United States Department of the Interior

FISH AND WILDLIFE SERVICE
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IN REPLY REFER TO:
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June 10, 2011

Memorandum

To: District Manager, California Desert District, Bureau of Land Management, Moreno Valley, California

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

Subject: 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)

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) issuance of a right-of-way grant to Solar Partners I, LLC, Solar Partners II, LLC, and Solar Partners VIII, LLC for the Ivanpah Solar Electric Generating System (ISEGS) and its 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.). Because BrightSource Energy is a parent company for all Solar Partner Companies, this biological opinion refers to the project proponents collectively as BrightSource. The proposed project involves construction, operation, maintenance, and decommissioning of a 370-megawatt solar thermal power plant and associated infrastructure and facilities on 3,582 acres of public land managed by the Bureau. This biological opinion replaces our October 1, 2010 biological opinion previously issued for the Bureau's right-of-way grant for the ISEGS project (Service 2010d). Your February 24, 2011 request for re-initiation of the October 1, 2010, consultation was received in our office on February 28, 2011, and was followed by information to support your request on March 25, 2011 and April 25, 2011.

We based this biological opinion on information you provided on March 25 and April 25, 2011, information that accompanied your initial December 7, 2009, request for consultation, and additional information regarding population estimates and revisions to the translocation strategy. This information includes the biological assessment to support re-initiation (Bureau 2011a), Unit 1 clearance survey data (Woodman 2011a), population survey data for Units 2, 3, and the revised recipient sites (Vaughn 2011, Woodman 2011b), the biological assessment for the previous consultation and its revision (CH2MHill 2009a, 2010a), the draft environmental

impact statement and final staff assessment (Bureau and California Energy Commission 2009), the supplemental draft environmental impact statement (Bureau 2010), the management plan for common ravens (CH2MHill 2008b), the project site reclamation plan (CH2MHill 2009c), and the site plan for management of weeds (CH2MHill 2008c). A record of this consultation can be made available at the Ventura Fish and Wildlife Office.

Construction, operation, maintenance, and decommissioning of the ISEGS facility and translocation of desert tortoises do not require activities that would adversely affect the primary constituent elements of critical habitat for the desert tortoise because the actions would not take place within critical habitat or directly or indirectly affect the primary constituent elements. Therefore, we do not address critical habitat in this biological opinion.

Consultation History

On December 7, 2009, the Bureau initiated consultation for construction, operation, maintenance, and decommissioning of the ISEGS facility. Following public comment on the Bureau's draft environmental impact statement and the California Energy Commission's final staff assessment, BrightSource modified its project to reduce adverse effects to desert tortoises and rare plant species. On April 26, 2010, we issued a draft biological opinion to the Bureau (Service 2010c). We revised the draft biological opinion based on comments from the Bureau and BrightSource. On July 21, 2010, the Bureau provided us with a revised translocation strategy (Fesnock 2010b) that required significant revisions to the draft biological opinion. On September 21, 2010, the Bureau provided additional changes to the translocation strategy (Fesnock 2010a), requiring further revisions of the draft biological opinion. On October 1, 2010, we issued a final biological opinion that analyzed the effects associated with the reduced project footprint, the revised translocation strategy, and the comments received from the Bureau and BrightSource.

Following desert tortoise clearance surveys of the first portion of the project, the Bureau provided an annual status report that summarized the results of these surveys (Bureau 2011b). This report did not provide any new information to suggest that the analysis in the 2010 biological opinion was inaccurate and, at that point, the Bureau had not exceeded the take exempted through the 2010 biological opinion. However, disease testing of desert tortoises cleared from Unit 1 of the project site indicated that the translocation strategy in the 2010 biological opinion required revision prior to moving forward with clearance surveys of the other portions of the project because this indicated that the adjacent translocation recipient sites were also likely to contain diseased animals. In addition, construction monitoring of perimeter fence installation around Units 2 and 3 in the winter and spring of 2011 indicated that these portions of the project might contain more desert tortoises than anticipated in the 2010 biological opinion. Based on the need to reassess the population estimates on Units 2 and 3 and the need to revise the translocation strategy to address disease concerns, the Bureau requested re-initiation of consultation on February 24, 2011 (Bureau 2011c). On March 15, 2011, we informed the Bureau that it had not provided sufficient information to initiate consultation

because its request did not include a biological assessment or other information to allow us to perform a new analysis (Service 2011a). On March 25, 2011, the Bureau provided additional information to support re-initiation of consultation (Fesnock 2011a). Following the start of consultation, the Bureau provided a revised biological assessment on April 25, 2011 (Bureau 2011a).

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

Introduction

The Bureau has issued a right-of-way grant to BrightSource for the proposed project for a period of 30 years. BrightSource is proposing to construct and operate a solar energy plant approximately 4.5 miles southwest of Primm, Nevada, and 1.6 miles west of Ivanpah Dry Lake. The proposed site is 0.5 mile west of the Primm Valley Golf Club. The facility would consist of 3 solar electric generating plants, constructed over a 4-year period as follows: (1) Ivanpah 1 – construction of the Ivanpah 1 plant (southernmost site; 914 acres), construction of shared facilities (i.e., power substation, administrative facilities, water line, power lines, and construction logistics area), and improvement of Colosseum Road ; (2) Ivanpah 2 – construction of the Ivanpah 2 plant (middle site; 1,097 acres); and (3) Ivanpah 3 – construction of the Ivanpah 3 plant (northern site; 1,227 acres). BrightSource would also install a 5.7-mile natural gas distribution line, install a 9.5-mile fiber optic line, and re-route several dirt roads/trails that currently cross the proposed ISEGS site.

With respect to construction, operation, maintenance, and decommissioning of the ISEGS facility, the Bureau has not changed the description of the project from the previous consultation. We have restated those aspects of the 2010 biological opinion in addition to all of the previous general minimization measures, common raven measures, weed management measures, and the discussion of the Bureau's compensation requirements. Of these actions, BrightSource has fenced all portions of Unit 1, the construction logistics area (CLA), Colosseum Road, and portions of Units 2 and 3 with desert tortoise exclusion fencing. In addition, it fenced the access route and central power block of Unit 2. BrightSource has begun construction of the power block of Units 1 and 2 and has begun construction of the heliostat field for Unit 1.

This revision to the project description in this biological opinion focuses on the proposed changes to the translocation strategy, proposed modifications to desert tortoise handling procedures, and installation of desert tortoise fencing and culverts along Colosseum Road and Yates Well Road. We summarized the following description of the proposed action from the Bureau's biological assessment and the 2010 biological opinion (Bureau 2011a and Service 2010d).

Construction

Construction of the ISEGS facility would require an average workforce of 474 and a peak workforce of 959. Below, we have provided a detailed description of each stage of project development for the three project sites, the construction logistics area, and other associated infrastructure (i.e., access roads, water wells, water line, gas line and tie-in facility, fiber optic line, etc.). We have described the measures that BrightSource will implement to avoid or minimize adverse effects to the desert tortoise in a later section.

Construction Logistics Area

BrightSource would develop a construction logistics area (CLA) between the Ivanpah 1 and 2 project sites to accommodate construction support facilities (e.g., temporary construction trailers, construction tool sheds, construction lay down areas, and construction parking), the electrical tie-in substation, water wells, permanent facility parking areas, permanent administrative and warehouse facilities, and wheel wash areas. In addition, the CLA would accommodate a segment of Colosseum Road that BrightSource would re-route through the CLA to avoid the Ivanpah 2 project site.

CLA development would begin with surveying and staking the CLA boundaries and grading of a 10-foot-wide perimeter road along the boundary of the CLA to facilitate fence installation. BrightSource would then install an 8-foot high chain-link security fence with desert tortoise exclusion fencing attached to the bottom around the perimeter of the CLA. Alternatively, BrightSource may install desert tortoise exclusion and security fencing separately. Regardless of the method for fence installation, all site development and construction activities described for the CLA would occur within this fenced boundary. This includes grading of selected locations and construction or installation of all construction support facilities and permanent operational facilities.

Ivanpah 1, Ivanpah 2, and Ivanpah 3 Project Sites

Each project site would consist of one heliostat (mirror) array constructed around a 459-foot-tall centralized solar power tower. Ivanpah 1 would contain approximately 53,500 heliostats and Ivanpah 2 and 3 would contain approximately 60,000 heliostats each. Each heliostat consists of two 75.8-square-foot mirrors. All three units (Ivanpah 1, 2, and 3) would have their own individual power block; the biological assessment describes the components of the power blocks. In the re-initiation of consultation, the Bureau has expanded the work area for the power block of Unit 2 by 46 acres.

Prior to site development and construction activities for each phase, BrightSource would install a desert tortoise exclusion fence or a combined exclusion fence and security fence around the entire perimeter of the phase. BrightSource would use the same methods described above for the CLA in installation of this fence. Following fence installation, BrightSource would mow all

vegetation on the project sites to within 12 to 18 inches of the ground surface, grade a site for the power block, and grade additional areas within the project site for parking areas, construction lay down areas, building pads, and internal roads. During the construction stage, BrightSource would improve internal project-site roads, construct the power block, install the heliostat field, install underground piping and wiring, install the generation tie-line, and erect fabrication shops and other construction and administrative buildings. In addition, BrightSource would re-route existing dirt roads/trails around the perimeter of the project site.

Gas Line

In addition to the CLA and the three project sites, BrightSource would construct a 5.7-mile natural gas distribution pipeline. The pipeline would connect to the Kern River Gas Transmission line that traverses Ivanpah Valley 0.5 mile north of the Ivanpah 3 project site. At the point of connection with the Kern River Gas Transmission line, BrightSource would construct a permanent gas metering station (100 feet by 150 feet), requiring a 200-foot by 200-foot temporary construction area. From this metering station, the natural gas line and an 8- to 12-foot-wide access road would head south along the eastern edge of Ivanpah 3 to a metering station (10 feet by 40 feet) near the middle of its western side. From the metering station at Ivanpah 3, the gas line and access road would continue along the eastern edge of Ivanpah 2 to another metering station (20 feet by 40 feet) on the east side of Ivanpah 2. From the Ivanpah 2 metering station, the gas line would continue along the west side of Ivanpah 2 following the asphalt access road to Ivanpah 1. Gas line installation would require a 50-foot-wide construction corridor for access, storage of excavated soil, and pipefitting. In addition, construction of the Ivanpah 3 metering station would require a temporary lay down area within the Ivanpah 3 project site. The Ivanpah 1 and 2 metering stations would use a portion of the Ivanpah 2 solar field for construction lay down.

To allow for gas company access, BrightSource would construct the gas line, access road, and metering stations outside of the fenced project sites for Ivanpah 1, 2, and 3. A portion of the gas line to the Ivanpah 1 project site would be located within the fenced CLA. BrightSource would construct additional spur lines within the fenced project sites to carry gas from the edge of the respective project site to the main power block.

Construction activities related to the metering stations would include grading a pad and installing aboveground and underground gas piping, metering equipment, gas conditioning, pressure regulation, and pigging facilities. The construction contractor would determine which method to use to install the natural gas pipeline. The most common method of pipeline construction includes installation of the pipeline into an open trench approximately 36 inches wide and 3 to 10 feet deep.

Fiber Optic Line

To allow for remote monitoring of the new electrical substation, Southern California Edison (SCE) would construct an 8-mile fiber optic line from the Ivanpah substation to an interface point designated by the local telecommunication carrier in Mountain Pass. SCE would use existing distribution line poles for installation. Installation would require use of a bucket truck, four people, and two pick-up trucks. SCE would string out fiber optic cable between the existing poles. Every 10,000 to 20,000 feet, SCE would establish a 40-foot by 60-foot line stringing set. Crews would work within this area to raise the cable and string it tight over the existing poles. SCE estimates that approximately 20 poles are not accessible from the existing dirt service roads. Workers on foot would install the fiber optic line on these poles.

Access Road Fencing and Culvert Installation

Under the previous consultation, BrightSource fenced Colosseum Road to reduce desert tortoise injury and mortality associated with access route use. To further reduce the potential for mortality on other portions of the project access route, BrightSource would now fence Yates Well Road from Interstate 15 to Colosseum Road with desert tortoise exclusion fencing. The fencing of Yates Well Road would tie into the existing Colosseum Road fencing and into the Interstate 15 fencing. To reduce habitat and population fragmentation associated with this barrier, BrightSource would install three culverts under Colosseum Road to allow movement of desert tortoises under the road.

Operation

The ISEGS facility would have an operating life of up to 30 years and would operate 7 days a week for up to 14 hours a day. During operation, approximately 90 full-time employees would work at the site. ISEGS would use a maximum of 100 acre-feet of water per year for operational purposes. Heliostat washing is the only identified activity that we have described in this section because it is the only operational activity with the potential to have some effects on desert tortoise.

To keep heliostats clean, BrightSource would wash some portion of the heliostat field on a nightly basis, so that every heliostat within the 3 project sites is washed once every 2 weeks. The application rate per heliostat would be about 2.5 gallons per washing for a total use of 10.97 acre-feet per year for Ivanpah 1 and about 12 acre-feet per year for Ivanpah 2 and 3. However, the application rate on Ivanpah 1 may double during construction of Ivanpah 3 due to increased amounts of construction- related dust. During each washing, approximately 0.17 gallon per linear foot of mirror would run off onto the ground beneath the mirror.

Maintenance

In addition to regular, day-to-day operation of the ISEGS facility, BrightSource would need to perform a variety of maintenance actions. BrightSource has grouped these anticipated maintenance activities into three classes. Any maintenance activities that are outside the

approved right-of-way boundary (i.e., the fenced boundary of the project site and the associated perimeter road) for the project will require additional authorizations from the Bureau and additional section 7 consultation.

Class I activities are those maintenance actions that do not result in new surface disturbance. BrightSource would perform these activities by hand or with the use of tools, equipment, and/or vehicles. Class I activities would take place on existing structures or would be staged from existing roads or other disturbed areas. These activities would not include off-road travel. Vehicles used during these activities might include low-boy tractor and trailer, flat bed, utility trucks, forklifts, scissor lifts, cherry pickers, and mechanical hoists. Labor may involve several workers confined to the area in need of maintenance. BrightSource may need to perform these activities on a daily basis.

Class II activities would result in minimal surface disturbance, but would likely require heavy earth-moving equipment including motor graders, bulldozers, front-end loaders, backhoes, water trucks, asphalt pavers, and dump trucks. Typical Class II activities would include: 1) underground utility (e.g., water, gas, sewage, electrical, communication, etc.) repairs, upgrades and tie-ins to structures; 2) motor grading and repairs of existing dirt roads, shoulders, and berms; 3) cut or fill of soil surface to re-establish appropriate cover due to soil erosion after rainfall events; 4) maintenance of drainages, fords and culverts for proper flow of water runoff; 5) maintenance of asphalt roads, shoulders and parking lots; 6) security and desert tortoise exclusion fence repairs; and 7) minor natural gas pipeline repairs that require excavation.

Class III includes maintenance activities that result in major surface disturbance. Typical Class III activities would include: 1) installation of a new underground pipeline a distance of 1,000 feet or more and 2) disturbance of an acre or more for construction of new storm water drainage features. Because we do not have sufficient detail regarding Class III maintenance activities, we cannot adequately analyze their potential effects on desert tortoises. Consequently, we are not addressing Class III maintenance activities or any Class II maintenance activities that would occur outside of the fenced project site that are not associated with repair of fencing. The Bureau has indicated that these actions would require future site-specific authorizations. At the time the Bureau considers authorization of these future activities, it will need to determine whether these future activities may affect desert tortoises. Some of these actions may require future site-specific consultation under section 7.

Decommissioning and Restoration

BrightSource would perform restoration work on all sites disturbed during construction, operation, maintenance, and decommissioning of the ISEGS facilities. For short-term disturbances, BrightSource would begin restoration following completion of ground disturbance and would implement the following general steps: 1) decompaction of soils, 2) spreading of topsoil salvaged prior to construction, and 3) seeding of the disturbed area with native plant species. BrightSource would time seeding to avoid drought periods to the extent possible.

Decommissioning of the facility would occur sequentially in the order of construction (i.e., Ivanpah 1, followed by Ivanpah 2, Ivanpah 3, and the shared facilities). Following decommissioning of the ISEGS facility, BrightSource would remove all structures from the project area and begin restoration of all long-term disturbances. Decommissioning and restoration/reclamation would involve the following general activities: 1) rehabilitate access roads by removing asphalt, decompacting soil, and revegetating, 2) remove all structures and foundations less than 6-feet deep from the project area, 3) remove all physical components of the generation facility except for the SCE substation, the diversion structure, and asphalt access road, 4) re-contour and decompact soils associated with disturbed areas, 5) implement revegetation procedures using native species, 6) remove all exclusion and security fencing, and 7) monitor revegetated areas for success and control non-native weeds.

Minimization Measures

General Protective Measures

To minimize adverse effects to the desert tortoise, BrightSource will implement the following protective measures during construction, operation, maintenance, and decommissioning activities. The wording of some measures differs from those proposed by the Bureau and BrightSource. We have changed the wording of some measures to improve clarity, but we have not changed the substance of the measures that BrightSource and the Bureau have proposed.

1. BrightSource 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 and will be required for monitoring of any construction, operation, or maintenance activities that may result in take of the desert tortoise. The current guidance is entitled *Desert Tortoise – Authorized Biologist and Monitor Responsibilities and Qualifications* (Service 2008a).

2. BrightSource will provide the credentials of all individuals seeking approval as authorized biologists to the Bureau. 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. BrightSource will designate a field contact representative who will oversee compliance with protective measures during construction, operation, maintenance, and decommissioning activities that may result in injury 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. Individuals approved to capture and handle desert tortoises (i.e., authorized biologists and supervised desert tortoise monitors) will do so in compliance with the most up-to-date guidance from the Service. The Service is currently using the *Desert Tortoise Field Manual* (Service 2009a).

5. BrightSource 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. Bright Source will fence the boundaries of the Ivanpah 1, 2, and 3 project sites, the CLA, and Colosseum Road 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. Authorized biologists will perform clearance surveys of unfenced work areas outside of the main project sites and CLA (e.g., gas distribution line, utility right-of way, etc.) immediately prior to the onset of construction, operation, or maintenance activities.

8. BrightSource will employ an appropriate number of authorized biologists and desert tortoise monitors to monitor 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 construction work areas.

9. BrightSource will confine all construction activities, project vehicles, and equipment within the delineated boundaries of construction areas that authorized biologists or designated desert tortoise monitors have identified and cleared of desert tortoises. BrightSource 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. BrightSource will use previously disturbed areas to the extent feasible.

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

11. BrightSource will prohibit project personnel from driving off road or performing ground-disturbing activities outside of designated areas during construction, operation, maintenance, or decommissioning except to deal with emergencies.

12. During operation and maintenance activities at the completed project site, BrightSource will confine all vehicle parking, material stockpiles, and construction-related materials to the permanently fenced project sites and CLA.

13. BrightSource will confine project access to Colosseum Road for construction, operation, maintenance, and decommissioning of the facility. BrightSource will permanently fence this road with desert tortoise exclusion fencing prior to the onset of construction. To reduce the potential for vehicle strikes of desert tortoise on unfenced access roads (i.e., gas line road, fiber optic right-of-way road, etc.), BrightSource will enforce a 20-mile-per-hour speed limit for project related travel (i.e., construction, operation, maintenance, and decommissioning) in these areas. BrightSource will post speed limit signs along all access routes.

14. With the exception of security personnel, BrightSource will prohibit firearms on the project site.

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. BrightSource 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. 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 the presence of desert tortoises. As an alternative, BrightSource may cap all such structures before storing them outside of fenced area.

Management of Common Ravens

BrightSource will implement the following project design features and protective measures to reduce the adverse effects associated with predation of desert tortoises by common ravens (*Corvus corax*). The draft management plan for common ravens (CH2MHill 2008b) contains more detailed information on the following actions:

1. BrightSource will contain all trash associated with the project that could serve as an attractant to predators in secure, self-closing receptacles to prevent the introduction of anthropogenic food resources for common ravens.

2. BrightSource will promptly remove and dispose of all road-killed animals on the project site or its access roads.

3. BrightSource will use water for construction, operation, maintenance, and decommissioning (e.g., truck washing, dust suppression, heliostat washing, landscaping, etc.) in a manner that does not result in puddling.

4. BrightSource will use closed tanks to store water for all project site water needs to eliminate an open water source for common ravens.

5. BrightSource will use closed tanks to store water associated with boiler commissioning and emergency outfalls. BrightSource will not use storm-water detention basins in its project design.

6. BrightSource will install generation tie-lines on utility poles designed to be incompatible with nesting of common ravens in accordance with Avian Power Line Interaction Committee guidelines (2006) and will monitor the effectiveness of these deterrence measures. BrightSource will implement alternative measures if the current effort is unsuccessful.

7. All transmission lines associated with the ISEGS facility will be designed in a manner that will reduce the likelihood of nesting by common ravens. BrightSource will monitor all utility lines and other potential nesting structures and remove common raven nests that it identifies following authorization by the Bureau and the Service.

8. BrightSource will monitor the ISEGS facilities to identify frequently used perching locations for common ravens. If it identifies such locations, BrightSource will install bird barrier spikes or other functional equivalent following specific discussion with the Bureau and the Service.

9. BrightSource will coordinate with the Bureau and the Service to implement or fund hazing or lethal removal of problem common ravens. Problem common ravens are individuals that have been shown to prey on desert tortoises through monitoring.

10. BrightSource will monitor the effectiveness of its management plan for common ravens during all 3 phases of construction and for 2 years following completion of the final phase. BrightSource will implement adaptive management measures if monitoring shows that the management plan is not effective in controlling common raven use of the

project site. BrightSource will consult with the Bureau and the Service prior to implementing adaptive management changes.

Weed Management

BrightSource will implement the following weed management measures to reduce adverse effects to desert tortoises and their habitat during construction operation and maintenance of the ISEGS facilities:

1. BrightSource will designate an environmental compliance manager to provide oversight of construction practices and ensure compliance with weed management provisions.

2. BrightSource will provide training to all personnel charged with environmental management responsibilities that will include the following: a) weed plant identification, b) impacts of noxious weeds on native vegetation, wildlife, and fire activity, and c) required measures to prevent the spread of noxious weeds on the site.

3. During construction, BrightSource will perform weekly inspections during the growing season of all construction areas, access routes, and equipment cleaning facilities for the presence of noxious weeds and weed seed. Following the completion of construction activities, from March through August, BrightSource will continue monitoring according to the following schedule: 1) once a month during the first 2 years of the revegetation, 2) quarterly for the third and fourth years, and 3) semi-annually for year 5 through 10.

4. During operation of completed facilities, BrightSource will perform general site monitoring according to the schedule described above (Measure 3) and perform weed control at least every other week during the growing season (March through August) and once a month during the remainder of the year. Weed control will consist of physical control methods (e.g., hand pulling, hoeing, etc.) or herbicide application.

5. BrightSource will apply all herbicides used in weed treatments according to a plan approved by the Bureau and in accordance with the herbicide labels. BrightSource will only use qualified individuals for herbicide application and will suspend herbicide use when any of the following conditions are met: a) wind velocity exceeds 6 miles per hour during application of liquids or 15 miles per hour during application of granular herbicides, b) snow or ice covers the foliage of noxious weeds, c) precipitation is occurring or is imminent, or d) air temperatures exceed 90 degrees Fahrenheit.

6. BrightSource will monitor all locations of weed treatment to ensure that treatments are effective.

7. BrightSource will limit disturbance areas during construction to the minimal required to perform work and will only use defined routes when accessing work areas.

8. BrightSource will use vehicle wash and inspection stations and closely monitor all material brought onto the site to minimize the potential for weed introductions.

9. BrightSource will identify and flag all areas of noxious weed infestation and minimize use of these areas by project personnel until weed treatment of the area has occurred.

10. BrightSource will preferentially perform native seed collection for restoration work from areas adjacent to the project site. When it is necessary (i.e., native seed from the surrounding area is not available for collection) to use native seeds from commercial vendors, BrightSource will only accept seed that is free of non-native weed seeds.

Desert Tortoise Translocation

Translocation Activities Performed under the Previous Consultation

Under the previous consultation, BrightSource fenced all portions of Unit 1, the construction logistics area (CLA), Colosseum Road, and portions of Units 2 and 3 with desert tortoise exclusion fencing. In addition, it fenced the access route and central power block of Unit 2. Although BrightSource fenced most of the perimeter of Unit 2, it left gaps in the fence line. In the fall of 2010, BrightSource performed clearance surveys of Unit 1, the CLA, and the power block area of Unit 2.

