

**DESERT TORTOISE (MOJAVE POPULATION)  
FIELD MANUAL  
(*Gopherus agassizii*)**

[December 2009]

**prepared by:**

U.S. Fish and Wildlife Service

***Warning: This Manual does not authorize individuals to handle desert tortoises. Such authorization comes from both Federal and State wildlife resource agencies, including, at least, those listed above. This document supersedes what was previously titled Guidelines for Handling Desert Tortoises during Construction Projects (Desert Tortoise Council 1994, revised 1999).***

Cite as: U.S. Fish and Wildlife Service. 2009. Desert Tortoise (Mojave Population) Field Manual: (*Gopherus agassizii*). Region 8, Sacramento, California.

## ACKNOWLEDGEMENTS

The Desert Tortoise Council provided desert tortoise handling guidelines in 1994. Edward L. LaRue, Jr. assembled the information and drafted these guidelines on behalf of the Council with input from the U.S. Fish and Wildlife Service (USFWS) field offices in California, Arizona, Nevada, and Utah. Mr. LaRue initiated review of these guidelines in April 1996 and revised them in July 1999. Information was provided by the Desert Tortoise Council, the USFWS, California Department of Fish and Game (CDFG), Utah Division of Wildlife Resources (UDWR), Nevada Department of Wildlife (NDOW), Arizona Game and Fish Department (AGFD), U.S. Bureau of Land Management (BLM), U.S. Geological Survey (USGS), private consultants, universities, Tortoise Group, and other individuals and organizations. The latest document, the Desert Tortoise Field Manual, is a revision of the handling guidelines and assembly/revision of other documents that provide regulatory guidance and requirements for the desert tortoise. The Desert Tortoise Field Manual is a compilation of efforts by many offices of the USFWS with input and review by the CDFG, NDOW, AGFD, UDWR, and consultants. We appreciate the efforts of all involved in this evolving document from the first version in 1994 to the current version.

## AGENCY/ORGANIZATION CONTACT INFORMATION

### U.S. Fish and Wildlife Service

Desert Tortoise Recovery Office  
Nevada Fish and Wildlife Office  
1340 Financial Boulevard  
Reno, Nevada 89502  
(775) 861-6300

Nevada Fish and Wildlife Office-Las Vegas  
4701 North Torrey Pines Drive  
Las Vegas, Nevada 89130  
(702) 515-5230

In California, for Inyo, Kern, Los Angeles, and San Bernardino Counties:

U.S. Fish and Wildlife Service  
Ventura Fish and Wildlife Office  
2493 Portola Road, Ste. B  
Ventura, California 93003  
(805) 644-1766

In California, for Imperial and Riverside Counties, and Joshua Tree National Park and the San Bernardino National Forest in San Bernardino Co:

Carlsbad Fish and Wildlife Office  
6010 Hidden Valley Road  
Carlsbad, California 92009  
(760) 431-9440

Utah Fish and Wildlife Office  
2369 West Orton Circle  
West Valley City, Utah 84119  
(801) 975-3330

Arizona Fish and Wildlife Office- Flagstaff  
323 North Leoux Street, Suite 101  
Flagstaff, Arizona 86001  
(928) 226-0614

Nevada Department of Wildlife

Southern Region  
4747 Vegas Drive  
Las Vegas, Nevada 89108  
(702) 486-5127

California Department of Fish and Game

Region 4 (Kern County)  
1234 East Shaw Avenue  
Fresno, California 993710  
(559) 243-4005

Region 5 (Los Angeles and  
San Diego Counties)  
4949 Viewridge Avenue  
San Diego, California 92123  
(858) 467-4201

Region 6 (Imperial, Inyo, Riverside,  
and San Bernardino Counties)  
3602 Inland Empire Boulevard  
Suite C-220  
Ontario, California 91764  
(909) 484-0167

Utah Division of Wildlife Resources

Southern Region  
1470 N Airport Rd  
Cedar City, Utah 84720  
(435) 865-6100

Washington County Field Office  
344 East Sunland Drive, Suite #8  
St. George, Utah 84790  
(435) 688-1426

Arizona Game and Fish Department

State Headquarters--Nongame  
Branch  
5000 W. Carefree Highway  
Phoenix, Arizona 85086  
(623) 236-7767

Bureau of Land Management- Nevada

Southern Nevada District Office  
4701 North Torrey Pines Drive  
Las Vegas, Nevada 89130  
(702) 515-5000

Ely District Office  
702 N. Industrial Way  
HC 33 Box 33500  
Ely, Nevada 89301  
(775) 289-1800

Caliente Field Office  
U.S. Highway 93  
P.O. Box 237  
Caliente, Nevada 89008  
(775) 726-8100

Tonopah Field Office  
1553 South Main Street  
PO Box 911  
Tonopah, Nevada 89049  
(775) 482-7800

Bureau of Land Management - California

California Desert District Office  
22835 Calle San Juan de Los Lagos  
Moreno Valley, California 92553  
(951) 697- 5200

Ridgecrest Field Office  
300 South Richmond Road  
Ridgecrest, California 93555  
(760) 384-5400

Barstow Field Office  
2601 Barstow Road  
Barstow, California 92311  
(760) 252-6000

Palm Springs Field Office  
1201 Bird Center Drive  
Palm Springs, California 92262  
(760) 833-7100

BLM- Utah

St. George Field Office  
345 East Riverside Drive  
St. George, Utah 84790  
(435) 688-3200

Needles Field Office  
1303 South Hwy 95  
Needles, California 92363  
(760) 326-7000

El Centro Field Office  
1661 South 4<sup>th</sup> Street  
El Centro, California 92243  
(760) 337-4400

BLM- Arizona

Arizona Strip Field Office  
345 East Riverside Drive  
St. George, Utah 84790  
(435) 688-3200

# Table of Contents

---

Title Page

Acknowledgements

Agency/Organization Contact Information

Chapter 1 Purpose

Chapter 2 Procedures for Federal Endangered Species Act Compliance for the Desert Tortoise

Chapter 3 Federal and State Authorizations for Implementing Desert Tortoise Measures Required Under Sections 7 or 10 of the ESA

Chapter 4 Preparing For Any Action That May Occur Within the Range of the Mojave Desert Tortoise

USFWS Desert Tortoise Pre-Project Survey Guidance (Excel Table)

Chapter 5 Preliminary Consideration Before Going to the Field

Chapter 6 Desert Tortoise Clearance Survey Protocol

Chapter 7 Guidelines for Handling Desert Tortoises and Their Eggs

Chapter 8 Desert Tortoise Exclusion Fence

## CHAPTER 1. PURPOSE

The purpose of the Desert Tortoise Field Manual (Manual) is to update and consolidate existing survey and handling protocols, procedures, and applicable Federal regulations related to the federally-threatened desert tortoise – Mojave population (*Gopherus agassizii*) into one document. This Manual supersedes all previous handling guidelines and procedures documents for the Mojave population of the desert tortoise. This Manual was developed specifically for the Mojave population of the desert tortoise. Additional information on the desert tortoise, including its biology, ecology, and Federal status, can be downloaded at [http://www.fws.gov/nevada/desert\\_tortoise/](http://www.fws.gov/nevada/desert_tortoise/)

This Manual is a consolidation and revision of the following documents:

- Procedures for Endangered Species Act Compliance for the Mojave Desert Tortoise (USFWS 1992a)
- Field Survey Protocol for Any Federal Action that May Occur Within the Range of the Desert Tortoise (USFWS 1992b)
- Field Survey Protocol for Any Non-Federal Action that May Occur Within the Range of the Desert Tortoise (USFWS 1992c)
- Guidelines for Handling Desert Tortoises during Construction Projects, previously prepared by the Desert Tortoise Council (July 1994, revised July 1999)
- Desert Tortoise Exclusion Fence Specifications, prepared by the USFWS (Chapter 8).

This Manual provides guidance for pre-project survey methods to determine the status of the desert tortoise for projects occurring within the species' range on Federal and non-Federal lands. The purpose of this guidance is to provide technical assistance to entities to determine whether a biological opinion or incidental take permit may be needed prior to project implementation. This Manual is also intended for use by Authorized Biologists and desert tortoise Monitors (section 3.1) conducting activities under an Endangered Species Act (ESA) section 7 biological opinion or section 10 incidental take permit and provides guidance on handling desert tortoises that need to be moved out of harm's way or prevented from re-entering a project site.

This Manual does not authorize desert tortoise handling/capturing or any other form of take (See Chapter 2 for definition of "take") without appropriate Federal and State authorizations. The responsible Federal and State agencies will review the qualifications statement for each potential desert tortoise biologist and authorize him/her to serve as an Authorized desert tortoise Biologist for a given project. The Manual includes methods that are effectively used by professional desert tortoise researchers; as field protocols evolve, they will be updated with new information as it becomes available and posted on-line.

We encourage comments on this Manual; please submit problems encountered and recommendations for improvement to the USFWS (see AGENCY/ORGANIZATION CONTACT INFORMATION section above). In subsequent years, the USFWS will use your input to revise and incorporate new information and methods.

## **Literature Cited**

Desert Tortoise Council. 1994. Guidelines for handling desert tortoises during construction projects. Edward L. LaRue, Jr., editor. San Bernardino, California. Revised 1999.

U.S. Fish and Wildlife Service. 1992a. Procedures for Endangered Species Act compliance for the Mojave desert tortoise. Regions 1, 2, and 6. October 1992. 18 pages plus appendices.

U.S. Fish and Wildlife Service. 1992b. Field survey protocol for any federal action that may occur within the range of the desert tortoise. January 1992. 16 pages.

U.S. Fish and Wildlife Service. 1992c. Field survey protocol for any non-federal action that may occur within the range of the desert tortoise. January 1992. 22 pages.

## **CHAPTER 2. PROCEDURES FOR FEDERAL ENDANGERED SPECIES ACT COMPLIANCE FOR THE DESERT TORTOISE**

On August 4, 1989, the USFWS published an emergency rule listing the Mojave population of the desert tortoise as endangered (54 FR 42270). On April 2, 1990, the USFWS determined the Mojave population of the desert tortoise to be threatened (55 FR 12178). Section 9 of the ESA prohibits the "take" of any federally listed threatened or endangered species without first obtaining the necessary take exemption from the USFWS and state permits where applicable. Take is defined as: "harming, harassing, pursuing, hunting, shooting, wounding, killing, capturing, collecting, or attempting to engage in any such conduct" (Section 3(18), ESA). Harm is defined as: "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or shelter" (50 CFR § 17.3(c)). Take also includes modification of habitat that would result in harm to the desert tortoise. There are two ways to legally take a threatened or endangered species; one is through an incidental take statement in a USFWS biological opinion under section 7 of the ESA and the other is through a permit issued by the USFWS under section 10 (refer to Section 2.1.1 for more information on biological opinions and section 2.2 and Chapter 3 for section 10 permits).

For purposes of the ESA, desert tortoise habitat is defined as 1) areas with presence of desert tortoises or desert tortoise sign (*e.g.*, shells, bones, scutes, scats, sheltersites, tracks, egg shell fragments, courtship rings, drinking sites, etc.) that are likely to be part or all of a lifetime home range, 2) dispersal areas (*i.e.*, habitat corridors), or 3) areas suitable for desert tortoises as identified by the USFWS or in the most recent recovery plan for the Mojave population of the desert tortoise ([http://www.fws.gov/nevada/desert\\_tortoise/](http://www.fws.gov/nevada/desert_tortoise/)).

Pre-project surveys for the desert tortoise following the USFWS guidance in Chapter 4 are not expected to result in take and therefore do not require surveyors to first obtain a recovery permit. However, to ensure quality control and reduce the likelihood of USFWS non-concurrence with survey results, we recommend that each potential surveyor complete and sign the Desert Tortoise Authorized Biologist Request Form ([http://www.fws.gov/ventura/speciesinfo/protocols\\_guidelines/](http://www.fws.gov/ventura/speciesinfo/protocols_guidelines/)) and submit it to USFWS and the appropriate State agency for review prior to initiating any survey. Upon receiving the survey results, if the USFWS determines that the methods implemented or qualifications of the surveyors were inadequate, the USFWS may not accept the survey results. In such cases, surveys would need to be repeated using approved methods and qualified surveyors.

### **2.1. Federal Actions**

#### **2.1.1. Consultation under Section 7 of the ESA**

Section 7(a)(1) of the ESA requires all Federal agencies, in consultation with the Secretary of the Interior (delegated to the USFWS), to utilize their authorities in furtherance of recovering federally listed species by carrying out programs for the conservation of endangered and threatened species.

Section 7(a)(2) of the ESA and implementing regulations (50 CFR § 402) require all Federal agencies to consult with the USFWS for certain actions. There are two types of consultations, informal and formal. Informal consultation with the USFWS occurs when the Federal agency determines that an action they propose to authorize, fund, or carry out “may affect” a federally endangered or threatened species or critical habitat. Through the informal consultation process, the Federal agency, in coordination with the USFWS, may develop changes to the proposed action that result in no effect to the listed species, only beneficial effects to the listed species, or may affect but is not likely to adversely affect the listed species. In the first two situations, the consultation process is documented and terminated. In the last situation, the informal consultation process is completed with the USFWS issuing a letter of concurrence.

Section 7(a) regulations of the ESA require each Federal agency to review its actions at the earliest possible time to determine whether any action they propose to authorize, fund, or carry out may adversely affect listed species or adversely modify designated critical habitat. If such a determination is made, formal consultation is required with the USFWS; please contact the USFWS to determine the type of consultation required.

Through completion of the formal section 7 process, the USFWS may issue a biological opinion to the Federal agency stating "no jeopardy/adverse modification" is expected as a result of the proposed action for listed plants and animals, and exempting incidental take of listed animals. A no jeopardy/adverse modification biological opinion concludes that the proposed action will not jeopardize the continued existence of the species or result in adverse modification of designated critical habitat. Without this exemption, the Federal agency would violate section 9 of the ESA if the proposed project were implemented and resulted in take of a listed species.

Federal actions that are nondiscretionary, entirely beneficial to the listed species, or have no adverse effects on listed species are not subject to formal consultation. All actions which require approval by the Federal action agency are considered discretionary. The “may affect” standard applies to those activities that occur in suitable habitat, or habitat considered necessary for the conservation of a listed species. It is the responsibility of the Federal action agency to determine which actions may affect threatened or endangered species or critical habitat, and to initiate consultation accordingly with the USFWS.

Once a Federal agency has determined that its action may adversely affect a listed species or critical habitat, the Federal agency should submit a written request to the USFWS for formal consultation. This request should be accompanied by a biological assessment/evaluation of the action and its impacts (Section 2.3).

The Federal agency requesting formal consultation is responsible for providing the USFWS with the best scientific and commercial data available and relevant to the consultation. The “best data” mean data that are available and/or can be obtained during consultation, and are needed for an adequate review of the effects that an action may have on listed species or critical habitat (50 CFR § 402.14(d)).

Should the Federal action agency determine that the effect to the desert tortoise is entirely beneficial, then formal consultation may not be required. In this case, the action agency may

request concurrence from the USFWS that the action is not likely to adversely affect the desert tortoise through informal consultation. Beneficial actions that are part of a larger action which has not undergone section 7 consultation cannot be considered under informal consultation if the larger action includes adverse effects to the desert tortoise (*e.g.*, construction of a pasture fence within an allotment in desert tortoise habitat which has not yet undergone section 7 consultation). In such instances, grazing within the allotment is considered to be an “interrelated” and “interdependent” action of the proposed fence. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Both interrelated and interdependent actions are considered “effects of the action” (50 CFR § 402.02).

Formal consultation results in a biological opinion issued by the USFWS to the action agency. The biological opinion makes a determination on whether or not the proposed action subject to consultation is likely to jeopardize the continued existence of the listed species or result in destruction or adverse modification of critical habitat. The finding takes into account the: 1) rangewide status of the species, 2) the environmental baseline condition of the listed species in the action area; 3) the direct, indirect, interrelated, and interdependent effects attributable to the Federal action at hand; and 4) the cumulative effects of State and private actions reasonably certain to occur in the area of the Federal action.

Biological opinions issued by the USFWS will contain the following information:

1. An assessment of the status of the species, both rangewide and within the action area.
2. An analysis of the direct and indirect effects, as well as the effects of interrelated and interdependent activities (50 CFR § 402) and cumulative effects of future non-Federal activities that are reasonably certain to occur in the action area.
3. A determination whether the action is likely or not likely to jeopardize the continued existence of the species, or will result in the destruction or adverse modification of critical habitat. Reasonable and prudent alternatives will be provided, if at all possible, if the biological opinion indicates that the proposed action is likely to jeopardize the continued existence of the species (jeopardy opinion) or result in the destruction or adverse modification of critical habitat (adverse modification opinion).
4. An incidental take statement that identifies the anticipated level of incidental take that is expected to occur and provides mandatory reasonable and prudent measures and mandatory terms and conditions for minimizing any incidental take exempted in the biological opinion. This includes monitoring and reporting requirements.
5. Conservation recommendations that, if implemented, would minimize impacts and promote the conservation of the species. Conservation recommendations are not mandatory but are intended to provide an opportunity for the agency to further

the conservation of the desert tortoise as mandated under section 7(a)(1) of the ESA.

Confusion often arises concerning the difference between reasonable and prudent alternatives and reasonable and prudent measures. “Reasonable and prudent alternatives,” part of a jeopardy or adverse modification opinion, are modifications to the proposed action that will avoid jeopardizing the continued existence of a listed species and/or destroying or adversely modifying the listed species’ critical habitat. The Federal agency decides whether or not to implement reasonable and prudent alternatives. Failure to implement these alternatives, however, can lead to a violation of section 7(a)(2), if the action at any point in time causes a listed species to become jeopardized or results in the destruction or adverse modification of critical habitat. A Federal agency must notify the USFWS of its final decision regarding implementation of reasonable and prudent alternatives. The Federal agency can apply for an ESA exemption if it determines that it cannot comply with the requirements of section 7(a)(2) after consultation with the USFWS.

“Reasonable and prudent measures,” along with terms and conditions that implement them, are mandatory elements that minimize incidental take. Reasonable and prudent measures cannot alter the basic design, location, scope, duration, or timing of the action and may involve only minor changes (50 CFR § 402.14(i)(2)). They include monitoring and reporting requirements. The Federal action agency must comply with the terms and conditions that implement the reasonable and prudent measures, which the USFWS considers necessary to minimize incidental take, to be in compliance with the ESA.

It is not possible to determine an exact point at which the continued existence of a species would be jeopardized or adverse modification of critical habitat would occur without fully analyzing proposed actions in relation to the existing environmental baseline. Therefore, the USFWS will analyze each Federal action submitted for formal consultation on a case-by-case basis.

Formal consultation is initiated on the date the Federal agency’s request is received by the USFWS if the Federal agency provides all relevant data required by 50 CFR § 402.14(c). Within 10 working days, the USFWS will acknowledge receipt of the consultation request in writing. Upon reviewing the biological assessment provided by the Federal action agency, the USFWS will advise the Federal agency if insufficient information has been provided, and request additional information needed to complete the formal consultation process.

Formal consultation concludes within 90 days after its initiation unless suspended because of insufficient information or extended in accordance with 50 CFR § 402.14(e). The USFWS may use an additional 45-day period (total of 135 days) to issue the biological opinion to the Federal agency. The USFWS is responsible for ensuring that biological opinions are prepared and delivered within 135 days of initiation of consultation. The USFWS may request an extension of the consultation period.

When the Federal agency asks to review the draft biological opinion, the above time frames continue to apply. However, no final opinion will be issued before 135 days while the agency is reviewing the draft. Once comments on the draft are received by the USFWS, the biological

opinion is finalized and delivered to the Federal agency. If comments on the draft opinion result in major changes or clarifications, a time extension can be sought by the USFWS from the Federal agency.

If relevant data are known to be available to the Federal agency or will be available as a result of ongoing or imminent studies, the USFWS may request the data and any other analyses in accordance with 50 CFR § 402.14(c) or suggest that consultation be postponed until those data or analyses are available. The USFWS has the responsibility to alert the Federal agency (and any applicant) of areas where additional data would provide a better information base from which to formulate a biological opinion. The advice from the USFWS is intended to help the Federal agency to better satisfy its duty to ensure that its proposed action is not likely to jeopardize listed species or adversely modify/destroy critical habitat.

If the Federal agency insists that consultation be completed without the requested data or analyses, the USFWS will document in the biological opinion that certain analyses or data were not provided and why the information would have been helpful in conducting the consultation. In cases where gaps occur in the data base, the USFWS will evaluate the worst-case scenario and provide the benefit of the doubt to the species concerned.

