortoise, this process involves considering the effects at the level of the action area, then at the level of the recovery unit (in this case, the Eastern Mojave Recovery Unit), and then finally for the range of the listed taxon. Logically, if a proposed action is unlikely to cause a measurable effect on the listed taxon within the action area, it is unlikely to affect the species throughout the recovery unit or the remainder of its range. Conversely, an action with measurable effects on the listed entity in the action area may degrade the status of the species to the extent that it is affected at the level of the recovery unit or range-wide.

In the following sections, we will synthesize the analyses contained in the Effects of the Action section of this biological opinion to determine how each of the proposed actions affects the reproduction, number, and distribution of the desert tortoise. We will then assess the effects of the proposed actions on the recovery of the species and whether they are likely to appreciably reduce the likelihood of both the survival and recovery of the desert tortoise.

Reproduction

Construction of the solar facilities would not have a measurable long-term effect on reproduction of individual desert tortoises that live adjacent to the solar facilities because this intense activity would occur over a relatively brief time relative to the reproductive life of female desert tortoises. Furthermore, desert tortoises are well adapted to highly variable and harsh environments and their longevity helps compensate for their variable annual reproductive success (Service 1994).

We expect that translocated desert tortoises may exhibit decreased reproduction in the first year following translocation. Based on research conducted by Nussear et al. (2012), however, the reproductive rates of translocated desert tortoises are likely to be the same as those of resident animals in subsequent years. Based on work conducted by Saethre et al. (2003), we do not expect the increased density of desert tortoises that would result from translocation to affect the reproduction of resident animals.

For these reasons, we expect that the proposed Stateline and Silver State South facilities are not likely to appreciably diminish reproduction of the desert tortoise in the action area.

Numbers

We expect that the proposed actions are likely to result in the injury or mortality of few large desert tortoises because most construction activities (the aspect of the proposed actions that would be most likely to kill or injure desert tortoises) would occur within areas that have been fenced and cleared of desert tortoises. For activities outside of fenced areas, the Applicants would implement measures to reduce the level of mortality during all work activities. We anticipate that the proposed actions are likely to result in injury or mortality of numerous small desert tortoises because of their small size and cryptic nature. Consequently, densities of large desert tortoises serve as the basis for our following analysis.

In the Environmental Baseline – Status of the Desert Tortoise in the Action Area section of this biological opinion, we estimated that approximately 4,572 large desert tortoises occurred within approximately 328,640 acres within the Ivanpah Valley. For the California portion of the action area, we extrapolated the number of large desert tortoises from the density of large individuals in an area that is considered to provide the best habitat and support the highest densities (i.e., the Ivanpah Critical Habitat Unit). Densities within the action area may be different and are likely lower. For the Nevada portion of the action area, we used the density calculated for the larger

area surrounding the Silver State South facility site and extrapolated it to the northern portion of the action area.

Survey results for the proposed Stateline facility indicate that up to 94 large desert tortoises will require capture and movement from harm's way as a result of construction of the solar facility. Based on the estimated desert tortoise densities within the action area, construction of the Stateline solar facility would affect approximately 2 percent (e.g., 94 of 4,572 individuals) of the large desert tortoises within the action area. Based on density estimates for the Silver State South facility, we anticipate that up to 115 large individuals will be translocated. This encompasses approximately 2.5 percent (e.g., 115 of 4,572 individuals) of the estimated large desert tortoises within the action area. The combined construction and operation of the Stateline and Silver State South solar facilities would affect approximately 4.6 percent (e.g., 208 of 4,572 individuals) of the large desert tortoises in the action area based on the high end of the density estimates.

Range-wide monitoring in the Eastern Mojave Recovery Unit indicates that the lower and upper confidence intervals (at 95 percent) of the densities of large desert tortoises to be approximately 4.7 to 18.9 per square mile (point estimate of 9.4) (Allison 2013a). Assuming the worst-case scenario (i.e., the number of large desert tortoises in the region is close to the lower confidence interval [29,101] and in the footprint of the Silver State South Project is close to the upper limit [115]), the Silver State South Project would require translocation of approximately 0.4 percent of the large desert tortoises in the Eastern Mojave Recovery Unit. Using this same scenario for the Stateline Project, Stateline would translocate approximately 0.32 percent of the large desert tortoises in the recovery unit (93 of 29,101). We expect that Silver State will capture most of the large desert tortoises within the solar fields and the Silver State South Project's substation and move them to translocation areas. Based on the results of studies conducted at Fort Irwin and the Ivanpah Solar Electric Generating System, we expect the majority of these animals will survive the translocation.

We acknowledge that the Applicants will likely kill some large desert tortoises during construction of the facilities; however, as we have discussed previously in this biological opinion, the proposed measures to protect desert tortoises during these activities will ensure that few large animals die or are injured. Additionally, few large desert tortoises are likely to die during work along linear facilities and in the course of operations and maintenance over the life of the projects. We have reached this conclusion because construction work along linear facilities would involve much smaller areas, most work associated with operations and maintenance would occur within fenced areas, and the Applicants would implement protective measures while conducting these activities. Overall, the number of large desert tortoises likely to be killed or injured as a result of construction, operation, and maintenance of the proposed projects would comprise a minor portion of the population within the action area.

The potential exists that factors unrelated to the Stateline and Silver State South projects may affect desert tortoises in the action area. If the overall number of desert tortoises in the recovery

unit decreases, we expect that the number of desert tortoises that inhabit the action area would also decrease. Some potential exists that the number of desert tortoises within the action area may increase relative to adjacent areas if the overall human disturbance decreases and the mortality rate of desert tortoises decreases concurrently. In spite of the uncertainties related to the overall future trend in the number of desert tortoises, the proposed actions are not likely to appreciably diminish the number of large desert tortoises in the action area during the life of the projects.

We expect that many of the small desert tortoises and eggs within the boundaries of the solar facilities are likely to be killed or injured during construction, although the Applicants would likely find some small animals and translocate them. We estimated that the sites might support up to 1,906 small desert tortoises and eggs. We did not attempt to compare this estimate with one of the same size classes for the Eastern Mojave Recovery Unit for two reasons. First, the large number of assumptions involved, particularly in the context of the entire recovery unit, decreases the value of this exercise. Second, the natural high rate of mortality among eggs and juveniles would reduce the value of the estimate. Additionally, small desert tortoises are likely to die during work along linear facilities and in the course of operations and maintenance; however, protective measures are likely to be more effective in preventing mortality or injury during these activities because of the smaller areas involved. Although we are not comparing the overall estimate of the numbers of small desert tortoises and eggs likely to be killed or injured to the overall numbers within the recovery unit, we can reasonably conclude that the estimate is a small percentage of the overall numbers of small desert tortoises and eggs because the number of large desert tortoises affected by the proposed actions is a small percentage of the population in the Eastern Mojave Recovery Unit. Consequently, although construction is likely to kill many small desert tortoises and eggs and some additional animals and eggs would be killed during operations and maintenance, the proposed actions are not likely to appreciably diminish the number of small desert tortoises or eggs in the action area.

Distribution

The long-term loss of 4,039 acres of desert tortoise habitat that would result from implementation of the 2 solar projects (1,651 acres for Stateline; 2,388 acres for Silver State South) is not likely to appreciably reduce the distribution of the desert tortoise. The Eastern Mojave Recovery Unit may support as much as 7,443 square miles of desert tortoise habitat (Allison 2013a). Consequently, the proposed actions would result in the loss of approximately 0.08 percent of the habitat in the Eastern Mojave Recovery Unit (0.03 percent for Stateline; 0.05 percent for Silver State South).

We anticipate that the long-term habitat loss associated with the Silver State South Project will reduce connectivity between the southern and northern ends of Ivanpah Valley. The Bureau's proposal to restore disturbed habitat and increase the level of law enforcement around the Silver State South Project should offset, to some degree, the decrease in the width of the linkage. We are uncertain as to whether the reduced width of the corridor between the Silver State South

Project and the Lucy Gray Mountains would cause demographic or genetic instability. As we discussed in the Effects of the Action – Effects on Recovery section of this biological opinion, if the Silver State South Project degrades connectivity between the northern and southern portions of Ivanpah Valley, monitoring by the U.S. Geological Survey should be able to detect any such change, and the long generation time and re-initiation requirements of section 7(a)(2) would enable the Bureau to undertake corrective actions on the ground to bolster connectivity and for the Bureau and Service to re-evaluate the effects of the proposed action during re-initiation of formal consultation, either during the life of the project or at the end of the 30-year right-of-way grant.

To summarize, we concluded that the proposed actions are not likely to appreciably diminish reproduction, numbers, or distribution of the desert tortoise in the action area, or to appreciably impede long-term recovery of the desert tortoise. Integral to that conclusion is our expectation that the reduction in the width of habitat east of the Silver State South Project is either unlikely to degrade demographic or genetic stability in Ivanpah Valley or that we will be able to detect degradation of those values and implement remedial actions, if necessary.

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed actions, and the cumulative effects, it is the Service's biological opinion that the Bureau's proposed issuance of right-of-way grants for the Silver State South and Stateline projects and Southern California Edison's substation are not likely to jeopardize the continued existence of the desert tortoise. We reached these conclusions for these projects because:

Silver State South Project

1. We do not expect that the issuance of a right-of-way grant for the Silver State South Project would affect the reproductive capacity of desert tortoises in the action area.

2. The Bureau and Silver State have proposed numerous measures, including translocation of desert tortoises from the project site, to minimize injury and mortality of desert tortoises. Information from previous large-scale translocations has demonstrated that it can be an effective tool for reducing mortality at project sites. Consequently, the proposed action is not likely to appreciably reduce the number of desert tortoises in the Eastern Mojave Recovery Unit.

