DRAFT

ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED ISSUANCE OF AN INCIDENTAL TAKE PERMIT FOR CALIFORNIA CONDOR FOR THE MANZANA WIND POWER PROJECT, KERN COUNTY, CALIFORNIA

Palm Springs Fish and Wildlife Office
U.S. Fish and Wildlife Service
777 E Tahquitz Canyon Way, Suite 200
Palm Springs, California 92284

Version: December 21, 2020

Estimated Lead Agency Total Costs Associated with Developing the Environmental Assessment: $60,000

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The U.S. Fish and Wildlife Service (Service) is considering the issuance of a permit, pursuant to section 10(a)(1)(B) of the Endangered Species Act, for the incidental take of a limited number of California condors (*Gymnogyps californianus*, condors), a federally endangered species. Manzana Wind LLC (Applicant), a wholly owned subsidiary of Avangrid Renewables LLC, has applied for an incidental take permit for the take of no more than four condors (two free-flying birds and two associated eggs or chicks), over a 30-year period during the operation of the existing Manzana Wind Power Project (Project) The permit area covers approximately 5,515 acres in the Antelope Valley region of Kern County, California, along the southern foothills of the Tehachapi Mountains (Figure1). The Project began operations in 2012 and includes 126 1.5 megawatt (MW) wind turbines, for a total nameplate capacity of 189 MW. The Project is providing renewable energy to the California electrical grid and contributing to the goals of the State's Renewable Portfolio Standard program (California Senate Bill 100).

As the wild population of condors has continued to increase in number, the geographic range of these birds has also expanded as they reoccupy parts of the species' historic range. To date there have been no documented cases of a wind turbine-related injury or fatality of a condor; however, over the past 10-15 years, the southern California flock of condors has increased their use of the Tehachapi Mountains, including areas with wind energy facilities. As a result, there is risk of potential incidental take of condors from the operations of existing wind energy facilities, including the Project. The Applicant has applied for an incidental take permit because of documented condor activity at the Project and to address the risk associated with this condor activity.

As part of the issuance criteria for an incidental take permit under section 10 of the Endangered Species Act, the Applicant has prepared a conservation plan (Avangrid 2020; Enclosure 1) that describes how they will minimize risk and mitigate to the maximum extent practicable the impacts of the take of condors over the life of the permit. To minimize the risk of incidental take, the Applicant will maintain a program to detect condors approaching the Project and temporarily curtail operating wind turbines when appropriate; the conservation plan also includes adaptive management to allow for maintaining the protection of condors as technologies, condor behavior, and other factors change over time. To mitigate and fully offset the impact of the potential incidental take of two free-flying condors and two eggs or chicks, the Applicant will work with an existing captive breeding facility to fund the production of six additional condors for release into the wild; the captive rearing and release of condors is a primary component of the Service's recovery program for the condor. The Service and the Applicant used a population viability analysis to inform the mitigation strategy and ensure the level of potential injury or mortality of condors permitted at the Project would not impede recovery of the species.

In the absence of the Service issuing an incidental take permit for condors to the Applicant, the Project would continue to operate without an exemption to section 9 of the Endangered Species Act. Additionally, the minimization program (i.e., detection and curtailment system) would remain voluntary and the Applicant would not implement a mitigation program to fully offset impacts from the potential incidental take of condors. The result is that there would be no direct conservation actions to benefit condors and minimize and mitigate impacts from the potential incidental take of condors at the Project.

LIST OF ACRONYMS AND ABBREVIATIONS

Applicant	Manzana Wind LLC.
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulation
condor	California condor
FONSI	Finding of No Significant Impact
FR	Federal Register
GPS	Global Positioning System
GSM	Global System for Mobile Communications
kV	kilovolt
MW	megawatt
NEPA	National Environmental Policy Act
PVA	population viability analysis
Service	U.S. Fish and Wildlife Service
USC	U.S. Code
USEPA	U.S. Environmental Protection Agency
VHF	very high frequency

SECTION 1
PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

The U.S. Fish and Wildlife Service (Service) has prepared this environmental assessment in accordance with the requirements of the National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S. Code [USC] 4321 et seq.), and Council on Environmental Quality (CEQ) regulations for implementing NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508). The CEQ published updated regulations for implementing NEPA on July 16, 2020; however, because we had already completed a substantive draft of this environmental assessment, we are exercising our discretion to conduct our NEPA analysis based on the prior applicable regulations. This environmental assessment evaluates the impacts of, and the alternatives to, the Service's proposed issuance of an incidental take permit, pursuant to section 10(a)(1)(B) of the Endangered Species Act, for take of the federally endangered California condor (condor; *Gymnogyps californianus*) during the operation of the Manzana Wind Power Project (Project) in Kern County, California (Figure 1). The Project is an existing facility that began commercial operations in 2012 and consists of 126 General Electric 1.5 megawatt (MW) wind turbines, for a total nameplate capacity of 189 MW. The incidental take permit would allow for the take of up to two free-flying condors and two associated eggs or chicks over a 30-year permit term and require that Manzana Wind LLC (Applicant), a wholly owned subsidiary of Avangrid Renewables LLC, abide by the Project's conservation plan and conditions set forth in the incidental take permit to minimize and mitigate the impact of the potential incidental take to the maximum extent practicable.

As the wild population of condors has continued to increase in number since reintroduction of the species into the wild, the geographic range of these birds has also expanded as they reoccupy parts of the historic range of the species. In southern California, condors now occur throughout the Tehachapi Mountains, including areas with existing wind energy facilities. To date there have been no documented cases of a wind turbine injuring or killing a condor; however, wind turbine collisions are a known source of injury and mortality to large soaring birds. Therefore, there is risk of incidental take of condors from the operations of wind energy facilities in the Tehachapi Mountains, including the Project. As a result, the Applicant has applied for an incidental take permit to address the risk associated with condor activity at the Project.

1.2 BACKGROUND

Section 9 of the Endangered Species Act and its implementing regulations prohibit "take" of fish and wildlife species that are listed as endangered (16 USC 1531-1544). Section 3 of the Endangered Species Act defines "take" as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. The Service has further defined "harm" to mean an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 CFR 17.3).

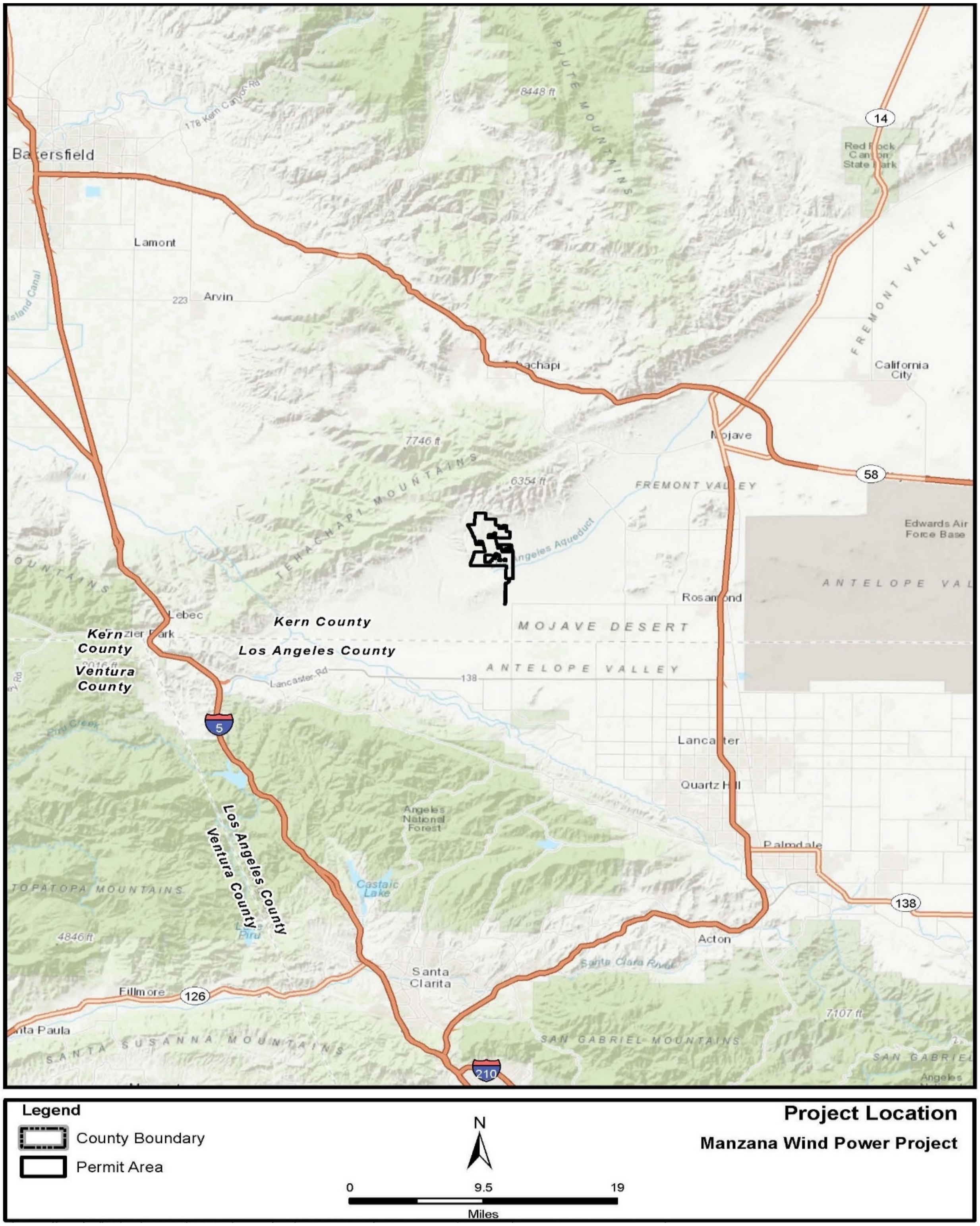


Figure 1. Location of the Manzana Wind Power Project.

For federal actions, exemptions to the prohibition against take require consultation with the Service under section 7 of the Endangered Species Act. In instances where a project has no federal nexus, proponents (e.g., the Applicant) of actions that are reasonably certain to take listed animal species can comply with the Endangered Species Act by applying for an incidental take permit from the Service pursuant to section 10(a)(1)(B).

1.2.1 Section 10 Conservation Plans and Incidental Take Permits

To receive an incidental take permit, the applicant must submit a conservation plan to the Service under section 10(a)(2)(A), that specifies:

- The impact that will likely result from such taking;
- The steps the applicant will carry out to monitor, minimize and mitigate the impact of that take to the maximum extent practicable and the funding that will be available to implement such steps and the procedures to be used to deal with unforeseen circumstances;
- The alternative actions to such taking that the applicant considered and the reasons why such alternatives are not proposed to be utilized; and
- Other measures that the Service may require as being necessary or appropriate for the purposes of the conservation plan.

Issuance criteria for an incidental take permit (50 CFR 17.22) requires that the Service find that:

- The taking will be incidental to otherwise lawful activities;
- The applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking;
- The applicant will ensure that adequate funding for the conservation plan and procedures to deal with unforeseen circumstances will be provided;
- The taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild;
- The applicant will meet the measures, if any, that the Service requires as being necessary or appropriate for the purposes of the conservation plan; and
- The Service has received such other assurances as it may require that the plan will be implemented.

To obtain an incidental take permit, an applicant first coordinates with the Service to determine whether an application for a permit is appropriate. An applicant that decides to apply for an incidental take permit prepares a draft conservation plan that integrates the project's covered activities with the conservation of covered listed species and meets the issuance criteria for an incidental take permit. The applicant may seek the Service's assistance during the preparation of the conservation plan.

Once the applicant submits a complete application, including application fee and conservation plan, the Service publishes a notice of availability of an application for an incidental take permit in the *Federal Register*. This publication opens the conservation plan to a 30-day public review period, per section 10(a)(1)(C). The Service considers comments received during the public review, completes an internal consultation pursuant to section 7(a)(2) of the Endangered Species Act to ensure the proposed action is not likely to jeopardize the continued existence of the species, and evaluates whether the conservation plan meets the issuance criteria in a set of findings.

Because issuance of an incidental take permit is a discretionary federal action, the Service must comply with the requirements of NEPA. Additionally, the Service must comply with section 106 of the National Historic Preservation Act to assess the effects of any federal action on historic properties. CEQ regulations encourage the integration of the NEPA process with other environmental reviews. Therefore, we address section 106 of the National Historic Preservation Act in this environmental assessment. Depending on the level of NEPA conducted, a federal agency may make the draft NEPA document available for public review. In the case of an environmental assessment, publication of a draft document is not required, but depending on the circumstances the federal agency may decide to seek comments from the public and revise an environmental assessment accordingly (43 CFR 46.305). Service policy, as defined in our section 10(a)(1)(B) handbook (Service 2016), calls for us to publish notices of applications for incidental take permits and the associated NEPA documents in the *Federal Register*. If the Service determines on the basis of an environmental assessment not to prepare an environmental impact statement, then the Service will prepare a finding of no significant impact. Once completed, the Service must notify the public of the availability of an environmental assessment and any associated finding of no significant impact (43 CFR 46.305).

Finally, the Service issues an incidental take permit upon its determination that the applicant has met all statutory criteria, and notifies the public of permit issuance through the publication of an annual notice in the *Federal Register*. After issuance of the incidental take permit, the permittee and any other responsible entities implement the conservation plan (e.g., minimization, mitigation, monitoring, and reporting activities) in accordance with the terms and conditions of the incidental take permit. The Service monitors permittee compliance with the conservation plan and its long-term progress and success.

1.3 PURPOSE AND NEED OF THE PROPOSED FEDERAL ACTION

1.3.1 Purpose

The Service's purpose in considering the proposed action, the issuance of an incidental take permit for the federally endangered condor, is to fulfill our obligations under section 10(a)(1)(B) of the Endangered Species Act, which would also ensure the long-term protection of condors that fly through the Project area.

1.3.2 Need

Section 10(a)(2)(B) of the Endangered Species Act directs the Service to issue incidental take permits to non-federal entities for take of listed wildlife if an applicant satisfies the issuance criteria. Issuance of the incidental take permit is a discretionary federal action because the Service has broad latitude in assessing whether the applicant has met the issuance criteria. Therefore, the need for the federal action is to respond to Manzana Wind LLC's application for an incidental take permit.

1.4 AGENCY AND PUBLIC INVOLVEMENT PROCESS

Scoping is the early and open process for determining the scope of issues to address in the planning process and may involve the public in identification of significant issues associated with proposed federal actions. Scoping is not required for an environmental assessment and the methods for providing public notification and opportunities for public involvement are at the discretion of the Service (43 CFR 43.605). In this case we did not specifically involve the public in the scoping process. However, the Service has made available for public review a draft of this environmental assessment and the draft conservation plan and published a Notice of Availability in the *Federal Register*. We will respond to all substantive comments in the finding of no significant impact or draft environmental impact statement, as appropriate (43 CFR 46.305).

Additionally, as described in section 1.2.1, *Section 10 Conservation Plans and Incidental Take Permits*, the Service will make available for public review the information received as part of the application for an incidental take permit (e.g., conservation plan). We will review and consider all comments submitted during the 30-day public comment period and address comments that are relevant to issuance criteria for the incidental take permit in a set of findings, pursuant to section 10(a)(2)(B) of the Endangered Species Act.

1.5 SCOPE OF THE ENVIRONMENTAL ASSESSMENT

Per CEQ regulations for implementing NEPA and recent guidance issued by the Department of the Interior (e.g., Secretarial Order 3355), an environmental assessment should be a concise public document to briefly provide sufficient evidence and analysis for evaluating potential impacts to resources. The level of detail and depth of impact analysis should normally be limited to the minimum needed to determine whether the proposed federal action would cause significant environmental effects (43 CFR 46.310). As such, following internal scoping, we have dismissed from detailed analysis those resources that would experience either no or negligible impacts associated with the proposed federal action.

The Project is an existing, operational wind energy facility that was constructed prior to the proposed action (County of Kern 2008). The proposed action is the Service's issuance of an incidental take permit, pursuant to section 10(a)(1)(B) of the Endangered Species Act. The baseline conditions for consideration of the proposed action include the continued operations and maintenance of the wind energy facility; in this case, the Project has been in operation since 2012 and could continue to operate regardless of whether the Service issues an incidental take permit. Implementation of the conservation plan that supports the incidental take permit would not result in any ground-disturbing activities or construction of new structures that could result in potential impacts to the human and natural environment. For example, the issuance of an incidental take permit for condors would not result in any changes to air quality and greenhouse gas emissions or land use and transportation impacts associated with the Project. Similarly, the issuance of the incidental take permit would not change impacts to general wildlife resources (e.g., migratory birds, etc.) associated with the Project.

Therefore, due to the specific circumstances of this Project, we have determined that the proposed action will not result in significant effects to the following resource areas and have dismissed them from further analysis:

- Air Quality and Greenhouse Gas Emissions
- Cultural and Historic Resources
- General Wildlife
- Geology and Soils
- Climate Change
- Land use and Transportation
- Noise
- Socioeconomics and Environmental Justice
- Vegetation
- Visual Impacts
- Water Resources and Water Quality
- Wetlands/Waters of the U.S.

Given the nature of the proposed action, we have carried forward potential impacts to endangered species, specifically the California condor, for further analysis. Consequently, this environmental assessment focuses on evaluating potential environmental impacts to the condor that could occur as a result of the proposed action.

1.6 CONSULTATION AND COORDINATION

1.6.1 National Historic Preservation Act and Tribal Outreach

Section 106 of the National Historic Preservation Act of 1966 requires that federal agencies take into account the effects of their actions on historic properties. Following internal discussions and consultation with the State of California Office of Historic Preservation (Service 2020, State of California Office of Historic Preservation 2020), including a review of the undertaking (i.e., proposed action) and historic properties in the permit area (e.g., County of Kern 2008), we concluded that the proposed action has no potential to affect historic properties. We based this determination in part on the fact that, while condors may play a role in the culture of the area's Tribes, animal species by themselves, including condors, do not meet the National Historic Preservation Act definition of historic property. Therefore, the potential take of condors associated with issuance of an incidental take permit would not affect historic properties (36 CFR 800.3.a.1). Additionally, the activities covered by the proposed incidental take permit represent no change from the existing suite of activities presently occurring at the Project. Finally, the conservation strategy (i.e., minimization and mitigation activities) required for issuance of an incidental take permit would not involve major ground disturbance or other actions that could affect historic properties. Therefore, issuance of a permit for incidental take of condors is an undertaking with no potential to affect historic properties (36 CFR 800.3(a)(1)).

In keeping with our trust responsibility (e.g., Executive Order 13175), the Service sent letters on November 16, 2018, and again on May 29, 2020, to federally recognized Indian Tribes within the current geographic range of the southern California condor population. These letters notified the tribes of the Service's work with wind energy companies on the development of conservation plans, as part of applications for incidental take permits for condors at existing wind energy projects in the Tehachapi Mountains. To date, we have received one response; the San Manuel Band of Mission Indians stated that the Tehachapi Mountains are outside of the Serrano ancestral territory and that the proposed incidental take permit will not impact their Tribe (Mauck 2020). The Service will continue to inform the tribes of our efforts, including the availability of documents associated with the current application for an incidental take permit (i.e., the draft conservation plan and draft environmental assessment). We will consider written comments or other communications from the tribes during the environmental review process for this application and, if requested, engage in formal Government-to-Government consultation on the proposed action.

SECTION 2
PROPOSED ACTION AND ALTERNATIVES

This section describes the proposed action, the issuance of an incidental take permit pursuant to section 10(a)(1)(B) of the Endangered Species Act, authorizing take of condors that is incidental to the otherwise lawful covered activities associated with the continued operations and maintenance of the Project. The proposed action also includes the activities associated with the conservation strategy (i.e., minimization and mitigation programs) specified in the conservation plan submitted by the Applicant (Avangrid 2020), per section 10(a)(2)(A). This conservation plan is included here as Enclosure 1. In addition to the proposed action, CEQ regulations require an assessment of potentially effective and reasonably feasible alternatives for implementation of the proposed action. Further, CEQ regulations require analyzing the "alternative of no action" (40 CFR 1502.14) to assess any environmental consequences that may occur if the proposed action is not implemented.

We provide below a description of the no action alternative and the proposed action, along with other alternatives that we considered, but dismissed from further analysis.

2.1 ALTERNATIVES CARRIED FORWARD FOR DETAILED ANALYSIS

CEQ regulations for implementing NEPA require analysis of a range of reasonable alternatives, including a no action alternative. The no action alternative provides a baseline for comparison with the proposed action. The no action alternative identifies and describes the potential environmental impacts of the *status quo* (i.e., if the proposed action were to not be implemented) over the duration of the proposed action.

2.1.1 No Action Alternative

Under the no action alternative, the Service would not issue an incidental take permit to the Applicant for the potential incidental take of condors at the Project. In the absence of an incidental take permit, if a condor was injured or killed as a result of otherwise lawful activities at the Project, the take would be in violation of section 9 of the Endangered Species Act. Implementation of the current minimization measures would remain voluntary and not a requirement of the incidental take permit, thus the Applicant could choose to end these measures at any time. Similarly, the Applicant would not implement the mitigation strategy to fund a captive breeding facility to increase the number of captive-reared condors available for release into the wild population.

2.2 PROPOSED ACTION: ISSUANCE OF AN INCIDENTAL TAKE PERMIT

2.2.1 Proposed Permit/Plan Area and Permit Term

The permit area is defined as the area where the incidental take permit would apply to covered activities. Thus, the permit area for the proposed action totals approximately 5,515 acres and includes those areas with the Project's wind turbines, collection and transmission lines and associated poles, operations facilities, and access roads and fencing (Figure 2). The plan area is defined as the area associated with implementation of the conservation plan, including the covered activities as well as the conservation program (i.e., minimization and mitigation programs). Note that the Applicant's conservation plan proposes a mitigation program that provides funding to the Oregon Zoo's Jonsson Center for Wildlife Conservation, however, this facility maintains its own applicable federal permits for activities, including those associated with the Applicant's proposed mitigation program (i.e., for breeding and rearing condors). Therefore, for the proposed action considered in this environmental assessment, the permit area and plan area, are the same.

The permit term for the proposed incidental take permit is 30 years, which is approximately the length of time of existing land leases for the Project.

2.2.2 Federally Listed Species Covered by the Proposed Conservation Plan

The Service recommends that an applicant seeking an incidental take permit under section 10(a)(1)(B) include as covered species all federally listed wildlife species for which take from covered activities is reasonably certain to occur, unless take is addressed through a separate mechanism (e.g., section 7 of the Endangered Species Act; Service and National Marine

Fisheries Service 2016). In this case, the Applicant's conservation plan and the proposed action for this environmental assessment addresses the incidental take of the California condor. For a complete description of the condor, including its life history, habitats, status, and recognized threats, please refer to section 3.2, *Covered Species*, of the conservation plan prepared by the Applicant (Enclosure 1) and the Service's website for the "California Condor Recovery Program."

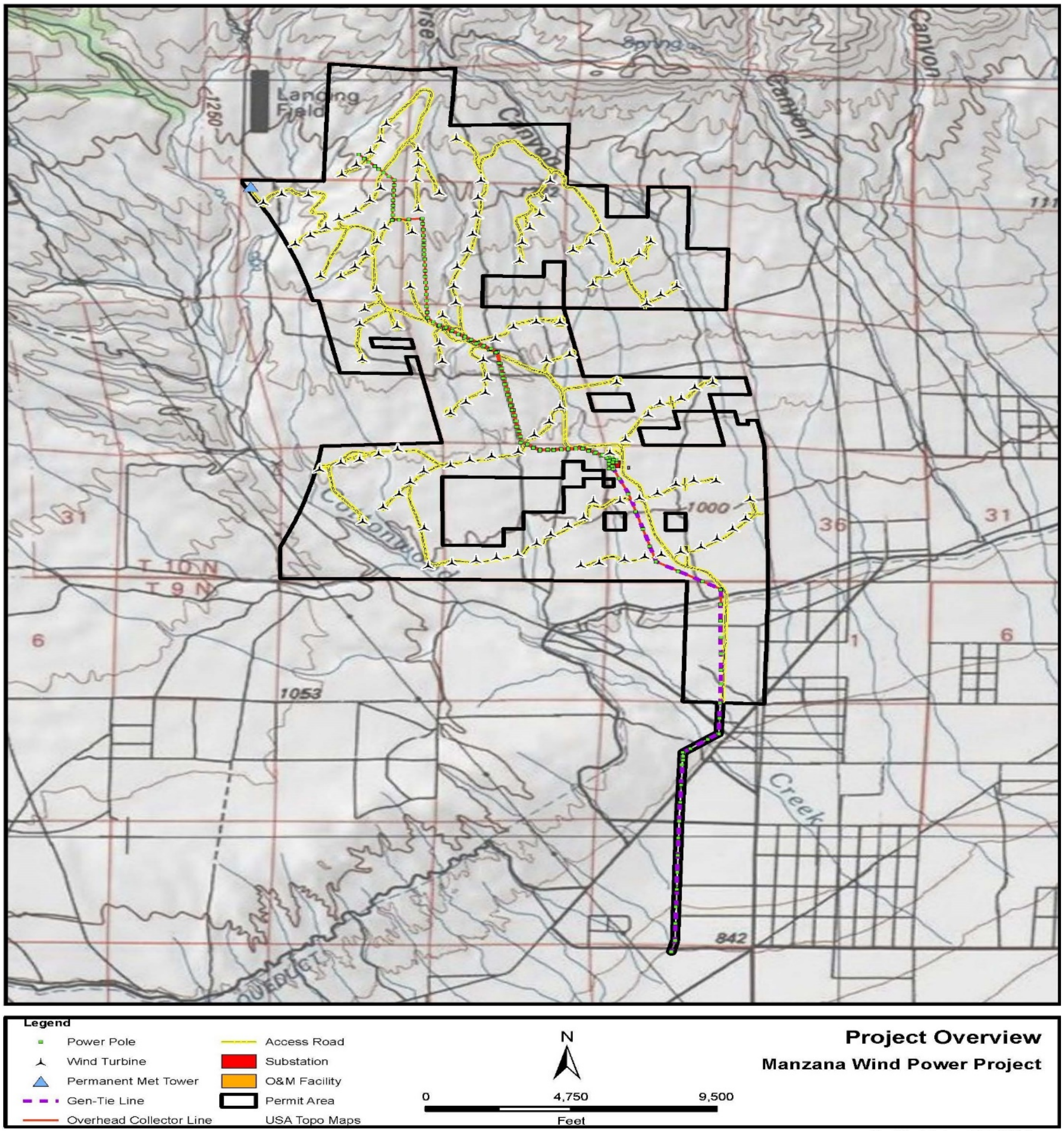


Figure 2. Map of facility components at the Manzana Wind Power Project.

The Service considered whether other federally listed species warranted inclusion as covered species, including the desert tortoise (*Gopherus agassizii*), least Bell's vireo (*Vireo bellii pusillus*), southwestern willow flycatcher (*Empidonax traillii extimus*), and the western distinct population segment of the yellow-billed cuckoo (*Coccyzus americanus*). We did not recommend inclusion of desert tortoise because the Project is located on the periphery of the species range and no tortoises have been detected in the permit area during preconstruction and post-construction biological surveys, or continued incidental wildlife monitoring during Project operations (see Enclosure 1 for citations). The closest known observation of a desert tortoise is several miles to the east of the Project (Service, unpublished data). Similarly, there is no breeding or primary stopover habitat in the permit area for any of the above listed bird species. These birds have not been detected in the permit area during biological surveys and incidental wildlife monitoring (see Enclosure 1 for citations). Other available information, such as the California Natural Diversity Database (California Department of Fish and Wildlife 2018) and eBird (Sullivan et al. 2009), indicates that these birds do not commonly occur within the vicinity of the Project. Therefore, the Service determined that incidental take of these species was not reasonably certain to occur and did not recommended their inclusion in the conservation plan (e.g., Service 2017).

2.2.3 Activities Covered by the Proposed Conservation Plan

The proposed conservation plan identifies those activities that could result in the potential incidental take of condors and for which under normal circumstances a certain level of take (e.g., mortality or injury) would be permitted under the proposed incidental take permit (Table 1). The principal covered activity is the operation of the wind turbines at the facility, including both active (i.e., with spinning blades) and inactive wind turbines. Also included are all activities associated with the operations, maintenance, repair, replacement, and removal/decommissioning of wind turbines at the Project. The operations and maintenance of ancillary facilities and structures includes operations of transmission and collection lines and poles and their routine maintenance, repair, and/or replacement; use and maintenance of the operations and maintenance building, permanent meteorological tower, and electrical substation; and use and maintenance of roads. Covered activities include the use of trucks and heavy equipment, including cranes. For a complete description of the facility components and covered activities for the proposed action, refer to section 2, *Project Description and Covered Activities*, of the conservation plan (Enclosure 1).

2.2.4 Take Limits under the Proposed Conservation Plan

The proposed issuance of an incidental take permit for condors at the Project has defined limits on the permitted amount of take. The conservation plan includes a detailed risk assessment and estimate of the anticipated level of take resulting from covered activities over the 30-year permit term (see section 4.1, *Effects and Anticipated Take*, of Enclosure 1). The primary source of risk to condors from covered activities at the Project is potential collisions with rotating wind turbine blades. We are not aware of any instances of a wind turbine injuring or killing a condor, or the injury or death of a condor from other activities at a wind energy facility. However, wind turbine collisions are a known source of mortality for raptors and other large soaring birds, both in North

America and elsewhere (Watson et al. 2018). Examples of this include golden eagles (*Aquila chrysaetos*) in the United States (Pagel et al. 2013) and griffon vultures (*Gyps fulvus*) in Europe (de Lucas et al. 2012). Based on this information, wind turbine collisions have been identified as a potential threat to condors (Service 2013a, 2016; Service et al. 2011).

Table 1. Covered activities and associated threats to California condors.

Covered Activities	Threats to California Condors
Operation of wind turbines	Collisions with wind turbine blades
Maintenance, repair, replacement, and removal of wind turbines.	Collision with wind turbine blades or equipment (e.g., cranes); vehicular collisions
Operation of transmission and collection lines and poles. Includes routine maintenance, repair, and/or replacement.	Collision with electrical lines; electrocution; vehicular collisions
Use and maintenance of operations building, permanent meteorological tower, and electrical substation.	Vehicular collisions
Repowering upgrades to existing wind turbines or infrastructure (no change in tower/blade dimensions or location).	Collisions with equipment (e.g., cranes); vehicular collisions
Use and maintenance of roads.	Vehicular collisions

The other covered activities could also result in the potential incidental take of condors, even if the relative risk of take is lower than from the operation of wind turbine. For example, collisions and electrocutions at overhead power lines are a known source of anthropogenic mortality of condors throughout the species' range (Rideout et al. 2012, Service 2019a). Most of the captive breeding facilities conduct power pole aversion training with young captive-reared condors and similar training is repeated at release and trap sites (Service 2017). These efforts have reduced the electrocution threat associated with condors perching on power poles (Kelly et al. 2015), however, mid-span collisions and electrocutions still occur (Service, unpublished data).

Ultimately, we do not have a quantitative model or approach to estimating the anticipated level of take of condors at a wind energy project and instead rely on a qualitative assessment that considers information regarding condor behavior and use of the permit area, the covered activities and associated Project facilities, and the existing and proposed minimization actions for the Project. Based on this information, the Service is considering the issuance of an incidental take permit for the take of up to two free-flying condors and two eggs or chicks at the Project over a 30-year permit term. We include two eggs or chicks because condors generally require both parents to successfully fledge young, so if take of a breeding condor occurred, we assume that any dependent eggs or chicks would die.

2.2.5 Minimization and Mitigation Measures

Section 10(a)(2)(A) of the Endangered Species Act requires that a conservation plan specify the measures that the permittee would take to meet the permit issuance criteria under section 10(a)(2)(B), to minimize and mitigate to the maximum extent practicable the impacts of the taking of any federally listed species as a result of covered activities. The Applicant provides details of these measures that are part of the proposed minimization and mitigation strategies in section 5, *Conservation Program*, of their conservation plan (Enclosure 1). We also consider these minimization and mitigation strategies under section 4, *Environmental Consequences*, of this environmental assessment as part of our evaluation of impacts that would result from implementation of the proposed action and the no action alternative.

The Applicant currently employs general conservation measures at the Project to minimize risk of mortality or injury to wildlife, including condors. Examples include:

- Vehicular speed limits to minimize potential for collisions with wildlife.
- Following standard industry practices for the design and maintenance of their transmission and collection lines to minimize the potential for wildlife electrocutions (e.g., Avian Powerline Interaction Committee 2006).
- The use of fencing to control livestock access in the permit area.
- A program to promptly cover and then remove or bury any animal carcasses found in the permit area to limit the attraction of condors to this potential food resource.
- A program to manage microtrash at the Project to limit the potential for ingestion of microtrash by condors.

The Applicant is also implementing a Condor Risk Minimization Program, on a voluntary basis, that focuses on systems to detect condors in the vicinity of the Project and curtail wind turbines (i.e., slow the spinning blades) if a condor is at risk of collision. Previous studies have shown that curtailing wind turbines can be an effective strategy for minimizing fatalities of large soaring birds (de Lucas et al. 2012). The Project and a number of other wind energy facilities in the Tehachapi Mountains currently use an automated geofence system that tracks condors wearing specialized transmitters and informs wind turbine curtailment when condors approach a facility (Sheppard et al. 2015, Service 2017). If the Service issues an incidental take permit for condors at the Project, the condor minimization measures outlined in the Applicant's conservation plan would become mandatory as part of the permit terms and conditions.

The Applicant has developed a mitigation strategy to fully offset the potential impacts from the take of condors allowable in the proposed incidental take permit. The focus of the mitigation strategy is to increase the number of captive-reared condors at existing breeding facilities that are subsequently available for release into the wild populations. Specifically, the Applicant has coordinated with the Oregon Zoo's Jonsson Center for Wildlife Conservation to determine the most effective means to increase capacity at this breeding facility and produce six additional 1.5-year-old captive-reared condors; following issuance of the permit, the Applicant would fund a full time employee at the facility for the number of years required to produce these additional condors. We provide more detailed information on the selection of this mitigation strategy and the proposed level of mitigation under section 4.1.1, *Proposed Action*.

2.3 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALSYSIS

The Service identified several alternatives to the proposed action of issuing an incidental take permit that we considered for detailed analysis. However, following a preliminary examination, we eliminated the alternatives below from further consideration and did not analyze these in detail in this environmental assessment.

2.3.1 Reduced Permit Term Alternative

Under the reduced permit term alternative, the incidental take permit issued for the Project would have a shorter permit duration than the 30-year permit term under consideration for the proposed action. The Applicant anticipates that the Project will continue to operate for approximately 30 years. Consequently, under the reduced permit term alternative, the take coverage and the required minimization measures would not extend for the duration of the Project's anticipated lifespan. As a result, the Project would continue operating for a period without a permit and, during this time, would not be required to minimize or mitigate potential impacts to condors. The Service does not perceive any benefits in the form of reduced impacts to condors resulting from this alternative and therefore there is no rationale for carrying this alternative forward for detailed analysis.

2.3.2 Regional Conservation Plan Alternative

Under the regional condor conservation plan alternative, the Applicant would not pursue an independent incidental take permit for the Project, but would instead seek condor take coverage through a regional conservation plan covering multiple projects and permittees. No such conservation plan for wind projects in the Tehachapi Mountains exists at this time; this alternative would require that the Applicant join with owners of other wind projects in the region to develop a multiple-project conservation plan as part of a permit application. Pursuant to section 10(a)(1)(B) of the Endangered Species Act and its implementing regulations, the Applicant makes the determination of whether to apply for an incidental take permit. The Service's responsibilities are to review the conservation plan and issue an incidental take permit, if the applicant meets all issuance criteria.

Ultimately, this alternative does not meet the Service's purpose and need in considering the proposed action, to fulfill our authority and obligations under section 10(a)(1)(B) of the Endangered Species Act and to issue an incidental take permit if an applicant satisfies the issuance criteria in section 10(a)(2)(B).

