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Via email only

6 January 2020

Bureau of Land Management
Attn: Northern Corridor
345 East Riverside Drive
St. George, UT 84790
BLM_UT_NorthernCorridor@blm.gov

U.S. Fish and Wildlife Service
Utah Ecological Services Field Office
2369 West Orton Circle
West Valley City, Utah 84119
laura_romin@fws.gov, Hilary_Whitcomb@fws.gov

RE: Environmental Impact Statement to Consider a Highway Right-of-Way with Associated Issuance of an Incidental Take Permit, and Resource Management Plan Amendments, Washington County, UT

Dear Bureau of Land Management and U.S. Fish and Wildlife Service,

The Desert Tortoise Council (Council) is a non-profit organization comprised of hundreds of professionals and laypersons who share a common concern for wild desert tortoises and a commitment to advancing the public's understanding of desert tortoise species. Established in 1975 to promote conservation of tortoises in the deserts of the southwestern United States and Mexico, the Council routinely provides information and other forms of assistance to individuals, organizations, and regulatory agencies on matters potentially affecting desert tortoises within their geographic ranges.

We appreciate this opportunity to provide comments on the above-referenced project. Given the location of the proposed project in habitats likely occupied by Agassiz's desert tortoise (*Gopherus agassizii*) (synonymous with "Mojave desert tortoise"), our comments pertain to enhancing protection of this species during activities authorized by the Bureau of Land Management (BLM) and U.S. Fish and Wildlife Service (USFWS).

Precedent-setting Action

The Council contends the proposed actions are setting a precedent by seeking to approve the construction, use, and maintenance of a new highway bisecting a conservation area designated under the issuance of the Washington County Incidental Take Permit (ITP) in 1996, and a conservation area established under the Omnibus Public Lands Management Act of 2009 by Congress. (Please see Alternatives to the Northern Corridor below). Granting a 300-foot wide permanent easement through the 62,000-acre Red Cliffs Desert Reserve (Reserve) and the 45,000-acre congressionally established Red Cliffs National Conservation Area (NCA) "opens the door" for approval of future requests for permanent rights-of-ways or development easements that would destroy more habitat for the tortoise and undermine the purpose for which the Reserve/NCA was created through issuance of the ITP and passed by Congress. For example, prior to issuance of the ITP and passage of the Omnibus Public Lands Management Act, the BLM had the ability to grant such rights-of way or easements under the Recreation and Public Purposes Act.

Although the BLM may argue that granting a right-of-way (ROW) or easement may be temporary, we assert that the direct loss of tortoises and habitat from these actions and the indirect impacts of further loss of tortoises and degradation of habitat beyond the footprint of these developments lasts for decades or longer. These impacts do not comply with the Omnibus Public Lands Management Act directive to "only allow uses of the NCA that the Secretary determines would further a purpose described in subsection (a)." These are "to conserve, protect, and enhance for the benefit and enjoyment of present and future generations the ecological, scenic, wildlife, recreational, cultural, historical, natural, educational, and scientific resources of the National Conservation Area; and to protect each species that is located in the National Conservation Area; and listed as a threatened or endangered species on the list of threatened species or the list of endangered species."

In addition, we believe the proposed actions violate the direction, spirit, and intent of Sections 2, 3, 7(a)(1),and 10(a)(1)(B) of the Federal Endangered Species Act (FESA) and section 4(f) of the Department of Transportation Act of 1966. Please provide an explanation of how all the proposed actions and action alternatives comply with these laws and the ITP.

In the Federal Register Notice of Intent (NOI), the BLM and USFWS (collectively = Agencies) listed four proposed actions they intend to describe and analyze in the draft environmental impact statement (DEIS). The four proposed actions are:

(1) Whether the BLM will approve a 1.75-mile ROW for the approximately 4-mile long Northern Corridor highway (herein "Northern Corridor") that crosses the 62,000-acre Red Cliffs Desert Reserve (Reserve) and the 45,000-acre congressionally established NCA;
(2) whether the BLM will amend the Red Cliffs NCA Resource Management Plan (RMP) to allow for a transportation ROW and/or corridor within the NCA;
(3) whether the BLM will amend the St. George Field Office RMP to modify management on approximately 6,800 acres outside the Reserve and NCA to offset the ROW impacts; and
(4) whether the USFWS will issue an associated ITP for the Mojave desert tortoise for specific land use and land development activities in Washington County.

The Council requests that a new proposed action be included, which is to develop a solution to alleviate traffic flow in the St. George area without the Northern Corridor through the Reserve. As it is, except for the no action alternative, all alternatives would accommodate the Northern Corridor through the Reserve, which we do not recognize as an adequate range of alternatives. We believe the Agencies narrowed the proposed action to analyze only the impacts of granting one specific ROW in one specific location. By adding a fifth, broader proposed action, a unique alternative to granting a ROW for a highway and a specific location would be developed.

For example, we are aware that in earlier discussions, a route was identified that would run from Washington Parkway, north up to Ice House/Mustang Pass area, across Broken Mesa rim, and over to SR18. Why is this not included as an alternative? This route would take the Northern Corridor directly north to high elevation areas and would not bisect the high density tortoise areas, as the preferred and alternative routes currently do. Although *the Council does not believe that any routes should be developed through the Reserve*, we reservedly admit that this alternative would be better than any of the others the Agencies are proposing.

We request that the National Environmental Policy Act (NEPA) document broaden its proposed action and include other reasonable courses of actions (40 CFR 1508.25) including mitigation measures not in the proposed actions published in the NOI.

Pursuant to Section 1508.25 of the Council on Environmental Quality's (CEQ) regulations (40 CFR 1508.25), any DEIS must cover the entire scope of a proposed action, considering all connected, cumulative, and similar actions in one document. Pursuant to Section 1506.1(a) of these regulations, agency action cannot "[l]imit the choice of reasonable alternatives before reaching a final decision in a published [Record of Decision] ROD." These regulations ensure agencies will prepare a complete environmental analysis that results in a "hard look" at the environmental consequences of all proposed actions instead of segmenting environmental reviews (Novack 2015).

Based on the information in the NOI, the Council believes that the Agencies have artificially narrowed the proposed actions to segment their environmental analysis so the only choice is to issue authorizations to UDOT (agent for the Federal Highway Administration - FHWA) to locate a highway in Zone 3 of the Reserve/NCA or to not authorize. This limitation removes alternatives that would be less damaging to the environment and potentially more cost effective. The identified proposed actions for the NEPA document do not consider "all connected, cumulative, and similar actions." Please refer to the information we provided in the Pre-decisional Planning Decisions, Alternatives to the Northern Corridor, and Precedent-setting Action sections. We request that the Agencies prepare a NEPA document that includes all connected, cumulative, and similar actions including the Washington Parkway, and alternatives to the Northern Corridor that would be less damaging to the environment.

Pre-decisional Planning Decisions

• The Council is concerned that Utah Department of Transportation (UDOT) has already begun to construct the Washington Parkway from the east up to the eastern boundary of the Red Cliffs Reserve/National Conservation Area ("Reserve/NCA"), which is construed as a pre-decisional planning effort that presumes development of the Northern Corridor before three other planning documents, including two RMPs and the habitat conservation plan (HCP) have been considered by the public and finalized. In the absence of the Northern Corridor, there would be no need for the dead-end Washington Parkway development project, and we are concerned that the regulatory agencies have already decided that the Northern Corridor would be developed regardless of violating existing agreements and public input into the planning process and decisions; otherwise the Washington Parkway would not be developed. The Council believe this pre-decisional action is a violation of NEPA and other federal statutes, and this issue should be address in the NEPA document.

• Given the above concerns, we disagree with the statement on page 1 of UDOT's Draft Plan of Development (UDOT 2019) that "The Northern Corridor (UDOT project number SR499(324)) and Washington Parkway (Green Spring Drive to I-15) (UDOT project number FR499(326)) are separate projects in the Statewide Transportation Improvement Program (STIP) (UDOT 2018a;" see UDOT 2019 for references stated therein). *But for* the Northern Corridor, there would be no need for the Washington Parkway to be constructed. We also contend that development of the Washington Parkway on private lands does not necessitate development of the Northern Corridor on public lands, particularly since those BLM lands are already identified for protection and conservation of tortoises *in perpetuity* by the Washington County HCP and existing RMPs.

<u>Alternatives to the Northern Corridor</u>
The Council presumes that if the UDOT as an agent of the FHWA decides to construct and maintain the Northern Corridor, a separate NEPA document will be prepared that describes the proposed action (to improve the flow of traffic), various alternatives, and the impacts from implementation of each alternative. For example, when the BLM has been asked by other federal agencies to grant a ROW across BLM land for construction and operation of linear features or utilities, a description of that linear feature or utility is included in the BLM's NEPA document along with various alternatives to the preferred alternative. The Council requests that the BLM provide this information for the Northern Corridor and alternatives to this highway.

The Council contends that the BLM with UDOT/FHWA have an obligation to develop and analyze other viable alternatives to granting the ROW for the Northern Corridor. To support this contention, we note that a federal appellate court has previously ruled that in its EIS the BLM must evaluate a reasonable range of alternatives to the project including other sites, and must give adequate consideration to the public's needs and objectives in balancing ecological protection with the purpose of the proposed project, along with adequately addressing the proposed project's impacts on the desert's sensitive ecological system (National Parks & Conservation Association v. Bureau of Land Management, Ninth Cir. Dkt Nos. 05-56814 et seq. (11/10/09). Therefore, the Council requests that the BLM develop and analyze other viable alternatives in addition to granting the ROW for the Northern Corridor, that is "other reasonable courses of actions" (40 CFR 1508.25).

The alternatives analysis should include an economic analysis that provides the total cost of constructing the Northern Corridor versus other alternatives, so the public can see how much the total cost of each alternative is. This would include an analysis of the costs of replacing all public resources that would be lost from granting the ROW for the development of the proposed Northern Corridor including direct, indirect, and cumulative impacts. Please note, this analysis would include replacement or creation costs including the time needed to achieve full replacement, not just acquisition, management, monitoring, and adaptive management costs. Included in this economic analysis would be the cost of acquiring land sufficient to replace the reserve design configuration and connectivity needs that would be lost or substantially degraded from the Northern Corridor dissecting Zone 3. In addition, it would include the costs of increasing the Mojave desert tortoise and other wildlife species to the numbers, densities, and ages that occur on the Northern Corridor ROW and road effect zone in addition to the existing densities at the new location.