3. The proposed action will not appreciably reduce the distribution of the desert tortoise in the action area because it would result in the loss of approximately 0.05 percent of suitable habitat in the Eastern Mojave Recovery Unit. Construction of the project would result in a net loss of desert tortoise habitat and may impair connectivity to some degree in the linkage between the project site and the Lucy Gray Mountains, which is the most critical linkage remaining in the Ivanpah Valley. However, the average width of the remaining corridor can accommodate one lifetime desert tortoise utilization area

throughout the length of the linkage, the Bureau and Silver State will fund and implement numerous measures to enhance connectivity and secure desert tortoises populations in the surrounding area, the U.S. Geological Survey will monitor demographic and genetic stability, and the Bureau will be required to re-initiate formal consultation if monitoring detects loss of stability. The long generation time of desert tortoises will allow the Bureau to take remedial actions if the U.S. Geological Survey detects degradation of demographic or genetic instability.

Stateline Project

1. We do not expect that the issuance of a right-of-way grant for the Stateline Project would affect the reproductive capacity of desert tortoises in the action area.

2. The Bureau and Stateline have proposed numerous measures, including translocation of desert tortoises from the project site, to minimize injury and mortality of desert tortoises. Information from previous large-scale translocations has demonstrated that it can be an effective tool for reducing mortality at project sites. Consequently, the proposed action is not likely to appreciably reduce the number of desert tortoises in the Eastern Mojave Recovery Unit.

3. The proposed action will not appreciably reduce the distribution of the desert tortoise in the action area because it would result in the loss of approximately 0.3 percent of suitable habitat in the Eastern Mojave Recovery Unit. Construction of the project would result in a net loss of desert tortoise habitat and is likely to impair connectivity to some degree in the linkage between the project site and the Clark Mountains. This linkage has already been compromised to a large degree by the Ivanpah Solar Electric Generating System, DesertXpress, Primm, and the Large-Scale Translocation Site. Additionally, the point of constriction that the proposed action would cause would be short in length and natural features in that area also pose constraints to connectivity. The Bureau and Stateline will fund and implement numerous measures to improve management of the remaining habitat for desert tortoises in the surrounding area. These measures include expanding the Ivanpah Desert Wildlife Management Area by approximately 42 square miles; this change in management direction would increase the emphasis on protection of desert tortoises in the remaining habitat.

Southern California Edison Substation

1. We do not expect that the issuance of a right-of-way grant for the Southern California Edison substation would affect the reproductive capacity of desert tortoises in the action area.

2. The Bureau and Southern California Edison have proposed numerous measures, including translocation of desert tortoises from the project site, to minimize injury and

mortality of desert tortoises. Information from previous large-scale translocations has demonstrated that it can be an effective tool for reducing mortality at project sites. Consequently, the proposed action is not likely to appreciably reduce the number of desert tortoises in the Eastern Mojave Recovery Unit.

3. The proposed action will not appreciably reduce the distribution of the desert tortoise in the action area. Construction of the substation would result in a net loss of a small amount of desert tortoise habitat (28 acres, which we included in the total for the Silver State South Project) and is likely to impair further the connectivity in the linkage between the project site and Roach Dry Lake. This linkage has already been compromised to a large degree by the Silver State North Project, the Walter M. Higgins Generating Station, an existing railroad, the portion of Primm that lies east of the freeway, and general human disturbance, which is likely an edge effect of Primm. The Bureau intends for the measures described for the Silver State South Project to also apply to this project.

Under normal circumstances, we would analyze the three proposed actions separately; as we completed the analysis for the first action, its impacts would then alter the status of the species for the next consultation. To ensure that we are not compromising the section 7(a)(2) process by ignoring their aggregative effects on desert tortoises in the Ivanpah Valley, we will now consider all three actions in combination.

1. Effects to the reproductive capacity of desert tortoises are not additive across the three proposed projects. Most of the large desert tortoises that occur in project area would be translocated to suitable habitat; we expect that these individuals would continue to reproduce at the same rate as prior to translocation.

2. The Bureau and the Applicants will use techniques that have proven to be effective in protecting large desert tortoises during clearance surveys of the project areas. Although we acknowledge that some large individuals will likely be killed or injured because of the proposed actions, mostly during construction, the overall number of animals we expect will die (including small animals and eggs) would be a minor fraction of the number of desert tortoises within the Eastern Mojave Recovery Unit. Several measures proposed by the Bureau and the Applicants to offset these losses (e.g., fencing of Morningstar Mine Road, removal of cattle from the Clark Mountain Allotment, management of off-highway vehicle use near the Silver State South Project) are likely to reduce the number of individuals that are killed by anthropogenic activity within the Eastern Mojave Recovery Unit upon their implementation.

3. Construction of the projects would result in a net long-term loss of approximately 4,039 acres of desert tortoise habitat of varying quality and decrease the width of 3 linkages between the northern and southern portions of Ivanpah Valley. The measures that the Bureau and the Applicants will implement to offset the reduction in width are likely to enhance the ecological value of the remaining habitat within and adjacent to the linkages.

> These measures include altering management strategies to be more protective of desert tortoises, increased presence of law enforcement personnel to reduce damage to habitat and injury and death of desert tortoises, and habitat restoration to reduce illegal use of unauthorized routes within desert tortoise habitat. These measures, taken together, are likely to improve the viability of desert tortoise populations within and surrounding the linkages. Furthermore, we expect the monitoring to be conducted by the U.S. Geological Survey would allow detection of demographic or genetic instability and the long generation time and requirements for re-initiation of formal consultation would allow for remediation of such effects.

As we noted previously in this biological opinion, the analysis we conduct under section 7(a)(2) of the Endangered Species Act must be conducted in relation to the status of the entire listed taxon. We considered the action area for this biological opinion to be Ivanpah Valley because the effects of the loss of connectivity would affect the entire valley. Because we have reached the determination that the proposed actions are not likely to appreciably diminish reproduction, numbers, or distribution of the desert tortoise in Ivanpah Valley, these actions are also not likely to affect desert tortoises within the remainder of the Eastern Mojave Recovery Unit or to the remainder of the range of the Mojave population of the desert tortoise.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened wildlife species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and not the purpose of, the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement and the avoidance and minimization measures proposed by the Bureau.

The measures described below are non-discretionary; the Bureau must include these measures as binding conditions of its right-of-way grants to Stateline, Silver State and Southern California Edison for the exemption in section 7(o)(2) to apply. The Bureau has a continuing duty to regulate the activity covered by this incidental take statement. If the Bureau fails to require Stateline, Silver State and Southern California Edison to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the right-of-way grants, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take,

the Bureau must report the progress of the actions and its impact on the species to the Service as specified in the incidental take statement (50 Code of Federal Regulations 402.14(i)(3)).

Although we have combined the analyses of the effects of the projects, we have provided separate conclusions with regard to our section 7(a)(2) determinations because the Bureau is proposing the issuance of three separate right-of-way grants. For this reason, we are also providing separate incidental take statements for the projects.

Stateline Solar Project

Construction of the Stateline Solar Field

We anticipate that all desert tortoises within the Stateline Solar project site are likely to be taken. We anticipate that most of the large individuals (i.e., those greater than 160 millimeters in length) within this area will be captured and moved from harm's way to adjacent habitat. Desert tortoises that are not detected during clearance surveys prior to construction may be killed or wounded; because of the difficulty in finding small desert tortoises, we expect that most of these individuals are likely to be killed or wounded during construction.

We estimate that, at most, approximately 94 larger tortoises and 853 small desert tortoises and eggs may be present within the boundaries of the solar facility. We are unable to state precisely how many desert tortoises are present within the area where the proposed solar facility would be built for several reasons. Desert tortoises are cryptic (i.e., individuals spend much of their lives underground or concealed under shrubs), they are inactive in years of low rainfall, and their numbers and distribution within the action area may have changed since the surveys were completed because of hatchings, deaths, immigration, and emigration. The numbers of hatchlings and eggs are even more difficult to quantify because of their small size, the location of eggs underground, and the fact that their numbers vary depending on the season; that is, at one time of the year, eggs are present but they become hatchlings later in the year.

Determining the amount or extent of the forms in which the take is likely to occur (killed, injured, or captured) is also difficult. As we noted previously, most of the large individuals within this area will likely be captured and moved from harm's way to adjacent habitat. Few larger desert tortoises are likely to be killed or wounded because our prior experience is that the proposed avoidance and minimization measures will be effective. However, occasionally even larger animals remain undetected during clearance surveys and are likely to be killed or wounded during construction. Stateline is also likely to find and translocate some of the small desert tortoises; eggs are unlikely to be detected.

Using the total number of individuals within the site of the solar facility as the anticipated level of take in the form of desert tortoises that are killed or wounded as a result of the proposed action would be inappropriate because we fully expect that Stateline will capture and move numerous individuals into adjacent habitat. Therefore, we anticipate that the number of individuals killed

or wounded resulting from the proposed action will be a subset of the number of desert tortoises estimated to be within the action area. Because Stateline is not likely to find every dead or wounded desert tortoise within the area of the solar facility, the number of dead or wounded individuals that are found likely will be a subset of the number that are killed or wounded.

To summarize, we do not know the precise number of desert tortoises within the area of the solar facility and cannot predict the numbers of animals that Stateline will capture and move from harm's way prior to and during construction, the number of individuals that are likely to be killed or wounded, or the number of dead or injured individuals that will be found. Therefore, we cannot precisely quantify the number of individuals that are likely to be killed or wounded during construction of the proposed solar field. Because Stateline is unlikely to find every individual that is killed or wounded but we know that this number will be a fraction of the total number of desert tortoises present, we will consider the amount or extent of take to be exceeded if three killed or wounded large desert tortoises are found within the solar field. We used large desert tortoises to establish this amount or extent of take because small desert tortoises are difficult to find and the method by which we calculate their abundance contains more assumptions and therefore more potential for variation than does our method for predicting the number of large desert tortoises.