SECTION 3
AFFECTED ENVIRONMENT

3.1 RESOURCES EVALUATED AND FOUND WARRANTING FURTHER ANALYSIS

This section describes the status of resources potentially affected by the proposed action and the no action alternative. In compliance with NEPA, CEQ regulations, and Secretarial Order 3355 the description of the affected environment focuses on only those resources that are potentially subject to impacts; therefore, this section focuses on the condor. For additional explanation, refer to Section 1.5, *Scope of the Environmental Assessment*.

The permit area is located in the Antelope Valley region of Kern County, along the southern foothills of the Tehachapi Mountains (Figure 1). A detailed description of the existing physical environment (i.e., climate, topography, and hydrology), land use, and vegetation can be found in section 3.1 of the conservation plan (Enclosure 1).

3.1.1 Endangered Species: California Condor

The California condor once ranged across North America and historical observations during the time of European-American colonization indicate that condors were widespread and locally abundant from southern British Columbia, Canada, to Baja California, Mexico (D'elia and Haig 2013). Following continued precipitous population declines, the Service listed the condor as endangered in 1967 (32 FR 4001) and, by 1987, had captured and moved all remaining condors from the wild to captive facilities (Snyder and Schmitt 2002). The resulting captive population totaled 26 condors housed at the San Diego Wild Animal Park and the Los Angeles Zoo. With the development of successful captive breeding programs, the Service started releasing condors back into the wild in 1992. Through the efforts of the Service's California Condor Recovery Program and numerous partner organizations, by the end of 2019, the global population had grown to 518 condors in the wild and at captive facilities (Service 2019a). At that time, the 337 wild, free-flying condors comprised four separate and disjunct subpopulations (hereafter flocks) in Arizona and Utah (98 condors), central California (101 condors), southern California (99 condors), and Baja California, Mexico (39 condors). As the geographic ranges of these flocks continue to expand, we anticipate they will eventually begin merging into fewer, larger functioning flocks, but it is difficult to predict when this might happen. The southern California flock is currently the only condor flock with a geographic distribution that overlaps the permit area and therefore is the focus of this section on the affected environment. For a more detailed description of the condor, its life history, habitats, range, status, and threats, see Section 3.2, *Covered Species* of the conservation plan (Enclosure 1) and the Service's website for the "California Condor Recovery Program".

The number of wild condors varies throughout the year (i.e., both increases and decreases) due to various factors, including the number of birds fledged in the wild, the release of captive-reared birds, and both natural and human-caused mortality (Service 2017, 2019b). The wild condor population has increased in most years (Service 2019a), and the southern California flock, which grew from 6 condors in 1992 to 99 in 2019 (Figure 3), currently numbers 94 birds (Service, unpublished data). We anticipate the continued increase of the flock over time with the addition of wild-fledged birds and the release of captive-reared birds. Releases of captive-reared condors continues to be the primary driver of population growth in wild condor flocks (Bakker and Finkelstein 2020; Enclosure 2), but the number of wild-fledged birds in the southern California flock has also continued to increase over time (Figure 3).

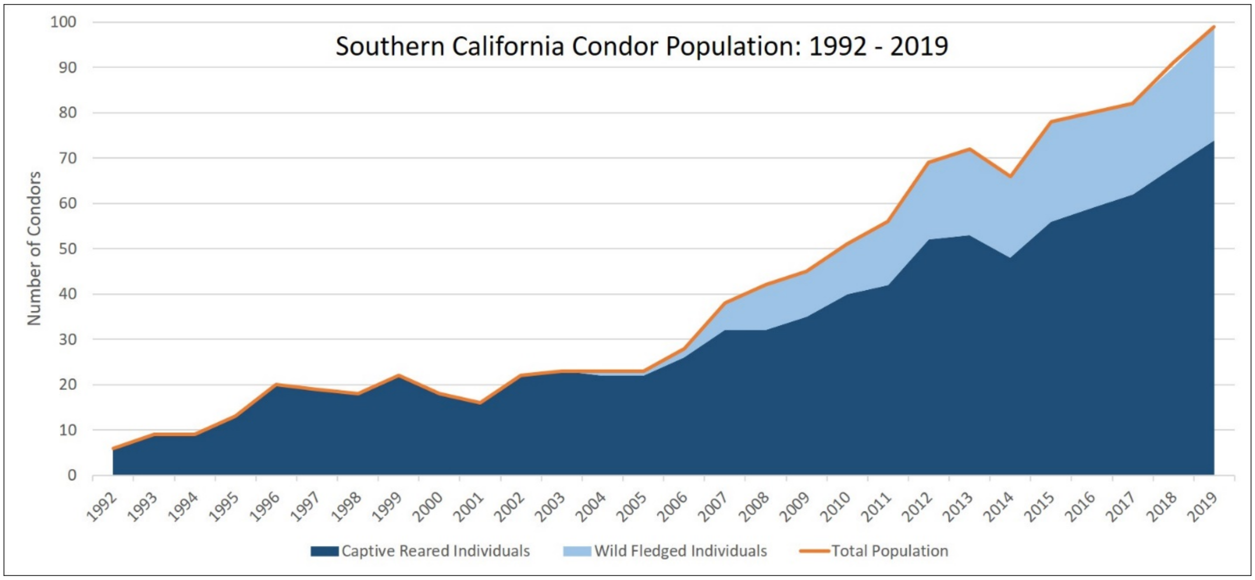


Figure 3. Numbers of wild California condors in southern California flock from 1992-2019.

As the number of condors in the southern California flock has increased, so has the geographic distribution of these birds. For example, the movements of condors in the southern California flock tagged with Global Positioning System (GPS) transmitters spanned an area of approximately 17,500 square miles in 2017 versus 10,500 square miles in 2012 (Service 2012, 2019b). Of particular relevance here is that between 2005 and 2006, condors in the southern California flock started using areas in the Tehachapi Mountains and now regularly occur throughout these mountains and into the western Sierra Nevada (Figure 4).

Information on condor movements and activity, including in the permit area, comes from both visual observations and data from birds wearing transmitters. The Service currently attempts to trap as many condors as possible in the southern California flock, twice annually, to conduct health assessments, and attach and maintain numbered tags and transmitters on as many birds as possible. The Service fits each condor with a uniquely numbered patagial (i.e., wing) tag and up to two different transmitters, a VHF and a combined GPS and Global System for Mobile Communications (GSM) transmitter, to identify individual condors and track their movements in the wild. In some cases a condor might have a VHF transmitter but not a GPS/GSM transmitter. The proportion of tagged condors varies annually (e.g., transmitters fall off or fail, success of trapping efforts varies, etc.) and as of the end of October 2020, 57 percent of the birds were wearing VHF transmitters and 53 percent were wearing GPS/GSM transmitters (Service, unpublished data).

The Applicant's conservation plan provides a detailed summary of condor activity in the permit area and immediate vicinity (Enclosure 1). In this section, we provide a general summary of this information and the most recent data from GPS/GSM-tagged condors. The permit area lacks suitable condor nesting habitat and we have not documented any nesting attempts in the immediate vicinity. Similarly, the permit area lacks the large trees and rock outcrops that condors typically use for roosting; no traditional roost sites occur in the permit area. Condors could stop in the permit area to feed on carrion; to the best of our knowledge, condors have not scavenged carcasses in the permit area since the Service started tracking condors and the Applicant employs a carcass management program at the Project that limits the potential for dead livestock and other large carrion (i.e., deer, coyote, etc.).

During the planning and approval process for the Project, biologists conducted comprehensive desktop studies and biological field surveys in 2004-2005 and again in 2009. These efforts did not indicate any condor activity in the permit area. Post-construction avian field surveys conducted at the Project included bird mortality monitoring from 2013 to 2015, winter raptor surveys from 2012 to 2014; raptor nesting surveys in 2013 and 2014; and bird use surveys in 2013, 2014, and spring 2015. These post-construction surveys did not detect any condor activity in the permit area. The conservation plan has citations for these desktop studies and field surveys (Enclosure 1).

The Project is located in the foothills of the Tehachapi Mountains with topography that becomes more rugged (i.e., mountainous) in the most northern sections of the permit area and thus more suitable for condor flight associated with orographic lift and thermal updrafts (Poessel et al 2017, 2018). From late 2014 until the end of 2018, the Project stationed a biological monitor in the northwest portion of the permit area to conduct daily visual observations for condors and use VHF telemetry equipment to monitor and record activity of tagged birds. The biological monitors periodically detected condors in the permit area, particularly during the months of September to November. However, in all cases, these birds were flying above the height of the wind turbines. During these observations, the monitor could call for curtailment of wind turbines if they identified risk to a condor at the Project. The conservation plan summarizes activity of GPS/GSM-tagged condors in the permit area from November 2013 through July 2017. More recently, from July 1, 2019 to December 15, 2020, data from GPS/GSM-tagged condors indicated 26 occurrences in the permit area that included 16 different condors on 21 different days. Multiple condors (two to three individuals) occurred in the permit area on four different days. In most cases (88 percent), these birds were flying at altitudes above the 340 foot-height of the Project's wind turbines (i.e., 390 to 4,000 feet above ground level). However, on three occasions the flight altitude of a GPS-tagged condor in the permit area was within the height range of the rotor swept area of the wind turbines. Over this period, GPS/GSM-tagged condors occurred in the permit area almost exclusively in the months of June through November, with a single detection in March. Eighty-one percent of the 26 occurrences in the permit area were between the months of August and December with 58 percent in the months of August and September. In 2018, the Applicant began using a geofence system to detect GPS/GSM-tagged condors approaching the Project and curtail wind turbines, thus minimizing risk to condors at the Project. A more detailed description of the geofence is in section 5.2.2 of the conservation plan, *Condor Risk Minimization Program*, and Appendix 2 of Service (2017).

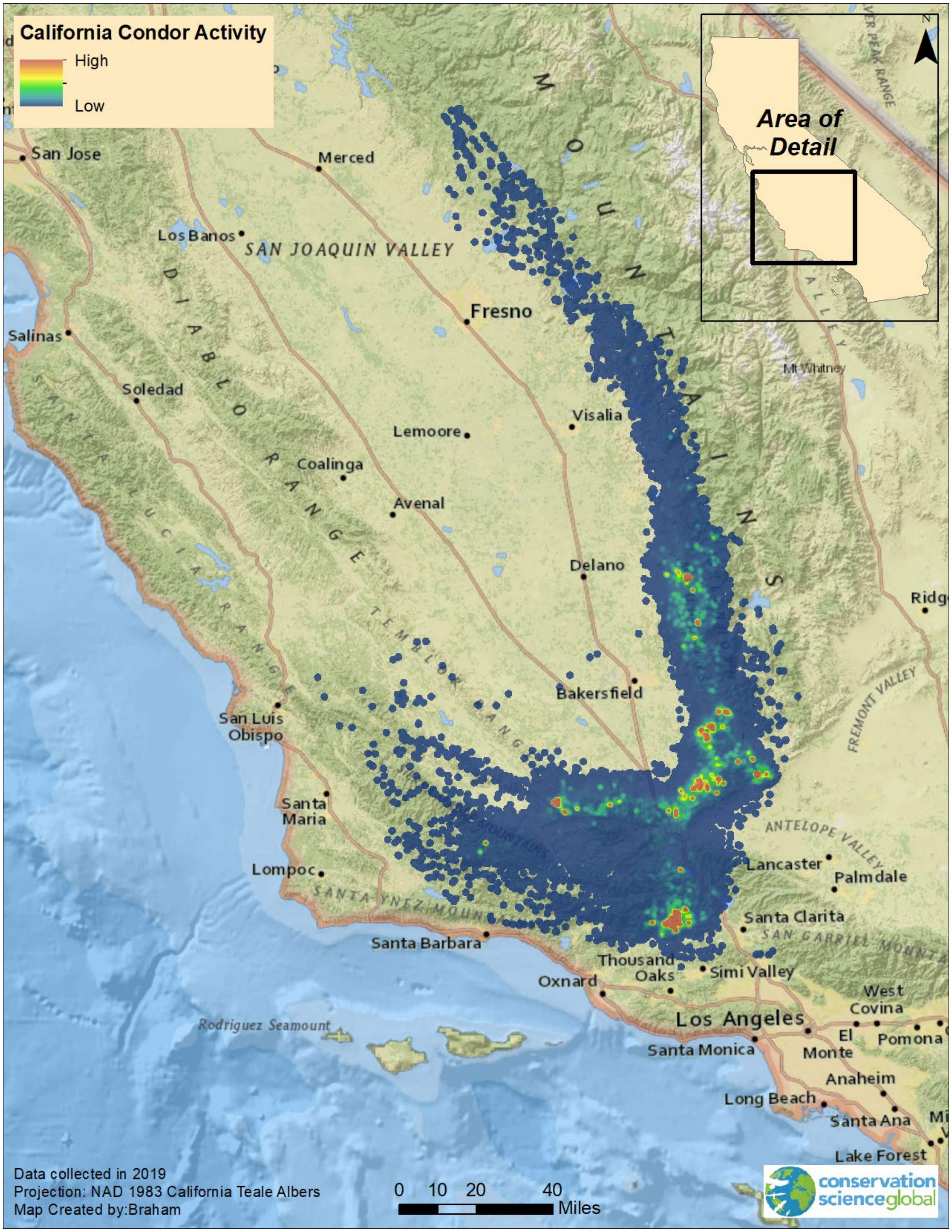


Figure 4. Map of California condor locations in southern California in 2019.

SECTION 4
ENVIRONMENTAL CONSEQUENCES

In this section, we evaluate impacts that would result from implementation of the proposed action and the no action alternative. Analysis of potential impacts to resources typically includes: 1) identification and description of resources that could potentially be affected; 2) examination of the proposed action and the potential effects the proposed action may have on the resource; 3) assessment of the significance of potential impacts; and 4) development of mitigation, special procedures, or adaptive management measures in the event that potentially significant impacts are identified.

4.1 ENDANGERED SPECIES – CALIFORNIA CONDOR

As we stated in section 1.5, *Scope of the Environmental Assessment*, the Service conducted internal scoping that identified the condor as a resource warranting further evaluation for potential impacts from the proposed action. Section 2.1.4, *Take Limits under the Proposed Conservation Plan*, summarizes the qualitative risk assessment that was the basis for determining take limits for the proposed incidental take permit. Finally, section 3, *Affected Environment*, describes the status of condors in the Tehachapi Mountains and in particular, recent condor activity and behaviors (i.e., flight altitudes) in the permit area. Therefore, we focus here on assessing the significance of potential impacts of the proposed action (i.e., permitted take), including the activities outlined in the conservation plan (i.e., minimization and mitigation programs), and the no action alternative on the condor.

4.1.1 No Action Alternative

Under the no action alternative, the Service would not issue an incidental take permit to the Applicant for the take of condors at the Project. The Project would continue to operate without an exemption to section 9 of the Endangered Species Act. Under this alternative, the minimization program would remain voluntary; in the absence of minimization measures the risk of incidental take of condors would be greater. The Applicant also would not implement a mitigation program to offset impacts from the potential incidental take of condors. Because the no action alternative would not require any minimization or mitigation efforts, this alternative would provide no benefits to the condor. If the Applicant chose not to voluntarily continue the minimization program, the risk of incidental take of condors would be greater under this alternative than the proposed action.

During the development of the Applicant's conservation plan, an independent team of researchers conducted a population viability analysis (PVA) to inform key aspects of conservation planning efforts for condors at existing wind energy projects in the Tehachapi Mountains (Bakker and Finkelstein 2020). The PVA investigated the relative impact on the population growth of the southern California condor flock from different levels of simulated take associated with wind energy projects (or other sources of human-caused mortality), in the absence of any mitigation. Specifically, the PVA estimated relative changes in the condor population growth rate and number of birds as a result of various levels of take over a 30-year period. The PVA presented results after a 40-year analysis period (i.e., in year 2060) to allow time for the model simulations to capture potential impacts to the flock. Under the analysis scenario that assumes the Service would continue releases of captive-reared condors for the foreseeable future (i.e., 15 years or longer) and examined the lowest level of simulated take (i.e., 4 adult condors), the PVA estimated that the mean flock growth rate would decrease between 0.4 to 2.9 percent compared to the baseline of no simulated mortalities. For this same scenario, the PVA estimated a 0.6 to 2.2 percent decrease in the flock size, as a proportion of population size, with no simulated wind mortalities (i.e., from the Project or other wind energy facilities).

Under the no action alternative, any take resulting from the Project would not be exempted under section 9 of the Endangered Species Act. Additionally, because the no action alternative would not include a mitigation program, the impacts of any take would result in some level of long-term impacts to the condor population.

4.1.2 Proposed Action

Under the proposed action, the Service would issue the Applicant an incidental take permit for the potential take of up to two free-flying condors and two associated eggs or chicks, from covered activities at the Project over a 30-year permit term. Table 1 lists the activities and associated threats that could result in the incidental take of condor at the Project and would be covered under the proposed incidental take permit.

4.1.2.1 Minimization of Incidental Take

As required for permit issuance, the Applicant's conservation plan specifies measures to minimize the risk of take of condors at the Project (Enclosure 1). As described in section 2.1.5, *Minimization and Mitigation Measures*, the Applicant currently implements general operational measures and a voluntary Condor Risk Management Program to minimize risk to condors; these minimization measures would become mandatory as part of the permit issuance criteria. Additionally, the conservation plan includes an adaptive management strategy to manage condor risk and maintain effective minimization measures over the duration of the permit term. The Applicant coordinated with the Service on the development of the adaptive management strategy and the triggers that would result in the implementation of additional or alternative minimization measures (Enclosure 1).

4.1.2.2 Mitigation of Incidental Take

The goals of the PVA developed by the independent team of researchers were to provide an objective and quantifiable approach for developing mitigation measures to offset the impacts of the incidental take of a condor and to evaluate the potential effects on the condor population from the issuance of incidental take permits in the absence of mitigation (Bakker and Finkelstein 2020). Accordingly, the specific objectives of the PVA were to 1) estimate the number of captive-bred juvenile condor releases needed to offset the mortality of a free-flying adult condor and any dependent progeny; and 2) quantify the relative impact on condor population growth from potential mortalities at wind energy facilities in the absence of mitigation to offset such losses. To accomplish each of these objectives, the researchers used the PVA to analyze a wide range of scenarios that were determined following discussions with the Service. The researchers focused these analyses on the southern California flock, because take associated with the proposed incidental take permit would directly affect that flock; all of the flocks currently act as distinct sub-populations, although on a small number of occasions condors have visited territories of different flocks. Therefore, the analysis simulated the population dynamics and demographic parameters (e.g., age and breeding classes, survivorship, etc.) in the southern California flock. The PVA report is included here as Enclosure 2, along with a "Frequently Asked Questions" document (Enclosure 3) that the Service developed to help answer basic questions related to the PVA work.

As described in section 2.1.5, *Minimization and Mitigation Measures*, the Applicant developed a mitigation strategy to fully offset the impacts of incidental take permitted under the proposed action (i.e., two free-flying condors and two associated eggs or chicks). Using the results of the PVA referenced above, the focus of this mitigation would be to increase the number of captive-reared condors available for release into the wild. Specifically, the PVA estimated that the loss of an adult condor and its contribution to population growth could be offset by the release of 2.0-3.0 captive-bred, 1.5 year-old juvenile condors. This range of replacement ratios accounts for a worst-case scenario where take always involves a breeding bird with dependent young, as well as the scenario where take could be a non-breeding bird with no dependent young. The Applicant would initiate the mitigation program following issuance of the incidental take permit (i.e., regardless of whether incidental take has occurred or not) and work with the Oregon Zoo's breeding facility to fund the measures needed (i.e., additional staff) to produce six additional 1.5-year-old captive-reared condors for release into the wild population.

The level of mitigation uses the upper range of replacement ratios and based on the PVA would fully offset the impacts of the permitted take. Therefore, the proposed action would not result in significant adverse impacts to condors and would not impede recovery of the species. Conversely, if the take that occurs are juvenile or non-breeding birds, or if the actual amount of take is less than what is permitted, the potential exists that the mitigation associated with the proposed action would provide a net benefit to the recovery of the California condor.

SECTION 5
CUMULATIVE IMPACTS

Cumulative impacts result from incremental impacts of the proposed action which, when combined with other past, present, and reasonably foreseeable future actions in an affected area, may collectively cause more substantial impacts. For the purposes of this environmental assessment, we defined the cumulative effects analysis area as the Tehachapi Mountains. We selected this spatial scale because it is a defined area that includes the current Project and other related development (i.e., wind energy facilities) that could affect condors, the southern California condor flock regularly occurs in this area, and there is sufficient information to evaluate past, present, and reasonably foreseeable future actions.

5.1 WIND ENERGY CONSERVATION PLANS AND INCIDENTAL TAKE PERMITS

The Tehachapi Mountains comprise the largest wind energy resource area in California, both in terms of the extent of this area and overall energy production. As of 2016, the operational wind energy capacity in this resource area was 3,282 MW and accounted for 57 percent of the statewide wind energy generation (Hingtgen et al. 2019). As of 2016, just under 50 projects and approximately 4,200 wind turbines occurred in this area (Hingtgen et al. 2019). The Service is the only regulatory agency with the authority to authorize take of condor.

As stated previously, we are not aware of any injury or death of a condor at a wind energy facility. However, similar to the Manzana Wind Power Project, other existing wind energy facilities in the Tehachapi Mountains also represent some level of risk of incidental take of condors over time. With one exception, all of these facilities are located entirely on private lands. In 2013, the Bureau of Land Management (2013) issued a right-of-way grant for the construction and operation of the Alta East Wind Project. The Service (2013a) completed a biological opinion for this project that analyzed the potential effects on the condor, concluded that the proposed action was not likely to jeopardize the continued existence of the species, and included an incidental take statement for the take of one condor and its dependent young over the 30-year life of the project. The Alta East Wind Project employs mandatory measures to minimize potential impacts to condors.

The Bureau of Land Management and Service also consulted on the Desert Renewable Energy Conservation Plan (Bureau of Land Management 2015), which included the future development of wind energy facilities on up to 264 acres that roughly overlap the permit area for the Project. In its biological opinion for this land use plan amendment, the Service (2016) concluded that the future development of wind energy facilities in that planning area was not likely to jeopardize the continued existence of the condor. The land use plan amendment did not authorize any specific development, however, it does contain conservation and management actions that would guide the development of any future wind energy facilities in the planning area. In its biological opinion, the Service anticipated that future wind energy facilities on lands managed by the Bureau of Land Management were likely to kill four condors over the 25-year planning horizon for the land use plan amendment.

The Service is also working with the Los Angeles Department of Water and Power on the development of a conservation plan for condors at its operational Pine Tree Wind Power Project in the Tehachapi Mountains. The Los Angeles Department of Water and Power is considering submission of an application for a condor incidental take permit under section 10 of the Endangered Species Act; the requested level of take and conservation strategy would closely match that of the current proposed action under consideration. We have also been communicating with other wind energy operators in the Tehachapi Mountains about the potential for a larger-scale conservation plan for condors at existing operational projects in this area.

The Service's addressing of the potential effects of wind energy facilities on the California condor, through section 7(a)(2) and section 10(a)(1)(B) of the Endangered Species Act, constitutes cumulative impacts. The PVA described initially in sections 4.1.1, *No Action*

Alternative, and 4.1.2, *Proposed Action* (Bakker and Finkelstein 2020; Enclosure 2), provides a way to evaluate the potential impacts on the southern California condor flock, in the absence of mitigation, of potential incidental take at wind energy facilities. For instance, under the analysis scenario that assumes the Service continues its existing release program of captive-reared condors for the foreseeable future (i.e., 15 years or longer), the PVA estimates that the intermediate level of take (i.e., take of 15 condors) would result in a decrease in the mean rate of flock growth from 1.7 to 7.6 percent at the end of the 40-year analysis period. For this same scenario, the PVA estimated that the size of the southern California flock would decrease by 2.8 to 7.2 percent over the same time period. However, any project seeking an incidental take permit would also need to propose a strategy to minimize and mitigate the impacts of potential incidental take to the maximum extent practicable. Regardless, the Service would continue to evaluate potential impacts on the condor population from any application submitted for an incidental take permit. Therefore, we do not anticipate the issuance of additional incidental take permits for condors in the Tehachapi Mountains, particularly for existing wind energy projects, would result in significant cumulative impacts to condors.

5.2 OTHER ACTIONS

Other past, present, and reasonably foreseeable future actions that could affect condors exist in the Tehachapi Mountains. For instance, the incremental growth of local communities (e.g., Tehachapi) could result in residential development and some level of habitat loss. However, this potential future development will likely be balanced by open space areas, along with the fact that condors are a wide-ranging species that continue to expand their range and are not considered habitat limited (Service 1996, 2019b).

The Service (2013b) issued an incidental take permit for the Tehachapi Uplands Multiple Species Habitat Conservation Plan (Tejon Ranch) that included the non-lethal, incidental take of up to four condors in the case that habituation occurs. The conservation strategy for this plan includes measures to minimize and mitigate impacts to condors, including the preservation as open space of more than 90 percent of the 142,000 acre permit area. The issuance of the Tejon Ranch incidental take permit will not result in the injury or mortality of condors; in its record of decision, the Service (2013b) concluded that "the vast majority of suitable condor foraging habitat and all traditional condor roost sites within the plan area boundaries would be permanently protected and managed…".

5.3 CUMULATIVE IMPACTS CONCLUSION

Based on this analysis, we conclude that the Service's past and future regulatory activities in the cumulative impacts analysis area (i.e., Tehachapi Mountains), combined with the current proposal to issue an incidental take permit for the operation and maintenance of the Manzana Wind Project, would not substantially contribute to cumulative impacts to the southern California condor population.

SECTION 6
REFERENCES

[Avangrid] Avangrid Renewables LLC. 2020. Manzana Wind Power Project draft California condor conservation plan. Prepared by Avangrid, Portland, Oregon; Dudek, Encinitas, California; and Nossaman LLP, Austin, Texas. Dated November 2020.

Avian Powerline Interaction Committee. 2006. Suggested practices for avian protection on power lines: the state of the art in 2006. Edison Electric Institute, Avian Powerline Interaction Committee, and the California Energy Commission. Washington, D.C. and Sacramento, California.

Bakker, V., and M. Finkelstein. 2020. Quantitative analyses to inform conservation planning efforts associated with California condors (*Gymnogyps californianus*). Report prepared for the U.S. Fish and Wildlife Service, Palm Springs, California; Avangrid Renewables, LLC, Portland, Oregon; and the City of Los Angeles Department of Water and Power, Los Angeles, California. Dated April 8, 2020.

Bureau of Land Management. 2013. Notice of availability of the Record of Decision for the Alta East Wind Project, Kern County, California. Agency/Docket Number CACA 052537. Federal Register Notice Volume 78, No. 106.

Bureau of Land Management. 2015. Desert Renewable Energy Conservation Plan. Proposed land use plan amendment and final environmental impact statement. Sacramento, California. Dated October 2015.

California Department of Fish and Wildlife. 2018. California Natural Diversity Database. Government version. Dated June 1, 2018.

County of Kern. 2008. PdV Wind Energy Project Final Environmental Impact Report (SCH Number 200606115). Prepared by County of Kern Planning Department, Bakersfield, California. Dated February 2008.

de Lucas, M., M. Ferrer, M. J. Bechard, and A. R. Munoz. 2012. Griffon vulture mortality at wind farms in southern Spain: distribution of fatalities and active mitigation measures. Biological Conservation 147: 184–189.

D'Elia, J., and S. M. Haig. 2013. California Condors in the Pacific Northwest. Oregon State University Press, Corvallis, Oregon.

Hingtgen, J., D. Le, B. Davis, and B. Huang. 2019. Productivity and status of wind generation in California, 2014 through 2016. California Energy Commission. CEC-200-2019-002.

Kelly, T. R., B. A. Rideout, J. Grantham, J. Brandt, L. J. Burnett, K. J. Sorenson, D. George, A. Welch, D. Moen, J. Rasico, M. Johnson, C. Battistone, and C. K. Johnson. 2015. Two decades of cumulative impacts to survivorship of endangered California condors in California. Biological Conservation 191: 391–399.

Mauck, J. 2020. Conservation plans and proposed issuance of incidental take permits for California condors at wind energy projects in the Tehachapi Mountains. Email from the Director of Cultural Resources Management, San Manuel Band of Mission Indians, Highland, California to the Palm Springs Fish and Wildlife Office, Palm Springs, California. Dated June 9, 2020.

Pagel, J. E., K. J. Kritz, B. A. Millsap, R. K. Murphy, E. L. Kershner, and S. Covington. 2013. Bald eagle and golden eagle mortalities at wind energy facilities in the contiguous United States. Journal of Raptor Research 47: 311–315.

Poessel, S. A., J. Brandt, T. A. Miller, and T. E. Katzner. 2017. Meteorological and environmental variables affect flight behavior and decision-making of an obligate soaring bird, the California condor (*Gymnogyps californianus*). Ibis 160: 36–53.

Poessel, S. A., J. Brandt, L. Mendenhall, M. A. Braham, M. J. Lanzone, A. J. McGann, and T. E. Katzner. 2018. Flight response to spatial and temporal correlates informs risk from wind turbines to the California condor. Condor 120: 330–342.

Rideout, B. A., I. Stalis, R. Papendick, A. Pessier, B. Puschner, M. E. Finkelstein, D. R. Smith, M. Johnson, M. Mace, R. Stroud, J. Brandt, J. Burnett, C. Parish, J. Petterson, C. Witte, C. Stringfield, K. Orr, J. Zuba, M. Wallace, and J. Grantham. 2012. Patterns of mortality in free-ranging California condors (*Gymnogyps californianus*). Journal of Wildlife Diseases 48: 95–112.

[Service] U.S. Fish and Wildlife Service. 1996. California Condor Recovery Plan. Third revision. U.S. Fish and Wildlife Service, Portland, Oregon.

[Service] U.S. Fish and Wildlife Service. 2012. Hopper Mountain National Wildlife Refuge Complex: California Condor Recovery Program 2012 Annual Report. Hopper Mountain National Wildlife Refuge Complex, Ventura, California.

[Service] U.S. Fish and Wildlife Service. 2013a. Biological opinion for the Alta East Wind Project, Kern County, California. Ventura Fish and Wildlife Office, Ventura, California. Dated May 8, 2013.

[Service] U.S. Fish and Wildlife Service. 2013b. Record of Decision for the Tehachapi Uplands Multiple Species Habitat Conservation Plan Environmental Impact Statement. Dated April 29, 2013.

[Service] U.S. Fish and Wildlife Service. 2016. Biological opinion on the proposed Land Use Plan Amendment under the Desert Energy Renewable Energy Plan. Carlsbad Fish and Wildlife Office, Carlsbad, California. Dated August 16, 2016.

[Service] U.S. Fish and Wildlife Service. 2017. USFWS recommendation that inclusion of southwestern willow flycatcher as covered species for Manzana Wind Power Project conservation plan not warranted. Memo from the Palm Springs Fish and Wildlife Office to Avangrid LLC. Dated October 31, 2017.

[Service] U.S. Fish and Wildlife Service. 2019a. California Condor Recovery Program 2019 Annual Population Status. Hopper Mountain National Wildlife Refuge Complex, Ventura, California.

[Service] U.S. Fish and Wildlife Service. 2019b. Hopper Mountain National Wildlife Refuge Complex: California Condor Recovery Program 2017 Annual Report. Hopper Mountain National Wildlife Refuge Complex, Ventura, California.

[Service] U.S. Fish and Wildlife Service. 2020. Consultation for Issuance of an Incidental Take Permit for California Condor at the Manzana Wind Power Project. Letter from the Carlsbad Fish and Wildlife Office to the State of California Office of Historic Preservation. Dated September 22, 2020.

[Service] U.S. Fish and Wildlife Service, Bureau of Land Management, and California Department of Fish and Wildlife. 2011. California condor, golden eagle, and wind energy workshop proceedings. California State University, Sacramento Center for Collaborative Policy, Sacramento, California. December 1-2, 2011.

[Service] U.S. Fish and Wildlife Service and National Marine Fisheries Service. 2016. Habitat Conservation Planning and Incidental Take Permit Processing Handbook.

Sheppard, J. K., A. McGann, M. Lanzone, and R. R. Swaisgood. 2015. An autonomous GPS geofence alert system to curtail avian fatalities at wind farms. Animal Biotelemetry 43: 43.

Snyder, N. F. R., and J. Schmitt. 2002. California Condor (*Gymnogyps californianus*). *In* The Birds of North America Online. A. Poole, Editor). Cornell Lab of Ornithology, Ithaca, New York.

Sullivan, B. L., C. L. Wood, M .J. Iliff, R. E. Bonney, D. Fink, and S. Kelling. 2009. eBird: a citizen-based bird observation network in the biological sciences. Biological Conservation 142: 2,282–2,292.

State of California Office of Historic Preservation. 2020. Section 106 Consultation: Issuance of an Incidental Take Permit for California Condor at the Manzana Wind Power Project, Kern County, California. Letter from the State of California Office of Historic Preservation to the Carlsbad Fish and Wildlife Office. Dated October 22, 2020.

Watson, R. T., P. S. Kolar, M. Ferrer, T. Nygård, N. Johnston, W. G. Hunt, H. A. Smit-Robinson, C. J. Farmer, M. Huso, and T. E. Katzner. 2018. Raptor interactions with wind energy: case studies from around the world. Journal of Raptor Research 52: 1–18.

SECTION 7
LIST OF PREPARERS

Table 2. List of Preparers of this Document.

Name	Title
Brian Croft	Division Supervisor - Mojave Desert Division Palm Springs Fish and Wildlife Office
Ray Bransfield	Senior Biologist Palm Springs Fish and Wildlife Office
Peter Sanzenbacher	Fish and Wildlife Biologist Palm Springs Fish and Wildlife Office

ENCLOSURE 1

Manzana Wind Power Project
Draft California Condor Conservation Plan

MANZANA WIND POWER PROJECT
CALIFORNIA CONDOR DRAFT CONSERVATION PLAN

Prepared by:

Avangrid Renewables LLC
1125 NW Couch Street, Suite 700
Portland, Oregon 97209
Contact: Amy E. Parsons

DUDEK
605 Third Street
Encinitas, California 92024
Contact: Mike Howard

NOSSAMAN LLP
816 Congress Avenue, Suite 970
Austin, Texas 78701
Contact: Brooke M. Wahlberg

NOVEMBER 2020

TABLE OF CONTENTS

Section **Page No.**

TABLE OF CONTENTS (CONTINUED)

Section **Page No.**

APPENDIX

TABLE OF CONTENTS (CONTINUED)

Page No.

TABLES

FIGURES

INTENTIONALLY LEFT BLANK

ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
amsl	above mean sea level
APLIC	Avian Power Line Interaction Committee
EIR	environmental impact report
ESA	federal Endangered Species Act
FAA	Federal Aviation Administration
FTE	full-time employee
GE	General Electric
GPS	Global Positioning System
GSM	Global System for Mobile Communications
ITP	incidental take permit
kV	kilovolt
MBTA	Migratory Bird Treaty Act
MW	megawatt
NCC	National Control Center
NEPA	National Environmental Policy Act
NWR	National Wildlife Refuge
PVA	population viability analysis
SCADA	Supervisory Control and Data Acquisition
SCE	Southern California Edison
USFWS	U.S. Fish and Wildlife Service
VHF	very high frequency

MEASUREMENT CONVERSIONS

U.S. Units	International System of Units
1 acre	0.40 hectares
1 foot	0.30 meters
1 inch	2.54 centimeters
1 mile	1.61 kilometers
1 mile per hour	0.45 meters per second
1 pound	0.45 kilograms
1 square foot	0.09 square meters
1 square mile	2.59 square kilometers

INTENTIONALLY LEFT BLANK

1 INTRODUCTION

1.1 Overview and Background

The Kern County Board of Supervisors issued a conditional use permit for the Manzana Wind Power Project (Manzana or Project) after development and review of an environmental impact report (EIR) in accordance with California Environmental Quality Act standards (County of Kern 2008). Manzana began commercial operations in 2012 and is owned and operated by Manzana Wind LLC (Manzana Wind), a wholly owned subsidiary of Avangrid Renewables LLC (formerly Iberdrola Renewables LLC). Manzana, located in the Antelope Valley region of southern Kern County, California (Figure 1), was developed to provide clean, renewable energy in response to federally and state-mandated greenhouse gas emissions reduction targets and renewable energy portfolio standards.