#### 2.1.2. Incidental Take under Section 7 of the ESA

In cases where the USFWS concludes through consultation procedures that an action and the resultant take of listed species is not likely to jeopardize the continued existence of the listed species, the USFWS must provide an incidental take statement that specifies the anticipated level (amount or extent) of such taking and those reasonable and prudent measures considered necessary or appropriate to minimize such impact (50 CFR § 402.14(i)). There are two types of take under the ESA, incidental and intentional. An incidental take situation would exist if an otherwise lawful activity would result in the direct loss of a individual desert tortoise, or a sheltersite with a desert tortoise inside. An example would be the unintentional crushing of a desert tortoise by heavy equipment used for the otherwise lawful purpose of constructing a house. The take of the desert tortoise would be “incidental” to construction of the house. Conversely, intentional take is the purposeful take of a listed species, such as hunting, or capturing a listed species. Because the definition of “fish and wildlife” in the ESA includes eggs, the USFWS must also consider incidental take of desert tortoise eggs in a biological opinion, if such take may occur.

In a biological opinion, the USFWS estimates the amount of incidental take for individual desert tortoises and the amount of habitat that may be modified, and provides reasonable and prudent measures and terms and conditions that minimize adverse effects to the listed species. Under section 7(o)(2) of the ESA, a biological opinion with an incidental take statement operates as an exemption to the section 9 prohibitions against take.

Incidental take may also occur when federally listed wildlife are harmed or harassed by activities within their home range. For desert tortoises, harm may include destruction or degradation of habitat components (*e.g.*, soil, vegetation) necessary for the desert tortoise’s existence.

However, habitat cannot be “taken” in the context of the ESA. Harassment may occur when a desert tortoise is moved out of the action area to avoid harm. In these situations, the USFWS recommends that the project proponent initiate a dialogue with the USFWS to discuss the likelihood of incidental take.

Any unauthorized take of desert tortoises that results from activities carried out in a manner not consistent with, or not authorized under, the provisions of section 7 of the ESA may be subject to investigation by the USFWS pursuant to section 9 of the ESA. Criminal penalties for illegal take of a threatened species include up to \$25,000 in fines and 6 months in prison. Civil penalties may also be imposed as the ESA has a provision for citizen lawsuits.

## **2.2. Non-Federal Actions**

### **2.2.1. Conservation Planning under Section 10 of the ESA**

A permit from the USFWS pursuant to section 10(a)(1)(B) of the ESA authorizes incidental take for a non-Federal entity much as a section 7 consultation does through an incidental take statement in a biological opinion for a Federal action. Individuals, corporations, non-Federal government entities, State and local governments, Tribes, and other parties can apply for an incidental take permit by submitting an application and a habitat conservation plan (HCP) to the USFWS. “Habitat conservation planning” is the term often used to refer to this process.

Section 10(a)(1)(B) of the ESA requires that the Secretary of the Interior may not issue a permit for incidental take unless the applicant submits a conservation plan. Section 3 of the ESA defines conservation as using all methods and procedures necessary to bring an endangered or threatened species to the point at which measures provided in the ESA are no longer necessary (i.e., recovery). Congress intended that the conservation planning process be used to reduce conflicts between listed species and non-Federal development, and to provide a framework that would encourage creative partnerships between the private sector and local, State, Tribal, and Federal agencies in the interests of listed species and habitat conservation. The existing laws and regulations provide for, and encourage, flexibility and ingenuity in the development of an HCP that will reduce pertinent conflicts under the ESA. The USFWS recommends maximizing efficiency of effort by developing regional HCPs which include incidental take requests from a number of entities through the appropriate local regulatory agency.

The issuance of an incidental take permit by the USFWS is contingent upon the applicant’s development of a USFWS-approved HCP for the listed species affected by the project or action. Unlisted species may be included in the process and become covered under the permit if they are listed during the term of the permit. A more detailed document, “Habitat Conservation Planning and Incidental Take Permit Processing Handbook” is available from the USFWS’s Sacramento, Albuquerque, and Denver Regional Offices, or any field office, and on the internet at: <http://www.fws.gov/endangered/hcp/hcpbktoc.pdf>.

Upon receipt of the application and HCP, the USFWS may issue an incidental take permit if it determines that the following conditions have been met:

1. The taking will be incidental to an otherwise lawful action;

2. The applicant will, to the maximum extent practicable, minimize and mitigate the impacts of taking;
3. The applicant will ensure that adequate funding will be provided for the conservation plan and changed circumstances;
4. The applicant will provide procedures to deal with unforeseen circumstances;
5. The taking will not appreciably reduce the likelihood of the survival and recovery of the subject species in the wild;
6. The applicant will ensure that other measures required by the USFWS will be provided (e.g., Implementing Agreement); and
7. The plan will be implemented.

The third item above, regarding funding, generally requires development of an implementing agreement. This agreement is a legal document binding all implementing parties to the proposed HCP and their specific responsibilities.

Issuance of an incidental take permit by the USFWS is a Federal action requiring National Environmental Policy Act (NEPA) compliance through preparation of a categorical exclusion, an environmental assessment, or an environmental impact statement. To expedite this process, the USFWS will often delegate the development of information necessary for NEPA documentation to the applicant. Generally, if the incidental take permit will result in a significant net loss of individuals and/or habitat, an environmental impact statement likely will be required. This process often requires 2 years to complete. Conversely, if the permit will result in a net gain or insignificant net loss of individuals and/or habitat, an environmental assessment leading to a finding of no significant impact likely will be sufficient for NEPA compliance. In such a scenario, a permit could be considered for issuance within 1 year. Preparation times for HCP and NEPA documents vary according to the specific circumstances of each proposed action and are therefore difficult to predict.

When the HCP is approved by the USFWS, the section 7 consultation process is initiated on the proposed issuance of an incidental take permit to the applicant. The USFWS prepares and issues a biological opinion on the proposed Federal action to issue a Federal incidental take permit. When issued, the permit would authorize incidental take of listed, or future listed species covered under the permit, provided that the applicant institutes appropriate conservation measures for habitat maintenance, enhancement, and protection, coincident with development, which are detailed in the HCP.

The USFWS recognizes that completion of measures proposed in an HCP often takes a considerable amount of time. To provide incentives for all parties to participate in the conservation planning process, assurances exist that the terms and conditions of the incidental take permit will be available for the life of the HCP. Permits of 30 years or more duration may be appropriate to provide assurances to the private sector and non-Federal governments that long-term commitments to funding, land use restrictions, and habitat conservation will be maintained. Funding, land use restrictions, and habitat conservation are usually required to continue in perpetuity. Ensuring adequate funding for management of conserved habitat may require establishment of a trust fund.

The USFWS will evaluate all requests for incidental take permits under section 10(a)(1)(B) of the ESA. Permit applicants must submit an official application form (Form 3-200) to the appropriate Regional Director of the USFWS. ESA permits are issued in accordance with 50 CFR § 13.21.

### 2.3. Recommended Format for Biological Evaluations/Biological Assessment

The following is provided as a recommended guideline, although information should be presented in the order identified below. As projects vary in complexity, the biological evaluation/biological assessment (BE/BA) may also vary. Development of the BE/BA may not occur in the format order. Rather, as additional information becomes available during the crafting of the BE/BA, the appropriate sections will be modified. Federally funded or permitted exploratory activities that may affect listed species and occur prior to project implementation must also undergo section 7 consultation.

**Cover Page:** Name of project, location (city, county, etc.), and date.

**Table of Contents** (all pages must be numbered)

#### A. Executive Summary

1. Brief summary of project (2 or 3 sentences)
2. In tabular format, identify the species, critical habitat, status, and effects determinations. If “no effect”, include a brief paragraph for each species (these will not be addressed again.) For example:

SPECIES	LISTING STATUS	DETERMINATION
Mojave desert tortoise	Threatened	Likely to adversely affect
Mojave desert tortoise, critical habitat	Designated	Likely to adversely affect
Southwestern willow flycatcher	Endangered	Not likely to adversely affect

#### B. Project Description

**1. Location:** Describe construction boundary: mileposts, State, county, and GPS coordinates ). Include vicinity map (all maps and photographs must be first generation copies, legible and at a scale to be meaningful to the description of the activity).

**2. Definition of Action Area:** All areas affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. Include all off-site use areas (e.g., access roads, new utility lines, materials sources, waste sites, mitigation sites,

stockpiling areas, staging) and locations. A map is helpful, overlaying the entire action area with species and habitat occurrences. Please see Chapter 4 of the USFWS's section 7 handbook for a complete description and examples of the Action Area (<http://www.fws.gov/endangered/consultations/s7hndbk/s7hndbk.htm>).

### **3. Proposed Action:**

- a. Describe the anticipated steps involved in the action in their expected or logical order of implementation and include diagrams that are useful. The intent of the proposed action section is to describe what will be built, how it will be built, and when. Include description of actions for the entire action area (including interrelated and interdependent actions (see section 2.1.1)). Describe how the project will be accessed and if ongoing operations and maintenance is anticipated to occur following completion of the construction phase of the project. If the contractor proposes an alternative construction method other than that described in the BE/BA, concurrence from the Services is required.
- b. Identify Best Management Practices (BMPs), weed-control, habitat restoration, and other measures (i.e., work windows, construction techniques, avoidance) designed to minimize adverse effects in this section.
- c. Describe monitoring and reporting plans, as well as conservation bank credits or mitigation sites if applicable.

### **C. Description of the species and their habitat**

Identify each species and each critical habitat. Include the following (repeat for each listed species and listed habitat):

1. Consultation with State wildlife agency and/or Natural Heritage database;
2. Literature reviews;
3. Consultation with experts on species, as necessary;
4. Descriptions of the species and general habitat requirements;
5. Relationship of habitat in the project area to local populations;
6. Map of the project area at an appropriate scale to show vegetation types and important biological features, such as habitat for sensitive species, wetlands or unique plant assemblages;
7. Photographs keyed to locations labeled on the project map;
8. Species information in Action Area including survey protocol used, by whom, etc. Include names of surveyors and a statement of their qualifications or authorizations to conduct the survey; and
9. Identify designated or proposed critical habitat as separate listed entities. List the primary constituent elements and address the extent to which they are found in the

action area. These can be introduced in table format and elaborated in subsequent text.

**D. Environmental Baseline**

Describe the past and present effects of human actions on the species or critical habitat in the action area. Describe existing habitat conditions and species trends in detail. Use watershed analysis from the BLM or Forest Service where available, State wildlife agency, or any other available scientific or commercial databases or information. Include information on climate change (e.g., changes to the species' range, distribution, habitat, etc.).

**E. Effects of the Action:** Include a discussion of direct and indirect effects relative to the species:

1. Direct Effects - Those effects caused directly by the proposed action (include those based on sideboards). Provide the rationale for each determination;
2. Indirect Effects - Caused by or will result from the proposed action and are later in time, but are still reasonably certain to occur; and
3. Cumulative Effects - Those effects of future State or private activities, not Federal activities, that are reasonably certain to occur within the action area.

**F. Determination of Effect**

This section must include a clear statement of effect for each species. Example: "We conclude that the Fiber-Optic Line Project may affect, but will not likely adversely affect the Mojave desert tortoise because..."

**G. References and Personal Communications Cited**

*Example of Literature Cited:*

Smith, D. M. 2001. Genetic subdivision and speciation in the western North American spotted snake complex, *Thamnophis punctatus*. *Evolution* 4:29-35.

*Example of Personal Communications (must be documented):*

Leslie Brown, Research Biologist  
Smith Nature Center  
4125 Willowtree Drive  
Greenville, Oregon 85194  
January 8, 2009 telephone communication (or email, site visit, etc.)

## **CHAPTER 3. FEDERAL AND STATE AUTHORIZATIONS FOR IMPLEMENTING DESERT TORTOISE MEASURES REQUIRED UNDER SECTIONS 7 OR 10 OF THE ESA**

When a project will be implemented under the purview of a section 7 biological opinion or a section 10 permit for the Mojave population of the desert tortoise, the USFWS requires each desert tortoise survey be conducted by a desert tortoise Authorized Biologist approved by the USFWS. In addition, the appropriate State wildlife agency should be contacted for their permitting requirements. Within the States of Nevada, California, Utah, and Arizona, individuals must obtain the appropriate permits or authorizations from the respective State wildlife agency to be authorized to handle desert tortoises. Authorized individuals must comply with any section 7 biological opinion and Federal and State permits for the project. In California, CDFG must approve the all individuals involved in handling desert tortoises including Monitors and Authorized Biologists. Contact the appropriate agencies for clarification if there are questions about or conflicting conditions between a section 7 biological opinion/section 10 incidental take permit and a State permit.

As a general rule, an Authorized Biologist has a bachelors or graduate degree in biology, ecology, wildlife biology, herpetology, or related discipline with prior field experience using accepted resource agency techniques to survey for desert tortoises. The proposed Authorized Biologist shall submit to the USFWS a completed and signed “Desert Tortoise - Authorized Biologist and Monitor Responsibilities and Qualifications Form” (Qualifications Form) provided below. USFWS is developing a training and certification program for persons who want to be Authorized Biologists. Until this program is in place, Authorized Biologists will be reviewed based on the information submitted on the Qualifications Form.

Submit the Qualifications Form to the appropriate USFWS field office (See AGENCY/ORGANIZATION CONTACT INFORMATION preceding Chapter 1) **at least 30 days prior to initiation of activities**. If required, submit the Qualifications Form to the Federal action agency with whom the USFWS has consulted under section 7 of the ESA. Submit an updated Qualifications Form for each project even if you have been approved previously, unless you have been instructed otherwise by the USFWS or State wildlife agency. If you seek approval to attach/remove/insert any devices or equipment to/into desert tortoises, withdraw blood, or conduct other procedures on desert tortoises, a recovery permit (section 10(a)(1)(A) permit) or similar authorization may be required. The application for a recovery permit requires completion of Form 3-200-55, which can be downloaded at <http://www.fws.gov/forms/3-200-55.pdf>. Submit the completed form to the appropriate USFWS regional office (<http://www.fws.gov/endangered/permits/permitscontact.html>).

### **3.1. Desert Tortoise - Authorized Biologist and Monitor Responsibilities and Qualifications Form**

**AUTHORIZED BIOLOGIST** – Authorized Biologists must keep current with the latest USFWS protocols, guidelines, and regulations pertaining to the desert tortoise. Some of these are available at [http://www.fws.gov/ventura/speciesinfo/protocols\\_guidelines/](http://www.fws.gov/ventura/speciesinfo/protocols_guidelines/).

Authorized Biologists will serve as mentors to train Desert Tortoise Monitors and should approve Monitors to conduct specific activities based on the Monitor’s demonstrated skills, knowledge and qualifications. Direct supervision is always required for field and clearance surveys; direct supervision means that the Authorized Biologist has direct voice and sight contact

with the desert Tortoise Monitor. An Authorized Biologist is responsible for the outcome of all desert tortoise related activities for which the project is approved, including errors committed by Desert Tortoise Monitors.

The Authorized Biologist must have thorough and current knowledge of desert tortoise identification, behavior, natural history, ecology, and physiology, and demonstrate substantial field experience and training to safely and successfully conduct their required duties. Authorized Biologists are approved to monitor project activities within desert tortoise habitat and are responsible for locating desert tortoises and their sign (*i.e.*, conduct field and clearance surveys). Authorized Biologists must ensure proper implementation of protective measures, and make certain that the effects of the project on the desert tortoise and its habitat are minimized in accordance with a biological opinion or incidental take permit. All incidents of noncompliance in accordance with the biological opinion or permit must be recorded and reported.

To be authorized, the applicant must have the knowledge and experience to conduct any or all of the following, as needed:

- Locate, identify, and report all forms of desert tortoise sign in accordance with approved protocols;
- Handle and temporarily hold desert tortoises;
- Relocate/translocate desert tortoises prior to implementation of projects;
- Excavate burrows to locate desert tortoises or eggs;
- Reconstruct desert tortoise burrows;
- Unearth and relocate desert tortoise eggs;
- Review and approve individual Desert Tortoise Monitors and their activities based on qualifications of the Monitors;
- Directly supervise Desert Tortoise Monitors during clearance surveys and train Monitors in all aspects of protecting desert tortoises during implementation of projects;
- Be familiar with the project biological assessment and biological opinion or incidental take permit (copy in hand);
- Ensure proper implementation of protective measures;
- Record and report incidents of noncompliance in accordance with a biological opinion or permit; and
- Halt project activities per provisions of the biological opinion or permit.

**DESERT TORTOISE MONITOR** – Desert Tortoise Monitors will be approved by the Authorized Biologist(s) or USFWS (if an Authorized Biologist is not required) for a project. Desert Tortoise Monitors will assist the Authorized Biologist on project activities within desert tortoise habitat, ensure proper implementation of protective measures, and record and report desert tortoise and sign observations in accordance with approved protocol. They will report incidents of noncompliance in accordance with a biological opinion or permit, move desert tortoises from harm's way when desert tortoises enter project sites and place these animals in designated safe areas or maintain the desert tortoises in their immediate possession until an Authorized Biologist assumes care of the animal. Monitors assist Authorized Biologists during surveys and serve as apprentices to acquire experience. Monitors may not conduct field or clearance surveys or other specialized duties of the Authorized Biologist unless directly supervised by an Authorized Biologist; "directly supervised" means the Authorized Biologist has direct voice and sight contact with the Monitor.

### 3.2. DESERT TORTOISE AUTHORIZED BIOLOGIST QUALIFICATIONS FORM

This form should be used to provide your qualifications to agency officials if you wish to undertake the duties of an authorized biologist with regard to desert tortoises during construction or other projects authorized under Sections 7 (Biological Opinions) or 10(a)(1)(B) (i.e. Habitat Conservation Plans) of the Endangered Species Act.

(If you seek approval to attach/remove/insert any devices or equipment to/into desert tortoises, withdraw blood, or conduct other procedures on desert tortoises, a recovery permit or similar authorization may be required. Application for a recovery permit requires completion of Form 3-200-55, which can be downloaded at <http://www.fws.gov/forms/3-200-55.pdf>.)

#### 1. Contact Information:

<b>Name</b>	
<b>Address</b>	
<b>City, State, Zip Code</b>	
<b>Phone Number(s)</b>	
<b>Email Address</b>	

#### 2. Date:

#### 3. Areas in which authorization is requested (check all that apply):

- San Bernardino, Kern, Inyo and Los Angeles Counties, California (Ventura office)
- Riverside, San Diego, and Imperial Counties, California (Carlsbad office)
- Nevada     Utah     Arizona

#### 4. Please provide information on the project:

<b>USFWS Biological Opinion or HCP No.</b>  <b>When Applicable</b>		<b>Date:</b>
<b>Project Name</b>		
<b>Federal Agency (If Applicable)</b>		
<b>Proponent or Contractor</b>		

5. If you hold, or have held, any relevant state or federal wildlife permits provide the following:

<b>Species</b>	<b>Dates</b>	<b>State (specify) or Federal Permit Number</b>	<b>Authorized Activities</b>

6. **Education:** Provide up to three schools, listing most recent first:

Institution	Dates attended	Major/Minor	Degree received

**7. Desert Tortoise Training.**

Name/Type of Training	Dates (From/To)	Location	Instructor/Sponsor
1. Classes			
2. Field Training			
3. Translocation			
4.			

**8. Experience** – Include only those positions relevant to the requested work with desert tortoises. Distinguish between wild Mojave desert tortoise and other experience. Include only your experience, not information for the project you worked on (e.g., if 100 tortoises were handled on a project and you handled 5 of those tortoises, include only those 5. List most recent experience first. Handling a Mojave desert tortoise must be authorized by a Biological Opinion or other permit and reported to the USFWS. Information provided in this section will be used by the USFWS to track the numbers of tortoises affected by previous projects (baseline). **Be sure to include a project supervisor or other contact that can verify your skills and experience in relation to your job performance.** Attach additional sheets as necessary. Please use numbers in each column; do not use “X’s” to indicate participation in the activity. If your experience is limited to **less than three desert tortoise positions**, please include additional job experience and references in the section below.

**Experience by project and activity:**

<b>Project Name:</b> <b>Job Title:</b> <b>Dates of Employment:</b>	<b>Supervisor / Project Contact Name:</b> <b>Phone:</b> <b>Email Address:</b>		<b>Conduct Clearance Surveys (Hrs/Days)</b>	<b>Excavate DT burrows (No.)</b>	<b>Locate DT No. &lt; 100mm ≥ 100mm</b>	<b>Handled for Relocation DTs (No.)</b>	<b>Excavate, and relocate DT nests (No.)</b>
1.					/		
2.					/		
3.					/		
4.					/		
5.					/		
6.					/		
7.					/		

**Experience by project and activity (continued):** Each project number should correspond with the project listed on the previous page

<b>Project Name</b> (Number should correspond to previous page)	<b>Construct Artificial Burrows (No.)</b>	<b>Monitor project equipment and activities (Hrs/Days)</b>	<b>Oversee project compliance (Hrs/Days)</b>	<b>Supervise DT field staff (Hrs/Days) and No. staff supervised</b>	<b>DT fence Installation and inspection (Hrs/Days)</b>	<b>Present DT Awareness Training (No.)</b>
1.						
2.						
3.						
4.						
5.						
6.						
7.						