In the previous paragraphs, we described the difficulties involved with quantifying the numbers of desert tortoises that are likely present in the solar field and of desert tortoises that are likely to be moved from harm's way. However, we based our overall section 7(a)(2) analysis in this biological opinion on the premise that at most approximately 94 large and 853 small desert tortoises and eggs are likely to occur within the boundaries of the proposed solar field. If Stateline's surveys were inaccurate and more desert tortoises actually reside on site, Stateline would exceed the amount or extent of incidental take that we have anticipated; additionally, this increased number of individuals would constitute new information revealing effects of the agency action that may affect the desert tortoise to an extent that the Service did not consider in this biological opinion. Consequently, we will consider the amount or extent of take to be exceeded if Stateline captures and translocates more than 89 large desert tortoises from within the solar field. We used this number because it is less than the 94 large desert tortoises upon which we based our analysis, it accounts for the number of killed or wounded desert tortoises at which the Bureau would need to re-initiate formal consultation (3), and it provides for a reasonable number of large individuals that may die but not be detected (2).

More uncertainty exists in the numbers of small desert tortoises and eggs that are likely to be present because of the assumptions that we make to derive an estimate; additionally, circumstances could lead to the authorized biologists and monitors finding more small desert tortoises than we predicted (e.g., an unusually high survival rate in the previous year, long periods of good weather leading to greater activity levels, biologists with better search images for small animals, etc.). Because our estimate of the number of large desert tortoises within the project area forms the basis for the estimate of the number of small desert tortoises, finding more large animals than we predicted would likely mean that our estimate of the number of small

animals is too low. Therefore, we are not establishing an independent re-initiation criterion for the number of small desert tortoises or eggs that would be moved out of harm's way during construction of the proposed project.

We expect that most of the eggs present within boundaries of the solar field will be destroyed. We cannot predict how many eggs desert tortoises will produce prior to the onset of construction and the number of eggs present would vary depending upon the time of the year Stateline conducts the clearance surveys. Biologists are unlikely to find many eggs because they are difficult to detect. For these reasons, predicting the number of eggs that may be taken is not possible and we are not establishing a re-initiation criterion for eggs for the loss of eggs. As we noted in the previous paragraph regarding small desert tortoises, the amount or extent of take of large desert tortoises we established previously in this section serve as a surrogate for the number of eggs; if the amount or extent of take for large desert tortoises is exceeded, the re-initiation of formal consultation would also require re-evaluation of the effects of the action on eggs.

Translocation

Because Stateline will employ experienced biologists, approved by the Service and the Bureau, and sanctioned handling techniques, we do not expect that the take, in the form of capture or collection, required to move desert tortoises out of harm's way during construction of the proposed project will result in mortality or injury of any individuals. Consequently, we do not anticipate that the activities involved with capturing and transporting desert tortoises from the solar field to the recipient site is likely to kill or injure any desert tortoises.

The work required to translocate desert tortoises and to monitor translocated and resident animals would necessitate increased use of vehicles in suitable habitat when desert tortoises are active. We acknowledged this fact in the Effects of the Action - Effects Associated with Capture and Translocation of Desert Tortoises. We cannot predict how many desert tortoises are likely to be killed or wounded in this manner because of the numerous variables involved (the density of desert tortoises in the area, how many animals are active when biologists are working in the area, the condition of the roads, etc.). Additionally some desert tortoises (particularly small individuals) may be killed or wounded but never detected. Because Stateline will employ experienced biologists, approved by the Service and the Bureau, we expect that few desert tortoises are likely to be killed or wounded by vehicle strikes during translocation. For these reasons, we will consider the amount or extent of take to be exceeded if Stateline kills or wounds more than 2 large desert tortoises as a result of vehicle strikes during translocation activities.

We do not anticipate any differences in mortality rates among translocated, resident, and control desert tortoises. To ensure that the effects of translocation are consistent with our analysis, we will consider the amount or extent of take of translocated or resident desert tortoises to be exceeded if the mortality rates of either translocated or resident animals is significantly different (alpha = 0.05) from that of control individuals.

Operation and Maintenance of the Stateline Solar Facility

Operations and maintenance activities would occur primarily within the fenced facility; however, desert tortoises may occasionally breach the fence and would then likely be taken, either by being captured and moved outside the fence into suitable habitat or by being killed or injured. We cannot reasonably anticipate the number of desert tortoises that may breach the fence during the life of the project or predict the numbers of those individuals that would be killed, injured, or captured because of the numerous variables involved. For example, we cannot predict the future numbers of desert tortoises that may reside near the project site or when an animal would then find a hole in the fence and enter the facility. We also cannot predict whether the animal would be killed, injured, or captured.

Because we cannot precisely quantify the number of individuals that are likely to be killed, injured, or captured during operations and maintenance of the proposed solar field, we will consider the amount or extent of take to be exceeded if more than two large desert tortoises are killed or wounded within the solar facility in any calendar year.

Geotechnical Investigations and Construction, Operation, and Maintenance of Linear Facilities

Determining the number of desert tortoises that are likely to be taken along linear facilities is extremely difficult. In addition to the reasons we have already discussed regarding why the take of desert tortoises is difficult to quantify, narrow linear facilities pose additional difficulty in that they most likely cross only a small portion of a desert tortoise's home territory. Consequently, desert tortoises that are detected during a survey may be absent during construction or vice versa. Additionally, the likelihood of encountering a desert tortoise varies with the time of day, season, and long- and short-term weather conditions. These same factors influence estimating the amount of take that is likely to result from geotechnical investigations because of the small amount of disturbance associated with this activity.

Consequently, we have not tried to quantify the number of desert tortoises that Stateline is likely to encounter during geotechnical investigations or the construction, operations, and maintenance of its linear facilities. Rather, because the proposed protective measures have been effective in minimizing the injury and mortality of desert tortoises in similar linear and small projects and Stateline is unlikely to find every desert tortoise it kills during construction, we will consider the amount or extent of take to be exceeded if more than two large desert tortoises are killed or wounded during geotechnical investigations and construction of the linear facilities. We will consider the amount or extent of take to be exceeded if more than two desert tortoises are killed or wounded during operations and maintenance of the linear facilities in any calendar year. We are not establishing a limit for moving desert tortoises from harm's way if they are encountered during geotechnical investigations and construction, operations, or maintenance of linear facilities. As we discussed previously, we cannot reasonably assess how many individuals are likely to be encountered during work activities and moving these desert tortoises a short distance from harm's way will not adversely affect them in a measurable manner.

Silver State South Project

The same factors that render quantifying the amount or extent of take that we described for the Stateline Project apply for the Silver State South Project. Consequently, we will not repeat the discussion but will provide our quantification in the following sections.

Construction of the Silver State South Solar Facility

We estimate that approximately 115 large tortoises and 1,053 small desert tortoises and eggs may be present within the boundaries of the solar facility. We will consider the amount or extent of take to be exceeded if 5 killed or wounded desert tortoises are found within the solar field.

We will consider the amount or extent of take to be exceeded if Silver State captures and translocates more than 107 large desert tortoises from within the solar field. We used this number because it is less than the 115 large desert tortoises upon which we based our analysis, it accounts for the number of killed or wounded desert tortoises at which the Bureau would need to re-initiate formal consultation (5), and it provides for a reasonable number of large individuals that may die but not be detected (3).

We are not establishing a re-initiation criterion for the number of small desert tortoises or eggs that would be moved out of harm's way during construction of the proposed project. We are not establishing a re-initiation criterion for the loss of eggs.

We expect that most of the eggs present within boundaries of the solar field will be destroyed. We cannot predict how many eggs desert tortoises will produce prior to the onset of construction and the number of eggs present would vary depending upon the time of the year Silver State conducts the clearance surveys. Biologists are unlikely to find many eggs because they are difficult to detect. For these reasons, predicting the number of eggs that may be taken is not possible.

The amount or extent of take of large desert tortoises established previously in this section serves as a surrogate for the number of small desert tortoises and eggs; if the amount or extent of take for large desert tortoises is exceeded, the re-initiation of formal consultation would also require re-evaluation of the effects of the action on small desert tortoises and eggs.

Translocation

We do not anticipate that the activities involved with capturing and transporting desert tortoises from the solar facility to the recipient site is likely to kill or injure any desert tortoises.

We will consider the amount or extent of take to be exceeded if Silver State kills or wounds more than 2 large desert tortoises as a result of vehicle strikes during translocation activities.

We will consider the amount or extent of take of translocated or resident desert tortoises to be exceeded if the mortality rates of either translocated or resident animals is significantly different (alpha = 0.05) from that of control individuals.

Operation and Maintenance of the Silver State South Solar Facility

We will consider the amount or extent of take to be exceeded if more than three large desert tortoises are killed or wounded within the solar field in any calendar year.

Construction, Operation, and Maintenance of Linear Facilities

We will consider the amount or extent of take to be exceeded if more than two large desert tortoises are killed or wounded during construction of the linear facilities. We will consider the amount or extent of take to be exceeded if more than two large desert tortoises are killed or wounded during operations and maintenance of the linear facilities in any calendar year. We are not establishing an upper limit for moving desert tortoises from harm's way if they are encountered during construction, operations, or maintenance of linear facilities.

Primm Substation and Ancillary Facilities

The same general factors that render quantifying the amount or extent that we described for the solar project apply for the Primm Substation and ancillary facilities; the only difference is the smaller size of the facility. Consequently, we will not repeat the discussion but will provide our quantification in the following sections.