1.2 Purpose

Manzana Wind is applying to the U.S. Fish and Wildlife Service (USFWS) for a permit pursuant to Section 10(a)(1)(B) of the Endangered Species Act (ESA) of 1973, as amended, for the potential incidental take of the federally endangered California condor (condor; *Gymnogyps californianus*) associated with operating the Project. Pursuant to the requirements for a Section 10(a)(1)(B) permit, Manzana Wind, in coordination with USFWS, has developed this Manzana Wind Power Project California Condor Conservation Plan (Manzana Conservation Plan; Conservation Plan).

1.3 Permit Duration

The Manzana Conservation Plan is based on a permit term and duration of 30 years. The permit duration is based on the approximate duration of existing land leases on the Project site. Before the end of the permit term, Manzana Wind may apply to amend the Conservation Plan and associated permit to extend the permit duration.

1.4 Permit Area / Plan Area

A Permit Area is where the incidental take permit (ITP) applies to Covered Activities, and the Plan Area is the area where the Covered Activities, including mitigation, will occur (USFWS and NMFS 2016). The Manzana Conservation Plan Permit Area includes the portions of the Project site with wind turbines, transmission and collection lines and poles, access roads, and other facilities, including the overhead electrical line corridor (co-owned with EDF Renewables; see Section 2.1) that runs south and connects the Project to the existing Southern California Edison (SCE) Whirlwind Substation (Figure 2). See Section 2.1 for a description of the Project and Section 2.2 for a discussion of Covered Activities. Manzana Wind has control over operations of the Project through long-term lease agreements with the landowners. In total, the Conservation Plan

Permit Area covers approximately 5,515 acres. The Plan Area for the Manzana Conservation Plan includes the Permit Area.

1.5 Covered Species

The Manzana Conservation Plan covers the potential incidental take of condor. No other federally listed wildlife species are reasonably certain to be taken in the Permit Area and no critical habitat for any species, including condors, has been designated in the Permit Area (USFWS 2016a; enXco 2009; County of Kern 2008).

Manzana Wind conducted analysis and conferred with USFWS on the potential for southwestern willow flycatcher (flycatcher; *Empidonax traillii extimus* [federally endangered]) to occur on the Project site. Environmental analysis conducted for the Project determined that the site does not support suitable riparian vegetation or food-rich habitat resources that would support breeding populations of flycatcher or that would serve as a stopover attractant during migration events. Based on this assessment, and with USFWS concurrence, take of flycatcher is not reasonably certain to occur at the Project site.

The potential for desert tortoise (*Gopherus agassizii* [federally threatened]) to occur within the Project area was previously evaluated in the EIR. Protocol-level surveys conducted during prior environmental analyses of the Project area resulted in no observations of individuals or signs of this species. This species is not expected to occur on the Project site and the take of desert tortoise is not reasonably certain to occur at the site.

1.6 Permit Structure

Manzana Wind is the Applicant seeking incidental take coverage for operations and maintenance (O&M) activities at the Manzana facility. Manzana Wind will be the permit holder and will be responsible for Conservation Plan funding and implementation.

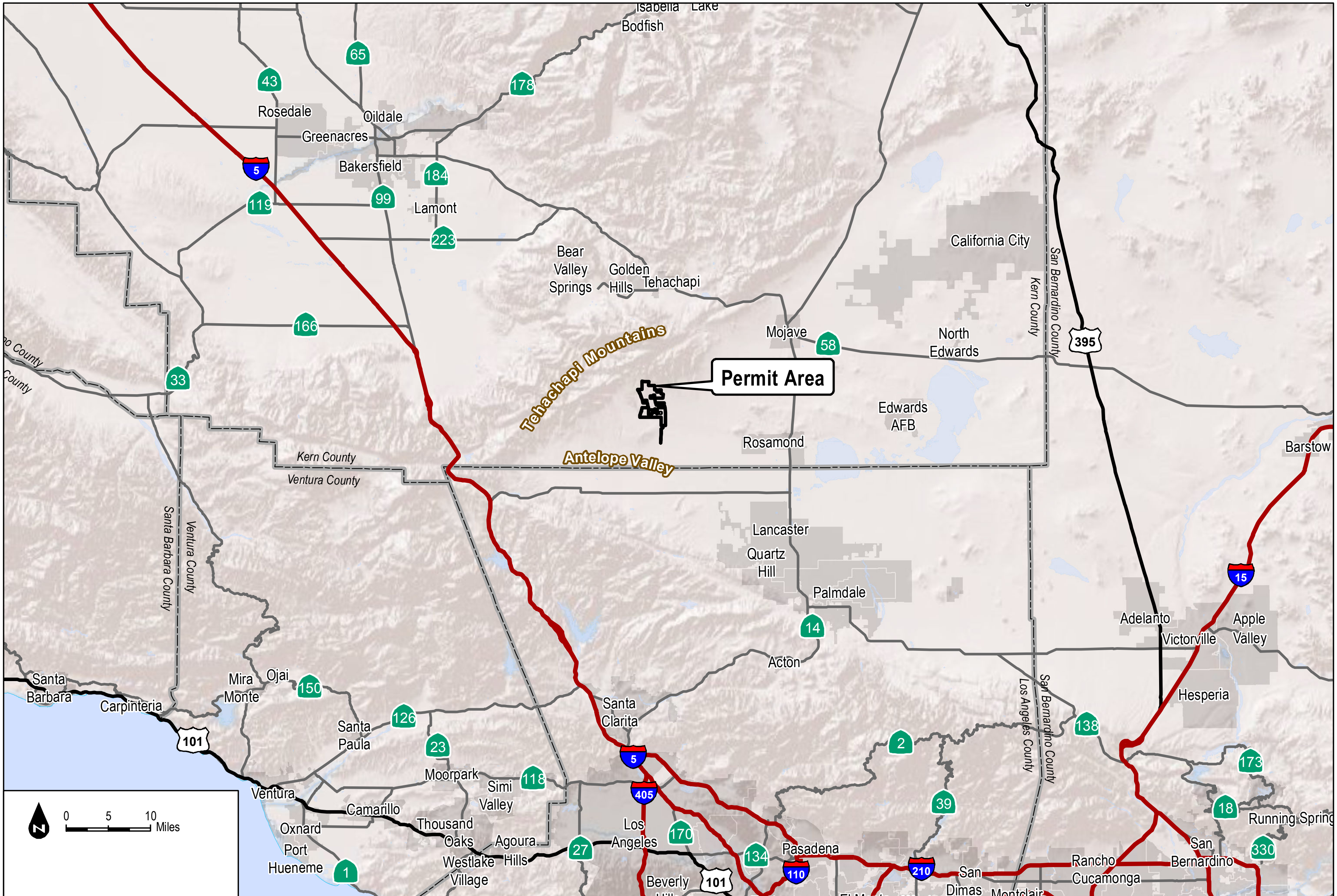


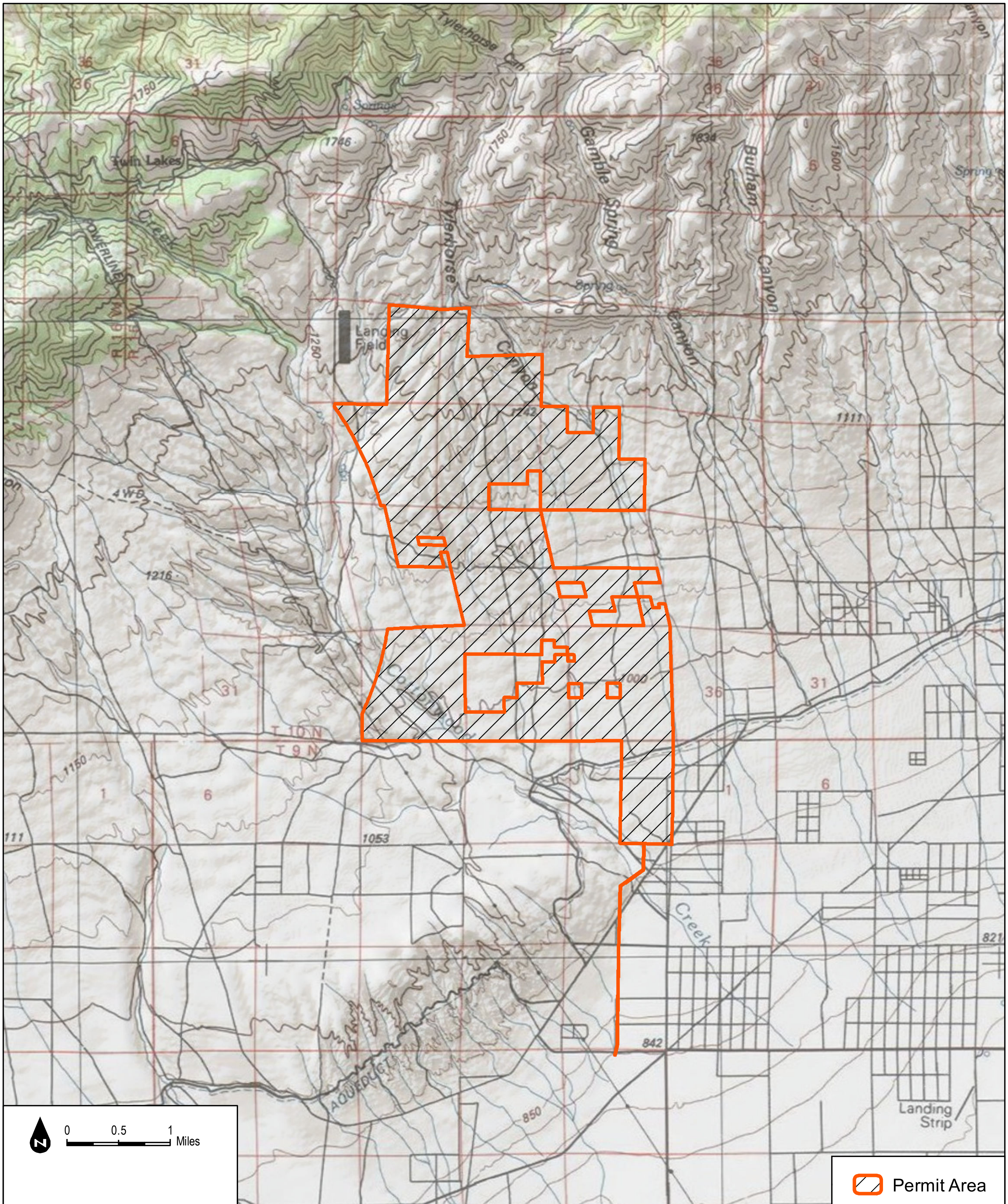
FIGURE 1

Regional Map

DUDEK

Manzana Wind Power Project - California Condor Conservation Plan

INTENTIONALLY LEFT BLANK



SOURCE: USGS 7.5-minute Tylerhorse Canyon Quadrangle

FIGURE 2

Permit Area

Manzana Wind Power Project - California Condor Conservation Plan

INTENTIONALLY LEFT BLANK

1.7 Regulatory Framework

The following provides a brief regulatory framework relevant to the issuance of an ITP for the Manzana Conservation Plan.

1.7.1 Endangered Species Act

The ESA (16 USC 1531 et seq.), as amended, protects federally listed endangered wildlife species from unlawful take and provides measures for their protection and recovery. Section 9 of the ESA prohibits the take of threatened and endangered wildlife species. In Section 3 of the ESA, "Take" is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Harass is defined as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." Harm is defined as "an act which actually kills or injures wildlife. Such acts may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering" (50 CFR, Part 17.3).

Under Section 10(a)(1)(B) of the ESA, nonfederal entities may obtain ITPs authorizing the taking of federally listed wildlife species if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity that lacks a federal nexus. Section 10(a)(2)(A) of the ESA requires an applicant for an ITP to submit a conservation plan to USFWS. This document is commonly referred to as a habitat conservation plan, but because there is no habitat component for the Project, "conservation plan," which is the actual term used in Section 10(a)(2)(A) of the ESA, is used in this circumstance. Prior to issuing an ITP, USFWS conducts an internal Section 7 consultation to determine whether the issuance of the ITP will appreciably reduce the likelihood of the survival and recovery of the species covered by the conservation plan or adversely modify designated critical habitat. If USFWS finds that the proposed taking will be incidental; that the applicant will ensure adequate funding of the conservation plan; that the conservation plan will not appreciably reduce the likelihood of the survival and recovery of the species; and that the measures in the conservation plan will minimize and mitigate the impact of the taking to the maximum extent practicable, it will issue an ITP.

1.7.2 National Environmental Policy Act

Issuance of an ITP under Section 10 of the ESA is a federal action subject to the National Environmental Policy Act (NEPA) (42 USC 4321 et seq.). The NEPA process provides an overall framework for the evaluation and public disclosure of the environmental effects of federal actions.

Regulations for the implementation of NEPA provisions require federal agencies to analyze the impacts of proposed actions and involve other agencies and the public in the process.

USFWS is typically the NEPA lead agency for actions related to conservation plans for terrestrial species and would initiate the process by determining the type of NEPA compliance required to evaluate the potential environmental impacts of ITP issuance and conservation plan implementation. Major federal actions significantly affecting the quality of the human environment would require preparation of an environmental impact statement. For actions that do not require an environmental impact statement and do not qualify for a categorical exclusion, an environmental assessment would be prepared. If significant effects on the quality of the human environment are not likely to occur based on the environmental assessment, USFWS would issue a finding of no significant impact; otherwise, an environmental impact statement would be prepared. Once the NEPA process is completed, USFWS will make a determination on whether or not to issue the ITP.

1.7.3 National Historic Preservation Act

Section 106 of the National Historic Preservation Act of 1966, as amended (54 USC 300101 et seq.), requires federal agencies to take into account the effects of their actions on historic properties listed or eligible for listing in the National Register of Historic Places. Historic properties are defined as prehistoric and historic sites, buildings, structures, districts, and objects included in or eligible for inclusion on the National Register of Historic Places, as well as artifacts, records, and remains related to such properties. Historic properties may include places of traditional religious and cultural importance to Indian tribes. USFWS issuance of an ITP is subject to compliance with Section 106 of the National Historic Preservation Act.

1.7.4 Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 (MBTA), as amended (16 USC 703 et seq.), is the domestic law that implements the United States' commitment to international conventions for the protection of migratory bird resources. The MBTA protects most native birds occurring in the United States and their nests, eggs, young, and parts from possession, sale, purchase, barter, transport, import, export, and take. USFWS implements and enforces the MBTA. For species listed under both the ESA and the MBTA, USFWS has the authority to authorize incidental take under Section 10(a)(1)(B) of the ESA, which can also serve as a special-purpose permit under the MBTA.

1.8 Coordination with the U.S. Fish and Wildlife Service

Coordination with USFWS for Manzana began in 2005 and continued throughout the planning and County permitting phase of the Project. As part of the EIR process for the Project, the County of Kern (County) notified USFWS of the Project in 2006, USFWS submitted written comments on the Project in 2007, and the County provided responses to comments in 2008. Following Project approval, post-construction studies were provided to USFWS per conditions outlined in the conditional use permit.

In an August 2014 letter to Avangrid Renewables (then Iberdrola Renewables), USFWS provided updated information on condor activity in relation to Manzana and requested the development of a condor avoidance and minimization strategy for Manzana.

In September 2014, Avangrid Renewables staff met with USFWS, including staff from the California Condor Recovery Program, to discuss condor tracking data and various avoidance strategies and technologies. In a follow-up letter to USFWS, Avangrid Renewables provided a review of existing tracking technologies, documented existing minimization measures and technologies employed at Manzana, and reiterated Avangrid Renewables' continued efforts to proactively and collaboratively manage potential environmental concerns at Manzana.

In November 2014, USFWS sent letters to operators of wind facilities in the Tehachapi region, including Avangrid Renewables, requesting development of avoidance and minimization strategies for condor.

In November 2015, Avangrid Renewables again met with USFWS to discuss condor activity in relation to Manzana operations.

In January 2016, Avangrid Renewables notified USFWS of its intent to develop a conservation plan and apply for an ITP under Section 10(a)(1)(B) of the ESA. In July 2016, Avangrid Renewables, Dudek, and USFWS conducted a site visit at Manzana and kicked off development of the Manzana Conservation Plan.

Avangrid Renewables and USFWS coordination on the ITP application has been ongoing since 2016.

INTENTIONALLY LEFT BLANK

2 PROJECT DESCRIPTION AND COVERED ACTIVITIES

The following sections provide a project description for Manzana and define the Covered Activities addressed under the ITP for the Manzana Conservation Plan.

2.1 Project Description

Manzana is an operating wind power project situated in the Antelope Valley region of Kern County along the southern foothills of the Tehachapi Mountains (Figure 1). The County of Kern's Manzana conditional use permit authorized construction and operation of up to 300 megawatts (MW) of commercial energy production. Manzana has a current nameplate capacity of 189 MW, consisting of 126 General Electric (GE) 1.5 MW turbines, which began commercial operations in December 2012. The following describes the components of the Manzana facility, as shown on Figure 3.

Turbines

Each turbine comprises a monopole tower, a nacelle, and three blades attached to the hub. The Manzana GE turbines have a hub height of 213 feet and a rotor diameter of 253 feet. The rotor-swept zone extends from 87 to 340 feet above ground level. Safety lighting was installed on a total of 47 turbines, per requirements determined by the Federal Aviation Administration (FAA), and consists of synchronized flashing red lights mounted on the nacelle.

The turbines at the Manzana facility occur in multiple strings that are generally oriented southwest to northeast. Turbines are located throughout the Permit Area at elevations ranging from approximately 3,200 to 4,300 feet above mean sea level (amsl). Typical spacing between turbine towers within a string is 600 to 800 feet. See Figure 3 for the turbine locations and turbine array boundary that encompasses the Manzana turbines.

Transmission and Collection Lines and Associated Poles

The electrical infrastructure at the Manzana facility includes approximately 24 miles of underground electrical collection lines, 7 miles of 34.5-kilovolt (kV) overhead electrical collection lines, 4 miles of 230 kV overhead transmission lines, and 2 miles of underground fiber-optic lines. The 230 kV transmission line connects to the SCE Whirlwind Substation located approximately 3 miles south of the Project site. The transmission line is co-owned with EDF Renewables; poles, associated hardware, and conductors are co-managed and maintained, but each entity operates its own lines independently.

The overhead electrical transmission and collection lines and associated poles are generally configured in a north-to-south direction. The electrical collection line poles are approximately 85 feet tall and generally located at 200- to 300-foot intervals, and the electrical transmission line poles are approximately 125 feet tall and generally located at 700- to 800-foot intervals. Overhead electrical infrastructure is consistent with Avian Power Line Interaction Committee (APLIC) suggested practices for reducing avian electrocution (APLIC 2006). See Figure 3 for locations of the transmission and collection lines.

Operations Facilities

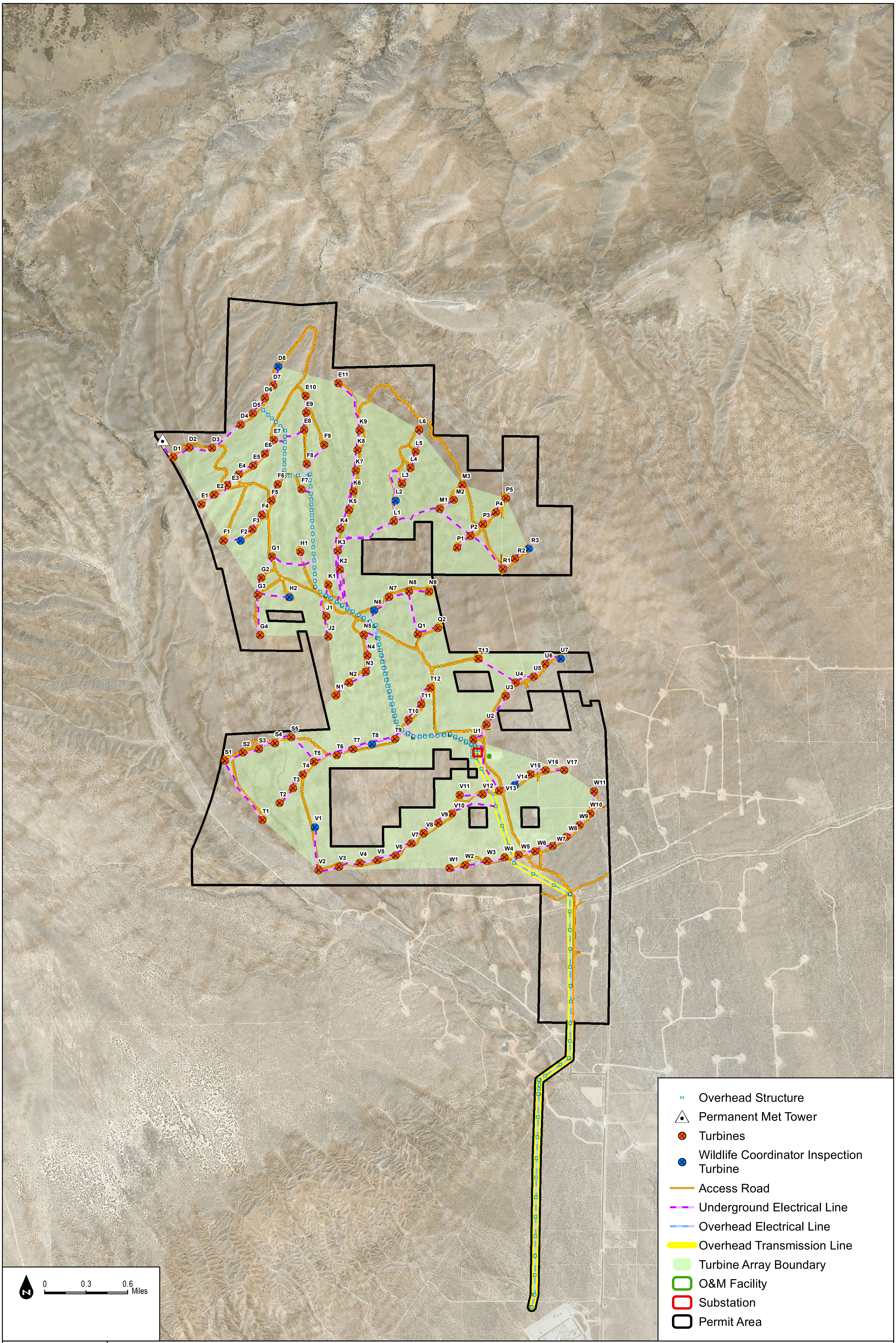
Operations facilities include an O&M building and yard, one permanent meteorological tower, and an electrical substation. The O&M building is approximately 7,500 square feet, and the O&M yard covers approximately 4 acres. The permanent meteorological tower is freestanding (without guy wires), is approximately 213 feet tall, and is lighted in accordance with FAA requirements with a medium-intensity dual red-and-white lighting system. The electrical substation covers approximately 2.2 acres. See Figure 3 for the location of the O&M facilities.

Access Roads and Fencing

Access throughout the Manzana facility is via approximately 34 miles of gravel access roads. The access roads generally follow the turbine string alignments and connect between turbine strings and the O&M facilities (see Figure 3). Perimeter and interior fencing are used at Manzana to aid in controlling unauthorized access (including access related to grazing and off-road vehicle use) to the facility.

2.2 Covered Activities

Covered Activities are those non-federal activities under the direct control of the permittee for which incidental take is authorized by an ESA Section 10(a)(1)(B) ITP. The following describes the Covered Activities for the Manzana Conservation Plan (see Table 2, Threats Associated with Covered Activities).



DUDEK

SOURCE: Kern County 2014

FIGURE 3

Facility Map

Manzana Wind Power Project - California Condor Conservation Plan

INTENTIONALLY LEFT BLANK

Turbine Operation and Maintenance

The primary Covered Activity addressed by the Manzana Conservation Plan is the operation of 126 wind turbines at Manzana, including both rotating and non-rotating turbine blades. Blade rotation speed depends on several factors, including wind speed and Supervisory Control and Data Acquisition (SCADA) system controls. Each turbine is designed to pivot into the prevailing wind direction and begin generating power (rotating) at wind speeds of approximately 6 mph or above, and will discontinue operation at sustained wind speeds above approximately 55 mph. Turbines are non-rotating when necessary wind speeds are absent, or when they are placed offline during periods of maintenance, or during other planned or unplanned outages. Turbine operation is controlled and monitored through the SCADA system at the plant level and through the Avangrid Renewables National Control Center (NCC) located in Portland, Oregon.

Covered Activities include all activities associated with the operations, maintenance, repair, replacement, and removal/decommissioning of the turbines at Manzana. Routine and unscheduled maintenance of turbines is performed by qualified personnel using light trucks and includes inspection and servicing of turbine components, lubrication system, electrical components, and instrumentation. Major repair, replacement, or removal of turbine components, if necessary, may require heavy equipment, such as cranes.

Operations and Maintenance of Ancillary Facilities and Infrastructure

Covered Activities associated with ancillary facilities and infrastructure include the following: (1) operations of transmission and collection lines and poles and their routine maintenance, repair, and/or replacement; (2) use and maintenance of the O&M building, permanent meteorological tower, and electrical substation; and (3) use and maintenance of roads.

Qualified personnel with light trucks routinely inspect and maintain the overhead and underground lines, overhead electrical line poles, the O&M building and substation, and meteorological tower. Heavy construction equipment or excavators may be used for repairs and replacements, if necessary. Road use is limited to employees and other authorized personnel (e.g., landowners, contractors), and the speed limit is posted at 25 mph. Roads are maintained as necessary by grading and compacting to provide unimpeded access and minimize erosion.

Repowering

Covered Activities associated with repowering would include any upgrades to the turbines or infrastructure that would not result in a change in location or physical structure of the turbines. For example, repowering can include changes or upgrades to software, gear boxes, or other turbine components.

INTENTIONALLY LEFT BLANK

3 ENVIRONMENTAL SETTING AND BIOLOGICAL RESOURCES

The following sections describe the environmental setting and biological resources for the Manzana Conservation Plan. Section 3.1 describes the setting in terms of climate, topography and geology, hydrology, existing land use, and vegetation. Section 3.2 describes the baseline biology of the condor as the Covered Species under the Manzana Conservation Plan.

3.1 Environmental Setting

3.1.1 Climate

The Permit Area is located in the Antelope Valley area of southern Kern County, where the climate can be characterized as hot in the summer and cold in the winter. The nearest representative weather station is in the City of Mojave, located approximately 17 miles to the northeast. Average temperatures recorded at the station range from lows of 33°F in winter to highs of 97°F in summer (Western Regional Climate Center 2016). Mean annual precipitation is 6 inches, most of which falls as rain, primarily from November through March (Western Regional Climate Center 2016).

3.1.2 Topography

The Permit Area is in the Mojave Desert ecoregion on an ancient alluvial fan sloping gradually downward from northwest to southeast (Figure 4). Elevations range from approximately 4,500 feet amsl in the northern portion of the Permit Area to approximately 2,800 feet amsl at the southern extent of the Permit Area.

3.1.3 Hydrology

The Antelope Valley basin is the westernmost basin in the Mojave Desert and is characterized by infrequent alluvial fans and dry washes that terminate in the desert. Tylerhorse Canyon meanders in and out of the Permit Area along the eastern Project boundary, and Cottonwood Creek occurs along the southwestern corner of the Permit Area. Surface hydrology of the Permit Area consists primarily of shallow ephemeral drainages that flow generally in a southeasterly direction into Tylerhorse Canyon or Cottonwood Creek (see Figure 2) or into the groundwater aquifer or that ultimately evaporate.

3.1.4 Existing Land Use

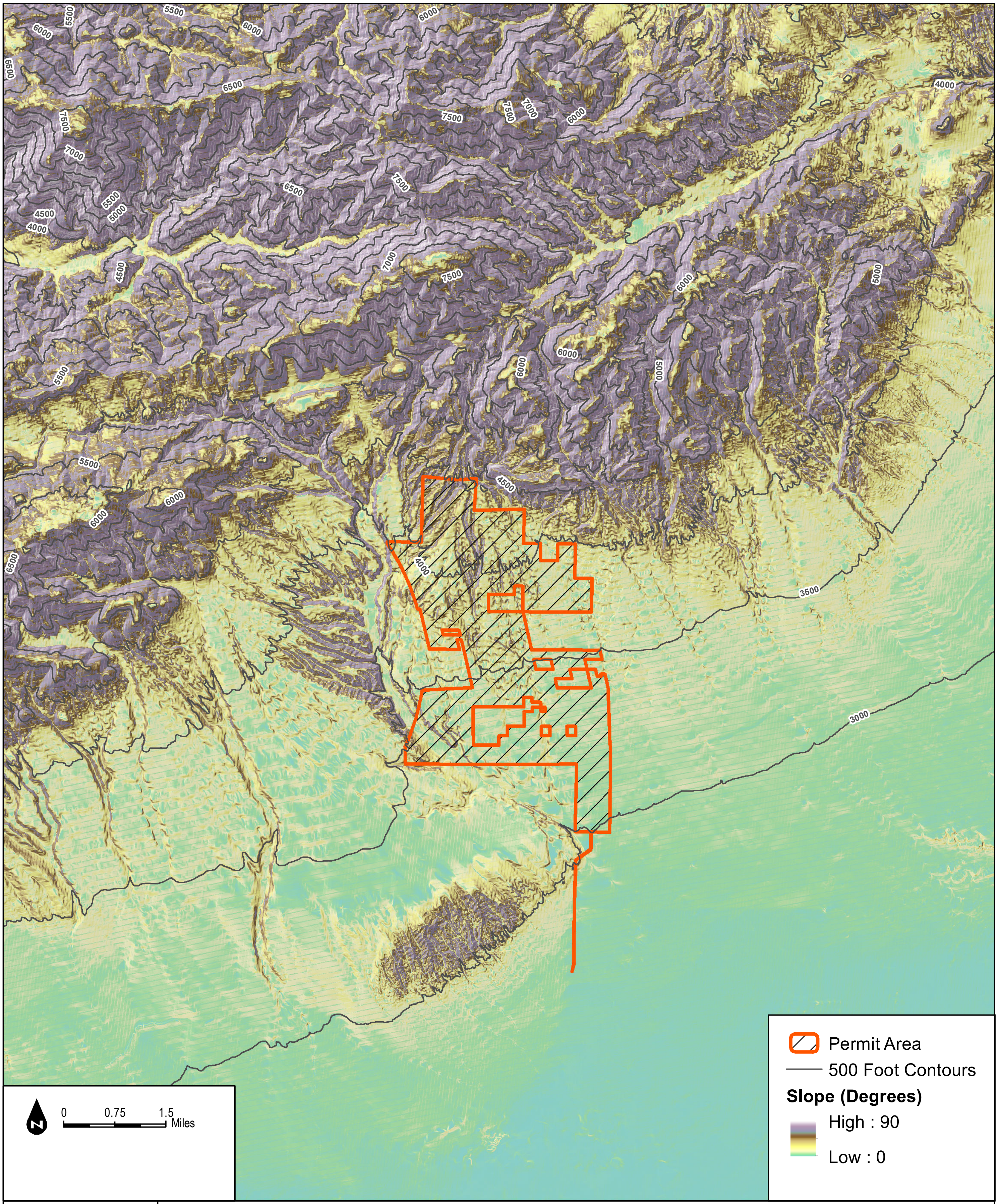
Manzana is the primary existing land use in the Permit Area. The detailed Project description for Manzana is provided in Section 2.1 of this Conservation Plan. Additional land uses within the Permit Area include approximately 0.5 miles of an existing SCE transmission line corridor (including four transmission line poles), livestock grazing, and outdoor recreation (i.e., hiking on the Pacific Crest Trail, which bisects the site). Currently, one participating landowner conducts livestock (sheep) grazing within the Permit Area. The extent, timing, and intensity of the grazing across the landscape vary depending on number of animals grazed, weather, range conditions, and other considerations. Manzana has an existing Carcass Management Plan with the participating landowner, which requires notification from the landowner prior to planned grazing activities. Off-highway vehicle use by landowners and non-landowners may occasionally occur within the Permit Area. The Permit Area is located in a remote setting with surrounding land uses that include sparse rural residential land use, livestock grazing, and an adjacent wind energy facility. Scattered public land parcels with grazing leases managed by the Bureau of Land Management are immediately adjacent to the Permit Area. These adjacent Bureau of Land Management parcels are part of the approximately 7,000-acre Antelope Valley sheep grazing allotment, with a capacity of 545 animal unit months (BLM 2016). The SCE Whirlwind Substation is located approximately 3 miles south of Manzana.

3.1.5 Vegetation

The Permit Area is characterized by vegetation communities common to those found throughout the western Antelope Valley region. The gradually sloping alluvial fan landform characteristic of a majority of the Permit Area is dominated by desert scrub and grassland communities intermixing with juniper woodland and Joshua tree woodland. Cottonwood Creek and Tylerhorse Canyon are characterized by desert wash vegetation communities. The Permit Area and the surrounding lands have historically been used for livestock grazing, which has affected vegetation structure and composition throughout the Permit Area. Within the Permit Area, developed/disturbed land cover occurs as part of the network of existing access roads and at the substation and O&M building.

3.2 Covered Species

The species proposed for coverage under the Manzana Conservation Plan is the condor. The following provides a species account for condor, including a brief species overview; a discussion of condor distribution, recovery, and current population status; a description of condor foraging behavior and habitat use; a summary of condor management considerations and activities; and a description of condor activity in relation to the Permit Area.



SOURCE: Kern County 2014

FIGURE 4

Topography

DUDEK

Manzana Wind Power Project - California Condor Conservation Plan

INTENTIONALLY LEFT BLANK

3.2.1 Species Overview

Condors are a member of the New World vultures family (Cathartidae) and are the largest flying land bird in North America, with adults weighing approximately 17 to 22 pounds and possessing a wingspan of up to 9.5 feet. Condor plumage is black, with prominent white under-wings and naked skin on the head and neck that ranges from gray to shades of yellow, red, and orange. Condor courtship and nesting occur in winter, producing single-egg clutches between late January and early April (USFWS 2013a). Condors are obligate scavengers that currently occur in Southern and Central California, northern Arizona, and southern Utah in the United States, and in Baja California in Mexico (USFWS 2013a). Condors are listed as endangered under the ESA, and USFWS has designated critical habitat for the species. A federal recovery plan (USFWS 1996) was prepared, and the USFWS 5-Year Review for the species was completed in June 2013 (USFWS 2013a).

3.2.2 Condor Distribution, Population Decline, and Recovery

Historically, condors were distributed across North America. By the middle of the twentieth century, the condor's range was reduced to a horseshoe-shaped area in Southern and Central California that generally included the mountains and foothills of Monterey, San Benito, San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Kern, and Tulare counties (USFWS 2013a, 1996). The condor population in 1950 was an estimated 150 individuals and continued to decline to 50–60 individuals in the late 1960s and as few as 25 individuals in 1978 (Sibley 1969, cited in USFWS 1996; Snyder and Johnson 1985; Wilbur 1980; Koford 1953; Robinson 1940, 1939). This decline has largely been attributed to human-caused factors, including shooting, poisoning, egg collecting, predator control, and lead poisoning from ammunition (USFWS 2013b; Cade 2007; Grantham 2007; Hall et al. 2007; Snyder and Snyder 2000; Pattee et al. 1990; Bloom et al. 1989; Janssen et al. 1986; Koford 1953).

USFWS listed the condor as federally endangered on March 11, 1967 (32 FR 4001) and designated critical habitat for the species on September 24, 1976 (41 FR 41914–41916) (see Figure 5). A captive breeding program for condors was initiated in 1982 in response to continuing population decline, and the last free-flying condors were captured and brought into the captive breeding program by 1987 (Snyder and Schmitt 2002).