During fence installation, BrightSource moved desert tortoises out of harm's way if they were within the fence line right-of-way or associated perimeter access route. It attached transmitters to all of these individuals and monitored them to determine if individuals along the fence line were selecting areas inside or outside of the project site. If individuals exhibited a substantial amount of fence pacing behavior (i.e., moving back and forth along the fence in an attempt to get out of the project site), BrightSource placed these individuals outside of the project site. Following completion of fence installation around Unit 1, the CLA, and the power block of Unit 2, BrightSource performed five full clearance sweeps of these areas and placed all individuals encountered into the quarantine facility that it constructed within the CLA. BrightSource performed health assessments, including blood collection, on most of these individuals.

In addition to fencing and clearance activities, BrightSource performed extensive searches of the recipient site, the control site, and Units 2 and 3. During these searches, it attached transmitters to desert tortoises to facilitate post-translocation monitoring and to improve the likelihood of finding Unit 2 and 3 individuals during subsequent clearance surveys. BrightSource also collected blood from and performed health assessments on many of these individuals to determine disease prevalence within the translocation recipient population, as

required by the 2010 biological opinion. In April 2011, BrightSource performed surveys of the proposed recipient sites to determine population density.

Revised Desert Tortoise Translocation Strategy

We have summarized the following description of the revised desert tortoise translocation strategy for the ISEGS project from BrightSource's translocation plan (CH2MHill 2009b) and the Bureau's biological assessment used for re-initiation of consultation (Bureau 2011a). Portions of the revised translocation strategy do not differ from the previous strategy, but we have described the entire proposal for clarity. In cases where BrightSource completed some portions of the strategy under the previous consultation, we have only described the changed actions.

Fencing and Clearance

BrightSource will complete fencing around the boundary of Unit 2 and 3, the Kern River Gas metering station, the expansion of the Unit 2 power block, and the power block and access road for Unit 3 in the summer of 2011. BrightSource will install desert tortoise guards, as described in attachment B of the previous biological assessment (CH2MHill 2009a), at gated entries to prevent desert tortoises from gaining entry to the project site.

Within 24 hours prior to the initiation of construction of the desert tortoise-exclusion fence, BrightSource will conduct 2 complete desert tortoise clearance surveys of the fence line segment and associated disturbance right-of-way that will be fenced that day. During these surveys, an authorized biologist will inspect all burrows to determine occupancy and collapse all unoccupied burrows. To the extent feasible, BrightSource will make modifications in fence alignment to fence occupied burrows out of the ISEGS project areas. If the fence line cannot avoid a given burrow, an authorized biologist will remove the desert tortoise and place it in a sheltered location outside of the ISEGS project area.

Following construction of the desert tortoise exclusion fence around a given portion of the ISEGS project site, BrightSource will perform a clearance survey pass of the fenced area during the spring or fall and excavate all burrows that could house a desert tortoise (including rodent holes). This pass will not count as one of the clearance passes described in the Service's translocation guidance. Following completion of this initial pass, BrightSource will perform a full clearance survey of the fenced area, in accordance with the Service's desert tortoise translocation guidance (Service 2010e). If the Service releases revised guidance on desert tortoise translocation prior to initiation of clearance surveys, BrightSource will perform surveys in accordance with the revised guidance. BrightSource may extend its survey window outside of the times outlined in the Service guidance (i.e., spring and fall) for clearance of the fence line construction around the boundary of Unit 2 and 3, the Kern River Gas metering station, the expansion of the Unit 2 power block, and the power block and access road for Unit 3, which would occur in the summer of 2011. Extension of the survey window will only occur in

accordance with the conditions and criteria outlined in this biological opinion (see *Clearance Surveys during the Summer of 2011*). BrightSource will initially place all desert tortoises or eggs cleared from the fenced project site into the onsite quarantine facility.

Translocation

As discussed previously, BrightSource has completed disease testing of most individuals that it cleared and quarantined from Unit 1, the CLA, and the power block area of Unit 2 under the provisions of the 2010 biological opinion. BrightSource will address the translocation of these animals from the quarantine facility and the translocation of animals from Units 2 and 3 in accordance with the following description.

As stated above, BrightSource will initially place all desert tortoises or eggs cleared from the fenced project site into the onsite quarantine facility to await results of disease testing of the desert tortoises. All individuals will receive health assessments, including blood collection and disease testing in accordance with the Service's translocation guidance. BrightSource will X-ray all female desert tortoises of reproductive age to determine if they are gravid. The period of time that individuals spend in the quarantine facility will vary depending on a variety of factors (i.e., length of time it takes to get disease test results, timing of clearance surveys, environmental conditions within the recipient site, size of the individual, etc.). Some individuals may remain in the quarantine facility for a season prior to final translocation. For example, if clearance surveys occur toward the end of the survey window and BrightSource does not receive disease test results in time to release individuals during the translocation window; these individuals may remain in the quarantine facility until the following active season. In addition, BrightSource will retain gravid females at the quarantine facility until they lay their eggs, so that this reproductive output is not lost. Finally, the Bureau has indicated that translocation would not occur during a drought year and BrightSource would not release smaller individuals until they reach at least 120 millimeters, carapace length (all further desert tortoise measurements in this document refer to the carapace length measurement). Following receipt of disease test results and Service approval of the recipient sites described below, translocation of individuals will proceed according to the procedures outlined below.

The Bureau has identified the revised recipient site as a 2-kilometer area that extends out from the boundaries of the project site, excluding an area to the east of Units 1, 2, and 3 that is currently under a separate right-of-way application (Bureau 2011a, Figure 2-2 and Woodman 2011c). The recipient site would also extend south from Unit 1 to Interstate 15 and along the western edge of Interstate 15 from Yates Well Road to Nipton Road (Bureau 2011a, Figure 2-2 and Woodman 2011c). BrightSource will fence the portion of the recipient site adjacent to Interstate 15 (i.e., permanent desert tortoise exclusion fencing along the interstate and temporary exclusion fencing along the north, south, and east boundaries for a distance of 1 kilometer from the interstate fencing) for a period of approximately 10 years. BrightSource would not release individuals into the recipient sites described above until it has completed fencing of the Interstate 15 recipient site, completed all surveys recommended by the Service's translocation

guidance (i.e., density estimation, disease prevalence, etc.), and received approval for release from the Bureau and the Service.

BrightSource will translocate desert tortoises larger than 120 millimeters that were initially found within 500 meters of an external fence, over that fence except along the eastern boundary of Unit 2 and 3 using all appropriate measures listed below. BrightSource will place these individuals in a similar spatial distribution as they found them on the site. In the remainder of the biological opinion, we have referred to these movements as "within-home-range translocations". BrightSource will place all individuals larger than 120 millimeters that were initially located farther than 500 meters from an external fence line into the fenced recipient site next to Interstate 15 using all appropriate measures listed below. In the remainder of the biological opinion, we have referred to these movements as "outside-home-range translocations".

Improved Juvenile Survival

All individuals smaller than 120 millimeters will remain in the quarantine facility until they reach 120 millimeters or have been captive for a period of 5 years, whichever comes first; any desert tortoises that hatch within the facility will be held for the same period. BrightSource will X-ray all females of reproductive age that come into the quarantine facility and retain gravid individuals until they lay their eggs. Once a cohort of 30 desert tortoises reaches 120 millimeters, BrightSource will release it as a group during the next appropriate translocation season if it is not a drought year. BrightSource will release these cohorts into the recipient site along Interstate 15 unless it is a drought year or monitoring of the translocated adults and the other environmental variables in this location (see below) indicates that this would be inappropriate.

Monitoring

BrightSource will monitor desert tortoises cleared from the IESGS project site in accordance with the Service's current translocation guidance (Service 2010e) or more recent update. The current guidance recommends 5 years of post-release monitoring, but this term may increase in subsequent updates to the guidance. Based on the delayed translocation strategy for some individuals, described above, monitoring would last for at least 10 years following the initial translocation release. BrightSource will attach transmitters to all desert tortoises released into the recipient sites and to an equal number of desert tortoises that are resident to the recipient site to facilitate monitoring. The monitored resident population will mimic the size class distribution of the population that BrightSource would release into the recipient site to the greatest extent possible. If a sufficient number of resident animals cannot be located, BrightSource will transmitter as many animals as it can locate within the resident population. In addition, BrightSource will attach button temperature data loggers to a subset of monitored desert tortoises. To assess the health of the recipient-site population, BrightSource will perform surveys with transects spaced at 10-meter intervals and perform health assessments, including

blood sampling, on all desert tortoises that it encounters. It will perform these health assessments between May 15 and October 31.

BrightSource will also attach transmitters to and monitor desert tortoises in a population that will serve as a control group for translocation monitoring. The control area will be south and east of the project area. Nipton Road, the McCullough Mountains, Interstate 15, and Primm, Nevada, will form the boundaries of the control population. Because Nipton Road does not have desert tortoises exclusion fencing, the perimeter of the proposed control area will be set back 500 meters from this road. BrightSource will perform surveys with transects spaced at 10-meter intervals and perform health assessments, including blood sampling, on all desert tortoises that it encounters. It will perform these health assessments between May 15 and October 31. The monitored control population will mimic the size class distribution of the population that BrightSource would release into the recipient site to the greatest extent possible. BrightSource will establish the control group prior to release of translocated individuals into the recipient sites.

During monitoring, BrightSource will investigate the drivers of post-translocation survival. Specifically, it will investigate the interdependent roles of desert tortoise movement patterns, habitat use, health status, environmental toxicants, road noise and vibration, and physical features (e.g., habitat structure, composition, and fragmentation, soil properties) and processes (e.g., precipitation and temperature gradients) across a focal study landscape (i.e., translocated, recipient, and control populations within Ivanpah Valley). BrightSource will compare the information collected on the movements, home ranges, habitat characteristics, disease prevalence, and survival of the resident and control populations with that collected on translocated desert tortoises. BrightSource will perform health assessments on the monitored populations at least twice per year.

To minimize adverse effects to the desert tortoise, BrightSource will implement the following protective measures when implementing the translocation strategy described above:

1. BrightSource will fence Interstate 15 between Yates Well Road and Nipton Road with desert tortoise exclusion fencing and complete fencing and culvert placement along the Yates Well portion of its access road prior to release of desert tortoises into the recipient sites.

2. BrightSource will fence the recipient site used for outside-home-range translocations with temporary desert tortoise exclusion fencing that will tie into the Interstate 15 fencing. This fenced area will be large enough to accommodate all desert tortoises released into this area at a density of 21 or fewer desert tortoises larger than 160 millimeters per square mile.

3. BrightSource will design all permanent desert tortoise exclusion fencing in accordance with the most up-to-date Service guidance. The Service is currently using guidance provided in the *Desert Tortoise Field Manual* (Service 2009a).

4. BrightSource will ensure that within-home-range recipient sites are large enough to accommodate a post-translocation density of less than 21 desert tortoises larger than 160 millimeters per square mile.

5. To improve the likelihood that BrightSource will locate a high percentage of the desert tortoises on the project site, BrightSource will perform one full clearance pass according to the procedures outlined in the 2010 biological opinion and excavate all burrows that could potentially house a desert tortoise (including rodent burrows). This initial survey will be performed in addition to the other clearance passes required in the 2010 biological opinion. Following this initial coverage, clearance surveys would proceed as described in the 2010 biological opinion. BrightSource will comply with the most up-to-date guidance for performing desert tortoise clearance surveys, handling, and transmitter attachment. The Service is currently using the *Desert Tortoise Field Manual* (Service 2009a) except for the timing of clearance surveys for some portions of the project (see below in *Clearance Surveys during the Summer of 2011*).

6. BrightSource will use authorized biologists for the performance of clearance surveys and for any other activities that require the handling of desert tortoises. If BrightSource uses desert tortoise monitors during clearance surveys or for other activities that require identification of sign or handling of desert tortoises, the monitors will work under the direct supervision of an authorized biologist.

7. BrightSource will perform health assessments, including blood collection and ELISA testing, from a sufficient number of individuals within the recipient site and control site to detect a population disease prevalence of 15 percent.

8. BrightSource will consider ELISA-testing results valid for a period of one year on any individual desert tortoise. BrightSource will coordinate with the Service to determine the necessity for re-testing of individuals based on the circumstances of their quarantine and their proposed plan for disposition of the individual. BrightSource will only draw blood for ELISA testing between May 15 and October 31, when immune systems are most active, to ensure accurate ELISA testing results. If BrightSource can determine the emergence date for an individual desert tortoise, ELISA testing can occur earlier than May 15, but it must occur at least 6 weeks following the desert tortoise's initial emergence date.

9. BrightSource will only use Service-authorized individuals that have experience in collecting blood for ELISA testing and identifying the clinical signs of upper respiratory tract disease, herpes virus, and cutaneous dyskeratosis for the performance of health

assessments. BrightSource will provide the Service with the qualifications of any authorized biologists that it proposes to use to perform health assessments or blood collection on desert tortoises during clearance and translocation activities. BrightSource will provide these qualifications at least 30 days prior to the need for the health assessment and blood collection. These qualifications will include a certification that the individual has completed the Service's health assessment training.

10. BrightSource will send all samples for ELISA to a laboratory qualified to perform these tests.

11. BrightSource will quarantine, perform health assessments, and collect blood for ELISA testing from all desert tortoises that it clears from the fenced project site. Individuals will remain in quarantine until BrightSource receives the results of ELISA testing. This requirement applies to individuals cleared from the fenced project sites but not to individuals moved a short distance out of harm's way along project perimeter fencing or other linear facilities (see Measure 14).

12. Desert tortoises moved a short distance (i.e., less than 30 feet) out of harm's way along a linear feature (including project-site perimeter fencing) will be assessed for clinical signs of disease (see measure 18 for information on how these individuals will be processed). BrightSource will attach a transmitter to these individuals prior to moving them out of harm's way and will monitor their movement patterns until fence installation is complete. If desert tortoises exhibit a substantial amount of fence pacing behavior and are inside the project footprint, BrightSource will move these desert tortoises outside the project footprint, immediately adjacent to the fence that the animal is pacing.

13. Because fencing of Units 2 and 3 will be completed in summer of 2001 , but will not be cleared until Fall 2011, BrightSource will frequently patrol fences to ensure that pacing animals do not succumb to heat related illnesses.

14. BrightSource will only perform clearance surveys during the spring (April 1 to May 31) and fall (September 1 to October 15). It may extend the clearance survey window for some portions of the project outlined in this biological opinion if it receives prior authorization from the Service (see *Clearance Surveys during the Summer of 2011* below). BrightSource will only release cleared desert tortoises into a recipient site during the spring (March 25 to April 15) or early fall (October 1 to October 5).

15. BrightSource will not perform any clearance surveys or translocation activities when the ambient air temperature is above 95 degrees Fahrenheit or is likely to exceed 95 degrees Fahrenheit before completion of handling or processing. BrightSource will not perform any clearance surveys or translocation activities when the ambient air temperature is below 65 degrees Fahrenheit or is anticipated to go below 50 degrees Fahrenheit during

the week after release. BrightSource will measure ambient air temperature in the shade, protected from wind, at a height of 2 inches above the ground surface.

16. BrightSource will assess all desert tortoises on the project site for clinical signs of disease including those along perimeter fence alignments. It will remove and temporarily quarantine any desert tortoises with clinical signs of disease that it encounters on the ISEGS project site. BrightSource will use the descriptions of clinical signs of disease described in the available scientific literature (Berry and Christopher 2001, Origgi et al. 2004, Ritchie 2006; all in CH2MHill 2009a), unless the Service provides more appropriate guidance. BrightSource will contact the Ventura Fish and Wildlife Office within 24 hours of collection of an animal to determine the appropriate disposition of animals showing clinical signs of disease. These animals may require more extensive testing prior to determination of their final disposition.

17. Following receipt of disease testing results for all animals cleared from the project site for translocation, BrightSource will develop disposition plans for each individual desert tortoise that it wishes to release into a recipient site. Disposition plans will articulate the proposed release site (i.e., map coordinates) of each desert tortoise and the complete health assessment for each individual. BrightSource will not release desert tortoises into recipient sites until it has received concurrence with the proposed disposition plan from the Service.

18. BrightSource will not release any desert tortoises into the recipient site that have clinical signs of disease or positive ELISA-test results unless authorized by the Service. Along linear facilities, where BrightSource moves desert tortoises a short distance out of harm's way, it will remove and quarantine any individuals showing clinical signs of disease and contact the Service regarding disposition of these individuals.

19. BrightSource will not release desert tortoises into recipient sites during drought years. If BrightSource needs to move desert tortoises off the project site during a drought year, it will place these individuals into its quarantine facility.

20. Release of desert tortoises into recipient sites will only occur when temperatures range between 65 and 85 degrees Fahrenheit and are not likely to exceed 90 degrees Fahrenheit within 3 hours of release or 95 degrees within one week of release. In addition, release should not occur if forecasted daily low temperatures are lower than 50 degrees Fahrenheit for one week post-release.

21. BrightSource will pre-select release points for each individual desert tortoise within the respective recipient sites and transport individuals to the release points in clean, ventilated containers. If containers are re-used, BrightSource will disinfect these containers using 10 percent household bleach or other solution approved by the Service. BrightSource will hydrate all desert tortoises scheduled for translocation within 12 hours

prior to release.

22. BrightSource will release all individuals at unoccupied shelter sites (i.e., soil burrows, caliche caves, under shrubs).

23. Following clearance of desert tortoises from the fenced project sites, CLA, and utility right-of-way, an authorized biologist will be onsite during initial clearing and grading to move any desert tortoises missed during the initial clearance surveys. If BrightSource identifies a desert tortoise with clinical signs of disease, it will contact the Ventura Fish and Wildlife Office to determine appropriate disposition of the animal.

24. BrightSource will maintain a record of all desert tortoises encountered and translocated during project surveys and monitoring. The record will include the following information for each desert tortoise: the location (narrative, vegetation type, and maps) and dates of observations, burrow data, general conditions and health, measurements, any apparent injuries and state of healing, the location from which it was captured and the location in which it was released, whether animals voided their bladders, diagnostic markings (i.e., identification numbers), results of health assessments, and ELISA-test results.

25. Following release, BrightSource will locate and monitor translocated desert tortoises according to the following frequency: 1) once within 24 hours of release, 2) twice weekly for the first 2 weeks following release, and then 3) once a week from March through November, and 4) once every other week from November through February. BrightSource will monitor individuals that it has attached transmitters to in the recipient and control populations according to the following frequency: 1) once a week from March through November and 2) once every other week from November through February.

26. If a desert tortoise within the project site is exhibiting fence line pacing and seems to be in distress due to adverse conditions, BrightSource will immediately move it to the within-home-range recipient site in accordance with the translocation strategy defined above.

Clearance Surveys during the Summer of 2011

The Bureau proposes to allow BrightSource to proceed with the following activities during the summer of 2011: 1) construction of perimeter security and desert tortoise exclusion fencing around the remaining portions of Unit 2 and 3; 2) construction of the Kern River Gas metering station and gas pipeline; 3) construction of the access road to the Unit 3 power block; and 4) construction activities within Unit 1 and the power block areas of Unit 2 (including the Unit 2 power block expansion) and Unit 3. All of these activities will require the clearance of desert tortoises from project work areas during the less active season for desert tortoises. All

individuals cleared from project work areas would be placed in the on-site quarantine facility. BrightSource would follow the procedures outlined in the Desert Tortoise Field Manual (Service 2009a), except as modified by the following measures:

1. BrightSource will only capture and transport desert tortoises when the temperature is below 95 degrees Fahrenheit, and will not begin handling desert tortoises if the temperature is expected to exceed 95 degrees Fahrenheit prior to completion of clearance related activities for that desert tortoise. If the temperature rises above 95 degrees Fahrenheit after capture, BrightSource will keep the desert tortoise in a climate-controlled environment (see Service 2009a, Chapter 7, for details on handling tortoises in high temperatures). BrightSource will not release desert tortoises into the quarantine facility until the temperature has dropped to 85 degrees Fahrenheit, which may require holding individuals in a climate controlled facility until night.

2. If time and temperature constraints do not allow BrightSource to remove all desert tortoises during daylight hours, it will remove desert tortoises with radio transmitters from the project site after sunset within the temperature constraints. However, BrightSource will conduct all clearance surveys during daylight hours.

3. Following release of individuals into the quarantine facility, BrightSource will continuously monitor quarantine pens when temperatures are above 85 degrees Farenheit. Temperatures should be recorded in each burrow and outside (shaded bulb 5 cm above the ground) several times across the heat of the day to ensure that the burrows are providing adequate thermal buffer.

4. If BrightSource identifies desert tortoises within the quarantine pens that are exhibiting behavior that may lead to overheating, they will take temporary measures to reduce the desert tortoises exposure to high-temperatures (i.e., block the animal into its burrow or place the animal in a climate controlled facility until temperatures drop below 85 degrees Fahrenheit).

5. BrightSource will erect shade structures above each pen to mitigate temperature extremes experienced by desert tortoises.

6. BrightSource will ensure the use of humane climate controlled holding facilities, approved by a qualified veterinarian or Institutional Animal Care and Use Committee. Documentation of the approval of this facility shall be provided to the Service and the Bureau.

7. Bright Source will design and implement a monitoring study to determine how effective the shade structures, mister systems (if deployed), and burrows in holding pens are in providing refuge from high temperatures. Dataloggers will be used for continuous monitoring, and instantaneous read thermometers will also be used. Data will be

gathered for the following: open desert habitat, habitat with shade structure, and habitat with shade and mister. Data loggers will be placed at 2 inches above ground in each of these conditions. Additionally, data loggers will be placed in burrows in general to collect their temperature profiles and, should a tortoise be confined in a burrow, a data logger would be placed inside with the tortoise.

Ivanpah Valley Population Monitoring

Because ISEGS may further fragment populations and further constrict connectivity within the Ivanpah Valley, Brightsource will work with the Bureau and the Service to develop a monitoring program aimed at identifying adverse effects to desert tortoise populations as a result of the ISEGS project relative to changes in demographic and genetic stability of the desert tortoise population and connectivity within the Ivanpah Valley. This monitoring would commence in 2012 and continue for the life of the right-of-way grant. The Bureau and the U.S. Geological Survey, in consultation with the Service, will determine the methodologies employed in this monitoring program. To the extent possible, this monitoring program will build upon the existing monitoring and sampling of desert tortoises translocated as a result of the construction of the proposed project. A control population, with which the affected population will be compared, would be located in Shadow Valley or another area deemed more appropriate by the agencies. The use of study animals with VHF or satellite telemetry or other data loggers may be incorporated or leveraged with animals in the translocation-effectiveness monitoring program.

Results from the monitoring program described above will be used to identify movement obstructions, management problems, and opportunities to maintain a viable population and genetic connectivity through an adaptive management scheme. If a greater than 20 percent change in baseline metrics is detected, an adaptive management program will be implemented to correct the shift (e.g., move the population back towards baseline conditions). By the spring of 2012, the Bureau will prepare an adaptive management framework for how to respond to demographic or genetic impacts (should they occur) is established. At this point, the proposed method to address such impacts is translocation or augmentation of desert tortoises (either from other areas or from existing head start programs). Other methods for correcting demographic or genetic impacts (e.g., project reconfiguration at the end of the 30-year permit term to allow for larger movement corridors, land-use restrictions to reduce or eliminate threats such as recreational use) could be incorporated in the adaptive management framework. If monitoring indicates imbalances are occurring in this area, the Bureau will consult with the Service before renewing the right-of-way permit for the proposed project, which will be up for renewal after 30 years.

Because we do not currently have sufficient detail regarding this monitoring program, we have not analyzed the effects of this program or exempted take associated with the monitoring methodology in this biological opinion. Authorization of take associated with this monitoring scheme would occur through a 10(a)(1)(A) recovery permit, if issuance criteria are met, issued to the primary investigator tasked with implementing the monitoring program.

Compensation

The following information was briefly discussed in the revised biological assessment (CH2MHill 2010a) and clarified with more detail in follow up communications with the Bureau (Fesnock 2010a and 2010b). The Bureau will require BrightSource to compensate for loss of desert tortoise habitat in accordance with the Northern and Eastern Mojave amendment to the California Desert Conservation Area (CDCA) Plan (Bureau 2002). The Bureau will apply a compensation ratio of 1:1, as described in this plan. This compensation will provide for acquisition of up to 3,582 acres of land in the Northeastern Mojave Recovery Unit, or desert tortoise habitat enhancement or rehabilitation activities on existing public land, or some combination of the two. The following is a list of potential habitat enhancement and rehabilitation actions, identified by the Bureau, that could be implemented solely or in combination with land acquisition to fulfill the Bureau's compensation requirements:

1. Install at least 50 miles of desert tortoise exclusion fencing along the following road segments: a) Interstate 15 between Nipton Road and Ivanpah Dry Lake, b) U.S. Highway 95 through Piute Valley from the California-Nevada state line to Goffs Road, c) Nipton Road, between the California-Nevada border and Interstate 15, and d) Ivanpah Road, from Nipton Road through portions of the Mojave National Preserve.
2. Restore habitat, including vertical mulching, of at least 50 routes that the Bureau has designated as closed in the Shadow Valley, Piute Valley, and Ivanpah Valley Desert Wildlife Management Areas.
3. Install three-strand fencing or other suitable fencing around the boundary of the towns of Nipton and Goffs.
4. Remove exotic plant species from areas important to desert tortoises.
5. Identify and clean up destroyed or damaged habitat areas, such as illegal dumpsites and illegal routes, in Shadow Valley, Piute Valley, Ivanpah Valley, and the critical habitat portions of Mojave National Preserve.
6. Fund desert tortoise head start research, if approved by the Service's Desert Tortoise Recovery Office.