Construction of the Primm Substation

We estimate that approximately 7 large tortoises and 60 small desert tortoises and eggs may be present within the boundaries of the substation. (We used the observations of desert tortoises noted in figure 8 of the biological assessment [Bureau and Ironwood 2013c] to establish the number of large individuals and extrapolated the number of small desert tortoises and eggs from that. We note that none of these observations were within the boundaries of the substation; however, the information in figure 9 indicates that at least some of these animals may have spent some time in the area.) We will consider the amount or extent of take to be exceeded if one large desert tortoise is found killed or wounded within the substation.

We will consider the amount or extent of take to be exceeded if Southern California Edison captures and translocates from within the substation more than seven large desert tortoises. We used this number because the small size of this area should allow for authorized biologists to find all of the large desert tortoises present.

We are not establishing a re-initiation criterion for the number of small desert tortoises or eggs that would be moved out of harm's way during construction of the proposed project. We are not establishing a re-initiation criterion for the loss of eggs.

We expect that most of the eggs present within boundaries of the Primm Substation and associated Southern California Edison facilities will be destroyed. We cannot predict how many eggs desert tortoises will produce prior to the onset of construction and the number of eggs present would vary depending upon the time of the year Southern California Edison (or its contractor) conducts the clearance surveys. Biologists are unlikely to find many eggs because they are difficult to detect. For these reasons, predicting the number of eggs that may be taken is not possible.

The amount or extent of take of large desert tortoises established previously in this section serves as a surrogate for the number of small desert tortoises and eggs; if the amount or extent of take for large desert tortoises is exceeded, the re-initiation of formal consultation would also require re-evaluation of the effects of the action on small desert tortoise and eggs.

Translocation

We do not anticipate that the activities involved with capturing and transporting desert tortoises from the substation to the recipient site is likely to kill or injure any desert tortoises.

Any desert tortoises within the Primm Substation and other Southern California Edison facilities would be translocated with animals from the Silver State South solar facility and would be placed among the same residents. Consequently, assigning animals that are wounded or killed as a result of vehicle strikes during translocation activities to either Silver State or Southern California Edison would not be practical. The same holds true for attributing different mortality rates among translocated, resident, and control desert tortoises to Southern California Edison or Silver State. Additionally, the number of desert tortoises within the Southern California Edison facilities is likely to be a small fraction of those within the Silver State South solar facility. For these reasons, we will not assign an amount of extent of take solely to the Southern California Edison facilities but will instead rely on those established for the Silver State South solar facility.

Operation and Maintenance of the Primm Substation and Ancillary Facilities

We will consider the amount or extent of take to be exceeded if more than one desert tortoise is killed or wounded within the substation in any calendar year.

Construction, Operation, and Maintenance of Linear Facilities

We will consider the amount or extent of take to be exceeded if more than one desert tortoise is killed or wounded during construction of the linear facilities. We will consider the amount or extent of take to be exceeded if more than one desert tortoises is killed or wounded during

operations and maintenance of the linear facilities in any calendar year. We are not establishing an upper limit for moving desert tortoises from harm's way if they are encountered during construction, operations, or maintenance of linear facilities.

General Considerations

The exemption provided by this incidental take statement to the take prohibitions contained in section 9 of the Endangered Species Act extends only to the action area as described in the Environmental Baseline section of this biological opinion.

These incidental take statements are separable by right-of-way grants. That is, if the project proponent for a specific right-of-way grant exceeds the anticipated amount or extent of take for that grant, the requirement to re-initiate would apply only to that grant. The Bureau must determine how work would proceed during the re-initiation process, pursuant to section 7(d) of the Endangered Species Act.

We did not include exemptions for activities associated with decommissioning of the projects because most activities would occur within fenced facilities where desert tortoises are absent. When more information becomes available at the end of the right-of-way grants, the Bureau will determine how it wants to proceed in light of the information that is available at that time. Re-authorization of industrial use of the sites may require re-initiation of formal consultation.

We have not exempted take for activities associated with the monitoring for demographic and genetic stability because the U.S. Geological Survey is not a party to this formal consultation. Additionally, the work that the U.S. Geological Survey would conduct would be more appropriately evaluated under the auspices of section 10(a)(1)(A) of the Endangered Species Act. We will coordinate with the Service's Desert Tortoise Recovery Office on this issue.

We did not have enough information to analyze the potential effects of the measures to offset the adverse effects of the proposed projects on the desert tortoise. Consequently, this biological opinion does not exempt the incidental take that may occur as a result of those future actions. The Bureau is required to follow the consultation procedures of section 7(a)(2) of the Endangered Species Act with regard to those future actions.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of desert tortoises during the construction, operation, and maintenance of the proposed facilities:

Stateline Project

1. The Bureau must condition Stateline right-of-way grant to ensure that the perimeter fence of the solar facility is sufficiently maintained to preclude desert tortoises from entering the facility.

2. The Bureau must condition Stateline right-of-way grant to reduce mortality associated with fences.

Silver State South Project

1. The Bureau must condition Silver States right-of-way grant to ensure that the perimeter fence of the solar facility is sufficiently maintained to preclude desert tortoises from entering the facility.

2. The Bureau must condition Silver State right-of-way grant to reduce mortality associated with fences.

Primm Substation and Ancillary Facilities

We do not have any reasonable and prudent measures or terms and conditions for the Primm Substation or Southern California Edison's ancillary facilities.

Our evaluation of the proposed action includes consideration of the protective measures proposed by the Bureau in the biological assessments and re-iterated in the Description of the Proposed Action section of this biological opinion. Consequently, any changes in these protective measures may constitute a modification of the proposed action that causes an effect to the desert tortoise that was not considered in the biological opinion and require re-initiation of consultation, pursuant to the implementing regulations of the section 7(a)(2) of the Act (50 Code of Federal Regulations 402.16).

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the Act, the Bureau must ensure that Stateline, Silver State or Southern California Edison complies with the following terms and conditions, which implement the reasonable and prudent measures, and the following reporting and monitoring requirements. These terms and conditions are non-discretionary.

Stateline Project

1. The following terms and conditions implement reasonable and prudent measure 1:

a. The Bureau must require Stateline to inspect the fence around the solar facility on a quarterly basis and immediately after any rain or wind storm that has the potential to compromise the effectiveness of the perimeter fence.

b. The Bureau must require Stateline to effect repairs to the perimeter fence within 2 days of an inspection during the spring, summer, and fall. Stateline may repair the fence within a week in the winter.

2. The following term and condition implements reasonable and prudent measure 2:

The Bureau must require Stateline to install shade structures periodically along the outside of the fences around the solar facility that face habitat occupied by desert tortoises. If Stateline installs interior fences that would be in place during the active season and prior to the removal of desert tortoises from within the area of the solar facility, the Bureau must also require Stateline to include shade structures along these fences. The structures must be sufficiently large and long enough to allow the largest desert tortoises to be completely covered. Prior to the onset of construction, the Bureau must submit a plan for this activity to the Service for its review and approval; the plan must include information on the design of the structures, their spacing along fences, and a schedule for monitoring their effectiveness. The plan must also include a proposal to establish a duration for the monitoring and may include a proposal that would assist the Service in determining when daily inspections are no longer needed; these proposals should be based on observations of activity levels of desert tortoises at the project site and the degree to which translocated desert tortoises have reduced their wandering.

Silver State South Project

1. The following terms and conditions implement reasonable and prudent measure 1:

a. The Bureau must require Silver State to inspect the fence around the solar facility on a quarterly basis and immediately after any rain or wind storm that has the potential to compromise the effectiveness of the perimeter fence.

b. The Bureau must require Silver State to effect repairs to the perimeter fence within 2 days of an inspection during the spring, summer, and fall. Silver State may repair the fence within a week in the winter.

2. The following term and condition implements reasonable and prudent measure 2:

The Bureau must require Silver State to install shade structures periodically along the outside of the fences along the main access road and around the solar facility that face habitat occupied by desert tortoises. If Silver State installs interior fences that

would be in place during the active season and prior to the removal of desert tortoises from within the area of the solar facility, the Bureau must also require Silver State to include shade structures along these fences. The structures must be sufficiently large and long enough to allow the largest desert tortoises to be completely covered. Prior to the onset of construction, the Bureau must submit a plan for this activity to the Service for its review and approval; the plan must include information on the design of the structures, their spacing along fences, and a schedule for monitoring their effectiveness. The plan must also include a proposal to establish a duration for the monitoring and may include a proposal that would assist the Service in determining when daily inspections are no longer needed; these proposals should be based on observations of activity levels of desert tortoises at the project site and the degree to which translocated desert tortoises have reduced their wandering.

REPORTING REQUIREMENTS

Within 60 days of the completion of each proposed action (i.e., activities under each right-of-way grant), the Bureau must provide a report to the Service that provides details on the effects of the action on the desert tortoise. Specifically, the reports must include information on any instances when desert tortoises were killed, injured, or handled, the circumstances of such incidents, and any actions undertaken to prevent similar mortalities or injuries from re-occurring. The reports must also include a description of the monitoring efforts that the Applicants implements. In addition, the Bureau must provide an annual report by January 31 for each facility with this information; if animals are moved from harm's way during this period, the Bureau must include that information in these reports.

We also request that the Bureau provide us with the names of any monitors who assisted the authorized biologists and an evaluation of the experience they gained on the projects; the qualifications form on our website (http://www.fws.gov/ventura/sppinfo/protocols/deserttortoise_monitor-qualifications-statement.pdf), filled out for each project, along with any appropriate narrative would provide an appropriate level of information. This information would provide us with additional reference material in the event these individuals are submitted as potential authorized biologists for future projects.