**Summary of experience:**

Total time spent for all desert tortoise-related field activities (referenced above):

Specify total number of hours:

OR total number of 8-hour days: \_\_\_\_\_

Total number of miles/kilometers walked conducting survey transects:

Total number of wild, free-ranging desert tortoises you personally handled:

<100 mm: \_\_\_\_\_

≥100 mm: \_\_\_\_\_

Additional supervisory experience other than with desert tortoise work:

Project	Hours	Staff (No.)

Additional references for individuals who have held **less than three** positions working with desert tortoise

<p><b>Project Name:</b></p> <p><b>Job Title:</b></p> <p><b>Dates of employment:</b></p>	<p><b>Supervisor / Project Contact:</b></p> <p><b>Name:</b></p> <p><b>Phone:</b></p> <p><b>Email address:</b></p>
<p><b>Project Name:</b></p> <p><b>Job Title:</b></p> <p><b>Dates of employment:</b></p>	<p><b>Supervisor / Project Contact:</b></p> <p><b>Name:</b></p> <p><b>Phone:</b></p> <p><b>Email address:</b></p>

<b>Project Name:</b>  <b>Job Title:</b>  <b>Dates of employment:</b>	<b>Supervisor / Project Contact:</b>  <b>Name:</b>  <b>Phone:</b>  <b>Email address:</b>
--	--

I certify that the information submitted in this form is complete and accurate to the best of my knowledge and belief.

I understand that any false statement herein may subject me to the criminal penalties of 18 U.S.C. Ch.47, Sec. 1001.

**Signed:** \_\_\_\_\_ **Date:** \_\_\_\_\_

<b>Table 3. USFWS Desert Tortoise Pre-Project Survey Guidance</b>		
<b>What is the estimated number of tortoises and associated 95% confidence interval for the action area?</b>		
<b>INSTRUCTIONS</b> Use this tab when your transects were of unequal length.		
Enter the appropriate values from the survey into the yellow cells below. The number of tortoises and associated 95% confidence interval for the action area will be calculated.		
	<b>N =</b>	<b>42.4</b>
	<b>Lower 95%CI =</b>	<b>19.41</b>
	<b>Upper 95%CI =</b>	<b>92.54</b>
<b>Total action area (acres)</b>		<b>3000</b>
<b>Prob that a tort is above ground given winter rainfall (Pa from Table 2) =</b>		<b>0.800</b>
<b>Total length of transects walked (km) =</b>		<b>1080</b>
<b>Number of transects walked =</b>		<b>108</b>
<b>Number of tortoises found during surveys (n) =</b>		<b>19</b>
<b><i>Transects of various lengths</i></b>		
<b>Transect</b>	<b>Length (km)</b>	<b>Tortoises within 5m of centerline</b>
1	10.0	0
2	10.0	0
3	10.0	0
4	10.0	0
5	10.0	2
6	10.0	0
7	10.0	0
8	10.0	0
9	10.0	0
10	10.0	2
11	10.0	0
12	10.0	0
13	10.0	2
14	10.0	1
15	10.0	1
16	10.0	1
17	10.0	1
18	10.0	0
19	10.0	0
20	10.0	0
21	10.0	2
22	10.0	0
23	10.0	0
24	10.0	0
25	10.0	0

26	10.0	0
27	10.0	0
28	10.0	0
29	10.0	0
30	10.0	0
31	10.0	0
32	10.0	0
33	10.0	0
34	10.0	0
35	10.0	0
36	10.0	1
37	10.0	0
38	10.0	0
39	10.0	0
40	10.0	1
41	10.0	0
42	10.0	0
43	10.0	0
44	10.0	0
45	10.0	0
46	10.0	0
47	10.0	1
48	10.0	0
49	10.0	1
50	10.0	0
51	10.0	0
52	10.0	0
53	10.0	0
54	10.0	0
55	10.0	0
56	10.0	0
57	10.0	0
58	10.0	0
59	10.0	0
60	10.0	0
61	10.0	0
62	10.0	0
63	10.0	0
64	10.0	0
65	10.0	0
66	10.0	0
67	10.0	0
68	10.0	0
69	10.0	0
70	10.0	0
71	10.0	0
72	10.0	0
73	10.0	0
74	10.0	0
75	10.0	0
76	10.0	0

77	10.0	0
78	10.0	0
79	10.0	0
80	10.0	0
81	10.0	0
82	10.0	0
83	10.0	1
84	10.0	0
85	10.0	0
86	10.0	0
87	10.0	1
88	10.0	0
89	10.0	0
90	10.0	0
91	10.0	0
92	10.0	0
93	10.0	0
94	10.0	0
95	10.0	0
96	10.0	0
97	10.0	0
98	10.0	0
99	10.0	0
100	10.0	0
101	10.0	1
102	10.0	0
103	10.0	0
104	10.0	0
105	10.0	0
106	10.0	0
107	10.0	0
108	10.0	0
109	5.0	0
110	5.0	0
111	5.0	0
112	5.0	0
113	5.0	0
114	5.0	0
115	5.0	0
116	5.0	0
117	5.0	0
118	5.0	0
119	5.0	0
120	5.0	0
121	5.0	0
122	5.0	0
123	5.0	1
124	5.0	0
125	5.0	0
126	5.0	0
127	5.0	0

128	5.0	0
129	3.0	0
130	3.0	0
131	3.0	0
132	3.0	0
133	3.0	0
134	3.0	0
135	3.0	0
136	3.0	0
137	3.0	0
138	3.0	0
139	3.0	0
140	3.0	0
141	3.0	0
142	3.0	0
143	3.0	1
144	3.0	0
145	3.0	0
146	3.0	0
147	3.0	0
148	3.0	0
149	3.0	0
150	3.0	0
151	3.0	0
152	3.0	0
153	3.0	0
154	3.0	0
155	3.0	0
156	3.0	0
157	3.0	0
158	3.0	0
159	3.0	0
160	3.0	0
161	3.0	0
162	3.0	0
163	3.0	0
164	3.0	0
165	3.0	0
166	3.0	0
167	3.0	0
168	3.0	0
169	3.0	0
170	3.0	0
171	3.0	0
172	3.0	0
173	3.0	0
174	3.0	0
175	3.0	0
176	3.0	0
177	3.0	0
178	3.0	0

179  
180  
181  
182  
183  
184  
185  
186  
187  
188  
189  
190  
191  
192  
193  
194  
195  
196  
197  
198  
199  
200  
201  
202  
203  
204  
205  
206  
207  
208  
209  
210  
211  
212  
213  
214  
215  
216  
217  
218  
219  
220  
221  
222  
223  
224  
225  
226  
227  
228  
229

230  
231  
232  
233  
234  
235  
236  
237  
238  
239  
240  
241  
242  
243  
244  
245  
246  
247  
248  
249  
250

<b>Table 3. USFWS Desert Tortoise Pre-Project Survey Guidance</b>	
<b>What is the estimated number of tortoises and associated 95% confidence interval for the action area?</b>	
<b>INSTRUCTIONS</b> Use this tab when all your transects were of equal length. Enter the appropriate values from the survey into the yellow cells below. The number of tortoises and associated 95% confidence interval for the action area will be calculated.	
	<b>N = 42.4</b>
	<b>Lower 95%CI = 19.41</b>
	<b>Upper 95%CI = 92.52</b>
Total action area (acres)	3000
Prob that a tort is above ground given winter rainfall (Pa from Table 2) =	0.800
Total length of transects walked (L, km) =	1080
Transect length (km)	10
Number of transects walked (k) =	108
Number of tortoises found during surveys (n) =	19
<i>Transects all the same length</i>	
Number of tortoises (n <sub>i</sub> )	Number of transects on which (n <sub>i</sub> ) tortoises were
0	93
1	11
2	4
3	0
4	0
5	0
6	0
7	0
8	0
9	0

---

## CHAPTER 4. PREPARING FOR ANY ACTION THAT MAY OCCUR WITHIN THE RANGE OF THE MOJAVE POPULATION OF THE DESERT TORTOISE

### 4.1. General Information on the Ecology of the Desert Tortoise

Most habitat for the Mojave population of the desert tortoise is below 4,500 feet (1372 meters) elevation in the creosote bush-bursage series of the Mojave desert scrub biome; dominant plants are creosote bush (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*). Desert tortoise habitat may also include various cacti species (*Opuntia* spp.), saltbush (*Atriplex* spp.) scrub, and Joshua tree (*Yucca brevifolia*) woodlands at elevations up to approximately 5,000 feet (1524 meters). The desert tortoise is a large, herbivorous reptile. Mojave desert tortoises are typically active during the day and when annual plants are most abundant during spring and early summer. However, they can also be active following rain events and unseasonably warm periods during fall and winter. If rain events occur at night, tortoises may emerge from their burrows to drink. Female desert tortoises construct nests during the late afternoon and evening, and any desert tortoise may emerge from its burrows at night during extreme heat (see section 7.3). Desert tortoises usually spend the remainder of the year in sheltersites, escaping the extreme weather conditions of the Mojave Desert. Location and type of sheltersites vary greatly in different geographic locations (see section 4.2). For detailed information on the ecology of the Mojave desert tortoise, please see [http://www.fws.gov/nevada/desert\\_tortoise](http://www.fws.gov/nevada/desert_tortoise).

### 4.2 Desert Tortoise Burrows

Desert tortoises use a variety of sheltersites including soil burrows, caliche caves, lava tubes, pallets, rock caves, rodent or other animal's burrows, and shrubs or man-made structures, such as vehicles and equipment. For this Manual, the term "burrow" means any structure that could be used by a desert tortoise for shelter.

#### 4.2.1. Determining if a Desert Tortoise is Present in a Burrow

If sufficient sunlight is available, use a mirror to direct light into the opening of the burrow to locate desert tortoise sign including a desert tortoise. Alternatives to a mirror are the use of a LED flashlight, fiber-optic scope, or miniature camera. Please refer to section 7.6 for disinfecting procedures for equipment. If the terminus of the burrow or any side chambers cannot be observed, or if the light is insufficient, use a fiber-optic scope or miniature camera to inspect all areas of the burrow.

#### 4.2.2. Describing Burrows

Desert tortoises typically excavate soil burrows that are flat on the bottom and domed on top to match the profile of the desert tortoise shell (half-moon shape). The condition class of a burrow (see below) does not necessarily exclude use or occupation by a desert tortoise. When aestivating in a burrow, desert tortoises may backfill the burrow giving the appearance of the terminus. Spider webs, litter, and other debris may accumulate in burrow openings overnight, and openings may collapse during winter rains. Do not assume that a burrow is inactive if it

looks unused or collapsed. Desert tortoises may use canid or mustelid excavations, and may be found in burrows of other animals, particularly kit foxes. Burrowing owls may use desert tortoise burrows, but do not assume that burrows occupied by owls are not also occupied by desert tortoises. Juvenile desert tortoises create their own burrows, which may resemble rodent burrows, or use rodent burrows. Therefore, consider all burrows to be occupied by desert tortoises until determined otherwise.

Record basic information on the data sheet for each burrow including its class, if occupied by a desert tortoise or other animals, other sign present, GPS location, and other distinguishing information (see below). We recommend photographing burrows and submitting the photographs to the USFWS with the data sheets. Record the information electronically or use permanent black ink and high rag content, acid-free paper when recording all data.

**Condition Class:**

1. currently active, with desert tortoise or recent desert tortoise sign
2. good condition, definitely desert tortoise; no evidence of recent use
3. deteriorated condition which includes collapsed burrows; definitely desert tortoise (please describe)
4. good condition; possibly desert tortoise (please describe)
5. deteriorated condition which includes collapsed burrows; possibly desert tortoise (please describe)

4.2.3. Mapping Burrows

Map desert tortoise burrows using a GPS unit with sufficient accuracy to easily navigate back to the location. Indicate the condition class of the burrow and whether it is occupied by a desert tortoise. There are several important reasons for mapping it: a) resource agencies can determine how many desert tortoises were encountered on the project compared with the number of burrows excavated, b) the information will be available for future projects in the same area, c) burrow locations may be important for organizing desert tortoise removals and determining desert tortoise hot spots versus areas where few, if any, desert tortoises are found, and d) the number and location of burrows found during initial desert tortoise surveys can be compared with the number and location of burrows found during monitoring or subsequent surveys; (i.e., the data may provide information to determine appropriate take limits based on the findings of initial surveys). Typically, the USFWS requires a report that includes the number of desert tortoises observed during the project. Some projects require that all desert tortoise sign be mapped. If an artificial burrow is used, map it accurately. If the burrow is blocked or temporarily penned (see section 7.10.3, Penning Desert Tortoises), map and mark it in the field to easily find it later.

4.2.4. Map Types

For reporting purposes, display burrow locations on maps of appropriate scale, preferably on aerial photography maps. If monitoring a linear right-of-way, number the burrows sequentially within a given portion (e.g., "B-23-2," for burrow #23 on reach 2). As an alternative, use United States Geological Survey (USGS) 7.5' topographical maps (scale 1" = 2,000'), paper or

electronic, or enlargements of them. Project maps at a scale of 1" = 100' or 1" = 200' are particularly useful when burrows are common and better resolution is necessary. The assigned numbers may be cross-referenced with data sheets, field notes, and photographs.

### **4.3. Presence/absence and abundance desert tortoise survey protocol**

This protocol provides recommendations for survey methodology to determine presence/absence and abundance of desert tortoises for projects occurring within the species range on Federal and non-Federal lands, and to provide a standard method for reporting survey results. Information gathered from these procedures will: 1) help determine the appropriate level of consultation with USFWS and the appropriate State wildlife agency, 2) help determine the incidental take of desert tortoises resulting from proposed projects as defined by the ESA and California Endangered Species Act (CESA) and 3) help minimize and avoid take.

This guidance includes:

- Site Assessment
- Pre-project Field Survey Protocol for Potential Desert Tortoise Habitats
- USFWS Desert Tortoise Pre-project Survey Data Sheet

This guidance is subject to revision as new information becomes available. Before initiating the protocols described below, please check with your local USFWS and appropriate State wildlife agency to verify that you are implementing the most up-to-date methods. To ensure quality and reduce the likelihood of nonconcurrence with survey results, we recommend that the names and qualifications of the surveyors be provided to USFWS and appropriate State agency for review prior to initiating surveys.

---

In Nevada:

U.S. Fish and Wildlife Service  
Nevada Fish and Wildlife Office  
4701 North Torrey Pines Drive  
Las Vegas, Nevada 89130  
(702) 515-5230

---

In California:

Inyo, Kern, Los Angeles, and San Bernardino Counties:

U.S. Fish and Wildlife Service  
Ventura Fish and Wildlife Office  
2493 Portola Road, Suite B  
Ventura, California 93003  
(805) 644-1766

Imperial and Riverside Counties, and Joshua Tree National Park and the San Bernardino National Forest in San Bernardino Co:

U.S. Fish and Wildlife Service  
Carlsbad Fish and Wildlife Office  
6010 Hidden Valley Road  
Carlsbad, California 92009  
(760) 431-9440

---

---

In Utah:

U.S. Fish and Wildlife Service  
Utah Ecological Services Field  
Office  
2369 West Orton Circle  
West Valley City, Utah 84119  
(801) 975-3330

---

In Arizona:

U.S. Fish and Wildlife Service  
Arizona Fish and Wildlife  
Conservation Office -Flagstaff  
323 North Leroux Street, Suite 201  
Flagstaff, Arizona 86001  
(928) 226-0614

---

---

**State Wildlife Agencies**

---

Nevada: Department of Wildlife:

Southern Region  
4747 Vegas Drive  
Las Vegas, Nevada 89108  
(702) 486-5127

---

California Department of Fish and Game (CDFG)

For Fresno, Kern, Kings, Madera, Mariposa, Merced, Monterey, San Benito, San Luis  
Obispo, Stanislaus, Tulare and Tuolumne Counties:

Central Region Headquarters Office  
1234 E. Shaw Avenue  
Fresno, California 93710  
(559) 243-4005 ext. 151

For Imperial, Inyo, Mono, Riverside and San Bernardino Counties:

Inland Deserts Regional Office  
3602 Inland Empire Boulevard, Suite C-220  
Ontario, California 91764  
(909) 484-0167

For Los Angeles, Orange, San Diego, Santa Barbara and Ventura Counties:

South Coast Regional Office  
4949 Viewridge Avenue  
San Diego, California 92123  
(858) 467-4201

---

---

Utah Division of Wildlife Resources:

Southern Region  
1470 N Airport Road  
Cedar City, Utah 84720  
(435) 865-6100

Washington County Field Office  
344 East Sunland Drive, Suite #8  
St. George, Utah 84790  
(435) 688-1426

---

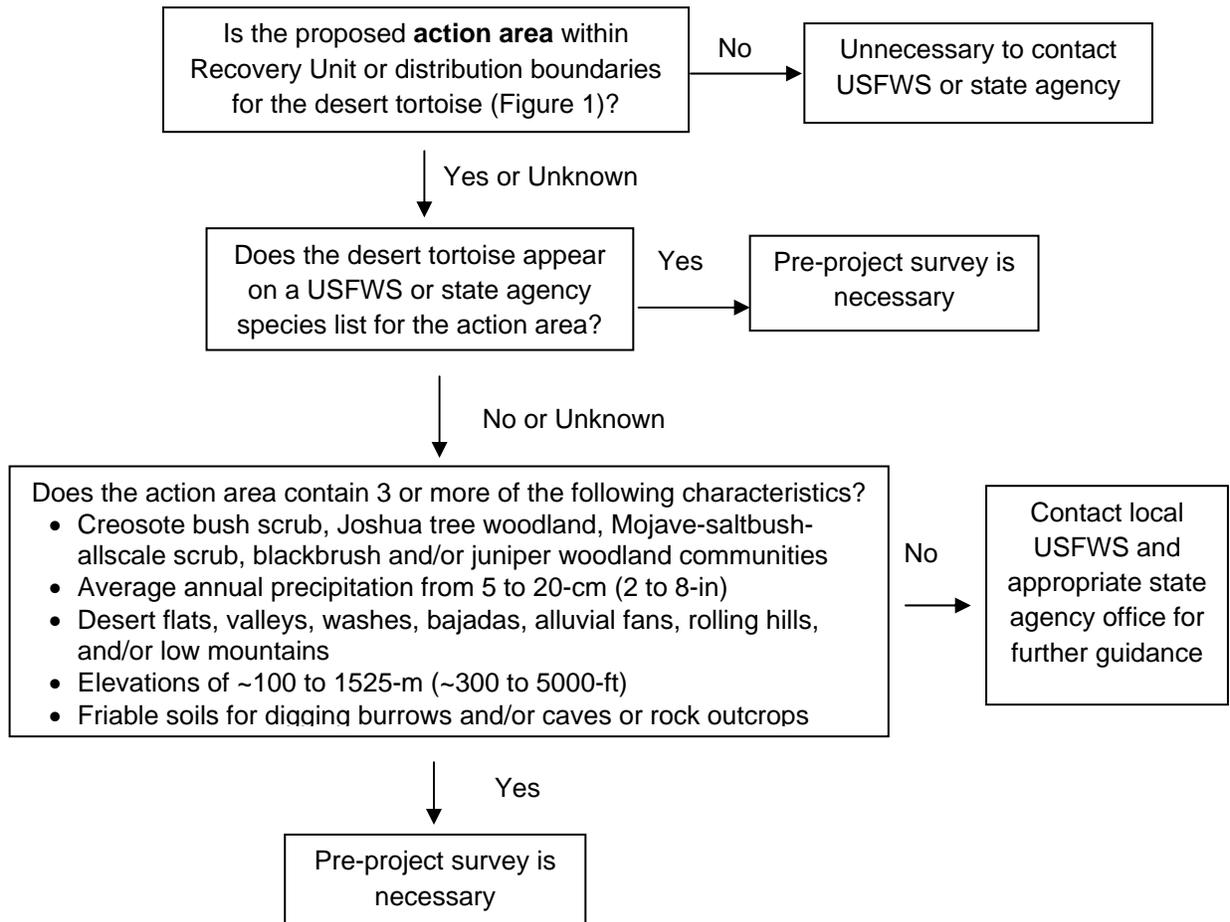
Arizona Game & Fish Department  
State Headquarters--Nongame Branch  
5000 W. Carefree Highway  
Phoenix, Arizona 85086  
(623) 236-7767

---

---

## Site Assessment

Use the below key to assess if desert tortoises may be present within or near the action area and determine survey and consultation requirements<sup>1</sup>. The **action area** is defined by regulation as all areas to be affected directly or indirectly and not merely the immediate area involved in the action (50 CFR §402.02). The extent of the action area is not limited to the footprint of the action nor is it limited by the authority of the Federal, State, or local agency or any other entity proposing the project. The environmental baseline, the analysis of the effects of the action, and the amount or extent of incidental take are based upon the action area. If you cannot access the entire action area during your surveys for some reason (e.g., access to private property is unavailable), please note that in your survey report.