Compliance with Section 4(f) of the Department of Transportation Act of 1966

Please provide an analysis of how granting a ROW or permit for the construction, maintenance, and use of the Northern Corridor complies with this law. According to the Handbook on Departmental Review of Section 4(f) Evaluations (DOI 2014), Section 4(f) protects publicly owned parks, recreation areas, and wildlife and waterfowl refuges of national, state, or local significance and historic sites of national state, or local significance from use by transportation projects. These include "Areas publicly owned in fee, less than fee, lease, or otherwise, that receive *de facto* use as park, recreation, or refuge lands (DOI 2014). "These properties may only be used if there is no prudent or feasible alternative for their use and the program or project encompasses all possible planning to minimize harm resulting from its use." The Council believes that alternatives are available including widening existing roadways, highways, and/or freeways; timing lights, minimizing access points (e.g. cross streets) to roadways/parkways providing better public transportation, and others, and in various combinations; and that the program has not encompassed all possible planning to minimize harm (please see Alternatives to the Northern Corridor section above). In addition, from the information provided on impacts to the Mojave desert tortoise, we believe this information clearly shows the granting of the ROW and subsequent construction, use, and maintenance of the Northern Corridor would not qualify for a *de minmis* determination.

Description of Each Alternative

Please explain how the alternatives presented comply with Section 1974, Red Cliffs National Conservation Area and Section 1979, Management of Priority Biological Areas of the Omnibus Public Lands Management Act of 2009. Specifically, how each alternative complies with the all of following requirements of this legislation:

Section 1974:

- The Secretary shall manage the National Conservation Area in a manner that conserves, protects, and enhances the resources of the National Conservation Area; and in accordance with the Federal Land Policy and Management Act of 1976.
- The Secretary shall only allow uses of the National Conservation Area that the Secretary determines would further a purpose described in subsection (a). These are "to conserve, protect, and enhance for the benefit and enjoyment of present and future generations the ecological, scenic, wildlife, recreational, cultural, historical, natural, educational, and scientific resources of the National Conservation Area; and to protect each species that is located in the National Conservation Area; and listed as a threatened or endangered species on the list of threatened species or the list of endangered species published under section 4(c)(1) of the Endangered Species Act of 1973."

- “Except in cases in which motorized vehicles are needed for administrative purposes, or to respond to an emergency, the use of motorized vehicles in the National Conservation Area shall be permitted only on roads designated by the management plan for the use of motorized vehicles. Management plan is defined as the management plan for the National Conservation Area developed by the Secretary under subsection (d)(1). Subsection (d)(1) says “Not later than 3 years after the date of enactment of this Act [2009] and in accordance with paragraph (2) [Consultation with State, tribal and local entities and the public], the Secretary shall develop a comprehensive plan for the long-term management of the National Conservation Area.”

Section 1979:
“(a) In accordance with applicable federal laws (including regulations), the Secretary of the Interior shall

- identify areas located in the County where biological conservation is a priority; and
- undertake activities to conserve and restore plant and animal species and natural communities within such areas.

“(b) In carrying out subsection (a), the Secretary of the Interior may make grants to, or enter into cooperative agreements with, State, tribal, and local governmental entities and private entities to conduct research, develop scientific analyses, and carry out any other initiative relating to the restoration or conservation of the areas.”

We note that section 1977, Washington County Comprehensive Travel and Transportation Management Plan of the Omnibus Public Lands Management Act of 2009 states that:

- “In developing the travel management plan, the Secretary shall (A) in consultation with appropriate federal agencies, State, tribal, and local governmental entities (including the County and St. George City, Utah), and the public, identify one or more alternatives for a northern transportation route in the County.”

We request that this section explain that the legislation requires the BLM to identify one or more alternatives. It does not require the granting of a ROW to implement an identified alternative. In addition, it does not dismiss compliance with sections 1974, 1979, or compliance with federal environmental legislation such as NEPA or FESA.

Affected Environment Section of the NEPA Document
The Affected Environment and the Environmental Consequences sections of the NEPA document are key to demonstrating that the action alternatives proposed comply with Sections 1974 and 1979 of the Omnibus Public Lands Management Act of 2009 for the Mojave desert tortoise and other special status species. We request that the NEPA document provide an analysis of how the current and future status of these species and their habitats including linkage habitats to other populations would change with implementation of each action alternative and how this would affect their survival and future conservation/recovery.

Surveys for Flora and Fauna – For the DEIS to fully assess the effects and identify potentially significant impacts including cumulative impacts, surveys should be performed by qualified biologists to determine the extent of rare plant and animal populations occurring within the area that will be affected both directly and indirectly by the proposed actions. Specifically, formal protocol surveys for the Mojave desert tortoise (USFWS 2018) must be conducted at the proper times of year. This information should be included in the NEPA document.

The results of these surveys will help the Agencies conduct and present a thorough analysis in the DEIS of direct, indirect, and cumulative impacts, and develop and implement effective mitigation (avoiding, minimizing, rectifying, reducing, ,and compensating) (40 CFR 1508.20), monitoring, and adaptive management for all impacts. This thorough analysis and mitigation, monitoring, and adaptive management should be included in the NEPA document.

Status of the Mojave Desert Tortoise – Please see Appendix A on the *Status of the Mojave Desert Tortoise (Gopherus agassizii).* As part of the best available science, we expect that the Agencies will use this information when describing the Affected Environment for the tortoise and the Red Cliffs Desert population in the NEPA document.

The recognition of *G. morafkai* reduces the range of *G. agassizii* to occupying about 30% of its former range. Given drastic population declines in *G. agassizii* during the past few decades, it might be endangered.

Environmental Consequences
The NEPA document should include an analysis of impacts to Mojave desert tortoise at the population (Red Cliffs Desert), recovery unit (Upper Virgin River), and species levels for the following stressors:

Direct Impacts of the Northern Corridor
• With regards to the following statement on page 1 of UDOT (2019), "At full build out, the roadway would be an approximately 4.5-mile-long, four-lane divided highway with two 12-foot wide travel lanes in each direction. Other features would include a median, drainage swales, bicycle and pedestrian trails, and associated signage," we note that there are no provisions for either underground or aboveground linear facilities in the project description. We assume that this is an intentional statement and that UDOT or other proponents, like Washington County, will not have the latitude to amend the project description if the Northern Corridor is developed. We ask that the project description clearly state that no additional development features other than those described herein can be added to the Northern Corridor at a later date.

• It is our concern that the following impacts will result with construction of the Northern Corridor, and *but for* this construction, the Reserve would not be subject to elevated levels of these impacts. We ask that the NEPA document fully assess the following direct, indirect, and growth-inducing impacts to the tortoise and other wildlife species that will predictably result by granting the ROW for the Northern Corridor and the construction, use, and maintenance of the new freeway:

- Result in direct mortality of tortoises during construction, use, and maintenance.
- Introduce construction activities into a dedicated Reserve area.
- Fragment high density tortoise habitats.
- Result in the outright loss and adverse modification of critical habitat for the desert tortoise that is not in a designated take area.
- Impair efficacy of an already minimally-sized reserve and introduce adverse effects to the tortoise population (e.g., creating an island of habitat and an "island population") that isolates them from adjacent/nearby populations.

- Undermine population viability of the Red Cliffs Desert population of the tortoise in the Upper Virgin River Recovery Unit.
- Degrade high density tortoise habitats that would not otherwise be disturbed.
- Introduce and spread non-native invasive plant species.
- Reduce native annual forbs that are necessary for adequate tortoise nutrition, health, reproduction, and recruitment.
- Increase risk of fire, which has already decimated tortoise populations in the Reserve.
- Increase predation of tortoises by common ravens and canids.
- Introduce impacts of the road effect zone, including deterioration/loss of wildlife habitat, hydrology, geomorphology, and air quality; increased competition and predation, including by humans; and the loss of naturalness or pristine qualities.
- Possibly promote disease and impair tortoise health by introducing chemicals associated with vehicles.
- Increase noise from construction/maintenance vehicles and equipment and introduce use of the Northern Corridor by the public (including future increases in use) and its effects on desert tortoise behavior (e.g., movements, seeking mates, foraging bouts, ability to detect predators, etc.).
- Increase human access to Reserve areas that would result in increased poaching and vandalism of tortoises.
- Promote growth-inducing impacts, including how the proposed actions, including the construction, use, and maintenance of the Northern Corridor, may directly or indirectly foster economic or human population growth (e.g., the construction of additional housing, businesses, etc.) in the surrounding/nearby environment in the future, and the safeguards that would prevent this access and development with respect to the tortoise and tortoise habitat.
- Result in impacts from climate change. For example, the proposed Northern Corridor would promote the use of more vehicles in natural areas, resulting in a larger carbon footprint within the Reserve. This would impact the tortoise by favoring the further spread of nonnative invasive plants and increasing the frequency, spatial extent, and severity of wildfires. Alteration of temperature and precipitation patterns as a result of climate change would result in decreased survivorship of the Mojave desert tortoise by causing physiological stress on the animals and increased mortality and reducing reproduction and recruitment.
- Promote impacts from a combination of threats. Combinations of threats working synergistically with one another have the ability to negatively impact species to a greater degree than individual threats operating alone. Multiple stressors can alter the effects of other stressors or act synergistically to affect individuals and populations.

The threats analysis should document whether the combination of threats will exacerbate the overall degree of impacts that threaten the continued survival and recovery of the tortoise in the Upper Virgin Recovery Unit and Red Cliffs Desert population.

<u>Zone 6 Management</u>

• The NEPA document needs to analyze the validity of the following statement: Since the tortoises in Zone 6 are already protected under the FESA and existing HCP, and much of the area is within the existing BLM Red Bluffs Area of Critical Environmental Concern (ACEC), adding Zone 6 to the Reserve will not substantially increase tangible tortoise protection or effectively mitigate for the loss and fragmentation of tortoise habitat in the core Reserve encompassed by Zone 3.

• Given the above statements, in its environmental documentation, the BLM must describe current management of the Red Bluffs ACEC. What tortoise studies have been completed and what are the results? In keeping with BLM's mandate for ACEC management, how has it been proactively managed for desert tortoises so far? How does BLM propose to manage it differently, in such a way that is supersedes current management sufficient to offset impacts associated with the Northern Corridor? Since about 40% of the proposed Zone 6 area is owned by State of Utah School and Institutional and Trust Lands Administration (SITLA), how does BLM propose to implement management on these non-public lands that are not under its jurisdiction? Given that the BLM is already mandated to protect the Red Bluffs ACEC, how is newly designating it as part of the Red Cliffs Reserve/NCA, in name only, going to offset impacts associated with the Northern Corridor?