DISPOSITION OF DEAD OR INJURED DESERT TORTOISES

Within 3 days of locating any dead or injured desert tortoises, you must notify the Service by telephone and by facsimile or electronic mail. The report must include the date, time, and location of the carcass, a photograph, cause of death, if known, and any other pertinent information. For the Silver State South Project and Southern California Edison's substation, please contact the Southern Nevada Fish and Wildlife Office by telephone at (702) 515-5230 or electronic mail. For the Stateline Project, please contact the Ventura Fish and Wildlife Office by

telephone (805 644-1766) and or electronic mail.

Injured desert tortoises must be taken to a qualified veterinarian for treatment. If any injured desert tortoises survive, the Bureau must contact the Service regarding their final disposition.

Care must be taken in handling dead specimens to preserve biological material in the best possible state for later analysis, if such analysis is needed. The Service will make this determination when the Bureau provides notice that a desert tortoise has been killed by project activities.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. We recommend that the Bureau require Stateline to mark small desert tortoises from within the Stateline project site prior to their translocation. This marking would provide some information on their status post-translocation if they are encountered during future surveys or monitoring efforts. If the Bureau determines that it will include this requirement, we suggest that the authorized biologist contact the Desert Tortoise Recovery Office to ascertain the most appropriate means of marking the animals.

2. During site visits in the vicinity of the Stateline Hills, Service staff observed copious amounts of burro scat. Because burros can trample small desert tortoises; spread weeds; disrupt the surface of the substrate and cryptogamic crusts, which facilitates the spread of weeds; and disturb or destroy shrubs that desert tortoises use for cover, we recommend that the Bureau conduct additional burro gathers in this area.

3. We recommend that the Bureau and Applicants develop a disposition plan for any nests that relocated from the project sites. We recommend that the nests be monitored periodically to ascertain whether the eggs hatched. This information may prove useful in determining whether our current guidance (Service 2009) needs revision.

4. We recommend that the Bureau require Stateline, Silver State and Southern California Edison to conduct specific searches for small desert tortoises in portions of the project areas where densities of these individuals may be greater. Biologists at the Ivanpah Solar Electric Generating System removed numerous small individuals by using search techniques specific to small desert tortoises.

5. In the Effects of the Action - Effects on Recovery section of this biological opinion, we noted that changes in any of the sampled metrics over time and among sites that rise to the level of significance (alpha = 0.05) would likely indicate changes in demographic and genetic stability and that the Bureau would be required to re-initiate formal consultation, pursuant to section 7(a)(2) of the Endangered Species Act, if this new information was related to the effects of the Silver State South or Stateline Solar Projects on connectivity. To attempt to avoid the need for re-initiation of formal consultation, we recommend that the Bureau contact the Service if changes in any of the sampled metrics differ at the alpha = 0.2 level of significance. This early warning may enable the agencies and Applicants to implement adaptive measures to avoid greater differences in the mortality rates.

6. In the Incidental Take Statement of this biological opinion, we noted that we would consider the amount or extent of take of translocated or resident desert tortoises to be exceeded if the mortality rates among these groups of desert tortoises is significantly different (alpha = 0.05). To attempt to avoid the need for re-initiation of formal consultation, we recommend that the Bureau contact the Service if the mortality rates of translocated and resident desert tortoises in comparison to control animals differs at the alpha = 0.2 level of significance. This early warning may enable the agencies and Applicants to implement adaptive measures to avoid greater differences in the mortality rates.

REINITIATION NOTICE

This concludes formal consultation on the Bureau's proposal to issue right-of-way grants to the Stateline and Silver State South projects, respectively, and to Southern California Edison for the substation and ancillary facilities. As provided in 50 Code of Federal Regulations 402.16, re-initiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

As we discussed in the Effects of the Action - Effects on Recovery section of this biological opinion, we noted that changes in any of the sampled metrics over time and among sites that rise to the level of significance (alpha = 0.05) would likely indicate changes in demographic and genetic stability; we also noted that these changes may be related to the Silver State South and Stateline Solar projects. If the changes in demographic and genetic stability are related to the Silver State South and Stateline Solar projects, this new information would reveal effects of the agency actions that may affect the desert tortoise in a manner or to an extent that we did not consider in this biological opinion.

In instances where the amount or extent of incidental take is exceeded, the exemption issued pursuant to section 7(o)(2) will have lapsed and any further take would be a violation of section 4(d) or 9. Consequently, we recommend that any operations causing such take cease pending re-initiation.

If you have any questions, please contact Ray Bransfield of my staff at (805) 644-1766, extension 317, or Michael Burroughs of the Southern Nevada Fish and Wildlife Office at (702) 515-5242.

Appendices

1 - Mojave population of the desert tortoise (*Gopherus agassizii*). 5-year review: summary and evaluation. Available on disk or hard copy by request or at http://ecos.fws.gov/docs/five_year_review/doc3572.DT%205Year%20Review_FINAL.pdf.

2 - Methodology used to estimate the number of desert tortoises and eggs present in the action area.

Appendix 2. Estimating the Number of Large Desert Tortoises in the Ivanpah Valley

California portion

Average density of large desert tortoises in the Ivanpah Critical Habitat Unit (Service 2009b, 2012a, 2012b, 2012e, 2012f) = 9.7/square mile

Modeled desert tortoise (does not include the Primm Valley Golf Course, Ivanpah Solar Electric Generating System, joint port of entry, etc.) (Darst 2013) = 258.18* square miles

9.7/square mile x 258.18* square miles = 2,504.35 large desert tortoises

Nevada portion

Estimated density of large desert tortoises from past surveys in the northern part of the valley (Ironwood 2012b) = 8.1/square mile

Modeled desert tortoise (does not include Primm, the Silver State North Project, Walter M. Higgins Generating Station, etc.) (Darst 2013)= 255.32* square miles

8.1/square mile x 255.32* square miles = 2,068.09 large desert tortoises

Total
2,504.35 + 2,068.09 = 4,572.44 large desert tortoises

REFERENCES CITED

Allen, M.F., and A. McHughen. 2011. Solar power in the desert: are the current large-scale solar developments really improving California's environment? U.C. Riverside: center for conservation biology.

Allendorf, F.W., G. H. Luikart, and S.N. Aitken. 2007. Conservation and the genetics of populations. Wiley-Blackwell.

Allison, L. 2013a. Electronic mail. Desert tortoise densities in the Eastern Mojave Recovery Unit. Dated July 22. Desert tortoise monitoring coordinator, Desert Tortoise Recovery Office, U.S. Fish and Wildlife Service. Reno, Nevada.

Allison, L. 2013b. Electronic mail. Range-wide population trends. Dated September 9. Desert tortoise monitoring coordinator, Desert Tortoise Recovery Office, U.S. Fish and Wildlife Service. Reno, Nevada.

Averill-Murray, R. 2013. Electronic mail. Ivanpah connectivity figures. Dated April 19. Desert Tortoise recovery coordinator, Desert Tortoise Recovery Office, U.S. Fish and Wildlife Service. Reno, Nevada.

Averill-Murray, R., C.R. Darst, N. Strout, and M. Wong. 2013. Conserving population linkages for the Mojave desert tortoise. Herpetological Conservation Biology 8(1):1-15.

Beier, P., D.R. Majka, and W.D. Spencer. 2008. Forks in the road: choices in procedures for designing wildland linkages. Conservation Biology 22(4):836-851.

Berry, K.H. 1986. Desert tortoise (*Gopherus agassizii*) relocation: implications of social behavior and movements. Herpetologica 42(1):113-125.

Blandford, C. 2013a. Electronic mail. Application of the Turner (1987) life table to the adult population estimates for the Stateline and Silver State South project areas. Dated July 1. Ironwood Consulting, Inc. Riverside, California.

Blandford, C. 2013b. Electronic mail. Information on desert tortoise survey results and acreages – Silver State South. Dated August 2. Ironwood Consulting, Inc. Riverside, California.

Blandford, C. 2013c. Electronic mail. Information on desert tortoise incidental sightings and burrow locations. Dated July 25. Ironwood Consulting, Inc. Riverside, California.

Boarman, W.I. 2002. Threats to desert tortoise populations: A critical review of the literature. San Diego Field Station, Western Ecological Research Center, U.S. Geological Survey. San Diego, California.

Bransfield, R. 2013. Brief prepared for the Secretary of the Interior. Dated June 25. Senior Biologist, Ventura Fish and Wildlife Office, U.S. Fish and Wildlife Service. Ventura, California.

Britten, H.B., B.R. Riddle, P.F. Brussard, R. Marlow, and T.E. Lee. 1997. Genetic delineation of management units for the desert tortoise, *Gopherus agassizii*, in the northeastern Mojave Desert. Copeia:523-530.

Bureau of Land Management. 1998. Proposed Las Vegas resource management plan and final environmental impact statement. Las Vegas Field Office, Las Vegas, Nevada. 2 volumes.

Bureau of Land Management. 2002. Final environmental impact statement: proposed Northern and Eastern Mojave Desert management plan – amendment to the California Desert Conservation Area Plan. California Desert District. Moreno Valley, California.

Bureau of Land Management. 2010a. Record of decision for the Silver State Solar Energy Project. Las Vegas Field Office. Las Vegas, Nevada.

Bureau of Land Management. 2010b. Record of decision for the Ivanpah Solar Electric Generating System project and associated amendment to the California Desert Conservation Area Plan. Needles Field Office. Needles, California.

Bureau of Land Management. 2012a. Draft environmental impact statement for the Stateline Solar Farm Project. Needles Field Office. Needles, California.

Bureau of Land Management. 2012b. Draft environmental impact statement for the Silver State Solar South Project. Las Vegas Field Office. Las Vegas, Nevada.

Bureau of Land Management. 2013a. Revised biological assessment. Stateline Solar Farm Project. Case file number CACA-48669. San Bernardino County, California. Dated July 3. Needles, California.