<sup>1</sup>If determined that the proposed project is not likely to adversely affect the desert tortoise and a tortoise or tortoise sign (shells, bones, scutes, limbs, burrows, pellets, scats, egg shell fragments, tracks, courtship rings, drinking sites, mineral licks, etc.) is found in the action area during implementation of the proposed project, the proposed action should *immediately* stop and then it must be determined whether further or formal consultation is necessary to comply with the ESA or CESA in California. It is recommended that the USFWS and CDFG in California be notified in writing within three days of the discovery. This short notification period will help ensure a prompt response by USFWS and CDFG to facilitate ESA and CESA compliance.

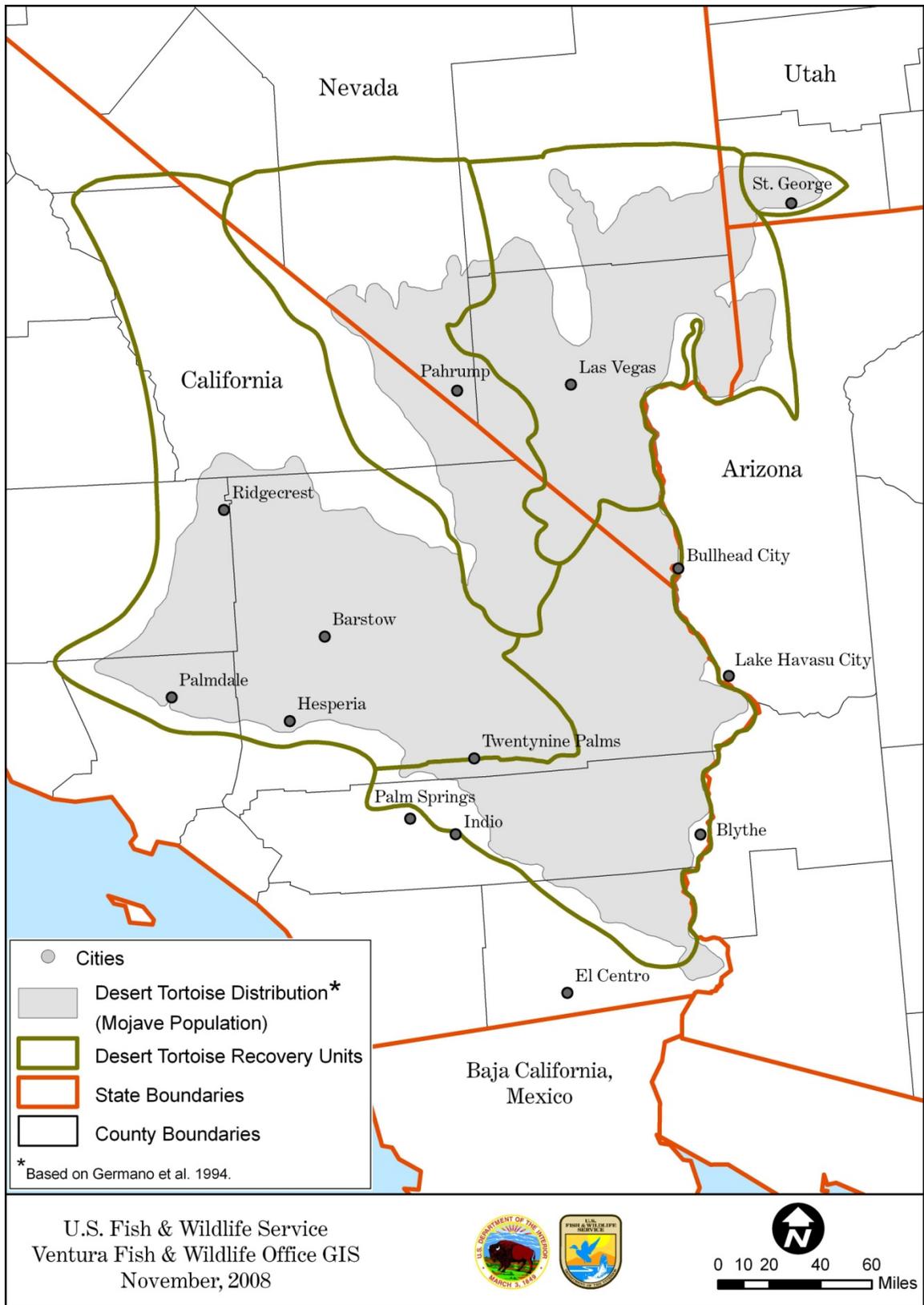


Figure 1: Known Range of the Desert Tortoise (Mojave Population)

## Pre-project Field Survey Protocol for Potential Desert Tortoise Habitats

### Objectives of survey

- Determine presence or absence of desert tortoises within the action area
- Estimate the number of desert tortoises (abundance) within the action area
- Assess the distribution of desert tortoises within the action area to inform take avoidance and minimization

The **action area** is defined by regulation as all areas to be affected directly or indirectly and not merely the immediate area involved in the action (50 CFR §402.02). The action area is not limited to the "footprint" of the action or jurisdiction. Rather, it is a biological determination of the reach of the proposed action on listed species.

### Field Methods

This protocol takes into account the fact that not all desert tortoises within the action area are seen by the surveyor. Provided is an equation which accounts for tortoises that are below ground at the time of surveys and for above-ground desert tortoises that are cryptic and may be missed.

$$\left( \begin{array}{c} \text{Estimated number of tortoises} \\ \text{within action area} \end{array} \right) = \frac{\left( \begin{array}{c} \text{Number of tortoises} \\ \text{observed above ground} \end{array} \right)}{\left( \begin{array}{c} \text{Probability that} \\ \text{a tortoise is} \\ \text{above ground (P}_a\text{)} \end{array} \right) \left( \begin{array}{c} \text{Probability of} \\ \text{detecting a tortoise,} \\ \text{if above ground (P}_d\text{)} \end{array} \right)} \left( \begin{array}{c} \text{Action area} \\ \text{Area surveyed} \end{array} \right)$$

Surveys of 100% coverage, or probabilistic sampling where appropriate, should utilize this equation to estimate the number of desert tortoises within the action area (see below; Table 1, P<sub>a</sub> and P<sub>d</sub>).

- Information to determine presence/absence *and* estimate number of desert tortoises within the action area is collected during the same survey effort. Surveyed objects include all desert tortoises that are above ground (both out of burrows and within burrows but still visible), as well as all desert tortoise sign (burrows, scats, carcasses, etc.). Record all locations of desert tortoises and sign encountered during the survey effort using the USFWS 2009 Desert Tortoise Pre-Project Survey Data Sheet (attached). Please submit a copy of the original datasheets with results of the survey to your local USFWS office.
- Surveys should be conducted during the desert tortoise's most active periods (April through May or September through October) (Nussear and Tracy 2007; Inman 2008; USFWS 2009). Surveys outside these time periods may be approved by USFWS, and CDFG in California (e.g., warm weather in March or rainfall in August stimulating increased desert tortoise activity).
- Desert tortoises utilize burrows to avoid daily and annual thermal extremes (Woodbury and Hardy 1948). Therefore, surveys should take place when air temperatures are below 40 degrees C (104 degrees F) (Zimmerman et al. 1994; Walde et al. 2003; Inman 2008). Air

temperature is measured ~5-cm from the soil surface in an area of full sun, but in the shade of the observer.

- Ten-meter (~30-ft) wide belt transects should be used during surveys. For all projects, surveys which cover the entire project area with the 10-m belt transects (100 percent coverage) are always an acceptable option. For very large action areas, probabilistic sampling may also be an option, such that the appropriate proportion of the action area is surveyed (Table 2). If probabilistic sampling is an option for the project site, each transect should be chosen either systematically or randomly ensuring that the entire action area has an equal probability of being included in the sample. Transects should be completed in a random order, oriented in a logistically convenient pattern (e.g., lines, squares, or triangles). Any sampling design other than simple systematic or random sampling must be approved by USFWS (e.g. stratification). See *Frequently Asked Questions* section for a discussion of 100 percent coverage and probabilistic sampling.
- USFWS considers the results of a pre-project survey to be valid for no more than one year. If survey results are older than one year, please contact the local USFWS office.

#### *Presence or absence of desert tortoises within the project vicinity*

- Occurrence of either live desert tortoises or desert tortoise sign (burrows, scats, and carcasses) in the action area indicates desert tortoise presence and therefore requires formal consultation with USFWS.
- If neither desert tortoises nor sign are encountered during the action area surveys and the project, or any portion of project, is  $\leq$  (less than or equal to) 0.8 km<sup>2</sup> (200 acres) or linear, three additional 10-m (~30-ft) belt transects at 200-m (~655-ft) intervals parallel to and/or encircling the project area perimeter (200-m, 400-m, and 600-m from the perimeter of the project site) should be surveyed. These transects are employed only as part of the presence/absence determination; they are not included in the estimation of desert tortoise abundance. See *Frequently Asked Questions* section below for an explanation of why additional surveys are needed.
- If neither desert tortoises nor sign are encountered during the action area surveys, as well as project perimeter surveys where appropriate, please contact your local USFWS office. Informal consultation with the USFWS may be required even though no desert tortoises or sign are found during surveys.

#### *Number of desert tortoises within the action area*

The attached Table 4.3 spreadsheet will estimate the number of adult desert tortoises (> (greater than) 160 mm MCL) within the action area using the “Number of desert tortoises within the action area” equation from above.

Enter the requested information into the Table 4.3 spreadsheet, as follows:

1. Enter the total project area.
2. Enter the appropriate value from Table 1 for the term “probability that a desert tortoise is above ground” ( $P_a$ ).
3. Enter the number of adult desert tortoises (>160-mm midline carapace length) found during the survey of the action area for the term “number of desert tortoises observed above ground” ( $n$ ).

---

**Table 4.1.** Probability that a desert tortoise is above ground ( $P_a$ ) relative to the previous winter’s rainfall (October through March)

---

*Use amount of rainfall from the winter preceding the pre-project survey to determine which value of  $P_a$  is appropriate for the project*

*To find this amount of rainfall, go to the Western Regional Climate Center site:*

*<http://www.wrcc.dri.edu/summary/Climsmsca.html>; click on your location and scroll down to “monthly totals”*

Previous Winter Rain	Probability ( $P_a$ )	Variance( $P_a$ )
<40 mm (~1.5 inches)	0.64	0.08
≥40 mm (~1.5 inches)	0.80	0.05

---

The estimate for the term “probability of detecting a desert tortoise if above ground ( $P_d$ )” is already included in spreadsheet Table 3 ( $P_d = 0.63$ ; variance = 0.011). See *Frequently Asked Questions* section below for how  $P_a$  and  $P_d$  and their associated variances were estimated.

See *Appendix 1* for a detailed description of the method used to estimate desert tortoise abundance.

#### *100 percent Coverage or Probabilistic Sampling?*

100% coverage surveys are always an acceptable option, regardless of the size of the action area. For very large action areas, probabilistic sampling may be an additional option, such that the appropriate proportion of the action area is surveyed as detailed below.

**For the 2009 field season, probabilistic sampling is not an option for desert tortoise pre-project surveys in California due to the requirement of CESA to avoid, minimize, and fully mitigate (CDFG code section 2081). In addition, probabilistic sampling is not an option for desert tortoise pre-project surveys in the Upper Virgin River Recovery Unit due to its small size and its need to be intensively managed (USFWS 1994).**

**Table 4.2.** Is probabilistic sampling an appropriate option for the proposed action area?

*Is your action area smaller than the area given below for the recovery unit in which the project occurs?*

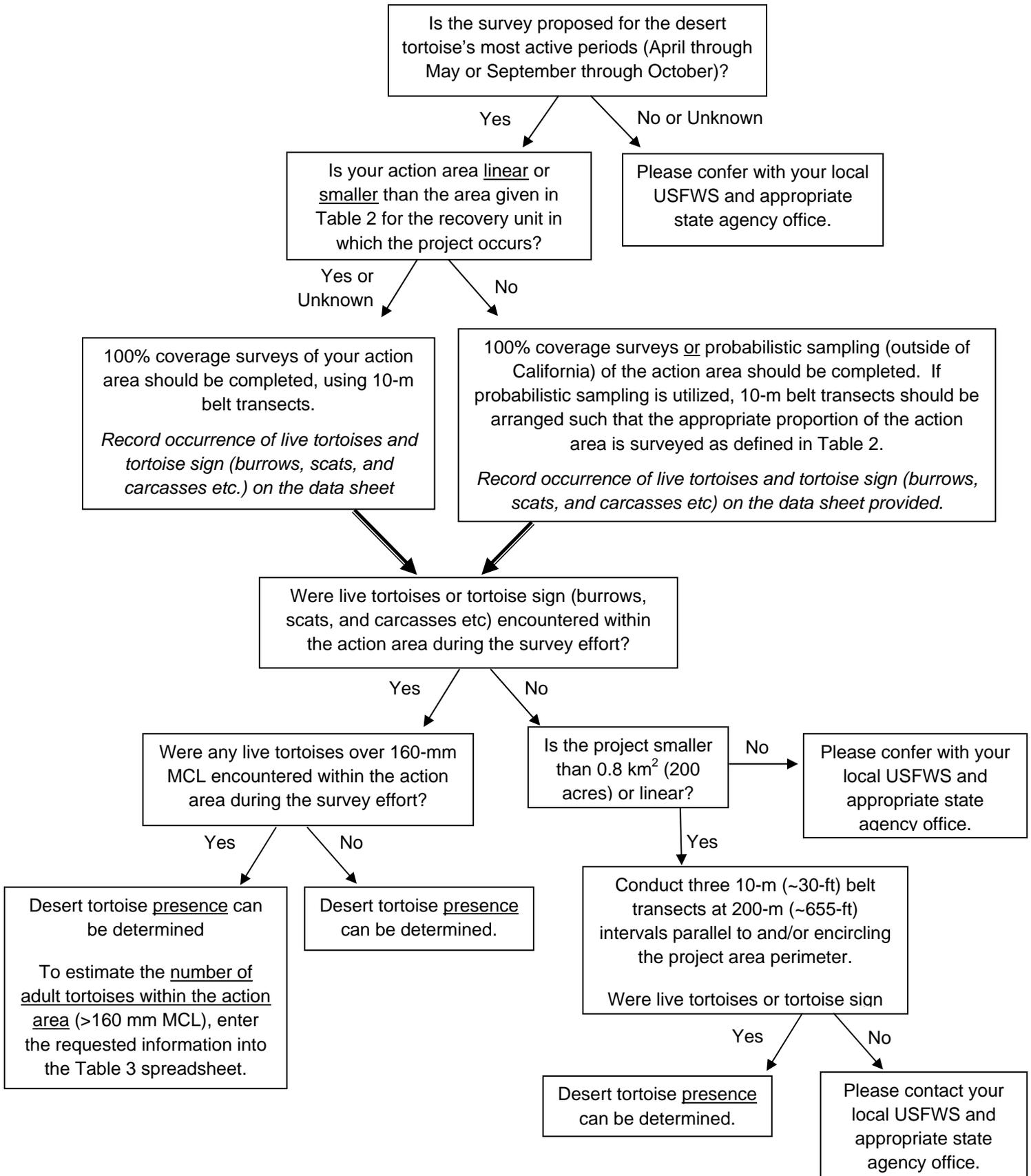
Recovery Unit	Threshold Action Area to Allow Sampling
Western Mojave	7.2 km <sup>2</sup> (1777 acres)
Eastern Mojave	10.8 km <sup>2</sup> (2676 acres)
Colorado Desert	6.4 km <sup>2</sup> (1573 acres)
Northeastern Mojave	23.3 km <sup>2</sup> (5764 acres)

*If yes: 100% coverage surveys of your action area must be completed.*

*If no, total transect lengths that must be surveyed are given below. 100% coverage surveys are also an option, regardless of the size of the project.*

Recovery Unit	Total Transect Length (km) to Sample
Western Mojave	719
Eastern Mojave	1083
Colorado Desert	637
Northeastern Mojave	2333

**Decision Tree for Pre-project Field Survey Protocol for Potential Desert Tortoise**



---

## **Frequently Asked Questions: Desert Tortoise Pre-project Field Survey Protocol**

### ***Why did USFWS revise the 1992 USFWS Desert Tortoise Pre-project Survey Protocol?***

Desert tortoises occur at low densities across most of the Mojave Desert (USFWS 2006). They are cryptic and spend much of their time underground in burrows (Burge 1977; Nagy and Medica 1986; Bulova 1994) and therefore not all animals within an area will be seen by even the best trained surveyors. Tortoises underground in burrows, as well as individuals hidden above ground, need to be included in estimates.

The 1992 USFWS Desert Tortoise Pre-project Survey protocol was based on a BLM protocol from the mid-1970s, which utilized the best available information at the time, but did not take into account that some tortoises will be underground and missed during the survey effort. The data collected during the extensive USFWS range-wide monitoring program (currently <7,000-km of transects each year; USFWS 2006) have allowed us to improve pre-project survey methods. Data about the proportion of tortoises underground in burrows, as well as the probability that an above-ground tortoise will be observed by the surveyor are included in the estimate of the number of tortoises within the action area ( $P_a$  and  $P_d$ ).

This protocol also addresses the potential for using probabilistic sampling when the action area is above the size limits given in Table 2. One hundred percent coverage surveys are *always* an acceptable option, regardless of the size of the action area. For very large action areas, sampling may be an additional option, such that the abundance estimates can be calculated when an appropriate proportion of the action area is surveyed. Estimates of tortoise densities within recovery units from the range-wide monitoring program have been used to calculate how many km<sup>2</sup> of a project site must be surveyed to produce a statistically robust abundance estimate (Table 4.2).

### ***What happened to the zone of influence transects recommended in the 1992 protocol?***

This revised protocol requires that the entire action area, rather than just the project footprint, be included in the survey effort. The **action area** is defined by regulation 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). The action area is therefore not limited to the footprint of the project nor is it limited by the Federal agency's authority. Rather, the action area is a biological determination of the reach of the proposed action on listed species, which must, by definition, encompass the zone of influence of the project.

### ***How did USFWS determine the values for the “probability that a tortoise is above ground”?***

The USFWS range-wide monitoring program estimated the proportion of the desert tortoise population that is visible using telemetered animals from focal areas in spring 2001-2005 (USFWS 2006). This probability is related to the previous winter's rainfall, as illustrated in

Table 4.1. The range of fall above-ground activity is similar to spring numbers, but the variability is much higher (Nussear and Tracy 2007; Inman 2008). Until more robust estimates of fall above-ground activity are available, spring estimates based on the previous winter's rainfall (October through March) are used for surveys conducted in either active period.

***How did USFWS establish the value for the “probability of detecting a tortoise, if above ground”?***

For the past 5 years, surveyors in the USFWS range-wide monitoring program have undergone training on established transects with artificial tortoises. Trained surveyors detected an average of ~63% of model tortoises that were within 5-m of either side of the transect center-line (USFWS unpublished).

***Why are only tortoises over 160-mm MCL used to estimate the number of tortoises within the action area?***

The values of  $P_a$  and  $P_d$  used in the equation to estimate the number of tortoises within the action area are based on USFWS range-wide monitoring data collected for tortoises  $\geq 160$ -mm MCL.

***What is the purpose of 100% coverage surveys versus probabilistic sampling?***

The purpose of surveying is to determine presence/absence and estimate the abundance of desert tortoises within the action area. For 100% coverage surveys, transects are placed across the entire action area; thus, the entire area for which abundance is estimated is surveyed. A probabilistic sampling approach, on the other hand, uses data from randomly or systematically placed transects to draw inferences about locations where surveys are not conducted. All locations for which abundance will be estimated *must* have an equal probability of being included in the sample.