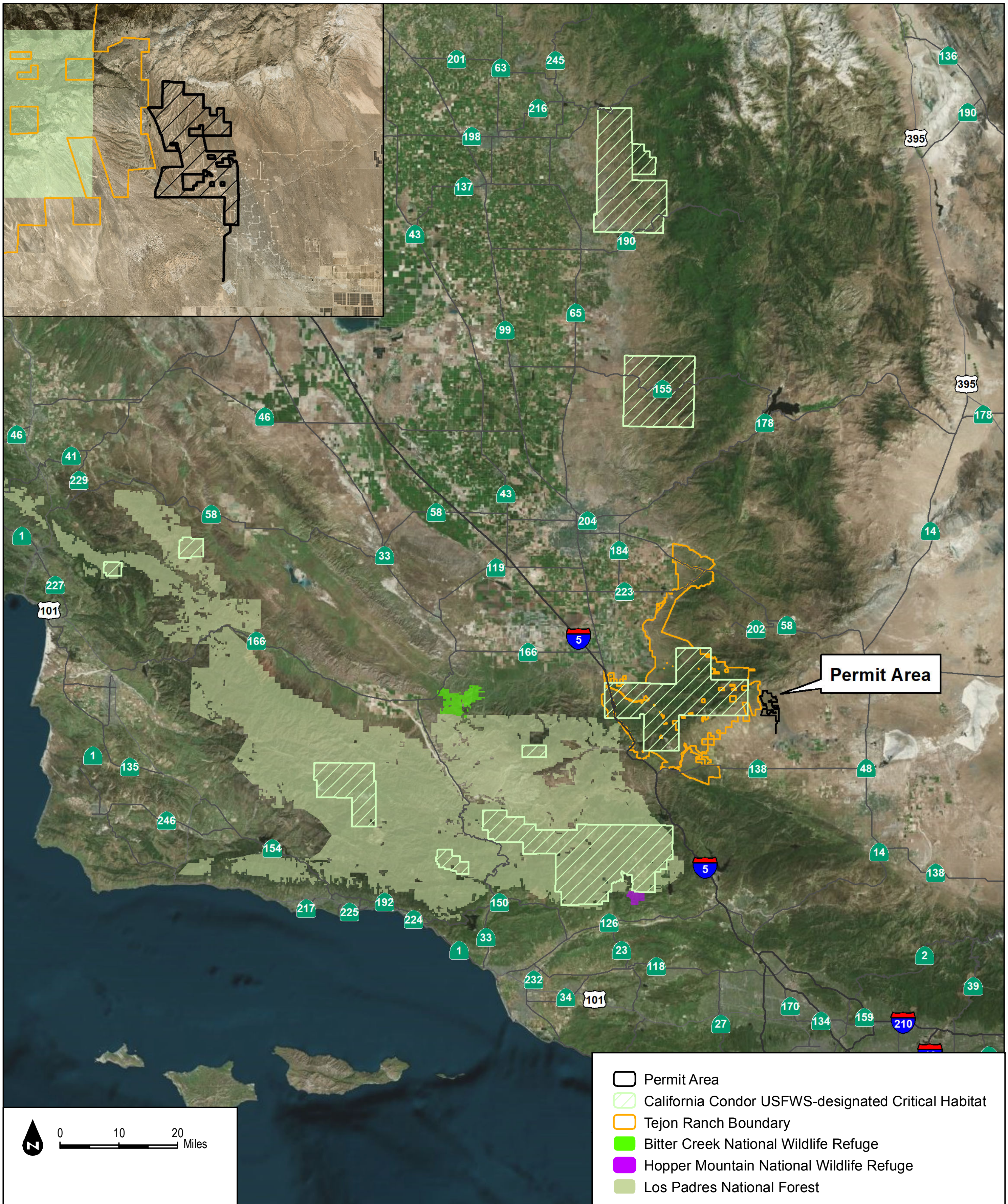
The captive breeding program was successful and by the late 1990s, an average of 20 offspring per year was produced by captive birds (Snyder and Schmitt 2002). In 1992, USFWS started releasing captive-bred condors from the Hopper Mountain National Wildlife Refuge Complex (NWR) into the Sespe Condor Sanctuary within the Los Padres National Forest. In coordination with USFWS, the Peregrine Fund began releasing condors in 1996 into northern Arizona/southern Utah, which was designated as experimental, non-essential population under Section 10(j) of the ESA (61 FR 54044). In subsequent years, condors were also released in the Ventana Wilderness along California's central coast, in Pinnacles National Park in Central California, and in the Sierra San Pedro de Martir, Baja California, Mexico.

In April 2019, a Draft Environmental Assessment was published for the proposed reintroduction of an experimental, non-essential population of condors, under Section 10(j) of the ESA, in an area centered at Redwood National Park in Northern California. The Draft Environmental Assessment assumes releases of up to six condors on an annual basis for up to 20 years.

By the end of 2019, the total world population of condors was reported to be 518 individuals, which included a wild free-flying population of 337 individuals and a captive population of 181 individuals (USFWS 2019c). Condors in the wild are generally described as occurring in four geographic populations: Southern California, Central California, Arizona/Utah, and Baja, Mexico.

The number of wild birds in each geographic population was as follows at the end of 2019:

- Southern California population: 99 individuals
- Central California population: 101 individuals
- Arizona/Utah population: 98 individuals
- Baja, Mexico population: 39 individuals



SOURCE: Kern County 2014; USFWS 2013, 2016; CDFW 2016; BLM 2016

DUDEK

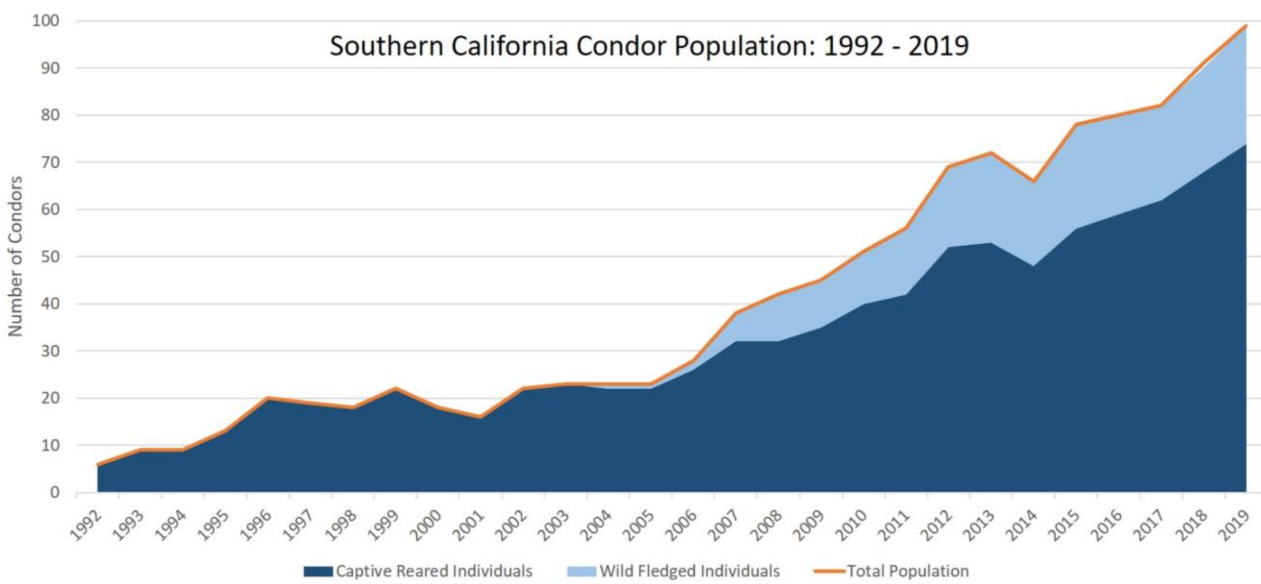
FIGURE 5

California Condor USFWS-Designated Critical Habitat

Manzana Wind Power Project - California Condor Conservation Plan

INTENTIONALLY LEFT BLANK

The Southern California condor population, which is the focus of the analysis in the Manzana Conservation Plan due to its proximity to the Project, has increased steadily over time, from a total of 6 individuals in 1992 to 99 individuals as of the end of 2019 (Figure 6). This population growth has been primarily driven by captive releases (59 of the 80 birds in the Southern California population in 2016 resulted from captive releases) (USFWS 2017a, 2017b). Although condors in the Southern California population have successfully reproduced in the wild since 2004, annual condor mortalities continue to exceed annual wild fledged condors; therefore, captive releases are currently considered the strongest management tool for recovery and are expected to continue (USFWS 2017b). Captive releases are part of the comprehensive California Condor Recovery Program (Recovery Program) managed by USFWS that includes seven primary management and recovery actions: monitoring resource use, lead monitoring and mitigation, mortality detection, nest management, captive releases and transfers, behavioral modification, and public outreach (USFWS 2017a). See Section 3.2.4 for additional information on condor management considerations and activities.



Sources: USFWS 2019c, 2018b, 2017a.

Figure 6. Southern California Condor Population Trend, 1992–2019

As the Southern California population has grown under the Recovery Program, the spatial distribution of condor activity has also expanded. In 2017, activity of condors in the Southern California population fitted with Global Positioning System (GPS)/Global System for Mobile Communications (GSM) transmitters spanned approximately 17,500 square miles (USFWS 2019d). This compares to the reported spatial distribution of condor activity for the Southern California population spanning approximately 10,500 square miles in 2012 (USFWS 2012). Ongoing population growth is expected to continue to drive range expansion of the species. As a result, instances of range overlap between the Southern and Central California populations of condors has been documented. In the future, these two populations are likely to merge into one (USFWS 2017b).

3.2.3 California Condor Foraging Behavior and Habitat Use

Foraging Behavior

Condors regularly use long-distance soaring reconnaissance flights in search of food (i.e., foraging). Due to their large body size and broad wings, condors use soaring flight rather than constant flapping to cover such distances. One condor was recorded flying a distance of approximately 140 miles from Tulare County south through the Tehachapi Mountains to Santa Barbara County in 1 day (Snyder and Snyder 2000). Similar long-range flights have been recorded since individual condors were outfitted with transmitters by USFWS in the early 2000s. Condor movements are highly dependent on topography, prevailing wind patterns, and meteorological parameters such as thermal height and thermal velocity (Rivers et al. 2014a; Snyder and Snyder 2000; USFWS 1996). Although condors can fly over a variety of terrain, the majority of condor flights follow mountains and foothills, where they use topography and associated orographic lift (ascending airflow caused by rising terrain) and thermal updrafts to generate lift (Snyder and Snyder 2000). Foraging height is also correlated to topography, terrain, and land cover. In particular, condors have been found to fly at higher elevations over flatter, smoother terrain with relatively low vegetation cover and at lower elevations over rougher, steeper terrain with dense vegetation cover (Poessel et al. 2018).

Condors are opportunistic scavengers that rely on dead animal carcasses for food (USFWS 1996). As obligate scavengers that locate food by sight, condors forage during the daylight hours. Foraging typically includes long-distance flights, lengthy circling flights over potential food items, and waiting at a roost or on the ground near a carcass (USFWS 2013a). Foraging behavior has been observed to shift seasonally as a result of climatic cycles or changes in food availability (USFWS 2013b; Snyder and Snyder 2000). Condors frequently feed in a communal manner. If a single bird locates a carcass and begins to descend, other individuals flying nearby may also be attracted to the area. As many as 30 condor individuals have been observed gathering and feeding on the same carcass (Koford 1953). Activity by other species, notably common ravens (*Corvus corax*), turkey vultures (*Cathartes aura*), and golden eagles (*Aquila chrysaetos*), can provide visual cues to foraging condors. Condor food items in the California interior were reported to include mule deer (*Odocoileus hemionus*), tule elk (*Cervus elaphus nannodes*), pronghorn antelope (*Antilocapra americana*), and smaller mammals (USFWS 1996; Emslie 1987; Koford 1953). Koford (1953) estimated that 95% of the species' diet after the arrival of European settlers consisted of cattle (*Bos primigenius*), domestic sheep (*Ovis aries*), ground squirrels (*Spermophilus beecheyi*), mule deer, and horses (*Equus caballus*). Introduced wild pigs (*Sus scrofa*) and gutpiles left behind when hunters field-dress their kills (which has resulted in ongoing lead-poisoning issues with condors when lead ammunition is ingested; see Section 3.2.2 and Section 3.2.4 for additional discussion) have also been reported as food sources for condors (USFWS 2013b; Snyder and Snyder 1989).

Home range size for the species is very large, with substantial home range overlap between individuals. The mean monthly home range size reported for individuals in the Southern California population, based on telemetry data from 2003 to 2010, was 346 square miles (221,359 acres); monthly home range was larger for adult birds than juvenile birds and larger in the late summer and early fall than at other times of year (Rivers et al. 2014b).

Based on kernel density analysis of GPS/GSM data, three primary centers of activity are used by the Southern California flock. These include the following:

- Bitter Creek NWR, where most captive bred condors are released and are regularly captured for health inspections and to attach transmitters
- The Tehachapi Mountains, where ongoing cattle ranching and hunting occur
- Hopper Mountain NWR and adjacent regions on private lands and in the southern portions of the Los Padres National Forest north of Highway 126 near the City of Fillmore, where the majority of nesting in the Southern California flock has occurred to date

As the population increases, the Southern California flock continues to expand its range, including increased condor activity in the northern Tehachapi Mountains and southern Sierra Nevada (USFWS 2017a). In the vicinity of the Permit Area, the vast majority of condor foraging and movement patterns occur north of Manzana in response to available large animal carcasses or water sources. Again, condor movement in this region is primarily focused in the foothill and mountain areas. Condors also traverse the western edge of the Antelope Valley, including over the Permit Area; however, the majority of flights from condors with GPS/GSM transmitters are in the foothill and mountain areas. Bakker et al. (2016) found that as the size of the Southern California population has grown, individual condors fed less frequently at proffered feedings and were detected less often at monitoring locations, both of which are indicative of range expansion. The extent to which condors may expand their use of the Antelope Valley is unknown at this time. See

Section 3.2.5, California Condors and the Permit Area, for additional discussion of condor locality data and habitat suitability relative to the Permit Area.

Habitat Use

Nesting

Condors typically nest in cavities found in rock formations such as caves, crevices, overhung cliff ledges, potholes on remote cliffs or steep slopes, and, more rarely documented, in cavities in giant sequoia trees (*Sequoiadendron giganteum giganteus*) (Snyder et al. 1986). Most nests have some form of overhead cover and most nest sites are located on steep slopes or cliffs to allow for easy take-offs and landings. Cavities or the broken-out tops of giant coast redwoods (*Sequoia sempervirens*) are regularly used by condors nesting along the Central Coast of California (Ventana Wildlife Society 2016). As condors recolonize the Sierra Nevada, the Recovery Program anticipates that condors will eventually nest in giant sequoia trees again (USFWS 2017b).

The first documented nesting attempt in the wild by reintroduced condors was in the Los Padres National Forest in 2001 (USFWS 2013b). Nesting now occurs in all wild condor populations across a much wider range than before their removal from the wild in 1987, including Arizona/Utah, Baja California, Southern California, Pinnacles National Monument, and the Big Sur Coast Sanctuary in the Ventana Wilderness. In the Southern California population, there were six documented nesting attempts in the wild in 2016 and again in 2017; the annual numbers ranged from five to seven during the years of 2011–2015 (USFWS 2016b, 2018b). Two unsuccessful nesting attempts (one in 2017 and one in 2018) were reported in the Tejon Ranch Condor Study Area located in the Tehachapi Mountains (USFWS, pers. comm. 2019b).

Foraging

Most foraging occurs in open terrain of foothill grassland and oak savannah habitats that allow access to food (USFWS 2013a; Snyder and Snyder 2000; USFWS 1996; Koford 1953). Condors typically feed in large open spaces but will also feed under the tree canopies and on slopes and in canyon bottoms, as long as there is open access to carcasses under tree canopies and adjacent open areas for taking off and landing are available. In a study of condor resource selection, habitats with sparse vegetation and coastal habitats were found to be preferentially selected by condors as foraging habitat based on a review of telemetry data, indicating that these habitats were where food resources and predators could be more easily detected and where conditions for taking off from the ground were more favorable (Rivers et al. 2014a).

Roosting

Condors have been documented to repeatedly use traditional roosting sites (typically large trees or groves of trees and/or rock outcrops) that are located near important foraging grounds or nest sites. In the Southern California population, traditional roost sites have been located in the Tehachapi Mountains (Bear Mountain and Tejon Ranch), Sespe Condor Sanctuary in the Los Padres National Forest, Bitter Creek NWR, and Hopper Mountain NWR (see Figure 5). However, temporary roost sites next to a large carcass will be used for days and even weeks until the carcass has been consumed. Cliffs and tall conifers are generally used as roost sites in nesting areas. Although most roost sites are near nesting or foraging areas, scattered roost sites are located throughout the range (USFWS 2013b).

Condors usually remain at roosts until mid-morning and generally return in mid- to late afternoon (USFWS 1996). Within the Southern California population, the most common time condors left nighttime roost sites, based on telemetry data, was 0900 and the most common time condors began roosting was 1800; however, these times varied throughout the year. In winter, condors are likely to remain perched longer and not fly as far or as often, probably due to climatic conditions conducive to flight (Rivers et al. 2014a; Cogan et al. 2012). If they have recently fed, condors will often remain perched throughout the day.

3.2.4 California Condor Management Considerations and Activities

Threats and Stressors

Threats and stressors to condors include lead poisoning, eggshell thinning, collision or electrocution, microtrash ingestion, predation, West Nile virus, shooting, habituation, and wildfires (USFWS 2013a, 2013b; Ventana 2020). Although habitat loss has been suggested as a threat, it is currently not limiting population growth, range expansion, or reproduction (USFWS 2017b).

Lead poisoning, typically due to the ingestion of lead ammunition fragments within the carcasses of hunter-killed animals, likely caused many deaths of condors historically and continues to be the leading source of mortality and an obstacle to species recovery (USFWS 2017c; Kelly et al. 2015; Finkelstein et al. 2012; Cade 2007; Grantham 2007; Meretsky et al. 2000). In an analysis of survivorship of condors in the Southern and Central California populations from 1992 to 2011, lead poisoning was found to account for 27% of condor mortalities (Kelly et al. 2015). Legislation addressing lead-free ammunition is discussed further below.

Eggshell thinning has resulted in nest failure for condors that feed on the carcasses of marine mammals that have been exposed to toxic chemicals (i.e., pesticides). To date, this threat has been limited to the Central California flock of condors (Kurle et al. 2016; Burnett et al. 2013).

Since their reintroduction into the wild, condor mortality as a result of collision with or electrocution from overhead power lines has occurred (USFWS 2016c; Rideout et al. 2012; Grantham 2007; Mee and Snyder 2007; Meretsky et al. 2000). In particular, collision with or electrocution from overhead lines is the second-largest anthropogenic (human-caused) source of condor mortality behind lead poisoning (USFWS 2017c; Kelly et al. 2015; Rideout et al. 2012). However, design modifications and power pole aversion training with captive condors prior to release have reduced the electrocution threat associated with condors perching on power poles (Kelly et al. 2015). Wind turbine collision has been identified as a potential threat to condors; however, no condor collision with a wind turbine has ever been documented (USFWS 2013a; USFWS 2013c).

Microtrash (small bits of plastic and metal such as bottle caps, pop-tops, PVC pipe fragments, and broken glass) that is fed to hatchlings by some (but not all) parent condors, has been the major cause of nest failure in wild breeding populations (Grantham 2007; Mee et al. 2007). In 2007, as a result of low condor nest success, USFWS biologists managing the Southern California flock of condors initiated nest management practices that include entering nests to test the health of chicks, remove microtrash from the nest substrate, and more recently, to maintain nest cameras (USFWS 2017a). Because bone chips are a normal part of a growing condor’s diet and provide an important source of calcium to mineralize growing bones, it has been proposed that these adult condors mistakenly feed bits of microtrash to young (Houston et al. 2007). Although the digestive systems of young condors may be well adapted to digesting bone fragments, they are not suited to handling plastic, metal, and glass.

Predation by terrestrial mammals (e.g., cougar [*Puma concolor*], black bear [*Ursus americanus*], and coyote [*Canis latrans*]) and golden eagles has been documented as a source of mortality for roosting and feeding condors (USFWS 2013a). Additionally, condor adults, nestlings, and eggs can be susceptible to predation by bobcat (*Lynx rufus*), cougar, black bear, coyote, and raven when in the nest.

West Nile virus has caused deaths in both captive and wild condor populations (Rideout et al. 2012). Currently, all captive and free-flying condors are vaccinated for West Nile virus and provided with a booster annually, and both wild and captive-bred chicks are vaccinated for this virus.

Illegal shooting of condors remains a potentially significant threat to free-flying birds. As of 2018, there have been 10 fatalities in total to the reintroduced wild condor population due to shooting; nine by gun shot and one by arrow (Rideout et al. 2012; USFWS, pers. comm. 2019a). Five of these deaths occurred in Arizona and five in southern California. Nonlethal shooting of condors has also been documented (USFWS 2013a).

USFWS has defined habituation in condors as the point at which condors that are attracted to human activity and/or structures no longer respond effectively to hazing (i.e., USFWS-approved methods for deterring such behavior) and must be removed from the wild to avoid physical injury or death. Even without the risk of subsequent physical injury or death, the habituation of condors to human presence can disrupt essential behavioral patterns of individual birds, impairing their ability to survive in the wild.

Habitat used historically by condors for foraging has been lost by development in Los Angeles and Ventura counties over the years. While substantial areas of condor foraging habitat remain in protected open space and private ranch land to support the expanding California population of condors, the threat of habitat loss is a concern for condors into the future if conservation of foraging habitat and/or grazing practices do not keep pace with development across the species' range.

Climate change may have the potential to affect condor food sources, influence fire patterns, reduce water availability, and alter prevailing winds used for soaring; however, the very wide historical range of the condor indicates the species is capable of adapting to changing climate conditions (USFWS 2013a). In their review of the species in 2013, USFWS determined that "based on what we know about the species and the known and likely effects of climate change, we do not consider climate change as a significant threat to the species" (USFWS 2013a).

Current Management and Recovery Actions

Management and recovery actions being implemented for the species are part of a comprehensive program that includes the following: monitoring resource use, lead monitoring and mitigation, detecting mortalities, nest management, captive releases and transfers, behavioral modification (e.g., power pole aversion), and public outreach, including the benefits of using non-lead ammunition (USFWS 2017a, 1996).

To monitor condor nesting, foraging, roosting, movement patterns, and mortality, USFWS uses very high frequency (VHF) radio transmitters and GPS/GSM transmitters attached to a portion of the condor population. To detect the presence of condors with VHF radio transmitters in real time, biological monitors on the ground use handheld radio telemetry equipment to continuously scan the known radio frequencies of condors. For the majority of the wild-ranging Southern California population fitted with GPS/GSM transmitters, verified tracking data (released approximately quarterly by USFWS) and preliminary daily data (non-verified) are produced that provide spatial information on condor location, altitude, direction, and speed taken at regular intervals (USFWS 2017a, 2016c; Waltermire et al. 2016; Matthew et al. 2010). Several different GPS/GSM transmitters are in use in the Southern California population, recording condor locations at intervals ranging from approximately 15 seconds to 1 hour during daylight hours.

Intensive nest management in Southern California has been especially critical for wild nesting success, which was 6% until nest management was instituted in 2007 (AOU and Audubon

California 2008). The percentage of wild condors that fledged compared to the number of eggs laid for the Southern California population increased substantially since that time, with overall nest success at 57% in 2011, 66% in 2012, and 83% in 2013 (USFWS 2016b). However, the Recovery Program began scaling back nest management in 2015 and replaced frequent nest visits to determine status of chicks with remote monitoring using nest cameras. Recent data suggests nesting success for managed and un-managed nests are fairly comparable; 44% vs 47%, respectively (USFWS, pers. comm. 2019b). The Recovery Program expects to analyze this data further and adjust nest management efforts accordingly. Nest management activities include vaccinating chicks for West Nile virus, examining chicks monthly for ingestion of microtrash, testing their blood for lead, removing trash from the nest substrate, and evacuating chicks for treatment by veterinarians.

As part of the outreach component of the Recovery Program, the Institute of Wildlife Studies conducts education and outreach each year at sportsman shows, at shooting ranges, and with ranchers and other groups about the benefits of using non-lead ammunition within the range of the Southern California condor population. The Institute of Wildlife Studies was involved in 154 outreach events from 2015 to 2020, directly reaching over 15,000 people (IWS 2020).

Legislation in California in 2007 (the Ridley-Tree Condor Preservation Act, Assembly Bill 821) required the use of non-lead ammunition for big-game hunting within the range of the condor in California. The California Fish and Game Commission adopted regulations in December 2007 to require the use of “lead-free” ammunition, including .22 rimfire cartridges, for all forms of hunting (except upland game bird hunting) within the condor range as of July 1, 2008. In October 2013, Assembly Bill 711 was signed into law requiring the use of non-lead ammunition when taking any wildlife with a firearm in California. The California Fish and Game Commission is phased in the statute’s requirements, with full implementation as of July 1, 2019.

3.2.5 California Condors and the Permit Area

The following sections provide a discussion of condor locality data and habitat suitability relative to the Permit Area.

3.2.5.1 California Condor Locality Data Relative to the Permit Area

Locality data for individual condors come from two general sources: field observations and VHF/GPS/GSM transmitters. This section provides a description of the existing condor locality data as they relate to the Permit Area.

Field Observations

The following summarizes the pre-construction surveys and studies, post-construction studies, and operations monitoring that have been conducted in the Permit Area.

Pre-Construction Surveys and Studies

Pre-construction surveys and studies of the Permit Area were conducted in 2004–2005 and again in 2009 during the planning and approval process for Manzana and included literature reviews, searches of public species occurrence databases, and comprehensive biological surveys of the Permit Area (EnXco 2009; County of Kern 2008; Sapphos Environmental 2006). Condors were not observed during pre-construction surveys of the Permit Area.

The Project EIR acknowledged the USFWS-designated critical habitat for the species in the vicinity but determined that the Project would not result in significant impacts on the condor (County of Kern 2008). In response to comments about condor relative to the Permit Area, the EIR stated that "No California condors were observed within view from the proposed project site after 138 days of avian surveys," and that "based on information and consultation with the agencies it has been determined that the likelihood of an occurrence of a California condor at the project site is too remote to present a potentially significant risk of collision with a wind turbine" (County of Kern 2008). The County's response to EIR comments concluded that "even though it is plausible that a condor could occasionally wander onto or over the project site, the likelihood is remote. And even in the case of such a rare event, it is most likely that the individual or individuals would traverse the site at high altitude, as is typically the case when condors are traveling long distances" (County of Kern 2008).

Post-Construction Studies and Operations Monitoring

Following construction of Manzana and in accordance with conditions of approval for the Project, two years of post-construction bird and bat fatality studies were conducted from 2013 to 2015 (Weller and Domschke 2015). Additionally, winter raptor surveys were conducted in 2012, 2013, and 2014 (Bloom Biological 2014a), raptor nesting surveys were conducted in 2013 and 2014 (Bloom Biological 2014b), and bird use count surveys were conducted in 2013, 2014, and spring 2015 (Bloom Biological and Cardno Entrix 2015; Bloom Biological 2015). During the 2 years of post-construction bird and bat fatality studies, no condor fatalities were detected and no live condors were observed (Weller and Domschke 2015). In addition, no condor observations were reported from the winter raptor surveys, raptor nesting surveys, and bird use count surveys conducted in the Permit Area from late 2012 through mid-2015 (Bloom Biological and Cardno Entrix 2015; Bloom Biological 2015, 2014a, 2014b).

From late 2014 until the end of 2018, a biological monitor conducted daily visual observations, primarily from a designated observation point in the northwest portion of the Permit Area using

VHF telemetry equipment to monitor and actively manage condor risk at Manzana. The biological monitor communicated directly with Avangrid Renewables' NCC to call for a curtailment of a subset of turbines within the Permit Area, if necessary, and recorded observed condor flight paths in proximity to the Permit Area.

During the 2018 effort, biologists recorded 574 condor occurrences (i.e., an instance when one or more condor individuals are observed), consisting of 3,062 observations (i.e., a visual observation of an individual condor), from the observation point. This compares to 464 occurrences (2,880 observations) in 2017, 572 occurrences (2,103 observations) in 2016, and 206 occurrences (420 observations) in 2015 (Bloom Biological 2020). Of these condor observations, 57 observed during the 2018 effort passed within approximately 1.24 miles (2 kilometers) of the Permit Area, including nine birds within the Permit Area of which 5 flew below 656 feet (200 meters) agl. This compares to 129 individuals in 2017 that flew within 1.24 miles of the Permit Area, including 21 within the Permit Area (six of which flew below 656 feet agl); 91 condors flying within 1.24 miles in 2016, including 18 birds within the Permit Area (one of which flew below 656 feet agl); and 30 condors flying within 1.24 miles in 2015, including nine individuals within the Permit Area (one of which flew below 656 feet agl).

In 2018, biologists observed four condors that passed within 1.24 miles of the Permit Area that stopped flying and perched. All of these were on the ground or rocks and in one general location (Bloom Biological 2020). This compares to six condors in 2017 that were observed perching within 1.24 miles of the Permit Area, also on the ground or rocks and in two general areas, and only one condor that was observed perching in 2016 (on the ground) and no condors observed perching in 2015 within 1.24 miles of the Permit Area. Condors have never been observed perching within the Permit Area during this monitoring effort (Bloom Biological 2020).

In terms of seasonal patterns, Bloom Biological (2016, 2019, 2020) notes that there was a pronounced peak in activity in the fall months (September, October, and November) in each of the four years (2015–2018) in which monitoring was conducted. Condor activity was generally lowest from April through July, with sporadic observations occurring during mid-December through March, and again in late July and early August (Bloom Biological 2020).

In September 2018, Manzana Wind began implementation of a geofence technology that uses GPS/GSM transmitters (see Section 5.2.2) to monitor and track condor activity in proximity to the Permit Area. If a transmittered condor crosses a defined curtailment zone, a third-party contractor located near Mojave, California (approximately 20 miles to the northeast of Manzana) communicates directly with Avangrid Renewables' NCC to call for the curtailment of a subset of turbines within the Permit Area. See Section 5.2.2 for further information pertaining to geofence technology.

GPS/GSM Transmitters

USFWS monitors the locations of a portion of the Southern California flock of condors in the wild with GPS/GSM transmitters. Verified transmitter data are released approximately quarterly to the public and are documented in the Recovery Program's annual reports. Table 1 provides a summary of the number of birds in the Southern California population with GPS/GSM transmitters used by USFWS to monitor condor activity.

Table 1
California Condors in the Southern California Population with GPS/GSM Transmitters from 2011 to 2018

Year	Condors with Transmitters[a]	Condor Population Size	Percentage of the Population
2011	36	56	64%
2012	31	69	45%
2013	29	72	40%
2014	34	66	52%
2015	34	78	44%
2016	37	80	46%
2017	57	80	71%
2018	80	90	89%
2019	81	99	81%

Source: USFWS 2020, 2018a, 2017a, 2016c, 2014, 2013d, 2012.
Notes: GPS/GSM = Global Positioning System/Global System for Mobile Communications.
[a] Reflects the number of condors in the Southern California population with GPS/GSM transmitters for at least part of that year.

A summary of the GPS/GSM transmitter data relative to Manzana is provided in this section.

Summary of GPS/GSM Transmitter Data

The following provides a summary of the USFWS data set for condor individuals fitted with GPS/GSM transmitters, recording points at intervals ranging from approximately 15 seconds to 1 hour during daylight hours, in the Southern California population. Key information from this data set used to summarize condor activity include the geospatial location for each point, individual condor ID, date and time, altitude, and ground speed.

Condor activity in the Permit Area from November 24, 2013 through June 30, 2018, is summarized as follows:[1]

- Of the 1,679 days covered by the GPS/GSM data set, condor activity in the Permit Area was recorded on a total of 38 days from 34 different condor individuals. Condor activity

[1] GPS/GSM data points referred to as "in the Permit Area" are points with recorded latitude and longitude coordinates located within the two-dimensional Permit Area boundary as shown on Figure 2.

from multiple birds occurred in the Permit Area on 10 days, and 13 individuals had activity in the Permit Area on multiple days.

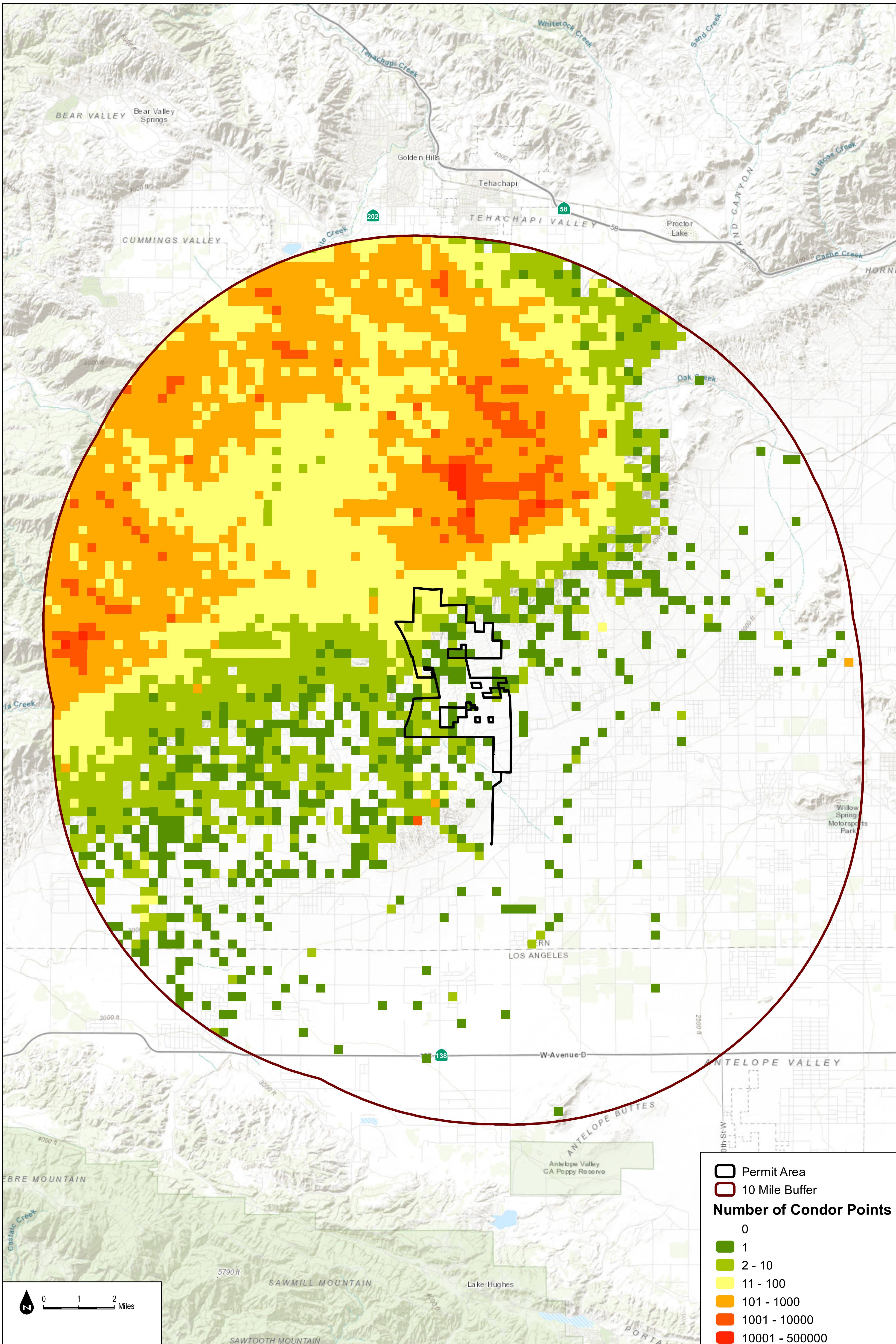
- The majority (26 of the 38 days) of the condor activity in the Permit Area occurred in 2017. Condor activity in the Permit Area was also recorded on 1 day in 2014, 1 day in 2015, and 10 days in 2016. No condor activity was recorded in the Permit Area in late 2013 or the first half of 2018.
- Condor activity recorded in the Permit Area has been highest between August 1 and December 15, with 37 of the 38 (97.4%) days of condor activity occurring during this period.
- Condor activity recorded in the Permit Area generally occurred after sunrise and before sunset, with 98 of the 118 points recorded between 0800 and 1700 hours (83%). The earliest data point documented in the Permit Area was at 0556 hours, with the exception of 2 data points with a timestamp of 0102 hours, and the latest at 1752 hours.