Bureau of Land Management. 2013b. Withdrawal of request for reinititation of consultation for the Calico Solar Project. Dated August 09. Memorandum to Field Supervisor, Ventura Fish and Wildlife Office, Ventura, California. From Deputy State Director, California State Office. Sacramento, California.

Bureau of Land Management. 2013c. Initiation of consultation on First Solar's Stateline Solar Farm Project. Dated January 02. Memorandum to Field Supervisor, Ventura Fish and Wildlife Office, Ventura, California. From Field Office Manager, Needles Field Office. Needles, California.

Bureau of Land Management. 2013d. Re-initiation of consultation on First Solar's Silver State Solar Project. Dated February 11. Memorandum to Field Supervisor, Ventura Fish and Wildlife Office, Ventura, California. From Field Office Manager, Needles Field Office. Needles, California.

Bureau of Land Management. 2013e. Agreement to consolidate consultations on First Solar's Stateline Solar Farm Project and Silver State Solar South Project. Dated March 12. Memorandum to Field Supervisor, Ventura Fish and Wildlife Office, Ventura, California. From Field Office Manager, Needles Field Office. Needles, California

Bureau of Land Management. 2013f. Desert tortoise translocation plan for Stateline Solar Farm Project. Dated June 27. Prepared with support from Ironwood Consulting. Redlands, California. Needles, California.

Bureau of Land Management. 2013g. Final supplemental environmental impact statement for the Silver State Solar South Project and proposed Las Vegas Field Office resource management plan amendment. DOI-BLM-NV-S010-2012-0067-EIS. Las Vegas Field Office. Las Vegas, Nevada.

Bureau of Land Management, County of San Bernardino, and City of Barstow. 2005. Final environmental impact report and statement for the West Mojave Plan; a habitat conservation plan and California Desert Conservation Area Plan amendment. California Desert District, Moreno Valley, California.

Bureau of Land Management and Ironwood Consulting. 2013a. Desert tortoise connectivity assessment within the Ivanpah Valley: discussion of the Stateline Solar Farm and Silver State Solar South Projects. Dated July 30. Prepared for Southern Nevada Field Office and Ventura Fish and Wildlife Office, U.S. Fish and Wildlife Service, Las Vegas, Nevada, and Ventura, California. Las Vegas Field Office, Las Vegas, Nevada, and Needles Field Office, Needles, California, and Redlands, California.

Bureau of Land Management and Ironwood Consulting. 2013b. Desert tortoise translocation plan for Silver State Solar South Project. Dated July 21. Las Vegas Field Office, Las Vegas, Nevada and Redlands, California.

Bureau of Land Management and Ironwood Consulting. 2013c. Supplemental biological assessment. Silver State Solar South Project. Case file N-85077. Dated June 30. Las Vegas, Nevada, and Redlands, California.

Bureau of Land Management, Ironwood Consulting, and Corvus Ecological Consulting. 2013. Raven management plan for Silver State Solar South Project. Dated July 25. Prepared for Southern Nevada Field Office, Las Vegas, Nevada. Las Vegas Field Office, Las Vegas, Nevada, Redlands, California, and Flagstaff, Arizona.

Burroughs, M. 2012. Electronic mail. Information on solar projects in desert tortoise habitat in Nevada for which the Service has issued biological opinions. Dated April 26. Fish and Wildlife Biologist, Southern Nevada Field Office, U.S. Fish and Wildlife Service. Las Vegas, Nevada.

Burroughs, M. 2013a. Electronic mail. Information on seasonal restriction of the Southern Nevada Off-Road Enthusiasts biological opinion. Dated July 30. Biologist, Southern Nevada Field Office, U.S. Fish and Wildlife Service. Las Vegas, Nevada.

Burroughs, M. 2013b. Electronic mail. Comments on the draft biological opinion for the Stateline and Silver State Solar South projects, San Bernardino County, California, and Clark County, Nevada (Stateline: 2800(P), CACA-048669, CAD090.01; Silver State South: 6840 (NV-052)) (Stateline: 8-8-13-F-43; Silver State South: 84320-2010-F-0208-R003). . Dated September 23. Biologist, Southern Nevada Field Office, U.S. Fish and Wildlife Service. Las Vegas, Nevada.

Christ, N. 2013. Electronic mail. Status of the Southern Nevada Supplemental Airport. Dated September 26. Renewable energy project manager (acting), Pahrump Field Office, Bureau of Land Management. Las Vegas, Nevada.

Cota, M. 2013a. Electronic mail. Translocation and adequate rainfall. Dated August 28. Wildlife biologist, Pahrump Field Office, Bureau of Land Management. Las Vegas, Nevada.

Cota, M. 2013b. Electronic mail. Comments on the draft biological opinion for the Stateline and Silver State Solar South projects, San Bernardino County, California, and Clark County, Nevada (Stateline: 2800(P), CACA-048669, CAD090.01; Silver State South: 6840 (NV-052)) (Stateline: 8-8-13-F-43; Silver State South: 84320-2010-F-0208-R003). Dated September 18. Wildlife biologist, Pahrump Field Office, Bureau of Land Management. Las Vegas, Nevada.

Darst, C. 2013. Electronic mail. Calculated desert tortoise habitat potential within the action area. Dated August 1. Desert Tortoise Recovery Biologist, U.S. Fish and Wildlife Service Desert Tortoise Recovery Office. Ventura, California.

Davis, D. 2013a. Electronic mail. Number of desert tortoises being monitored as control animals for the Ivanpah Solar Electric Generating System. Dated September 9. Senior Compliance Manager, BrightSource Energy, Inc. Oakland, California.

Davis, D. 2013b. Electronic mail. Number of desert tortoises removed from the joint port of entry site. Dated September 24. Senior Compliance Manager, BrightSource Energy, Inc. Oakland, California.

Desert Stateline, LLC. 2013. Integrated weed management plan Stateline Solar Farm Project San Bernardino County, California. Oakland, California.

Drake, K.K., T.C. Esque, K.E. Nussear, C. Aiello, P. Emblidge, P.A. Medica. 2010. An annual report for desert tortoise translocation research at the Fort Irwin Southern Expansion Translocation Area. Prepared for the U.S. Army National Training Center, Natural Resource Program Manager.

Drake, K.K., K.E. Nussear, T.C. Esque, A.M. Barber, K.M. Vittum, P.A. Medica, C.R. Tracy, and K.W. Hunter. 2012. Does translocation influence physiological stress in the desert tortoise? Animal Conservation doi:10.1111/j.1469-1795.2012.00549.x.

Edwards, T., C.S. Goldberg, M.E. Kaplan, C.R. Schwalbe, and D.E. Swann. 2004. Implications of anthropogenic landscape change on inter-population movements of the desert tortoise (*Gopherus agassizii*). Conservation Genetics 5:485-499.

Ennen, J.R., J.E. Lovich, K.P. Meyer, C. Bjurlin, and T.R. Arundel. 2012. Nesting ecology of a population of Gopherus agassizii at a utility-scale wind energy facility in Southern California. Copeia 2:222-228.

Esque, T.C., K.E. Nussear, K.K. Drake, A.D. Walde, K.H. Berry, R.C. Averill-Murray, A.P. Woodman, W.I. Boarman, P.A. Medica, J. Mack, J.S. Heaton. 2010. Effects of subsidized predators, resource variability, and human population density on desert tortoise populations in the Mojave Desert, USA. Endangered Species Research 12(2):167-177.

Fernandes, J., N. Flynn, S. Gibbes, M. Griffis, T. Isshiki, S. Killian, L. Palombi, N. Rujanavech, S. Tomsky, and M. Tondro. 2010. Renewable energy in the California desert. Mechanisms for evaluating solar development on public lands. School of Natural Resources and Environment, University of Michigan. Ann Arbor, Michigan.

Fesnock, A. 2013a. Electronic mail. Use of control desert tortoises from the Ivanpah Solar Electric Generating System for the Stateline Solar Project. Dated September 3. Wildlife and Threatened and Endangered Species Lead, California State Office, Bureau of Land Management. Sacramento, California.

Fesnock, A. 2013b. Electronic mail. Duration of post-translocation monitoring. Dated September 10. Wildlife and Threatened and Endangered Species Lead, California State Office, Bureau of Land Management. Sacramento, California.

Field, K.J. 2013. Electronic mail. Information regarding disease testing of desert tortoises. Dated September 9. Desert tortoise recovery biologist, Desert Tortoise Recovery Office, U.S. Fish and Wildlife Service. Reno, Nevada.

Field, K.J., C.R. Tracy, P.A. Medica, R.W. Marlow, and P.S. Corn. 2007. Return to the wild: translocation as a tool in conservation of the desert tortoise (*Gopherus agassizii*). Biological Conservation 136:232-245.

Fort Irwin Research Coordination Meeting. 2008. Meeting notes. Dated October 29.

Germano, D.J., R.B. Bury, T.C. Esque, T.H. Fritts, and P.A. Medica. 1994. Range and habitat of the desert tortoise. Pages 57-72 *in* R.B. Bury and D.J. Germano (eds.), Biology of the North American Tortoises. National Biological Survey, Fish and Wildlife Research 13, Washington, D.C.

Hagerty, B.E., and C.R. Tracy. 2010. Defining population structure for the Mojave desert tortoise. Conservation genetics 11:1795-1807.

Hagerty, B.E., K.E. Nussear, T.C. Esque, C.R. Tracy. 2010. Making molehills out of mountains: landscape genetics of the Mojave desert tortoise. Landscape Ecology:26:267-280.

Hoff, K.V., and R.W. Marlow. 2002. Impacts of vehicle road traffic on desert tortoise populations with consideration of conservation of tortoise habitat in southern Nevada. Chelonian Conservation and Biology 4:449-456.