***How were the threshold project sizes calculated for determining whether 100% coverage or probabilistic sampling is appropriate?***

The validity of probabilistic sampling requires that all locations for which abundance will be estimated have an equal probability of being included in the sample, as well as the expected sample size. Estimating the number of tortoises within the project area using probabilistic sampling is limited by the number of tortoises encountered during the survey effort. Therefore, whether or not the project area must be surveyed using 100% coverage or can be probabilistically sampled is based on the area expected to yield a survey count of 20 tortoises (Krzysik 2002). Table 4.2 uses tortoise densities and detection probabilities estimated from 2001-2005 range-wide line-distance sampling efforts for each tortoise Recovery Unit (USFWS 2006) to calculate that area of a project site that must be surveyed to produce a statistically robust estimate. If the project area is large enough to allow the option of probabilistic sampling, Table 4.2 provides the minimum transect kilometers (10-m wide) that must be surveyed.

***What if the minimum length of 10-m wide transect kilometers are completed but 20 tortoises were not found in the action area?***

If probabilistic sampling is used and < 20 tortoises are found after surveying the total transect length prescribed by Table 4.2, number of tortoises within the action area may be estimated using number found.

***Do I keep surveying if 20 tortoises are found before the minimum transect kilometers that must be surveyed are completed?***

If probabilistic sampling was used and the transects have been completed in a random order, project area surveys may be considered complete when 20 tortoises have been found or the specified number of kilometers have been sampled, whichever happens first. It is okay if more than 20 tortoises are found, this will decrease the width of the 95% confidence interval for the abundance estimate.

***Why do small and linear projects where no tortoises were found have to do additional surveys at 150-m (~500-ft) intervals parallel to the project area perimeter?***

Even though neither tortoises nor tortoise sign were found within the action area at the time of the survey, the area may be part of an animal's home range. The home range of a female desert tortoise averages around 0.15 to 0.16 km<sup>2</sup> (35 to 40 acres), about one third the size of male home ranges, which are variable and can be > 2 km<sup>2</sup> (O'Conner et al. 1994; Duda et al. 1999; Harless et al. in press). Therefore, projects that are ≤ 0.8 km<sup>2</sup> (200 acres) or linear may overlap only part of a tortoise's home range and the possibility that a resident tortoise was outside the project area at the time surveys were conducted must be addressed. In these cases, USFWS recommends three additional 10-m (~30-ft) belt transects at 200-m (~655-ft) intervals parallel to and/or encircling the project area perimeter (200-m, 400-m (~1312 ft), and 600-m (~1968 ft) from the perimeter of the project site). Record any tortoises or sign encountered during these surveys. These transects are employed only as part of the presence/absence determination; they are not included in the estimation of tortoise abundance within the project area.

***What does the 95 percent confidence interval for the number of tortoises within the action area mean?***

Confidence intervals are used to indicate the reliability of an estimate. The interval gives an estimated range of values, calculated from a set of sample data, which is likely to include an unknown population parameter (in this case, the true number of tortoises within the action area). A wider confidence interval indicates that less certainty is associated with the estimate (see Appendix 2). The Table 4.3 spreadsheet calculates the abundance and associated 95 percent confidence interval for the estimated number of tortoises within the project area (Buckland et al. 2001).

---

## **Acknowledgments**

The USFWS Desert Tortoise Recovery Office is grateful to the many individuals and agencies that were instrumental in development and review of this revised protocol. Specifically, we thank Jim Nichols (USGS) and Tony Krzysik (Prescott Audubon Society) for assistance with concept design; Alice Karl (independent tortoise biologist) and Andrew Thompson (USFWS) for development discussion, and Kirk Waln (USFWS) for GIS support.

This protocol has undergone extensive review. We would like to thank the 2008/2009 USFWS desert tortoise coordination group (Ashleigh Blackford, Ray Bransfield, Michael Burroughs, Renee Chi, Brian Croft, Tannika Engelhard, Tyler Grant, Michael Glenn, Judy Hohman, Leilani Takano, and Brian Wooldridge) for invaluable thoughts and suggestions. We would also like to thank Bob Steidl (University of Arizona), Kathy Ralls (Smithsonian National Zoo), Alice Karl (independent tortoise biologist), Andrew Thompson (USFWS), Bill Boarman (Conservation Science Research & Consulting), Phil Medica (USGS), Paulette Conrad (NDOW), Steve Ferrand (Nevada Biological Consulting), and the California Department of Fish and Game (including Kim Nicol, Julie Vance, Scott Flint, and Becky Jones) for insightful comments on the document.

## Literature Cited

- Anderson, D.R. and K.P. Burnham. 1996. A monitoring program for the desert tortoise. Report to the Desert Tortoise Management Oversight Group. 15 pages.
- Buckland, S.T., D.R. Anderson, K.P. Burnham, J.L. Laake, D.L. Borchers, and L. Thomas. 2001. Introduction to Distance Sampling: Estimating Abundance of Biological Populations. Oxford University Press, Oxford. 432 pages.
- Bulova, S.J. 1994. Patterns of burrow use by desert tortoises: gender differences and seasonal trends. *Herpetological Monographs* 8:133-143.
- Burge, B.L. 1977. Daily and seasonal behavior, and areas utilized by the desert tortoise, *Gopherus agassizii*, in southern Nevada. *Proceedings of the Desert Tortoise Council Symposium* 1977:59-94.
- Duda, J.J., A.J. Krzysik, and J.E. Freilich. 1999. Effects of drought on desert tortoise movement and activity. *The Journal of Wildlife Management* 63:1181-1192.
- Germano, D.J., R.B. Bury, T.C. Esque, T.H. Fritz, and P.A. Medica. 1994. Range and habitats of the desert tortoise. Pages 73-84 in R.B. Bury and D.J. Germano, eds. *Biology of North American Tortoises*. National Biology Survey Technical Report Series, Fish and Wildlife Research 13.
- Harless, M.L., A.D. Walde, D.K. Delaney, L.L. Pater, W.K. Hayes. In press. Home range, spatial overlap, and burrow use of the desert tortoise in the West Mojave Desert. *Copeia*.
- Inman, R.D. 2008. How elusive behavior and climate influence the precision of density estimate of desert tortoise populations. Master of Science in Biology Thesis. University of Nevada, Reno.
- Krzysik, A.J. 2002. A landscape sampling protocol for estimating distribution and density patterns of desert tortoises at multiple spatial scales. *Chelonian Conservation and Biology* 4:366-379.
- Nagy, K.A., and P.A. Medica. 1986. Physiological ecology of desert tortoises. *Herpetologica* 42:73-92.
- Nussear, K.E., and C.R. Tracy. 2007. Can modeling improve estimation of desert tortoise population densities? *Ecological Applications* 17:579-586.
- O'Connor, M.P., L.C. Zimmerman, D.E. Ruby, S.J. Bulova, and J.R. Spotila. 1994. Home range size and movement by desert tortoises, *Gopherus agassizii*, in the eastern Mojave Desert. *Herpetological Monographs* 8:60-71.

- 
- U.S. Fish and Wildlife Service. 1990. Endangered and threatened wildlife and plants; determination of threatened status for the Mojave population of the desert tortoise. Federal Register 55 FR 12178-12191.
- U.S. Fish and Wildlife Service. 2006. Range-wide monitoring of the Mojave population of the desert tortoise: 2001-2005 summary report. Report by the Desert Tortoise Recovery Office, U.S. Fish and Wildlife Service, Reno, Nevada. 85 pages.
- U.S. Fish and Wildlife Service. 2009. Draft Revised Recovery Plan for the Mojave Population of the Desert Tortoise (*Gopherus agassizii*). U.S. Fish and Wildlife Service Region 8, Sacramento, California. 221 pages.
- Walde, A.D., L. Bol, D.K. Delaney, and L.L. Pater. 2003. The desert tortoise: a preliminary analysis of operative and environmental temperatures. A Report by the Construction Engineering Research Laboratory to the U.S. Fish and Wildlife Service. 18 pages.
- Zimmerman, L.C., M.P. O'Connor, S.J. Bulova, J.R. Spotila, S.J. Kemp, and C.J. Salice. 1994. Thermal ecology of desert tortoise in the Eastern Mojave Desert: seasonal patterns of operative and body temperatures, and microhabitat utilization. Herpetological Monographs 8:45-59.

## Appendix 1. Detailed description of desert tortoise abundance and CI estimation

The estimated abundance of adult desert tortoises within the action area is given by:

$$\left( \begin{array}{c} \text{Estimated number of tortoises} \\ \text{within action area} \end{array} \right) = \frac{\left( \begin{array}{c} \text{Number of tortoises} \\ \text{observed above ground} \end{array} \right)}{\left( \begin{array}{c} \text{Probability that} \\ \text{a tortoise is} \\ \text{above ground} \end{array} \right) \left( \begin{array}{c} \text{Probability of} \\ \text{detecting a tortoise,} \\ \text{if above ground} \end{array} \right)} \left( \begin{array}{c} \text{Action area} \\ \text{Area surveyed} \end{array} \right),$$

which is equivalent to:

$$\hat{N} = \left[ \frac{(n)}{(Table2)(0.63)} \right] \left[ \frac{(A)}{(a)} \right],$$

where  $\hat{N}$  = estimated abundance within entire action area,  $n$  = number of tortoises observed above ground,  $A$  = total action area, and  $a$  = actual area surveyed (= total # km surveyed \* 0.01). For 100% coverage surveys,  $A/a = 1$ .

Table 3 uses the following equations to calculate the 95% confidence interval for the estimate of tortoise abundance within the action area (Buckland et al. 2001), assuming all replicate transect lines are the same length, 10-km.

$$\text{var}(n) = L \sum_{i=1}^k l_i \left( \frac{n_i}{l_i} - \frac{n}{L} \right)^2 / (k-1)$$

where  $\text{var}(n)$  = the spatial variation in the number of tortoises detected through the total transect length  $L$ ,  $n_i$  = the number of tortoises seen on transect  $i$ ,  $l_i$  = the length of individual transect  $i$ , and  $k$  = total number of transects walked.

Putting the sources of variability together, the variance of density is:

$$\text{var } \hat{D} = \hat{D}^2 \left[ \frac{\text{var}(n)}{n^2} + \frac{\text{var}(\hat{P}_a)}{(\hat{P}_a)^2} + \frac{\text{var}(\hat{P}_d)}{(\hat{P}_d)^2} \right]$$

Because the tortoise density sampling distribution is positively skewed, the confidence interval is calculated using a log-distribution for density and built with division and multiplication, rather than addition and subtraction from the mean as with a symmetrical interval (Buckland et al. 2001).

Thus, the 95% confidence interval for  $\hat{N}$  is:

$$\left(\hat{N} / C_N, \hat{N} \cdot C_N\right),$$

$$\text{where } C_N = \exp\left[z_{\alpha} \sqrt{\text{var}(\log_e \hat{D})}\right] \text{ and } \text{var}(\log_e \hat{D}) = \log_e \left[1 + \frac{\text{var}(\hat{D})}{\hat{D}^2}\right].$$

Given the simplifying assumptions in this protocol, the 95% confidence interval around the estimated number of tortoises within the action area will be wide (e.g., the estimate of the number of tortoises will be imprecise). While this level of imprecision would not be appropriate for recovery planning and decision making at large scales, this protocol provides estimates at local scales that most efficiently utilize the best information that is available to provide statistically defensible results.

## Appendix 2. Example

Project location = near Beatty, NV (within the Eastern Mojave RU)

Action area = 12 km<sup>2</sup> (3,000 acres)

According to this protocol's Site Assessment key, the proposed action is within the known range of the desert tortoise. The local USFWS and appropriate State wildlife agency offices were contacted and a species list, which includes the desert tortoise, was obtained for the action area. Therefore, pre-project survey and consultation are necessary.

The project footprint is only 10 km<sup>2</sup>, but since the project will include blasting, the reach of the proposed action on listed species extends to 12 km<sup>2</sup>. Thus, the action area (and therefore the area which needs to be surveyed for desert tortoises) is 12 km<sup>2</sup> (which is more inclusive than the 10 km<sup>2</sup> project footprint).

According to Table 2 of the pre-project survey protocol, the project size of 12 km<sup>2</sup> is above the threshold project area to allow probabilistic sampling in the Western Mojave RU (10.8 km<sup>2</sup> threshold). Therefore, at a minimum, 1,083 km of transects must be walked. For this example, 108 10-km transects (10-m wide) were placed systematically across the project site and were completed in a random order. Surveys of 100% coverage in which 10-m wide transects were placed across the entire 12 km<sup>2</sup> action area would also have been acceptable.

Transects totaling 1,083 km were conducted and 19 adult tortoises (> 160 mm carapace length) were found (as well as tortoise sign, both of which were catalogued using the USFWS 2009 DT pre-project survey protocol data sheet). If 20 adult tortoises had been encountered before the 1,083 km of transects were completed, and transects were conducted in a random order, then surveys could have been considered complete after the 20<sup>th</sup> tortoise was catalogued.

Data collected from the 108 transects (live animals encountered <160-mm MCL)

Number of tortoises (n <sub>i</sub> )	Number of transects on which n <sub>i</sub> tortoises were seen
0	93
1	11
2	4

Using the Western Regional Climate Center website, it was determined that the Beatty area had received 97-mm (3.8 inches) of rain in the October through March preceding the survey effort, which is above the 40-mm (1.5 inches) in Table 1. Therefore, P<sub>a</sub> of 0.80 will be used in this estimation.

Thus, from

$$\hat{N} = \left[ \frac{(n)}{(Table2)(0.63)} \right] \left[ \frac{(A)}{(a)} \right], \text{ we get } \hat{N} = \left[ \frac{(19)}{(0.80)(0.63)} \right] \left[ \frac{(12 \text{ km}^2)}{(10.8 \text{ km}^2)} \right], \text{ or } \hat{N} \approx 42 \text{ tortoises}$$

$$\text{Density} = \frac{(\hat{N})}{(A)}, \text{ we get } \hat{D} = \frac{(42)}{(12 \text{ km}^2)}, \text{ or } \hat{D} \approx 3.5 \text{ tortoises/km}^2$$

To calculate the 95% confidence interval for our abundance estimate, we use:

$$\text{var}(\hat{n}) = L \sum_{i=1}^k l_i \left( \frac{n_i}{l_i} - \frac{n}{L} \right)^2 / (k-1),$$

$$\text{we get } \text{var}(\hat{19}) = 1080 \left[ (93)(10) \left( \frac{0}{10} - \frac{19}{1080} \right)^2 + (11)(10) \left( \frac{1}{10} - \frac{19}{1080} \right)^2 + (4)(10) \left( \frac{2}{10} - \frac{19}{1080} \right)^2 \right] / (108-1), \text{ or}$$

$$\text{var}(\hat{19}) = 23.88$$

And for,

$$\text{var } \hat{D} = \hat{D}^2 \left[ \frac{\text{var}(n)}{n^2} + \frac{\text{var}(\hat{P}_a)}{(\hat{P}_a)^2} + \frac{\text{var}(\hat{P}_d)}{(\hat{P}_d)^2} \right], \text{ we get } \text{var } \hat{D} = 3.5^2 \left[ \frac{23.88}{19^2} + \frac{0.05}{0.80^2} + \frac{0.011}{0.63^2} \right], \text{ or } \text{var } \hat{D} = 2.107$$

Using our log-transformation because the tortoise density sampling distribution is positively skewed,

$$\text{var}(\log_e \hat{D}) = \log_e \left[ 1 + \frac{\text{var}(\hat{D})}{\hat{D}^2} \right], \text{ we get } \text{var}(\log_e \hat{D}) = \log_e \left[ 1 + \frac{2.107}{3.5^2} \right], \text{ or } \text{var}(\log_e \hat{D}) = 0.15$$

Then,

$$C_N = \exp \left[ z_{\alpha} \sqrt{\text{var}(\log_e \hat{D})} \right], \text{ we get } C_N = \exp \left[ (1.96) \sqrt{0.15} \right], \text{ or } C_N = 2.18$$

And,

$$\left( \hat{N} / C_N, \hat{N} \cdot C_N \right), \text{ we get } ((42 / 2.18), (42 \cdot 2.18)), \text{ or } \sim (19, 92).$$

---

## Summary

Using the Site Assessment key, it was determined that survey and consultation were necessary for the proposed action. Thus, the pre-project field survey protocol was implemented. In this case, probabilistic sampling with equal length transects (10-km long) was used and 19 adult tortoises and tortoise sign were found during the sampling of the action area, indicating presence. Using the equations and data presented in Appendix 1 of this protocol, Table 3 estimated the actual number of tortoises within the project was estimated to be ~42, with a 95% confidence interval of ~(19, 92).

**USFWS DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET**

Date of survey: \_\_\_\_\_ Survey biologist(s): \_\_\_\_\_  
(month, day, year)

Site description: \_\_\_\_\_  
(project name and size; general location)

County: \_\_\_\_\_ Quad: \_\_\_\_\_ Location: \_\_\_\_\_  
(UTM coordinates, lat-long, and/or TRS; map datum)

Transect #: \_\_\_\_\_ Transect length: \_\_\_\_\_ Type of survey: \_\_\_\_\_  
(acres to be surveyed; 100% coverage/probabilistic sampling)

GPS Start-point: \_\_\_\_\_ Start time: \_\_\_\_\_ am/pm  
(easting, northing, elevation in meters)

GPS End-point: \_\_\_\_\_ End time: \_\_\_\_\_ am/pm  
(easting, northing, elevation in meters)

Start Temp: \_\_\_\_\_ °C Weather: \_\_\_\_\_ End Temp: \_\_\_\_\_ °C

**Live Tortoises**

Detection number	GPS location		Time	Tortoise location <i>(in burrow: all of tortoise beneath plane of burrow opening, or not in burrow)</i>	Approx MCL >160-mm? <i>(Yes, No or Unknown)</i>	Existing tag # and color, if present
	Easting	Northing				
1						
2						
3						
4						
5						
6						
7						
8						

**Tortoise Sign (burrows<sup>1</sup>, scats, carcasses, etc)**

Detection number	GPS location		Type of sign <i>(burrows, scats, carcass, etc)</i>	Description and comments
	Easting	Northing		
1				
2				
3				
4				
5				
6				
7				
8				

<sup>1</sup> See section 4.1.2 for information on burrow condition class and photographing burrows

## **CHAPTER 5. AFTER A BIOLOGICAL OPINION OR TAKE PERMIT HAS BEEN ISSUED FOR THE DESERT TORTOISE - MOJAVE POPULATION: PRELIMINARY CONSIDERATIONS BEFORE GOING TO THE FIELD**

### **5.1. Marking and Numbering**

Typically, desert tortoises are not marked or numbered in association with most projects. If you intend to permanently mark or number desert tortoises (e.g., by notching the shell or attaching a tag), you must be authorized to do so and coordinate with the USFWS Desert Tortoise Recovery Office (DTRO) for instruction. The DTRO in coordination with other agencies assigns tortoise numbers that are used by scientists to mark desert tortoises throughout its range. You must contact the DTRO and appropriate State wildlife agency before marking desert tortoises.

### **5.2. Field Supplies and Equipment**

Prepare in advance for a variety of field situations. A list of materials needed for handling desert tortoises is provided below. Many researchers have a kit for each type of activity (e.g., tortoise handling kit, burrow excavation kit, etc.). Organize all the materials and equipment that you need to expeditiously handle desert tortoises to ensure their safety and minimize stress.

All authorized personnel (Authorized Biologists and 10(a)(1)(A) permitted biologists) must be knowledgeable on diseases, parasites, and precautions to avoid the spread of pathogens when handling desert tortoises. Upper Respiratory Tract Disease, (URTD) caused by *Mycoplasma* spp. was identified as one of the threats that contributed to the population decline and subsequent listing of the desert tortoise as threatened by the USFWS and CDFG. This and other diseases (e.g., cutaneous dyskeratosis) are present in many populations of the desert tortoise. Also present are parasitic ticks, which are potential vectors of disease to humans (Berry and Christopher 2001).