• With regards to the following statement in the Federal Register Notice (dated 12/5/2019), "Specifically, the County has proposed creating a new habitat Zone 6 in the Reserve to provide additional desert tortoise habitat and to offset habitat loss potentially occurring from a ROW," we take exception to the phrase "…to provide additional desert tortoise habitat…" These cannot be construed as "additional habitats" because they are "existing habitats," and most importantly, they are already being managed by the BLM in the Red Bluffs ACEC. Given this assumption, we ask that the NEPA document provide tangible evidence that BLM has been managing the Red Bluffs ACEC for tortoise conservation and recovery. How many citations for noncompliance issues like cross-country vehicle travel and illegal target practice have been issued in the ACEC by BLM rangers? How many monitoring studies, including focal tortoise surveys, have been implemented by the BLM or other entities? Has there been any vertical mulching or other methods employed to close redundant routes within the Red Bluffs ACEC?

• On page 49 of the USFWS 1994 Recovery Plan (USFWS 1994a), it states that "Blocks of habitat that are roadless or otherwise inaccessible to humans are better than blocks containing roads and habitat blocks easily accessible to humans." Does the BLM plan to eliminate all roads from the proposed Zone 6 management area? Since the proposal seems to be that Zone 6 would constitute an enlargement of the Reserve, would not all roads in Zone 6 need to be eliminated to achieve Reserve-level management? There are currently organized recreational events in the Zone 6 area. Would these be allowed under the new Reserve-level management or eliminated as they have been from the existing Reserve?

• It is our understanding that there is a statewide championship dirt bike event in Zone 6 that county officials have said would not be affected by tortoise management of Zone 6. We are not sure if this is true and what other measures would be allowed on BLM and State lands in Zone 6 if nominally converted to Red Cliffs Reserve (expansion). The NEPA documents must clarify what future uses of Zone 6 would be allowed and prohibited, and analyze how these uses would strengthen and weaken proactive, mandated management of ACECs by the BLM. We ask that the environmental documents list incompatible uses that would be prohibited in perpetuity from both the current Reserve and Zone 6 lands.

• We understand that there is currently grazing on some of the BLM lands that would be included in the proposed Zone 6 management area. Would grazing continue or, similar to the management of the Red Cliffs NCA, would grazing rights be purchased and cattle removed? There is no evidence that grazing is compatible with desert tortoise recovery and, further, grazing is associated with habitat degradation including soil compaction, loss of vegetation diversity, and increase in noxious weeds.

• We are concerned that the BLM has segmented management of the Red Bluffs ACEC by cutting it in half so that a "Western Corridor" can be accommodated through the middle of the ACEC. We contend that if the BLM were sincere about offsetting (i.e., fully mitigating) the impacts of the Northern Corridor on the existing Reserve, that it would not bisect the Red Bluffs ACEC so that only approximately the eastern half of the ACEC would be managed as a satellite reserve to the main, existing Reserve; rather the entire Red Bluffs ACEC would be re-designated as the Red Cliffs Reserve/NCA.

• At the very least, in its cumulative effects analysis, the BLM must reveal its intent to allow another highway through the Red Bluffs ACEC, which it ostensibly proposes to protect in the current planning effort. The BLM must also analyze how this new Western Corridor with its indirect effects similar to those of the Northern Corridor, will undermine the efficacy of establishing the new Red Cliffs Reserve/NCA on the Zone 6 lands.

• If the BLM is successful in curtailing impacts on Zone 6 lands, we are concerned that these displaced recreational activities, including unacceptable cross-country vehicle use and shooting in the existing eastern half of the Red Bluffs ACEC, will predictably be displaced onto the western parts of the ACEC. The BLM must consider this displaced impact and commit to environmental monitoring that will allow future management of the entire Red Bluffs ACEC, particularly western areas, to ensure these areas are not adversely affected by prohibiting and redirecting current uses in the Zone 6 area to the west.

• We ask that the NEPA documents address the following concerns. Zone 3 encompassing the Red Cliffs Reserve has ostensibly (until now) served to compensate for the loss of thousands of acres of tortoise habitat and displacement of about 500 tortoises. That being the case, we believe that construction of the Northern Corridor would undermine the conservation balance achieved over the past 24 years. The Council contends that construction of this new highway would create new impacts and threats that cannot be mitigated by managing Zone 6, which is neither contiguous nor sufficiently large to contribute to tortoise conservation in the existing Reserve. New impacts within the already-impacted Reserve would predictably include increased predation on tortoises as predators are attracted to road-killed animals; increased weed species and a concomitant increase in the number of wildfires; unacceptable additional habitat fragmentation to a Reserve area that is already too small (see reserve design discussion in the 1994 Recovery Plan); indirect impacts that degrade habitats out to 4,000 meters from the roadside (von Seckendorff Hoff and Marlow 2002). The construction of this new highway through the dedicated Reserve will have the adverse effects given above to a population of tortoises that has already undergone a 41% decline in numbers.

• If the Northern Corridor is developed, to offset impacts, all lands within the Red Bluffs ACEC, including Zone 6 lands that are not currently designated as tortoise critical habitat, should be newly designated as critical habitat.

<u>Cumulative Impacts Analysis</u>
The CEQ (1997) states "Determining the cumulative environmental consequences of an action requires delineating the cause-and-effect relationships between the multiple actions and the resources, ecosystems, and human communities of concern. The range of actions that must be considered includes not only the project proposal but all connected and similar actions that could contribute to cumulative effects." The analysis "must describe the response of the resource to this environmental change." Cumulative impact analysis should "address the sustainability of resources, ecosystems, and human communities."

The CEQ issued a document to help agencies in their preparation of cumulative impacts analysis. It contains eight principles of cumulative impacts analysis (CEQ 1997, Table 1-2). These are as follows and must be analyzed in all pertinent NEPA documents:

1. Cumulative effects are caused by the aggregate of past, present, and reasonable future actions.
The effects of a proposed action on a given resource, ecosystem, and human community, include the present and future effects added to the effects that have taken place in the past. Such cumulative effects must also be added to the effects (past, present, and future) caused by all other actions that affect the same resource.

2. Cumulative effects are the total effect, including both direct and indirect effects, on a given resource, ecosystem, and human community of all actions taken, no matter who (federal, non-federal, or private) has taken the actions.
Individual effects from disparate activities may add up or interact to cause additional effects not apparent when looking at the individual effect at one time. The additional effects contributed by actions unrelated to the proposed action must be included in the analysis of cumulative effects.

3. Cumulative effects need to be analyzed in terms of the specific resource, ecosystem, and human community being affected.
Environmental effects are often evaluated from the perspective of the proposed action. Analyzing cumulative effects requires focusing on the resources, ecosystem, and human community that may be affected and developing an adequate understanding of how the resources are susceptible to effects.

4. It is not practical to analyze the cumulative effects of an action on the universe; the list of environmental effects must focus on those that are truly meaningful.
For cumulative effects analysis to help the decision maker and inform interested parties, it must be limited through scoping to effects that can be evaluated meaningfully. The boundaries for evaluating cumulative effects should be expanded to the point at which the resource is no longer affected significantly or the effects are no longer of interest to the affected parties.

5. Cumulative effects on a given resource, ecosystem, and human community are rarely aligned with political or administrative boundaries.
Resources are typically demarcated according to agency responsibilities, county lines, grazing allotments, or other administrative boundaries. Because natural and sociocultural resources are not usually so aligned, each political entity actually manages only a piece of the affected resource or ecosystem. Cumulative effects analysis on natural systems must use natural ecological boundaries and analysis of human communities must use actual sociocultural boundaries to ensure including all effects.

6. Cumulative effects may result from the accumulation of similar effects or the synergistic interaction of different effects.
Repeated actions may cause effects to build up through simple addition (more and more of the same type of effect), and the same or different actions may produce effects that interact to produce cumulative effects greater than the sum of the effects.

7. Cumulative effects may last for many years beyond the life of the action that caused the effects.

Some actions cause damage lasting far longer than the life of the action itself (e.g., acid mine damage, radioactive waste contamination, species extinctions). Cumulative effects analysis needs to apply the best science and forecasting techniques to assess potential catastrophic consequences in the future.

8. Each affected resource, ecosystem, and human community must be analyzed in terms of its capacity to accommodate additional effects, based on its own time and space parameters.

Analysts tend to think in terms of how the resource, ecosystem, and human community will be modified given the action's development needs. The most effective cumulative effects analysis focuses on what is needed to ensure long-term productivity or sustainability of the resource.

In addition, CEQ (1997) states, "The consequences of human activities will vary from those that were predicted and mitigated." "[M]onitoring for accuracy of predictions and the success of mitigation measures is critical." "Adaptive management provides the opportunity to combine monitoring and decision making in a way that will ensure protection of the environment and societal goals."

We expect that the DEIS will (1) include an analysis of impacts in addition to a description of the impacts; (2) include these eight principles in its analysis of cumulative impacts to the Mojave desert tortoise; (3) address the sustainability of the tortoise in the Upper Virgin River Recovery Unit and Red Cliffs Desert population given the information in Appendix A; and (4) include a mitigation plan along with monitoring and adaptive management for all direct, indirect, and cumulative impacts to the desert tortoise and their habitats.

<u>Mitigation</u>

The NEPA document should include a mitigation plan that will be implemented to fully offset the direct, indirect, combination of, and cumulative impacts from the proposed actions (please see <u>Direct Impacts of the Northern Corridor</u> section above), and include monitoring and adaptive management to ensure that the mitigation is effective and modified if it is not. It should provide funding assurances that the mitigation plan will be fully funded. The mitigation plan should use the best available science in its development and implementation. It should include a commitment to implement mitigation that is commensurate with or in advance of the impacts to the tortoise and its habitats.

The Council would like to emphasize that compensation lands for the tortoise should be acquired, improved, and restored in perpetuity (i.e., permanent conservation easement, etc.) from future development and human use, include appropriate buffers, and include a plan to protect in perpetuity tortoise translocation area(s) from future development and human use with appropriate buffers. In addition, the compensation plan should include a plan to acquire and manage another block of habitat (=compensation lands) if stressors such as climate change affect the tortoise compensation land such that the land is no longer providing suitable conditions for perpetuating a tortoise population.

Previous Planning and Current Management Documentation

• It is our understanding that both BLM and USFWS have in previous planning efforts denied ROW authorization for the Northern Corridor, but given the long history, the Council is not clear on the extent of these previous decisions. So, we ask that the NEPA documentation fully disclose all previous decisions denying development of the Northern Corridor and the reasons for those decisions.

• There seems to be a widespread miscommunication that tortoises in southern Utah were translocated there, are therefore not native, and therefore do not warrant protection. We ask that the NEPA documents specifically address this issue and consider the final rule that listed the desert tortoise population found north and west of the Colorado River as threatened (USFWS 1990). We ask that the following three literature sources, which we believe show that tortoises are native to the area, be reviewed and included in the discussion: Lamb *et al*. 1989, Murphy *et al*. 2007, and Sánchez-Ramírez *et al*. 2018.