The California Energy Commission has already approved the proposed action. In addition to the required compensation described above, the California Energy Commission will require compensation for loss of desert tortoise habitat at a ratio of 2:1. Lands acquired to meet the California Energy Commissions requirements would meet the following criteria:

1. must be as close as possible to the project site,
2. provide good quality habitat for desert tortoises with capacity to regenerate naturally when disturbances are removed,
3. be near larger blocks of lands that are either already protected or planned for protection, or which could feasibly be protected long-term by a public resource agency

or a non-governmental organization dedicated to habitat preservation,
4. be connected to lands currently occupied by desert tortoise, ideally with populations that are stable, recovering, or likely to recover,
5. not have a history of intensive recreational use or other disturbance that might make habitat recovery and restoration infeasible,
6. not be characterized by high densities of invasive species, whether on or immediately adjacent to the parcels under consideration, that might jeopardize habitat recovery and restoration, and
7. not contain hazardous wastes.

To meet land acquisition requirements, BrightSource will either directly purchase lands, or it will deposit funds with the National Fish and Wildlife Foundation (NFWF). If BrightSource chooses to deposit funds with NFWF, a compensation fee will be assessed based on current fair market appraised value for the specific geographic area in which the acquisition occurs. If BrightSource chooses to provide funds to NFWF, the following conditions will be met: 1) funds will be provided prior to project construction, 2) lands will be acquired prior to completion of project construction, and 3) lands will be conserved in perpetuity by a legal mechanism agreed to by the Bureau and California Department of Fish and Game. If BrightSource directly acquires the lands rather than providing funds to NFWF, it will acquire the lands prior to completion of project construction and will conserve these lands in perpetuity through a legal mechanism approved by the Bureau and California Department of Fish and Game.

Regardless of the acquisition method (i.e., directly or through NFWF), BrightSource will establish a management fund for the acquired lands to comply with requirements of the California Endangered Species Act. The management fund will consist of an interest-bearing account (as described in the memorandum of agreement between the Renewable Energy Action Team Agencies and NFWF) with the amount of capital commensurate to generate sufficient interest to fund all monitoring, management, and protection of the acquired lands, including reasonable administrative overhead, biological monitoring, improvements to carrying capacity, law enforcement measures, and other actions designed to protect or improve the habitat values of the acquired lands. A Property Analysis Record (PAR) analysis, or comparable method, will be conducted by BrightSource, the Bureau, and the California Department of Fish and Game to determine the management needs and costs described above, which then will be used to calculate the amount of capital needed for the management fund. The management fund will be held and managed by NFWF or another entity approved by the Bureau, Service, and California Department of Fish and Game.

To mitigate this project's portion of the cumulative effect of increasing the number of common ravens in the desert region, the California Energy Commission will also require BrightSource to contribute $105.00 per acre for the 3,582 acres associated with the project site. These funds will contribute to an account established with NFWF to carry out a regional management for the common raven. This account was established under a memorandum of agreement between

Renewable Energy Action Team agencies (i.e., the Bureau, Service, the California Energy Commission, and the California Department of Fish and Game) and NFWF to manage funds to implement regional common raven management. Activities that would be carried out to reduce common raven predation on desert tortoises include reduction of human-provided attractants (e.g., food, water, sheltering and nesting sites), education and outreach, removal of common ravens and their nests, and evaluation of effectiveness and adaptive management. The total fee for this project of $376,110 will fund the project's portion of the regional raven management. BrightSource will make the payment within six months of final project approval.

Implementing control of common ravens and habitat enhancement and rehabilitation to fulfill some of the Bureau's compensation requirements may result in adverse effects to desert tortoises. These actions will require future site-specific Bureau authorizations and future project-specific consultation. Consequently, we will analyze the adverse effects of these actions in a general way, but cannot provide any site-specific analysis for these future actions in this biological opinion.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY DETERMINATION

Section 7(a)(2) of the Endangered Species 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: (1) the status of the species, 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 the survival and recovery of the desert tortoise; (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, 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 the survival and recovery of the desert tortoise in the wild.

The jeopardy analysis in this biological opinion places an emphasis on consideration of the range-wide survival and recovery needs of the desert tortoise and the role of the action area in

the survival and recovery of the desert tortoise as the context for evaluation of the significance of the effects of the proposed federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

STATUS OF THE SPECIES

Basic Ecology of the Desert Tortoise

The desert tortoise is a large, herbivorous reptile found in portions of the California, Arizona, Nevada, and Utah deserts. It also occurs in Sonora and Sinaloa, Mexico. In California, the desert tortoise occurs primarily within the Creosote, Shadscale, and Joshua Tree Series of Mojave Desert Scrub, and the Lower Colorado River Valley subdivision of Sonoran Desert Scrub. Optimal habitat has been characterized as creosote bush scrub in areas where precipitation ranges from 2 to 8 inches, diversity of perennial plants is relatively high, and production of ephemerals is high (Luckenbach 1982, Turner and Brown 1982, Schamberger and Turner 1986). Soils must be friable enough for digging of burrows, but firm enough so that burrows do not collapse. In California, desert tortoises are typically associated with gravelly flats or sandy soils with some clay, but are occasionally occur in windblown sand or in rocky terrain (Luckenbach 1982). Desert tortoises occur in the California desert from below sea level to an elevation of 7,300 feet, but the most favorable habitat occurs at elevations of approximately 1,000 to 3,000 feet (Luckenbach 1982, Schamberger and Turner 1986). Recent range-wide monitoring efforts have consistently documented desert tortoises above 3,000 feet (Service 2006a).

Desert tortoises may spend more time in washes than in flat areas outside of washes; Jennings (1997) notes that, between March 1 and April 30, desert tortoises “spent a disproportionately longer time within hill and washlet strata” and, from May 1 through May 31, hills, washlets, and washes “continued to be important.” Jennings’ paper does not differentiate between the time desert tortoises spent in hilly areas versus washes and washlets; however, he notes that, although washes and washlets comprised only 10.3 percent of the study area, more than 25 percent of the plant species on which desert tortoises fed were located in these areas. Luckenbach (1982) states that the “banks and berms of washes are preferred places for burrows;” he also recounts an incident in which 15 desert tortoises along 0.12 mile of wash were killed by a flash flood.
Desert tortoises are most active in California during the spring and early summer when annual plants are most common. Additional activity occurs during warmer fall months and occasionally after summer rain storms. Desert tortoises spend most of their time during the remainder of the year in burrows, escaping the extreme conditions of the desert; however, recent work has demonstrated that they can be active at any time of the year. Further information on the range, biology, and ecology of the desert tortoise can be found in Burge (1978), Burge and Bradley (1976), Hovik and Hardenbrook (1989), Luckenbach (1982), Weinstein et al. (1987), and Service (1994).

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

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

Desert tortoises can produce from one to three clutches of eggs per year. On rare occasions, clutches can contain up to 15 eggs; most clutches contain 3 to 7 eggs. Desert tortoises generally lay eggs from mid-May to early July, but occasionally as late as October (Ernst et al. 1994). The eggs typically hatch from late August through early October, but the incubation period is fairly constant regardless of the time eggs are laid. At the time of hatching, the desert tortoise has a substantial yolk sac; the yolk can sustain them through the fall and winter months until forage is available in the late winter or early spring. However, neonates will eat if food is available to them at the time of hatching; when food is available, they can reduce their reliance on the yolk sac to conserve this source of nutrition. Neonate desert tortoises use abandoned rodent burrows for daily and winter shelter; these burrows are often shallowly excavated and run parallel to the surface of the ground.

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

Neonate and juvenile desert tortoises require approximately 12 to 16 percent protein content in their diet for proper growth. Desert tortoises, both juveniles and adults, seem to selectively forage for particular species of plants with favorable ratios of water, nitrogen (protein), and potassium. This is because desert tortoises do not readily excrete potassium, so forage with favorable ratios of these nutrients is required to prevent accumulation of excess potassium. The potassium excretion potential model (Oftedal 2001) predicts that, at favorable ratios, the water and nitrogen in forage allow desert tortoises to excrete high concentrations of potentially toxic

potassium, which is abundant in many desert plants. Oftedal (2001) also reports that variation in rainfall and temperatures cause the potassium excretion potential index to change annually and during the course of a plant's growing season. Changes in the type of forage available for desert tortoises can result in a greater abundance of plants with low potassium excretion potential, which are less likely to be selected. Therefore, the changing nutritive quality of plants, combined with their increase in size, further limits the forage available to small desert tortoises to sustain their survival and growth.

In summary, the ecological requirements and behavior of neonate and juvenile desert tortoises are substantially different from those of subadults and adults. Smaller desert tortoises use abandoned rodent burrows, which are typically more fragile than the larger ones constructed by adult desert tortoises. They are active earlier in the season. Finally, small desert tortoises rely on smaller annual plants with greater protein content; the smaller plant size allows them to gain access to food and the higher protein content promotes growth.

Legal Status of the Desert Tortoise

On August 4, 1989, the Service published an emergency rule listing the Mojave population of the desert tortoise as endangered (54 *Federal Register* 32326). In its final rule, dated April 2, 1990, the Service determined the Mojave population of the desert tortoise to be threatened (55 *Federal Register* 12178). The Mojave population of the desert tortoise includes those animals living north and west of the Colorado River in the Mojave Desert of California, Nevada, Arizona, southwestern Utah, and in the Colorado Desert in California (55 *Federal Register* 12178).

The Service listed the desert tortoise in response to loss and degradation of habitat caused by numerous human activities including urbanization, agricultural development, military training, recreational use, mining, and livestock grazing. The loss of individual desert tortoises to increased predation by common ravens, collection by humans for pets or consumption, collisions with vehicles on paved and unpaved roads, and mortality resulting from diseases also contributed to the Service's listing of this species.

Recovery Plan for the Desert Tortoise

The recovery plan for the desert tortoise (Service 1994) is the basis and key strategy for recovery and delisting of the desert tortoise. The recovery plan divides the range of the desert tortoise into 6 distinct population segments or recovery units and recommends the establishment of 14 desert wildlife management areas throughout the recovery units. Within each desert wildlife management area, the recovery plan recommends implementation of reserve level protection of desert tortoise populations and habitat, while maintaining and protecting other sensitive species and ecosystem functions. The recovery plan also recommends that desert wildlife management areas be designed to follow the accepted concepts of reserve design and be managed to restrict human activities that negatively affect desert tortoises. The delisting criteria

established by the recovery plan are:

1. The population within a recovery unit must exhibit a statistically significant upward trend or remain stationary for at least 25 years;

2. Enough habitat must be protected within a recovery unit or the habitat and desert tortoises must be managed intensively enough to ensure long-term viability;

3. Populations of desert tortoises within each recovery unit must be managed so discrete population growth rates (lambdas) are maintained at or above 1.0;

4. Regulatory mechanisms or land management commitments that provide for long-term protection of desert tortoises and their habitat must be implemented; and

5. The population of the recovery unit is unlikely to need protection under the Endangered Species Act in the foreseeable future.

The recovery plan based its descriptions of the six recovery units on differences in genetics, morphology, behavior, ecology, and habitat use over the range of the Mojave population of the desert tortoise. The recovery plan contains generalized descriptions of the variations in habitat parameters of the recovery units and the behavior and ecology of the desert tortoises that reside in these areas (pages 20 to 22 in Service 1994). The recovery plan (pages 24 to 26 from Service 1994) describes the characteristics of desert tortoises and variances in their habitat, foods, burrow sites, and phenotypes across the range of the listed taxon. Consequently, to capture the full range of phenotypes, use of habitat, and range of behavior of the desert tortoise as a species, conservation of the species across its entire range is essential.

In 2003, the Service established the Desert Tortoise Recovery Plan Assessment Committee, which was composed of scientists familiar with the desert tortoise and other disciplines relevant to the conservation of this species, to assess whether the 1994 recovery plan needed to be revised; the group concluded that the recovery plan was “fundamentally strong but could benefit substantially from modification” by recognition of new patterns of diversity within the Mojave population of the desert tortoise, explicit implementation of the prescriptions in the original recovery plan, greater appreciation of the implications of multiple, simultaneous threats facing desert tortoise populations, and applying recent advances in analytical techniques to desert tortoise recovery (Tracey et al. 2004).

As a result of these recommendations, the Service has released a draft revised recovery plan for public review (Service 2008c). The draft revised recovery plan includes discussions of reducing the number of recovery units to five based on information that has been generated since the release of the original document and of the other recommendations contained in the assessment.

Relationship of Recovery Units, Evolutionary Distinct Populations, Desert Wildlife

Management Areas, Critical Habitat Units, and Areas of Critical Environmental Concern

The recovery plan for the desert tortoise defines a "recovery unit" as "a geographic area harboring an evolutionarily distinct population of the desert tortoise" (Service 1994). Over the years, workers have commonly used the term "recovery unit" in reference to these geographic areas defined in the recovery plan; the term "evolutionarily distinct population" has not been in common use.

The recovery plan (Service 1994) recognized six recovery units or evolutionarily significant units across the range of the listed taxon, based on differences in genetics, morphology, behavior, ecology, and habitat use of the desert tortoises found in these areas. The boundaries between these areas are vaguely defined. In some cases, such as where the Western Mojave Recovery Unit borders the Eastern Mojave Recovery Unit, a long, low-lying, arid valley provides a fairly substantial separation of recovery units. In other areas, such as where the Eastern Mojave Recovery Unit borders the Northern Colorado Recovery Unit, little natural separation exists. Because of the vague boundaries, the acreage of the recovery units has not been quantified.

The recovery plan recommended that land management agencies establish one or more desert wildlife management areas within each recovery unit. The recovery plan recommended that these areas receive reserve-level management to remove or mitigate the effects of the human activities responsible for declines in the number of desert tortoises. As was the case for the recovery units, the recovery plan did not determine precise boundaries for the desert wildlife management areas; the recovery team intended for land management agencies to establish these boundaries, based on the site-specific needs of the desert tortoise. At this time, desert wildlife management areas have been established throughout the range of the desert tortoise.

Based on the recommendations contained in the draft recovery plan for the desert tortoise, the Service designated critical habitat throughout the range of the desert tortoise (59 *Federal Register* 5820). The 14 critical habitat units have defined boundaries and cover specific areas throughout the 6 recovery units.

The Bureau used the boundaries of the critical habitat units and other considerations, such as conflicts in management objectives and more current information, to propose and designate desert wildlife management areas through its land use planning processes. In California, the Bureau also classified these desert wildlife management areas as areas of critical environmental concern, which allows the Bureau to establish management goals for specific resources in defined areas. Through the land use planning process, the Bureau established firm boundaries for the desert wildlife management areas.

Finally, we note that the Department of Defense installations and National Park Service units in the California desert did not establish desert wildlife management areas on their lands. Where the military mission is compatible with management of desert tortoises and their habitat, the

Department of Defense has worked with the Service to conserve desert tortoises and their habitat. Examples of such overlap include the bombing ranges on the Navy's Mojave B and the Chocolate Mountains Aerial Gunnery Ranges; although the target areas are heavily disturbed, most of the surrounding land remains undisturbed. Additionally, the Army has established several areas along the boundaries of Fort Irwin where training with vehicles is prohibited; desert tortoises persist in these areas, which are contiguous with lands off-base. The National Park Service did not establish desert wildlife management areas within the Mojave National Preserve, because the entire preserve is managed at a level that is generally consistent with the spirit and intent of the recovery plan for the desert tortoise.

Methods of Estimating the Number of Desert Tortoises

Before entering into a discussion of the status and trends of the desert tortoise in the Northeastern Mojave Recovery Unit where the proposed action is located, a brief discussion of the methods of estimating the numbers of desert tortoises would be useful. Three primary methods have been widely used: permanent study plots, triangular transects, and line distance sampling.

Generally, permanent study plots are defined areas that are visited at roughly 4-year intervals to determine the numbers of desert tortoises present. Desert tortoises found on these plots during the spring surveys were registered; that is, they were marked so they could be identified individually during subsequent surveys. Between 1971 and 1980, 27 plots were established in California to study the desert tortoise; 15 of these plots were used by the Bureau to monitor desert tortoises on a long-term basis (Berry 1999). Range-wide, 49 plots have been used at one time or another to attempt to monitor desert tortoises (Tracy et al. 2004).

Triangular transects are used to detect sign (i.e., scat, burrows, footprints, etc.) of desert tortoises. The number of sign is then correlated with standard reference sites, such as permanent study plots, to allow workers to estimate the relative abundance of desert tortoises.

The third methodology, line distance sampling, involves walking transects while trying to detect live desert tortoises. Based on the distance of the desert tortoise from the centerline of the transect, the length of the transect, and a calculation of what percentage of the animals in the area were likely to have been above ground and visible to surveyors during the time the transect was walked, an estimation of the density can be made. This density only represents an estimation of the number of desert tortoises that are greater than 180 millimeters (approximately 7 inches) in size, because desert tortoises that are smaller than this size are difficult to detect. Desert tortoises that are larger than this size are typically classified as subadult or adult desert tortoises.

Each of these methods has various strengths and weaknesses. In general, permanent study plots have been used to estimate the status of desert tortoises across large areas over time. Triangular transects were used to assess the density of desert tortoises on specific sites at a point in time;

this method was commonly used to determine how many desert tortoises may be affected by a specific proposed action. In 2001, the Service initiated line distance sampling to estimate the density of desert tortoises in desert wildlife management areas and critical habitat throughout the range.

Tracy et al. (2004) acknowledged, in its assessment of the recovery plan, that determining the number of desert tortoises over large areas is extremely difficult. Desert tortoises spend much of their lives underground or concealed under shrubs, are not very active in years of low rainfall, and are distributed over a wide area in several different types of habitat. Other factors, such as the inability to sample on private lands and rugged terrain, further complicate sampling efforts. Consequently, the topic of determining the best way to estimate the abundance of desert tortoises has generated many discussions over the years. As a result of this difficulty, estimations of the density of desert tortoises in each recovery unit or desert wildlife management area often reflect inconsistencies in the way in which data were gathered.

Given the difficulty in determining the density of desert tortoises over large areas, the differences in density estimates in the recovery plan and those derived from subsequent sampling efforts may not accurately reflect on-the-ground conditions. However, the absence of live desert tortoises and the presence of carcasses over large areas of some desert wildlife management areas provide an indication that desert tortoise populations seem to be in a downward trend in some regions.

Status and Trends of Desert Tortoise Population in the Northeastern Mojave Recovery Unit

The following paragraphs provide general information on the status and trends of the desert tortoise population in the Northeastern Mojave Recovery Unit, where the proposed action is located. We have not included detailed information on the status of the desert tortoise in the other recovery units throughout the range of the species in this biological opinion. This omission will not compromise the analysis in the biological opinion because our determination regarding whether a proposed action is likely to jeopardize the continued existence of a species must be conducted at the level of the listed taxon. When the range of the listed taxon is divided into recovery units, our level of analysis begins with the recovery unit; if the effects of the proposed action have the potential to compromise the ability of the species to survive and recover within the recovery unit, the next level of analysis considers how the compromised recovery unit would affect the listed taxon throughout its range (Service 2005a). Our analysis can therefore be conducted in a comprehensive manner through an iterative process. The Northeastern Mojave Recovery Unit comprises one of six recovery units for the desert tortoise; consequently, our level of analysis in this biological opinion will begin at this level.

The table below summarizes the population density information from the 1994 desert tortoise recovery plan (Service 1994) and the population density information collected through the Service's range-wide monitoring program (Service 2009b, 2010f, 2010g). Because sampling

intensity varies from year to year based on funding, annual variation in density estimates is likely a reflection of the survey effort in a given year and not necessarily a result of changes in population size. Consequently, we can more accurately estimate recovery unit density by averaging the years 2001 to 2010. In this manner, we estimate a recovery unit density of 7.5 desert tortoises per square mile. However, this density only applies to the areas that the Service actually samples through range-wide monitoring (i.e., critical habitat units and other desert tortoise conservation areas), and it is not reflective of the true density across all portions of the recovery unit. Desert tortoise densities in many areas outside of critical habitat and other desert tortoise conservation areas likely do not have densities of this size due to the greater effects of human disturbance in these unprotected areas.

Desert Wildlife Management Area (DWMA)	**Density Estimates (desert tortoises per square mile)**									
	1994 Recovery Plan	**2001**	**2002**	**2003**	**2004**	**2005**	**2007**	**2008**	**2009**	**2010**
Northeastern Mojave Recovery Unit		**6.2**	**-**	**9.6**	**-**	**-**	**4.4**	**-**	**8.8**	**8.3**
Beaver Dam Slope DWMA	5 to 60	14.5	-	-	-	2.3	3.1	2.9	8.3	8.6
Gold Butte-Pakoon DWMA	5 to 60	3.1	-	4.7	1.8	0.52	3.1	0	5.7	4.7
Mormon Mesa DWMA	40 to 90	4.7	-	9.9	6	12.7	8.6	4.9	18.9	14.3
Coyote Springs DWMA	up to 90	5.7	9.1	14.2	3.4	8.6	3.7	3.1	5.2	9.4
Ivanpah Critical Habitat Unit	5 to 250	7.3	14	-	12.2	11.9	16.9	18.4	10.4	2.9

The following table summarizes the estimated number of desert tortoises in the desert wildlife management areas in the Northeastern Mojave Recovery Unit, based on the Service's range-wide monitoring program (Service 2010f, 2010g).

Desert Wildlife Management Area	**Population Abundance**		
	2008	**2009**	**2010**
Northeastern Mojave Recovery Unit	-	-	-
Beaver Dam Slope DWMA	778 (295-2047)	2251 (902-5621)	2323 (1342-4019)
Gold Butte-Pakoon DWMA	-	3284 (1287-8379)	2640 (1327-5250)
Mormon Mesa DWMA	1521 (737-3136)	5954 (2903-12210)	4486 (2976-6759)
Coyote Springs DWMA	1180 (658-2117)	1847 (921-3703)	3412 (2132-5460)

Ivanpah Critical Habitat Unit	16301 (6143-43248)	9272 (3990-21547)	2622 (1075-6390)

Based on the work by Nussear et al. (2009), we calculated that the Northeastern Mojave Recovery Unit contained approximately 7,583 square miles of modeled desert tortoise habitat in the 2010 biological opinion (Service 2010d). Because the model does not take into account existing human disturbance, we used data on highly converted lands from The Nature Conservancy's ecoregional assessment (Randall et al. 2010) to remove areas from which desert tortoises are known to be extirpated (e.g., Las Vegas, Pahrump, etc.) and to characterize the amount of remaining habitat that is currently degraded by human impacts. Based on this analysis, we estimate that the Northeastern Mojave Recovery Unit contains approximately 6,916 square miles of habitat with the potential to support desert tortoises in the absence of habitat degradation (Waln 2011a). In addition, wildfire burned approximately 470 square miles of desert tortoise habitat in the Northeastern Mojave Recovery Unit in 2005 (Burroughs 2005). Therefore, we estimate that approximately 6,400 square miles of modeled desert tortoise habitat remains in the recovery unit. Of this total, moderately degraded habitat, which Randall et al. (2010) define as lands that are fragmented by roads or off-road vehicle trails or are in close proximity to urban, agricultural, or other developments, comprises approximately 850 square miles (Waln 2011b); these areas likely contain lower density populations than the habitat historically supported. These estimates likely overstate the amount of extant desert tortoise habitat because the Randall et al. (2010) data on human disturbance are mapped at a coarse scale that does not allow for analysis of smaller scale disturbances and do not take into account spatially explicit information on threats, such as invasive species, that can also degrade habitat.

A kernel analysis was conducted in 2003 and 2004 for the desert tortoise (Tracy et al. 2004) as part of the reassessment of the 1994 recovery plan. The kernel analyses revealed several areas in which live desert tortoises and carcasses did not overlap. The pattern of non-overlapping kernels that is of greatest concern is those in which large areas encompassed carcasses but not live animals. These regions represent areas within desert wildlife management areas (DWMAs) where recent die-offs or declines in desert tortoise populations likely occurred. The kernel analyses indicated large areas in the Piute-Eldorado Valley where carcasses were found but no live desert tortoises. For this entire area in 2001, workers found 6 live and 15 dead desert tortoises found along 103 miles of transects, resulting in a live encounter rate of 0.06 desert tortoise per mile of transect for this area. This encounter rate was among the lowest that year for any of the areas sampled in the range of the Mojave desert tortoise (Tracy et al. 2004).