In terms of condor activity in the vicinity of the Permit Area, the majority of condor activity (81.3%; 195 of 240 days) within 2 miles of the Permit Area occurred during the period of August 1 through December 15. Of the approximately 4,100 GPS/GSM points recorded within 2 miles of the Permit Area, the vast majority (91%) occurred during the daytime hours from 0800 to 1700.

Summary of Period and Location of Greatest Condor Risk

Based on the analysis of the GPS/GSM data as well as the monitoring observations described previously, the period of greatest condor risk in the Permit Area is considered to be August 1 through December 15 during the daytime hours between 0800 and 1700.

Figure 7 shows all condor GPS/GSM data points within 10 miles of the Permit Area from late 2013 through mid-2018, represented as a heat map of the number of recorded points within 0.25-mile grid cells (40 acres). As this figure illustrates and as has been documented in the USFWS Recovery Program Annual Reports, the majority of all condor activity in the vicinity of Manzana occurs north of the Permit Area in the Tehachapi Mountain Range. This also corresponds to the USFWS 2013 condor range map, as shown on Figure 5. Therefore, the primary location of greatest condor risk in the Permit Area is considered the northern portion of the Permit Area.



DUDEK

SOURCE: USFWS 2017

FIGURE 7

California Condor GPS/GSM Data Point Heat Map

Manzana Wind Power Project - California Condor Conservation Plan

Note: Number of condor points within 0.25-mile grid cells. GPS/GSM data points from November 2013 through June 30, 2018

INTENTIONALLY LEFT BLANK

3.2.5.2 Habitat Suitability of the Permit Area for California Condor

This section characterizes the suitability of the Permit Area to provide nesting, foraging, or roosting habitat for condor. The Permit Area does not contain USFWS-designated critical habitat for the condor.

Nesting

Condors have never been documented nesting in the Permit Area. The Permit Area is not suitable for condor nesting because it lacks the cliff faces, steep slopes, rock formations, and trees characteristic of condor nesting habitat in Southern California. There have been two known nesting attempts in the Tehachapi Mountains, one in 2017 and one in 2018, within what is known as the Condor Study Area on Tejon Ranch (approximately 15 miles to the northwest of the Permit Area); however, both of these attempts failed (USFWS, pers. comm. 2019a). The nearest known successful condor nest (fledging occurred) is approximately 25 miles southwest of the Permit Area in the Los Padres National Forest of western Los Angeles County.

Foraging

As described in Section 3.1.5, the Permit Area is characterized primarily by desert scrub, grassland, and juniper and Joshua tree woodland. These on-site vegetation communities generally contain the appropriate vegetative structure characteristic of condor foraging habitat because they are relatively sparse and open and allow for both the detection of food resources and access to these resources. In addition, livestock grazing (discussed in Section 3.1.4) occurs on and adjacent to the Permit Area and can provide potential carrion resources for condors. Wildlife species, such as mule deer, coyote, red fox (*Vulpes vulpes*), and black-tailed jackrabbit (*Lepus californicus*), may infrequently occur in the Permit Area or the vicinity and could also serve as potential carrion resources.

On-site habitat characteristics and potential food sources indicate that the Permit Area is potentially suitable for condor foraging; however, condor activity in the Permit Area has historically been very low, and no condors have ever been observed feeding in the Permit Area.

Roosting

The Permit Area has not been documented as a traditional roost location for condor. Furthermore, the Permit Area does not support large trees or rock outcrops that are typically used by condors in this region for roosting. Therefore, condors are not expected to roost within the Permit Area, temporarily or otherwise.

INTENTIONALLY LEFT BLANK

4 POTENTIAL BIOLOGICAL EFFECTS AND TAKE ASSESSMENT

The effects associated with the operating wind turbine facility, and take associated with these effects, are evaluated in this chapter.

4.1 Effects and Anticipated Take

Effects of the Project

The primary source of potential condor take associated with Covered Activities is collision with rotating wind turbine blades. To date, there are no reported instances of a condor collision with wind turbines. As discussed in Section 3.2.5.1, thirteen condor flight observations were documented as occurring below 656 feet (200m) in the Permit Area during daily monitoring observations between 2014 and 2018. In addition, condors have not been observed perching in the Permit Area (Bloom Biological 2016). Furthermore, while data from condors with GPS/GSM transmitters has indicated infrequent flights over the Permit Area by individual condors, the majority of the condor activity in the Permit Area region occurred north of the Permit Area in the Tehachapi Mountain Range, including the adjacent Tejon Ranch. Therefore, while it is expected that the number of condors in the vicinity of the Permit Area will increase as the Southern California condor population continues to expand into its historical range areas in the state, the potential for condors to collide with rotating turbine blades at Manzana is expected to be low based on historic use and because of the lack of nesting or roosting habitat in the Permit Area.

The other Covered Activities could also result in the potential take of condor, but relative threat is lower for these activities. For instance, while no condor collisions or electrocutions with existing overhead power lines at Manzana have occurred to date, condor collisions or electrocutions could occur at the Project if condors fly through the Permit Area at low flight altitudes or attempt to land on transmission poles. While condor mortalities due to collisions and/or electrocutions with power lines have been documented (Rideout et al. 2012; Meretsky et al. 2000; Grantham 2007; Mee and Snyder 2007), power pole aversion training is given to condors prior to release to deter condors from using power poles. Such training is provided under the premise that if birds do not approach power lines to perch, they will spend less time in the vicinity of power lines; consequently, this behavior may reduce the likelihood of collisions and electrocutions (USFWS 2013c). In addition, because the Project site is located in a relatively flat area, existing overhead lines do not extend over valleys or canyons and are not located along ridgelines, topographical areas that provide a higher risk for collisions. Furthermore, since 1995, all captive-bred condors go through power pole aversion training prior to their release in the wild to minimize the potential for released birds to attempt to land on transmission and power line poles. Such training has substantially reduced incidents of power line collision or electrocution (USFWS 2013a). For these reasons, and because of the infrequent condor flights over the Permit Area, condor collisions with or electrocutions from existing overhead power lines are expected to be very low during the expected 30-year life of the ITP.

An analysis of condor mortality from 1992 through 2010 did not document any instances of condors colliding with large, stationary objects (Rideout et al. 2012). Moreover, condors are known to land and perch on radio towers, telephone poles, and other large structures (USFWS 2013c). Therefore, the potential for condor collisions with stationary structures in the Permit Area is expected to be very low.

As discussed in Section 2.2, other Covered Activities addressed in this Conservation Plan include the use and maintenance of the O&M building, permanent meteorological tower, and electrical substation, use and maintenance of on-site roads, and repowering upgrades to and removal of existing turbines or infrastructure. The potential effects of these activities include collisions by motor vehicles with condors perching/resting/feeding on the ground on or adjacent to on-site roads. However, given the low level of historical and ongoing occurrences of condor within the Permit Area and continuing wildlife awareness training provided to site personnel, the activities and effects associated with these other Covered Activities are expected to have a very low potential to result in take of condors.

Table 2 summarizes the primary threats to condors and their likelihood to occur, as a result of the Covered Activities identified above.

Table 2
Threats Associated with Covered Activities

Activity	Threat	Likelihood of Threat
Operation of wind turbines	Collisions with turbine blades	Low
Maintenance, repair, replacement, and removal of wind turbines	Collision with turbine blades or equipment (cranes); vehicular collisions	Very Low
Operation of transmission and collection lines and poles, and their routine maintenance, repair, and/or replacement	Collision with electrical lines; electrocution; vehicular collisions	Very Low
Use and maintenance of operations building, permanent meteorological tower, and electrical substation	Vehicular collisions	Very Low
Repowering upgrades to existing turbines or infrastructure (no change in tower/blade dimension)	Collisions with equipment (cranes); vehicular collisions	Very Low
Use and maintenance of roads	Vehicular collisions	Very Low

Anticipated Take

For this Conservation Plan, Manzana Wind is unable to create a quantitative model to predict the number of condor fatalities that may occur as a result of the operation of the wind facility for several reasons. First, prediction of condor use of the Project over the 30-year term of the incidental take permit is challenging because condor flights in proximity to the Project are expected to increase over time due to (1) the continued release of captive-bred condors by USFWS and the number of condors breeding in the wild and (2) the anticipated condor range expansion. Second, Manzana Wind is unable to predict whether turbine blades will be spinning if condors fly through the Project, whether clouds or fog will limit their ability to see the infrastructure, or whether they are foraging or merely passing through and flying at altitudes above the height of the wind turbines. Third, Manzana Wind will continue to take measures to minimize potential attractants in the site (e.g., livestock or wildlife carcasses) and support a detection and curtailment system designed to minimize the potential for condor collisions with wind turbines. Fourth, since 1995, USFWS has used aversion training on all captive-bred condors prior to their release in the wild to minimize the potential for released birds to attempt to land on power poles; this training has substantially reduced incidents of power line electrocution (USFWS 2013a). Last, an analysis of condor mortality from 1992 through 2010 did not document any instances of condors colliding with large, stationary objects (Rideout et al. 2012).

Therefore, Manzana Wind used a qualitative approach to estimate the potential take of condors resulting from Covered Activities in the Permit Area. Specifically, the overall take estimate of condors is based on known information regarding condor behavior and use of the Permit Area, relevant information about the Covered Activities and other existing land uses in the Permit Area, and existing and proposed minimization actions as described in the Manzana Conservation Plan's Conservation Program (Chapter 5). USFWS used a similar approach with the two previous USFWS Biological Opinions issued for condor take that addressed mortality (USFWS 2013c; BLM 2016). For the Project, this Conservation Plan anticipates take of up to two free-flying condors and up to two eggs or chicks over the 30-year permit term resulting from Covered Activities in the Permit Area. The anticipated take in the form of injury or mortality of two free-flying condors and up to two eggs or chicks is based on the absence of a condor fatality at an operating wind facility, including Manzana, their tendency to feed in a communal manner (if attracted to an exposed carcass in the Permit Area), and the Condor Risk Minimization Program that will be in place during the permit term.

4.2 Anticipated Impact of Take of California Condor

No population-level impacts of the taking are anticipated because the requested take will be fully mitigated (see Section 5.3). However, to be conservative, a team of independent academic researchers ran a population viability analysis (PVA) to evaluate the impacts of the taking in the absence of mitigation. PVAs use demographic rates (i.e., reproductive rate and survival rates for different life stages and age classes of birds) to predict future population size in 40 years. To address the question of the anticipated impact of the taking, model runs of the PVA were conducted to evaluate the impact of losing four free-flying condors without mitigation over 30 years (i.e., if two permits for two condors were issued), 15 condors without mitigation over 30 years (i.e., if multiple condor permits were issued), or 25 condors without mitigation over 30 years (i.e., if many condor permits were issued). Each of these removal scenarios was evaluated in the context of three different scenarios of when the condors would be lost from the population (early, throughout, or later in the 30 year period), at three different anthropogenic mortality rates (current, lower, and higher) and three different captive release scenarios (current release rates, discontinued releases, no releases). Collectively, these model runs provide a realistic range of impacts to the condor population in the absence of mitigation. Here we focus on the results from the loss of four condors because that best represents the take level requested in this conservation plan; however, the full results of the PVA are provided in Appendix A. In these scenarios in the absence of mitigation, the removal of four adult condors would result in a decrease in population growth rate ranging from 0.4 to 10.8 over 40 years (median = 1.3).

5 CONSERVATION PROGRAM

This chapter describes the Conservation Program of the Manzana Conservation Plan, which has been developed in accordance with ESA Sections 10(a)(2)(A) and 10(a)(2)(B), the ESA implementing regulations (50 CFR, Parts 17.22, 222.307), and the Habitat Conservation Planning and Incidental Take Permitting Handbook (USFWS and NMFS 2016). The Conservation Program includes biological goals and objectives, measures to minimize and mitigate the impacts of the potential take of condor, and a monitoring program to track Conservation Plan compliance. The Conservation Program also incorporates an adaptive management strategy that establishes the process for adjusting elements of the Conservation Program over time based on new information and monitoring results.

5.1 Biological Goals and Objectives

Biological goals are broad, guiding principles that describe the desired future condition to ensure that the operating Conservation Program is consistent with and contributes to the conservation and recovery goals established for the species. For this Conservation Plan, the biological goal and objectives are as follows:

Goal: Implement a conservation strategy that minimizes impacts and increases the survival or reproduction of condors.

> **Objective 1:** Develop and implement practicable approaches to minimize the potential for take of condor from Covered Activities in the Permit Area through implementation of the Condor Risk Minimization Program.
>
> **Objective 2:** Fund the implementation of condor recovery actions by increasing the captive breeding and release capacity.

5.2 Measures to Minimize Take

Manzana Wind will minimize risk to condors using two avenues. First, Manzana Wind employs general operational measures to minimize risk to wildlife including condors. Second, Manzana Wind will implement a targeted Condor Risk Minimization Program. These efforts are described in the following sections and summarized collectively in Table 3 in the context of the Covered Activities.

Table 3
Condor Threat Minimization Associated with Operational Activities

Activity	Threat	Minimization Measures
Operation, maintenance, repair,	Collisions with turbine blades or equipment	• Implementing the Condor Risk Management Program, which will use one or more of the following options to minimize collisions with turbine

Table 3
Condor Threat Minimization Associated with Operational Activities

Activity	Threat	Minimization Measures
replacement, and removal of wind turbines	(cranes); ingestion of microtrash; vehicular collisions	blades: biomonitors; GPS/GSM technology; or high-resolution video-based detection, alert, and curtailment system; available new detection, alert, and curtailment technology; or enhancement of existing technology, in the future • Ongoing training of operations personnel, focusing on the identification of condors in the Permit Area that will inform turbine curtailment when necessary • Reporting of incidental observations of wildlife, including condors, by all on-site operations personnel; monthly turbine checks around the pad (base) of each turbine looking for spills, leaks, and wildlife; seasonal inspections around the road and pad of 10 turbines by designated operations personnel • Monitoring and removing/covering potential condor attractants in the Permit Area (livestock or wildlife carcasses, microtrash) • Limiting vehicle speeds within the Permit Area to 25 mph (posted speed) to minimize the likelihood of collisions with vehicles
Operation of transmission and collection lines and poles, and their routine maintenance, repair, and/or replacement	Collision with electrical lines; electrocution; ingestion of microtrash; vehicular collisions	• Routine inspections of overhead electrical lines and poles every 6 months by operations personnel • Monitoring and removing/covering potential condor attractants to avoid attractants in the Permit Area (livestock or wildlife carcasses, microtrash) • Limiting vehicle speeds within the Permit Area to 25 mph (posted speed) to minimize the likelihood of condor collisions with vehicles
Use and maintenance of operations building, permanent meteorological tower, and electrical substation	Ingestion of microtrash; vehicular collisions	• Ongoing training of operations personnel, focusing on the identification of condors in the Permit Area that will inform turbine curtailment when necessary • Monitoring and removing/covering potential condor attractants to avoid attractants in the Permit Area (livestock or wildlife carcasses, microtrash) • Limiting vehicle speeds within the Permit Area to 25 mph (posted speed) to minimize the likelihood of condor collisions with vehicles • Retaining existing unguyed meteorological tower in the Permit Area, thereby minimizing risk of condor collisions
Repowering upgrades to existing turbines or infrastructure (no change in tower/blade dimension)	Collisions with turbine blades or equipment (cranes); vehicular collisions; ingestion of microtrash	• Implementing the Condor Risk Management Program, which will use one or more of the following options to minimize collisions with turbine blades: biomonitors; GPS/GSM technology; or high-resolution video-based detection, alert, and curtailment system; available new detection, alert, and curtailment technology; or enhancement of existing technology, in the future • Ongoing training of operations personnel, focusing on the identification of condors in the Permit Area that will inform turbine curtailment when necessary • Reporting of incidental observations of wildlife, including condors, by all on-site operations personnel; monthly turbine checks around the pad (base) of each turbine looking for spills, leaks, and wildlife;

Table 3
Condor Threat Minimization Associated with Operational Activities

Activity	Threat	Minimization Measures
		seasonal inspections around the road and pad of 10 turbines by designated operations personnel • Monitoring and removing/covering potential condor attractants to avoid attractants in the Permit Area (livestock or wildlife carcasses, microtrash) • Limiting vehicle speeds within the Permit Area to 25 mph (posted speed) to minimize the likelihood of condor collisions with vehicles
Use and maintenance of roads	Ingestion of microtrash; Vehicular collisions	• Monitoring and removing/covering potential condor attractants to avoid attractants in the Permit Area (livestock or wildlife carcasses, microtrash) • Limiting vehicle speeds within the Permit Area to 25 mph (posted speed) to minimize the likelihood of collisions with vehicles

Notes: GPS/GSM = Global Positioning System/Global System for Mobile Communications

5.2.1 General Operational Measures

Avangrid Renewables has developed a Wildlife Protection Program consisting of voluntary measures to avoid, minimize, or mitigate risk to wildlife at operating facilities. The Wildlife Protection Program implemented at Manzana includes components (detailed in this section) that are designed to avoid or minimize risk to wildlife in general (typically birds and bats) but that also minimize risk to condors. Manzana Wind will commit to implementing these measures for the life of the incidental take permit, upon permit issuance.

Carcass Management and Removal – minimization of local condor attractant within the Permit Area:

- Operations personnel immediately cover non-avian carcass discoveries (livestock, wild animals) with a tarp or burlap-type material and coordinate immediate removal of the carcass. If a large avian carcass is discovered, it will be covered and left in place.
- The sole landowner within the Permit Area that conducts livestock grazing has agreed to provide prior notification of livestock entering Manzana, require their shepherds to notify the Manzana Plant Manager of any livestock carcasses and their location, and promptly cover or bury livestock carcasses if immediate removal is not feasible. Manzana will subsequently coordinate removal of the carcass.

Site Access Control – minimization of local condor attractants in the Permit Area:

- Exterior and interior fencing at Manzana is used to control trespassing of livestock and minimize associated condor attractants (i.e., dead livestock).

Removal of Microtrash – minimization of local condor attractant in the Permit Area:

- Operations personnel regularly remove microtrash within the Permit Area.

Operational Wildlife Monitoring – ongoing implementation of wildlife monitoring and reporting system as described in Section 5.4.

Overhead Electrical Lines – existing overhead electrical lines that are consistent with 2006 APLIC suggested practices (for avian species, including condors) for reducing collisions with overhead lines:

- Overhead lines on Manzana are built to 2006 APLIC suggested practices; termination covers and wildlife barrier discs were installed on identified riser poles.
- Operations personnel perform maintenance inspections of overhead lines twice a year.

Vehicular Speed Limits – minimization of potential condor/vehicle collisions:

- All employees and authorized personnel using vehicles within the Permit Area are required to adhere to the posted speed limit of 25 mph to minimize potential for wildlife collisions.

5.2.2 Condor Risk Minimization Program

Manzana Wind will implement a Condor Risk Minimization Program over the duration of the ITP, which is intended to minimize the potential for condor take. The Condor Risk Minimization Program described in this section employs a practicable approach to condor detection and collision minimization at Manzana. Over the course of the ITP term, Manzana Wind may modify the Condor Risk Minimization Program, with USFWS concurrence, within the framework of the Conservation Plan’s adaptive management strategy (Section 5.5).

The Condor Risk Minimization Program will use one or a combination of the following options: biomonitors, GPS/GSM technology, high-resolution video imaging, or available new technology. While effectiveness will be the primary factor in evaluating the preferred option, the decision on which option or options to implement will also be made based on an overall assessment of implementation costs, logistical constraints, condor behavior, and available condor-related technology. All options discussed in this section are ultimately designed to detect condors and curtail turbine blades if collision with a condor is determined to be likely.

Option 1 Manzana Wind would employ a biological monitor to actively manage condor risk by curtailing turbines when condors are at risk of turbine collisions. The biological monitor would be stationed at a dedicated observation point in the northern portion of the Permit Area (see Figure 7) during the period of greatest risk (August 1–December

15) from approximately 0800–1700 hours (see Section 3.2.5). Times would be adjusted to account for daylight saving time. See Section 5.5.2 for adaptive management of locations and timing. The biological monitor would have direct communication with the Avangrid Renewables NCC to call for the curtailment of a subset (zone) of turbines or all turbines within the Permit Area, depending on the risk location. The biological monitor would use visual observations (naked eye, binoculars, spotting scope), which may be supplemented by handheld radio telemetry equipment (for condors with VHF transmitters), to detect and track condor movements. The biological monitor would use best judgment of proximity, behavior, and trajectory of the condor to assess the need to curtail turbines. When the biological monitor has determined that the risk has abated, the biological monitor would make a second call to the Avangrid Renewables NCC to release the curtailment.

Option 2 Manzana Wind would employ an automated GPS/GSM-based detection, alert, and curtailment system (e.g., geofence; see USFWS 2017a and Sheppard et al. 2015) that has been demonstrated effective for reducing condor risk. For example, the geofence system, which is currently being implemented by Manzana Wind and other operating wind facilities in the vicinity of the Permit Area, uses near real-time location of condors equipped with GPS/GSM transmitters that are in proximity to the Permit Area. Condor movements would be tracked remotely by a full-time monitor during daylight hours. The geofence system utilizes two virtual fences (outer fence and inner fence) and a curtailment zone. The outer fence is located approximately four miles from the outermost boundary of the turbines. When a transmittered condor is outside the outer fence, location data is collected every 10 minutes and transmitted to the monitor every 24 hours. If a transmittered condor "crosses" the outer fence, a notification is sent to the monitor to be aware of its presence in the area. The notification includes the following information: time, condor tag number, transmitter number, and coordinates. The monitor tracks the condor's location, flight direction and patterns, and proximity to wind turbines. Location data is collected electronically every 60 seconds and transmitted every five minutes. The monitor receives a second notification when the condor crosses the outer fence again, departing the area.

The inner fence is located approximately 1.5 to four miles from the outermost boundary of turbines. If the condor "crosses" the inner fence, a notification is sent to the monitor with the aforementioned information. The condor's location is collected every 10 seconds and transmitted at a five-minute window at this stage until the bird leaves the inner fence. The curtailment zone is an approximate 1.5- to two-mile boundary around the outermost project turbines. If a condor crosses into the curtailment zone, the monitor would immediately contact Avangrid's NCC to implement a curtailment of a subset (zone) of turbines or all turbines within the Permit Area. Based on initial testing of Manzana turbines, when a curtailment is implemented blade speed immediately decreases and can take approximately 60 to 90 seconds to reach two rotations per minute (i.e., the speed at which a turbine is considered safe for birds and bats). When the monitor has determined that the risk has abated, generally when the condor has crossed outside of the curtailment zone, a second call would be placed to Avangrid's NCC to release the curtailment. Fences and zones would be periodically evaluated and optimized accordingly. See Section 5.5.2 for adaptive management of the changes in the number of transmittered condors.

Option 3 Manzana Wind would employ an automated high-resolution video-based detection, alert, and curtailment system (e.g., IdentiFlight; see McClure et al. 2018) that has been demonstrated effective for minimizing condor risk, to address the location of greatest condor risk: the northern portion of the Permit Area. For example, IdentiFlight, which is currently in use at operating wind facilities, uses high-resolution video cameras and species-specific algorithms to identify when golden eagles are at risk and trigger turbine curtailment, as appropriate. Manzana Wind would work with the technology vendor to establish a method that can correctly identify condors (e.g., neural network or other artificial intelligence) based on collected condor images used to train the system. Manzana Wind would then work with the technology vendor to develop an appropriate algorithm specific to Manzana that would implement and release curtailment commands when the system classifies a bird as a condor and the criteria of the algorithm are met. The technology would be integrated into Manzana's SCADA system to allow for the informed curtailment of turbines, based on condor detection and the prescribed algorithm. If Option 3 is implemented, Manzana Wind would review the recommended technology with USFWS and obtain USFWS consent prior to implementation of the technology at Manzana Wind.

Option 4 Manzana Wind may test alternate detection, alert, and curtailment technologies or approaches for potential deployment at Manzana if new technologies become available or existing technologies are enhanced. Subsequent implementation of any new technologies would require USFWS concurrence. During this alternate technology testing period, Manzana Wind would also implement at least one of the other options outlined in this section to ensure that risk minimization measures for condors are in place. If Option 4 is implemented, Manzana Wind would review the recommended technology with USFWS and obtain USFWS consent prior to implementation of the technology at Manzana Wind.

5.3 Measures to Mitigate Impacts of Potential Take

The USFWS California Condor Recovery Program currently considers the release of captive-reared birds into the wild as a priority and focus of recovery efforts because it is the most effective method of increasing population size. Other interventions, such as nest management and habitat conservation, do not demonstrate the same benefits achieved by captive breeding (USFWS 2018b). Therefore, Manzana Wind has developed a mitigation strategy that increases the number of captive-reared birds produced at breeding facilities, which provides a quantifiable and measurable approach to mitigating the impact of the permitted take of condors. The following sections describe the current condor breeding program at the Oregon Zoo’s Jonsson Center for Wildlife Conservation (Oregon Zoo) and Manzana Wind’s proposal to enhance that program as the means to mitigate the impacts of the permitted take of condors at Manzana.

5.3.1 Current Status of the Breeding Program at the Oregon Zoo

The Oregon Zoo is one of four facilities that raise captive-bred condors to be released at established sites in an effort to increase the size of the free-flying population. Condors are considered releasable once they reach 1.5 years of age and are recommended for release based on a behavioral and physical evaluation. The Oregon Zoo currently has two full-time employees (FTEs) (condor keepers, or keepers) that work with 11 breeding condor pairs. These 11 pairs have hatched 7 condor chicks in each of the last two breeding seasons (2016 and 2017) (Oregon Zoo, pers. comm. 2018). However, with only two FTEs, the Oregon Zoo is limited in the number of releasable condors it can produce because successfully breeding condors in captivity requires a high level of observation and potential interventions by the condor keepers. Therefore, Manzana Wind has proposed funding an additional FTE at the Oregon Zoo as mitigation to increase the annual number of releasable condors. Activities conducted by this FTE would be covered by the Oregon Zoo’s existing 10(a)(1)(A) permit; therefore, no additional permitting would be required by the Oregon Zoo.

5.3.2 Description of the Breeding Program at the Oregon Zoo

As mentioned above, successfully raising captive-bred condors requires a high level of observation and intervention throughout the breeding period. In the early breeding stages, the condor keepers observe adult condor pairs through a remote camera monitoring system to intervene if one or both birds demonstrate overly aggressive behavior. Once breeding is successful and eggs are present, the condor keepers maintain a diligent watch day and night, 7 days a week, to ensure that eggs and nestlings are in good health and are being appropriately tended to by adults. During incubation, the keepers watch for smooth egg exchanges among the adults and that the eggs are not uncovered for long periods, particularly at night. If the adults are not caring for the eggs properly, then keepers will transfer these eggs to an incubator. When the eggs are near hatching, keepers return the pipping egg to the adults (pipping is when the chick starts breaking the eggshell and cracking is visible). For all pipping eggs, the keepers watch the pair carefully to provide hatching assistance, either their own or a veterinarian’s, if needed by the chicks. Once the chicks hatch, keepers continue watching to ensure that the adults feed the nestlings regularly. Initially, chicks need approximately 5 to 6 feedings during the day; this amount decreases as they grow older. If the adults are not providing adequate food to the chicks, the keepers will either move the chick to a foster pair of condors or will puppet-rear the chicks. Puppet-rearing entails keepers using a condor hand-puppet to hand-feed the condor chicks. This approach helps to avoid imprinting the chicks to people. Throughout this process, if condors begin behaving aggressively toward each other or the chicks, the keepers remove the eggs or chicks from the pair.

5.3.3 Calculation of the Appropriate Amount of Mitigation Needed to Offset the Loss of a Condor

A PVA was run by a team of independent academic researchers to evaluate the amount of mitigation required to offset an individual condor fatality. Mitigation in this context is increasing the number of 1.5-year-old captive-reared condors, which is the minimum age at which condors can be successfully released into the wild (Oregon Zoo, pers. comm. 2019). PVAs use demographic rates (i.e., reproductive rate and survival rates for different life stages and age classes of birds) to predict future population size. The PVA is provided in Appendix A. In order to determine how many captive-reared condors would be needed to replace one adult condor, the PVA was used to predict the condor population size in year 2050 under different management scenarios. Specifically, these scenarios compared population sizes with the additional fatalities from a hypothetical project modeled in the PVA to the baseline population size without the additional fatalities (i.e., with only the known fatalities, such as those caused by lead poisoning). The amount of mitigation required was then calculated as the number of captive-reared condors released into the wild that would be needed to maintain the population at the same population size as no additive condor fatalities. In other words, how many captive-reared releasable condors are needed to replace one adult in a population context.

To account for unknowns, two different management scenarios were considered in the PVA and two different methods of determining the breeding status of the condor fatalities were used. The two management scenarios accounted for uncertainty with respect to condor population growth. The first scenario conservatively assumed no population growth, as if current condor management were discontinued. The second management scenario assumed that the current level of condor population management continued, and therefore condor population growth would be maintained at its current level of 5% increase per year. Models also evaluated the likelihood that the condor fatalities were breeding adults (i.e., where the loss of an adult would also result in the loss of an egg or chick). The first method was conservative and assumed that any fatality would be a breeding adult and therefore also would result in the loss of a dependent egg or chick. The second method assumed that fatalities could affect breeding or non-breeding individuals, based on the average proportion of breeders or non-breeders in the population. In this context, the loss of a breeding condor would result in the additional loss of an egg or chick, whereas the loss of a non-breeding condor would not. Collectively, these different model runs provide a range of the number of captive-reared releasable condors needed to mitigate for loss of one adult condor.

The results of the various PVA model scenarios resulted in a replacement rate for one adult condor ranging between 2.0 and 3.0 captive-reared releasable condors. USFWS determined that the most likely management scenario is the current population growth, as the California Condor Recovery Program has been funded since 1992 and is expected to continue into the future. Per USFWS, the higher replacement rate is based on the assumption that every condor fatality would be an adult breeder, which they believe to be conservative, whereas the lower rate does not assume that every fatality would be a breeding adult. Based on this logic, USFWS has recommended that the mitigation required to offset the loss of one adult condor be three captive-reared releasable condors. Therefore, the requested take of two adults, which also accounts for potential take of dependent eggs or chicks, requires a total of six captive-raised condors to offset the impacts of the taking.

- Number of captive-raised condors per adult = 3
- Total mitigation = 2 adults × 3 captive-raised condors per adult = 6 captive-reared releasable condors

5.3.4 Increased Condor Production through the Addition of an FTE

Manzana Wind will mitigate the impacts of condor take by funding an additional FTE for the Oregon Zoo's condor keeper staff, thereby increasing the number of releasable captive-reared condors produced in each funding year. As mentioned in Section 5.3.1, because of the high level of observation and the potential for intervention required at all stages in the breeding process, the condor breeding program at the Oregon Zoo has been constrained by current staffing levels, thereby limiting the number of condor pairs they are breeding in a given year. The Oregon Zoo has estimated that an increase in staff by one FTE would result in a 30% increase in condor chick production per year. Increasing their current production rate by 30% would result in 2.1 more chicks being produced per year (rounded down to 2 chicks per year and based on the average number of breeding pairs (11) and production rate (7 chicks) per year, at the time of discussion). With an additional skilled FTE in place, the Oregon Zoo can increase production in the following ways:

1. Increase the number of breeding pairs. On average, the Oregon Zoo produces 0.64 chicks/pair (7/11). Two additional breeding pairs would result in an additional 1.3 chicks per year (0.64 × 2).
2. Increase the number of breeding pairs double clutching from 1 to 4 pairs, which would result in an additional 2 to 3 chicks per year. This is accomplished by taking an egg from a pair that has produced two clutches in previous years. The first egg is fostered or puppet-reared, allowing the original pair to produce a second egg and raise the second chick.
3. Accept fertile eggs from other institutions to replace infertile eggs that have been laid by local pairs. An additional FTE allows for capability to physically transfer the egg from the institution of origin.

4. Create different pairs among condors. Inexperienced condors often have trouble successfully raising their chicks to independence. Creating different pairings would increase condor production by ensuring that inexperienced adults are matched with other adults that are experienced, so each pair can breed and rear chicks successfully. An additional FTE would offer the keepers the extra time necessary to invest in ensuring successful re-pairing.

Based on the information provided by the Oregon Zoo, the average base production of releasable captive-reared condors from the Oregon Zoo is 7 individuals per year without mitigation funding, and an extra FTE would provide an additional 2 or more chicks per year. However, the number of chicks produced per year and releaseable individuals may vary from year to year for a variety of reasons (management limitations, unpredicted events such as wildfires or pandemic, logistics). Manzana Wind will rely on the Oregon Zoo to determine how many successfully reared, releasable condors can be attributed to the additional FTE per year, as a result of Manzana Wind's mitigation funding. Mitigation funding will be provided annually until a total of 6 additional captive-reared releasable condors are produced and will be used to support the FTE and incremental costs associated with rearing and transporting the additional condors to the respective release sites.

5.4 Monitoring

Monitoring will be used to assess the level of take that may occur during the permit period. Manzana Wind will use information from two sources: (1) USFWS California Condor Recovery Program fatality data and (2) operational wildlife monitoring conducted by Manzana operations staff. Unless and until the monitoring is modified as a result of the adaptive management strategy (see Section 5.5), monitoring for permit compliance will include the following:

A. **USFWS California Condor Recovery Program:** The USFWS California Condor Recovery Program implements condor management and monitoring for the Southern California population using GPS/GSM transmitters and VHF transmitters. In 2010, 81% of the Southern California flock was equipped with transmitters, and USFWS is able to track condor mortality of transmittered birds on an ongoing basis. Based on the history of USFWS's efforts, this may continue for the permit duration but most likely will diminish over time. Take of a condor with a GPS/GSM or VHF transmitter resulting from Covered Activities in the Permit Area would likely be detected by this ongoing USFWS monitoring, and USFWS would notify Manzana Wind if any such event occurs.

B. **Operational Wildlife Monitoring:** Manzana will continue to implement the wildlife monitoring and reporting system as discussed below. This system includes wildlife monitoring conducted by trained operations personnel for the purpose of documenting wildlife injuries and fatalities and live sightings of sensitive species; managing wildlife risk; and identifying potential patterns of species of concern, including condors, in the Permit Area. Reporting and documentation are managed through an internal database that is monitored by Avangrid

Renewables Wildlife Compliance. Operations personnel receive various levels of wildlife training: annual general wildlife awareness training, initial Wildlife Coordinator training with annual refreshers, and periodic species of concern training.

Operational wildlife monitoring consists of the following:

- Reporting of incidental observations of wildlife injuries and fatalities, nests, and sensitive species, including condors, by all on-site operations personnel during the normal course of operational activities (e.g., maintenance, entering/leaving the site).
- Monthly turbine checks around the gravel pad of each turbine for spills, leaks, or wildlife injuries or fatalities. Wind technicians typically drive around the gravel pad of each turbine, once a month. Gravel pads are typically around 5 meters (16.4 feet) wide.
- Seasonal weekly inspections for wildlife injuries or fatalities at 10 established turbine locations distributed throughout the Permit Area, conducted by an operations person designated as the site's Wildlife Coordinator. Inspections occur during spring (April–May) and fall (August–mid-October) migration seasons for nocturnal avian and bat migrants (for 8 and 10 weeks, respectively). The Wildlife Coordinator parks their vehicle along the access road, 80 meters (262 feet) from the driveway of the turbine to be inspected. They then walk towards the turbine driveway, down the driveway, and around the gravel pad of the turbine, scanning the gravel area and adjacent area with the naked eye. At 0° and 180° of the turbine pad, the Wildlife Coordinator stops and scans the landscape with binoculars. The Wildlife Coordinator then proceeds out of the driveway and walks 80 meters along the access road in the opposite direction of the vehicle. At the end of 80 meters, the Wildlife Coordinator walks to the opposite side of the access road and back to the vehicle. See Figure 8. The fall inspection period coincides with the onset of increased condor activity in proximity to the Permit Area based on several years of biological observations and evaluation of the GPS/GSM data (Section 3.2.5.1).