#### 5.2.1. Documents

Agency document(s) regulating the specific project may include:

- USFWS biological opinion or incidental take permit
- BLM stipulations
- USFWS Authorized Biologist or desert tortoise Monitor approval and/or
- Copy of 10(a)(1)(A) permit or other permits
- State wildlife agency permit
- State memorandum of understanding

#### 5.2.2. Basic supplies and equipment

- Hand-held GPS unit with extra batteries
- Desert Tortoise Field Manual
- Thermometer (to measure air and ground temperatures)

- Watch or clock (to record start and finish processing times)
- Hand held mirror (for viewing inside burrow)
- LED flashlight
- Water
- Project maps
- Clipboard
- Data sheets (in this Manual)
- Tortoise tapping rod (collapsible fishing pole, etc.)
- Surveyor's tape

### 5.2.3. Desert tortoise handling and marking

- Disposable latex gloves (for handling tortoise)
- Different sizes of coffee cans (or similar cylinders) and waterproof disposable plastic (for immobilizing tortoise and preventing disease transmission)
- Toothbrush, disinfected (for cleaning dirt from scute to be numbered)
- Acrylic paint or typewriter correction fluid (for making dot to number tortoise)
- Waterproof, capillary pen (for numbering the tortoise and keeping notes)
- ½-inch masking tape (to cover growth areas prior to applying epoxy)
- Epoxy, toothpicks, wooden coffee stirrer, tongue depressors (to cover the number on the scute and to apply the epoxy)
- Hand lens (for observing parasites)
- 0.175 percent sodium hypochlorite (bleach) solution (1 part household bleach to 10 parts water) in a spray bottle (for disinfecting equipment) or Nolvasan (chlorhexidine diacetate)
- Rubber/plastic container and lid (for soaking instruments in Nolvasan)
- Container for rehydrating tortoises
- New, disposable cardboard boxes or disinfected plastic containers (for holding and/or transporting tortoises)
- Plastic, ziplock bags (for holding unused latex gloves and weighing juvenile tortoises)
- Garbage bags (for disposing of used gloves, grocery bags, etc.)
- Disposable baby changing sheets
- DTRO/State wildlife agency-approved, sequential numbering scheme for marking tortoises and three-cornered files

### 5.2.4. Desert tortoise weighing and measuring

- Cloth bags to transport desert tortoises (allows air flow; should be wetted to cool desert tortoises; and must be washed and bleached before reuse)
- Cord with appropriate tensile strength (to harness and weigh the desert tortoise)
- Calipers (for measuring mid-line carapace length)
- Metal or plastic rule
- 100 gram, 1.0 kilogram, and 5.0 kilogram tubular spring scale (to weigh desert tortoises)

### 5.2.5. Desert tortoise burrow excavation and construction

- Measuring tape (for burrow dimensions)
- Compass (for burrow orientation)
- Leather or cloth gloves (to avoid animal stings and/or bites)
- Shovels (2) (for excavating burrow)
- Garden trowel (for excavating small burrows and nests)
- 4 foot x 8 foot x ¼ inch thick plywood (for artificial burrow construction)
- Hand saw (to cut plywood into appropriate size and shape)
- Surveyor's tape (for marking a burrow)

#### 5.2.6. Desert tortoise egg handling

- Felt-tipped pen (for marking eggs)
- Plastic bucket (for transporting eggs)
- Garden trowel (for excavating nest)

#### 5.2.7. Other

- Fiber-optic scope or miniature camera and clear protective covering (to avoid disease transmission)
- Pads or blanket for truck bed to cushion transported tortoise and reduce heat
- Phone number and contact person of local USFWS field office, State wildlife agency, BLM field office, etc.
- Phone number of nearest qualified veterinarian to treat injured tortoise
- Extra change of clothing, including extra shoes

### **LITERATURE CITED**

Berry, K. H. and M. M. Christopher 2001. Guidelines for the field evaluation of desert tortoise health and disease. *Journal of Wildlife Diseases*, 37(3) 427-450.

McCullough, D.L., K.D. Jones, and T.E. Olson. 1993. List of materials to be carried in the truck; list of materials to be included in the tortoise kit; tortoise excavation/removal data sheets; tortoise shell data sheet; and rough draft of a handling protocol. Materials received from McCullough Ecological Systems and Dames & Moore in response to a request for materials to be included in these Guidelines. Las Vegas, Nevada and Santa Barbara, California.

## **CHAPTER 6. CLEARANCE SURVEY PROTOCOL FOR THE DESERT TORTOISE - MOJAVE POPULATION**

### **6.1. Objectives**

- Locate as many desert tortoises as possible within the project site.
- Remove all desert tortoises encountered from the project site.
- Safely excavate, collect, and rebury desert tortoise eggs.

### **6.2. Applicability of Clearance Surveys**

For projects located in occupied desert tortoise habitat, especially those projects with a permanent or linear disturbance (e.g., pipelines, roads, transmission lines), a clearance survey may be required as part of the Terms and Conditions of a biological opinion or incidental take permit. This survey is intended to reduce the likelihood that desert tortoises are killed or injured as a result of the proposed action. Clearance survey methods may include temporarily penning desert tortoises within the area surrounding its burrow, relocating desert tortoises from the impact area, or translocating desert tortoises to a designated area outside its home range in accordance with a USFWS-approved translocation plan (Section 7.10).

### **6.3. Methodology**

- Clearance surveys require 100 percent coverage of the project area, with a focus on locating all desert tortoises above and below ground within the project area. This survey would be conducted immediately prior to surface disturbance at each site within the project area or following construction of a desert tortoise-proof fence or similar barrier encompassing the project area to ensure that tortoises cannot enter the project area.
- Clearance surveys at the project site must consist of at least 2 consecutive surveys of the site. Surveys shall involve walking transects less than or equal to 15-feet (5-meter) wide under typical conditions. In areas of dense vegetation or when conditions limit the ability of the surveyor's to locate desert tortoises, transects should be reduced in width accordingly. Clearance surveys should be conducted when desert tortoises are most active (April through May or September through October). If desert tortoises are found during the second pass, the USFWS and appropriate State wildlife agency may require a third survey. If any desert tortoises need to be translocated follow the USFWS-approved translocation plan for that project.
- After the desert tortoise exclusion fence has been installed, the fencing should be checked several times a day to ensure a tortoise has not been trapped within the fence and may be exposed to lethal temperatures. Desert tortoises often pace along new fences attempting to gain access to the other side or return to areas from which they were removed.
- All methods used for handling desert tortoises during the clearance surveys must be in accordance with this Manual. Anyone that handles desert tortoises during clearance activities must have the appropriate authorizations from USFWS and the State.
- During the clearance surveys, desert tortoises in burrows may be removed through tapping (Section 6.4) or careful excavation. Multiple visits may be necessary if desert tortoises are inaccessible in deep caves or burrows.

- During all handling procedures, desert tortoises shall be treated in a manner to ensure that they do not overheat or exhibit signs of overheating (e.g., gaping, foaming at the mouth, etc.), or are placed in a situation where they cannot maintain surface and core temperatures necessary to their well-being. Desert tortoises shall be kept shaded at all times until it is safe to release them. Ambient air temperature shall be measured in the shade, protected from wind, at a height of 2 inches (5 centimeters) above the ground surface. All clearance activities (capture, transport, release, etc.) shall occur when ambient temperatures are below 95 degrees F (35 degrees C) and not anticipated to rise above 95 degrees F (35 degrees C) before handling and processing desert tortoises are completed. Refer to section 7.4 for handling desert tortoises during hot temperatures.
- If a desert tortoise is encountered aboveground and outside the temperature limits refer to Section 7.4 or 7.5.
- The area cleared and number of desert tortoises found within that area must be reported to the local USFWS and the appropriate State wildlife agency. The report should be made in writing, either by mail or email. Notification should be received within one week.
- If a desert tortoise is encountered after clearance surveys have been completed, process the tortoise according to the methods described above.

#### **6.4. Extracting Desert Tortoises from Burrows**

Before touching a desert tortoise or using any instrument that comes into contact with a desert tortoise, implement procedures described in Section 7.6. Examine the burrow for other occupants (e.g., snakes, spiders, scorpions, wasps, Gila monsters, etc.). Firmly pound the soil at the side of the “apron” or soil mound at the entrance of the burrow 5 to 6 times with an open hand then listen for desert tortoise movement; wait 30 seconds and repeat several times if needed. Avoid disturbing or pounding the center of the apron or entrance of the burrow where desert tortoises typically dig nests and lay their eggs. If the desert tortoise is visible deep in its burrow, the observer can gently tap the carapace 3 to 4 times with a stick (Medica et al. 1986). The observer should then remove the stick and move away from the burrow entrance. If tapping is successful, the desert tortoise will emerge, usually to the burrow entrance. If desert tortoise movements are not heard within a few minutes, discontinue tapping.

If the desert tortoise is within arm’s reach, firmly grasp the gular, plastron, or posterior edge of the carapace and gently pull the tortoise towards the burrow entrance. If the desert tortoise resists to the point where moderate pulling effort is unsuccessful, stop pulling while maintaining a grip on the tortoise; resume when the tortoise relaxes. **Never use a hook or other instrument to remove a desert tortoise from a burrow or otherwise compromise the integrity of a burrow if the desert tortoise will remain in the project area.**

If the area is to be cleared of all desert tortoises, excavate the burrow as described in Section 6.5. If the tortoise is in a deep caliche cave which cannot be excavated without potentially harming the desert tortoise, record the location and contact the USFWS for instruction.

## 6.5. Excavating Burrows

According to most agency documents, desert tortoise burrows are excavated only if they occur within a proposed disturbance area. If excavating a burrow to relocate a desert tortoise, and an artificial burrow is required, it should be constructed before beginning the excavation (Section 6.7.). Biological opinions and permits typically require that such areas be flagged and that project activities be confined to those areas. As an alternative to excavation in certain circumstances, the immediate area surrounding a burrow occupied by a desert tortoise may be temporarily penned, if authorized by the USFWS and the appropriate State wildlife agency (Section 6.9.).

When required, take measurements of the burrow before excavating it. Before excavation, feel for desert tortoise eggs by gently probing the soil in front of the burrow opening (i.e., the mound) with a blunt instrument (e.g., knitting needle) or similar instrument, and along the floor of the burrow as you excavate the burrow. The purpose of probing is to locate areas of excavated soil which are less compacted and may indicate a nest. Eggs have been found up to 6 feet (1.9 meters) in front of burrow openings and up to 6 feet (1.9 meters) within the entrance of a burrow; they may also occur in the mound at the burrow opening. To avoid crushing eggs, do not scrape the shovel across the bottom of the burrow, but continue to probe the area with your fingers as you proceed. Removal of the top 10 inches (25 centimeters) of soil (or until a hard layer of soil is encountered) will typically ensure that you find any desert tortoise eggs. Be particularly careful from late April to mid-October when eggs are most likely present. If found, follow the USFWS's egg handling protocol (Section 6.6.).

Excavators should wear leather or cloth gloves during burrow excavation to avoid being bitten or stung by venomous animals. Use blunt-nosed shovels or garden trowels. The preferred method involves two individuals, each with a shovel, to excavate a burrow. Place a shovel in the burrow entrance, or garden trowel for small burrows, and slice away the ceiling with the second shovel or trowel. Remove the soil with the first shovel or trowel as excavation proceeds and repeat. Excavate the burrow slowly and carefully and stop often to see if a desert tortoise is within reach. Do not collapse the burrow ahead of the shovel or trowel inside the burrow. You should feel the shovel contact the other shovel with each stroke to avoid striking a desert tortoise. It may take several minutes or several hours to excavate a desert tortoise burrow, depending on its length and other characteristics.

Always excavate the burrow to its absolute end(s), and then excavate an additional foot-or-so (0.3 meter) of harder soil beyond the suspected end to ensure that a desert tortoise is not behind a dirt plug or mound. Search all side tunnels within the burrow for desert tortoises, especially in kit fox dens. If a desert tortoise is found, do not assume that it is alone. After removing the first desert tortoise encountered, return to the burrow and continue to excavate it looking for additional desert tortoises. After excavating the burrow, leave it collapsed so that no desert tortoise may reuse it easily.

When excavating a burrow, stop digging when a desert tortoise is encountered. If during the desert tortoise less-active period (i.e., during July - August, and November - February; in Arizona the less-active period may begin in late May or June), relocate the desert tortoise to an artificial burrow. If it is during the most-active period (i.e., when desert tortoises are most likely

above ground; March - June, and September - October), place the desert tortoise in the shade of a shrub, or depending on conditions, in an artificial burrow (Section 6.7.).

## **6.6. Nest and Egg Handling Protocol**

Desert tortoises may lay eggs during the months of May through July and usually hatch July through October. Some eggs may not hatch, or hatchlings may not emerge until the following spring. Because desert tortoise eggs are also protected by the ESA, the Authorized Biologist shall search for nests and encouraged to search prior to clearance surveys. Desert tortoise eggs shall be moved to artificial nests either in the wild or at a USFWS-approved facility. If you encounter unemerged hatchlings, contact the USFWS and appropriate State wildlife agency for instructions. Authorized Biologists must receive special training in the procedures outlined below. If you discover a nest and have not been trained, the nest shall be carefully covered with soil so as not to move the eggs then contact the USFWS and appropriate State wildlife agency for instructions.

Any nest that is found shall be carefully excavated by hand at a time of day when the air temperature 6 inches (15 centimeters) above the ground is approximately equal to the soil temperature at egg level. Immediately upon finding a nest, discontinue using large tools. The Authorized Biologist shall excavate the nest using his or her hands. Disposable rubber or latex gloves must be worn when marking and handling eggs. Before disturbance of nest contents, each egg shall be gently marked with a small dot on the top using a felt-tipped pen to establish the egg's orientation in the nest. In handling nest contents, eggs must be maintained in this orientation at all times. Because egg shells become extremely fragile in the last few weeks before hatching, special care shall be taken with eggs found from August to mid-October. Because the egg is very fragile, it may break during handling; this will be lethal to the developing tortoise inside. Broken eggs shall be buried nearby and left in the field, or the contents preserved and made available for research projects. Report broken eggs to the USFWS and appropriate State wildlife agency as required for tortoise mortalities.

The Authorized Biologist shall measure and record the depth of the nest below the soil surface, the cardinal location of the nest in relation to any adjacent shrub (i.e., north, south, east, or west side of the shrub), the species of shrub and its approximate foliage volume, and the soil type. Place approximately 1 inch (2.5 centimeters) of soil from the nest area in a bucket and carefully transfer the eggs to the bucket, maintaining egg orientation. Gently cover the eggs with soil that is free of cobbles and pebbles, to a depth equivalent to that of the original nest.

If good desert tortoise habitat is available in the general area, the eggs shall be relocated between 150 to 1,000 feet (45.7 to 305 meters) from outer boundary of the project site, unless directed differently by USFWS. Eggs and tortoises shall only be placed on lands administered by a Federal agency or on lands when a written authorization to bury the eggs or relocate the tortoises has been obtained. A nest shall be prepared with the same depth, orientation, location in relation to a specific shrub species, and in the same soil type as the original nest. The eggs shall be transferred to the new nest, maintaining their original orientation. The eggs shall be replaced so that they touch one another. Gently cover with soil from which cobbles and pebbles have been removed so that all the air spaces around the eggs are filled. Relocated nests in the wild shall be monitored by an Authorized Biologist. The monitoring program shall be developed in

consultation with the USFWS and appropriate State wildlife agency. Care must be taken to remove any scent of tortoise eggs or human activity at the nest site to minimize nest predation.

If a suitable site for a nest is not available in the wild, the eggs shall be prepared for incubation in a suitable holding facility. A small amount of soil shall be placed in a bucket and the eggs transferred to the bucket using the technique specified above, making sure that the eggs are touching one another. The bucket shall be carefully filled to the depth of the original nest, but leave the top of the soil layer 3 inches (7.6 centimeters) below the rim of the bucket so that future hatchlings cannot escape. The bucket shall be buried in soil in a safe location at a holding facility approved by the USFWS and appropriate State wildlife agency.

The Authorized Biologist shall record in detail all the procedures used in moving eggs. Personnel caring for incubating eggs at a facility shall maintain a record of where the eggs were found, method of incubation, length of time and conditions under which the eggs were incubated, observations of eggs during the incubation period, information about hatchling health and behavior, and disposition of the hatchlings.

## **6.7. Constructing Artificial Burrows**

Constructing an artificial burrow will take from 30 minutes to several hours, depending on the substrate. An artificial burrow is intended to provide replacement shelter and protection to a desert tortoise when removed from its natural burrow. The USFWS requires experience and training in burrow construction prior to being authorized to construct an artificial burrow. The information provided below including Figures 6.1 and 6.2 is a general description of the methods for constructing artificial burrows taken from Tortoise Group's adoption and care pamphlet ([www.tortoisegroup.org](http://www.tortoisegroup.org)).

Create an artificial burrow that is the same orientation and size as the burrow from which the desert tortoise was taken. The burrow for a juvenile desert tortoise should be 3 to 4 feet (0.9 to 1.2 meters) long and an adult tortoise burrow should be 5 to 6 feet (1.5 to 1.8 meters) long. Burrow construction involves digging a three-sided shelf upon which plywood will be placed to serve as the roof of the burrow. A channel is dug below the level of the shelf which approximates the width of the tortoise and functions as the actual burrow (Figure 6.1).

Determine the width and length to dig the shelf, place the plywood on the ground. Use corner stakes and twine to delineate the perimeter. Dig the burrow in a downward slant of 15 to 20 degrees below the horizontal line of the ground (Figure 6.2). Place the plywood onto the shelf. Fit the plywood snugly and then remove it. Next, dig the channel and loosen the soil along the floor of the channel to a depth of 6 inches (15.2 centimeters) to allow a tortoise to dig its way out should the plywood sag and possibly trap or pin it in the burrow. Replace the plywood and shovel dirt on top. Place rocks along the eave of the burrow roof, above the opening (Figure 6.2). Mound the dirt so that rain water will not puddle on top of the finished burrow.

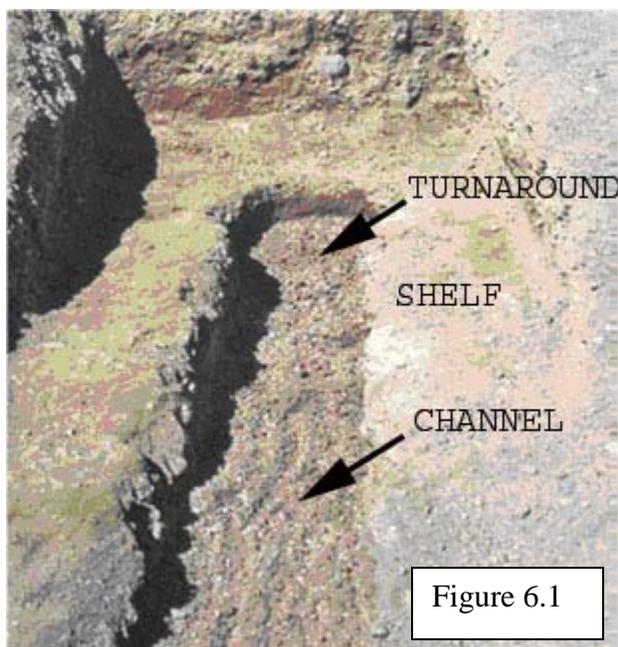


Figure 6.1

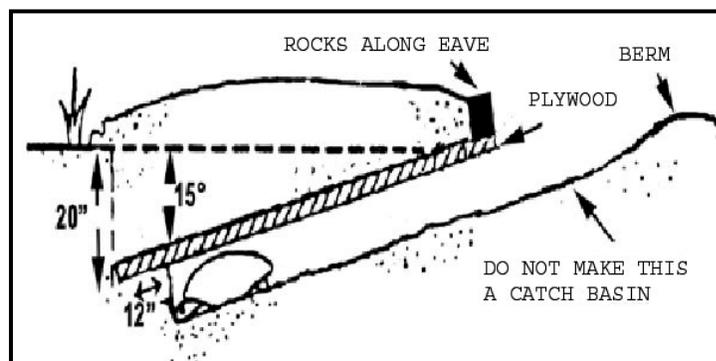


Figure 6.2

We recommend that you cover the opening of the artificial burrow with rocks or wood for 2 or 3 days to ensure that the tortoise remains within the burrow and out of harm's way, or that it resumes hibernation or aestivation.

Alternatively, the tortoise and its burrow may

be temporarily penned (Section 6.9). Providing an artificial burrow is particularly important if most of the burrows have been lost to disturbance and a desert tortoise would be unable to find an existing burrow in a reasonable amount of time. After several days, when project activities have ceased in the area (i.e., as on a pipeline or transmission line), or when you are reasonably sure that the tortoise is safely hibernating or aestivating, **it is absolutely essential that you remove the rocks from the opening of the blocked burrow or remove the pens around the tortoise and its burrow.**

## 6.8. Mapping and Finding Blocked Burrows

If you block a desert tortoise inside a burrow or temporarily pen the tortoise and its burrow according to instructions from the USFWS, you must return to that burrow and unblock it or remove the enclosure as soon as possible. Tortoises shall not be blocked in burrows during extreme high temperatures and construction activity shall be carefully monitored in the area around the blocked or penned tortoise. Accurately map the burrow with GPS so that you can find it again. Additionally, we recommend that you mark the area as a backup in case of GPS failure. For example, mark burrows with lath or ribbon placed a minimum of 100 feet (30.5 meters) from burrow. The marker should provide a cryptic message sufficient to locate the burrow (e.g., B23-2100FTS, to indicate that Burrow #23 on Reach 2 is 100 feet (30.5 meters) south of the lath (LaRue 1993)). The area must be discretely marked to avoid attracting people or ravens to the burrow.