Results of desert tortoise surveys at three survey plots in Arizona indicate that all three sites have experienced significant die-offs. Six live desert tortoises were located in a 2001 survey of the Beaver Dam Slope exclosure plot (Walker and Woodman 2001). Three had definitive signs of upper respiratory tract disease, and two of those animals also had lesions indicative of cutaneous dyskeratosis. Previous surveys of this plot detected 31 live desert tortoises in 1996, 20 in 1989, and 19 in 1980. The 2001 survey report indicated that a reproductively viable population of desert tortoises likely no longer persisted on this study plot. Thirty-seven live desert tortoises were located in a 2002 survey of the Littlefield plot (Young et al. 2002). None

had definitive signs of upper respiratory tract disease. Twenty-three desert tortoises had lesions indicative of cutaneous dyskeratosis. Previous surveys of this plot detected 80 live desert tortoises in 1998 and 46 live desert tortoises in 1993. The survey report indicated that the site might be in the middle of a die-off due to the high number of carcasses found since the site was last surveyed in 1998. Nine live desert tortoises were located during the mark phase of a 2003 survey of the Virgin Slope Plot (Goodlett and Woodman 2003). The surveyors determined that the confidence intervals of the population estimate would be excessively wide and not lead to an accurate population estimate, so the recapture phase was not conducted. One desert tortoise had definitive signs of upper respiratory tract disease. Seven desert tortoises had lesions indicative of cutaneous dyskeratosis. Previous surveys of this plot detected 41 live desert tortoises in 1997 and 15 live desert tortoises in 1992. The survey report indicated that the site may be at the end of a die-off that began around 1996 or 1997.

Nussear et al. (2009) modeled desert tortoise habitat across the range of the desert tortoise. This model, which is based on 3,753 desert tortoise locations, uses 16 environmental variables, such as precipitation, geology, vegetation, and slope. In addition, Nussear et al. used 938 additional occurrence locations to test the model's accuracy. Using this model, we estimate that the Northern and Eastern Mojave Recovery Unit contains approximately 4,853,368 acres of potential desert tortoise habitat (Darst 2010). Although this analysis likely omits some marginal desert tortoise habitat, it explains the occurrence of 95 percent of the 938 test points used in the Nussear et al. (2009) model. This modeling and mapping analysis does not consider habitat loss, fragmentation, or degradation associated with human-caused impacts; however, it provides a reference point relative to the amount of desert tortoise habitat within the Northeastern Mojave Recovery Unit.

Fires, Drought, and Non-native Plants

In the previous section, we mentioned that, in 2005, fires burned approximately 470 square miles of the Northeastern Mojave Recovery Unit. The fires adversely affected the status of the desert tortoise by reducing the number of individuals (i.e., desert tortoises killed by the fire), possibly by reducing reproductive rates (i.e., desert tortoises in burned areas may have lower reproductive rates because of the decreased value of the habitat), and by degrading a portion of the habitat available to the species.

In addition, drought has been implicated as a factor in reduced survival rates on desert tortoises in local areas (Longshore et al. 2003). In this 9-year study, researchers compared 2 "closely situated, but physiographically different, sites" in the Lake Mead National Recreation Area, Nevada. After a period during which survival rates were stable, the survival rate decreased on one of the sites that experienced drought conditions in 3 out of 4 years. The authors postulate that if such local incidents occur on a regular basis, "source-sink population dynamics may be an important factor" in determining the density of desert tortoise populations.

Finally, we have included the following paragraphs from the revised draft recovery plan for the

desert tortoise (Service 2008c) as a general discussion of threats the desert tortoise faces with regard to the anthropogenic factors that affect their ability to meet their nutritional needs. All references are in the draft recovery plan (i.e., in Service 2008c); we have omitted some areas where the level of detail in the draft recovery plan was unnecessary for the current discussion.

Surface disturbance from off-highway vehicle activity can cause erosion and large amounts of dust to be discharged into the air. Recent studies on surface dust impacts on gas exchanges in Mojave Desert shrubs showed that plants encrusted by dust have reduced photosynthesis and decreased water-use efficiency, which may decrease primary production during seasons when photosynthesis occurs (Sharifi et al. 1997). Sharifi et al. (1997) also showed reduction in maximum leaf conductance, transpiration, and water-use efficiency due to dust. Leaf and stem temperatures were also shown to be higher in plants with leaf-surface dust. These effects may also impact desert annuals, an important food source for (desert) tortoises.

Off-highway vehicle activity can also disturb fragile cyanobacterial-lichen soil crusts, a dominant source of nitrogen in desert ecosystems (Belnap 1996). Belnap (1996) showed that anthropogenic surface disturbances may have serious implications for nitrogen budgets in cold desert ecosystems, and this may also hold true for the hot deserts that (desert) tortoises occupy. Soil crusts also appear to be an important source of water for plants, as crusts were shown to have 53 percent greater volumetric water content than bare soils during the late fall when winter annuals are becoming established (DeFalco et al. 2001). DeFalco et al. (2001) found that non-native plant species comprised greater shoot biomass on crusted soils than native species, which demonstrates their ability to exploit available nutrient and water resources. Once the soil crusts are disturbed, non-native plants may colonize, become established, and out-compete native perennial and annual plant species (DeFalco et al. 2001, D'Antonio and Vitousek 1992). Invasion of non-native plants can affect the quality and quantity of plant foods available to desert tortoises. Increased presence of invasive plants can also contribute to increased fire frequency.

Proliferation of invasive plants is increasing in the Mojave and Sonoran deserts and is recognized as a significant threat to desert tortoise habitat. Many species of non-native plants from Europe and Asia have become common to abundant in some areas, particularly where disturbance has occurred and is ongoing. As non-native plant species become established, native perennial and annual plant species may decrease, diminish, or die out (D'Antonio and Vitousek 1992).

Land managers and field scientists identified 116 species of non-native plants in the Mojave and Colorado deserts (Brooks and Esque 2002).

Increased levels of atmospheric pollution and nitrogen deposition related to increased human presence and combustion of fossil fuels can cause increased levels of soil nitrogen, which in turn may result in significant changes in plant communities (Aber et al. 1989). Many of the

non-native annual plant taxa in the Mojave region evolved in more fertile Mediterranean regions and benefit from increased levels of soil nitrogen, which gives them a competitive edge over native annuals. Studies at three sites within the central, southern, and western Mojave Desert indicated that increased levels of soil nitrogen can increase the dominance of non-native annual plants and promote the invasion of new species in desert regions. Furthermore, increased dominance by non-native annuals may decrease the diversity of native annual plants, and increased biomass of non-native annual grasses may increase fire frequency (Brooks 2003).

Nutritional intake affects growth rates in juvenile desert tortoises (Medica et al. 1975) and female reproductive output (Turner et al. 1986, 1987; Henen 1992). Invasion of non-native plants can affect the quality and quantity of plant foods available to desert tortoises, and thereby affect nutritional intake. Desert tortoises are generally quite selective in their choices of foods (Burge 1977; Nagy and Medica 1986; Turner et al. 1987; Avery 1992; Henen 1992; Jennings 1992, 1993; Esque 1992, 1994), and in some areas the preferences are clearly for native plants over the weedy non-natives.

As native plants are displaced by non-native invasive species in some areas of the Mojave Desert, non-native plants can be a necessary food source for some desert tortoises. However, non-native plants may not be as nutritious as native plants. Recent studies have shown that calcium and phosphorus availability are higher in forbs than in grasses and that desert tortoises lose phosphorus when feeding on grasses but gain phosphorus when eating forbs (Hazard et al. 2002). Nagy et al. (1998), in a comparative study on the nutritional qualities of native vs. nonnative grasses and forbs commonly consumed by desert tortoises (*Achnatherum hymenoides* [Indian ricegrass] vs. *Schismus barbatus*; *Malacothrix* spp. [desert dandelion] vs. *Erodium cicutarium*), found that the nutritional value of the two grasses was similar, but both grasses had much lower nutritional value than the forbs. This suggests that the proliferation of non-native grasses such as *Schismus* to the exclusion of native forbs and other plants (D'Antonio and Vitousek 1992) places desert tortoises at a nutritional disadvantage. Furthermore, if (desert) tortoises consume just enough food to satisfy their energy needs (as commonly noted in other vertebrate groups), then the native forbs provide significantly more nitrogen and water than the non-native forbs (Nagy et al. 1998).

Changes in the abundance and distribution of native plants also may affect desert tortoises in more subtle ways. In the Mojave Desert, many food plants are high in potassium (Minnich 1979), which is difficult for desert tortoises to excrete due to the lack of salt glands that are found in other reptilian herbivores such as chuckwallas (*Sauromalus obesus*) and desert iguanas (*Dipsosaurus dorsalis*) (Minnich 1970; Nagy 1972). Reptiles are also unable to produce osmotically concentrated urine, which further complicates the ability for desert tortoises to expel excess potassium (Oftedal and Allen 1996). Oftedal (2002) suggested that desert tortoises may be vulnerable to upper respiratory tract disease or other diseases due to their need to obtain sufficient water and nitrogen from food plants to counteract the negative effects of dietary

potassium. Only high quality food plants (as expressed by the Potassium Excretion Potential, or PEP, index) allow substantial storage of protein (nitrogen) that is used for growth and reproduction, or to sustain the animals during drought. Non-native, annual grasses have lower PEP indices than most native forbs (Oftedal 2002; Oftedal et al. 2002). Foraging studies have demonstrated that juvenile Mojave tortoises are highly selective while foraging, selecting both the plant species and plant parts that are have the highest PEP value. Impacts to vegetation (such as livestock grazing, invasion of non-native plants, and soil disturbance) that reduce the abundance and distribution of high PEP plants may result in additional challenges for foraging desert tortoises (Oftedal et al. 2002).

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 CFR 402.02). For the purposes of this biological opinion, we consider the action area to include the southern portion of Ivanpah Valley. Specifically, it includes the 3,454-acre-acre project site, the 9,475-acre within-home-range recipient site, the 1,273-acre outside-home-range recipient site, the 50,000-acre control site, and areas along Colosseum Road, the gas line, and the fiber optic line. The action area also encompasses all contiguous desert tortoise habitat in the southern Ivanpah Valley from just north of the state line south to the vicinity of Cima, California (Croft 2011a). This area includes all areas to which desert tortoises may move following translocation and areas that would be potentially vulnerable to fragmentation of the local population. The action area defined for this biological opinion is approximately 330 square miles (Croft 2011a).

Habitat Characteristics of the Action Area

In the 2010 biological opinion, we summarized information on vegetation types for the project site, natural gas distribution line, fiber optic line, Colosseum Road, and the previously proposed recipient sites. The information in the following paragraph provides the discussion of habitat characteristics from the 2010 biological opinion (Service 2010d) and the remaining portion of this section provides information from vegetation surveys of the project site and recipient sites that BrightSource performed in the spring of 2011 (Solar Partners 2011).

All portions of the project site and recipient sites are located on a large, alluvial fan that slopes eastward from the Clark Mountains to Ivanpah Dry Lake at a 3 to 5 percent grade. Numerous ephemeral washes dissect the ISEGS project site with active channels up to 15 feet wide. Elevations within the ISEGS project site range from 2,850 to 3,150 feet above sea level. Elevations along the route of the fiber optic line range from 2,850 feet to 5,320 feet. Creosote bush scrub is the dominant vegetation type on the ISEGS project site, recipient site, Colosseum Road, and the lower elevation portions of the fiber-optic line. Mojave wash scrub also occurs

on the ISEGS project site. Vegetation at higher elevations along the fiber optic line is characterized by blackbrush (*Coleogyne ramosissima*), Joshua trees (*Yucca brevifolia*), Utah juniper (*Juniperus osteosperma*), single-leaf pinyon (*Pinus monophylla*), and Mormon tea (*Ephedra* sp.).

In the spring of 2011, BrightSource performed plant surveys of the project site and the recipient sites described under the revised translocation strategy. The following information summarizes the results of these surveys (Solar Partners 2011). Creosote (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*) comprises 77 to 86 percent of the perennial plant composition across the project site and the recipient sites. Cheesebush (*Hymenoclea salsola*) and range ratany (*Krameria erecta*) make up most of the remaining cover and both are present in greater than one percent on all sites. Several other perennial shrub species are present, but none comprises more than one percent of the total perennial cover. All portions of the ISEGS project site and the recipient sites are composed of a creosote and white bursage plant community with high variability in annual plant cover across these areas.

In addition to perennial plant cover, Solar Partners (2011) assessed the botanical species richness of the project site and recipient sites and observed higher species richness on the recipient sites than on the project sites and higher species richness on Unit 3 than on Units 1 and 2. Finally, the 2011 surveys collected data on annual plant cover within the project site and recipient sites (Solar Partners 2011). These surveys found that annual plant cover and cover of important desert tortoise forage (i.e., those having a high potassium excretion potential) are similar between the project site and recipient sites for Units 1, 2, and 3. However, the southern portion of the Interstate 15 recipient site has lower cover of annual plants and important forage species than the project site and other recipient sites.

We do not have specific plant survey information for the remaining portions of the action area. However, 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

The region described in the Environmental Baseline - Action Area section of this biological opinion begins in the southern end of Ivanpah Valley, where the Ivanpah Mountains to the north and the New York Mountains to the south converge and the valley begins to merge into higher elevation habitat at the edge of Cima Dome. In the north, the action area ends where the Lucy Gray Mountains to the east, the Spring Mountains to the west, and the northern end of Ivanpah Dry Lake converge. The western edge of the action area is bounded by the New York and Clark mountains from south to north; the eastern edge is bounded by the Ivanpah and Lucy Gray mountains from south to north.

In this section, we discuss the anthropogenic and natural conditions in the action area as they relate to the 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.

Terrain

The predominant natural feature in the valley is a large wash complex that flows from Cima Dome in the south to the southern end of Ivanpah Dry Lake to the north. The dry lake then extends to the northern edge of the action area. The dry lake does not provide habitat to desert tortoises because of its fine, compacted substrate and lack of most perennial and annual plants species. Although Ivanpah Dry Lake does not present a complete barrier to the movement of desert tortoises, we expect that they attempt to cross it only infrequently, because of the almost total lack of cover.

The Clark, Lucy Gray, New York, and Ivanpah mountains encircle most of Ivanpah Valley and form natural barriers to the movement of desert tortoises. They are higher in elevation and steeper than most areas where desert tortoises normally reside, although, on rare occasions, individuals are found much farther up mountain slopes that would normally be expected. Cima Dome, at the southern end of the valley, is higher in elevation than areas in which desert tortoises usually occur but its gentler slope would allow them to access it easily, if they attempted to do so.

Alluvial fans cover most of the area between Ivanpah Dry Lake and the mountains. The alluvial fans provide most of the areas of suitable habitat for desert tortoises. They support the plant communities where desert tortoises find food and shelter, generally suitable substrates in which desert tortoises can burrow, and numerous washes. Plant communities on alluvial fans are generally diverse.

As the alluvial fans near Ivanpah Dry Lake, the terrain generally becomes flatter. Because of the more gradual slope, the substrate is generally composed of finer materials, such as clay and silt, and is less suitable for burrowing by desert tortoises. The dominant shrubs are those that are able to tolerant the finer (and occasionally, more salty) substrate; in general, saltbush species (*Atriplex* spp.) are the most common perennial species and often form communities that are less diverse than higher on the alluvial fan. In general, the saltbush communities at the edge of dry lake beds do not provide the most optimal habitat for desert tortoises.

Land Management

Most land in the action area is owned by the Federal government. The State of California owns a few sections in Ivanpah Valley in California and a few small areas are privately owned.

The main areas of privately owned land are the Primm Valley Golf Course and the communities of Nipton, California, and Primm, Nevada. A few other residences are scattered around the valley, primarily to the west of Nipton along Nipton Road.

The Primm Valley Golf Course occupies approximately 0.75 square mile immediately adjacent to Interstate 15 just south of the dry lake. The development of this course removed all habitat value for desert tortoises from this area. Desert tortoises were not detected during surveys for this proposed development (Bransfield 2011); the proximity of the site to Interstate 15 and the dry lake bed may be responsible for this result.

The community of Nipton lies at the junction of Nipton Road and the Union Pacific Railroad line. This small town (approximately 0.5 mile long by 0.25 mile wide) is primarily a tourist destination. All habitat for desert tortoises has been removed from this area.

The community of Primm is a highly developed tourist and gambling area located immediately on the state line. This community is approximately 0.85 mile long by 0.5 mile wide. All habitat for desert tortoises has been removed from this area.

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. We cannot assess how far these indirect effects extend from each community; however, because of the greater level of disturbance at the site, we expect that Primm likely affects more surrounding habitat than the other two developments.

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 of the preserve was not likely to jeopardize the continued existence of the desert tortoise or destroy or adversely modify its critical habitat because most of the proposed actions would improve the condition of habitat within the Mojave National Preserve and reduce the level of mortality of desert tortoises.

Except for the State and private lands mentioned previously in this section, the Bureau manages the remainder of the land in the Ivanpah Valley. Most of the land north of the Mojave National Preserve and south and east of Interstate 15 lie within the Ivanpah Desert Wildlife Management Area; the Bureau manages these lands for conservation of the desert tortoises. We issued a biological opinion regarding the Bureau's land use plan for this area in which we determined that the Bureau's proposed management was not likely to jeopardize the continued existence of the desert tortoise or destroy or adversely modify its critical habitat because most of the proposed actions would improve the condition of habitat within the desert wildlife management area and reduce the level of mortality of desert tortoises (Service 2002a). For both the National Park Service's and Bureau's land use plans, we concluded that relatively few desert tortoises were likely to be killed or injured on an annual basis because of the ongoing casual use of these areas.

The remainder of the Bureau's lands in the valley are not managed 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 in such areas, such as renewable energy projects. 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 Bureau issues special use permits to organized high-speed racing events in this area that include hundreds of racing and spectator vehicles per event (Service 2010i). 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.

Use by Feral and Domestic Livestock

Livestock grazing in the Mojave Desert began long before the listing of the desert tortoise. After the desert tortoise was listed (and critical habitat designated), the Bureau and Service consulted on the effects of grazing on several occasions (Service 1993, 1994b). Most recently, the biological opinion for the California Desert Conservation Area Plan amendment for this area discussed the potential effects of cattle and burro grazing on desert tortoises and their habitat (Service 2005b).

In general, cattle grazing affects desert tortoises in several ways. Desert tortoises can be killed or injured during the construction, maintenance, and use of range improvements. Cattle have trampled desert tortoises. They also damage or destroy the burrows of desert tortoises. 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. Cattle grazing affects habitat of the desert tortoise 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 (i.e., corrals, water tanks, etc.).

The portion of the action area west of Interstate 15 is within a Bureau-managed cattle grazing allotment (Clark Mountain) and a wild burro herd management area (Bureau and CEC 2009, Bureau 2002). Burros affect desert tortoise habitat in much the same manner as cattle; to some extent, their effects on habitat (e.g., browsing and trampling of shrubs, crushing of burrows, consumption of annual plants, disturbance of soil crusts, etc.) may be more severe locally than cattle because large numbers often tend to congregate in smaller areas. In 2007, the Bureau removed most wild burros from the herd management area (Bureau and CEC 2009). However, given the recent nature of this removal and the persistence of some burros within the action area, adverse effects to habitat are likely to persist to some degree. The extent to which these adverse effects persist is likely a function of at least two factors. First, years of average or above-average rainfall likely speed the recovery of the plant community that is damaged by past

use. Second, the Bureau rarely is able to capture all burros in an area and the remaining burros soon begin to repopulate an area; therefore, the number of burros left after the capture and their rate of reproduction also affects the degree of recovery. We do not have information on the current condition of the burro herd in this area.

In the action area in Nevada, the Jean Lake Allotment was retired in 2006; this allotment covered the portion of Ivanpah Valley east of the railroad line. 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 Mojave National Park have been retired. The effects of cattle grazing 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 use by cattle; however, even in areas where cattle grazing has not occurred for decades, non-native plants persist and heavily used areas near range improvements exhibit visible disturbance.

Non-native Species

During surveys of the project site, BrightSource identified numerous non-native plant species, such as Sahara mustard (*Brassica tournefortii*), salt cedar (*Tamarix ramosissima*), red brome (*Bromus madritensis*), Mediterranean grass (*Schismus* spp.), London rocket (*Sisymbrium irio*), and red-stemmed filaree (*Erodium cicutarium*) (CH2MHill 2009a, CH2MHill 2008c). Surveyors located red brome, red-stemmed filaree, and Mediterranean grass throughout the project site with Mediterranean grass having a patchy distribution (CH2MHill 2008c). 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 crosses the northwestern portion of Ivanpah Valley and divides it into a larger southeastern portion and a much smaller northern portion. 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.

Interstate 15 is mostly an impermeable barrier to movement of desert tortoises. The freeway is wide enough and traffic heavy enough that desert tortoises are highly unlikely to travel across its four lanes without being struck; we anticipate that at least a few desert tortoises are killed on this road annually. In Nevada, the Interstate is fenced with desert tortoise exclusion fencing that only allows passage of individuals at culverts and bridges. Fencing to exclude desert tortoises from the California portion of Interstate 15 will be installed as a result of projects proposed by the California Department of Transportation (Service 2006c and the Bureau (i.e., for the ISEGS project).

In the Nevada section of the freeway, a few culverts may allow desert tortoises to cross under the freeway; 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, two undercrossings south of the golf course will allow desert tortoises to cross from side to side after the exclusion fencing is installed.

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. Although this road does not constitute an impermeable barrier to desert tortoises, it is heavily used by motorists traveling to Las Vegas at high speeds (NPS 2009). Desert tortoises are routinely killed on this road (NPS 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 south 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 effects of these roads on desert tortoises are similar to those we noted for Morning Star Mine Road but likely to a lesser degree because they are less heavily used.

Ivanpah Valley contains numerous unpaved roads, both within the Mojave National Preserve and on Bureau lands, that are used by desert recreationists and by workers who are maintaining various transmission facilities; we expect that most use is for recreation. These unpaved roads are not a barrier to movement, but result in occasional injury to or mortality of desert tortoises (NPS 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 kv to 500 kv) transmission lines tie either into the Walter M. Higgins Electrical Substation and switchyard, which is located due east of Primm, or continue to the southwest where they cross the State Line Hills and enter California. Four of these transmission lines pass into California to the north of

ISEGS Unit 1 (and the proposed Units 2 and 3). These lines lie within the Boulder Corridor, which is part of the greater Westwide Energy Corridor which was established as a priority area for future energy transportation facilities. Currently, this utility corridor also supports two gas lines and a fiber optic line; the gas lines were constructed and are maintained by the Kern River Gas Transmission Company (Service 1990, 2002b). The Service recently completed formal consultation on upgrades to an existing electrical transmission line that runs from the south of the Walter M. Higgins Electrical Substation, across Ivanpah Dry Lake, and to near Unit 1 (Service 2011c); this powerline would connect ISEGS to the electrical grid.

The construction of the numerous tower sites for the transmission lines disturbed or destroyed habitat. In general, the amount of habitat completely lost is relatively minor in comparison with the amount of habitat in the valley; a larger amount of habitat remains in a disturbed condition under and around towers. We do not have any quantitative information on the amount of disturbance.

Unpaved roads generally run parallel to the powerlines 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 resulted in the greatest habitat loss in association; we do not, at this time, have any quantitative information on the amount of habitat loss that these access and spur roads have caused.

The most substantial ongoing effect of the transmission lines is their ongoing 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 we discussed in the Status of the Species section of this biological opinion, common ravens prey on desert tortoises; the overabundance of common ravens in the California desert is likely detrimental to the recovery of the desert tortoise. Recently, a pair of nesting common ravens in the Ivanpah Valley was preying on desert tortoises and was removed by a worker from the U.S. Department of Agriculture, Wildlife Services.

The installation of the first Kern River gas line resulted in the disturbance of hundreds of acres of habitat and the deaths of approximately 23 desert tortoises (Service 2002b). (We do not have information regarding how many of these deaths may have occurred in this action area. Additionally, a portion of the mortalities occurred on another pipeline that was addressed in the same consultation.) The second line caused some additional disturbance. The disturbance caused by the pipelines remains evident and, on occasion, repair and inspection work result in new disturbances in the right-of-way.

The use of translocation access roads (both electric and gas) by workers and the public results in the ongoing injury and death of desert tortoises as desert tortoises are struck by vehicles. In one case in the West Mojave 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 have been 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.