Federal Register Notice – Intent of Scoping Process

• With regards to the Federal Register Notice, it makes the following statements: "The purpose of the public scoping process is to identify relevant subject areas that will influence the scope of the environmental analysis, including potential alternatives, and guide the process for developing the EIS. At present, the BLM and USFWS have identified the following preliminary subject areas: (a) Impacts to threatened and endangered species, including the federally listed Mojave desert tortoise; and, (b) impacts to the mitigation for the 1995 HCP." We ask that the following questions be addressed in NEPA documents:

(a) "Impacts to threatened and endangered species, including the federally listed Mojave desert tortoise:"

• Given that indirect impacts associated with highways may extend out to 4,000 meters either side of the highway (von Seckendorff Hoff and Marlow 2002), how does BLM and USFWS intend to avoid such documented indirect impacts associated with both the Northern Corridor and Western Corridor; the latter of which is being accommodated by bisecting the Red Bluffs ACEC in the proposed action? The NEPA documents must fully disclose vehicle impacts associated with roads and particularly highways. We expect that the literature given in Appendix B, which represents the best available science, will be included and specifically considered in the NEPA analysis.

• Between 1998 and 2003 there was a 41% reduction in tortoise numbers within the Reserve (McLuckie et al. 2012) largely due to fire; depredation by common ravens is increasing within the Reserve; there are problem areas associated with infestations of non-native plants; and there continue to be documented cases of poaching within the Reserve. And, importantly, these impacts have occurred in spite of reserve-level management by the BLM and Washington County. We know that 14,624 acres of habitats have recently burned on the Reserve, including 25 percent of the tortoise critical habitat therein (McLuckie et al. 2012). Raven depredation, introducing weed species, poaching, and wildfire are indirect impacts that are likely to increase in response to Northern Corridor construction, and must be analyzed and mitigations identified in NEPA documents. Please be sure that the NEPA documents fully disclose these impacts and, where possible, particularly for wildfires, map the locations of these impacts relative to known tortoise densities. Please superimpose the location of the proposed Northern Corridor relative to the wildfire footprint, existing tortoise densities, habitats to the north that are not deemed suitable for tortoises, etc. so that we can see the full extent and juxtaposition of the proposed Northern Corridor to these sustained and impacted tortoise densities.

(b) "Impacts to the mitigation for the 1995 HCP;" NEPA and other environmental documents must disclose:

• How many tortoises have been displaced and how many acres of tortoise-occupied and unoccupied habitats have been developed under the existing HCP/ITP? What are the take limits of tortoises and the number of acres that were authorized to be lost under the HCP/ITP? After revealing these statistics, please show a frequency distribution of the numbers of tortoises taken and the numbers of acres developed on a yearly basis, beginning in 1996 and extending to 2019. Are there certain years in which development has proceeded at elevated rates compared to years with relatively little development? Is there a documented elevated rate in the past 10 years, for example, that would justify the need to increase either the tortoise take limit or level of habitat loss? Were relatively more tortoises displaced in any given year or periods thereof? For example, has development in the past 10 years displaced as many tortoises as were displaced in the first 10 years of take authorization?

• As a subset of and in addition to the above analyses, please answer all the same questions for loss of tortoises and habitats from areas designated in 1994 as tortoise critical habitat (USFWS 1994b). What proportion of displaced tortoises and loss of occupied habitats has occurred in critical habitats compared to habitats outside critical habitat areas?

• In California where tortoises densities per unit area are significantly lower than those in southern Utah, the BLM standard for habitat compensation is 5:1; that is, for every acre of critical habitat developed, the proponent is required to replace the loss with five acres of lands managed in perpetuity (like was intended for the Red Cliffs Reserve). Now, given the acreage of critical habitat developed in Washington County, which would be determined in the above analysis, and the proposal to protect 6,685 acres in Zone 6, what is the ratio of loss of critical habitat to the protection of each of the 6,685 acres? Of the total amount of critical habitat that could be developed under the 1995 HCP, how much has been developed, how much more could be developed, and what are the ratios of lost critical habitat to protection of the 6,685 acres in Zone 6?

• Given the substantial declines in tortoises throughout the listed range, excepting the Northeast Mojave (Allison and McLuckie 2018), we believe that the BLM in Utah must apply, at a minimum, the standards set by other BLM offices within the listed range. Therefore, the 5:1 ratio of lost critical habitat to acquired habitat is a realistic standard to which this project must be held.

• The Council contends that the development of the Northern Corridor through the Reserve is an unforeseen event that must be addressed in the revised/renewed HCP and ITP in terms of the conservation balance that was achieved with take authorization in 1995. Equally important, we believe that the significant, ubiquitous declines in tortoises throughout the range in all but the Northeastern Mojave (Allison and McLuckie 2018) also constitutes an unforeseen event relative to the 1995 take authorization. Given these unexpected declines, the USFWS must convincingly document how the Northern Corridor, which *but for* these new planning efforts is an avoidable impact, does not undermine the regional conservation of tortoises, taking into account the numbers of tortoises displaced and the amounts of habitats lost, including critical habitat. Establishing the Reserve was judged to be sufficient to offset the displacement of tortoises and loss of habitats; so, how is allowing a new freeway through the Reserve not compromising that balanced conservation agreement?

• It is our understanding that 485 tortoises have been translocated into Zone 4 since 1999, which should be clarified in NEPA documents. We have also been told that, in the past year, 34 tortoises have been moved off the new Lakes development between St George and Zone 6 lands, and placed onto Zone 6 lands. As with earlier comments, we feel that the decision to move tortoises to Zone 6, which has yet to be codified as a satellite reserve to Red Cliffs Reserve, rather than Zone 4, which is the acceptable method under the existing HCP/ITP, is pre-decisional and demonstrates that, regardless of our input, the regulatory agencies and other local planning entities have already decided to construct the Northern Corridor in spite of any new evidence the public can provide.

• We also understand that the original incidental take limit was set at 1,169 tortoises, meaning that 1,169 tortoises may be taken (i.e., harassed, harmed, displaced, accidentally killed, etc. during otherwise authorized activities). We are relying on the NEPA documents to clarify the actual number, but, for sake of argument, if only about 520 tortoises have been taken under the existing ITP authorization in the last 20 years, this means that there remain approximately 650 tortoises that may still be taken under the existing authorization. Using actual numbers, may we assume that the take limit in the renewed ITP would remain the same? That there would be no need to increase the numbers of tortoises that may be taken?

• Given the above scenario and our understanding of the HCP and attendant ITP, there are both conservation areas (e.g. Red Cliffs Reserve) and 300,000 acres of designated incidental take areas, the latter of which include lands from which tortoises may be taken. But the two do not overlap. If the Northern Corridor is to be approved and tortoises are to be taken within the Reserve, under what authority can this take occur? We note that the Reserve is not a designated take area, that its expressed function is to conserve tortoises. So, how will take within the Reserve be authorized under the renewed ITP? Will this project result in the precedent of authorizing take from the very areas that are supposed to be conserved?

• In reviewing the best available science, the Council does not believe that establishing a 6,685-acre satellite reserve in Zone 6 that is physically separated from the actual Reserve in any way offsets direct and especially indirect impacts of the Northern Corridor within the actual Reserve or the planned-for Western Corridor on Zone 6 lands. To evaluate this contention, we ask that the NEPA document: (1) Consider reserve design as proposed in the original desert tortoise recovery plan (USFWS 1994a), which states that a minimum reserve would be 1,000 square miles (see page 34). What are the edge effects in creating this small reserve, sink effects that would be introduced to the actual Reserve by constructing the Northern Corridor, and how one realistically compensates for the other? (2) What is the current management of the Zone 6 lands within the context of BLM management of this existing ACEC; how changing the name would somehow enhance this management; and what new management prescriptions, over and above those already mandated, would be applied? (3) How will BLM management prescriptions be applied to SITLA lands, over which BLM has no management authority? Will BLM funding be applied to private land management of SITLA lands? Will SITLA lands be actively purchased, transferred to the BLM, and be subsequently managed as an ACEC? If not, how can ACEC management be applied to private lands?

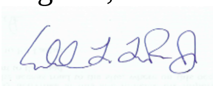
In conclusion, lost habitats and displaced tortoises from HCP-authorized development activities were considered allowable based on the understanding that protected and acquired habitats within the Reserve would be conserved. The Council finds that construction of a new highway through a conservation area whose function it is to offset tortoise losses attributed to authorized activities is counterintuitive and counterproductive; it violates the intent of the federal take permit and undermines the efficacy of conservation within the Reserve. A new highway through the Reserve was not a foreseen event in the federal take permit, so development of a new highway through the Reserve violates the premise of the HCP.

Based on available evidence, the existing HCP with a renewed deadline would be all that is needed to accommodate foreseeable urban growth in Washington County. We believe that the HCP has not been renewed since its expiration in 2015 in order to allow county governments and others to pursue a "creative solution" that would compromise the existing HCP by allowing construction of the Northern Corridor. The creative solution turns out to be giving an existing conservation area (Red Bluffs ACEC) a new name (Red Cliffs Reserve #2) that would distract attention from the fact that the existing conservation area (Red Cliffs Reserve, Zone 3) can now be compromised by constructing a new freeway through it. If the USFWS issues a revised HCP and incidental take permit that does little more than allow construction of this new freeway, we believe that the intent of the FESA to conserve and recover tortoises has been violated and that any existing conservation under Section 10a of FESA will have been compromised.

We are concerned that the agencies have predetermined the acceptance of this new "solution" and that they are now, for the first time since 2015, willing to reissue the permit without the benefit, and eventually in spite of, public input. It seems as if the preferred alternative has already been decided; approval has already been granted; UDOT is already acting "as if" the Northern Corridor has been approved by constructing the Washington Parkway; and the Agencies are not considering alternatives (excepting the mandated No Action Alternative), so that all actionable alternatives would result in construction of this freeway.

We appreciate this opportunity to provide input, and trust that our comments demonstrate that there are no acceptable mitigation measures to offset this consistently denied freeway through an established Reserve. Herein, we ask that the Desert Tortoise Council be identified as an Affected Interest for this and all other BLM projects that may affect species of desert tortoises in Utah, and that any subsequent environmental documentation for this particular project is provided directly to us at the contact information listed above.