## 6.9. Temporarily Confining Desert Tortoises

Desert tortoises found in the project area sheltering in a burrow during a period of reduced activity (e.g., winter), may be temporarily penned according to instructions from the USFWS. Tortoises shall not be penned in burrows during extreme high temperatures and construction activity shall be carefully monitored in the area around the penned tortoise. The methodology for penning desert tortoises (U.S. Department of Defense 2005) is adapted from a methodology developed by Gilbert Goodlett (EnviroPlus Consulting, Ridgecrest, California). Generally,

desert tortoises should not be penned in areas of moderate or heavy public use. Penning shall be accomplished by installing a circular fence, approximately 20 feet (6 meters) in diameter to enclose the tortoise/burrow. The pen should be constructed with durable materials (i.e., 16 gauge or heavier) suitable to resist desert environments. Fence material should consist of ½-inch hardware cloth or 1-inch horizontal by 2-inch (2.5 by 5.0 centimeters) vertical, galvanized welded wire. Pen material should be 24 inches (50 centimeters) in width. Steel T-posts or rebar (2 to 3 feet or 0.6 to 0.9 meter) should be placed every 5 to 6 feet (1.5 to 1.8 meters) to support the pen material. The pen material should extend 18 inches (45.7 centimeters) aboveground. The bottom of the enclosure shall be buried 6 to 12 inches (15 to 30 centimeters) or bent inward (towards the burrow), soil mounded along the base, and implement other measures to ensure zero ground clearance. Care shall be taken to minimize visibility of the pen by the public. An Authorized Biologist or Desert Tortoise Monitor shall check the pen at least daily and ensure that the desert tortoise is in the burrow or pen, the desert tortoise is okay, and the pen is intact. All instances of penning or issues associated with penning shall be reported to the USFWS within 3 days.

### **Literature Cited**

- LaRue, Jr., E.L. 1993. Monitoring guidelines for construction projects in desert tortoise habitat. Guidelines developed at Tierra Madre Consultants, Inc., Riverside, California.
- Medica, P.A., C.L. Lyons, and F.B. Turner. 1986. "Tapping:" A technique for capturing tortoises. *Herpetological Review* 17(1):15-16.
- U.S. Department of Defense. 2005. DARPA Grand Challenge 2005 after-action report. Defense Advanced Research Projects Agency (DARPA) Unpublished report prepared for the United States Fish and Wildlife Service, Southern Nevada Field Office. December 2005.

## **CHAPTER 7. GUIDELINES FOR HANDLING DESERT TORTOISES-MOJAVE POPULATION AND THEIR EGGS**

### **7.1. Objectives**

- Provide the reader with the most current methods for handling desert tortoises based on research and experience implementing previous handling protocols.
- Provide guidance to ensure the health and well-being of desert tortoises while allowing collection of data and necessary handling of desert tortoises.
- Ensure that diseases and parasites are not transmitted among desert tortoises.

### **7.2. Specific Considerations before Handling Desert Tortoises**

Depending on the circumstances, desert tortoises that are beneath machinery, in trenches or pipes, under pallets, or anywhere on the project site may be in danger and may need to be moved. Desert tortoises may be handled only by authorized personnel, but other project personnel may move a desert tortoise the shortest distance necessary to remove the desert tortoise from imminent danger if an Authorized Biologist is not present. The desert tortoise shall be monitored until an Authorized Biologist or USFWS is contacted for further instruction. If desert tortoises must be moved, a secure location must be available and the appropriate procedures in this Manual must be followed to ensure safe handling. If a secure location is not available, the tortoise must be held pending instruction from USFWS and the appropriate State wildlife agency. Before touching a desert tortoise, implement procedures described in Section 7.6.

### **7.3. Temperature Considerations**

Desert tortoises, particularly small ones, have been observed to be active aboveground every month of the year. However, the preferred daytime body temperature of desert tortoises is 69 degrees F to 101 degrees F (20.5 degrees C to 38 degrees C) (McGinnis and Voigt 1971). The critical maximum body temperature is between 103 degrees F and 112 degrees F (39 degrees C to 44 degrees C) (Brattstrom 1965, Naegle 1976). Berry and Turner (1984) found that juvenile desert tortoises preferred air temperatures of 63 degrees F to 66 degrees F (17 degrees C to 19 degrees C) during March, and 77 degrees F to 83 degrees F (25 degrees C to 28 degrees C) during June. Consequently, more juvenile desert tortoises were located in the morning (76.1 percent) than in the afternoon (23.9 percent). Zimmerman et al. (1994) found that air temperatures were comparable between 2 and 10 inches (5 centimeters to 25.4 centimeters) aboveground, with maximum variance of less than 3.5 degrees F (1.2 degrees C). Current information on lower temperature limits for desert tortoise activity is not well known.

Walde et al. (2003) observed that desert tortoises retreated into burrows when the air temperature reached 91.0 degrees F  $\pm$  3.5 degrees F (32.7 degrees C  $\pm$  1.2 degrees) and ground temperatures reached 95 degrees F  $\pm$  6 degrees F (35 degrees C  $\pm$  2.4 degrees); 95 percent of the desert tortoise observations aboveground occurred at air temperatures less than 91.4 degrees F (33 degrees C). Ground temperatures shall be measured on the ground surface in an area near the desert tortoise in full sun, with the thermometer in the shadow of the observer. Ambient air temperature shall

be measured in the shade, protected from wind, at a height of 2 inches (5 centimeters) above the ground surface.

During extreme heat, desert tortoises that shelter in relatively shallow burrows will remain in the burrow as long as the burrow temperature is lower than the temperature outside of the burrow. At night the air and surface temperatures drop faster than the temperature in the burrow. When the air and surface temperature drop below the burrow temperature, the desert tortoise may exit the burrow in an effort to lower its body temperature. Desert tortoises have been observed moving from a few feet out of the burrow to 50 feet (15 meters) or more during the night (Steve Ferrand, 2009, Nevada Biological Consulting, *in litt.*). Tortoises shall not be blocked in burrows during extreme temperatures and construction sites shall be carefully inspected during these periods for tortoises aboveground.

#### **7.4. Hot Temperatures**

Desert tortoises shall be treated in a manner to ensure that they do not overheat or exhibit signs of overheating, which include aggressive struggling by the desert tortoise, hot to the touch, frothing at the mouth, excessive salivation, or voiding its bladder. Desert tortoises shall not be placed in a situation where they cannot maintain surface and core temperatures necessary to their well-being. Desert tortoises shall be kept shaded at all times until it is safe to release them. Ground temperatures are much hotter than air temperatures thus never place a desert tortoise on unshaded ground. Removal of the upper layer of hot substrate would expose a cooler layer below.

No desert tortoise shall be captured, moved, transported, released, or purposefully caused to leave its burrow for whatever reason when the ground temperature is above 95 degrees F (35 degrees C). Temperature must be measured in the shade and protected from the wind at a height of 2 inches (5 centimeters) above the ground. No desert tortoise shall be captured if ground temperature is anticipated to exceed 95 degrees F (35 degrees C) before handling and relocation can be completed. If the ground temperature exceeds 95 degrees F (35 degrees C) during handling or processing, desert tortoises shall be kept shaded in an environment where the ambient air temperatures do not exceed 91 degrees F (32.7 degrees C) and ground temperature does not exceed 95 degrees F (35 degrees C). The desert tortoise shall not be released until ground temperature at the release site declines to below 95 degrees F (35 degrees C).

If a desert tortoise is found aboveground when these upper temperatures are exceeded and the desert tortoise must be moved from harm's way, place the desert tortoise in a clean, unused cardboard box or disinfected open plastic container, and keep it in a climate-controlled environment (e.g., air conditioned vehicle or building) until the ambient air and ground temperatures are below upper limits.

## Hyperthermic Desert Tortoises

Before touching a desert tortoise, implement procedures described in Section 7.6. If an animal begins frothing at the mouth, it is probably nearing an upper lethal body temperature and immediate action is required: a) capture, transport, and hold the desert tortoise in a climate-controlled environment, or b) if a nearby climate-controlled environment is unavailable, place the desert tortoise in an unused or open disinfected plastic container in the shade and pour cool water over the shell to a depth that ensures the nares remain above the water level. If no container is available, excavate a depression in a shaded area; place the desert tortoise in the depression and pour water over the shell. Heat-stressed desert tortoises shall not be released until they resume normal behavior. Monitor the desert tortoise after release until normal behavior resumes including sheltering.

### **7.5. Cold Temperatures**

If a desert tortoise is found aboveground during cold temperatures (i.e., ambient temperature less than 55 degrees F or 12.8 degrees C) and its burrow cannot be located nearby or will be destroyed, then capture the animal and implement the appropriate actions in Table 7.1. Before touching a desert tortoise, implement procedures described in Section 7.6. If relocating the desert tortoise to a natural burrow, ensure that the burrow is unoccupied; both a natural or artificial burrow must be of appropriate size within the average home range for that size and sex animal. If the end of the burrow cannot be seen, the burrow must be examined with a fiber-optic scope to ensure that the burrow and all side channels are unoccupied by other desert tortoises. Placing a desert tortoise in a burrow occupied by another desert tortoise may promote disease transmission and aggressive behavior between the desert tortoises.

**Table 7.1. Actions to implement for desert tortoises in harm’s way or adjacent to project areas during cold temperatures.**

CIRCUMSTANCE	ACTIONS		
	Find natural, unoccupied burrow; block tortoise inside	Construct artificial burrow; block tortoise inside	Construct pen around tortoise and burrow (Section 6.9)
<b>Desert tortoise above ground:</b>			
Desert tortoise in harm’s way, not in burrow	<b>X</b>	<b>X</b>	
Desert tortoise and burrow in harm’s way	<b>X</b>	<b>X</b>	
Desert tortoise in harm’s way, nearby burrow not in harm’s way			<b>X</b>
Desert tortoise adjacent to project, burrow in harm’s way	<b>X</b>	<b>X</b>	
Desert tortoise adjacent to project, no burrow	<b>X</b>	<b>X</b>	
Desert tortoise and burrow adjacent to project, not in harm’s way			<b>X</b>
<b>Desert tortoise in burrow:</b>			
Desert tortoise in harm’s way	<b>X</b>	<b>X</b>	
Desert tortoise adjacent to project			<b>X</b>

## **7.6. Procedures to Avoid Transmission of Diseases or Parasites**

At all times, handle a desert tortoise as if it has a contagious disease or parasites, and in such a way to avoid transmitting disease or parasites from one desert tortoise to another. Much of the following information was developed by Berry and Christopher 2001.

During handling each desert tortoise, wear a new pair of disposable latex or rubber gloves (i.e., one pair of gloves, per desert tortoise, per encounter). If a glove is torn while handling a desert tortoise, which is likely when its toenail scrapes the glove, put on a new glove over the old one. Used gloves and disposable supplies (e.g., surveyors tape or flagging, etc.) must be placed in a plastic trash bag and disposed of offsite.

All tools that contact desert tortoises shall be disinfected in accordance with procedures described in Section 7.6.2.

### **7.6.1. Disinfecting Clothing**

Do not allow a desert tortoise to contact clothing. If it does, change clothes before handling another desert tortoise. Contaminated clothes must be washed before worn again while handling desert tortoises. Keep a change of clothes on-hand and change clothes, including shoes, before leaving the site for another geographical location (e.g., another valley or mountain range would

be considered a separate location). As an alternative, wear disposable jumpsuits or gowns and disposable paper or plastic shoe covers. Use disposable paper or plastic sheeting to place under the desert tortoise or on the lap of field workers; disposable baby changing sheets may prove useful.

#### 7.6.2. Disinfecting Tools and Equipment

All equipment and work surfaces after contact with each desert tortoise, any equipment (e.g., scales, calipers, ruler, etc.) that comes in contact with a desert tortoise, including poles used to probe burrows or tap desert tortoises from burrows (Medica et al. 1986), must be disinfected. Disinfecting solutions shall be either 0.175 percent sodium hypochlorite (bleach) (Wendland et al. 2009) or *Nolvasan* (prepared according to the manufacturer's instructions). A 0.175 percent sodium hypochlorite bleach is a 1:10 dilution of 5 percent household bleach to water. Before disinfecting, first remove any organic debris (e.g., dirt, feces, etc.) by rinsing the area with water or brushing off the area with paper towels or a scrub brush. If using a bleach solution, the equipment and work surface shall be saturated with the solution and allowed to air dry. If using a *Nolvasan* solution, the equipment and work surface shall be submersed in the solution (bath) for a minimum of 10 minutes before being used on another animal. Equipment baths shall be changed regularly according to the label instructions. Measures should be taken to avoid transmission of pathogens between burrows when using a fiber-optic scope which may include covering the scope with a disposable plastic cover.

Between study sites, equipment, particularly buckets will be scrubbed using a dish soap and bleach solution. After rinsing, the bleach solution will be sprayed on the equipment and allowed to air dry. This will minimize the chance of cross-contamination between study sites.

Only metal or plastic rulers may be used; never use a wooden ruler, which is too porous and cannot be properly disinfected. If permitted to notch desert tortoises, files must be disinfected after each use.

Thoroughly clean field vehicles inside and out at a car wash before moving to another geographical location.

### **7.7. Capturing Desert Tortoises**

When encountering a desert tortoise outside its burrow, approach the animal slowly (e.g., if the desert tortoise is 15 feet (4.5 meters) away, pace your approach with pauses to contact the desert tortoise in 30 seconds). Put on a clean, unused pair of latex or rubber gloves and grasp the desert tortoise at its bridge (connection between the carapace and plastron) with both hands, holding it firmly with its plastron parallel to, and facing the ground. Slowly lift the desert tortoise to your waist height and slowly and smoothly walk to where the desert tortoise will be placed (e.g., remove from harm's way).

If a desert tortoise is collected at or near sunset and intended to be released the same day, hold the desert tortoise overnight in a clean, unused cardboard box or open disinfected plastic container, and release it the next morning at or near the capture site. Monitor the desert tortoise until it resumes normal behavior.

## 7.8. Processing Desert Tortoises

Before touching a desert tortoise, implement procedures described in Section 7.6. A desert tortoise shall only be processed (i.e., weighed, measured, or sexed) if authorized in a biological opinion or permit. An experienced biologist should be able to process a desert tortoise in 5 to 10 minutes. **Do not process a desert tortoise if the ambient temperature exceeds 95 degrees F (35 degrees C)** (Section 6.3 or 7.4.) or if there is a chance that a second desert tortoise could be in harm's way and requires timely action while processing the first one.

Inspect a desert tortoise and record data on size, sex, distinctive features, indications of health and disease (e.g., ectoparasites, shell lesions, signs of osteoporosis or osteomalacia, injuries, evidence of URTD, etc.). Ensure that the desert tortoise is maintained in a horizontal position at all times.

### 7.8.1. Measuring and Sexing

If authorized and required, measure the midline carapace length (MCL) of the desert tortoise from the nuchal to pygal scutes using calipers, which provide the most accurate measurement. Measurements should be taken in millimeters (mm). Before touching a desert tortoise, implement procedures described in Section 7.6.

The sex of desert tortoises less than 180 mm MCL cannot be accurately determined based on external characteristics. Generally, the following male characteristics differentiate them from females: a) concave plastron; b) longer, more curved gulars; c) larger, well-developed chin glands; d) longer, broader, more conical tail; and e) shorter, thicker toenails. Pay particular attention to the gular projection and the shape of the plastron, which are the two best features for differentiating the sexes. For very large desert tortoises, feel the concave (male) or flattened (female) plastron or see it by holding the desert tortoise at eye level without turning the desert tortoise on its back. When in doubt, record all other information and mark "sex unknown" on the data sheet.

### 7.8.2. Weighing

Handle desert tortoises carefully. Mishandling may result in injury or cause the tortoise to void its bladder. Before touching a desert tortoise, implement procedures described in Section 7.6. If using a digital scale, immobilize the desert tortoise as described in Section 7.8.3. If using a spring scale, place the desert tortoise inside a harness made of clean, unused cord that will avoid the spread of pathogens. It will also minimize gross contamination to the desert tortoise and to field equipment from urination or defecation. The harness shall consist of a double loop with one loop crossing the plastron posterior to the forelimbs and the other anterior to the hind limbs. As the Authorized Biologist slowly begins to raise the tortoise, the tortoise shall remain positioned horizontally and care shall be taken to ensure that the tortoise does slip out of the harness or fall. Using the harness allows the Authorized Biologist to observe any stressful behavior exhibited by the desert tortoise (e.g., flailing of legs) and act quickly to correct this situation. Suspend the harness from the scale, ensuring the desert tortoise is securely and safely positioned, a few inches above sand or soil substrate. Keep weighing time to a minimum; and

take every precaution to prevent the desert tortoise from falling or voiding. Once the desert tortoise has been weighed, dispose of the harness.

The following spring scale sizes are recommended: a) 0 to 100 gram scale with a 1.0 gram precision for small desert tortoises; b) 1 kilogram scale with a 10 gram precision for moderate-sized desert tortoises; and c) 5 kilogram scale with a 50 gram precision for large desert tortoises. It is best to use the smallest scale that will accommodate the weight of a desert tortoise. Occasionally a desert tortoise will weigh more than 5 kilograms; in this case you may use two 5-kilogram scales simultaneously on the harness and add the weights. Keep scales clean and calibrated.

Experts recommend weighing a desert tortoise immediately after capture. This provides a true weight. Should the desert tortoise void its bladder, weigh it afterwards to determine how much fluid has been lost. Another reason for weighing a desert tortoise is to determine if it is underweight for its size. Low weight may be the result of disease, drought conditions, recent egg-laying, or other factors.

### 7.8.3. Restricting Mobility

*Using cylinders* - Before touching a desert tortoise, implement procedures described in Section 7.6. A desert tortoise may be placed on the top of a cylindrical holding stand such as a coffee can or other large can to facilitate processing. The stand should be large enough to support the desert tortoise and small enough to prevent any waving appendages from touching the stand, and tall enough to prevent desert tortoise from touching a solid surface below. Given that desert tortoises come in all sizes, a range of stand sizes will be needed. Note that coffee cans and other types of stands come in several sizes and can be "nested" in one another for ease of transport thereby accommodating different-sized desert tortoises. Freedom to move its appendages may encourage a desert tortoise to extend its head, which allows observation of the eyes, nares, chin glands, and beak where most signs of URTD are observed. The stand must be disinfected before using it with another desert tortoise, or place waterproof plastic on top of the stand prior to each use, then position the desert tortoise on top of the plastic, and discard the plastic afterwards.

### 7.8.4. Assessing Desert Tortoise Health

A section 7 biological opinion or section 10 permit may require a health assessment for encountered desert tortoises. Before initiating this assessment, contact the appropriate USFWS office to determine the information to be included in the health assessment. This will determine the qualifications needed by the person conducting the health assessment. You will need the approval of the person conducting the health assessment from the USFWS.

### 7.8.5. Marking Desert Tortoises

You must contact the DTRO and appropriate State wildlife agency before marking desert tortoises. Before touching a desert tortoise, implement procedures described in Section 7.6. If authorized, first restrict movement of the desert tortoise (Section 7.8.3.). Next, use a clean, disinfected toothbrush to remove dirt from the left fourth costal scute, where the desert tortoise will be marked. If this scute is damaged, use the right fourth costal scute. Next, place a small

dot (i.e., no larger than 1/4 inch (0.64 centimeter) in diameter) of correction fluid (i.e., white out) or acrylic paint on the scute. The number is likely to last longer if placed on a rough, off-centered surface where shell-wear is less common, which is one reason only the fourth costal scutes are used for marking. Once the spot is dry, write the identifying mark on the spot using a waterproof, permanent black ink pen. Some biologists recommend using a capillary type technical pen (e.g., fine-tip Sharpie).

Allow the number to dry before applying 5-minute epoxy. Mix the epoxy on a file card or piece of paper, then transfer the mixed epoxy to the dot on the shell using a toothpick, wooden coffee stirrer, or tongue depressor. Wait several seconds until the epoxy starts to thicken but is still liquid enough to spread over the numbered spot with ease. Cover the paint spot overlapping its edges just enough to seal the paint. **Never allow the epoxy to spill over onto the growth area, which occurs at the border between two scutes.** Anticipate this when applying the paint so there will be space for the epoxy to overlap the paint without entering the seams. It may be helpful to cover the margins of the scute with 1/2-inch wide masking tape before applying the epoxy, to ensure that the epoxy does not touch the growth area, especially on smaller desert tortoises. Record the identifying mark on the data sheet. Dispose of used materials appropriately after use on each desert tortoise.