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 alongside of the Silver State Solar Project in Nevada. From this point, it travels parallel to Interstate 15. This rail line forms a semi-permeable barrier to desert tortoises. 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 proposed high-speed rail line, called Desert Express, which would enter Ivanpah Valley near the southeastern slope of the Clark Mountains, turn north along the upper alluvial fan, turn east to the north of Segment 3 of ISEGS, and then enter Nevada just to the north of Primm. The DesertXpress rail line would occupy a 75-foot-wide permanent right-of-way and require an additional width of approximately 160 feet to construct. 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. Because of the bridges and culverts, we anticipate that the proposed rail line would fragment desert tortoise habitat in the valley but not result in an impermeable barrier. The potential exists that the line would affect alluvial fans in the same manner that we have discussed with regard to the Union Pacific Railroad line.

Miscellaneous Facilities

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

Unit 1 and the CLA of the ISEGS project, which lies roughly to the north of the proposed joint port of entry, occupy approximately 914 acres of formerly suitable habitat for the desert tortoise; this area has been fenced and cleared of vegetation and desert tortoises. We have discussed the original biological opinion for this project previously in this document.

Between Primm and the Lucy Gray Mountains, the construction of the Walter M. Higgins Electrical Substation and switchyard removed all desert tortoise habitat. The area between Primm and substation is highly disturbed.

North of the substation, the Service has issued a biological opinion to the Bureau for the construction and operation of the 2,966-acre Silver State Solar Project. This project, which is located immediately west of the Lucy Gray Mountains and to the north and east of the substation, will result in the removal of all desert tortoise habitat from its footprint. Construction of the first unit of the solar facility is underway (Service 2010h).

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 2006c). This facility would occupy approximately 80 acres along approximately 4 miles of the freeway. Construction of this facility has not begun.

Status of the Desert Tortoise in the Action Area

Previous Consultation's Population Estimates for the Project Site

Based on 2007 and 2008 survey results for the project site, we estimated the number of desert tortoises larger than 180 millimeters in the project area in the 2010 biological opinion; based on this estimate, we calculated the number of individuals smaller than 180 millimeters (Service 2010). In the fall of 2010, BrightSource conducted clearance surveys and construction monitoring in Unit 1 and the CLA and their associated perimeter fences (Woodman 2011a). The following table depicts the numbers we estimated and that BrightSource found.

	Estimates from the 2010 Biological Opinion		**2010 Clearance Surveys and Construction Monitoring**	
	< 180 mm	**> 180 mm**	**< 180 mm**	**> 180 mm**
Unit 1 and CLA	15	14	17	20
Unit 2	7	6		
Unit 3	13	12		
Solar Exclusion Zone	9	8		

Revised Population Estimates for the Project Site (Individuals Larger than 160 millimeters)

Subsequent monitoring of perimeter fence construction around Unit 2 and 3 indicated that the 2010 biological opinion's population estimates were likely inaccurate for these units. In the

spring of 2011, following re-initiation of formal consultation, the Bureau required BrightSource to resurvey Units 2 and 3. Based on these surveys, the Bureau estimated the numbers of desert tortoises larger than 160 millimeters that would likely occur in Units 2 and 3 (Bureau 2011a). However, the 2010 biological opinion identified its subadult and adult population size based on individuals that are larger than 180 millimeters in size. In this biological opinion, we have revised our method for population estimation of larger size classes because the Service's 2010 pre-project survey protocol allows for the inclusion of individuals larger than 160 millimeters in developing a population estimate, thus allowing more of our population estimate to be based on actual measurement of the population. Using the 180 millimeter division in the 2010 biological opinion required estimation of population size for a larger portion of the population based on indirect methods of estimation. Although, use of the 160 millimeter division still requires estimation of population size for smaller size classes (i.e., smaller than 160 millimeters) through indirect methods (i.e., life table method described below) it reduces the degree to which we must use these indirect methods.

Prior to development of the Service's pre-project survey protocol, we believed that desert tortoises less than 180 millimeters would be too difficult to detect. Consequently, results of range-wide monitoring surveys, which are discussed in the Status of the Species and used for estimation of population size for portions of the action area where we do not have pre-project survey information, still report survey results based on the 180-millimeter division. Consequently, this biological opinion provides population estimates based on the 180-millimeter threshold for unsurveyed areas of the action area and population estimates for surveyed portions of the action area based on the 160-millimeter threshold. Because of the numerous assumptions that are involved with estimating population size – whether on a regional or project-specific scale – and the small number of desert tortoises that would fall into the 160- to 180-millimeter range, the difference in the size thresholds used in these two methods of estimating the number of desert tortoises in an area would not affect, in any substantial manner, the analysis contained in this biological opinion. We acknowledge that these different thresholds result in a bias toward more tortoises on the project site as compared to regional densities, but this bias is certainly small in comparison to the statistical error for either the local or regional estimates.

Regardless of the improvement in accuracy gained by use of the 160-millimeter threshold, the estimates have several sources of potential inaccuracy. Because the fences surrounding Unit 2 and 3 do not yet completely enclose these areas, animals with home ranges that overlap the project boundary may have been off-site during the 2011 surveys. Consequently, these animals would not factor into the population estimate, but they may move into the project site prior to clearance surveys. In addition, some individuals accounted for in the estimate may die during the time between the pre-project surveys and the clearance surveys. We cannot predict how many additional animals may move onto the project site or die prior to clearance surveys.

In addition, the method the Bureau used to derive the estimates (i.e., Service's 2010 pre-project survey protocol) does not take into account site-specific or temporal variability in the proportion

of desert tortoises above ground during surveys nor account for the variability in the ability of different surveyors to detect desert tortoises. For example, various environmental conditions could affect the proportion of desert tortoises above ground during the survey period; different environmental conditions require a different correction to calculate the estimate. In addition, variations in habitat type, topography, and other site-specific factors can also affect the detectability factor because surveyors are more likely to detect desert tortoises in flat, open desert, with low shrub density than in areas with deeply incised washes, undulating terrain, and high shrub density. Finally, use of less experienced survey crews may require a different correction factor for detectability because they are less likely to find all of the desert tortoises that are available for detection.

To reduce some of the inaccuracies associated with not knowing the proportion of desert tortoises above ground during the survey period, we looked at data on the number of desert tortoises found above ground on the Ivanpah Valley G_0 plot during a 2-week period before and after the 2011 surveys of Units 2 and 3 (G_0 is the proportion of the population available for sampling; for more detail on this method, please see Service 2009b). These data indicated that, in Ivanpah Valley during that period, approximately 84 percent of the desert tortoises were above ground and available for detection by survey crews. This information allowed us to change this correction factor (i.e., P_a) from the average value of 0.8 used in the Service's 2010 survey protocol (Service 2010) to a more site and time-specific correction factor of 0.84.

The table below summarizes the population estimates for desert tortoises larger than 160 millimeters on Unit 2 and 3 along with the known number of individuals in this size class that BrightSource cleared from Unit 1 and the CLA. It provides the population information from the Bureau's biological assessment and the population estimates derived from use of the site and time-specific Pa value (i.e., availability correction factor of 0.84 derived from the G_0 data). Given the sources of potential inaccuracy in the population estimates, we have described the number of desert tortoises on the project site that are larger than 160 millimeters as a range rather than a point estimate. We will use the estimates derived through use of the site and time-specific Pa value (i.e., derived using a Pa of 0.84) in the remainder of the biological opinion.

	Estimates based on Spring 2011 Surveys and 2010 Clearance Surveys and Construction Monitoring	
	$P_a = 0.8$	$P_a = 0.84$
Unit 1 and CLA		
Number Cleared	20	20
Unit 2		
Point Estimate	16	15.2
95 Percent Confidence Interval	6.47 - 39.62	6.71 - 34.62
Unit 3		
Point Estimate	49.5	47.1
95 Percent Confidence Interval	24 - 101.9	25.8 and 85.96
Project Site Total		

Point Estimate†	86	84
Range based on 95 Percent Confidence Interval†	50 - 162	51 - 141

† Values for each Unit are rounded to a whole number prior to summation. For point estimates and for the upper limit of the 95 percent confidence limit, the value was rounded up to the nearest whole number. For the lower limit of the 95 percent confidence interval, the number was rounded down to the nearest whole number.

Revised Population Estimates for the Project Site (Eggs and Individuals Smaller than 160 millimeters)

Our current pre-project survey protocol does not provide a method for estimating the number of desert tortoises smaller than 160 millimeters. In the 2010 biological opinion, we used an observed proportion of the population composed of different size classes at the Goffs study site (Turner et al. 1987) to derive an estimate of the number of smaller animals in the action area. The Bureau did not propose to use the method from the 2010 biological opinion for estimation of smaller size classes.

In the biological assessment for this consultation (Bureau 2011a), the Bureau proposed several potential methods for deriving an estimate from the available information. Because two of these methods (i.e., Method 1 and Method 2) provide estimates based on the number of individuals smaller than 160 millimeters that BrightSource found during clearance surveys, we have chosen not to base our analysis on these two methods. We have done so because clearance surveys and construction monitoring likely found only a small fraction of the individuals in these smaller size classes. Consequently, these methods are likely to underestimate the actual number of individuals on the project site.

In the biological assessment, the Bureau developed a hypothetical 15-year life table to derive its estimate (Bureau 2011a). Specifically, the Bureau uses a life table and estimates of annual egg production to derive a population estimate for smaller size classes. In this biological opinion, we have not used the life table provided by the Bureau because it is hypothetical and not based on population studies.

Instead, we have used a life table developed through study of the Goffs Study Plot (Turner et al. 1987). As stated in Turner et al. (1987), the life table has limited predictive ability because it assumes invariant schedules of reproduction and death and constant annual rates of increase or decrease in size. In addition, our use of the life table assumes that current egg production and survival rates on the ISEGS project site are similar to that on the Goffs study site in the early 1980s. However, differences in resource availability, threats, and a variety of other variables can result in differences in the overall mortality rate of individuals at different sites and times and thereby create differences in the proportion of the population composed of individuals in these smaller classes. In addition, this study relied on a survey that does not account for the dynamic changes in the number of juveniles that are present over the course of a year. Therefore, depending on the time of year that clearance surveys occur, the number of desert tortoises could vary considerably. For example, many more desert tortoises will be present

immediately following the hatching of multiple egg clutches in late summer or early fall than in the early spring when many juveniles from the previous season's cohort would likely have died.

We cannot determine the actual number of desert tortoises smaller than 160 millimeters with any accuracy. Even for larger size classes, where direct measurement of the population offers an opportunity to provide better estimates, the patchy distribution of desert tortoises on the landscape, the cryptic nature of the species, and variations in availability and detectability of individuals provide numerous sources of error and extremely wide confidence intervals. This problem is exacerbated when we use these estimates to derive population estimates for smaller size classes from a life table that has its own inherent flaws and assumptions. However, in the absence of a method for direct census of all size classes of individuals, the Goffs life table provides the best available information and thus a reasonable method of characterizing of the population. The desert tortoise population on the Goffs study site may have been more robust in the early 1980s than that currently on the ISEGS 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. The magnitude of this overestimate is unknown.

Using the annual survival rates from the Goffs life table, the formula for estimating annual egg production in the Bureau's biological assessment (Bureau 2011a), and a 1:1 sex ratio, we estimated the number of individuals smaller than 160 millimeters in all portions of the action area (Croft 2011c). In the summary below, we have grouped the egg and hatchling stage into a single estimate because we cannot predict the precise time of year when eggs from various clutches would hatch, so we cannot predict whether project activities would affect the egg or the hatchling stage at any given point in time. Because BrightSource performed the surveys of Unit 1 and the CLA in fall, most viable eggs had likely hatched by the time of clearance surveys and most unhatched eggs had been lost due to various sources of egg mortality. Turner et al. (1987) used an egg-hatching rate of 55 percent in the life table that we have used to estimate the number of individuals in smaller size classes. We have applied that rate to the yearly egg/hatchling production predicted in Croft (2011c) (i.e., approximately 61) for Unit 1 and the CLA to estimate how many hatchlings were available for detection during clearance surveys.

	Hatchlings/Eggs	**49.7 mm to 120 mm**	**120 mm to 160 mm**	**>160 mm**
Unit 1 and CLA	~34	~112	~9	20
Unit 2 and 3	99 to 373 (196)	181 to 684 (359)	15 to 56 (30)	31 to 121 (64)
Project Site Total	160 to 434 (257)	293 to 795 (471)	24 to 65 (39)	51 to 141 (84)

Numbers in parentheses indicate the population point estimate for individuals greater than 160 millimeters or an estimate derived from that point estimate using the life table estimation for individuals smaller than 160 millimeters.

Population Estimates for the Proposed Recipient sites

In the 2010 biological opinion, the translocation strategy divided the recipient sites into short-distance and long-distance recipient sites and our action area incorporated all areas to which desert tortoises might move following release (Service 2010d). Because no survey information was available to cover all portions of this area, the 2010 biological opinion extrapolated the estimated population density for the ISEGS project site to these sites to derive a population estimate. Because of the revisions to the recipient sites in this biological opinion and the availability of new survey information for the proposed recipient site, we have revised our previous population estimates.

In the spring of 2011, following re-initiation of formal consultation, BrightSource performed surveys of the recipient sites for the revised translocation strategy using the Service's pre-project survey protocol for desert tortoises (Service 2010). The table below summarizes the estimates for individuals larger than 160 millimeters (Woodman 2011b):

	Size (acres)	**Individuals Located During Survey**	**Point Estimate (>160 mm)**	**Population Estimate Range**	**Density Range (Point Estimate) [individuals per square mile]**
Unit 1 Recipient Site	3,222	22	44	21 to 94	4.0 to 18.6 (8.7)
Unit 2 Recipient Site	2,342	13	26	12 to 59	3.1 to 15.9 (7.1)
Unit 3 Recipient Site	3,911	43	86	43 to 170	7 to 27.7 (14.1)
Interstate 15 Recipient Site	1,273	16	32	15 to 68	9.9 to 40.6 (20.2)
Total Recipient Site	10,748	94	188	91 to 391	6 to 24 (11.2)

Values in parentheses represent the density estimate based on the population point estimate.

Based on application of the life table method for estimation of smaller size classes, we estimated the number of individuals smaller than 160 millimeters that could potentially occur within the recipient sites (Croft 2011c). The following table provides the results of the application of this estimation method for all size classes:

	Hatchlings/Eggs	**49.7 mm to 160 mm**	**>160 mm**	**Total Individuals**
Unit 1 Recipient Site	68 to 286 (135)	134 to 569 (267)	21 to 94 (44)	223 to 949 (446)
Unit 2 Recipient Site	38 to 183 (80)	74 to 363 (158)	12 to 59 (26)	124 to 605 (264)

Unit 3 Recipient Site	135 to 520 (263)	267 to 1031 (521)	43 to 170 (86)	445 to 1721 (870)
Interstate 15 Recipient Site	50 to 208 (99)	99 to 413 (196)	15 to 68 (32)	164 to 689 (327)
Recipient Area Total	291 to 1197 (577)	574 to 2376 (1142)	91 to 391 (188)	956 to 3964 (1907)

Values in parentheses represent the density estimate based on the population point estimate.

As stated in previous portions of this section, only the estimates for the number of individuals larger than 160 millimeters are based on direct measurement of the population. The remaining estimations, which we derived from the life table, are subject to numerous sources of potential error associated with the application of this method, and the values derived from this method may overestimate of the true population size, but we have determined that it represents a reasonable approach for deriving these estimates based on the best available information.

Population Estimates for the Remaining Portions of the Action Area

Because the Service has estimated the density of desert tortoises within the Ivanpah Critical Habitat Unit through line-distance sampling, we have applied this information to all other portions of the action area for which we do not have pre-project survey information. These additional areas include the control area and all portions of Ivanpah Valley that population fragmentation may indirectly affect. Based on the size of these areas (317 square miles, Croft 2011a) and an average of the yearly density between 2007 and 2010 for the Ivanpah Critical Habitat Unit (i.e., 12.2 adult desert tortoises per square mile), we estimate that these areas contain approximately 3,867 adult desert tortoises. All previous discussions regarding caveats for population estimates apply to these estimates. In addition, the sources of error are further compounded by the assumption that the desert tortoise density estimated for the entire Ivanpah Critical Habitat Unit would also apply to the subset of that critical habitat unit that overlaps the action area for this project.

Summary

Maintaining “self-sustaining populations of desert tortoises within each recovery unit into the future” is a primary objective for recovery of the Mojave desert tortoise (Service 1994 and Service 2008c). Absent the conservation of each recovery unit, we cannot conserve all of the genetic and morphological variations and differences in behavior and ecology that comprise the species. The Ivanpah Valley is an important component of the Northeastern Mojave Recovery Unit because it continues to support a relatively large number of desert tortoises across a range of habitat types. However, the existing developments within the Ivanpah Valley have likely affected population trends within the valley and affected the connectivity of populations within the action area to other desert tortoise populations in other portions of the recovery unit.

In an undisturbed state, desert tortoises in this valley would likely maintain long-term population stability and connections to desert tortoises to the north. However, even without human disturbance, the linkage from the Ivanpah Valley to the remainder of the desert tortoise's range is confined by mountain ranges and the northern end of Ivanpah Dry Lake. On the southern end of the valley, desert tortoises may maintain some connectivity across 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, 2010f, 2010g).

Under the existing conditions, numerous developments have resulted in the loss of a substantial amount of habitat in Ivanpah Valley; these features include, but are not limited to, the first units of ISEGS and the Silver State Solar project, the Primm Valley Golf Course, the communities of Nipton and Primm, Interstate 15, three paved and numerous unpaved roads, an electrical substation and switchyard, and the Union Pacific Railroad line. Other developments have undergone consultation and are likely to contribute to additional habitat loss in the future; these projects include the DesertXpress rail line, the remaining phases of the Silver State project, and the joint port of entry. The rail lines and freeway form semi-permeable barriers to the movement of desert tortoises through the valley. The roads (both paved and unpaved) contribute to ongoing mortality of desert tortoises. Transmission lines attract common ravens in the region. Historic (and, on a smaller scale, continued) grazing by cattle and burros have decreased the overall value of habitat in the basin.

Although we cannot quantify the overall effect on the viability of the population of desert tortoises in the valley, these developments and their associated activities decrease the long-term stability of desert tortoises in the Ivanpah Valley. Because of natural topographical constraints, the movement of desert tortoises into Ivanpah Valley to augment a decline in numbers would likely occur at a very slow rate. Given the additional constraints posed by Primm, Interstate 15, the Union Pacific RailRoad (and future DesertXpress) line, the electrical substation, and Silver State project, the rate of movement of desert tortoises into and out of Ivanpah Valley has likely been reduced even further.

EFFECTS OF THE ACTION

The estimates of the number of desert tortoises and eggs derived from the clearance surveys of Unit 1 and the CLA, the 2011 pre-project survey of Units 2 and 3, and the Service's range-wide monitoring program constitute the best available information regarding the number of desert tortoises in the action area. For this reason, we have used the estimates from the Environmental Baseline section of this biological opinion, in the following analysis. Because we report these as a range of potential values, our analysis also provides ranges when addressing the magnitude of effects.

We have organized this section into four primary subsections: 1) effects associated with movement of desert tortoise through translocation, 2) effects associated with mortality during

project construction, 3) effects associated with operation and maintenance of the facility, and 4) effects associated with habitat loss and population fragmentation.

Summary of Effects Associated with Clearance and Quarantine Activities under the Previous Consultation

Activities associated with the translocation effort have resulted in the handling (i.e., clearance surveys, transmitter placement, health assessments, and blood collection) of 152 desert tortoises (35 in the control site, 36 from Unit 1 and the CLA, and 81 from the recipient population or unfenced portions of Unit 2 and 3). BrightSource has placed transmitters on 131 of these desert tortoises, conducted visual health assessments on 30, and collected blood from 28 to facilitate disease testing (Woodman 2011a). No mortality of individuals occurred due to inappropriate handling of individuals. We anticipate that few if any individuals currently carrying transmitters would die because of improper handling. We have reached this conclusion because experienced biologists, authorized by the Service, performed these activities in accordance with approved handling procedures.

Of the 36 desert tortoises initially located on Unit 1 and the CLA, BrightSource placed 27 (i.e., 13 larger than 160 millimeters, 4 between 120 and 160 millimeters, 6 between 49.7 and 120 millimeters, and 4 hatchlings) in the onsite quarantine facility. The remaining 9 individuals (i.e., 7 larger than 160 millimeters and 2 between 49.7 and 120 millimeters) either moved outside of the project site prior to the completion of the perimeter fence or were placed outside of the project site after they demonstrated a substantial amount of fence-pacing behavior. BrightSource attached transmitters to these animals and continues to monitor them. No mortality has occurred in this group of individuals.

BrightSource has placed 36 desert tortoises (i.e., 16 larger than 160 millimeters, 4 between 120 and 160 millimeters, 10 between 49.7 and 120 millimeters, and 6 smaller than 49.7 millimeters) into quarantine pens from all portions of the project site to await translocation (Woodman 2011a). Most of these individuals were from Unit 1 and the CLA, but a small number of individuals were from Units 2 and 3. No mortality of these individuals has occurred in association with activities at the quarantine facility and we do not anticipate that any would occur in the future because BrightSource is managing the facility in accordance with an approved animal husbandry plan and desert tortoises readily adapt to captivity. In the fall of 2011, BrightSource will translocate all individuals located within the quarantine facility in accordance with the revised translocation strategy identified in this biological opinion.

Effects of the Revised Translocation Strategy

Effects of Clearance and Quarantine of Individuals 120 millimeters or Larger

Based on the size class information in Woodman (2011a), we anticipate that BrightSource would translocate 20 individuals larger than 120 millimeters from the onsite quarantine facility

in the fall of 2011. In addition, we anticipate that BrightSource would clear between 31 and 121 desert tortoises larger than 160 millimeters (point estimate of 64) from Units 2 and 3 in summer or fall of 2011. These individuals would be released in the recipient sites in the fall of 2011.

Although we anticipate that BrightSource would clear and translocate some additional individuals between 120 and 160 millimeters from Units 2 and 3, they are unlikely to find all individuals because of the difficulty in locating smaller size classes. In the Environmental Baseline, we estimated that Unit 1 and the CLA could have contained approximately 9 individuals between 120 and 160 millimeters. During clearance surveys of Unit 1 and the CLA, BrightSource located four individuals in this size range (i.e., approximately 44 percent of our estimate) (Woodman 2011a). Assuming that surveyors would find a similar percentage on Units 2 and 3, BrightSource could find between 7 and 25 desert tortoises between 120 and 160 millimeters (point estimate of 14).

Based on the information provided above, we estimate that BrightSource could release between 58 and 166 desert tortoises (point estimate of 98) into the recipient sites that are either currently in the quarantine facility or in Units 2 and 3 in the fall of 2011. We cannot predict how many of these individuals BrightSource would translocate to the within-home-range versus outside-home-range recipient sites because we cannot predict what portion of the project site that individuals would occupy when clearance surveys occur. Because of the need to await disease-testing results and the need to allow females to lay eggs within the quarantine facility, BrightSource may hold these individuals for several months prior to release. Because BrightSource would hold these individuals for a short period in a facility approved by the Service, we anticipate little if any injury or mortality of individuals held in short-term quarantine, but their normal behavioral patterns are likely to be affected. In addition, capturing and handling of desert tortoises during clearance, quarantine, or translocation for blood collection, health assessments, transmitter placement, or a variety of other reasons is likely to result in little if any injury or mortality because BrightSource will use experienced biologists authorized by the Service to perform these tasks. However, because the Bureau will allow clearance of individuals from some limited portions of the project site during the summer of 2011, we anticipate that individuals cleared from these areas will experience a higher potential for injury and/or mortality, and a higher degree of effects to their normal behavioral patterns. The Bureau has proposed numerous measures to reduce the potential effect of summer clearance activities, which should reduce the potential for mortality. In addition, the limited area that the Bureau would approve for clearance is likely to minimize the number of individuals affected. Consequently, we anticipate that summer clearance activities would result in the injury or mortality of few individuals.

Effects of Clearance and Quarantine of Individuals 120 millimeters or Smaller

Currently, BrightSource is maintaining 16 individuals smaller than 120 millimeters within the onsite quarantine facility (Woodman 2011a). In addition, BrightSource has quarantined 7

females of reproductive age that could produce up to 42 eggs if we apply the formula in the Bureau's biological assessment for egg production (Bureau 2011a). Using an 80 percent egg-hatching rate from Nagy (2010) to reflect higher egg hatching potential within the quarantine facility, we estimate that these eggs could produce up to 34 hatchlings that BrightSource would also maintain for a period of up to 5 years.

We have estimated that between 99 and 373 hatchlings or eggs (point estimate of 196) and between 181 and 684 desert tortoises smaller than 120 millimeters (point estimate of 359) could occur on Units 2 and 3. BrightSource is unlikely to locate a large portion of the smaller desert tortoises or any eggs, given the time of year for clearance surveys and the difficulty in finding eggs. Consequently, we do not anticipate that BrightSource will place any eggs in the quarantine facility from Units 2 or 3. To determine a worst-case scenario for the number of hatchlings present for a clearance survey on Units 2 and 3, we will assume that clearance surveys would occur after all eggs have hatched for a given year and a 55 percent egg-hatching rate, per the life table in the Environmental Baseline section. Therefore, we estimate that Units 2 and 3 could have between 55 and 206 hatchlings (point estimate of 108) under the worst-case scenario. Adding to this the number of individuals between hatchling size and 120 millimeters, we estimate between 236 and 890 desert tortoises smaller than 120 millimeters (point estimate of 467) could be present during the clearance of Units 2 and 3.