Observations of live condors would result in notification to the plant manager for immediate risk management (i.e., curtailment of turbines). Similarly, discoveries of carcasses that could be an attractant to foraging condors would be reported to the plant manager and either covered, removed, or buried.

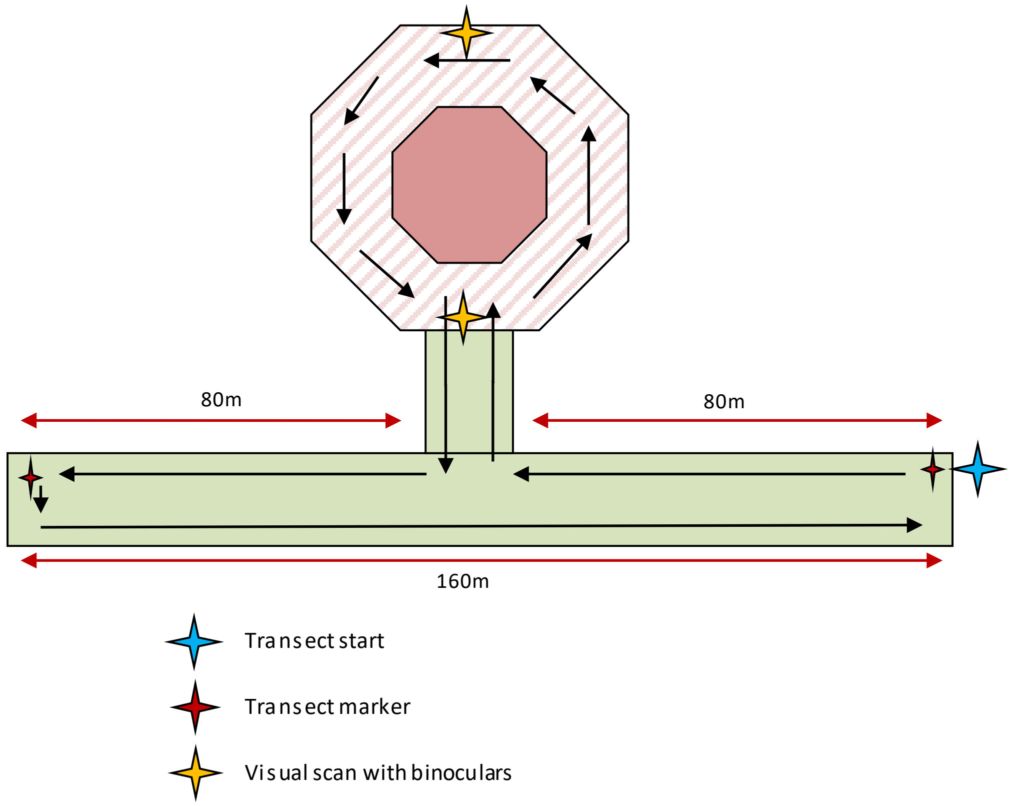


Figure 8. Wildlife Coordinator Inspection

5.5 Adaptive Management Strategy

An adaptive management strategy provides a process to adjust elements of the Conservation Program over time as conditions change or when new information becomes available. The adaptive management strategy allows for flexibility in management responses to addressing uncertainties (USFWS and NMFS 2016; Williams and Brown 2012; Williams et al. 2009; Atkinson et al. 2004).

5.5.1 Adaptive Management Approach to the Take of Condor

If take of any condor occurs from Covered Activities in the Permit Area, Manzana Wind will implement the adaptive management responses described below:

A. Evaluate the circumstances that resulted in the take of the condor, and the data collected and procedures implemented pursuant to the Condor Risk Minimization Program prior to the taking. Circumstances of the taking to be evaluated may include, but are not limited to, necropsy results, specific condor behavior/activity, flight pattern, location in the Permit Area, time of year, time of day, and weather conditions.

B. Determine whether changes to the Condor Risk Minimization Program would improve the effectiveness of the program in light of the circumstances of the taking, and revise components of the program if necessary. Such a determination would be made in coordination with USFWS to discuss potential changes, the effectiveness of those changes, and concurrence on revisions to the program to document agreed-upon changes.

C. Changes to the Condor Risk Minimization Program will primarily be made based on an overall assessment of the effectiveness of the technology used to detect condors and minimize impacts to condors. Other factors to be considered include implementation costs, logistical constraints, and available condor detection and avoidance technology.

5.5.2 Adaptive Management Approach to Managing Condor Risk

5.5.2.1 Changes Relative to Condor Greatest Risk Location in Permit Area

If minimization measures implemented in accordance with the Condor Risk Minimization Program described above do not encompass the entire site (i.e., are limited to the areas of greatest condor risk, currently in the northern portion of the Permit Area), like biomonitors or IdentiFlight technology, it may be necessary to change or expand the area of coverage if the condor behavior changes.

Trigger: If condor transmitter data is available in an accessible form for analysis and ten or more condor flight paths in the Permit Area below 500 feet above ground level (maximum turbine height of 340 feet plus a buffer) are reported to originate from the south over a one-calendar-year period.

Response if Using a Biomonitor: Flight path data will be reviewed during the first quarter of the year subsequent to the period of greatest risk. If this adaptive management has been triggered, then a second biomonitor would be deployed in the southern portion of the Permit Area in time for the subsequent calendar year's period of greatest risk. The second biomonitor would remain on site during the period of greatest risk until either a technology that has coverage of the southern portion of the Permit Area is deployed, or until condor activity has changed and fewer than 10 condor flight paths are reported to originate from the south during the months previously reported.

Response if Using IdentiFlight or Video System: Flight path data will be reviewed during the first quarter of the year subsequent to the period of greatest risk. If this adaptive management has been triggered, then either a biomonitor would be deployed in the southern portion of the Permit Area or one or more additional IdentiFlight units would be installed in the southern portion of the Permit Area, in time for the subsequent calendar year's period of greatest risk. This biomonitor or additional IdentiFlight unit or units would remain on site during the period of greatest risk until either a technology that has full site coverage is deployed, or condor activity has changed and fewer than 10 condor flight paths are reported to originate from the south during the months previously reported.

5.5.2.2 Changes Relative to Greatest Condor Risk Period in Permit Area

If the seasonal period of greatest condor risk changes, adaptive management will be needed if a non-year-round approach to condor detection (i.e., a biomonitor) is being used.

Trigger: The seasonal period of greatest condor risk changes by an increase of 10 or more detections per week in the Permit Area outside of the period identified as the period of greatest condor risk.

Response: Flight path data will be reviewed during the first quarter of the year subsequent to the period of greatest risk. If this adaptive management has been triggered, Manzana Wind would adjust the period of greatest risk to include the time frame that included the 10 or more detections for the following biomonitor effort. Alternatively, Manzana Wind would implement a technology such as geofence or IdentiFlight that does not have seasonal limitations.

Trigger: The diurnal period of greatest condor risk changes such that 10 or more of the detections per week in the Permit Area are outside of the diurnal of the period identified as the period of greatest condor risk.

Response: Flight path data will be reviewed during the first quarter of the year subsequent to the period of greatest risk. If this adaptive management has been triggered, Manzana Wind would adjust the diurnal period of greatest risk. Alternatively, Manzana Wind would implement a technology such as geofence or IdentiFlight that does not have diurnal/time of day limitations.

5.5.2.3 Changes Relative to Condors Equipped with Transmitters

If implementation of the Condor Risk Minimization Program relies on a technology that is dependent on the functionality of GPS/GSM transmitters, adaptive management may be needed if too few condors carry the equipment.

Trigger: Until such time as an automated alert system is deployed that allows Manzana wind to access condor data, USFWS will inform Manzana Wind that the number of condors equipped with functional transmitters has dropped below 70% at least three months immediately preceding the greatest risk period and the status continues into the greatest risk period, or the number of condors equipped with functional transmitters has dropped below 70% during the greatest risk period. However, additional information provided by USFWS may warrant a modification to the prescribed percentage threshold for various reasons, such as in response to changes in condor behavior/range, temporary resource limitation in condor management, or a significant population increase that holds stable for at least 12 months. In this case, USFWS and Manzana Wind would discuss this information to determine if there is a consensus that warrants a change.

Response: If this adaptive management has been triggered, Manzana Wind would implement an alternative or supplemental minimization strategy that does not rely on transmitters (e.g., biomonitors or alternative technologies) following the strategies identified in Section 5.2.2. If the number of condors equipped with functional transmitters drops below 70% during the greatest risk period at least three months immediately preceding the condor risk period or the number of condors equipped with functional transmitters has dropped below 70% during the greatest risk period, Manzana Wind may do one or more of the following actions; implement an alternative or supplemental minimization strategy that does not rely on transmitters within 30 days, supplement funding for additional transmitters, or direct funding to support condor management.

5.5.2.4 Fatality Monitoring Adaptive Management

Compliance monitoring (fatality monitoring) is based primarily on the use of VHF and GPS/GSM technology to identify the location and altitude of the condors. If not enough condors are equipped with transmitters, adaptive management will be implemented for fatality monitoring.

Trigger: The proportion of condors equipped with VHF and GPS/GSM transmitters drops below 70% for a duration of at least 12 months.

Response: Manzana Wind would conduct monthly scans of 100% of turbines, or similar commitments designed for eagles, during the greatest risk period for condors, currently considered August 1 through December 15, until either (1) another technology becomes available that is not dependent on VHF or GPS/GSM transmitters, but tracks condor locations, or (2) the proportion of condors equipped with VHF or GPS/GSM transmitters exceeds 70%.

5.5.2.5 Change in Number of Turbines and/or Blade Length

If Manzana Wind makes changes to existing turbine infrastructure, as described in section 2.1, such as physical dimensions or locations, adaptive management may be needed.

Trigger: Manzana Wind determines changes to turbine infrastructure (i.e., increase in blade length and/or tower height) and/or location are necessary.

Response: USFWS and Manzana Wind will evaluate the existing Condor Risk Minimization Program to determine if the effectiveness of minimization measures remain equivalent to their current levels. If effectiveness of these measures is considered equivalent or improved, then there would be no changes to the minimization measures. If either party determines that the effectiveness of the existing measures would be reduced, then additional minimization measures would be discussed and subsequently implemented.

5.6 Information Management and Reporting

An annual report will be submitted to USFWS by March 31 of each calendar year. Annual status reports will contain the following information:

1. Confirmation that the Conservation Plan is being implemented as written
    a. As part of the overall minimization strategy, information regarding condor detection and any curtailment activity such as the number of detections and the number of curtailments (expressed as a range or qualitatively).
2. Documentation of any condor fatality, including the date, location of the carcass, condition of the carcass, and timing of carcasses collection.
3. Summary of mitigation status (condor captive breeding progress).
4. Adaptive management triggers and responses, if implemented.
5. Changed circumstance triggers and actions, if implemented.

6 PLAN IMPLEMENTATION

6.1 Changed and Unforeseen Circumstances

ESA Section 10 regulations require that conservation plans include procedures for addressing changed and unforeseen circumstances that may arise during conservation plan implementation. In accordance with the "No Surprises" Assurances Rule for conservation plans (63 FR 8859–8873; 50 CFR, Part 17.22), no additional commitment of land, water, or financial compensation will be required and no additional restrictions will be imposed upon Manzana Wind for Covered Species beyond those specified in the Conservation Plan without consent of Manzana Wind, as long as Manzana Wind is properly implementing the Conservation Plan and the ITP. The following sections describe changed circumstances and unforeseen circumstances for the Manzana Conservation Plan.

6.1.1 Changed Circumstances

Federal regulations (50 CFR, Part 17.3) define changed circumstances as:

> Changed circumstances means changes in circumstances affecting a species or geographic area covered by a conservation plan or agreement that can reasonably be anticipated by plan or agreement developers and the Service and that can be planned for (e.g., the listing of new species, or a fire or other natural catastrophic event in areas prone to such events).

Under this Conservation Plan, changed circumstances that can be anticipated and planned for include:

- **Future Listings of Non-Covered Species.** During the permit term, it is possible that a species that is not covered by this Conservation Plan but that could be affected by Covered Activities will be listed under the ESA. If Manzana Wind determines prohibited take of a newly listed species is reasonably certain to occur from the Covered Activities, Manzana Wind will coordinate with USFWS. Depending on the circumstances, Manzana Wind will consider implementing measures that would avoid take of the species, amending the Conservation Plan to include the additional species, or pursuing other ESA compliance approaches.
- **Mitigation Entity Change.** If the Oregon Zoo were to discontinue its condor program prior to the completion of the mitigation required to offset the impacts of the taking, it would be a changed circumstance. In this case, Manzana Wind will either work with an alternative mitigation entity to conduct similar mitigation at a different location or meet with USFWS to evaluate other recovery actions being taken for condors that could meet any remaining mitigation needs.

6.1.2 Unforeseen Circumstances

Federal regulations (50 CFR, Part 17.3) define unforeseen circumstances as:

> Unforeseen circumstances means changes in circumstances affecting a species or geographic area covered by a conservation plan or agreement that could not reasonably have been anticipated by plan or agreement developers and the Service at the time of the conservation plan's or agreement's negotiation and development, and that result in a substantial and adverse change in the status of the covered species.

In case of an unforeseen event, USFWS has the burden of demonstrating that an unforeseen circumstance has occurred and that such circumstance is having or is likely to have a significant adverse effect on condors and/or their habitat. USFWS typically determines that an unforeseen circumstance has occurred by evaluating factors such as (1) size of the current range of the affected species, (2) percentage of the range conserved by the conservation plan, (3) percentage of the range adversely affected, (4) ecological significance of the portion of the range covered by the conservation plan, (5) level of knowledge of the affected species or habitat, and (6) whether failure to adopt additional conservation measures would significantly reduce the likelihood of survival and recovery of the species in the wild (50 CFR, Part 17.22; USFWS and NMFS 2016).

If USFWS determines that an unforeseen circumstance has occurred and additional conservation measures subsequently are deemed necessary to provide conservation of condors, and the Conservation Plan is being properly implemented, the obligation for such measures shall not rest with Manzana Wind. The USFWS is limited to implementing additional conservation measures within the Conservation Plan's operating conservation program and "maintain the original terms of the conservation plan to the maximum extent possible. (50 CFR 17.22(b)(5)(iii)(B). USFWS cannot require a "commitment of additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources otherwise available for development or use under the original terms" of the Conservation Plan without Manzana Wind's consent. (50 CFR 17.22(b)(5)(iii)(B).

6.2 Amendments

Changes in implementation of the Conservation Plan may require amendments to the Conservation Plan or ITP. Amendments can be made by an exchange of formal correspondence, addenda to the Conservation Plan, revisions to the Conservation Plan, or permit amendments. Amendments usually do not require Federal Register publication when levels of incidental take do not increase and the activity does not expand in ways not analyzed in the original NEPA or Section 7 documents (USFWS and NMFS 2016).

6.3 Permit Suspension/Revocation

USFWS should not consider permit suspension or revocation as the first step in compliance enforcement (USFWS and NMFS 2016). However, USFWS may suspend or revoke the Section 10(a)(1)(B) permit if Manzana Wind fails to implement the Conservation Plan in accordance with the terms and conditions of the permit. Permit suspension or revocation by USFWS shall be in accordance with 50 CFR, Parts 13.27–29.

6.4 Permit Renewal

The Section 10(a)(1)(B) permit may be renewed, without issuance of a new permit, provided that a renewal request is provided at least 30 days before expiration and that the biological circumstances and other pertinent factors affecting the Covered Species are not significantly different from those of the original Conservation Plan. USFWS will honor No Surprises assurances as much as practicable (USFWS and NMFS 2016) and will process the permit renewal request in accordance with 50 CFR, Part 13.22.

6.5 Permit Transfer

If there is a transfer of ownership of Manzana during the permit term, the Section 10(a)(1)(B) permit may be transferred to the new owner as specified in 50 CFR 13.25. The new owner shall submit the following in their permit transfer request to USFWS: a new permit application; a new permit fee; and written documentation demonstrating the capacity to implement the Conservation Plan, the legal ability to perform the authorized project, and funding assurances, as applicable (USFWS and NMFS 2016).

INTENTIONALLY LEFT BLANK

7 IMPLEMENTATION COSTS AND FUNDING

ESA Section 10(a)(2)(A) directs an applicant for an ITP to submit a conservation plan that specifies the funding that will be available for implementation, and ESA Section 10(a)(2)(B)(iii) states that "the applicant will ensure that adequate funding for the plan will be provided." The following provides an estimate of the Manzana Conservation Plan implementation over the permit term and a description of the funding source and assurance.

Implementation of the Manzana Conservation Plan includes the following costs: Condor Risk Minimization Program, mitigation, monitoring, adaptive management, and information management and reporting. Additionally, a contingency fund has been established for Conservation Plan implementation. Estimated costs for Manzana Conservation Plan implementation are described below and summarized in Table 4. Funding for Conservation Plan implementation will be provided by Manzana Wind, and the funding assurances for the implementation costs are also summarized in Table 4.

Condor Risk Minimization Program: The Condor Risk Minimization Program set forth in Section 5.2 describes the minimization measures that Manzana Wind will employ pursuant to this Conservation Plan. Actions associated with the program include:

- Implementation of one of the following turbine collision minimization approaches: biomonitors, GPS/GSM technology, high-resolution video imaging, or available new technology
- Ongoing training operations personnel.
- Monthly turbine checks and reporting of any wildlife observations
- Monitoring for and removal of potential condor attractants
- Twice-a-year inspections of overhead electrical lines

Implementation of the program is estimated to cost $8,780,541 ($200,000/year + 2.5% inflation escalation/year). This cost is based on the annual cost of deploying a biomonitor during the period of greatest risk, which is currently the highest cost minimization strategy to implement at Manzana. The other activities arising under the Condor Risk Minimization Program will not create any additional costs as these activities will be undertaken by existing personnel. Funding of a biomonitor and/or geofence has previously been provided through the Operations budget and will continue to be funded by the Operations budget through the ITP term.

Table 4
Cost Estimate and Funding Assurances

Funding Need	Per Unit Cost	Estimated Years	Estimated Total Cost	Funding Assurances
Condor Risk Minimization Program	\$200,000/year[a] +2.5% escalation/year	30 years	\$8,780,541	Operations budget
Mitigation	\$90,000 per condor keeper FTE per year (+2.5% escalator) + \$10,000 per year to transport additional condors to release sites	5 years [b]	\$527,822	First three years (\$308,181) paid within 12 months of ITP issuance, then annually out of Operations budget until mitigation is fully funded
Monitoring	Incorporated in cost of on-site operations personnel	—	—	Operations budget
Adaptive Management	\$250,000[c]	—	\$500,000	Corporate guaranty[d]
Information Management and Reporting	Incorporated in cost of on-site operations personnel	---	--	Operations budget
Contingency Fund	5% of total minimization costs	—	\$400,000	Corporate guaranty[d]

Notes: FTE = full-time employee; ITP = incidental take permit.

[a] Cost in Condor Risk Minimization Program is for biological monitors, which is currently the highest cost minimization strategy to implement at Manzana. Minimization funding has been provided through the Operations budget since 2014.

[b] Oregon Zoo anticipates funding an extra FTE will provide an additional two or more condor chicks per year. Duration is estimated for more than three years in the event that fewer than two additional condor chicks are produced in a given year.

[c] Cost of additional automated high-resolution video-based detection, alert, and curtailment system technology, which is currently the highest cost for adaptive management to implement at Manzana.

[d] Manzana Wind intends to obtain this via a Guaranty Agreement signed by Avangrid Renewables LLC.

Mitigation: Manzana Wind will fund an FTE at the Oregon Zoo's Jonsson Center for Wildlife Conservation annually until six additional 1.5-year condors are produced (Section 5.3). It is anticipated that this will require approximately three years at a cost of \$90,000/year (+2.5% inflation), however funding is estimated for five years in the event that fewer than two additional condor chicks are produced in a given year with the additional FTE. Additionally, fulfilling this mitigation commitment will include \$10,000/year for transportation of condors to the release site. Therefore, the total cost of mitigation is estimated to be \$527,822. Funding for the first three years, \$308,181, will be paid within 12 months of ITP issuance, then annually out of Operations budget until mitigation is fully funded.

Monitoring: Manzana Wind will continue to implement its Wildlife Monitoring and Reporting System (Section 5.4). This monitoring will not create any additional costs as the monitoring will be undertaken by existing personnel funded from the Operations budget.

Adaptive Management: Pursuant to Section 5.5.2, Manzana Wind may take various actions in response to adaptive management triggers. These responses could consist of deploying a second biomonitor, installing additional IdentiFlight units, or installing new technologies. Manzana Wind has estimated the cost of installing/implementing two additional automated high-resolution video-based detection, alert, and curtailment system technologies, which is currently the highest cost for adaptive management to implement at Manzana, to be $500,000 ($250,000/unit). It is anticipated that funding of the adaptive management responses will be paid for through the Operations budget. This assurance will be provided in the form of a corporate guaranty. Avangrid Renewables, LLC will execute a guaranty to assure that the $500,000 will be available for use to implement the Adaptive Management response.

Information Management and Reporting: Section 5.6 describes the annual report to be submitted to USFWS. This task will not create any additional costs as reporting and information management will be undertaken by existing personnel funded from the Operations budget.

Contingency Fund: It is anticipated that all funding set forth in this Conservation Plan will be paid for through the Operations budget. However, in the event of a shortfall or cost overrun, Manzana Wind has also provided a back-up assurance equal to 5% of the total minimization cost ($400,000). This assurance will be provided in the form of a corporate guaranty. Avangrid Renewables, LLC execute a guaranty that will assure that the $400,000 will be available for use to implement the Conservation Plan should the back-up funding become necessary.

Changed Circumstances: Changed circumstances identified in Section 6.1.1 do not require funding assurances and have therefore not been included in Table 4. Additional species listing would be covered by the operational budget and funds dedicated to the original mitigation entity would be reallocated to a new mitigation entity if a change were to occur.

INTENTIONALLY LEFT BLANK

8 ALTERNATIVES TO THE TAKING

ESA Section 10(a)(2)(A)(iii) requires that alternative actions to the taking be considered by the Applicant (Manzana Wind) and requires a discussion of the reasons that such alternatives are not being pursued. The following sections summarize the alternatives to the taking that were considered for the Manzana Conservation Plan.

8.1 Alternative 1: No Action Alternative

Under the No Action Alternative (no Conservation Plan), Manzana Wind would continue to operate Manzana for the next 30 years without a condor ITP from USFWS. Under this alternative, Manzana Wind would not be obligated to implement the minimization measures of this Conservation Plan, as described in the Conservation Program in Chapter 5; additionally, the mitigation measures would not occur. It is not possible to accurately anticipate condor movements or population status relative to Manzana over the next 30 years; however, given the fairly steady increase in the population of condors in Southern California since the 1990s (see Section 3.2.2), the risk of condor take from Manzana operations may increase based on the condor population and type of minimization implemented under this alternative. The No Action Alternative would not be required to reduce the risk of condor take from Manzana operations and would not implement measures to mitigate any take; therefore, this alternative was not considered further.

8.2 Alternative 2: Regional Condor Conservation Plan Alternative

Under the Regional Condor Conservation Plan Alternative, Manzana Wind would not pursue an independent ITP through the Manzana Conservation Plan but would instead obtain condor take coverage through a regional conservation plan covering multiple projects and permittees. A regional condor conservation plan for wind projects in the Tehachapi region has not been developed, and this alternative would require that Manzana Wind join with other wind project operators/developers in the region to collaboratively develop a multiple-project conservation plan that is approved by USFWS.

This alternative does not align with Manzana Wind's risk management for the facility. At this time, there are uncertainties as to whether a regional condor conservation plan will be developed in the future. Development of such a plan under this alternative would involve considerable time and resources from various wind energy applicants and USFWS, which would likely result in a longer period during which Manzana Wind would be operating without an ITP. Therefore, Manzana Wind did not pursue this alternative further.

8.3 Alternative 3: Reduced Permit Term Alternative

Under the Reduced Permit Term Alternative, the ITP issued for the Manzana Conservation Plan would have a shorter permit duration than the proposed 30-year permit term. Under this alternative, Manzana operations would be covered by the ITP for a shorter duration and the Conservation Plan's Conservation Program would also be limited to the shorter duration.

Under this alternative, the likelihood of condor take during the permit term would be reduced due to the shorter period of coverage; however, Manzana operations are expected to continue for an approximately 30-year lifespan. Therefore, this alternative would result in a period at the end of the Project lifespan when Manzana would be operating without permit coverage, which would occur when the condor population numbers would be expected to be higher than earlier in the permit term. Manzana Wind did not pursue this alternative further because it does not align with Manzana Wind's risk management for the facility over the Project lifespan.

9 REFERENCES

16 USC (United States Code) 703–712. Migratory Bird Treaty Act, as amended.

16 USC 1531–1544. Endangered Species Act of 1973, as amended.

32 FR (Federal Register) 4001. “Endangered Species Listing.” March 11, 1967.

41 FR 41914–41916. “Determination of Critical Habitat for American Crocodile, California Condor, Indiana Bat, and Florida Manatee.” September 24, 1976.

42 USC 4321–4370f. National Environmental Policy Act of 1969, as amended.

50 CFR (Code of Federal Regulations), Part 13, General Permit Procedures, Subpart C, Permit Administration.

50 CFR (Code of Federal Regulations), Part 13.22, Renewal of Permits.

50 CFR (Code of Federal Regulations), Part 13.25, Transfer of Permits and Scope of Permit Authorization.

50 CFR, Part 17, Endangered and Threatened Wildlife and Plants, Subpart C, Endangered Wildlife.

50 CFR, Part 17.3, Definitions.

50 CFR, Part 222.307, Permits for Incidental Taking of Species.

54 USC 300101–320301. National Historic Preservation Act of 1966, as amended.

61 FR 54044–54060. Final rule: “Endangered and Threatened Wildlife and Plants: Establishment of a Nonessential Experimental Population of California Condors in Northern Arizona.” October 16, 1996.

63 FR 8859–8873. Final rule: “Habitat Conservation Plan Assurances (‘No Surprises’) Rule.” March 25, 1998.

APLIC (Avian Power Line Interaction Committee). 2006. *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006*. Public Interest Energy Research (PIER) Final Project Report CEC-500-2006-022. Washington, DC, and Sacramento, California: Edison Electric Institute, APLIC, and the California Energy Commission. Accessed December 2020. http://www.aplic.org/mission.php.

Atkinson, A.J., KP.C. Trenham, R.N. Fisher, S.A. Hathaway, B.S. Johnson, S.G. Torres, and Y.C. Moore. 2004. *Designing Monitoring Programs in an Adaptive Management Context for Regional Multiple Species Conservation Plans.* Prepared by U.S. Geological Survey, Western Ecological Research Center, in partnership with California Department of Fish and Game and U.S. Fish and Wildlife Service.

AOU (American Ornithologists' Union) and Audubon California. 2008. *Status of the California Condor and Efforts to Achieve its Recovery*. Prepared by the AOU Committee on Conservation, California Condor Blue Ribbon Panel, a Joint Initiative of The American Ornithologists' Union and Audubon California. Prepared by J.R. Walters, S.R. Derrickson, D.M. Fry, S.M. Haig, J.M. Marzluff, and J.M. Wunderle, Jr. August 2008.

Bakker, V.J., D.R. Smith, H. Copeland, J. Brandt, R. Wolstenholme, J. Burnett, S. Kirkland, and M.E. Finkelstein. 2016. "Effects of Lead Exposure, Flock Behavior, and Management Actions on the Survival of California Condors (*Gymnogyps californianus*)." *EcoHealth* 14:S92–S105.

BLM (Bureau of Land Management). 2016. *Desert Renewable Energy Conservation Plan Land Use Plan Amendment to the California Desert Conservation Area Plan, Bishop Resource Management Plan, and Bakersfield Resource Management Plan*. September 2016.

Bloom, P.H., J.M. Scott, O.H. Pattee, and M.R. Smith. 1989. "Lead Contamination of Golden Eagles *Aquila chrysaetos* within the Range of the California Condor *Gymnogyps californianus*." In *Raptors in the Modern World*, edited by B-U. Meyburg and R.D. Chancellor, 481–482. London: World Working Group on Birds of Prey.

Bloom Biological. 2014a. *Manzana Wind Project 2012–2013 and 2013–2014 Final Winter Raptor Survey Report*. Prepared for Cardno Entrix. June 2014.

Bloom Biological. 2014b. *Manzana Wind Energy Plant 2013 and 2014 Final Raptor Nesting Survey Report*. Prepared for Cardno Entrix. June 2014.

Bloom Biological. 2015. *Bird Use Count Surveys at the Manzana Wind Energy Plan: Spring 2015 Final Report*. July 2015.

Bloom Biological. 2016. *Manzana Wind Power Project Large Bird Monitoring*. Final 2015 Annual Report. Prepared for Avangrid Renewables LLC. August 2016.

Bloom Biological. 2019. *Manzana Wind Power Project Large Bird Monitoring.* 2017 Annual Report. Prepared for Avangrid Renewables LLC. June 2019.

Bloom Biological. 2020. *Manzana Wind Power Project Large Bird Monitoring.* 2018 Annual Report. Prepared for Avangrid Renewables LLC. July 2020.

Bloom Biological and Cardno Entrix. 2015. *Bird Use Count Surveys at the Manzana Wind Energy Plant*. Prepared for Iberdrola Renewables. February 2015.

Burnett, L.J., K.J. Sorenson, J. Brandt, E.A. Sandhaus, D. Ciani, M. Clark, C. David, J. Theule, S. Kasielke, R.W. Risebrough. 2013. "Eggshell Thinning and Depressed Hatching Success of California Condors Reintroduced to Central California." *Condor* 115(3): 477–491.

Cade, T.J. 2007. "Exposure of California Condors to Lead from Spent Ammunition." *Journal of Wildlife Management* 71(7): 2125–2133.

Cogan, C.B., J. D'Elia, K. Convery, J. Brandt, and T. Bulgerin. 2012. "Analysis of California Condor (*Gymnogyps californianus*) Activity Using Satellite Telemetry Data." *Open Ornithology Journal* 5:82–93.

County of Kern. 2008. *PdV Wind Energy Project Environmental Impact Report*. Prepared by County of Kern Planning Department with technical assistance by Ecology and Environment Inc. February 2008.

Emslie, S.D. 1987. "Age and Diet of Fossil California Condors in Grand Canyon, Arizona." *Science* 237:768–770.

enXco (enXco Development Corporation). 2009. *Addendum to the Environmental Impact Report for the PdV Wind Energy Infill Project (SCH No. 200606115)*. Submitted to Kern County Planning Department. San Ramon, California: enXco. October 15, 2009.

Finkelstein, M.E., D.F. Doak, D. George, J. Burnett, J. Brandt, M. Church, J. Grantham, D.R. Smith. 2012. "Lead Poisoning and the Deceptive Recovery of the Critically Endangered California Condor." In *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 109, No. 28, edited by R.T. Paine, 11449–11454. Accessed July 2017. www.pnas.org/cgi/doi/10.1073/pnas.1203141109.

Grantham, J. 2007. "The State of the Condor." *Western Tanager* 73(6): 1–3.

Hall, M., J. Grantham, R. Posey, and A. Mee. 2007. "Lead Exposure among Reintroduced California Condors in Southern California." In *California Condors in the 21st Century,* edited by A. Mee and L.S. Hall. Nuttall Ornithological Club and the American Ornithologists' Union.

Houston, D.G., A. Mee, and M. McGrady. 2007. "Why Do Condors and Vultures Eat Junk? The Implications for Conservation." *Journal of Raptor Research 41*(3): 235–238.

IWS (Institute for Wildlife Studies). 2020. Non-Lead Ammunition Outreach and Education, 5-Year Review: 2015-2020. Final Report. Prepared for National Fish and Wildlife Foundation Renewable Energy Action Team Mitigation Account.

Janssen, D.L., J.E. Oosterhuis, J.L. Allen, M.P. Anderson, D.G. Kelts, and S.N. Wiemeyer. 1986. "Lead Poisoning in Free Ranging California Condors." *Journal of the American Veterinary Medicine Association* 189:1115–1117.

Kelly, T.R., B.A. Rideout, J. Grantham, J. Brandt, L.J. Burnett, K.J. Sorenson, D. George, A. Welch, D. Moen, J. Rasico, M. Johnson, C. Battistone, and C.K. Johnson. 2015. "Two Decades of Cumulative Impacts to Survivorship of Endangered California Condors in California." *Biological Conservation* 191:391–399. https://doi.org/10.1016/j.biocon.2015.07.012.

Koford, C.B. 1953. *The California Condor*. Washington, DC: National Audubon Society Research Report No. 4. New York: Dover Publishing.

Kurle, C.M., V.J. Bakker, H. Copeland, J. Burnett, J.J. Scherbinski, J. Brandt, and M.E. Finkelstein. 2016. "Terrestrial Scavenging of Marine Mammals: Cross-Ecosystem Contamination Transfer and Potential Risks to Endangered California Condors (*Gymnogyps californianus*)." *Environmental Science & Technology* 50(17): 9114–9123. https://doi.org/10.1021/acs.est.6b01990.

Matthew, J., J. Kern, and S.M. Haig. 2010. *Analysis of California Condor (*Gymnogyps californianus*) Use of Six Management Units Using Location Data from Global Positioning System Transmitters, Southern California, 2004–09—Initial Report*. U.S. Geological Survey Open-File Report 2010-1287.

McClure, C.J.W., L. Martinson, and T.D. Allison. 2018. "Automated Monitoring for Birds in Flight: Proof of Concept with Eagles at a Wind Power Facility." *Biological Conservation* 224:26–33.

Mee, A., and N.F.R. Snyder. 2007. "California Condors in the 21st Century – Conservation Problems and Solutions." In *California Condors in the 21st Century*, edited by A. Mee and L.S. Hall, 243–279. *Series in Ornithology*, No. 2. Washington, DC: American Ornithologists' Union and Nuttall Ornithological Club.

Mee, A., J.A. Hamber, and J. Sinclair. 2007. "Low Nest Success in a Reintroduced Population of California Condors." In *California Condors in the 21st Century*, edited by A. Mee and L.S. Hall. *Series in Ornithology*, No. 2. Washington, DC: American Ornithologists' Union and Nuttall Ornithological Club.

Meretsky, V.J., N.F.R. Snyder, S.R. Beissinger, D.A. Clendenen, and J.W. Wiley. 2000. "Demography of the California Condor: Implications for Reestablishment." *Conservation Biology* 14(4): 957–967.

Oregon Zoo. 2018. Personal communication re: condor breeding program. Jonsson Center for Wildlife Conservation.

Oregon Zoo. 2019. Personal communication from T. Koons (Oregon Zoo) re: condor captive-breeding program.

Pattee, O.H., P.H. Bloom, J.M. Scott, and M.R. Smith. 1990. "Lead Hazards within the Range of the California Condor." *Condor* 92:931–937.

Poessel, S.A., J. Brandt, T.A. Miller, and T.E. Katzner. 2018. "Meteorological and Environmental Variables Affect Flight Behaviour and Decision-Making of an Obligate Soaring Bird, the California Condor *Gymnogyps californianus.*" https://doi.org/10.1111/ibi.12531.

Rideout, B.A., I. Stalis, R. Papendick, A. Pessier, B. Puschner, M.E. Finkelstein, D.R. Smith, M. Johnson, M. Mace, R. Stroud, J. Brandt, J. Burnett, C. Parish, J. Petterson, C. Witte, C. Stringfield, K. Orr, J. Zuba, M. Wallace, and J. Grantham. 2012. "Patterns of Mortality in Free-Ranging California Condors (*Gymnogyps californianus*)." *Journal of Wildlife Diseases* 48(1): 95–112.