Regards,



Edward L. LaRue, Jr., M.S.
Desert Tortoise Council, Ecosystems Advisory Committee, Chairperson

Attachments – Appendices A & B

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Appendix A

Status of the Mojave Desert Tortoise (*Gopherus agassizii*)

To assist the Agencies with their analysis of the direct, indirect, and cumulative impacts of the proposed Project on the Mojave desert tortoise, we provide the following information on its status and trend.

The Council has serious concerns about direct, indirect, and cumulative sources of human mortality for the Mojave desert tortoise given the status and trend of the species range-wide, within each of the five recovery units, within the Tortoise Conservation Areas (TCAs) that comprise each recovery unit, and the Chuckwalla TCA. The Project is less than 6 miles from the Chuckwalla TCA and is located in tortoise habitat.

Densities of Adult Mojave Desert Tortoises: A few years after listing the Mojave desert tortoise under the Federal Endangered Species Act (FESA), the U.S. Fish and Wildlife Service (USFWS) published a Recovery Plan for the Mojave desert tortoise (USFWS 1994a). It contained a detailed population viability analysis. In this analysis, the minimum viable density of a Mojave desert tortoise population is 10 adult tortoises per $mile^2$ (3.9 adult tortoises per km^2). This assumed a male-female ratio of 1:1 (USFWS 1994a, page C25) and certain areas of habitat with most of these areas geographically linked by adjacent borders or corridors of suitable tortoise habitat. Populations of Mojave desert tortoises with densities below this amount are in danger of extinction (USFWS 1994a, page 32). The revised recovery plan (USFWS 2011) designated five recovery units for the Mojave desert tortoise that are intended to conserve genetic, behavioral, and morphological diversity necessary for the recovery of the entire listed species (Allison and McLuckie 2018).

Range-wide, densities of adult Mojave desert tortoises declined more than 32% between 2004 and 2014 (Table 1) (USFWS 2015). At the recovery unit level, between 2004 and 2014, densities of adult desert tortoise declined, on average, in every recovery unit except the Northeastern Mojave (Table 1). Adult densities in the Northeastern Mojave Recovery Unit increased 3.1% per year (SE = 4.3%), while the other four recovery units declined at different annual rates: Colorado Desert (4.5%, SE = 2.8%), Upper Virgin River (3.2%, SE = 2.0%), Eastern Mojave (11.2%, SE = 5.0%), and Western Mojave (7.1%, SE = 3.3%)(Allison and McLuckie 2018). However, the small area and low starting density of the tortoises in the Northeastern Mojave Recovery Unit (lowest density of all Recovery Units) resulted in a small overall increase in the number of adult tortoises by 2014 (Allison and McLuckie 2018). In contrast, the much larger areas of the Eastern Mojave, Western Mojave, and Colorado Desert recovery units, plus the higher estimated initial densities in these areas, explained much of the estimated total loss of adult tortoises since 2004 (Allison and McLuckie 2018).

At the population level, represented by tortoises in the TCAs, densities of 10 of 17 monitored populations of the Mojave desert tortoise declined from 26% to 64% and 11 have a density that is less than 3.9 adult tortoises per km^2 (USFWS 2015). The Chuckwalla population is near the proposed Project and has a population below the minimum viable density, and an 11-year declining trend (-37.4%)(USFWS 2015). We are concerned that the proposed Project would bring additional indirect and cumulative impacts to this population and its density and trend would further decline.

Population Data on Mojave Desert Tortoise: The Mojave desert tortoise was listed as threatened under the FESA in 1990. The listing was warranted because of ongoing population declines throughout the range of the tortoise from multiple human-caused activities. Since the listing, the status of the species has changed. Population numbers (abundance) and densities continue to decline substantially (please see Table 1).

Table 1. Summary of 10-year trend data for 5 Recovery Units and 17 Critical Habitat Units (CHU)/Tortoise Conservation Areas (TCA) for Agassiz's desert tortoise, *Gopherus agassizii* (=Mojave desert tortoise). The table includes the area of each Recovery Unit and Critical Habitat Unit (CHU)/Tortoise Conservation Area (TCA), percent of total habitat for each Recovery Unit and Critical Habitat Unit/Tortoise Conservation Areas, density (number of breeding adults/km^2 and standard errors = SE), and the percent change in population density between 2004-2014. Populations below the viable level of 3.9 breeding individuals/km^2 (10 breeding individuals per mi^2) (assumes a 1:1 sex ratio) and showing a decline from 2004 to 2014 are in red (USFWS 2015).

Recovery Unit Designated Critical Habitat Unit/Tortoise Conservation Area	Surveyed area (km^2)	% of total habitat area in Recovery Unit & CHU/TCA	2014 density/km^2 (SE)	% 10-year change (2004–2014)
Western Mojave, CA	**6,294**	**24.51**	**2.8 (1.0)**	**–50.7 decline**
Fremont-Kramer	2,347	9.14	2.6 (1.0)	–50.6 decline
Ord-Rodman	852	3.32	3.6 (1.4)	–56.5 decline
Superior-Cronese	3,094	12.05	2.4 (0.9)	–61.5 decline
Colorado Desert, CA	**11,663**	**45.42**	**4.0 (1.4)**	**–36.25 decline**
Chocolate Mtn AGR, CA	713	2.78	7.2 (2.8)	–29.77 decline
Chuckwalla, CA	2,818	10.97	3.3 (1.3)	–37.43 decline
Chemehuevi, CA	3,763	14.65	2.8 (1.1)	–64.70 decline
Fenner, CA	1,782	6.94	4.8 (1.9)	–52.86 decline
Joshua Tree, CA	1,152	4.49	3.7 (1.5)	+178.62 increase
Pinto Mtn, CA	508	1.98	2.4 (1.0)	–60.30 decline
Piute Valley, NV	927	3.61	5.3 (2.1)	+162.36 increase
Northeastern Mojave	**4,160**	**16.2**	**4.5 (1.9)**	**+325.62 increase**
Beaver Dam Slope, NV, UT, AZ	750	2.92	6.2 (2.4)	+370.33 increase
Coyote Spring, NV	960	3.74	4.0 (1.6)	+265.06 increase
Gold Butte, NV & AZ	1,607	6.26	2.7 (1.0)	+384.37 increase
Mormon Mesa, NV	844	3.29	6.4 (2.5)	+217.80 increase
Eastern Mojave, NV & CA	**3,446**	**13.42**	**1.9 (0.7)**	**–67.26 decline**
El Dorado Valley, NV	999	3.89	1.5 (0.6)	–61.14 decline
Ivanpah, CA	2,447	9.53	2.3 (0.9)	–56.05 decline
Upper Virgin River	**115**	**0.45**	**15.3 (6.0)**	**–26.57 decline**
Red Cliffs Desert	115	0.45	15.3 (6.0)	–26.57 decline
Total amount of land	**25,678**	**100.00**		**–32.18 decline**

Density Juvenile Mojave Desert Tortoises: Survey results indicate that the proportion of juvenile desert tortoises has been decreasing in all five recovery units since 2007 (Allison and McLuckie 2018). The probability of encountering a juvenile tortoise was consistently lowest in the Western Mojave Recovery Unit. Allison and McLuckie (2018) provided reasons for the decline in juvenile desert tortoises in all recovery units. These included decreased food availability for adult female tortoises resulting in reduced clutch size, decreased food availability resulting in increased mortality of juvenile tortoises, prey switching by coyotes from mammals to tortoises, and increased abundance of common ravens that typically prey on smaller desert tortoises.

Declining adult densities through 2014 have left the Western Mojave adult numbers at 49% (a 51% decline) and in the Eastern Mojave at 33% (a 67% decline) of their 2004 levels (Allison and McLuckie 2018, USFWS 2015). Such steep declines in the density of adults are only sustainable if there were suitably large improvements in reproduction and juvenile growth and survival. However, the proportion of juveniles has not increased anywhere in the range of the Mojave desert tortoise since 2007, and in the Western and Eastern Mojave recovery units the proportion of juveniles in 2014 declined to 91% (a 9 % decline) and 77% (a 23% decline) of their representation in 2004, respectively (Allison and McLuckie 2018).

Abundance of Mojave Desert Tortoises: Allison and McLuckie (2018) noted that because the area available to tortoises (i.e., tortoise habitat and linkage areas between habitats) is decreasing, trends in tortoise density no longer capture the magnitude of decreases in abundance. Hence, they reported on the change in abundance or numbers of the Mojave desert tortoises in each recovery unit (Table 2). They noted that these estimates in abundance are likely higher than actual numbers of tortoises and the changes in abundance (i.e., decrease in numbers) are likely lower than actual numbers because of their habitat calculation method. They used area estimates that removed only impervious surfaces created by development as cities in the desert expanded. They did not consider degradation and loss of habitat from other sources, such as the recent expansion of military operations (753.4 km^2 so far on Fort Irwin and the Marine Corps Air Ground Combat Center), intense or large scale fires (e.g., 576.2 km^2 of critical habitat that burned in 2005), development of utility-scale solar facilities (so far 194 km^2 have been permitted) (USFWS 2016), or other sources of degradation or loss of habitat (e.g., recreation, mining, grazing, infrastructure, etc.). Thus, the declines in abundance of Mojave desert tortoise are likely greater than those reported in Table 2.

Table 2. Estimated change in abundance of adult Mojave desert tortoises in each recovery unit between 2004 and 2014 (Allison and McLuckie 2018). Decreases in abundance are in red.

Recovery Unit	Modeled Habitat (km^2)	2004 Abundance	2014 Abundance	Change in Abundance	Percent Change in Abundance
Western Mojave	23,139	131,540	64,871	-66,668	-51%
Colorado Desert	18,024	103,675	66,097	-37,578	-36%
Northeastern Mojave	10,664	12,610	46,701	34,091	270%
Eastern Mojave	16,061	75,342	24,664	-50,679	-67%
Upper Virgin River	613	13,226	10,010	-3,216	-24%
Total	**68,501**	**336,393**	**212,343**	**-124,050**	**-37%**

Habitat Availability: Data on population density or abundance does not indicate population viability. The area of protected habitat or reserves for the subject species is a crucial part of the viability analysis along with data on density, abundance, and other population parameters. In the Desert Tortoise (Mojave Population) Recovery Plan (USFWS 1994a), the analysis of population viability included population density and size of reserves (i.e., areas managed for the desert tortoise) and population numbers (abundance) and size of reserves. The USFWS Recovery Plan reported that as population densities for the Mojave desert tortoise decline, reserve sizes must increase, and as population numbers (abundance) for the Mojave desert tortoise decline, reserve sizes must increase (USFWS 1994a). In 1994, reserve design (USFWS 1994a) and designation of critical habitat (USFWS 1994b) were based on the population viability analysis from numbers (abundance) and densities of populations of the Mojave desert tortoise in the early 1990s. Inherent in this analysis is that the lands be managed with reserve level protection (USFWS 1994a, page 36) or ecosystem protection as described in section 2(b) of the FESA, and that sources of mortality be reduced so recruitment exceeds mortality (that is, lambda > 1)(USFWS 1994a, page C46).