In the Environmental Baseline, we estimated that Unit 1 and the CLA could have contained up to 146 desert tortoises smaller than 120 millimeters prior to clearance. During clearance surveys, BrightSource located 12 individuals within this size class (i.e., 8.2 percent). Applying this proportion to the estimate above, we anticipate that BrightSource could clear and quarantine between 20 and 73 desert tortoises smaller than 120 millimeters (point estimate of 39). Based on the cumulative total of these estimates, BrightSource may need to quarantine between 70 and 123 desert tortoises (point estimate of 89) for up to 5 years. Handling of desert tortoises during clearance, quarantine, or translocation for blood collection, health assessments, transmitter placement, or a variety of other reasons is likely to result in little if any injury or mortality because BrightSource will use experienced biologists authorized by the Service to perform these tasks. However, given the length of time that some individuals would remain in the onsite quarantine facility some individuals are likely to die from natural causes or unforeseen circumstances.

Based on 5 years of data on desert tortoise survivorship at the Marine Corp Air Ground Combat Center's head-start facility, Nagy (2010) reported that up to 80 percent of hatchlings survived their first year of life and yearly survival for individuals larger than hatchlings was up to 90 percent. While this is not 100 percent yearly survival, this mortality rate is substantially less than what individuals in these size classes would experience in the wild. We cannot predict how long a group of animals will stay within the quarantine facility because we do not know what the size class distribution will be for animals removed from the project site or how long it would take to reach cohorts of 30 individuals of 120 millimeters. However, because we know that BrightSource would not hold animals for more than 5 years, we will apply a 10 percent

yearly mortality rate (i.e., 90 percent yearly survivorship) for individuals within the quarantine facility. Based on this mortality rate, we estimate that between 25 and 43 desert tortoises (point estimate of 31) would likely die in BrightSource's facility over the course of the quarantine period, which is substantially less than we would predict if these individuals were released directly into the translocation area. Based on the estimated mortality during long-term quarantine and our previous clearance survey estimates, we anticipate that BrightSource will translocate between 45 and 80 desert tortoises (point estimate of 58) to the Interstate 15 recipient site over the course of this 5-year period.

Effects of Post-Translocation Monitoring

Based on the post-translocation monitoring program described by the Bureau and the number of individuals that would likely be translocated, we anticipate that BrightSource could monitor a combined population of between 309 and 738 desert tortoises (point estimate of 468) in the translocated, recipient, and control populations for a period of up to 10 years (i.e., 5 years pos-translocation monitoring for initial translocation and 5 years post-translocation monitoring for the delayed release of individuals smaller than 120 millimeters). BrightSource will capture, handle, attach transmitters, and periodically perform health assessments of all these individuals over the monitoring period. As part of the post-translocation monitoring program, BrightSource will also collect blood from the translocated, recipient, and control populations to determine the overall disease prevalence within these populations. Based on the frequency of monitoring described in the Bureau's translocation strategy and the need to periodically change transmitters, BrightSource is likely to capture and handle each animal numerous times over the course of the monitoring period. Some potential exists that handling of desert tortoises may cause elevated levels of stress that may render these animals more susceptible to disease or dehydration from loss of fluids. Because BrightSource will use experienced biologists approved by the Service, and approved handling techniques, these desert tortoises are unlikely to suffer substantially elevated stress levels resulting from handling and monitoring activities.

Post-Translocation Effects

As stated above, we anticipate that BrightSource could release between 103 and 246 desert tortoises (point estimate of 156) into the recipient sites over the course of the next 5 years. However, because of the methods used to estimate population size for individuals smaller than 160 millimeters, this is likely an overestimate, but the magnitude of the overestimate is unknown. The Bureau has established a post-translocation density threshold of 21 desert tortoises per square mile for the recipient site. This threshold is 130 percent of the 2007-point estimate of the adult (i.e., individuals larger than 180 millimeters) population density of the Ivanpah Critical Habitat Unit. Generally, line-distance sampling occurs within the boundaries of desert wildlife management areas, which support the majority of critical habitat. The National Park Service does not have desert wildlife management areas on land it manages, but does have critical habitat in the Mojave National Preserve. Because we sample both National Park Service and Bureau lands, we will refer to the sampling area here as the critical habitat

unit. Because the ISEGS project site is in the same valley as a portion of this critical habitat unit and in close proximity to the remaining portions of the critical habitat unit, post-translocation density of 130 percent of this density estimate would likely not represent a substantial increase in overall population density in the recipient sites. In addition, if the threshold incorporated individuals in the Ivanpah Critical Habitat Unit that were between 160 millimeters and 180 millimeters, the density threshold would likely be larger. Consequently, compliance with the threshold proposed by the Bureau will provide a conservative limit on post-translocation density.

Because the density estimate for the Ivanpah Critical Habitat Unit is a point estimate for the adult population of the sampled area, we have used the point estimate densities for individuals larger than 160 millimeters for the project site and recipient sites to determine compliance with this threshold. Based on the point estimate for the number of desert tortoises that BrightSource will likely translocate over the next 5 years (i.e., 156 individuals larger than 120 millimeters), and the combined size of the recipient site (16.8 square miles), we anticipate that post-translocation density is not likely to exceed the density threshold established by the Bureau. Vegetation surveys of the recipient sites and project sites indicate that vegetation and forage resources are similar to the recipient sites than they are on the project site except for the southern end of the Interstate 15 recipient site.

Because BrightSource would enclose the Interstate 15 recipient site in exclusion fencing, we have also analyzed the ability for this individual recipient site to meet the density threshold. Based on our current population point estimate for the resident population in the Interstate 15 recipient site (i.e., 32 individuals larger than 160 millimeters) and the size of this recipient site (i.e., 2 square miles), we anticipate that it can accommodate additional desert tortoises without violating the Bureau's density threshold. We cannot predict whether this translocation area will be large enough to accommodate all outside-home-range translocated desert tortoises because we do not know what proportion of the project site animals will require this type of translocation.

Following release, we cannot predict the movement patterns that all translocated animals are likely to exhibit. Translocation studies, including a study performed in the Ivanpah Valley, have shown that straight-line movement distances following release can be over 3.73 miles in the first year for some desert tortoises (Berry 1986, Field et al. 2007, Nussear 2004). Mean dispersal distances observed on 3 study plots south of Fort Irwin ranged from 0.09 to 3.5 miles, with maximum dispersal distances of between 7.8 to 14.3 miles (Walde et al. 2008). For short distance translocations, data appear to indicate shorter post-translocation dispersal distances (0.5 to 0.9 miles) (Walde et al. 2008). Translocated populations can also significantly expand the area they occupy in the first year following translocation (e.g., from 3.9 to 6.9 square miles at a Nevada site; from 0.2 to 10.3 square miles at a Utah site). The degree to which these animals expand the area they use depends on whether the translocated animals are released into typical or atypical habitat; that is, if the recipient site supports habitat that is similar to that of the source area, desert tortoises are likely to move less (Nussear 2004).

Some translocation studies 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 (Field et al. 2007, Nussear 2004). 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). However, translocation studies at Fort Irwin have found that desert tortoises that were released a substantial distance from their capture site moved greater distances than both resident and control groups over a 3-year period, but animals released a short distance from their capture site had similar movement patterns to those of resident and control groups (Averill-Murray 2011). This may indicate that some translocations may result in translocated animals that take longer to settle into new home ranges after release, but this is likely influenced by the distance that the animals are moved from their capture site.

We cannot predict the direction that translocated animals are likely to move. In some studies, translocated desert tortoises have exhibited a tendency to orient toward the location of their capture and attempt to move in that direction (Berry 1986), but in other instances, no discernible homing tendency has been observed in translocated animals (Field et al. 2007). Information specific to short-distance translocations indicates that at least some individuals will attempt to return to their former home ranges after release (Stitt et al. 2003, Rakestraw 1997).

Based on this information, desert tortoises moved adjacent to the project site under the within-home-range translocations are likely to move distances similar to that observed by Walde et al. (2008) because they will be translocated a relatively short distance. Some of the translocated desert tortoises are likely to attempt to return to the project site, where they would encounter the project site fence and either turn around or walk the fence line. Walking the fence line can result in the death of desert tortoises, if they become overheated while persisting in their efforts to find an opening in the fence; one desert tortoise died in this manner in 2011 on the ISEGS project site (Woodman 2011d).

Following the first hibernation period after translocation, individuals moved to the within-home range recipient site are likely to significantly reduce movement distances and establish new home ranges. For individuals moved to the Interstate 15 recipient site under the outside-home-range translocations, attempts to make long-distance movements are likely to be greater than that predicted for the within-home-range translocations, and these animals are likely to take a significant amount of time to settle into new home ranges. Perimeter fencing around this recipient site will restrict this movement, but individuals in this recipient site are likely to exhibit some degree of fence pacing behavior. BrightSource will monitor fences desert tortoises exhibiting fence-pacing behavior. If desert tortoises are found exhibiting this behavior, they will be tracked to ensure that they do not perish along fence lines.

During the period prior to home range establishment, desert tortoises that BrightSource translocates off the project site may experience a higher potential for mortality because they are

moving larger distances through less familiar territory and are less likely to have established cover sites for protection. Studies have documented various sources of mortality for translocated individuals, including predation, exposure, fire, disease, crushing by cattle, and flooding (Nussear 2004, Field et al. 2007, Berry 1986, U.S. Army 2009, 2010). Because of the post-translocation movements exhibited by desert tortoises, some potential also exists for desert tortoises to die on roads during the period when translocated individuals are seeking new home range locations. Based on the location of the proposed recipient sites, the potential exists for all seven sources of mortality within the action area. However, fire is likely to be localized and highly dependent on the abundance of non-native grasses and other weeds. In addition, the potential for loss of individuals due to post-translocation road kills would be reduced because BrightSource will fence Interstate 15, Colosseum Road, and Yates Well Road, which are the only regularly used roads that translocated desert tortoises would come in contact with following release. However, some potential still exists for loss of a few individuals due to road kills on dirt routes that cross the translocation area.

As with other translocations (Nussear 2004, Field et al. 2007, U.S. Army 2009, 2010), we anticipate that predation is likely to be the primary source of post-translocation mortality. The level of winter rainfall may dictate the predation observed in desert tortoises (both translocated, resident, and control) (Drake et al. 2010). Study of translocated desert tortoises at Fort Irwin has documented a statistically significant relationship between decreased precipitation and increased predation (Drake et al. 2010). Because BrightSource would not translocate desert tortoises during drought years, post-translocation predation is unlikely to reach levels documented at Fort Irwin.

Translocating desert tortoises may also adversely affect resident desert tortoises within the action area due to local increases in population density. Increased densities may result in an increased spread of upper respiratory tract disease or other diseases, an increased incidence of aggressive interactions between individuals, and an increased incidence of predation that may not have occurred in the absence of translocation. 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. This study did not draw any conclusions regarding density-dependent effects on predation of desert tortoises.

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 likely to be low based on our population estimates for the action area. Second, desert tortoises will be released in a dispersed pattern. Third, the within-home-range recipient site is not a confined space, so released individuals would be able to disperse into other areas. Finally, the Bureau's post-

translocation density threshold is significantly lower than densities used by Saethre et al. (2003), who did not detect any effects of the increased density.

Translocation has the potential to increase the prevalence of diseases, such as upper respiratory tract disease, in a resident population. Stress associated with handling and movement or due to density dependent effects could exacerbate this threat if translocated individuals with subclinical upper respiratory tract disease or other diseases begin to exhibit clinical signs of disease due to the stress associated with handling and movement. However, recent information from the Fort Irwin translocation project indicates that translocations in that study did not cause a measurable physiological stress response (Averill-Murray 2011).

We cannot reasonably predict the increase in disease prevalence within the resident population that may occur due to translocation. However, several mitigating circumstances are likely to reduce the magnitude of this threat. First, for example, BrightSource will use experienced biologists and approved handling techniques that are unlikely to result in substantially elevated stress levels in translocated animals. 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, BrightSource 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 in the previous paragraph. Finally, BrightSource will not translocate any animal that has clinical signs of disease.

In a study conducted in Ivanpah Valley, 21.4 percent of 28 translocated desert tortoises died (Field et al. 2007). Other studies have documented mortality rates of 0, 15, and 21 percent in other areas (Nussear 2004, Cook et al. 1978 in Nussear 2004). Esque et al. (2010) observed mortality of 89 of 357 translocated desert tortoises (24.9 percent). Esque et al. (2010) and Nussear (2004) found that mortality among translocated animals was not statistically different from mortality observed in resident populations. In addition, Esque et al. (2010) found that mortality rates in resident (29 of 140 desert tortoises; 20.7 percent mortality), control (28 of 149 desert tortoises; 18.8 percent mortality), and translocated (89 of 357 desert tortoises; 24.9 percent) populations did not differ statistically and concluded that the translocation was not the cause of the observed mortality. With the exception of the Esque et al. (2010) study, none of the studies cited in this paragraph used controls to compare mortality rates in resident and translocated populations to the mortality rate experienced in populations not affected by translocation.

Based on this information, we anticipate that post-translocation mortality will be approximately equal among the resident, control, and translocated population. We cannot precisely predict the level of post-translocation mortality in these groups 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. Because we cannot, with any

certainty, predict the weather over the next 20 years, refined estimates of post-translocation mortality are not possible. If mortality rates were similar to that seen in the studies of previous translocations, we could expect post-translocation mortality of between 26 and 62 translocated desert tortoises (point estimate of 39); however, we have no information to suggest that we will experience similar levels of mortality during the translocation from the ISEGS facility. Because past studies have documented similar levels of mortality between translocated, recipient, and control site populations, we also estimate that a similar proportion of the control and recipient site populations would die. We do not anticipate this mortality will be the direct result of translocation because predation rates in the Ivanpah Valley are likely to be the primary driver of the mortality in the region, although individuals will also likely die from other causes. The monitoring of the control population will assist us in determining whether this prediction is realized.

Effects of Clearance of Individuals on Linear Facilities

BrightSource will move desert tortoise a short distance out of harm's way along linear facilities associated with this project (i.e., fiber-optic line, gas line, recipient site fencing). We cannot estimate the precise number of individuals that BrightSource would capture and handle during these activities. Capturing and handling of desert tortoises during these clearances is likely to result in little if any injury or mortality because BrightSource will use experienced biologists authorized by the Service to perform these tasks. However, any desert tortoise moved from linear facilities will likely continue to occupy familiar territory and use known shelter sites and is unlikely to suffer post-translocation mortality associated with displacement from the work area. However, construction of some linear facilities that create barriers to movement may result in additional effects. We have discussed these effects later in the analysis.

Summary of Effects Associated with Construction of the ISEGS Facility under the Previous Consultation

In the fall of 2010 and the spring of 2011, BrightSource installed perimeter fencing, including desert tortoise exclusion fencing around Unit 1 and portions of Units 2 and 3 and began construction of Unit 1 and the power block of Unit 2. During implementation of these actions, one juvenile desert tortoise died when it was crushed by a vehicle along the fence line of Unit 3 and one desert tortoise died when it overheated while pacing a project site fence line (Woodman 2011d, LaPre 2011a, LaPre 2011b). The Bureau attributed both mortalities to construction activities.

In addition to these documented mortalities, numerous individuals smaller than 160 millimeters, likely died within Unit 1 and the CLA during construction because clearance surveys probably did not locate all individuals within these areas. In the Environmental Baseline section, we estimated that Unit 1 and the CLA could have contained 155 desert tortoises smaller than 160 millimeters. Of these, BrightSource located 16 (10.3 percent) during clearance surveys and construction monitoring of Unit 1 and the CLA. Based on these population estimates and the

clearance surveys results, as many as 139 desert tortoises smaller than 160 millimeters in size may have died during construction in 2010 and 2011. As discussed previously, this number is likely an overestimate, given the numerous sources of error associated with our estimation of population size for smaller size classes. In addition, because detectability of individuals declines for smaller size classes (i.e., we predicted that BrightSource would find 44 percent of the individuals between 120 and 160 millimeters but a far smaller proportion for hatchlings and individuals from hatchling size to 120 millimeters), most of the individuals that would comprise the predicted mortality would be comprised of individuals that are far from being recruited into the population. Because there is so much mortality in juveniles, the stage that is most informative as to the effects on a given population is the recruitment rate (i.e., number of individuals reaching reproductive age per year) and the mortality rate of adult individuals. For tortoises, it is estimated that only 2 to 5 percent of hatchlings are recruited into the population (Service 1994). The rest die prior to reaching reproductive age, where they would be able to contribute to population stability. Consequently, of the predicted mortality above, it is likely that only a small portion of it (i.e., that comprised of individuals close to recruitment age) could have any measurable effect on population trends. The remaining juvenile mortality is unlikely to result in any measureable effect in population trend over the long term.

Effects Associated with Construction of the Remaining Portions of the ISEGS Facility

BrightSource will install desert tortoise exclusion fencing and security fencing around the remaining portions of Units 2 and 3 and clear all desert tortoises that it can locate on the project site prior to ground disturbance. During construction of the permanent perimeter fencing and during other ground-disturbing activities that are outside of the permanently fenced facilities (i.e., fiber optic line, highway fence, natural gas distribution line), BrightSource 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, including construction access, is likely to kill few if any individuals larger than 160 millimeters. Some potential always exists that surveyors may miss an individual during clearance surveys and construction monitoring. We cannot predict how many of these larger desert tortoises that clearance surveys and construction monitoring would miss. However, because BrightSource will use qualified biologists, authorized by the Service for clearance surveys, we anticipate that the number is likely to be small.

In addition, desert tortoises that are smaller than 160 millimeters and desert tortoise eggs are difficult to detect and clearance surveys and construction monitoring are likely to miss most of these individuals. These individuals are likely to remain in the work areas during construction. BrightSource is likely to kill these desert tortoises during construction. Based on the Environmental Baseline section of this biological opinion, we estimate that between 15 and 56 desert tortoises between 120 and 160 millimeters (point estimate of 30) may occur on Units 2 and 3. In our analysis of translocation effects, we predicted that surveyors would find 44 percent of these desert tortoises, leaving between 9 and 32 desert tortoises in this size class (point estimate of 17) that would likely die during construction of Units 2 and 3.

In the Environmental Baseline section we also estimated that between 181 and 684 non-hatchling desert tortoises that are smaller than 120 millimeters (point estimate of 359) may occur on Units 2 and 3. We previously estimated that Unit 1 and the CLA contained approximately 112 individuals in this size class, of which, clearance surveys located 8 (7.1 percent) (Woodman 2011a). Based on our population estimate for this size class on Units 2 and 3 and our estimated detection percentage from Unit 1 and the CLA, we estimate that construction of Units 2 and 3 could kill between 169 and 636 non-hatchling desert tortoises that are smaller than 120 millimeters (point estimate of 334).

Finally, we estimated in the Environmental Baseline that Units 2 and 3 could contain between 99 and 373 desert tortoise hatchlings or eggs (point estimate of 196). Because construction activities on Units 2 and 3 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. For Unit 1 and the CLA, we estimated that 34 desert tortoise hatchlings were potentially present during clearance surveys, of which, BrightSource located 4 (i.e., 11.8 percent). Assuming a similar clearance rate for Units 2 and 3, we estimate that BrightSource could clear between 11 and 44 desert tortoises hatchlings. We anticipate that detection of eggs is unlikely. Based on our population estimate for this size class on Units 2 and 3 and our estimated detection percentage from Unit 1 and the CLA, we estimate that construction of Units 2 and 3 could kill between 88 and 329 desert tortoise hatchlings or eggs (point estimate of 173). As discussed in the previous section, only a small portion of this mortality (i.e., loss of individuals that are close to recruitment) could have any meaningful effect on overall population trends.

Effects Associated with Construction of Linear Facilities

BrightSource has currently fenced Unit 1 and portions of Units 2 and 3 with desert tortoise exclusion fencing under the 2010 biological opinion. Because these are linear facilities and have different effects on desert tortoises relative to their construction, we have analyzed them here rather than grouping their effects with our analysis of the overall effects of construction of the solar fields. During installation of fencing, BrightSource moved individuals out of harm's way and continues to monitor these individuals. In the previous section, we indicated that two desert tortoises died along the fence line.

Going forward, BrightSource would install the 8-mile-long fiber-optic line to Mountain Pass, install the 7-mile-long fence along Interstate 15 between Nipton Road and Yates Wells Road, extend existing access route fencing from Colosseum Road out to the interstate, install culverts under Colosseum Road to reduce population fragmentation, install temporary desert tortoise exclusion fencing around the outside-home-range translocation site, and complete installation of the natural gas distribution line. We anticipate that overall habitat disturbance associated with this activity would be less than 200 acres based on the location, length, and overall habitat disturbance associated with these activities. BrightSource would have to capture, handle, and

move desert tortoises from construction areas. The location of all of these activities overlaps largely with translocation recipient sites surveyed in the spring of 2011. In the Environmental Baseline, we indicated that the density of individuals larger than 160 millimeters within the recipient sites was as high as 40 per square mile in some areas. Based on this information and the amount of surface disturbance that we anticipate (i.e., less than 200 acres), we anticipate that BrightSource would move few desert tortoises. We anticipate that construction activities, capture, handling, and movement of desert tortoises out of harm's way will result in direct effects in the form of injury or mortality of few desert tortoises for the reasons discussed previously. We expect the number that would be injured or killed to be small due to the numerous protective measures that the Bureau has proposed. We do not anticipate that this potential injury or mortality will substantially change the overall effects of the project.

In addition to direct effects in the form of injury and mortality of individuals due to fence installation activities, desert tortoises would die when exposed to harsh conditions (i.e., cold or hot temperatures) while pacing fences. Increased monitoring of fence lines and the Bureau's requirement that BrightSource immediately translocate any individual exhibiting "fence line distress", should reduce the potential for injury or mortality in the future. Finally, 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. We cannot predict the number of desert tortoise home ranges that project fence alignments might affect.

Effects of Operations and Maintenance Activities

Following fencing, operation and maintenance activities within permanently fenced areas are unlikely to injure or kill any desert tortoises. However, we have discussed additional indirect effects associated with operation and maintenance of this facility in the Miscellaneous Effects section later in this biological opinion.

Over the 30-year life of this project, BrightSource may conduct some ground-disturbing maintenance activities outside of fenced areas. These activities have the potential to injure or kill desert tortoises primarily as a result of 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 Class I maintenance activities would not result in surface disturbance or loss of habitat and BrightSource would implement protective measures to reduce the potential for effects to desert tortoises, Class I maintenance activities would kill few, if any, desert tortoises.

Class II maintenance activities associated with repair of desert tortoise exclusion fencing would likely kill or injure few, if any, desert tortoises for the following reasons: 1) fence repairs are likely to result in minimal ground disturbance in localized areas, 2) at least a portion of the work

area would be on disturbed areas within the fenced project site, 3) perimeter roads would exist that would allow access to most repair locations with minimal off-road travel, and 4) BrightSource would implement numerous protective measures to reduce the potential for injury or mortality of desert tortoises.

Because we do not have sufficient detail regarding the other types of maintenance activities discussed in the Description of the Proposed Action, we cannot adequately analyze the potential for injury or mortality of desert tortoises. Consequently, we are not analyzing Class III maintenance activities or any Class II maintenance activities that would occur outside of the fence and not be associated with repair of fencing. The Bureau has indicated that these actions would require future site-specific authorizations. At the time the Bureau considers authorization of these future activities, it will need to determine whether these future activities may affect desert tortoises. Some of these actions may require future site-specific consultation under section 7.

Effects of Restoration/Reclamation Activities

Decommissioning or restoration activities within the permanently fenced project area are unlikely to result in injury or mortality of desert tortoises. BrightSource will also need to perform restoration of long-term and short-term disturbance associated with the natural gas distribution line and fiber optic line. BrightSource would implement pre-activity clearance surveys and employ desert tortoise monitors to ensure that desert tortoises do not enter restoration work areas. Consequently, restoration activities will injure or kill few, if any, desert tortoises. These actions are likely to reduce the amount of time required to return disturbed areas to habitat suitable for desert tortoise occupancy. However, this process is likely to take several decades.

Effects of Loss of Habitat

With the exception of minor habitat loss associated with the installation of perimeter fencing around the Interstate 15 translocation area and along Yates Well Road, the anticipated habitat loss associated with this project has not changed since the previous consultation. However, the following analysis provides a more detailed assessment of the effects that this habitat loss would have on desert tortoises in Ivanpah Valley and on desert tortoises within the recovery unit.