Rivers, J.W., J.M. Johnson, S.M. Haig, C.J. Schwarz, J.W. Glendening, L.J. Burnett, D. George, and J. Grantham. 2014a. "Resource Selection by the California Condor (*Gymnogyps californianus*) Relative to Terrestrial-Based Habitats and Meteorological Conditions." *PLOS One* 9(2): e88430. https://doi.org/10.1371/journal.pone.0088430.

Rivers, J.W., J.M Johnson, S.M. Haig, C.J. Schwarz, L.J. Burnett, J. Brandt, D. George, and J. Grantham. 2014b. "An Analysis of Monthly Home Range Size in the Critically Endangered California Condor *Gymnogyps californianus*." *Bird Conservation International* 24:492–504.

Robinson, C.S. 1939. "Observations and Notes on the California Condor from Data Collected on Los Padres National Forest." Santa Barbara, California: U.S. Forest Service.

Robinson, C.S. 1940. "Notes on the California Condor, collected on Los Padres National Forest, California." Santa Barbara, California: U.S. Forest Service.

Sapphos Environmental Inc. 2006. *PdV Wind Energy Project Biological Resources Technical Report*. Prepared for enXco Inc. Pasadena, California: Sapphos Environmental Inc. August 25, 2006.

Sheppard, J.K., A. McGann, M. Lanzone, R.R. Swaisgood. 2015. "An Autonomous GPS Geofence Alert System to Curtail Avian Fatalities at Wind Farms." *Animal Biotelemetry* 3:43.

Snyder, N.F.R., and E.V. Johnson. 1985. "Photographic Censusing of the 1982–1983 California Condor Population." *Condor* 87:1–13.

Snyder, N.F.R., and N.J. Schmitt. 2002. "California Condor (*Gymnogyps californianus*)." In *The Birds of North America*, No. 610, edited by A. Poole and F. Gill. Philadelphia, Pennsylvania: The Birds of North America Inc.

Snyder, N., and H. Snyder. 1989. "Biology and Conservation of the California Condor." *Current Ornithology* 6:175–267.

Snyder, N., and H. Snyder. 2000. *The California Condor: A Saga of Natural History and Conservation*. San Diego: Academic Press.

Snyder, N., R. Ramey, and F.C. Sibley. 1986. "Nest-Site Biology of the California Condor." *Condor* 88:228–241.

USFWS (U.S. Fish and Wildlife Service). 1996. *California Condor Recovery Plan*. Third revision. Portland, Oregon: USFWS.

USFWS. 2012. *Hopper Mountain National Wildlife Refuge Complex: California Condor Recovery Program*. 2012 Annual Report. Ventura, California: USFWS.

USFWS. 2013a. *California Condor (*Gymnogyps californianus*) 5-Year Review: Summary and Evaluation*. USFWS, Pacific Southwest Region. June 2013.

USFWS. 2013b. "Biological Opinion on the Proposed Issuance of an Incidental Take Permit for the Tehachapi Uplands Multiple Species Habitat Conservation Plan (8-8-12-FW-55)." Ventura Fish and Wildlife Office. April 26, 2013. Accessed September 30, 2016. https://www.fws.gov/ventura/docs/hcps/final/TehachapiUpland/April2013DecisionDocs/TUMSHCP%20FINAL%20BO%208-8-12-FW-55.pdf.

USFWS. 2013c. "Biological Opinion for the Alta East Wind Project, Kern County, California (3031 (P), CACA-052537, CAD000.06)) (8-8-13-F-19)." May 8, 2013. Accessed September 2, 2016. http://www.blm.gov/style/medialib/blm/ca/pdf/ridgecrest/alta_east_wind.Par.97476.File.dat/AEWP_ROD_App2_BO_051313.pdf.

USFWS. 2013d. *Hopper Mountain National Wildlife Refuge Complex: California Condor Recovery Program*. 2013 Annual Report. Ventura, California: USFWS.

USFWS. 2014. *Hopper Mountain National Wildlife Refuge Complex: California Condor Recovery Program*. 2014 Annual Report. Ventura, California: USFWS.

USFWS. 2016a. "Information for Planning and Conservation (IPaC) Trust Resources Report." Query and report generated for the Manzana project site. Accessed August 25, 2016. https://ecos.fws.gov/ipac/.

USFWS. 2016b. "California Condor Recovery Program: 2016 Annual Population Status."

USFWS. 2016c. *Hopper Mountain National Wildlife Refuge Complex California Condor Recovery Program*. 2015 Annual Report. August 24, 2016. Ventura, California: USFWS.

USFWS. 2017a. *Hopper Mountain National Wildlife Refuge Complex: California Condor Recovery Program*. 2016 Annual Report. Ventura, California: USFWS.

USFWS. 2017b. Personal communication with Steve Kirkland (USFWS California Condor Recovery Field Coordinator) and Joseph Brandt (USFWS Supervisory Wildlife Biologist). June 20, 2017.

USFWS. 2017c. "California Condor Recovery Program: 2017 Annual Population Status."

USFWS. 2018a. Email communication with J. Brandt (USFWS Supervisory Wildlife Biologist).

USFWS. 2018b. "California Condor Recovery Program: 2018 Annual Population Status."

USFWS. 2019a. Email communication with S. Kirkland (USFWS California Condor Recovery Field Coordinator). April 12, 2019.

USFWS. 2019b. Email communication with J. Brandt and S. Kirkland (USFWS California Condor Recovery Field Coordinator), and P. Sanzenbacher (USFWS Ecological Services). September 11, 2019.

USFWS. 2019c. "California Condor Recovery Program: 2019 Annual Population Status."

USFWS. 2019d. *Hopper Mountain National Wildlife Refuge Complex: California Condor Recovery Program*. 2017 Annual Report. Ventura, California: USFWS.

USFWS. 2020. Email communication from P. Sanzenbacher (USFWS Ecological Services) to A. Parsons (Avangrid Renewables, LLC). November 22, 2020.

USFWS and NMFS (U.S. Fish and Wildlife Service and National Marine Fisheries Service). 2016. *Habitat Conservation Planning and Incidental Take Permitting Handbook*.

Ventana Wildlife Society. 2016. “MyCondor.org: California Condor Profiles & Life Histories.” Accessed August 19, 2016. http://www.mycondor.org/condorprofiles/condor190.html.

Ventana Wildlife Society. 2020. “Big Sur Fires” Accessed November 25, 2020. https://www.ventanaws.org/wildfires.html.

Waltermire, R.G., C.U. Emmerich, L.C. Mendenhall, G. Bohrer, R.P. Weinzierl, A.J. McGann, P.K. Lineback, T.J. Kern, and D.C. Douglas. 2016. *Improve Wildlife Species Tracking—Implementing an Enhanced Global Positioning System Data Management System for California Condors*. U.S. Geological Survey Open-File Report 2016–1030. Accessed December 2016. http://dx.doi.org/10.3133/ofr20161030.

Weller, T., and C. Domschke. 2015. *Post-Construction Fatality Monitoring at the Manzana Wind Plant, Kern County, California Two Year Report*. Prepared for Iberdrola Renewables. August 2015.

Western Regional Climate Center. 2016. “Mojave, California: NCDC 1981-2010 Monthly Normals.” Accessed September 28, 2016. http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?camoja+sca.

Wilbur, S.R. 1980. “Estimating the Size and Trend of the California Condor Population, 1965–1978.” *California Fish and Game* 66:40–48.

Williams, B.K., R.C. Szaro, and C.D. Shapiro. 2009. *Adaptive Management: The U.S. Department of the Interior Technical Guide.* Washington DC: U.S. Department of the Interior, Adaptive Management Working Group. https://pubs.er.usgs.gov/publication/70194537.

Williams, B.K., and E.D. Brown. 2012. *Adaptive Management: The U.S. Department of the Interior Applications Guide.* Washington DC: U.S. Department of the Interior, Adaptive Management Working Group. April 2012. https://www.fedcenter.gov/Bookmarks/index.cfm?id=21079&pge_prg_id=42732&pge_id=4241.

APPENDIX A

Population Viability Analysis

Quantitative analyses to inform conservation planning efforts associated with California condors (*Gymnogyps californianus*)

Victoria Bakker (Montana State University)
Myra Finkelstein (University of California Santa Cruz)

April 8th, 2020

Background

California condors (*Gymnogyps californianus*, hereafter referred to as condor[s]) are an endangered species recovering from very low population sizes. They exhibit a *K*-selected life history strategy characterized by high adult survival, long life expectancy, and low reproductive rates (Stearns 1992). Condors do not reach reproductive maturity until at least age five, often initiating breeding several years later. Breeding pairs lay a single egg and typically produce at most one fledgling every other year. Because of their life history strategy, their population growth rate is limited even in the absence of threats and is particularly sensitive to adult survival (Crowder et al. 1994; Saether et al. 1996).

The primary threat to the recovery of the condor is lead toxicosis from ingestion of lead-based ammunition while feeding on contaminated carcasses (Finkelstein et al. 2012). However, at least 11 condors have died from collisions with overhead power lines in California and collisions are the second most common anthropogenic cause of death of free flying condors after lead poisoning (Rideout et al. 2012). Because they soar over large distances, taking advantage of thermal winds, and have relatively low maneuverability, condors may be susceptible to collisions with wind turbines, especially as condors expand their range and wind energy facilities exist within or in close proximity to the condor's current and historical range in California (USFWS 2013). To date there have been no known collisions of condors with wind turbines.

We conducted two separate analyses to inform conservation planning efforts associated with condors and wind energy facilities in the Tehachapi Wind Resource Area in southern California. The objective of the first analysis was to estimate the number of captive-bred juvenile condor releases needed to offset the mortality of a free-flying adult condor and any dependent progeny (e.g., dependent egg or chick). The objective of the second analysis was to quantify the relative impact on condor population growth from potential mortalities at wind energy facilities in the absence of mitigation to offset such losses (i.e., additional rearing and releases of captive condors). These analyses could be used to inform mitigation and assess impacts to condors from various sources of anthropogenic mortality but, in this case, we targeted analyses to inform conservation planning efforts associated with wind energy facilities.

Analysis 1: Replacement ratios for California condors: Estimating the number of captive-bred juvenile releases needed to offset the mortality of a free-flying adult

Introduction

Because the condor population does not currently exhibit density-dependent regulation, the loss of adult condors due to collisions with wind turbines or other anthropogenic sources of mortality would slow their population growth rate if unmitigated, although the magnitude of this effect on long-term population health is unclear. One pillar of condor recovery has been the propagation and release of captive-bred individuals, with releases typically occurring when captive birds are about 1.5 years of age (approximately one year after fledging). Model simulations illustrate that releasing 1.5-year-old captive-bred juvenile condors has ~ a 6-fold higher benefit to long-term (e.g., 30 year) projected population growth compared to wild nest management (Bakker et al., in preparation). The release of captive-bred juveniles also has the potential to offset the effects of adult mortality that could occur from wind turbine collisions or other sources of mortality. Even though released juveniles have a higher impact on population growth than wild-hatched chicks, they make a smaller contribution to population growth rate compared to adults for several reasons. First, 1.5-year-old juveniles require several years before they are sexually mature and attain breeder status, during which time the lost adult would have had the potential to contribute offspring. Second, juveniles may not survive their pre-breeder years and recruit into the breeding population. Third, captive-bred birds experience elevated mortality for the first five years after release compared to wild-fledged birds of similar age, even after accounting for management actions such as power pole aversion training (Bakker et al. 2017). Thus, the number of captive-bred juveniles needed to maintain the population growth potential of a single adult is greater than one. Here we estimate the value of an adult condor of breeding age in terms of 1.5-year-old captive-bred juveniles, such that the adult's contribution to population growth is fully replaced.

The relative value of adults and juveniles for population growth has conceptual links to reproductive value (v_i), a measure of the relative reproductive potential of a female of a given age or stage *i* that is a weighted average of her present and future reproduction (Morris and Doak 2002). Weighting accounts for the population growth rate, such that for a growing population, future reproduction is discounted relative to current reproduction because individuals born in the future represent a smaller proportion of a growing population (Caswell 2001; Lanciani 1988). We calculated the reproductive value for wild condors using published survival rates (Bakker et al. 2017) in a stage-structured demographic matrix with a mean deterministic lambda (λ_d) in 2024 of 1.021 (Bakker et al. unpublished) and no releases of captive-bred birds into the population. We found that the estimated ratio of the reproductive value of a successful breeder (*sb*) to a wild 1.5-year-old, v_{sb}:$v_{1.5}$, was 1.6:1, and if we included the breeder's dependent chick in the calculation, ($v_{sb} + v_{chick}$):$v_{1.5}$, the value increased to 2.6:1. Thus, the contribution to population growth of each successfully breeding adult condor is estimated to be equal to between 1.6 and 2.6 wild 1.5-year-olds using the established metric of reproductive value. However, the reproductive value approach underestimates the relative value of an adult condor as it does not account for the lower survival of captive-bred birds relative to wild birds of the same age (Bakker et al. 2017). In addition, the reproductive value approach is suboptimal for condors as it does not reflect the effects of changes in management and releases, or account for effects of stochasticity and uncertainty on population growth rate.

To conduct a more comprehensive and realistic analysis of the number of captive 1.5-year-olds needed to offset the loss of an adult condor, we used a simulation approach with a range of scenarios for flock management. **We use this approach to estimate a metric we refer to as the replacement ratio, defined as the number of captive-bred 1.5-year-olds that must be released into the population to replace the contribution of an adult condor to future population growth over 50 years.** We considered two scenarios for growth: current growth conditions (stochastic lambda over 50 years, λ_{50}, of ~1.032 with releases) and no growth scenarios (λ_{50} of ~1.00). Wind energy facilities are in closest proximity to the southern flock; thus, we simplified our analyses by simulating the population dynamics of the southern flock in isolation. Since the survival rates of condors in the central California flock are similar to the southern flock (Bakker et al. 2017), combining the central and southern flocks would not substantially impact the replacement ratio.

In addition, we explored two scenarios for the lost adult's breeder class: 1) random expectation, in which successful breeders (breeding-age birds that successfully fledge a chick), failed breeders (breeding-age birds that attempt but fail to fledge a chick), widows (unpaired breeding-age birds whose most recent mate has died), and skippers (breeding-age birds that skip breeding activities in a given year, typically in the year following successful breeding) were removed at random in proportion to their abundance and 2) precautionary approach, in which the lost adult was assumed to be a successful breeder actively rearing a chick. Chicks are generally dependent on two parents at least until fledging and require extended post-fledgling care (Finkelstein et al. 2015). As such, for both scenarios (random and precautionary) we assumed that if a successful breeder was killed at any time throughout the year, their chick also died.

Methods

We built a female-only stochastic demographic matrix population model with demographic rates driven by statistical relationships with ecological and intrinsic covariates and by unexplained stochastic variance (Bakker et al. 2009), using Matlab (R2016b. Natick, MA: The MathWorks Inc., 2016). We used a stage + age-based projection matrix with a fledging time census and seven pre-breeder age classes as follows:

- hatch year (age 0) through age 4: wild-hatched and captive-reared juveniles were tracked separately as they have different survival rates (Bakker et al. 2017).
- age 5 through 7: wild-hatched and captive-reared juveniles tracked together. Condors start recruiting into the breeder class after age 4 with individuals having an increasing probability of recruitment into the breeder class until age 7.
- condors entered the breeder class after age 7 and we included four breeder stages. We used data on state-dependent breeding probabilities that allowed separation of recruited breeders into four classes: widows, successful breeders, failed breeders, and skippers (e.g., Bakker et al. 2018).

Because we used a female-only model, we simulated the loss of adult females and the release of juvenile females, but for this monogamous species with shared parental investment, the results are assumed to apply to birds of either sex.

We initiated the model in 2013 at the observed southern California flock size and age distribution and simulated removals of wild adults in 2025 and releases of captive-bred 1.5-year-olds in the subsequent year. **Our simulations calculate a replacement ratio by determining how many captive-bred 1.5-year-olds, released in a single event (the year after the adult condors are removed), offset lost population growth resulting from the one-time removal of an adult condor.** To increase the mathematical precision of the estimated replacement ratio, and after preliminary assessments to determine the appropriate range of ratios for bracketing the true value, we simulated the removal of 5 adults and the release of between 5 and 18 juveniles, or replacement ratios of 1:1 to 3.6:1 juveniles to adults. The replacement ratio estimates the value of a single adult condor, and the intent of simulating the removal of five adults was to achieve greater resolution in our estimate of this ratio.

We assessed both random and precautionary removal in scenarios of current growth and no growth. Current growth approximates current conditions and consists of current lead mortality rates and the ongoing management of 10 nests and replacement of up to 1 failed egg per year and the ongoing release of 6 females per year. The effect of these management actions on population growth rate declines through time because the population grows and the proportional influence of management wanes. For the no growth scenario, all nest management and releases cease and anthropogenic (i.e., lead) mortality doubles after 2020. For both scenarios, we assume the southern flock begins feeding on marine mammals starting in 2020, reaching a maximum flock-wide average of three years of cumulative feeding, which we predict will depress hatching success because of exposure to DDE (Kurle et al. 2016). For our basic model assumptions with respect to lead mortality rate, management intensity, degree of feeding on marine mammals, etc., we used scenarios agreed upon through discussions in multiple workshops with the U.S. Fish and Wildlife Service (USFWS) Condor Recovery Team personnel from Bitter Creek National Wildlife Refuge, Pinnacles National Monument, and Ventana Wildlife Society (Bakker et al., unpublished). For each scenario, we ran 10,000 replicate simulations for 50 years (~ two condor generations) after the one-time removal of five adults in 2025 and release of juveniles in 2026 and tracked the number of total females and adult females through time. We chose 2025 as a plausible early time frame for potential condor mortalities at wind energy facilities to minimize the uncertainties about condor demographic rates and population dynamics as time frames extend into the future.

We simulated 13 removal and release scenarios for the random and precautionary removal of adults under no population growth and current population growth as follows:

1) No population growth (λ_{50}~0)
    a. *Estimated lower replacement value* – random removal: 5 adults (breeder classes) removed at random (proportional to breeder class abundance in the population) and a range of juveniles (0, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18) released into the flock in a single event the subsequent year. If a successful breeder is randomly selected for removal, its chick is also removed.
    b. *Estimated upper replacement value* – precautionary removal: 5 successfully breeding adults removed with their dependent chicks and a range of juveniles (0, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18) released into the flock in a single event the subsequent year.

2) Current population growth with releases (λ_{50}~1.032)
    a. *Estimated lower replacement value* – random removal: 5 adults (breeder classes) removed at random (proportional to breeder class abundance in the population) and a range of juveniles (0, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18) released into the flock in a single event the subsequent year. If a successful breeder is randomly selected for removal, its chick is also removed.
    b. *Estimated upper replacement value* – precautionary removal: 5 successfully breeding adults removed with their dependent chicks and a range of juveniles (0, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18) released into the flock in a single event the subsequent year.

Results

1) No population growth (Figures 1 and 2):
Replacement value of an adult is 3.0 juveniles under the precautionary scenario and 2.0 juveniles under the random removal scenario.

2) Current population growth (Figures 3 and 4):
Replacement value of an adult is 3.0 juveniles under the precautionary scenario and 2.0 juveniles under the random removal scenario.

Summary

We found that the loss of an adult condor could be offset by the release of between 2.0 to 3.0 captive-bred 1.5-year-old juveniles. This range reflects the output of two scenarios for future condor population growth and two types of breeder class removal (random and precautionary). Our replacement ratio was generally consistent but higher than the ratio of reproductive values of wild adults to wild 1.5-year-old juveniles. Reproductive value is a more traditional metric to quantify reproductive potential (Morris and Doak 2002), but this approach fails to account for stochasticity, management effects, and the lower survival of captive-bred released birds. Thus, our simulation-based replacement ratios represent a more accurate and unbiased estimate for quantifying the relative contribution of juveniles and adults to future condor population growth. Our model simulations include assumptions related to future conditions that were agreed upon during several workshops with USFWS California Condor Recovery Team personnel. Changing these assumptions could alter the projected condor population growth, which would affect our estimated replacement ratios. In addition, we conservatively assumed the removal of a breeding-age adult in estimating replacement ratios. Therefore, we feel that the replacement ratios presented here reflect reasonable bounds between current and no condor population growth.

Figure 1. No growth scenario (no nest management, no releases, and increased mortality). *Estimated lower replacement value*: random removal: 5 adults (i.e., breeder classes) removed at random (proportional to breeder class abundance in the population) and between 5 and 18 juveniles released into the flock the subsequent year. If a successful breeder is randomly selected for removal, their chick is also removed. Simulations depict change in population size with no wind turbine mortality, no release of juveniles (no replacement), replacement of 5 juveniles to 5 adults (1:1 replacement) increasing to replacement of 18 juveniles to 5 adults (3.6:1). Replacement value of 2.0 achieves a similar population growth trajectory to the population without removals. Panel ‘a’ depicts change in total number of females in the population while panel ‘b’ depicts change in the number of adult females (i.e., breeder classes).

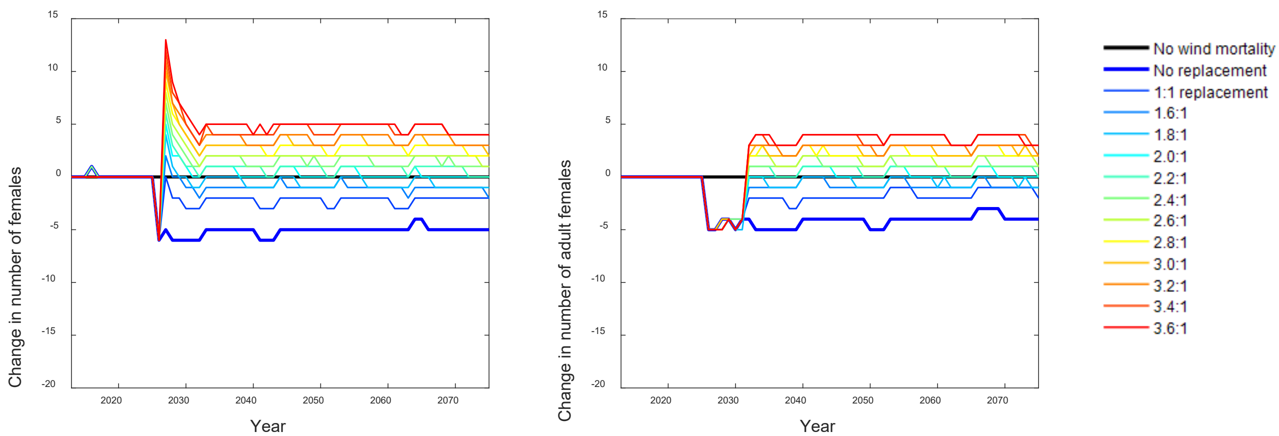


Figure 2. No growth scenario (no nest management, no releases, and increased mortality). *Estimated upper replacement value:* precautionary removal: 5 successfully breeding adults removed with their dependent chick and between 5 and 18 juveniles released into the flock the subsequent year. Simulations depict change in population size with no wind turbine mortality, no release of juveniles (no replacement), replacement of 5 juveniles to 5 adults (1:1 replacement) increasing to replacement of 18 juveniles to 5 adults (3.6:1). Replacement value of 3.0 achieves a similar population growth trajectory to the population without removals. Panel ‘a’ depicts change in total number of females in the population while panel ‘b’ depicts change in the number of adult females (i.e., breeder classes).

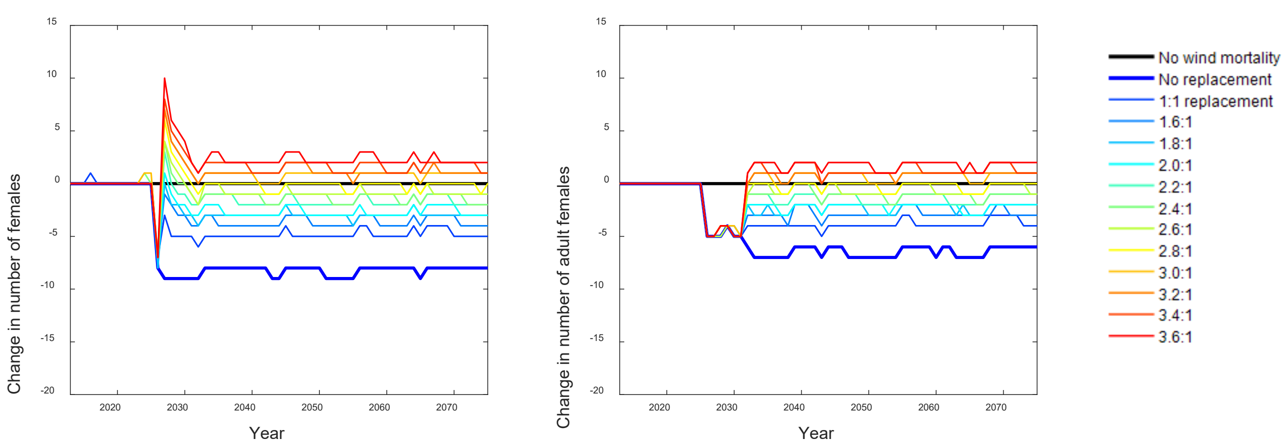


Figure 3. Current growth scenario (current management and ongoing releases). *Estimated lower replacement value*: random removal: 5 adults (i.e., breeder classes) removed at random (proportional to breeder class abundance in the population) and between 5 and 18 juveniles released into the flock the subsequent year. If a successful breeder is randomly selected for removal, their chick is also removed. Simulations depict change in population size with no wind turbine mortality, no release of juveniles (no replacement), replacement of 5 juveniles to 5 adults (1:1 replacement) increasing to replacement of 18 juveniles to 5 adults (3.6:1). Replacement value of 2.0 achieves a similar population growth trajectory to the population without removals. Panel ‘a’ depicts change in total number of females in the population while panel ‘b’ depicts change in number of adult females (i.e., breeder classes).

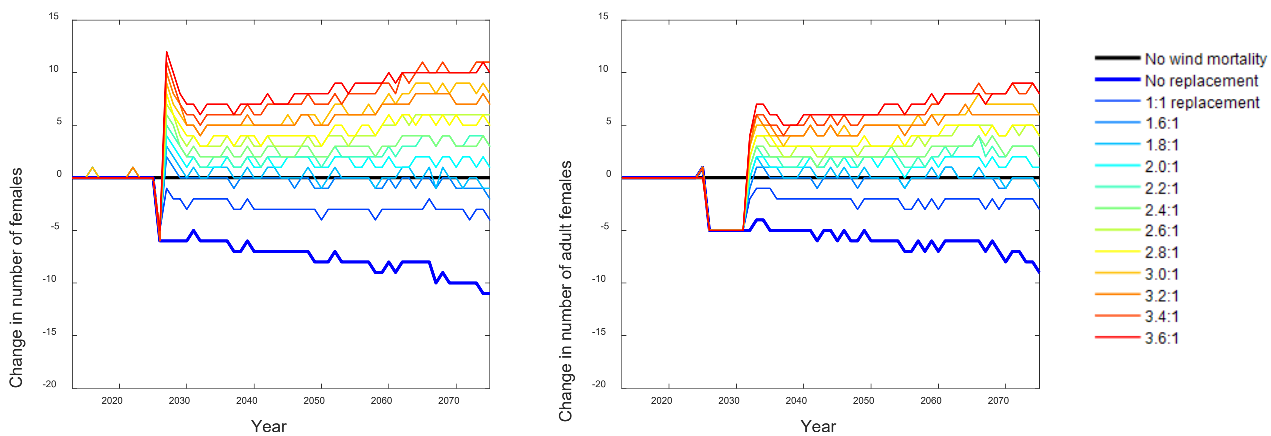
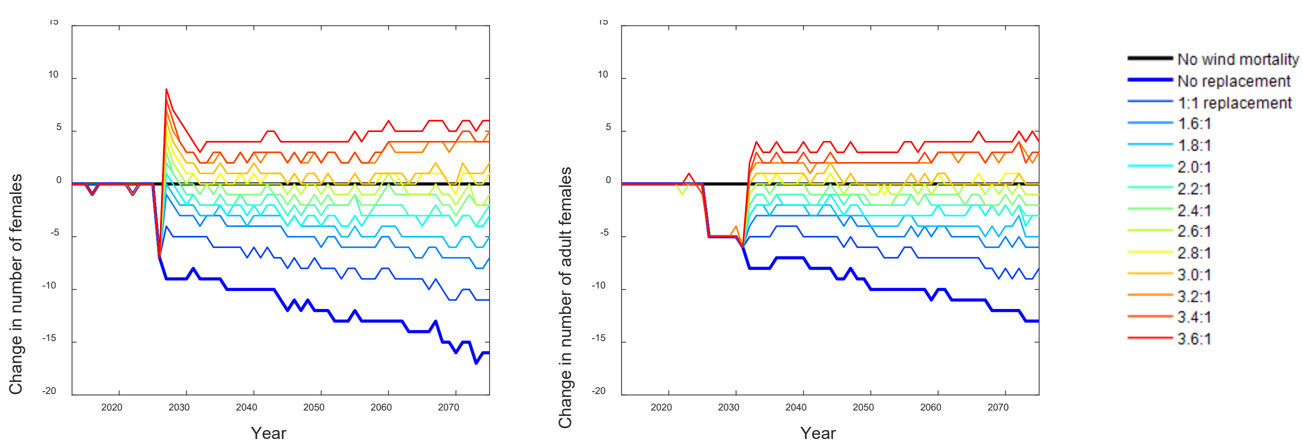


Figure 4. Current growth scenario (current management and ongoing releases). *Estimated upper replacement value:* precautionary removal: 5 successfully breeding adults (≥ 8 years of age) removed with their dependent chick and between 5 and 18 juveniles released into the flock the subsequent year. Simulations depict change in population size with no wind turbine mortality, no release of juveniles (no replacement), replacement of 5 juveniles to 5 adults (1:1 replacement) increasing to replacement of 18 juveniles to 5 adults (3.6:1). Replacement value of 3.0 achieves a similar population growth trajectory to the population without removals. Panel ‘a’ depicts change in total number of females in the population while panel ‘b’ depicts change in number of adult females (i.e., breeder classes).



Analysis 2. Quantify the relative population-level impact of potential California condor mortality associated with wind energy facilities in southern California

Introduction

In order to assess the relative impact to population growth of the southern condor flock from potential mortalities associated with wind energy facilities (wind mortalities) in the absence of mitigation in southern California, we used a population viability analysis (PVA) based upon existing survival data (Bakker et al. 2017) to estimate relative changes in the condor population growth rate and number of birds under a wide range of scenarios as explained below.

Methods

Population Model. We based our simulations of the effects of different levels of wind mortalities on our established condor demographic model. The model uses a female-only stochastic demographic matrix population model with demographic rates driven by statistical relationships with ecological and intrinsic covariates and by additional stochastic variance not explained by these covariates (Bakker et al. 2009) using Matlab (R2016b. Natick, MA: The MathWorks Inc., 2016). The population model is a stage + age-based projection matrix with a fledging-time census beginning at 0.5 year and seven pre-breeder age classes as follows (see also Figure 5):

- Hatch year (age 0, fledging – age 1.5) through age 4 (4.5 – 5.5): wild-hatched and captive-reared juveniles were tracked separately as they have different survival rates (Bakker et al. 2017).
- Age 5 (5.5 – 6.5) through 7 (7.5 – 8.5): wild-hatched and captive-reared juveniles tracked together. Condors start recruiting into the breeder class after age 4 with individuals having an increasing probability of recruitment with age.
- Four breeder stages. We used data on state-dependent breeding probabilities that allowed separation of recruited breeders into four classes: successful breeders (breeding-age birds that successfully fledged a chick in the most recent breeding season), failed breeders (breeding-age birds that attempted but failed to fledge a chick in the most recent breeding season), widows (unpaired breeding-age birds whose most recent mate has died), and skippers (breeding-age birds that skipped breeding activities in the most recent breeding season, which typically occurs in the year following successful breeding) (e.g., Bakker et al. 2018). Depending on their breeding fate in the immediately preceding year, and thus their breeding class, birds have different probabilities of breeding in a given year (e.g., last year's successful breeders and widows have a lower probability of breeding).

Because we used a female-only model, we assumed for this monogamous species with shared parental investment, that the results apply to birds of either sex.

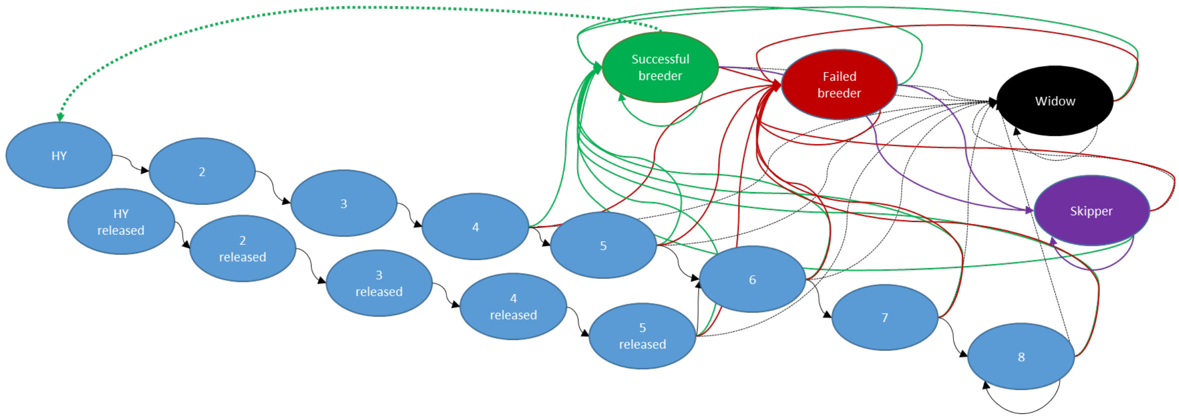


Figure 5. Life cycle diagram of the California condor population model used for model simulations to assess impacts from potential wind mortalities. As the hatch year (HY) age class is 0.5 -1.5 years, the one year increments in the model results in age classes being 0.5–1.5 years, 1.5-2.5 years, 3.5-4.5 years, etc. Lines represent transition probabilities based on empirical data (Bakker et al. 2017).

Scenarios. Multiple model scenarios were analyzed to explore the range of potential impacts to population growth of the southern condor flock from different levels of simulated wind mortalities. The scenarios and model assumptions were developed in collaboration with the USFWS Palm Springs Office and Condor Recovery Program team at the Hopper Mountain National Wildlife Refuge Complex (USFWS). Avangrid Renewables (Avangrid) and Los Angeles Department of Water and Power (LADWP) were given the opportunity to review and comment on model scenarios and assumptions but final model inputs, scenarios, and assumptions were decided upon by Drs. Bakker and Finkelstein. Note that the different levels of simulated mortality rates we investigated were not based on actual predictions of wind mortalities but instead were intended to assess potential impacts to the future growth of the southern condor flock from a range of wind mortality levels. All scenarios simulated wind-related mortalities in the absence of mitigation specifically intended to offset such losses (i.e., additional rearing and releases of captive birds) and included a range of captive release scenarios as detailed below.

Scenarios conservatively assumed wind mortalities were breeding age adults and the breeding class of the individuals – successful breeder, failed breeder, widow, or skipper – was selected at random in proportion to the prevalence of each breeding class present in the population at the time of mortality. Chicks are generally dependent on two parents at least until fledging and require extended post-fledgling care (Finkelstein et al. 2015). As such, we conservatively assumed that if a successful breeder was killed at any time throughout the year, their progeny of that year also died.

<u>Model assumptions for all scenarios:</u> We assumed that the effects of USFWS condor program management actions on condor survival and reproduction in the southern condor flock remained constant throughout the analysis timeframe including the ongoing management of 10 nests and replacement of up to one failed egg per year. Based on our prior work in collaboration with condor biologists and managers, we also assumed that the southern condor flock started feeding on marine mammals in 2020 and this feeding rate stabilized at a flock-wide mean rate of 3 years cumulative feeding on marine mammals, which we predict will depress hatching success because of exposure to DDE (Kurle et al. 2016).