#### 7.8.6. Photographing Desert Tortoises

Before touching a desert tortoise for photographing, implement procedures described in Section 7.6. If permitted, photograph processed desert tortoises as follows: a) dorsal view of the carapace; b) the numbered scute; and c) frontal view of the desert tortoise's face and forelegs. Photograph any recent or previously healed injuries or unusual anomalies. Unless specifically required, do not photograph the plastron which would require unnecessary handling and risk to the tortoise. It is important that each object fills 80 to 90 percent of the frame and that the object be clearly focused. Digital photographs are preferred. Two types of labels are recommended: a) hold a small card adjacent to the desert tortoise so that the above information is clearly visible on the photograph without blocking the part of the desert tortoise being photographed; or, b) attach a 1/2 inch x 1/2 inch, adhesive label to the desert tortoise to allow for closer, more detailed photographs of the subject. Dispose of label appropriately following use on each desert tortoise.

Keep a log of the photographs in your field notes (e.g., "photo number 453, carapace of desert tortoise 4"). You must be familiar with the features of the camera. Label photographs with the following information: date, biologist's name, project name, desert tortoise number, UTM or lat/long, county, and state.

Supplies and equipment:

- 3 inch x 5 inch file cards (for identifying photographs)
- 1/2 inch x 1/2 inch labels or other stickers (to attach to desert tortoise to identify photograph)
- Camera

## **7.9. Desert Tortoise Urination and Hydration**

Desert tortoises may void their bladder: 1) when first encountered, picked up, or carried; 2) the longer you handle them; and (3) during drought conditions, which is also when water availability is at its lowest. Since desert tortoises store water in their bladders, any loss of this fluid may result in death (Averill-Murray 2002). Discourage bladder voiding by gently and slowly moving the desert tortoise. If the tortoise does void, record on the data sheet the quantity, color, and viscosity of the urine. If the desert tortoise has already been weighed, weigh it again to estimate the amount of lost fluid. Avoid all unnecessary actions that may result in stress to the animal.

If the desert tortoise urinates, it should be rehydrated. To rehydrate, soak the desert tortoise at the release location in a tub with a clean unused plastic disposable liner for a minimum of 10 to 20 minutes in a quiet protected area. Water level shall not be higher than the lower jaw of the animal; the water temperature should be tepid. Desert tortoises must be soaked individually. Weigh the desert tortoise before and after placing in water. Even if desert tortoises do not drink, they can absorb water through their cloaca. Weighing the desert tortoise before and after placing it in water will determine if the tortoise took in water (James Jarchow, veterinarian, pers. comm.).

On warm days, transport the desert tortoise in the shade. Remember to roll up your sleeves and wear protective clothing to avoid transmitting disease or parasites to other desert tortoises that may come in contact with your clothing. When handling is complete, remove and properly dispose of your gloves and protective clothing.

## **7.10. Moving and Releasing Desert Tortoises**

In this Manual, relocating desert tortoises is defined as moving them from harm's way but allowing them to remain within their home ranges. To relocate, move the desert tortoise the distance directed in the permit or biological opinion once the desert tortoise has been processed. The minimum distance from the edge of the project footprint that a desert tortoise can be relocated will be determined by its age and sex (different home range sizes), the presence or absence of desert tortoise-proof fencing around the perimeter of the project footprint, and the duration of the project activity. Desert tortoises may attempt to return to their point of capture. A desert tortoise should not be placed on private land without the written permission of the landowner.

In this Manual, translocating desert tortoises is defined as moving them from harm's way to a location outside their home range (e.g., more than 1,000 feet (305 meters)). Translocating tortoises should only occur when authorized by the permitting agencies and in accordance with an approved, project-specific translocation plan. Translocation not only affects the desert tortoise being moved but also may impact resident desert tortoises in the translocation area. The effectiveness of translocation of desert tortoises as a conservation or recovery tool has not been proven. Until its effectiveness is determined, it should be implemented only on an experimental basis and in close coordination with the USFWS and State wildlife agency.

For temperature considerations, refer to Section 7.3. To discourage urination or if the tortoise voided during handling, refer to Section 7.9.

After processing is completed, release the desert tortoise as soon as possible while considering its well-being. Desert tortoises shall be released individually and not in groups. The biological opinion or permit may require that desert tortoises be removed from the project site and placed in the shade of a shrub, in a natural unoccupied burrow, or in an artificial burrow. Desert tortoises shall be released at a safe location as near to the point of capture as possible. If a desert tortoise is found aboveground, release it aboveground if environmental conditions are suitable (Sections 7.4 and 7.5), or hold it until conditions are suitable, then release it. When releasing the desert tortoise, slowly lower the animal to the ground, release it, and slowly walk away. Following release, monitor the desert tortoise until it exhibits and maintains normal behavior. Further, we recommend that desert tortoises **not** be put into existing burrows to avoid exposing the desert tortoise to diseases.

If a desert tortoise and its burrow are not in harm's way but adjacent to project activities, as an alternative to moving, construct a temporary restraining pen around the desert tortoise and its burrow to protect it during project activities (See Section 6.9.).

#### 7.10.1. Temporarily Holding Desert Tortoises

There may be a situation where a desert tortoise needs to be removed from the field, held overnight or longer, and then released at its point of capture. While held, each desert tortoise shall remain in a clean, unused or disinfected container that is covered or closed. Newspaper placed in the bottom will absorb any urine that is voided. The box shall be ventilated in such a way that a desert tortoise's leg or head cannot be caught in the ventilation hole. Never put more than one desert tortoise in a container, and avoid placing anything in a container occupied by a tortoise that previously came in contact with another tortoise without following disinfection procedures (Section 7.6.).

#### 7.10.2. Transporting by Vehicle

Do not allow desert tortoises to roam freely in the vehicle. Do not transport desert tortoises in shopping or grocery bags or other containers less sturdy than a new cardboard box. Discard the box immediately after use to ensure that it is not used for another desert tortoise.

Never place desert tortoises over the catalytic converter or other area in a vehicle that becomes hot. Pad truck beds or floorboards and travel at speeds that minimize vibrations or shifting of the box. Never leave a desert tortoise unattended in a vehicle. During summer months, transport desert tortoises in an air-conditioned vehicle, placing them in a covered, unused cardboard box while maintaining the vehicle interior temperature between 75 degrees F and 80 degrees F (23.9 degrees C and 26.7 degrees C). If a desert tortoise is captured during the winter, maintain the desert tortoise at its current body temperature, which will be less stressful to it than much warmer temperatures, and may allow it to remain in a physiological state of brumation. When transporting an adult female desert tortoise, assume it may be gravid (i.e., April through July) and take special care to avoid jolting and jostling to ensure that the eggs are not ruptured which may result in her death from egg yolk peritonitis.

## **7.11. Injured or Dead Desert Tortoises**

If an injured desert tortoise is encountered that may have been the result of project activities, follow the instructions of the biological opinion/permit, which typically requires immediate transport to a qualified veterinarian. Contact the USFWS and appropriate State wildlife agency. Document the injury with photographs and a written description of the injury; circumstances and probable cause; and recommendations to avoid future injuries. Submit this information to the USFWS and other appropriate agencies.

If a dying or dead desert tortoise is encountered, you may not salvage or collect it unless authorized to do so under a biological opinion, section 10 permit, or under 50 *Code of Federal Regulations* 17.31.

## LITERATURE CITED

- Averill-Murray, R.C. 2002. Effects on survival of desert tortoises (*Gopherus agassizii*) urinating during handling. *Chelonian Conservation and Biology* 4(2): 430-435.
- Berry, K.H. and M. M. Christopher. 2001. Guidelines for the field evaluation of desert tortoise health and disease. *Journal of Wildlife Diseases* 37(3):427-450.
- Berry, K.H. and F.B. Turner. 1984. Notes on the behavior and habitat preferences of juvenile desert tortoises (*Gopherus agassizii*) in California. *Proceedings of the Desert Tortoise Council Symposium* 1984:111-130.
- Brattstrom, B.H. 1965. Body temperatures of reptiles. *American Midland Naturalist*. 73:376-422.
- McGinnis, S.M. and W.G. Voigt. 1971. Thermoregulation in the desert tortoise, *Gopherus agassizii*. *Comparative Biochemical Physiology* 40A:119-126.
- Medica, P.A., C.L. Lyons, and F.B. Turner. 1986. "Tapping:" A technique for capturing tortoises. *Herpetological Review* 17(1):15-16.
- Naegle, S. 1976. Physiological response of the desert tortoise, *Gopherus agassizii*. Master of Science thesis, University of Nevada, Las Vegas, Nevada.
- Walde, A.D., L. Bol, D.K. Delaney, and L.L. Pater. 2003. The desert tortoise: a preliminary analysis of operative and environmental temperatures. A Report by the Construction Engineering Research Laboratory to the U.S. Fish and Wildlife Service. 18 pp.
- Wendland, L., H. Balbach, M. Brown, J. D. Berish, R. Littell, and M. Clark. 2009. Handbook on gopher tortoise (*Gopherus polyphemus*). Health evaluation procedures for use by land managers and reseachers. U.S. Army Corps of Engineers, Engineer Research and Development. ERCD/CERL TR-09-1. January 2009.
- Zimmerman, L.C., M.P. O'Connor, S.J. Bulova, J.R. Spotila, S.J. Kemp, and C.J. Salice. 1994. Thermal ecology of desert tortoise in the Eastern Mojave Desert: seasonal patterns of operative and body temperatures, and microhabitat utilization. *Herpetological Monographs* 8:45-59.
- Personal Communication
- Jarchow, J. 2005. Desert tortoise veterinarian, Orange Grove Animal Hospital, Tucson, Arizona.

## CHAPTER 8. DESERT TORTOISE EXCLUSION FENCE

### RECOMMENDED SPECIFICATIONS FOR DESERT TORTOISE EXCLUSION FENCING

These specifications were developed to standardize fence materials and construction procedures to confine tortoises or exclude them from harmful situations, primarily roads and highways. Prior to commencing any field work, all field workers should comply with all stipulations and measures developed by the jurisdictional land manager and the U.S. Fish and Wildlife Service for conducting such activities in desert tortoise habitat, which will include, at a minimum, completing a desert tortoise education program.

#### Fence Construction

##### Materials

Fences should be constructed with durable materials (*i.e.*, 16 gauge or heavier) suitable to resist desert environments, alkaline and acidic soils, wind, and erosion. Fence material should consist of 1-inch horizontal by 2-inch vertical, galvanized welded wire, 36 inches in width. Other materials include: Hog rings, steel T-posts, and smooth or barbed livestock wire. Hog rings should be used to attach the fence material to existing strand fence. Steel T-posts (5 to 6-foot) are used for new fence construction. If fence is constructed within the range of bighorn sheep, 6-foot T-posts should be used (see New Fence Construction below). Standard smooth livestock wire fencing should be used for new fence construction, on which tortoise-proof fencing would be attached.

##### Retrofitting Existing Livestock Fence

**Option 1 (see enclosed drawing).** Fence material should be buried a minimum of 12 inches below the ground surface, leaving 22-24 inches above ground. A trench should be dug or a cut made with a blade on heavy equipment to allow 12 inches of fence to be buried below the natural level of the ground. The top end of the tortoise fence should be secured to the livestock wire with hog rings at 12 to 18-inch intervals. Distances between T-posts should not exceed 10 feet, unless the tortoise fence is being attached to an existing right-of-way fence that has larger interspaces between posts. The fence must be perpendicular to the ground surface, or slightly angled away from the road, towards the side encountered by tortoises. After the fence has been installed and secured to the top wire and T-posts, excavated soil will be replaced and compacted to minimize soil erosion.

**Option 2 (see enclosed drawing).** In situations where burying the fence is not practical because of rocky or undigable substrate, the fence material should be bent at a 90E angle to produce a lower section approximately 14 inches wide which will be placed parallel to, and in direct

contact with, the ground surface; the remaining 22-inch wide upper section should be placed vertically against the existing fence, perpendicular to the ground and attached to the existing fence with hog rings at 12 to 18-inch intervals. The lower section in contact with the ground should be placed within the enclosure in the direction of potential tortoise encounters and level with the ground surface. Soil and cobble (approximately 2 to 4 inches in diameter; can use larger rocks where soil is shallow) should be placed on top of the lower section of fence material on the ground covering it with up to 4 inches of material, leaving a minimum of 18 inches of open space between the cobble surface and the top of the tortoise-proof fence. Care should be taken to ensure that the fence material parallel to the ground surface is adequately covered and is flush with the ground surface.

### New Fence Construction

Options 1 or 2 should be followed except in areas that require special construction and engineering such as wash-out sections (see below). T-posts should be driven approximately

24 inches below the ground surface spaced approximately 10 feet apart. Livestock wire should be stretched between the T-posts, 18 to 24 inches above the ground to match the top edge of the fence material; desert tortoise-proof fencing should be attached to this wire with hog rings placed at 12 to 18-inch intervals. Smooth (barb-less) livestock wire should be used except where grazing occurs.

If fence is constructed within the range of bighorn sheep, two smooth-strand wires are required at the top of the T-post, approximately 4 inches apart, to make the wire(s) more visible to sheep. A 20 to 24-inch gap must exist between the top of the fence material and the lowest smooth-strand wire at the top of the T-post. The lower of the top two smooth-strand wires must be at least 43 inches above the ground surface.

(72-inch T-posts: 24 inches below ground + 18 inches of tortoise fence above ground + 20 to 24-inch gap to lower top wire + 4 inches to upper top wire = 66 to 70 inches).

### **Inspection of Desert Tortoise Barriers**

The risk level for a desert tortoise encountering a breach in the fence is greatest in the spring and fall, particularly around the time of precipitation including the period during which precipitation occurs and at least several days afterward. All desert tortoise fences and cattleguards should be inspected on a regular basis sufficient to maintain an effective barrier to tortoise movement.

Inspections should be documented in writing and include any observations of entrapped animals; repairs needed including bent T-posts, leaning or non-perpendicular fencing, cuts, breaks, and gaps; cattleguards without escape paths for tortoises or needed maintenance; tortoises and tortoise burrows including carcasses; and recommendations for supplies and equipment needed to complete repairs and maintenance.

All fence and cattleguard inventories should be inspected at least twice per year. However, during the first 2 to 3 years all inspections will be conducted quarterly at a minimum, to identify and document breaches, and problem areas such as wash-outs, vandalism, and cattleguards that fill-in with soil or gravel. GPS coordinates and mileages from existing highway markers should be recorded in order to pinpoint problem locations and build a database of problem locations that may require more frequent checking. Following 2 to 3 years of initial inspection, subsequent inspections should focus on known problem areas which will be inspected more frequently than twice per year. In addition to semi-annual inspections, problem areas prone to wash-outs should be inspected following precipitation that produces potentially fence-damaging water flow. A database of problem areas will be established whereby checking fences in such areas can be done efficiently.

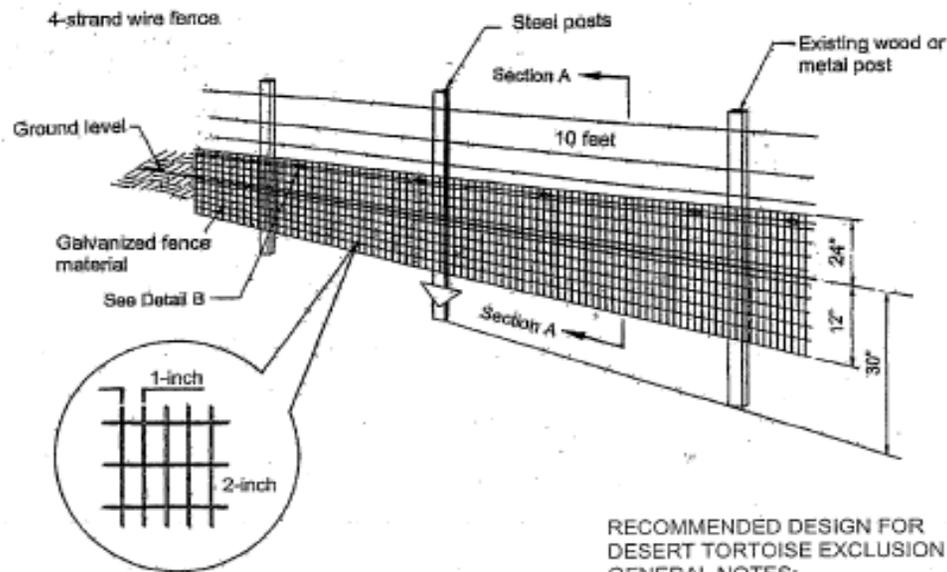
### **Repair and Maintenance of Desert Tortoise Barriers**

Repairs of fence wash-outs: (1) realign the fence out of the wash if possible to avoid the problem area, or (2) re-construct tortoise-proof fencing using techniques that will ensure that an effective desert tortoise barrier is established that will not require frequent repairs and maintenance.

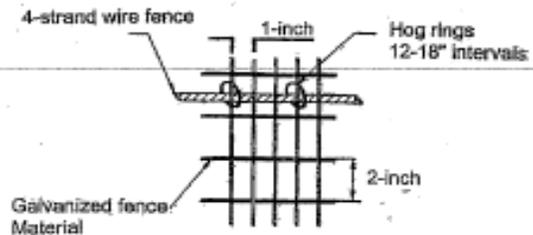
Gaps and breaks will require either: (a) repairs to the existing fence in place, with similar diameter and composition of original material, (b) replacement of the damaged section to the nearest T-post, with new fence material that original fence standards, (c) burying fence, and/or (d) restoring zero ground clearance by filling in gaps or holes under the fence and replacing cobble over fence constructed under Option 2. Tortoise-proof fencing should be constructed and maintained at cattleguards to ensure that a desert tortoise barrier exists at all times.

All fence damage should be repaired in a timely manner to ensure that tortoises do not travel through damaged sections. Similarly, cattleguards will be cleaned out of deposited material underneath them in a timely manner. In addition to periodic inspections, debris should be removed that accumulates along the fence. All cattleguards that serve as tortoise barriers should be installed and maintained to ensure that any tortoise that falls underneath has a path of escape without crossing the intended barrier.

DESERT TORTOISE EXCLUSION FENCE (2005)



DETAIL A



DETAIL B

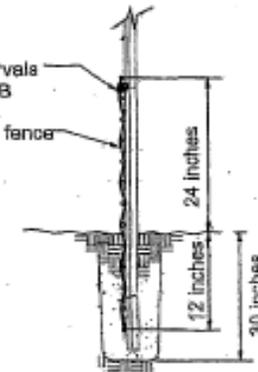
RECOMMENDED DESIGN FOR  
DESERT TORTOISE EXCLUSION FENCE  
GENERAL NOTES:

1. Ensure that fence posts and materials conform to the standards approved by the U.S. Fish and Wildlife Service.
2. Ensure that the height above ground level is no less than 18 inches and no higher than 24 inches.
3. Ensure that the depth of fence material below ground level is about 12 inches but no less than 6 inches. (See SECTION A above)
4. Install additional steel posts when span between existing fence posts exceed 10 feet.
5. Attach fence material to existing fence or wire using hog rings at 12-inch intervals.
6. Fasten fence material to posts with 3 tie wires with a wire near the top, bottom, and center of the fence material.
7. Backfill trenches with excavated material and compact the material.
8. Attach fence material to all gates. Ensure that clearance at base of gate achieves zero ground clearance.
9. Substitute smooth wire for barbed wire if additional support wires are necessary.
10. The number and placement of support wires may be modified to allow sheep and deer to pass safely.
11. Erosion at the edge of the fence material where the fence crosses washes may occur and requires appropriate and timely monitoring and repair.
12. Tie the fence into existing culverts and cattleguards when determined necessary to allow desert tortoise passage underneath roadways.

4-strand  
wire fence

Hog rings  
12-18" intervals  
See Detail B

Galvanized fence  
Material



SECTION A

### FOR BEDROCK OR CALICHE SUBSTRATE

1. Use this fence design (see below) only for that portion of the fence where fence material cannot be placed 6 inches below existing ground level due to presence of bedrock, large rocks or caliche substrate.
2. Ensure that the fence height above ground level is no less than 22 inches.
3. Ensure that there is a zero to 2-inch ground clearance at the bend.
4. Ensure that the bent portion of the fence is lying on the ground and pointed in the direction of desert tortoise habitat.
5. Cover the portion of the fence that is flush with the ground with cobble (rocks placed on top of the fence material to a vertical thickness up to 4 inches).
6. When substrate no longer is composed of bedrock or caliche, install fence using design shown above.