The biological assessment for the 2010 consultation defined permanent, long-term, and short-term disturbance as follows:

- Permanent Disturbance: project disturbance that would remain after the project's lifespan.
- Long-term Disturbance: project disturbance that would remain in place for the lifespan of the project, but would be restored following closure.

- Short-term disturbance: project disturbance restored within 5 years of the time of the disturbance.

Based on these definitions and the project description provided in the biological assessment, construction of the 3 project phases and the CLA, including installation of exclusion fencing, and improvements to Colosseum Road would result in 3,321.9 and 122.1 acres of permanent/long-term and short-term disturbance, respectively (CH2MHill 2009a). Installation of the natural gas distribution line and associated facilities will result in an additional 1.7 and 6 acres of new permanent/long-term and short-term disturbance. We anticipate that installation of fencing along Interstate 15 would temporarily disturb approximately 9.1 acres of desert tortoise habitat.

The following table, adapted from table 2.1-1 of the revised biological assessment (CH2MHill 2010a), provides details regarding the disturbance associated with each project feature.

Permanent and Long-term Disturbance	**Acres**
Ivanpah 1	913.5
Ivanpah 2	1,097
Ivanpah 3	1,227
CLA and SCE Substation	68.4
Gas Line	1.7
Colosseum Road	14.3
Total	**3,321.9**
Short-term disturbance	
CLA and SCE Substation	115.6
Gas Line	6.0
Construction areas for linear corridors	10.4
Credit for existing roads within project area	-9.9
Total	**122.1**

Based on the definitions above, we estimate that installation of the fiber optic line would result in approximately 0.28 acre of new short-term disturbance. In addition to the disturbances associated with construction of the ISEGS facility, Class II and III maintenance activities are likely to result in additional habitat disturbance over the 30-year life of the project. Based on the information provided, we cannot estimate the amount of disturbance associated with some Class II activities (i.e., those outside of the project site) or any Class III maintenance activities over the life of the project. We are not analyzing these activities in the biological opinion because they will require future authorizations from the Bureau.

These permanent, long-term and short-term disturbances will result in desert tortoise habitat loss that will persist for various periods. Following extensive disturbance and compaction, Mojave Desert soils 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, 3,321.9 acres, currently characterized as permanent/long-term disturbance, are likely to be permanently lost or unsuitable as habitat for several decades following decommissioning of the facilities and commencement of restoration work. Because active restoration will occur, we estimate that BrightSource will restore 122 acres of short-term disturbance to desert tortoise habitat prior to decommissioning of the facility. Based on the information provided, we cannot estimate the amount or duration of habitat loss associated with some Class II activities (i.e., those occurring outside of the project fence) or any Class III maintenance activities. Consequently, we are not analyzing the effects of these activities in this biological opinion. The Bureau has indicated that these actions will require future Bureau authorizations.

In the Status of the Species section of this biological opinion, we estimated that the Northeastern Mojave Recovery Unit contained approximately 5,600 square miles of desert tortoise habitat, of which some is composed of degraded habitat that likely supports low-density desert tortoise populations. Therefore, we anticipate that construction of the 5-square-mile ISEGS project would disturb less than one percent of the desert tortoise habitat in the Northeastern Mojave Recovery Unit. Although this percentage does not constitute a numerically substantial portion of the Northeastern Mojave Recovery Unit, the location of the habitat loss associated with ISEGS, in conjunction with other existing and foreseeable habitat loss in the action area, has the potential to affect population connectivity in the Ivanpah Valley. We have discussed those effects below.

Effects of Population Fragmentation

All recent genetic studies of the desert tortoises have concluded that its population structure is characterized by 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 suggests that gene flow in desert tortoises generally occurs according to a continuous-distribution model (Allendorf 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. (2011) concluded that geographic distance and the presence of geographic barriers provide the most reliable predictors for population structure in the desert tortoise and 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 Northeastern Mojave Recovery Unit and Ivanpah Valley was constrained through geographic and topographic bottlenecks. Because of these constrictions, the following analysis focuses on how the ISEGS facility, in combination with other barriers in the action area, will affect dispersal, gene flow, and population viability in the Ivanpah Valley. In addition, we address the relative contribution of the ISEGS facility to these effects in context with the other existing and approved developments within the valley.

Existing Population Linkages near Primm

Croft (2011d) provides a map of current or proposed developments in relation to the modeled linkages in Hagerty et al. (2011). The developments that have already affected or have the potential to affect dispersal and population connectivity in this corridor include ISEGS, portions of Interstate 15, Primm, the First Solar Silver State project, the Primm Valley Golf Course, an existing electrical substation near the proposed Silver State project, and the southern boundary fence of the Clark County large-scale translocation site (LSTS). The LSTS lies west of Interstate 15, south of Goodsprings Road, east of the Spring Mountains, and approximately 3 miles north of Stateline, Nevada. The portion of the fence along the southern boundary is approximately 1.2 miles long from Interstate 15 to the edge of the Spring Mountains. This fence is maintained and monitored regularly to ensure that desert tortoises are contained within the LSTS. The location, purpose, and continued maintenance of this fence virtually severs connectivity of desert tortoise populations within this recovery unit west of Interstate 15.

Additional developments in this area would also fragment habitat, but they are not likely to further block connectivity because dispersal and gene flow can occur through adjacent, intact habitat or they are permeable barriers (i.e., contain culverts or other passages that span a very short distance that allows for animals to move back and forth). These developments include Nipton, Nipton Road, MorningStar Mine Road, Ivanpah Road, unpaved roads, the Kern River pipelines, the Molycorp Wastewater Pipeline, the proposed Desert Express railroad, the Union Pacific Railroad, the Eldorado to Ivanpah Transmission Line, and other high-voltage power lines and fiber-optic lines that cross the Ivanpah Valley. However, human activities associated with these developments likely injure or kill several desert tortoises per year. These continued human-caused losses contribute to a decreased level of population viability in the action area.

Based on the location and extent of the existing and approved projects within the Ivanpah Valley, four potential linkages between the Clark and Lucy Grey Mountains would exist following construction of currently approved projects (Croft 2011d). The first potential linkage would be to the east of the proposed Silver State project (between the project and the Lucy Grey Mountains) and would be approximately 1.5 miles wide at its narrowest point. The second potential linkage would be to the north of the ISEGS project and the west of Primm (between the project and the Clark Mountains). The third potential linkage would be between the ISEGS project site and the Primm Valley Golf Course and would feed into the linkage described above that is to the north of ISEGS and west of Primm. The fourth potential linkage would be

between the town of Primm and an existing electrical substation, and would be approximately 0.5 mile wide (Croft 2011d).

Long-term Viability of Existing Linkages

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 connectivity of populations depends upon the existence of enough suitable and occupied habitat to maintain sustainable populations. Consequently, the long-term viability of the four linkages depends on the ability for the habitat in these linkages to sustain populations into the future and the absence of significant barriers to dispersal. The following discussion analyzes the likelihood that the linkages would maintain sustainable populations and population connectivity into the future.

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. Because the lifetime utilization area considers the expansion and contraction of desert tortoise 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 out (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. Croft (2011d) mapped circular 1.5-square-mile areas within the 4 potential linkage areas described above. This mapping shows that the linkages are of sufficient width to accommodate the diameter of these circular utilization areas. Although these figures provide a means for characterizing the potential minimum width of a linkage, the actual linkage-width needs 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, constrictions,

and edge effect will disrupt the linkage. The following discussion discusses the long-term viability of each linkage.

Because of its narrowness and the current level of human impacts within and adjacent to it, the linkage between Primm and the Silver State project will not likely provide any reliable level of population connectivity. The linkage to the north of Unit 3 of ISEGS and west of Primm has already experienced habitat loss due to the installation of the Kern River Gas Transmission Lines and several large transmission lines; the DesertXpress rail line would also be placed in this linkage. This linkage is also virtually severed north of Primm because of the location of the LSTS southern boundary fence and Interstate 15. Interstate 15 also blocks the southern end of this linkage. Although culverts and underpasses, north of Primm and west of Roach Lake, and between Yates Well Road and Nipton Road offer some small potential for population connectivity through this area, we anticipate that dispersal of desert tortoises through these underpasses does not likely contribute significantly to population connectivity.

The linkage east of the Silver State project has the lowest level of existing habitat degradation and likely provides the most reliable potential for continued population connectivity. However, desert tortoises may not persist within this linkage during years of low resource availability; they may die or move to other areas. Climate change may exacerbate this potential effect, given that temperatures are expected to rise; 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 these 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 also would 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).

A stochastic event, such as a fire or disease outbreak, could cause a decline in the number of desert tortoises throughout the valley or in a substantial portion of it. Rising temperatures resulting from climate change would likely exacerbate the effects of any such stochastic event, because of the increase in environmental variability in the region. (The effects of climate change on rainfall are less predictable at this time.) 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.

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 as a result 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.

Although the linkage to the east of the Silver State project is narrow, it will accommodate the width of a desert tortoise's lifetime utilization area and is likely wide enough to maintain a population at some level during times of low resource availability when desert tortoises may have to expand their year-to-year home ranges within the linkage to obtain necessary resources. However, existing and future habitat degradation from development within and adjacent to this linkage may reduce the capacity of it to support viable populations in years of poor resource availability. We cannot determine the probability that this linkage would be lost in the future, but the compromised nature of the other linkages in the vicinity of Primm makes this linkage critically important. Although we cannot predict that the development in the vicinity of Primm would result in loss of population connectivity, we have provided the following discussion of potential effects associated with this possibility.

Effect of the Loss of Population Connectivity in the Vicinity of Primm

The loss of connectivity between the northern and southern ends of Ivanpah Valley would have far-reaching implications if it occurred because of the confined nature of the population in the Ivanpah Valley. Hagerty et al. (2011) showed that historic connectivity through the southern end of Ivanpah Valley near Cima is narrowly constrained by topographic barriers. This constriction is sufficient to contain the width of two desert tortoise lifetime utilization areas (Croft 2011d). However, Nussear et al. (2009) identified this area as having a lower probability to support desert tortoises based on habitat attributes; additionally, no desert tortoises were detected in this area during line-distance sampling from 2007 through 2010 (Service 2009b, 2010f, 2010g). Considering the narrow width of this linkage, its 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 the valley is likely severely constrained. Consequently, loss of connectivity in the vicinity of Primm would likely create a nearly closed population in the southern end of the Ivanpah Valley.

The Service (1994) provided a population viability analysis for the desert tortoise to inform its recommended reserve designs during recovery planning. Based on this analysis, the Service concluded that the minimum viable population density for a population of desert tortoises was 10 adult desert tortoises per square mile; below this density, demographic stochasticity and genetic deterioration likely diminish the potential for population growth (Service 1994). This analysis also concluded that a minimum area of 1,000 square miles is needed 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 went extinct faster) and that lambda (i.e., population growth rate) needed to remain above 1 to avoid becoming extremely vulnerable to extinction.

Loss of population connectivity near Primm and Cima could create a nearly closed population of desert tortoises within a 317-square-mile area in the southern portion of the Ivanpah Valley. The most recent 4-year average density of desert tortoises in the Ivanpah Critical Habitat Unit, which contains the southern portion of the Ivanpah Valley, is approximately 12.2 adult desert tortoises per square mile (Service 2009b, 2010f, 2010g). This density is based on the sampled areas of the entire Ivanpah Critical Habitat Unit and may not reflect conditions in this smaller area. Given the small size of the area that development within the Ivanpah Valley could isolate, the relatively small population that currently occupies it, the ongoing sources of mortality in this area that we discussed in the Environmental Baseline, 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.

Isolation of the Ivanpah Valley to the north would also have negative implications for desert tortoise populations 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 the Eldorado and Piute valleys are often considered 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). Eldorado Valley is already disconnected by Las Vegas and Boulder City from tortoise populations to the north and has likely experienced population declines as discussed in the Status of the Species Section. If development in the Ivanpah Valley severed population connectivity, it would essentially isolate the Eldorado Valley population from the rest of the recovery unit.

We have addressed the potential long-term effects of loss of population connectivity in the vicinity of Primm to ensure a broadscale analysis of this issue. However, there is no information to indicate whether loss of the connectivity is probable because the linkage to the east of the Silver State project is still viable. Currently, this linkage is not threatened by existing or future development, and we cannot determine the probability that it would be compromised in the future by drought or other stochastic events. The Service (2010h) has also concluded that connectivity was likely to be maintained through this linkage.

Effects of the ISEGS Project on Population Connectivity and Fragmentation

Although the available information does not support a conclusion that connectivity would be lost in the vicinity of Primm, leading to population-level genetic and demographic effects in the southern end of the Ivanpah Valley, the existing effects of fragmentation caused by the LSTS fence, Interstate 15, Primm, and the Clark Mountains are likely to be exacerbated by the development of the ISEGS facility. Although culverts and underpasses, north of Primm and west of Roach Lake, and between Yates Well Road and Nipton Road, offer some small potential for population connectivity to this area, we have concluded that dispersal of desert tortoises through these underpasses does not likely contribute significantly to population connectivity. This lack of significant connectivity has resulted in a population west of Interstate

15 that is completely or nearly isolated from the remainder of the desert tortoise population in the southern end of the Ivanpah Valley.

The isolated population west of Interstate 15 is significantly smaller than the minimum viable population size identified in Service (1994), indicating that it is highly vulnerable to demographic stochasticity and genetic deterioration. The development of the ISEGS 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 individuals on the ISEGS project site will also likely have some effects on population recruitment (i.e., individuals reaching reproductive age). In addition to exacerbating demographic and genetic effects within this small population, the ISEGS facility would further fragment the small population west of Interstate 15 by constraining connectivity between populations east and west of the facility. However, because population connectivity would still remain to the north of Unit 3 and BrightSource would install culverts underneath its access road to alleviate fragmentation associated with it, we anticipate that populations to the west and east of ISEGS would still largely be connected.

We have concluded that the population west of Interstate 15 is likely isolated and suffering from demographic stochasticity and genetic deterioration because of existing barriers that greatly reduce the potential for movement (Service 1994). However, we currently have no information on the demographics of the population west of Interstate 15 or the degree to which individuals move between this population and populations in the surrounding area. Consequently, without this information we cannot confirm or estimate the magnitude of the effect associated with the development of ISEGS on the viability of this population. The Bureau has proposed a genetic and demographic monitoring and adaptive management program that will likely address these effects if they occur. In addition, the delayed translocation of smaller sized individuals from the project will offset, to some degree, the loss of recruitment associated project site mortality of pre-reproductive individuals.

Miscellaneous Effects

Indirect effects associated with construction, operation, maintenance, and decommissioning of the ISEGS facility 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, Nevada and Nipton, California), golf courses, an interstate highway, 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 ISEGS facility has the potential to attract additional common ravens and increase predation in the action area. BrightSource has proposed numerous measures to address predation by common

ravens associated with the project site. These measures include control of raven attractants, a monitoring program, and contingencies for removal of problem common ravens. In addition, BrightSource will provide funds for implementation of regional management actions for common ravens.

We cannot reasonably predict the amount of predation by common ravens that construction and operation of this project is likely to add to baseline levels within the action area, but we anticipate that the program proposed by BrightSource is likely to be effective in eliminating some, but not all, common raven use of the project site. 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 action area.

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 Ivanpah Valley, numerous features serve as vectors for infestation of the action area by non-native plant species (e.g., highways, cattle allotment). However, construction and operation of the ISEGS facility has 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 site and other project features by construction and operations personnel is likely to increase the volume and distribution of non-native seed carried into the action area. The increased abundance in non-native species associated with this project may result in an increased fire risk, which may result in future habitat loss.

BrightSource has proposed numerous measures to address control of non-native plant species within the project site. We cannot reasonably predict the increase in non-native species abundance that this project will create within the action area, but we anticipate that the program proposed by BrightSource will be reasonably effective in reducing the increase in some species. However, BrightSource has not proposed any measures to control species, such as red brome, that are ubiquitous in the area. Increases in the abundance of this species elevate the risk of fire, which, in turn, heightens the risk of future habitat loss, which could reduce the number and distribution of desert tortoises within the action area. We anticipate that BrightSource's use of herbicides in control of weeds would have minimal effects because these herbicides would be used within fenced areas that do not contain desert tortoises.

Effects of Compensation

The Bureau has required compensation for loss of habitat associated with this project at a ratio of 1:1 per the provisions of the Northern and Eastern Mojave Plan. Compensation will include acquisition of private lands containing desert tortoise habitat and their transfer to the Bureau, implementation of habitat enhancement and rehabilitation projects on public land, or some combination of these actions. The Bureau would implement all of these compensation requirements within the Northeastern or Eastern Mojave Recovery Unit.

Potential habitat enhancement and rehabilitation actions that the Bureau has proposed, include highway fencing, fencing the boundary of two desert residential communities, non-native plant control, rehabilitation of closed routes, and identification and clean up of degraded sites (i.e., illegal dumps, illegal routes). All actions would occur within or would benefit desert wildlife management areas or other areas that are important to desert tortoise conservation in the Northeastern Mojave Recovery Unit or in nearby areas in the Eastern Mojave Recovery Unit.

In addition to the Bureau's required compensation, the California Energy Commission required BrightSource to compensate for the loss of desert tortoise habitat at a ratio of 2:1. Although these funds may be spent in locations outside of the Northeastern Mojave Recovery Unit, at least some funds are likely to be expended within the unit; we expect that these funds would be used to implement actions similar to those implemented by the Bureau and would also result in actions that would promote the conservation of the species. The California Energy Commission has also required BrightSource to provide funding for the implementation of regional management programs for the common raven.

Although acquisition of suitable desert tortoise habitat through these compensation requirements will not create new habitat within the Northeastern Mojave Recovery Unit, it will result in a net increase in the amount of desert tortoise habitat managed for the conservation of this species. (The amount of acquired land may not equal the amount of habitat that is disturbed because relatively little private land remains in this portion of the desert.) In addition, the funding of management actions and regional management of common ravens are likely to result in restoration and rehabilitation of degraded habitat, protection of existing habitat from future sources of degradation, and a reduction in the direct mortality of desert tortoises. In general, the original and draft revised recovery plans (Service 1994, 2008c) identify the actions proposed for compensation as being necessary for the recovery of the desert tortoise. We cannot quantify the level of effects that these actions will have because we cannot assess the specific actions that will be implemented at this time. Because habitat enhancement actions and land acquisition would occur in desert wildlife management areas or other locations that are important to desert tortoise conservation, the proposed compensation requirements would provide a positive recovery benefit to the desert tortoise and at least partially offset loss of habitat associated with the project.

Implementation of some of the habitat enhancement actions has the potential to result in adverse effects to the desert tortoise. Because we do not have specific information regarding future habitat enhancement and rehabilitation projects, we cannot perform a detailed analysis of these actions. The Bureau has indicated that these actions would require future project-specific authorizations prior to implementation. Consequently, we will address their adverse effects to the desert tortoise in future project-specific section 7 consultations.

Summary of Effects

Based on the results of clearance surveys of Unit 1 and the CLA and the 2011 pre-project surveys of Units 2 and 3, we estimate that BrightSource would translocate between 103 and 246 project-site desert tortoises larger than 120 millimeters (point estimate of 156) over the next 5 years. All of these individuals are either currently in quarantine or would be placed in quarantine for some time prior to translocation. Because BrightSource will not translocate any individuals smaller than 120 millimeters, some of these individuals may remain in quarantine for up to 5 years. Because BrightSource will implement a variety of measures to reduce stress to these animals, we do not anticipate that injury or mortality will result from handling or short-term quarantine; short-term quarantine pertains to those animals that remain in quarantine only long enough for testing to occur and the appropriate translocation release period to arrive. However, we estimate that between 25 and 43 desert tortoises (point estimate of 31) will die during the long-term quarantine that is required for some individuals to reach 120 millimeters. We anticipate that this mortality rate is lower than what individuals within this size class would experience in the wild.

Following release of translocated animals, we anticipate that between 26 and 62 translocated desert tortoises (point estimate of 39) will die due to predation, exposure, fire, disease, crushing by cattle, road kills, or flooding during the 10-year monitoring period. In addition, some resident desert tortoises in the recipient sites are likely to die due to the same causes of mortality. However, based on the available information, we have concluded that mortality rates within the resident and translocated populations are unlikely to be above what they would experience in the absence of translocation, as would be demonstrated in the control population, and we do not anticipate that the act of moving desert tortoises will cause an increase in mortality as compared to the control population. If post-translocation monitoring indicates elevated levels of mortality in resident and translocated populations, re-initiation of consultation may be required to address this unanticipated effect.

We also anticipate that BrightSource would monitor between 309 and 738 desert tortoises (point estimate of 468), which would include the translocated animals described above, for a period of up to 10 years. Over this period, BrightSource could capture and handle each individual multiple times to facilitate transmitter replacement, health assessments, and periodic blood sampling. Some potential exists that handling of desert tortoises and blood collection could result in elevated levels of stress or injury, if done improperly. However, we anticipate that the number of desert tortoises that may be injured would be minimal because BrightSource would use experienced biologists authorized by the Service to perform these activities.

Because BrightSource's construction activities would continue to occur within areas that have been fenced and cleared of desert tortoises, we anticipate that construction of the ISEGS project, including use of access routes, is likely to directly kill or injure few desert tortoises larger than 160 millimeters. Because of the difficulty in detecting smaller animals, we estimate that construction of Unit 1 may have killed as many as 139 desert tortoises smaller than 160

millimeters. In addition, we estimate that construction of Unit 2 and 3 may kill or injure between 178 and 668 non-hatchling desert tortoises that are smaller than 160 millimeters (point estimate of 351). Finally, we estimate that project construction on Units 2 and 3 may kill or destroy between 88 and 329 desert tortoise hatchlings or eggs (point estimate of 173).

We also anticipate that construction of linear facilities (i.e., fiber optic line, access road fencing, project-site perimeter fencing, and recipient site fencing) may kill or injure a small number of desert tortoises due to adverse effects associated with fence pacing. In addition, fence installation has the potential to injure or kill some desert tortoises by displacing them from portions of their existing home ranges. We cannot predict precisely how many desert tortoises the construction of linear facilities and fence installation would affect because we do not know how many desert tortoises would have home ranges that overlap fence alignments.

Use of a life table to estimate the number of desert tortoises in smaller size classes has numerous sources of error and is likely an overestimate, but the magnitude of the overestimate is unknown. However, it provides a reasonable method for looking at how mortality in a cohort over time may affect the number of individuals that reach the 160-millimeter size class. Although this method likely overestimates the population size, thereby overestimating the adverse effects, it is an appropriate way to assess the effects of this project on the desert tortoise population.

Following construction, we do not anticipate that operations, maintenance, or restoration and reclamation activities within the permanently fenced portions of the ISEGS facility or regular access to the ISEGS facility along Colosseum Road will injure or kill desert tortoises. Because BrightSource will implement numerous protective measures, restoration activities in unfenced work areas are unlikely to injure or kill desert tortoises. We cannot accurately predict the number of desert tortoises that most Class II maintenance activities would kill or injure outside of the fenced project site because we do not have sufficient information to predict the location, frequency, or magnitude of these actions. However, Class I activities and Class II maintenance activities associated with fence repair would kill or injure few, if any, desert tortoises because of the nature of these activities and the protective measures that BrightSource would implement. Class III maintenance activities and Class II maintenance activities occurring outside of the project site would require future consultation.

Construction, operation, maintenance, and decommissioning of the ISEGS facility have the potential to increase common raven predation on desert tortoises within the action area. In addition, this project is likely to result in an increased abundance of non-native plant species and a subsequent increase in fire frequency within the action area. The measures proposed by BrightSource to address these threats will reduce the magnitude of these effects, but some level of adverse effect will likely persist. We cannot reasonably predict the number of desert tortoises that these threats will adversely affect.

Because desert tortoises are long-lived creatures and females can produce large numbers of offspring each year, the magnitude of the population level effects associated with desert tortoise mortality depends largely on the size class in which the mortality occurs and the local mortality rate for reproductive females. Several demographic models indicate that desert tortoises require high levels of survivorship and recruitment (i.e., survival to reproductive age) to recover mortality of reproductive adults in a declining population (Congdon et al. 1993, Doak et al. 1994, and Service 1994). Desert tortoises do not typically reach reproductive age until they are 12 to 25 years old (Turner et al. 1984). Once adults reach reproductive age, they can live for more than 80 years and produce offspring for their entire reproductive lifespan (approximately 50 to 60 years) (Service 1994). To maintain a stable population in the Ivanpah Valley, the number of individuals reaching reproductive age (i.e., surviving from hatchling stage for 12 to 25 years) must regularly replace the number of reproductive adults that die in the population. If mortality of adult females is high, then the population requires a higher survival of smaller size classes or the population will decline in size over time. Data are not available for us to analyze the current trend in adult population size within the Ivanpah Valley, so we cannot provide a precise analysis of the effect associated with loss of smaller size classes. Natural mortality of adult desert tortoises and mortality and habitat degradation associated with other projects will occur within the action area while ISEGS is in operation. In combination with this mortality, we anticipate that mortality of smaller size classes as a result of the proposed action, especially those that are close to reproductive age, will have a negative effect on population stability within some local portions of Ivanpah Valley that are close to the project site. We do not anticipate that it would affect a large enough portion of the population to affect substantially the overall population trend within the recovery unit or range wide. In addition, increased juvenile survival associated with desert tortoises held in the quarantine facility for up to 5 years prior to release may help to offset the initial impacts to recruitment associated with direct loss of individuals during construction.