Ironwood Consulting. 2011. Biological resources technical report – Stateline Solar Farm Project, San Bernardino County, California. Redlands, California.

Ironwood Consulting. 2012a. Draft raven management plan – Desert Stateline Solar Farm (Stateline) Project. Dated May 16. Prepared for Bureau of Land Management, Needles Field Office and Desert Stateline, LLC, San Francisco, California. Redlands, California.

Ironwood Consulting. 2012b. Revised biological resources technical report – Silver State Solar South Project. Clark County, Nevada. Redlands, California.

Ironwood Consulting. 2013. Integrated weed management plan. Silver State Solar Power South. Clark County, Nevada. Dated September 12. Redlands, California.

Jones, B. 2013. New diseases in the Mojave desert tortoise population. Dated August 28. Environmental specialist, California Department of Fish and Wildlife. Palmdale, California.

LaPre, L. 2013a. Electronic mail. Translocation and adequate rainfall. Dated August 27. Wildlife biologist, California Desert District, Bureau of Land Management. Moreno Valley, California.

LaPre, L. 2013b. Electronic mail. Comments on the draft biological opinion for the Stateline and Silver State Solar South projects, San Bernardino County, California, and Clark County, Nevada (Stateline: 2800(P), CACA-048669, CAD090.01; Silver State South: 6840 (NV-052)) (Stateline: 8-8-13-F-43; Silver State South: 84320-2010-F-0208-R003). Dated September 23. Wildlife biologist, California Desert District, Bureau of Land Management. Moreno Valley, California.

LaPre, L. 2013c. Electronic mail. Removal of the Mesquite site as an alternative recipient area. Dated September 19. Wildlife biologist, California Desert District, Bureau of Land Management. Moreno Valley, California.

LaPre, L. 2013d. Electronic mail. Duration of post-translocation monitoring. Dated September 30. Wildlife biologist, California Desert District, Bureau of Land Management. Moreno Valley, California.

Longshore, K.M., J.R Jaeger, and M. Sappington. 2003. Desert tortoise (*Gopherus agassizii*) survival at two eastern Mojave desert sites: death by short-term drought? Journal of Herpetology 37(1):169-177.

Lovich, J.E., and D. Bainbridge. 1999. Anthropogenic degradation of the Southern California Desert ecosystem and prospects for natural recovery and restoration. Environmental Management 25(3):309-326.

Lowe, W.H., and F.W. Allendorf. 2010. What can genetics tell us about population connectivity? Molecular Ecology 19:3038–3051.

Millstein, D., and M. Menon. 2011. Regional climate consequences of large-scale cool roof and photovoltaic array deployment. IOPscience 6:1-9.

Murphy, R.W., K.H. Berry, T. Edwards, and A.M. McLukie. 2007. A genetic assessment of the recovery units for the Mojave population of the desert tortoise, *Gopherus agassizii*. Chelonian Conservation and Biology 6:229-251.

National Park Service. 2009. Tortoise on roads in Mojave Preserve. Mojave National Preserve Science Newsletter 1:7-9.

National Park Service. 2011. Desert tortoise and highway traffic: a resource management concern. Mojave National Preserve Science Newsletter 1:14-16.

Nussear, K.E. 2004. Mechanistic investigation of the distributional limits of the desert tortoise *Gopherus agassizii*. Dissertation. University of Nevada. Reno, Nevada.

Nussear, K.E., T.C. Esque, R.D. Inman, L. Gass, K.A. Thomas, C.S.A. Wallace, J.B. Blainey, D.M. Miller, and R.H.Webb. 2009. Modeling habitat of the desert tortoise (*Gopherus agassizii*) in the Mojave and parts of the Sonoran Deserts of California, Nevada, Utah, and Arizona. U.S. Geological Survey Open-File Report 2009-1102.

Nussear, K.E., C.R. Tracy, P.A. Medica, D.S. Wilson, R.W. Marlow, and P.S. Corn. 2012. Translocation as a conservation tool for Agassiz's desert tortoises: Survivorship, reproduction, and movements. The Journal of Wildlife Management; DOI: 10.1002/jwmg.390.

Nussear, K.E., T.C. Esque, and A.G. Vandergast. 2013. Conservation corridors for desert tortoises. Dated August 2. Prepared for Southern Nevada Field Office and Ventura Fish and Wildlife Office, U.S. Fish and Wildlife Service, Las Vegas, Nevada, and Ventura, California. Las Vegas Field Office, Las Vegas, Nevada, and Needles Field Office, Needles, California, and Redlands, California.

Oftedal, O.T., S. Hillard, and D.J. Morafka. 2002. Selective spring foraging by juvenile desert tortoises (*Gopherus agassizii*) in the Mojave Desert: evidence of an adaptive nutritional strategy. Chelonian Conservation and Biology 4(2):341-352.

RECON. 2000. Final Clark County multiple species habitat conservation plan and environmental impact statement for issuance of a permit to allow incidental take of 79 species in Clark County, Nevada. Dated September 2000. Prepared for Clark County Department of Comprehensive Planning and U.S. Fish and Wildlife Service, Las Vegas and Reno, Nevada. San Diego, California.

Saethre, M.B., T.C. Esque, P.A. Medica, R. Marlow, and C.R. Tracy. 2003. Determining carrying capacity of desert tortoises. Abstract of a paper present at the 28th Annual Meeting and Symposium of the Desert Tortoise Council.

Schlesinger, W.H., J. Belnap, and G. Marion. 2009. On carbon sequestration in desert ecosystems. Global Change Biology 15(6):1488–1490.

Tracy, C.R., R. Averill-Murray, W.I. Boarman, D. Delehanty, J. Heaton, E. McCoy, D. Morafka, K. Nussear, B. Hagerty, and P. Medica. 2004. Desert Tortoise Recovery Plan Assessment. Prepared for the U.S. Fish and Wildlife Service. Reno, Nevada.

Turner, F.B., K.H. Berry, D.C. Randall, and G.C. White. 1987. Population ecology of the desert tortoise at Goffs, California, 1983-1986. Prepared for the Southern California Edison Company. Rosemead, California.

U.S. Fish and Wildlife Service. 1994. Desert tortoise (Mojave population) recovery plan. Portland, Oregon.

U.S. Fish and Wildlife Service. 1997a. Biological opinion for the proposed removal of hazardous materials at Molycorp's Mountain Pass Mine and Ivanpah Dry Lake, San Bernardino County, California. Dated May 1. Memorandum to District Manager, Bureau of Land Management, California Desert District, Riverside, California. From Field Supervisor, Ventura Fish and Wildlife Office. Ventura, California.

U.S. Fish and Wildlife Service. 1997b. Re-initiation of formal consultation for clean-up and remediation activities at Molycorp's hazardous material removal, San Bernardino County, California. Dated October 14. Memorandum to District Manager, Bureau of Land Management, California Desert District, Riverside, California. From Field Supervisor, Ventura Fish and Wildlife Office. Ventura, California.

U.S. Fish and Wildlife Service. 1998. Biological opinion for implementation of proposed actions in the Las Vegas District's proposed resource management plan/final environmental impact statement. File No. 1-5-98-F-053. Dated June 18. Memorandum to District Manager, Las Vegas District, Bureau of Land Management, Las Vegas, Nevada. From Field Supervisor, Reno Fish and Wildlife Office. Reno, Nevada.

U.S. Fish and Wildlife Service. 2001. Biological opinion for the General Management Plan for the Mojave National Preserve (1-8-00-F-36). Dated June 17. Memorandum to Superintendent, Mojave National Preserve, National Park Service. Barstow, California. From Field Supervisor, Ventura Fish and Wildlife Office. Ventura, California.

U.S. Fish and Wildlife Service. 2002. Biological opinion and request for concurrence with effect determination for listed and proposed species associated with the Kern River Gas Transmission Company Project in California, Nevada, Utah, and Wyoming. Dated July 9. Submitted to the Federal Energy Regulatory Commission. From Field Supervisor, Nevada Fish and Wildlife Office. Reno, Nevada.

U.S. Fish and Wildlife Service. 2005. Biological opinion for the California Desert Conservation Area Plan [desert tortoise] (6840 CA930(P)) (1-8-04-F-43R). Dated March 31. Memorandum to State Director, Bureau of Land Management, Sacramento, California. From Field Supervisor, Ventura Fish and Wildlife Office. Ventura, California.

U.S. Fish and Wildlife Service. 2006a. Biological opinion for construction of a joint port of entry facility, San Bernardino County, California (HAD-CA, File #08-SBd-15, PM 177.3/181.1, I-15 Joint Port of Entry Facility, Document # P54202) (1-8-06-F-20). Dated March 31. Submitted to California Division Administrator, Federal Highway Administration, Sacramento, California. From Acting Assistant Field Supervisor, Mojave/Great Basin Desert Division, Ventura Fish and Wildlife Office. Ventura, California.

U.S. Fish and Wildlife Service. 2006b. Biological opinion for Molycorp, Inc., proposed removal of wastewater discharge pipeline and associated contaminated soils, upgrade segments of adjacent freshwater pipeline within right-of-way, and abandonment of monitoring wells, Mountain Pass, San Bernardino County, California. Dated June 5. Memorandum to District Manager, Bureau of Land Management, California Desert District, Moreno Valley, California. From Acting Assistant Field Supervisor, Ventura Fish and Wildlife Office. Ventura, California.

U.S. Fish and Wildlife Service. 2008. Environmental assessment to implement a desert tortoise recovery plan task: reduce common raven predation on the desert tortoise. Ventura Fish and Wildlife Office. Ventura, California.