Habitat loss would also disrupt the prevailing population structure of this widely distributed species with geographically limited dispersal (isolation by distance; Murphy et al. 2007; Hagerty and Tracy 2010). Allison and McLuckie (2018) anticipate an additional impact of this habitat loss/degradation is decreasing resilience of local tortoise populations by reducing demographic connections to neighboring populations (Fahrig 2007). Military and commercial operations and infrastructure projects that reduce tortoise habitat in the desert are anticipated to continue (Allison and McLuckie 2018) as are other sources of habitat loss/degradation.

Allison and McLuckie (2018) reported that the life history of the Mojave desert tortoise puts it at greater risk from even slightly elevated adult mortality (Congdon et al. 1993; Doak et al. 1994), and recovery from population declines will require more than enhancing adult survivorship (Spencer et al. 2017). The negative population trends in most of the TCAs for the Mojave desert tortoise indicate that this species is on the path to extinction under current conditions (Allison and McLuckie 2018). They state that their results are a call to action to remove ongoing threats to tortoises from TCAs, and possibly to contemplate the role of human activities outside TCAs and their impact on tortoise populations inside them.

Densities, numbers, and habitat for the Mojave desert tortoise declined between 2004 and 2014. As reported in the population viability analysis, to improve the status of the Mojave desert tortoise, reserves (area of protected habitat) must be established and managed. When densities of tortoises decline, the area of protected habitat must increase. When the abundance of tortoises declines, the area of protected habitat must increase. We note that the Desert Tortoise (Mojave Population) Recovery Plan was released in 1994 and its report on population viability and reserve design was reiterated in the 2011 Revised Recovery Plan as needing to be updated with current population data (USFWS 2011, p. 83). With lower population densities and abundance, a revised population viability analysis would show the need for greater areas of habitat to receive reserve level of management for the Mojave desert tortoise. In addition, we note that none of the recovery actions that are fundamental tenets of conservation biology has been implemented throughout most or all of the range of the Mojave desert tortoise.

Definition of an Endangered Species: In 2011, Murphy et al. stated that the "recognition of *G. morafkai* reduces the range of *G. agassizii* to occupying about 30% of its former range." Given this reduction in species distribution and numbers and the "…drastic population declines in *G. agassizii* during the past few decades, it might be endangered."

In 2018, Agassiz's desert tortoise was added to the list of the world's most endangered tortoises and freshwater turtles. It is in the top 50 species. The International Union for Conservation of Nature's (IUCN) Species Survival Commission, Tortoise and Freshwater Turtle Specialist Group, now considers Agassiz's desert tortoise to be Critically Endangered (Turtle Conservation Coalition 2018).

The IUCN places a taxon in the Critically Endangered category when the best available evidence indicates that it meets one or more of the criteria for Critically Endangered. These criteria are 1) population decline - a substantial (>80 percent) reduction in population size in the last 10 years; 2) geographic decline - a substantial reduction in extent of occurrence, area of occupancy, area/extent, or quality of habitat, and severe fragmentation of occurrences; 3) small population size with continued declines; 4) very small population size; and 5) analysis showing the probability of extinction in the wild is at least 50 percent within 10 years or three generations.

In the FESA, Congress defined an "endangered species" as "any species which is in danger of extinction throughout all or a significant portion of its range…" Given the information on the status of the Mojave desert tortoise and the federal definition of an endangered species, the Council believes the status of the Mojave desert tortoise is that of an endangered species.

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Appendix B

Effects of Roads on Wildlife, Wildlife Populations, and the Mojave Desert Tortoise

Roads have a generally negative overall impact on native biological diversity and ecological integrity (Brocke et al., 1988; Jalkotzy et al. 1997; Gucinski et al. 2001). This includes the deterioration/loss of wildlife habitat, hydrology, geomorphology, and air quality, increased competition and predation (including by humans), and the loss of naturalness or pristine qualities (Forman et al. 1997; Jalkotzy et al. 1997). Roadless areas and areas with low road density are more likely to have greater ecological integrity and/or wildlife habitat value than similar areas with more roads (Noss 1995; Rudis 1995, as cited in Beazley et al. 2004).

Though roads comprise only 1 percent of surface area, an estimated 19 percent of the total land within the United States is ecologically affected by roads due to indirect effects that extend 100–800 meters beyond the physical footprint of the road (Forman 2000, as cited in Nafus et al. 2013).

Roads have been described as the single most destructive element in the process of habitat fragmentation (Noss 1993), and their ecological effects are considered the sleeping giant of biological conservation (Forman 2002:viii, as cited in van der Ree et al. 2011).

There are five major categories of primary road effects to wildlife: (1) wildlife mortality from collisions with vehicles, (2) hindrance/barrier to animal movements thereby reducing access to resources and mates, (3) degradation of habitat quality, and (4), habitat loss caused by disturbance effects in the wider environment and from the physical occupation of land by the road, and (5) subdividing animal populations into smaller and more vulnerable fractions (Jaeger et al. 2005a, 2005b; Roedenbeck et al. 2007). Road establishment is often followed by various indirect effects such as increased human access causing disturbance of breeding sites, increased exploitation via activities such as hunting (McLellan and Shackleton 1988; Kilgo et al. 1998), and the spread of invasive species (Parendes and Jones 2000). For the tortoise, road establishment and use results in increased human access and human-caused impacts including collision with vehicles and encounters with vehicles that result in collection or vandalism as this removes the tortoise from the populations – two sources of direct mortality, the spread of non-native invasive plant species that adversely affect tortoise nutrition, plant species cover and density, fire frequency, intensity, and size; and an increase in roadkill of wildlife species that subsidizes tortoise predators increasing predator numbers and increasing tortoise mortality.

Certain Animals Are Vulnerable to Road Mortality. Certain characteristics or behaviors make animals vulnerable to road mortality. In one study, the combination of the Northern Leopard Frog's apparent inability to avoid roads and their slow rate of movement make them highly vulnerable to road mortality (Bouchard et al. 2009, as cited in van der Ree et al. 2011).

Roads pose the greatest risk to species that are highly vagile, have large home ranges, large body mass, low reproductive rates, and long generation times (Carr and Fahrig, 2001; Gibbs and Shriver, 2002; Karraker and Gibbs, 2011; Rytwinski and Fahrig, 2011, 2012). Road effects may be particularly damaging to species with low reproductive rates and long generation times because such species have a low intrinsic ability to recover from population declines (Gibbs and Shriver, 2002; Rytwinski and Fahrig, 2012, as cited in Nafus et al. 2013). Species with life history traits tied to low lifetime reproductive rates do appear to be at the greatest risk for road-related declines (Nafus et al. 2013).

Road Configuration and Animal Behavior: Jaeger et al. (2005a) examined whether or not the configuration of road networks has an influence on the degree to which roads detrimentally affect wildlife populations and identified characteristics of road network configurations that make road networks less detrimental to the persistence of animal populations. They found that for animals that do not very strongly avoid roads (e.g., desert tortoise), it is more important to preserve core habitats at a sufficient distance from roads (e.g., individuals located in the habitat patches far away from any road (i.e., located in core habitat) would survive during their next movement because they cannot encounter a road). Even though a population may show no negative response to a certain number or density of roads, a different configuration of the road network (with the same total length of roads) may cause the extinction of the population. Note that density is different from configuration.

The degree to which a road network affects a wildlife population depends on the configuration of the road network and the behavior of the animals at roads (Jaeger et al. 2005b). In general, if a species is affected by road mortality, its core habitat should be maximized; large un-dissected areas of habitat should be protected from [the presence of] roads. If animals do not avoid roads but are often killed by traffic (e.g., amphibians), minimize the number of roads. For animals exhibiting low road avoidance (e.g., desert tortoise), the effect of roads is determined by the density of roads and the shape of the habitat patches (Jaeger et al. 2005b).

A population very sensitive to traffic mortality (or any form of additional mortality) will be most vulnerable to roads if individuals do not avoid crossing roads (Jaeger et al 2005b). Because tortoises do not avoid crossing roads, they are sensitive to traffic mortality. For wide-ranging species (e.g., desert tortoise), their persistence depends on cumulative management of road effects over expansive areas. Wider-ranging animals require analysis over larger areas.

Applying Ecological Research When Planning Roads. Although there is a growing body of evidence of the negative impacts of roads on wildlife (Trombulak and Frissell 2000; Underhill and Angold 2000; Forman et al. 2002; Sherwood et al. 2002; Spellerberg 2002, as cited in Roedenbeck et al. 2007), ecological research has had comparatively little effect on decision making in transportation planning (OECD 2002; UBA 2003, as cited in Roedenbeck et al. 2007). In part, this reflects the fact that, in the face of compelling economic and social arguments for road siting, design, and construction, the effects on ecological values are usually considered of secondary importance (Caid et al. 2002; Bratzel 2005, as cited in Roedenbeck et al. 2007).

For questions concerned with landscape-scale ecological effects and long-term consequences, a control-impact (CI) design study may be the best one can do in these situations (Roedenbeck et al. 2007). A control-impact (CI) design can be used in which the population is surveyed in sites with and without a road present (Roedenbeck et al. 2007).

For road ecology, and especially those issues relevant to landscape-level planning and management, a strong weight of evidence or the standard of proof required for consideration in the planning process must be comparatively low. The task of the road ecologist is to provide scientific answers with the highest inferential strength possible; the task of decision makers is to recognize and make decisions in the face of the inherent limitations and uncertainties in these answers (Roedenbeck et al. 2007).

The synergistic effects of roads and other factors that operate simultaneously need to be investigated and considered. This lack of knowledge is often used as a justification to create more roads by arguing that not enough is known and more research is needed before road construction may slow down. This constitutes a fragmentation spiral (Jaeger 2002), because research has been unable to catch up with the ecological effects of the rapid increase in road densities. This situation is contrary to the precautionary principle and flies in the face of the principles of sustainability (all from van der Ree et al. 2011).