Project development will result in 3,321.9 acres of long-term or permanent disturbance to desert tortoise habitat. Although all of this area, except for the permanent facilities (i.e., SCE substation and gas metering stations), will undergo restoration and reclamation work, it is unlikely to function as suitable desert tortoise habitat for many years following facility closure. We cannot predict the amount of time required to return areas of long-term disturbance to suitable desert tortoise habitat because of numerous variables associated with restoration success, including the timing and amount of rainfall. We estimate that BrightSource will return an additional 122.1 acres of short-term disturbance to suitable desert tortoise habitat by the end of the 30-year project lifespan.

In the Status of the Species section of this biological opinion, we indicated that the density of desert tortoises within sampled areas of the Northeastern Mojave Recovery Unit, surveyed through range-wide monitoring, was approximately 7.5 adults per square mile. Because the sampling occurred in areas that are considered to provide the best habitat and support the highest densities of desert tortoises (i.e., the desert wildlife management area), densities outside of these sampled areas are likely lower.

We also estimated that human activities have degraded approximately 850 square miles of desert tortoise habitat within the recovery unit; therefore, we did not include these areas in our estimate of the number of desert tortoises in the recovery unit. Based on our estimate of less disturbed desert tortoise habitat (5,600 square miles) and the average density that the Service has estimated for surveyed areas of this recovery unit (7.5 desert tortoises per square mile), we estimate that the Northeastern Mojave Recovery Unit supports approximately 42,000 adult desert tortoises. Because desert tortoises outside of the areas sampled through range-wide monitoring likely occur at lower densities, we have likely overestimated the true population size. Regardless of the actual population size of the recovery unit, we anticipate that loss of reproductive adult individuals due to project development, as detailed above, would result in the loss of a small portion of the total population size and reproductive potential within this recovery unit.

We currently do not have population survey data of a sufficient sampling intensity or duration to document a stable or increasing trend across the Northeastern Mojave Recovery Unit. In the Status of the Species section, we discussed habitat loss and degradation and documented declines in the number of desert tortoises in some local populations of this recovery unit. Given this information, desert tortoise populations are unlikely to be increasing in size in this recovery unit. Consequently, we anticipate that the population in this recovery unit is either stable or declining. Given the small percentage of the population of reproductive adults that this project would affect, the proposed action is unlikely to affect substantially the ability of the desert tortoise to reach stable or increasing population trends in the future.

We anticipate that the habitat loss associated with this project will not substantially add to the potential for loss of connectivity between the southern and northern ends of Ivanpah Valley. However, we anticipate that development of ISEGS is likely to exacerbate the effects associated with small population size for the nearly isolated population on the west side of Interstate 15. We anticipate that the Bureau's demographic monitoring program and adaptive management strategy, proposed for this population and the delayed translocation of individuals from the project site will reduce these effects to some degree. In addition, they will provide valuable information regarding the level of connectivity that this population has with other populations in the region.

The compensation required by the Bureau would likely offset some adverse effects of the proposed solar power facility. Compensation actions that would be undertaken are consistent with recommendations for recovery of the desert tortoise. However, the lack of specificity with regard to which actions will be implemented, the uncertainty of success of the actions, and the time lag between implementation of the conservation actions and a substantive effect on recovery of the desert tortoise prohibit us from fully analyzing its potential beneficial effects. Because of the long term or permanent loss of approximately 3,322 acres of desert tortoise habitat, the project will result in a net decrease in desert tortoise habitat.

We do not believe the proposed action would inhibit recovery potential of the desert tortoise, primarily because the ISEGS project is not located in an area that is considered crucial to the recovery of the desert tortoise (i.e., critical habitat unit, desert wildlife management area, or other conservation area for the desert tortoise). The effects of the proposed action may hinder connectivity between desert tortoises in the Ivanpah Valley and Eldorado Valley to some degree. Because of natural and anthropogenic features in the landscape, these connections are constrained, even without the proposed action. The Bureau's proposal to initiate a long-term study with regard to connectivity in this area is likely to inform the Bureau and Service if issues with regard to genetic exchange and demography arise between the action area and adjacent habitat that supports desert tortoises.

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. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. The Bureau and the National Park Service manage the majority of the land in the action area. We are not aware of any proposed, non-federal actions within the action area.

CONCLUSION

After reviewing its status, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the desert tortoise. We have reached this conclusion because:

1. Project activities are likely to kill few desert tortoises of reproductive age because BrightSource will fence work areas to prevent entry by desert tortoises, remove animals from these areas, and use qualified biologists, among other measures to protect desert tortoises.

2. Loss of individuals of smaller size classes is likely to cause some effects to the overall population trend in a localized region of Ivanpah Valley but it is unlikely to affect substantially the trajectory of population trends within the recovery unit or range wide.

3. Delayed translocation of individuals of smaller size classes is likely to offset, to some degree, the adverse effects associated with the direct loss of pre-reproductive individuals on the project site, by increasing the likelihood of population recruitment for the individuals that are cleared from the project site.

4. The number of desert tortoises injured and killed as a result of translocation will likely be small relative to the number of desert tortoises that occur within the Northeastern Mojave Recovery Unit and across the range of the species.

5. BrightSource will implement numerous measures to reduce the potential for increased predation by common ravens and spread of non-native plant species.

6. Compensation requirements through the Bureau and California Energy Commission may result in an increase in the amount of existing habitat that is managed for the conservation of the desert tortoise and will likely lead to restoration of lost or degraded habitat within these areas.

7. Regional management actions are likely to aid in reducing common raven predation in a portion of the desert tortoise's range.

8. Under current conditions, population connectivity can be maintained through the habitat linkages that would remain between the existing developments in Ivanpah Valley.

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 based the analysis in this biological opinion within the context of the Northeastern Mojave Recovery Unit because of the wide range of the desert tortoises. We have determined that the effects of this action would not compromise the integrity of the Northeastern Mojave Recovery Unit or impede the survival and recovery of the desert tortoise in an appreciable manner in this portion of its range, and therefore, by extension, conclude that the action is not likely to cause any appreciable reduction in the likelihood of both the survival and recovery 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 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 intentional or negligent actions that create the likelihood of injury to listed species by annoying it to such an extent as to significantly disrupt normal behavior 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 intended as part 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 an incidental take statement.

The measures described in this document are non-discretionary. The Bureau has a continuing duty to regulate the activities covered by the incidental take statement in the biological opinion. If the Bureau fails to include the terms and conditions of this incidental take statement as enforceable conditions of its right-of-way grant, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Bureau must report the progress of its action and its impact on the desert tortoise to the Service as specified in the incidental take statement [50 *Code of Federal Regulations* 402.14(i)(3)].

The proposed action will result in the take of all desert tortoises in the project area (i.e., Units 1, 2, and 3 and the CLA of ISEGS, along the fiber optic line, gas transmission line, access road, and in areas where exclusion fencing would be installed). The proposed action will also result in the take of numerous desert tortoises (i.e., resident and control animals) in the recipient and control sites. The following paragraphs define the form of take and the number of individuals we anticipate the proposed action will take. In the 2010 Biological Opinion, we included a table summarizing the levels of take that necessitated re-initiation of formal consultation. We have not included such a table in this biological opinion. In the remainder of the incidental take statement, the quantified capture, injury, and mortality take described for various aspects of the project is presented as a range of individuals. In our Effects of the Action section, we fully analyzed each range identified below. Therefore, the amount or extent of the taking specified in this incidental take statement is exceeded if the higher number in any of the identified ranges is exceeded.

For the anticipated take in the form of injury or mortality resulting from construction of the ISEGS facilities, we would consider the amount or extent of that taking to be exceeded if the number of individuals captured on the ISEGS project site and its perimeter fence lines exceeds 289 individuals. We would do so because the Bureau will not be able to measure compliance with the anticipated injury and mortality take identified below for the construction of the ISEGS facility (i.e., 405 to 1136 individuals). This is because virtually all of the individuals missed during clearance surveys and killed during construction will be smaller sized class individuals, and BrightSource or the Bureau are unlikely to locate the carcasses of many of these individuals. The inability to locate these carcasses will make it impossible for the Bureau to measure its compliance with this portion of the take statement by directly identifying dead individuals on the project site. To address this issue we have used the threshold for capture of individuals on the ISEGS project site as a surrogate measure of mortality. This will provide an appropriate surrogate for measurement of compliance of the estimate of the number of individuals that may be killed on the ISEGS project site during construction is related to our estimation of the number of desert tortoises (including the proportion of the population of smaller sized individuals) that clearance surveys are likely to find. Consequently, finding more than 289 individuals would indicate that a larger number of smaller individuals may be killed during construction. Because clearance surveys would occur prior to commencement of construction activities, use of this trigger would allow re-initiation of consultation and a reassessment of the estimated mortality take prior to any mortality occurring. Because we

estimate below that few if any desert tortoises, larger than 160 millimeter, would be killed, terms and conditions 2.b. and 2.c. set additional thresholds for re-initiation of consultation related to take, in the form of injury or death, of desert tortoises larger than 160 millimeters.

Clearance, Quarantine, Translocation, and Post-translocation Monitoring of Desert Tortoises from the ISEGS Project Site

Including the individuals captured from Unit 1 and the CLA under the 2010 biological opinion, we anticipate that clearance surveys, health assessments, blood testing, quarantine, translocation, and post-translocation monitoring of individuals from the ISEGS project site and its perimeter fence lines will involve the take, in the form of capture and harassment, of between 128 and 289 individuals (includes all size classes). Harassment of these individuals would be due to the need to collect blood and perform health assessments. Of the individuals captured and harassed on the project site, we anticipate that each individual would be captured and handled multiple times during the quarantine and post-translocation monitoring period to facilitate health assessments, transmitter replacement, and other activities associated with post-translocation monitoring and quarantine.

We anticipate that the proposed action will take, in the form of mortality, between 23 and 43 individuals during the 5-year quarantine. We anticipate that few if any of the additional captured individuals would die or be injured due to inappropriate handling during clearance surveys, health assessments, blood testing, quarantine, translocation, and post-translocation monitoring. Over the 10-year post-translocation monitoring period, we anticipate mortality of some individuals in the translocated population, but we do not anticipate that this mortality will be significantly different from that experienced by other populations in the region that are not affected by translocation. However, we anticipate the mortality of some desert tortoises from field workers assessing translocation areas. Because the frequency of monitoring would be spread out over time and field workers would be experienced biologists, we anticipate that these activities would result in the injury and mortality of few if any desert tortoises.

In addition to the individuals captured on the project site and its perimeter fence lines, we anticipate the capture of desert tortoises on other linear facilities associated with the project (i.e., translocation site fencing, access road fencing, fiber-optic line, gas line, etc.). We cannot precisely predict the number of individuals that BrightSource would move out of harm's way along linear facilities, but we anticipate that the number would be small given the small area that these activities would affect.

Post-translocation Monitoring of Desert Tortoises that are Resident to the Recipient and Control Sites

We anticipate the take, in the form of capture and harassment (due to blood collection and health assessment), of between 206 and 492 desert tortoises in the resident and control population to facilitate post-translocation monitoring. We anticipate that each of these

individuals would be re-captured multiple times during the post-translocation monitoring period to facilitate health assessments, transmitter replacement, and other activities associated with post-translocation monitoring. We anticipate that few if any individuals would be killed or injured due to inappropriate handling during the post-translocation monitoring period. We anticipate that some level of mortality would occur in the resident and control populations over the post-translocation monitoring period, but we anticipate that few if any would be killed or injured by translocation activities.

Construction of the ISEGS Facilities

We anticipate that construction of the ISEGS project site is likely to take, in the form of mortality or injury, between 405 and 1136 desert tortoises due to direct effects of construction or due to loss of 3,444 acres of habitat. This total estimate includes mortality reported under the 2010 biological opinion (i.e., 2 desert tortoises found dead) and additional mortality estimated through our analysis in this biological opinion for all units of the project. We anticipate that the vast majority of these will be individuals of smaller size or desert tortoise eggs that are difficult to detect during clearance surveys and construction monitoring; therefore, we are unlikely to find carcasses of these individuals. Therefore, at the beginning of the incidental take statement we provided a surrogate measure to ensure that the Bureau can monitor compliance with this take threshold. We anticipate that few, if any, of the animals injured, killed, or harmed would be larger than 160 millimeters. Because we cannot predict the time of year when activities would occur, we cannot predict whether project activities would affect hatchlings or eggs. Consequently, eggs have been combined with desert tortoises in this take statement in contrast to how we addressed eggs in the 2010 biological opinion.

We anticipate that the installation of desert tortoise exclusion fencing for the access route, translocation area, and project site has eliminated and will continue to eliminate portions of the home ranges of some desert tortoises. To the extent that desert tortoises with divided home ranges exhibit behavior that would result in injury or death, this would constitute take in the form of harm. We cannot quantify the take associated with this habitat loss with any certainty because we have no information on home range configurations for individuals affected by the project, including the fences.

Compensation

All enhancement actions associated with the Bureau's compensation requirements will require future Bureau authorizations. Consequently, we have not provided incidental take exemptions for these actions in this biological opinion. These actions will require future project-specific consultation if they may affect the desert tortoise or other listed species.

Operation and Maintenance of ISEGS Facilities

We anticipate that operation and maintenance activities, including site access, within

permanently fenced areas are likely to take few desert tortoises. A limited potential exists that a very small number of desert tortoises may find their way into a fenced area. Most of these individuals are likely to be taken in the form of capture as they are removed to offsite habitat; a small fraction of these individuals may be taken, in the form of injury or mortality, if they are exposed to adverse weather conditions or crushed by vehicles before they are detected.

We anticipate that Class I maintenance activities that are outside of fenced work areas and Class II maintenance activities associated with fence repair are likely to take, in the form of injury or mortality, few, if any, desert tortoises because Class I activities would not result in ground disturbance, Class II activities would be localized and infrequent, and access to repair sites would require little, if any, off-road travel. In addition, for all maintenance work, BrightSource would implement numerous protective measures to avoid killing or injuring desert tortoises. We anticipate that these maintenance activities may result in the take, in the form of capture, of a small number of desert tortoises if they are encountered during work activities and moved from harm's way.

Because we do not have sufficient information regarding the location or extent of other Class II and Class III maintenance activities that may occur outside of the permanently fenced work areas, we cannot determine the level of take associated with these activities. Consequently, we cannot provide an exemption from the prohibitions against take for these activities. These actions will require further site-specific or programmatic consultation.

Decommissioning and Restoration of ISEGS Facilities

We anticipate that restoration of temporary disturbance within fenced facilities during operation and maintenance or following decommissioning is unlikely to result in take of desert tortoises because BrightSource will clear all fenced areas of desert tortoises prior to construction of facilities. After facility closure, decommissioning activities and restoration of long-term disturbance within fenced areas are unlikely to take desert tortoises for the same reason. We anticipate that restoration of temporary disturbances and long-term disturbances outside of fenced work areas is likely to take, in the form of injury or mortality, few, if any, desert tortoises for the following reasons. We anticipate that a few desert tortoises are likely to be taken, in the form of capture, as they are moved out of harm's way, during these activities. Because much of this work would occur many years from now, we cannot quantify the number of animals that are likely to be taken in this manner. However, we do not anticipate that moving desert tortoises a short distance out of harm's way will result in any meaningful adverse effects to the individuals.

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 implementation of the ISEGS project:

1. The Bureau must ensure that desert tortoises do not enter fenced project facilities.

2. The Bureau must ensure that the level of incidental take associated with the ISEGS project is commensurate with the analysis contained herein.

3. The Bureau must ensure that the rate of mortality or injury of translocated and resident desert tortoises is not elevated above the rate of mortality or injury for other populations within the action area that are not affected by translocation.

4. The Bureau must ensure that the ISEGS facility does not serve as an attractant to common ravens.

5. The Bureau must ensure that desert tortoises that exhibit clinical signs of disease are not translocated.

6. The Bureau must ensure the proper implementation of health assessments and disease testing to ensure the accuracy of results and to minimize the injury of desert tortoises.

Our evaluation of the proposed action includes consideration of the protective measures described 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 comply with the following terms and conditions, which implement the reasonable and prudent measures described in the previous section, or make them enforceable conditions of its right-of-way grant, and must comply with the reporting and monitoring requirements. These conditions are non-discretionary.

1. The following term and condition implements reasonable and prudent measure 1:

   The Bureau must ensure that BrightSource monitors the integrity of all desert tortoise exclusion fencing at least once a month and following any rain events that result in surface flow of water in washes or sheet flow within the action area. The Bureau must ensure that BrightSource repairs damage immediately after it is identified during monitoring.

2. The following terms and conditions implement reasonable and prudent measure 2:

a. To ensure that the measures proposed by the Bureau and BrightSource are effective and are being properly implemented, the Bureau must contact the Service immediately if it becomes aware that a desert tortoise has been killed or injured by project activities. At that time, the Service and the Bureau must review the circumstances surrounding the incident to determine whether additional protective measures are required. Project activities may continue pending the outcome of the review, provided that the proposed protective measures and any appropriate terms and conditions of this biological opinion have been and continue to be fully implemented.

b. If 9 desert tortoises, larger than 160 millimeters, are killed or injured as a result of any construction, operation, maintenance, decommissioning, or restoration activities covered by this biological opinion over the life of the ISEGS project, the Bureau must request reinitiation of consultation, pursuant to the implementing regulations for section 7(a)(2) of the Endangered Species Act at 50 Code of Federal Regulations 402.16, on the proposed action. This term and condition also applies to direct mortality and injury of desert tortoises during translocation and post-translocation monitoring on the resident, control, and translocated populations (i.e., due to handling, road kills, or other effects caused by personnel working on the project). However, it does not apply to post-translocation mortality within these populations that is not connected directly to an action required to carry out the translocation and monitoring effort.

c. If 3 desert tortoises, larger than 160 millimeters, are killed or injured in any 12-month period as a result of any construction, operation, maintenance, decommissioning, or restoration activities covered by this biological opinion, the Bureau must request reinitiation of consultation, pursuant to the implementing regulations for section 7(a)(2) of the Endangered Species Act at 50 Code of Federal Regulations 402.16, on the proposed action. This term and condition also applies to direct mortality and injury of desert tortoises during translocation and post-translocation monitoring on the resident, control, and translocated populations (i.e., due to handling, road kills caused by personnel working on the project). However, it does not apply to post-translocation mortality within these populations that is not connected directly to an action required to carry out the translocation and monitoring effort.

The thresholds identified above apply to activities occurring under this biological opinion and not to activities that occurred under the 2010 biological opinion.

3. The following term and condition implements reasonable and prudent measure 3:

   If monitoring of translocated and resident desert tortoises indicates a statistically significant elevation in mortality rates above that observed in the control population, the Bureau must request reinitiation of consultation, pursuant to the implementing

regulations for section 7(a)(2) of the Endangered Species Act at 50 Code of Federal Regulations 402.16, on the proposed action.

4. The following term and condition implements reasonable and prudent measure 4:

   The Bureau must meet with the Service to review data and reports associated with BrightSource's monitoring and adaptive management program for common ravens prior to the cessation of these activities. If the agencies mutually determine that further monitoring and adaptive management are warranted, the Bureau must require BrightSource to extend these activities until such time that the agencies determine they are no longer needed. If, at any time during operation or decommissioning of the ISEGS facility, the agencies determine that the monitoring of and adaptive management program for common ravens needs to be re-instated, the Bureau must ensure that BrightSource resumes this activity.

5. The following term and condition implements reasonable and prudent measure 5:

   After performance of visual health assessments on project-site desert tortoises, the Bureau must ensure that the Service receives the results of the health assessments and the proposed disposition of each individual within 14 days prior to release into recipient sites. The Bureau must ensure that BrightSource receives authorization for translocation of these individuals from the Service prior to commencement of translocation.

6. The following term and condition implements reasonable and prudent measure 6:

   The Bureau must ensure that all individuals who intend to perform visual health assessments and blood collection have been specifically authorized or trained for that activity by the Service. The Bureau must provide the credentials for all individuals seeking approval to conduct these activities to the Service at least 30 days prior to the need for visual health assessments and blood collection.

7. The following term and conditions implement reasonable and prudent measure 7:

   If the proposed recipient sites are not large enough to accommodate all of the desert tortoises without violating the density threshold defined in the project description, the Bureau must request reinitiation of consultation, pursuant to the implementing regulations for section 7(a)(2) of the Endangered Species Act at 50 Code of Federal Regulations 402.16 to address modifications to the translocation plan.

REPORTING REQUIREMENTS

Within 60 days of the completion of the proposed action, the Bureau must provide a report to the Service that provides details on the effects of the action on the desert tortoise. The Bureau

must also provide monthly reports to the Service during construction of each unit and during the subsequent translocation monitoring. Specifically, these reports must include information on the effectiveness and practicality of minimization measures (i.e., examples of flaws and recommendations for improvement in certain measures), any instances when desert tortoises were killed, injured, captured, or handled; the circumstances of such incidents and the specific information for each animal; and any actions undertaken to prevent similar instances from re-occurring. In addition, these reports should provide detailed information on the translocation effort and results of translocation monitoring to include the following: 1) location of all desert tortoises carrying transmitters, 2) mortality rate from each population, 3) statistical analysis of mortality rate between all three populations, 4) health status and body condition of all desert tortoises that carry transmitters, 5) status of animals captured and moved, and 6) release location and date for each translocated animal. These reports should also provide an estimate of the actual acreage disturbed by various aspects of the construction and operation up to the time of the report.

We recommend that the Bureau provide us with any recommendations that would facilitate the implementation of the protective measures while maintaining protection of the desert tortoise. We also request that the Bureau provide us with the names of any monitors who assisted the authorized biologist and an evaluation of the experience they gained on the project; the qualifications form on our website (http://www.fws.gov/ventura/sppinfo/protocols/deserttortoise_monitor-qualifications-statement.pdf), filled out for this 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.

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 work with BrightSource and the Service to determine if the desert tortoises associated with the resident, control, and translocated populations can be used to answer additional research questions related to translocation or desert tortoise biology.

2. We recommend that the Bureau amend the necessary land use plans to prohibit large-scale development (e.g., solar energy facilities, wind development, etc.) within all remaining portions of the Ivanpah Valley to reduce fragmentation within the critical

linkage between the Ivanpah Critical Habitat Unit and the Eldorado Critical Habitat Unit.

3. We recommend that the Bureau perform additional wild burro gathers in the former Clark Mountain Herd Management Area to remove remaining burros that may adversely affect habitat within translocation areas.

4. Based upon our review, certain aspects of the weed management plan may result in an inefficient use of resources. We recommend that the Bureau and BrightSource work with the Mojave Resource Conservation District to develop a site-specific weed management plan that would be effective and efficient.

5. We recommend that the Bureau consider alternative configurations for this project and the First Solar-Silver State Project that would focus ground disturbance on lands closer to Ivanpah Lake that are likely to have fewer desert tortoises and are less crucial to population connectivity.

The Service requests notification of the implementation of any conservation recommendations so we may be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats.

DISPOSITION OF DEAD OR INJURED DESERT TORTOISES

Within 3 days of locating any dead or injured desert tortoises, you must notify the Ventura Fish and Wildlife Office by telephone (805 644-1766) and by facsimile (805 644-3958) or electronic mail. The report must include the date, time, location of the carcass, a photograph, cause of death, if known, and any other pertinent information.

We will advise you on the appropriate means of disposing of the carcass when you contact us. We may advise you to provide it to a laboratory for analysis. Until we provide information on the disposition of the carcass, you must handle it such that the biological material is preserved in the best possible state for later analysis. If possible, the carcass should be kept on ice or refrigerated (not frozen) until we provide further direction.

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

RE-INITIATION NOTICE

This concludes formal consultation on the Bureau's proposal to issue a right-of-way grant to BrightSource for construction of the ISEGS facility in San Bernardino County, California. Re-initiation of formal consultation is required where discretionary federal involvement or control over the action has been retained or is authorized by law and: (a) if the amount or extent of

taking specified in the incidental take statement is exceeded; (b) if new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (c) if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or (d) if a new species is listed or critical habitat designated that may be affected by the identified action (50 Code of Federal Regulations 402.16).

If you have any questions regarding this biological opinion, please contact the U.S. Fish and Wildlife Service at (909) 382-2677.

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