U.S. Fish and Wildlife Service. 2009a. Desert tortoise field manual. http://www.fws.gov/ventura/species_information/protocols_guidelines/index.html

U.S. Fish and Wildlife Service. 2009b. Range-wide monitoring of the Mojave population of the desert tortoise: 2007 annual report. Desert Tortoise Recovery Office. Reno, Nevada.

U.S. Fish and Wildlife Service. 2010a. Formal consultation for the Silver State Solar Project (NextLight Renewable Power, LLC), Clark County, Nevada. File No. 84320-2010-F-0208. Dated September 16. Memorandum to Field Manager, Pahrump Field Office, Bureau of Land Management, Las Vegas, Nevada. From State Supervisor, Nevada Fish and Wildlife Office. Reno, Nevada.

U.S. Fish and Wildlife Service. 2010b. Desert tortoise – authorized biologist and monitor responsibilities and qualifications. http://www.fws.gov/ventura/speciesinfo/protocols_guidelines/docs/dt/DT%20Auth%20Bio%20qualifications%20statement%2010_20_08.pdf

U.S. Fish and Wildlife Service. 2010c. Revised pre-project survey protocols for the desert tortoise (*Gopherus agassizii*). http://www.fws.gov/ventura/species_information/protocols_guidelines/docs/dt/DT%20Pre-project%20Survey%20Protocol_2010%20Field%20Season.pdf

U.S. Fish and Wildlife Service. 2010d. Mojave population of the desert tortoise (*Gopherus agassizii*) 5-year review: summary and evaluation. Desert Tortoise Recovery Office. Reno, Nevada.

U.S. Fish and Wildlife Service. 2010f. Biological opinion for Southern Nevada Off-Road Enthusiasts (SNORE) Racing Association's Battle at Primm Truck and Buggy Race, Clark County, Nevada. File No. 84320-2010-F-0105. Memorandum to Assistant Field Manager, Division of Renewable Resources, Las Vegas Field Office, Bureau of Land Management, Las Vegas, Nevada. Dated January 7. From State Supervisor, Nevada Fish and Wildlife Office. Reno, Nevada.

U.S. Fish and Wildlife Service. 2010g. Formal consultation for the Silver State Solar Project (NextLight Renewable Power, LLC), Clark County, Nevada. File No. 84320-2010-F-0208. Dated September 16. Memorandum to Field Manager, Pahrump Field Office, Bureau of Land Management, Las Vegas, Nevada. From State Supervisor, Nevada Fish and Wildlife Office. Reno, Nevada.

U.S. Fish and Wildlife Service. 2011a. Translocation of desert tortoises (Mojave Population) from project sites: plan development guidance.

U.S. Fish and Wildlife Service. 2011b. Revised recovery plan for the Mojave population of the desert tortoise (*Gopherus agassizii*). U.S. Fish and Wildlife Service, Pacific Southwest Region, Sacramento, California. May 2011.

U.S. Fish and Wildlife Service. 2011c. Biological opinion on BrightSource Energy's Ivanpah Solar Electric Generating System Project, San Bernardino County, California [CACA-48668, 49502, 49503, 49504] (8-8-10-F-24R). Dated June 10. Memorandum to District Manager, California Desert District, Bureau of Land Management, Moreno Valley, California. From Field Supervisor, Ventura Fish and Wildlife Office. Ventura, California.

U.S. Fish and Wildlife Service. 2011e. Recovery data call report. Fiscal year 2011. https://ecos.fws.gov/tess/reports.

U.S. Fish and Wildlife Service. 2011f. Formal consultation for the Eldorado-Ivanpah Power Transmission Project, Clark County, Nevada and San Bernardino County, California. Dated April 29. Memorandum to Assistant Field Managers, Needles and Las Vegas Field Offices, Bureau of Land Management. From Acting State Supervisor, Nevada Fish and Wildlife Office. Reno, Nevada.

U.S. Fish and Wildlife Service. 2011g. Re-initiation of consultation for operation and maintenance of the Kern River and Mojave Gas Transmission Pipeline in Nevada, California, Utah, and Wyoming. Dated September 28. Submitted to the Bureau of Land Management. From Acting State Supervisor, Nevada Fish and Wildlife Office. Reno, Nevada.

U.S. Fish and Wildlife Service. 2012a. Range-wide monitoring of the Mojave population of the desert tortoise: 2008 and 2009 annual report. Desert Tortoise Recovery Office. Reno, Nevada.

U.S. Fish and Wildlife Service. 2012b. Range-wide monitoring of the Mojave population of the desert tortoise: 2010 annual report. Desert Tortoise Recovery Office. Reno, Nevada.

U.S. Fish and Wildlife Service. 2012c. Biological opinion on the proposed addition of maneuver training lands at Fort Irwin, California (8-8-11-F-38R). Dated April 27. Letter to Chief of Staff, Headquarters, National Training Center and Fort Irwin, Fort Irwin, California. From Field Supervisor, Ventura Fish and Wildlife Office. Ventura, California.

U.S. Fish and Wildlife Service. 2012d. Biological opinion on the land acquisition and airspace establishment to support large-scale Marine Air Ground Task Force live-fire and maneuver training, Twentynine Palms, California (8-8-11-F-65). Dated July 17. Letter to Commanding General, Marine Corps Air Ground Combat Center, Twentynine Palms, California. From Field Supervisor, Ventura Fish and Wildlife Office. Ventura, California.

U.S. Fish and Wildlife Service. 2012e. Draft range-wide monitoring of the Mojave population of the desert tortoise: 2011 annual report. Desert Tortoise Recovery Office. Reno, Nevada.

U.S. Fish and Wildlife Service. 2012f. Draft range-wide monitoring of the Mojave population of the desert tortoise: 2012 annual report. Desert Tortoise Recovery Office. Reno, Nevada.

U.S. Fish and Wildlife Service. 2012g. Biological Opinion on the Kern River Gas Transmission Company's Mountain Pass Lateral Project, San Bernardino County, California [Docket No. CP11-46] (8-8-12-F-4). Dated January 11. Letter to James Martin, Federal Energy Regulatory Commission, Washington, D.C., and Raymond Lee, Bureau of Land Management, Needles, California. From Field Supervisor, Ventura Fish and Wildlife Office. Ventura, California.

U.S. Fish and Wildlife Service. 2013a. Acknowledgement of requests to initiate formal consultation on First Solar's Stateline Solar Project, San Bernardino County, California and re-initiate formal consultation on First Solar's Silver State South Project, Clark County, Nevada. Dated March 4. Memorandum to State Directors, Bureau of Land Management, Sacramento, California and Reno, Nevada. From Regional Director, Pacific Southwest Region. Sacramento, California.

U.S. Fish and Wildlife Service. 2013b. Biological opinion on the Desert Harvest Solar Project, Riverside County, California [CACA 044919]. Dated January 15. Memorandum to Field Manager, Palm Springs-South Coast Field Office, Bureau of Land Management, Moreno Valley, California. From Field Supervisor, Carlsbad Fish and Wildlife Office. Carlsbad, California.

U.S. Fish and Wildlife Service. 2013c. Biological opinion on the McCoy Solar Power Project, Riverside County, California. Dated March 6. Memorandum to Field Manager, California Desert District Office, Bureau of Land Management, Moreno Valley, California. From Field Supervisor, Carlsbad Fish and Wildlife Office. Carlsbad, California.

U.S. Fish and Wildlife Service. 2013d. Health assessment procedures for the Mojave desert tortoise (*Gopherus agassizii*): A handbook pertinent to translocation. Desert Tortoise Recovery Office. Reno, Nevada.

U.S. Fish and Wildlife Service. 2013e. Excel table of mortalities associated with the Ivanpah Solar Electric Generating System project. Accessed September 7. Ventura Fish and Wildlife Office. Ventura, California.

U.S. Fish and Wildlife Service. 2013f. Draft biological opinion for the Stateline and Silver State Solar South projects, San Bernardino County, California, and Clark County, Nevada (Stateline: 2800(P), CACA-048669, CAD090.01; Silver State South: 6840 (NV-052)) (Stateline: 8-8-13-F-43; Silver State South: 84320-2010-F-0208-R003). Dated September 11. Memorandum to Field Manager, Needles Field Office, Bureau of Land Management, Needles, California, and Assistant Field Manager, Las Vegas Field Office, Bureau of Land Management, Las Vegas, Nevada. From Acting Field Supervisor, Ventura Fish and Wildlife Office. Ventura, California.

U.S. Fish and Wildlife Service. 2013g. Formal programmatic consultation under section 7 of the Endangered Species Act for effects to threatened and endangered species and their critical habitat that may occur as a result of actions proposed by the Southern Nevada District Office, Bureau of Land Management. Dated January 2. Memorandum to Assistant Field Manager, Las Vegas Field Office, Bureau of Land Management, Las Vegas, Nevada. From State Supervisor, Nevada Fish and Wildlife Office. Reno, Nevada.

Walde, A.D., W.I. Boarman, and A.P. Woodman. 2011. Comparing translocation methods and effectiveness for desert tortoises at Fort Irwin, a comprehensive study: 2011 report. Dated December 31.

Webb, R.H. 2002. Recovery of severely compacted soils in the Mojave Desert, California, USA. Arid Land Research and Management 16:291-305.

Wilson, D.S., D.J. Morafka, C.R. Tracy, and K.A. Nagy. 1999. Winter activity of juvenile desert tortoise (*Gopherus agassizii*) in the Mojave Desert. Journal of Herpetology 33(3): 496-501.

Xian, G., C. Homer, and J. Fry. 2009. Updating the 2001 National Landcover Database land cover classification to 2006 by using Landsat imagery change detection methods. Remote Sensing of Environment 113:1133-1147.

Yanes, M., J.M. Velasco., and F. Suarez. 1995. Permeability of roads and railways to vertebrates: the importance of culverts. Biological Conservation 71:217-22