BLM has an ongoing control-impact experiment on landscape-scale ecological effects and long-term consequences from roads (and from grazing) on the desert tortoise. The Desert Tortoise Research Natural Area (DTRNA) serves as the control area and nearby Fremont Valley serve as the impact area. The DTRNA, about a 25,000-acre area, has been mostly protected from vehicle use, OHV activity, and grazing for a few decades because BLM fenced the DTRNA to exclude these uses in 1978-79. Near to the date it was established, the DTRNA had an estimated tortoise density of 50 tortoises per square kilometer in 1979 and the adjacent Fremont Valley has 43 tortoises per square kilometer 1980 (Berry et al. 2014). Currently the DTRNA has a tortoise density of 14.8 tortoises per square kilometer and the Fremont Valley critical habitat has a density of 2.4 tortoises per square kilometer (Berry et al. 2014). This experiment indicates that an area of 25,000 acres or more that is secured on the ground from road, OHV, and livestock use in a rural area will have substantially more tortoises and greater tortoise densities (in this case, six times greater density). It also indicates that despite environmental impacts (e.g., current state of climate change), densities of tortoises remained viable with effective land management practices that eliminated road, OHV, and grazing activities. We recommend that BLM use information from this experiment when designating open and limited use routes and grazing in tortoise management areas.

Reducing the negative effects of roads and traffic will only be possible if more dialogue is achieved between the scientific community and the planners and political decision makers (van der Ree *et al.* 2011).

Effects of Roads on the Desert Tortoise The Desert Tortoise Council's intent in providing the information below is to show that the adverse effects of roads to the desert tortoise and its habitat has been documented in the scientific literature for decades. Using this information, two recovery teams of scientists prepared a recovery plan (USFWS 1994b) and revised recovery plan (USFWS 2011a) with management actions that would recover the tortoise. Both recovery plans assert the need for large roadless areas if the tortoise is to recover and be removed from the federal list of threatened and endangered species.

The 1994 Recovery Plan recommended reserves at least 1,000 square miles as the target size. Reserves of this size will likely provide sufficient buffering from demographic stochasticity and genetic problems at low population densities and they are large enough to support recovered populations that have reasonable probabilities of persistence into the future. [definition of a reserve is a protected area; A site where human uses are restricted or prohibited and where conservation of biodiversity is a primary goal.]

Regarding reserve architecture, the principles of reserve design indicate that the shape of reserves is very important. Blocks of habitat that are roadless or otherwise inaccessible to humans are better than blocks containing roads and habitat blocks easily accessible to humans. Because the factors causing the decline of the desert tortoise are primarily human-related, many human activities within reserves will need to be strictly regulated or eliminated. Recommended management actions should be tailored to the needs of specific reserves and include activities such as eliminating grazing; limiting vehicular access, including prohibiting new vehicular access and reducing existing access; and prohibiting new surface disturbances, except to improve the quality of wildlife habitat and watershed protection.

The 2011 Recovery Plan provided a summary of many of the direct and indirect impacts from roads to the tortoise and its habitat.

Tortoise mortality along unfenced roads has been well documented (Boarman 2002). Boarman and Sazaki (1996) compared fenced and unfenced sections of Highway 58 and found that fencing with tortoise-proof materials reduced the number of road-killed tortoises by 93 percent (Boarman and Sazaki 1996). Radio-transmittered tortoises making long-distance movements were not able to cross the fence (Sazaki et al. 1995), supporting the interpretation that reduced road kill was due to the reduction in tortoises crossing the road.

Reduced densities of tortoises along roads suggest that road mortality is sufficient to affect population sizes (von Seckendorff Hoff and Marlow 2002). The size classes of tortoises killed by traffic include larger, reproductive individuals (Boarman *et al.* 2005) which are most important for population viability in this species (Doak *et al.* 1994). Support for considering roads a threat to desert tortoises, therefore, is strong at the individual and population levels (Boarman and Kristan 2006).

Paved and Unpaved Roads, Routes, Trails, and Railroads. Vehicular roads, routes, and trails are the most common type of human disturbance observed in desert ecosystems, and much emphasis has been placed on understanding the impacts these linear features have on arid environments (Brooks and Lair 2005). Brooks and Lair (2005) cite vehicular routes as one of the biggest challenges to land managers in the desert southwest, especially as they relate to the conservation status of the desert tortoise.

Direct and indirect impacts of roads on desert tortoise populations are well documented and include habitat and population fragmentation and degradation as well as mortality of individual tortoises (USFWS 1994a, Boarman 2002). Paved and unpaved roads serve as corridors for urbanization and dispersal of non-native invasive species and provide access to recreation. Roads also act as barriers to tortoise movement. Railroads are similar to roads as sources of mortality for desert tortoises, as tortoises can become caught between the tracks causing them to overheat and die or be crushed by trains (U.S. Ecology 1989).

Direct effects to desert tortoise habitat from roads, routes, trails, and railroads also occur during initial stages of construction or off-highway vehicle route/trail establishment when vegetation and soils are lost or severely degraded. Construction of these features can result in physical and chemical changes to soils within unpaved roadways as well as in adjacent areas (Brooks and Lair 2005). In addition, roadside vegetation is often more robust and diverse because water that becomes concentrated along roadside berms promotes germination, which attracts tortoises and puts them at higher risk of mortality as road-kill (Boarman *et al.* 1997). Raised roadbeds or other types of linear human infrastructure also affect water runoff patterns across the landscape, decreasing soil moisture on upland areas between channels downslope of the linear structure and resulting in lower shrub density and biomass (Schlesinger and Jones 1984; Brooks and Lair 2009).

von Seckendorff Hoff and Marlow (2002) demonstrated that there is a detectable impact on the abundance of desert tortoise sign adjacent to roads and highways with traffic levels from 220 to over 5,000 vehicles per day. The extent of the detectable impact was positively correlated with the measured traffic level; the higher the traffic counts, the greater the distance from the road reduced tortoise sign was observed (Hoff and Marlow 2002). This supports LaRue (1992) and Boarman et al. (1997), wherein depauperate desert tortoise populations were observed along highways. Subsequent research shows that populations may be depressed in a zone at least as far as 0.4 kilometers (0.25 miles) from the roadway (Boarman and Sazaki 2006). Hoff and Marlow (2002) also surmised that unpaved access roads with lower traffic levels may have significant effects on tortoises.

Desert tortoise populations may also be indirectly affected by road corridors that fragment habitat and limit an animal’s ability to migrate and disperse (Boarman et al. 1997). Subsequently, populations may become isolated and at higher risk of localized extirpation from stochastic events or from inbreeding depression (Boarman et al. 1997; Boarman and Sazaki 2006). Data suggest fences may reduce mortality of desert tortoises as well as other wildlife species (Boarman et al. 1997), and tortoises have been documented to use culverts to cross beneath roadways (Boarman et al. 1998), although the degree to which this use mitigates population-fragmenting effects has not been investigated.

Spread of Invasive Plants. Construction and maintenance of roadways facilitates changes in plant species composition and diversity. Non-native, invasive plant species and edge associated species often become dominant along these linear features, which serve as corridors for weed dispersal (Boarman and Sazaki 2006; Brooks 2009). Vegetation removal and manipulation, the addition of soils in preparation for road construction, and the grading of unpaved roads, create areas of disturbance that allow weedy species to become established and proliferate (Gelbard and Belnap 2003). Vehicles serve as a major vector in dispersal of non-native species along roadways (Brooks and Lair 2005).

Near Canyonlands National Park in Utah, cover of the non-native invasive grass *Bromus tectorum* (cheat-grass) was three times greater along paved roads than four-wheel-drive tracks, and richness (the number of species) and cover of non-native species were more than 50 percent greater and native species richness 30 percent lower at interior sites along paved roads than four-wheel-drive tracks (Gelbard and Belnap 2003). There also appears to be a correlation between the level of road improvement (*i.e.*, paved, improved, unpaved) and the level of invasion by non-natives (Gelbard and Belnap 2003). As previous studies show (LaRue 1993; Boarman et al. 1997; Hoff and Marlow 2002; Boarman and Sazaki 2006), the greater the distance from the road, the more desert tortoise sign is observed. Similarly, the cover and richness of non-native invasive plant species decreases as distance from the road increases (Boarman and Sazaki 2006).

As natural areas are impacted by linear features such as roads, routes, trails, and railroads, previously intact, contiguous habitats become degraded and fragmented, and non-native invasive species play a more dominant role in ecosystem dynamics. For instance, increases in plant cover due to the proliferation of non-natives have altered fire regimes throughout the Mojave Desert region (Brooks 1999; Brooks and Esque 2002; Esque et al. 2003; Brooks et al. 2004).

Predator Subsidies. In the desert southwest, common raven populations have increased over the past 25 years (greater than 1000 percent), probably in response to increased human populations and anthropogenic changes to the landscape, including roads, utility corridors, landfills, and sewage ponds (Knight and Kawashima 1993; Boarman and Berry 1995; Boarman et al. 1995; Knight et al. 1999; Boarman et al. 2006).

Invasive Plants. Proliferation of invasive plants is increasing in the Mojave and Sonoran deserts, largely as a result of human disturbance, and is recognized as a significant threat to desert tortoise habitat (Brooks 2009). Many species of non-native plants from Europe and Asia have become common to abundant in some areas, particularly where disturbance has occurred and is ongoing. As non-native plant species become established, native perennial and annual plant species may decrease, diminish, or die out (D'Antonio and Vitousek 1992).

Land managers and field scientists identified 116 species of non-native plants in the Mojave and Colorado deserts, including *Erodium cicutarium* (red-stem filaree), *Bassia hyssopifolia* (bassia), *Ambrosia acanthicarpa* (sand bur), *Ambrosia psilostachya* var. *californica* (western ragweed), *Hemizonia pungens* (common spikeweed), *Matricaria matricarioides* (pineapple weed), *Amsinckia intermedia* (fiddleneck), *A. tessellata* (bristly fiddleneck), *Descurainia sophia* (flixweed), *Sisymbrium altissimum* (tumble mustard), *S. irio* (London rocket), *Salsola iberica* (Russian thistle), *Eremocarpus setigerus* (turkey mullein), and *Marrubium vulgare* (horehound) (Tierra Madre Consultants, Inc.1991; Brooks and Esque 2002). Annual grasses include: *Bromus rubens* (red brome), *B. tectorum*, *Hordeum glaucum* (smooth barley), *H. jubatum* (foxtail barley), *H. leporinum* (hare barley), *Schismus barbatus* (split grass), and *S. arabicus* (Arab grass). *Brassica tournefortii* (Sahara mustard) and *Hirschfeldia incana* (Mediterranean mustard) are rapidly spreading, non-native winter annuals invading the desert southwest, especially in sandy soils (LaBerteaux 2006).

Brooks and Berry (2006) found that while non-native plant species comprised only a small fraction of the total annual plant flora (*i.e.*, a small fraction of the total number of plant species), they were the dominant component of the annual plant community biomass. For instance, in 1995, a high rainfall year in the Mojave Desert, non-native species comprised 6 percent of the flora and 66 percent of the biomass; in 1999, a low rainfall year, non-natives comprised 27 percent of the flora and 91 percent of the biomass. Annual species dominate the non-native flora, with *Bromus rubens*, *Schismus barbatus*, and *Erodium cicutarium* comprising up to 99 percent of the non-native biomass.

Increased levels of atmospheric pollution and nitrogen deposition related to increased human presence and combustion of fossil fuels can cause increased levels of soil nitrogen, which in turn may result in significant changes in plant communities (Aber et al. 1989; Allen et al. 2009). Many of the non-native annual plant taxa in the Mojave region evolved in more fertile Mediterranean regions and benefit from increased levels of soil nitrogen, which gives them a competitive edge over native annuals. Studies at three sites within the central, southern, and western Mojave Desert indicated that increased levels of soil nitrogen can increase the dominance of non-native annual plants and promote the invasion of new species in desert regions. Furthermore, increased dominance by non-native annuals may decrease the diversity of native annual plants, and increased biomass of non-native annual grasses may increase fire frequency (Brooks 2003).

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

As native plants are displaced by non-native invasive species in some areas of the Mojave Desert, non-native plants can be a necessary food source for some desert tortoises. However, non-native plants may not be as nutritious as native plants. Recent studies have shown that calcium and phosphorus availability are higher in forbs than in grasses and that desert tortoises lose phosphorus when feeding on grasses but gain phosphorus when eating forbs (Hazard et al. 2010). Nagy et al. (1998) conducted feeding trails on four plant species (native and non-native grasses *Achnatherum hymenoides* [Indian ricegrass] and *Schismus barbatus* [split grass] and native and non-native forbs *Malacothrix glabrata* [desert dandelion] and *Erodium cicutarium* [red-stemmed filaree]) to compare the nutritional qualities for the desert tortoise. The digestibility of the nutrients in the two forbs were similar. The dry matter and energy digestibility of the two grasses were much lower than the forbs, providing little nitrogen, and tortoises lost more water than they gained while processing grasses. Results of these feeding trials suggest that the proliferation of non-native grasses such as *Schismus* to the exclusion of forbs (D'Antonio and Vitousek 1992) places desert tortoises at a nutritional disadvantage. Furthermore, if, instead of eating to obtain a given volume of food, tortoises consume just enough food to satisfy their energy needs (as commonly noted in other vertebrate groups), then the native forbs provide significantly more nitrogen and water than the non-native forbs (Nagy et al. 1998).

Changes in the abundance and distribution of native plants also may affect desert tortoises in more subtle ways. In the Mojave Desert, many food plants are high in potassium (Minnich 1979), which is difficult for desert tortoises to excrete due to the lack of salt glands that are found in other reptilian herbivores such as chuckwallas (*Sauromalus obesus*) and desert iguanas (*Dipsosaurus dorsalis*) (Minnich 1970; Nagy 1972). Reptiles are also unable to produce concentrated urine, which further complicates the ability for desert tortoises to expel excess potassium (Oftedal and Allen 1996). Oftedal (2002) suggested that desert tortoises may be vulnerable to disease as a result of physiological stress associated with foraging on food plants with insufficient water and nitrogen to counteract the negative effects of dietary potassium. Only high quality food plants (as expressed by the Potassium Excretion Potential, or PEP, index) allow substantial storage of protein (nitrogen) that is used for growth and reproduction, or to sustain the animals during drought. Non-native, annual grasses have lower PEP indices than most native forbs (Oftedal 2002; Oftedal et al. 2002). Oftedal et al. (2002) found that foraging juvenile tortoises favored water-rich, high-PEP, native forbs. Much of the nutritional difference between available and selected forage was attributable to avoidance of abundant, non-native split grass (*Schismus* spp.) with mature fruit, which is very low in water, protein, and PEP. Of the species eaten, *Camissonia claviformis*, a native Mojave desert primrose, accounted for nearly 50 percent of all bites, even though it accounted for less than 5 percent of the biomass encountered, and was largely responsible for the high PEP of the overall diet. Impacts to vegetation (such as invasion of non-native plants, and soil disturbance) that reduce the abundance and distribution of high PEP plants may result in additional challenges for foraging desert tortoises (Oftedal et al. 2002).

Tracy et al. (2006) also quantified the rates of passage of digesta (food in the stomach) in young desert tortoises in relation to body size and diet quality. They observed that, compared to adults, young, growing tortoises need higher rates of nutrient assimilation to support their higher metabolic rates. Juvenile desert tortoises also forage selectively by consuming plant species and plant parts of higher quality (Oftedal et al. 2002) and pass food through the gut more quickly (Tracy et al. 2006). Hence, these findings of differential passage rates suggest that it is beneficial for young tortoises to specialize on low-fiber diets, as this would allow for more efficient uptake of nutrients. In addition, habitat disturbances (e.g., invasion of annual grasses) that favor species with little nutritional value and preclude access to low-fiber foods may negatively impact the physiological and behavioral ecology of young desert tortoises. Adults, on the other hand, may be better adapted to tolerate low-quality foods for a longer period of time because of their lower metabolism, more voluminous guts compared to subadults, and consequent longer retention times (Tracy et al. 2006).

Increasing Fuel Load. The proliferation of non-native plant species has contributed to an increase in fire frequency in tortoise habitat by providing sufficient fuel to carry fires, especially in the inter-shrub spaces that are mostly devoid of native vegetation (Brown and Minnich 1986; USFWS 1994b; Brooks 1998; Brooks and Esque 2002). Invasive, non-native annual grasses and forbs increasingly spread over the desert floor, resist decomposition, and provide flash fuel for fires. Brooks (1999) found that non-native annual grasses contributed most to the continuity and biomass of dead annual plants and to the spread of summer fires compared to native forbs. Red brome in particular has contributed to significant increases in fire frequency since the 1970s (Kemp and Brooks 1998; Brooks et al. 2003).

Fire also appears to affect the spread of non-native plants. Brooks and Berry (2006) found that proliferation of non-native invasive plants was best predicted by disturbance, specifically frequency and size of recent fires for biomass of *Bromus rubens*. Once fires occur, opportunities for invasion and proliferation of non-natives increase because they regenerate on burned areas more quickly than native plants (Brown and Minnich 1986). Changes in plant communities caused by non-native plants and recurrent fire negatively affect the desert tortoise by altering habitat structure and species composition of their food plants (Brooks and Esque 2002).

Fire. Fire has the potential to be an important force governing habitat quality and persistence of desert tortoises. Tortoises can be killed or seriously injured by burning and smoke inhalation during fire events. The extent of the direct impacts experienced by tortoises is influenced by tortoise activity at the time of fire (whether inside or outside burrow), depth of burrow (to afford through an area), and patchiness (extent of an area burned) (Esque *et al*. 2003). Early-season fires may be more threatening than summer fires because desert tortoises are active above ground and more vulnerable to direct effects of fire at that time. Fire can also compromise the quality of tortoise habitat by reducing the vegetation that provides shelter, cover, and nutrition (key forage plants) for tortoises (Brooks and Esque 2002; Esque *et al.* 2003).

Natural fire regimes have been altered due to profuse invasions of non-native grasses throughout much of the range of the desert tortoise. The biomass of weedy species has increased remarkably in the desert Southwest as a result of disturbance from vehicles, grazing, agriculture, urbanization, and other human land uses (Brooks and Berry 1999; Brooks and Esque 2002; Brooks et al. 2003; Brooks and Berry 2006; Brooks and Matchett 2006). Fuel loads that consist of dense annual grasses rather than sparse cover of native species make it more likely for fire to become hot enough to damage native shrubs, which are poorly adapted to survive and/or regenerate quickly after fire and are poor colonizers (Tratz and Vogl 1977; Tratz 1978). Ultimately, recurrent fire can result in conversion of shrublands to annual grasslands, which can be devastating for desert tortoises that depend upon shrubs for cover (Brooks and Esque 2002). Conversion to grassland also tends to create a self-perpetuating grass/fire cycle as fuels continuously reestablish in burned areas (D'Antonio and Vitousek 1992).

Years of high rainfall promote the growth of invasive annuals that increase the fine fuel loads, but high rainfall also increases food and water availability for desert tortoises. Desert tortoise reproduction also increases in high rainfall years. Small hatchlings are more vulnerable to fire than larger tortoises, and tortoises in general are more vulnerable to fire when they are above ground foraging. Thus, the high rainfall episodes that are important to maintaining healthy desert tortoise populations may also create the highest fire risk (Brooks and Esque 2002). Plant litter produced by non-native annual grasses decomposes more slowly than native annuals and accumulates during successive years, thus providing an excess of fine fuels that sustains and spreads fires throughout the desert ecosystem (Brooks 1999). Historical fire intervals of 30 to greater than 100 years have been shortened to an average of 5 years in some areas of the Mojave Desert, due to the invasion of non-native grasses. Additionally, fires can increase the frequency and cover of non-native annual grasses within 3 to 5 years of a fire event, thus promoting the continuity of this grass/fire cycle that shortens the fire interval (Brooks et al. 1999; Brooks and Esque 2002; Brooks and Minnich 2006). Increased levels of surface-disturbing activities, rainfall, and atmospheric nitrogen and carbon dioxide may also increase the dominance of non-native plants and frequency of fires in the future (Brooks and Esque 2002; Brooks *et al.* 2003).

The most striking changes in fire frequency in the Mojave Desert have been observed in the middle elevations dominated by *Larrea tridentata* (creosote bush), *Yucca brevifolia* (Joshua tree), and *Coleogyne ramosissima* (blackbrush), at the upper limits of desert tortoise distribution, where most of the fires occurred between 1980 and 2004 (Brooks and Matchett 2006). The combination of enough cover of native vegetation to carry a fire and the accumulation of fuels from non-native annual grasses following years of above average rainfall may result in significantly larger fires at shorter return intervals than normally expected in this zone. Bureau of Land Management, U.S. Forest Service, and California Department of Forestry geospatial data of the extent of fires in 2005, the wildfires burned over 58,208 hectares (140,000 acres) of critical habitat that year (Table A-2). The Bureau of Land Management's geospatial fire data depict slightly different acreages than have been reported elsewhere. According to McLuckie et al. (2007), 3,191 hectares (7,885 acres) burned within the Red Cliffs Desert Preserve, which encompasses the majority of the Critical Habitat within the Upper Virgin River Recovery Unit.

Given these many impacts to the Mojave desert tortoise and its habitat from roads, the USFWS (2011) states that the establishment of new roads should be avoided to the extent practicable within desert tortoise habitat within tortoise conservation areas; tortoise conservation areas should have a minimum goal of no net gain of roads.

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