Wind mortality rates (3 scenarios): The analysis included three different levels of wind mortalities (i.e., incidental take) of adult condors and their associated young over a 30-year period: lower, intermediate, and upper. The mortality rates described below were selected to assess impacts from different levels of simulated wind mortality and inform decisions on conservation planning and incidental take permits.

Lower = 4 adult condors taken over 30 years. This scenario evaluated the potential cumulative incidental take of condors at a small number of individual wind energy facilities (i.e., 2 facilities). Because we used a female-only model, this scenario involved removal of 2 females.

Intermediate = 15 adult condos taken over 30 years. This scenario evaluated the potential cumulative incidental take of condors at a small number of individual wind facilities (i.e., 2 facilities), as well as potential incidental take of condors associated with a larger group of wind energy facilities in the region. Because we used a female-only model, for each year we randomly removed either 7 or 8 females.

Upper = 25 adult condors taken over 30 years. This scenario evaluated the potential cumulative incidental take of condors at a small number of individual wind facilities (i.e., 2 facilities), as well as the potential incidental take of condors associated with a larger number of wind energy facilities in the region. Thus, this 'upper' level was intended to bracket the results and to some extent address the scenario where multiple wind facilities in the region seek separate incidental take permits. Because we used a female-only model, for each year we randomly removed either 12 or 13 females.

Wind mortality timing (3 scenarios): We explored scenarios in which wind mortalities occurred at three different time points over a 30-year period. These scenarios all assume that any permitted incidental take would occur in full (see above 'removal rate' scenarios) and do not account for minimization programs expected to influence the level and timing of when take might actually occur during each scenario. The 'early focus' scenario assumed mortalities occurred mainly within the first 10 years, the 'late focus' scenario assumed mortalities occurred mainly in the last ten years, and the 'even spread' scenario assumed mortalities occurred evenly throughout the 30-year analysis period. For each of these scenarios we used a probabilistic method that randomized when mortalities occurred across the thirty-year time frame (Table 1).

To allow time for the model simulations to capture the impacts of removals for the late focus timing, we ran simulations for 60 years and report results after 40 years, 10 years beyond the 30-year time window for when removals occurred.

Table 1. Distribution of removal across the 30-year time frame for three scenarios: late focus, in which probability of removal is highest late in the simulation time frame, even spread, in which the probability of removal is distributed across the time frame, and early focus, in which probability of removal is highest early in the simulation time frame.

	Probability of wind mortality 5-year (annual)					
Timing of mortalities	Years 1-5	Years 6-10	Years 11-15	Years 16-20	Years 21-25	Years 26-30
Late focus	0.010 (0.002)	0.020 (0.004)	0.030 (0.006)	0.040 (0.008)	0.300 (0.060)	0.600 (0.120)
Even spread	0.167 (0.033)	0.167 (0.033)	0.167 (0.033)	0.167 (0.033)	0.167 (0.033)	0.167 (0.033)
Early focus	0.600 (0.120)	0.300 (0.060)	0.040 (0.008)	0.030 (0.006)	0.020 (0.004)	0.010 (0.002)

<u>Lead and other anthropogenic-related mortality rates (3 scenarios)</u>: To account for uncertainty with respect to future condor mortality rates we considered three scenarios of mean mortality rates associated with lead and other anthropogenic sources of mortality: current, higher, and lower. Mortality rates were based upon a published survival analysis using six years of data from 2008-2013 (Bakker et al. 2017) that separated mortalities into those known or suspected to be lead associated, referred to as lead mortality, and all other mortalities, referred to as natural mortality.

Current anthropogenic mortality: The current or baseline mortality rate scenario that included lead mortality.

Low and high anthropogenic mortality: The low and high mortality rates were based on the variance in lead mortality from Bakker et al. (2017) and used the upper 75% and lower 25% values. This equated to a 'low' mortality rate equal to 0.58 time the current rate, or ~1.3% increase in annual survivorship from the current rates and 'high' mortality rate equal to 1.5 time the current rate, or ~1.5% decrease in annual survivorship from current rates. These low and high values attempt to explore the ramifications of future unknowns on condor survival. Substantial stochastic variance in lead mortality rates occurs across all scenarios.

<u>Captive releases (3 scenarios)</u>: We considered three scenarios of annual captive release levels: current, discontinued, and no releases. For all scenarios, individuals were assumed to be 1.5 years of age when released (i.e., 1-year post-fledging). We selected the sex of released individuals based on binomial proportions assuming a mean sex ratio of 0.5.

Current captive release rates: Based on current rates of release of captive individuals, this scenario assumed the release of 12 individuals (i.e., 6 females as model is female-only) into the southern flock each year for the entire timeframe of model simulations.

Discontinued releases: Assumed the current release rate of 12 individuals per year for the first 15 year of the simulations and then the cessation of release efforts starting in year 16. This scenario explores the influence of wind energy mortality if future captive rearing and release efforts cease because the focus of recovery efforts change, available funding decreases, or some other unknown factor.

No releases: We also included a scenario with no releases to bracket results and assess the impact of mortalities on natural demographic processes because the condor population is currently reliant upon captive-bred released birds for population growth (Finkelstein et al. 2012), and these releases dominate population dynamics.

Evaluation. For each scenario, we ran 10,000 population trajectories, starting in 2018 with the population initialized at its current size and age distribution. Simulated wind mortalities began in 2020 and ended in 2050. We summarized the predicted median population dynamics from the 82 scenarios described above. We assessed the difference in median numbers of total condors after 40 years (2020 – 2060). Finally, we calculated the percent difference in the mean short-term realized stochastic growth rate, denoted as λ_t where t is the number of years over which the growth rate is summarized (i.e., $(N_t/N_0)^{1/t}$). The average of λ_t values across multiple simulations was calculated as $e^{mean[\log(\lambda_t)]}$. We present impacts from wind energy mortalities as a function of reduction in condor stochastic growth rate over 40 years, λ_{40}.

Summary of results

Wind mortality rates. As expected, the higher the number of condors removed from the population due to simulated wind energy mortality, the stronger the reduction in 40-year stochastic population growth (λ_{40}, Figure 6). In simulations with no releases and current mortality rates, early focus mortality of 4 condors lowered λ_{40} by 5% while early focus mortality of 25 birds lowered λ_{40} by 38% (Figure 6). For scenarios in which the population is growing (current and reduced lead mortality scenarios), the lost growth potential in terms of numbers of condors continues to accrue over time beyond the evaluation year of 2060 (Figure 7, a-f).

Wind mortality timing. The early focus mortality scenario resulted in both greater numbers of condors lost (higher net difference in condors) after 40 years and a greater reduction in stochastic growth rates (λ_{40}). This occurs because timing of mortality influences both the relative size of the population from which wind mortalities occur and the number of years over which lost growth potential occurs. The influence of timing of mortality on numbers lost was greatest when the lead mortality rate was lowest and the influence on stochastic lambda (λ) was greatest when release rate was lowest (Figures 6-7).

Lead and other anthropogenic-related mortality rates. Increasing the mortality rate associated with lead or other anthropogenic-related factors increased the percent change in stochastic growth rate due to simulated wind energy associated mortalities but was inversely related to the net difference in numbers of condors after 40 years (Figure 7) (Table 3). The greater the lead mortality rate, the greater the impact of wind-associated mortality on stochastic growth rate because each individual represents a greater proportion of the population when populations are small. For the no release scenario, increasing lead mortality approximately doubles the impact of wind mortalities on λ_{40}. In contrast, the lower the lead mortality rate the greater the lost growth potential in terms of numbers of condors because the net difference in numbers is driven by demographic rates; the individual contribution of each bird to future flock numbers is greater when the lead mortality rate is lower.

Captive release rate. As expected, the higher the release rate, the lower the effect of simulated wind energy mortalities on λ_{40} (growth rate; Figure 6). In contrast, net difference in numbers of condors after 40 years was insensitive to release rate (Figure 7) (Table 3). For the current release scenario, 480 individuals were released into the population over the 40-year evaluation window, and for the discontinued releases scenario, which continues the current release rate for 15 years, the number released was 180. With these release rates, the number of condors removed as a result of mortality at wind energy facilities is a relatively small proportion of the number added, and the impact of mortalities on λ_{40} is reduced. For example, with the current release rate, the early focus mortality of 25 birds reduces λ_{40} by 5%, while with no releases, the early focus mortality of 25 birds reduces λ_{40} by 38% (Table 2, Figure 6c).

Table 2. Percent change in mean stochastic growth rates over 40 years (λ_{40}) of California condors (condors) in the southern flock in the presence of simulated wind mortalities. Shown are results for three wind mortality scenarios (lower, intermediate, and upper) and three timing scenarios for wind mortalities (late, even, early, see Table 1) as well as three ongoing management release scenarios and three lead mortality rate scenarios. Results shown graphically in Fig. 6. Changes are expressed at a percent change in predicted stochastic growth rate (e.g., a change from 1.022 to 1.020 is -0.002/0.022 = -9.0%). All scenarios simulated wind-related mortalities in the absence of mitigation specifically intended to offset such losses (i.e., additional rearing and releases of captive birds).

Ongoing management release rate		Lower removal rate: 4 adult condors			Intermediate removal rate: 15 adult condors			Upper removal rate: 25 adult condors		
Wind mortality timing		*Late*	*Even*	*Early*	*Late*	*Even*	*Early*	*Late*	*Even*	*Early*
	Mortality rate									
Current (12 condors annually)	reduced	-0.4	-0.5	-0.7	-1.7	-2.1	-2.6	-3.0	-3.5	-4.2
	current	-0.5	-0.5	-0.7	-1.9	-2.3	-2.6	-3.3	-3.9	-4.5
	increased	-0.8	-0.6	-0.7	-2.6	-2.7	-3.0	-4.4	-4.6	-5.1
Discontinued (12 condors annually stopping 2035)	reduced	-0.9	-1.1	-1.2	-3.4	-4.1	-4.9	-5.8	-6.9	-8.5
	current	-1.1	-1.3	-1.6	-4.3	-5.3	-5.8	-7.9	-9.0	-10
	increased	-1.8	-2.1	-2.0	-6.9	-7.6	-7.9	-12	-13	-14
None	reduced	-2.2	-2.9	-3.4	-9.9	-12	-15	-18	-22	-27
	current	-4.3	-4.9	-5.4	-17	-19	-22	-30	-33	-38
	increased	-9.5	-10	-11	-37	-38	-40	-63	-66	-70

Table 3. Percent reduction in total population size of California condors (condors) in the southern flock in the presence of simulated wind mortalities as a proportion of population size with no wind mortalities in evaluation year 2060. Shown are results for three wind mortality scenarios (low, medium, and high) and three timing scenarios for wind mortalities (late, even, early, see Table 1) as well as three ongoing management release scenarios and three lead mortality rate scenarios. Results shown graphically in Fig. 7. All scenarios simulated wind-related mortalities in the absence of mitigation specifically intended to offset such losses (i.e., additional rearing and releases of captive birds).

Ongoing management release rate		Lower removal rate: 4 adult condors			Intermediate removal rate: 15 adult condors			Upper removal rate: 25 adult condors		
Wind mortality timing		*Late*	*Even*	*Early*	*Late*	*Even*	*Early*	*Late*	*Even*	*Early*
	Mortality rate									
Current (12 condors annually)	reduced	0.6	0.8	1.1	2.8	3.4	4.5	5.1	5.9	7.4
	current	1.0	1.0	1.4	3.1	3.8	4.4	5.5	6.5	7.2
	increased	0.8	0.8	1.3	3.8	3.8	4.2	6.4	6.8	7.2
Discontinued (12 condors annually stopping 2035)	reduced	1.3	1.7	2.2	4.8	5.6	6.9	8.2	9.1	11
	current	1.1	1.6	2.2	4.9	6.0	6.6	8.8	9.9	12
	increased	2.2	2.2	2.2	6.5	7.2	7.2	11	12	12
None	reduced	1.6	2.4	2.4	7.9	9.5	12	14	17	20
	current	2.0	3.0	3.0	9.1	11	12	16	18	21
	increased	2.7	4.0	4.0	12	12	13	20	21	21

Figure 6 (see also Table 2): Predicted percent change (±95% CI) in mean stochastic growth rates over 40 years (λ_{40}) (2020 – 2060) of the southern flock of California condors (condors) in the presence of simulated mortality at wind energy facilities. Shown are results for three wind mortality scenarios (a) 4 adult condors, (b) 15 adult condors, or (c) 25 adult condors. For each, simulations considered three timing scenarios for mortalities (late, even, early, see Table 1) as well as three ongoing management release scenarios and 3 lead mortality rate scenarios. All scenarios simulated wind-related mortalities in the absence of mitigation specifically intended to offset such losses (i.e., additional rearing and releases of captive birds).

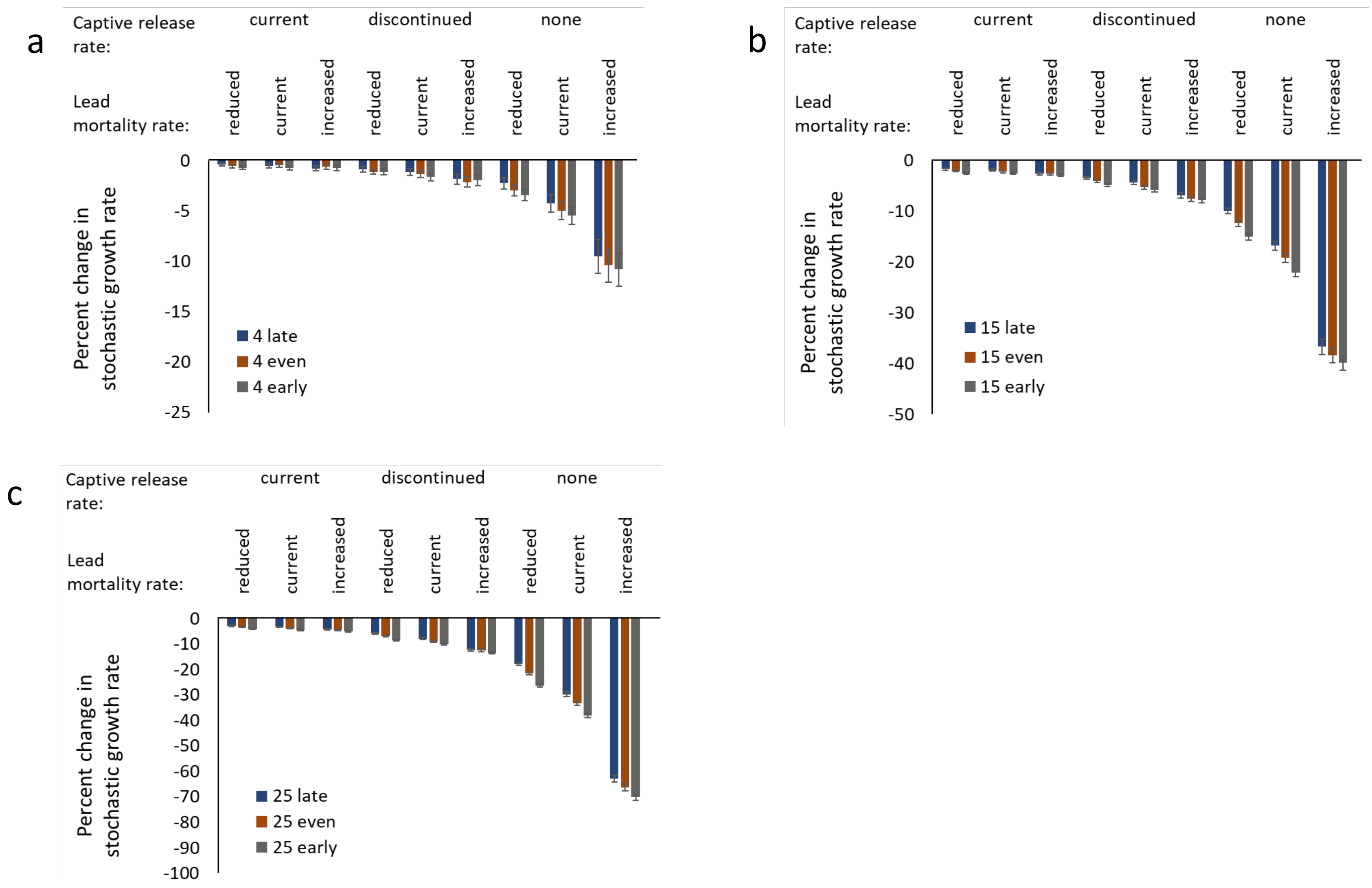
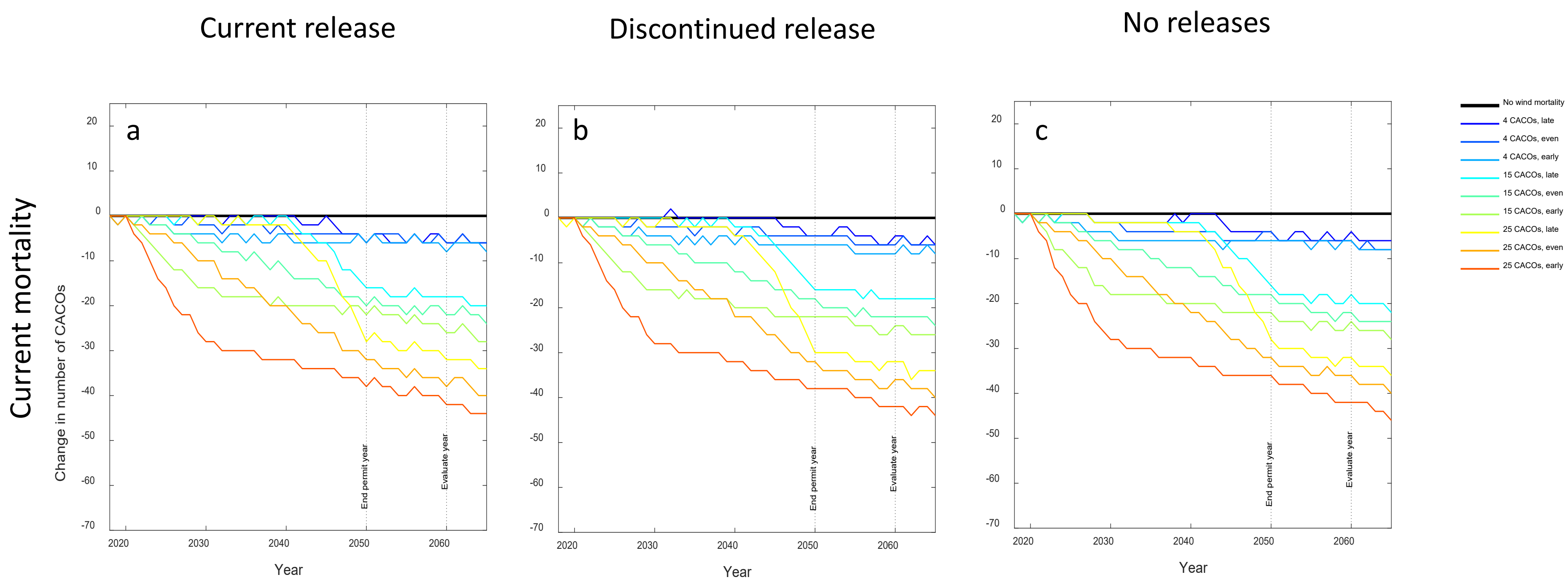
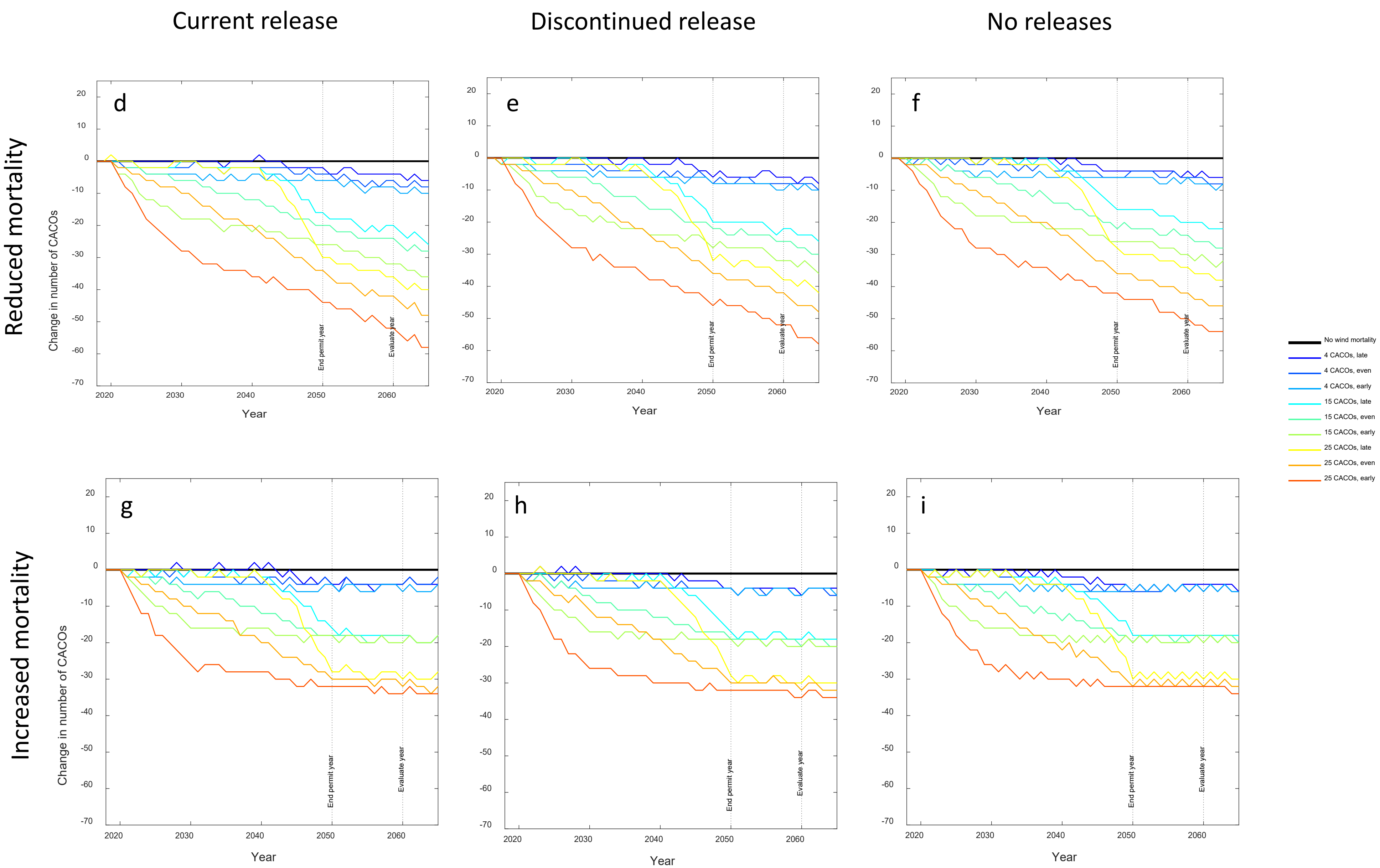


Figure 7. Predicted relative effects of California condor (condor, CACO) mortalities at wind energy facilities in southern California on the population dynamics of the southern California flock. Panels depict the difference in median numbers of total condors through time for lower (4), intermediate (15), and upper (25) wind-associated condor mortalities and early, even, and late timing of those mortalities, relative to no mortality, based on 10,000 replicate runs. Top panels show current lead mortality rate scenario, middle panels (d,e,f) show the reduced lead mortality rate (0.58 times current rate), and bottom panels (g,h,i) show the increased lead mortality rate (1.5 times current rate). Columns are grouped by release rate with the first column (a,d,g) for the current release scenario (12 condors released in southern flock annually), the second column (b,e,h) for the discontinued release scenario (12 condors released in southern flock annually until 2035, when releases cease), and the final column (c,f,i) for the no release scenario. Simulated wind-associated mortalities start in 2020 and end in 2050 (End permit year). All results are evaluated 10 years later, in 2060 (Evaluate year). See also Table 3. All scenarios simulated wind-related mortalities in the absence of mitigation specifically intended to offset such losses (i.e., additional rearing and releases of captive birds).




Current release
Discontinued release
No releases
Reduced mortality
Increased mortality
d
e
f
g
h
i
Change in number of CACOs
Year
End permit year
Evaluate year
No wind mortality
4 CACOs, late
4 CACOs, even
4 CACOs, early
15 CACOs, late
15 CACOs, even
15 CACOs, early
25 CACOs, late
25 CACOs, even
25 CACOs, early

Literature cited

Bakker, V.J., Doak D.F., Roemer, G.W., Garcelon, D.K., Coonan, T.J., Morrison, S.A., Lynch, C., Ralls, K., Shaw, M.R. 2009. Incorporating ecological drivers and uncertainty into a demographic population viability analysis for the island fox. Ecological Monographs 79, 77-108.

Bakker, V.J., Finkelstein, M.E., Doak, D.F., VanderWerf, E.A., Young, L.C., Arata, J.A., Sievert, P.R., Vanderlip, C. 2018. The albatross of assessing and managing risk for long-lived pelagic seabirds. Biological Conservation 217, 83-95.

Bakker, V.J., Smith, D.R., Copeland, H., Brandt, J., Wolstenholme, R., Burnett, J., Kirkland, S., Finkelstein, M.E. 2017. Effects of lead exposure, flock behavior, and management actions on the survival of California condors (*Gymnogyps californianus*). EcoHealth 14, 92-105.

Caswell, H. 2001. Matrix Population Models: Construction, analysis and interpretation, 2nd edition. Sinauer Associates.

Crowder, L.B., Crouse, D.T., Heppell, S.S., Martin, T.H. 1994. Predicting the impact of turtle excluder devices on loggerhead sea turtle populations. Ecological Applications 4, 437-445.

Finkelstein, M.E., Doak, D.F., George, D., Burnett, J., Brandt, J., Church, M., Grantham, J., Smith, D.R. 2012. Lead poisoning and the deceptive recovery of the critically endangered California condor. Proceedings of the National Academy of Sciences 109, 11449-11454.

Finkelstein, M., Z. Kuspa, N. F. Snyder, and N. J. Schmitt. 2015. California Condor (*Gymnogyps californianus*), version 2.0. In The Birds of North America (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.610

Kurle, C.M., Bakker, V.J., Copeland, H., Burnett, J., Jones Scherbinski, J., Brandt, J., Finkelstein, M.E. 2016. Terrestrial scavenging of marine mammals: Cross-ecosystem contaminant transfer and potential risks to endangered California condors (*Gymnogyps californianus*). Environmental Science and Technology 50, 9114–9123.

Lanciani, C.A. 1998. A simple equation for presenting reproductive value to introductory biology and ecology classes. Bulletin of the Ecological Society of America 79, 192-193.

Morris, W.H. & Doak, D.F. 2002. Quantitative Conservation Biology: Theory and Practice of Population Viability Analysis. Sinauer Associates, Oxford.

Rideout, B.A., Stalis, I., Papendick, R., Pessier, A., Puschner, B., Finkelstein, M.E., Smith, D.R., Johnson, M., Mace, M., Stroud, R., Brandt, J., Burnett, J., Parish, C., Petterson, J., Witte, C., Stringfield, C., Orr, K., Zuba, J., Wallace, M., Grantham, J. 2012. Patterns of mortality in free-ranging California condors (*Gymnogyps californianus*). Journal of Wildlife Diseases 48, 95-112.

Saether, B.E., Ringsby, T.H., Roskaft, E. 1996. Life history variation, population processes and priorities in species conservation: Towards a reunion of research paradigms. Oikos 77, 217-226.

Stearns, S.C. 1992. The evolution of life histories. Oxford University Press, Oxford.

U.S. Fish and Wildlife Service [USFWS]. 2013. California Condor (*Gymnogyps californianus*) 5-Year Review: Summary and Evaluation, Ventura, CA.

ENCLOSURE 2

Quantitative Analyses to Inform Conservation Planning Efforts Associated with California Condors (*Gymnogyps Californianus*)

Enclosure 2

Quantitative analyses to inform conservation planning efforts associated with California condors (*Gymnogyps californianus*)

Victoria Bakker (Montana State University)
Myra Finkelstein (University of California Santa Cruz)

April 8th, 2020

Background

California condors (*Gymnogyps californianus*, hereafter referred to as condor[s]) are an endangered species recovering from very low population sizes. They exhibit a *K*-selected life history strategy characterized by high adult survival, long life expectancy, and low reproductive rates (Stearns 1992). Condors do not reach reproductive maturity until at least age five, often initiating breeding several years later. Breeding pairs lay a single egg and typically produce at most one fledgling every other year. Because of their life history strategy, their population growth rate is limited even in the absence of threats and is particularly sensitive to adult survival (Crowder et al. 1994; Saether et al. 1996).

The primary threat to the recovery of the condor is lead toxicosis from ingestion of lead-based ammunition while feeding on contaminated carcasses (Finkelstein et al. 2012). However, at least 11 condors have died from collisions with overhead power lines in California and collisions are the second most common anthropogenic cause of death of free flying condors after lead poisoning (Rideout et al. 2012). Because they soar over large distances, taking advantage of thermal winds, and have relatively low maneuverability, condors may be susceptible to collisions with wind turbines, especially as condors expand their range and wind energy facilities exist within or in close proximity to the condor's current and historical range in California (USFWS 2013). To date there have been no known collisions of condors with wind turbines.

We conducted two separate analyses to inform conservation planning efforts associated with condors and wind energy facilities in the Tehachapi Wind Resource Area in southern California. The objective of the first analysis was to estimate the number of captive-bred juvenile condor releases needed to offset the mortality of a free-flying adult condor and any dependent progeny (e.g., dependent egg or chick). The objective of the second analysis was to quantify the relative impact on condor population growth from potential mortalities at wind energy facilities in the absence of mitigation to offset such losses (i.e., additional rearing and releases of captive condors). These analyses could be used to inform mitigation and assess impacts to condors from various sources of anthropogenic mortality but, in this case, we targeted analyses to inform conservation planning efforts associated with wind energy facilities.

Analysis 1: Replacement ratios for California condors: Estimating the number of captive-bred juvenile releases needed to offset the mortality of a free-flying adult

Introduction

Because the condor population does not currently exhibit density-dependent regulation, the loss of adult condors due to collisions with wind turbines or other anthropogenic sources of mortality would slow their population growth rate if unmitigated, although the magnitude of this effect on long-term population health is unclear. One pillar of condor recovery has been the propagation and release of captive-bred individuals, with releases typically occurring when captive birds are about 1.5 years of age (approximately one year after fledging). Model simulations illustrate that releasing 1.5-year-old captive-bred juvenile condors has ~ a 6-fold higher benefit to long-term (e.g., 30 year) projected population growth compared to wild nest management (Bakker et al., in preparation). The release of captive-bred juveniles also has the potential to offset the effects of adult mortality that could occur from wind turbine collisions or other sources of mortality. Even though released juveniles have a higher impact on population growth than wild-hatched chicks, they make a smaller contribution to population growth rate compared to adults for several reasons. First, 1.5-year-old juveniles require several years before they are sexually mature and attain breeder status, during which time the lost adult would have had the potential to contribute offspring. Second, juveniles may not survive their pre-breeder years and recruit into the breeding population. Third, captive-bred birds experience elevated mortality for the first five years after release compared to wild-fledged birds of similar age, even after accounting for management actions such as power pole aversion training (Bakker et al. 2017). Thus, the number of captive-bred juveniles needed to maintain the population growth potential of a single adult is greater than one. Here we estimate the value of an adult condor of breeding age in terms of 1.5-year-old captive-bred juveniles, such that the adult's contribution to population growth is fully replaced.

The relative value of adults and juveniles for population growth has conceptual links to reproductive value (v_i), a measure of the relative reproductive potential of a female of a given age or stage *i* that is a weighted average of her present and future reproduction (Morris and Doak 2002). Weighting accounts for the population growth rate, such that for a growing population, future reproduction is discounted relative to current reproduction because individuals born in the future represent a smaller proportion of a growing population (Caswell 2001; Lanciani 1988). We calculated the reproductive value for wild condors using published survival rates (Bakker et al. 2017) in a stage-structured demographic matrix with a mean deterministic lambda (λ_d) in 2024 of 1.021 (Bakker et al. unpublished) and no releases of captive-bred birds into the population. We found that the estimated ratio of the reproductive value of a successful breeder (*sb*) to a wild 1.5-year-old, v_{sb}:$v_{1.5}$, was 1.6:1, and if we included the breeder's dependent chick in the calculation, ($v_{sb} + v_{chick}$):$v_{1.5}$, the value increased to 2.6:1. Thus, the contribution to population growth of each successfully breeding adult condor is estimated to be equal to between 1.6 and 2.6 wild 1.5-year-olds using the established metric of reproductive value. However, the reproductive value approach underestimates the relative value of an adult condor as it does not account for the lower survival of captive-bred birds relative to wild birds of the same age (Bakker et al. 2017). In addition, the reproductive value approach is suboptimal for condors as it does not reflect the effects of changes in management and releases, or account for effects of stochasticity and uncertainty on population growth rate.

To conduct a more comprehensive and realistic analysis of the number of captive 1.5-year-olds needed to offset the loss of an adult condor, we used a simulation approach with a range of scenarios for flock management. **We use this approach to estimate a metric we refer to as the replacement ratio, defined as the number of captive-bred 1.5-year-olds that must be released into the population to replace the contribution of an adult condor to future population growth over 50 years.** We considered two scenarios for growth: current growth conditions (stochastic lambda over 50 years, λ_{50}, of ~1.032 with releases) and no growth scenarios (λ_{50} of ~1.00). Wind energy facilities are in closest proximity to the southern flock; thus, we simplified our analyses by simulating the population dynamics of the southern flock in isolation. Since the survival rates of condors in the central California flock are similar to the southern flock (Bakker et al. 2017), combining the central and southern flocks would not substantially impact the replacement ratio.

In addition, we explored two scenarios for the lost adult's breeder class: 1) random expectation, in which successful breeders (breeding-age birds that successfully fledge a chick), failed breeders (breeding-age birds that attempt but fail to fledge a chick), widows (unpaired breeding-age birds whose most recent mate has died), and skippers (breeding-age birds that skip breeding activities in a given year, typically in the year following successful breeding) were removed at random in proportion to their abundance and 2) precautionary approach, in which the lost adult was assumed to be a successful breeder actively rearing a chick. Chicks are generally dependent on two parents at least until fledging and require extended post-fledgling care (Finkelstein et al. 2015). As such, for both scenarios (random and precautionary) we assumed that if a successful breeder was killed at any time throughout the year, their chick also died.

Methods

We built a female-only stochastic demographic matrix population model with demographic rates driven by statistical relationships with ecological and intrinsic covariates and by unexplained stochastic variance (Bakker et al. 2009), using Matlab (R2016b. Natick, MA: The MathWorks Inc., 2016). We used a stage + age-based projection matrix with a fledging time census and seven pre-breeder age classes as follows:

- hatch year (age 0) through age 4: wild-hatched and captive-reared juveniles were tracked separately as they have different survival rates (Bakker et al. 2017).
- age 5 through 7: wild-hatched and captive-reared juveniles tracked together. Condors start recruiting into the breeder class after age 4 with individuals having an increasing probability of recruitment into the breeder class until age 7.
- condors entered the breeder class after age 7 and we included four breeder stages. We used data on state-dependent breeding probabilities that allowed separation of recruited breeders into four classes: widows, successful breeders, failed breeders, and skippers (e.g., Bakker et al. 2018).

Because we used a female-only model, we simulated the loss of adult females and the release of juvenile females, but for this monogamous species with shared parental investment, the results are assumed to apply to birds of either sex.

We initiated the model in 2013 at the observed southern California flock size and age distribution and simulated removals of wild adults in 2025 and releases of captive-bred 1.5-year-olds in the subsequent year. **Our simulations calculate a replacement ratio by determining how many captive-bred 1.5-year-olds, released in a single event (the year after the adult condors are removed), offset lost population growth resulting from the one-time removal of an adult condor.** To increase the mathematical precision of the estimated replacement ratio, and after preliminary assessments to determine the appropriate range of ratios for bracketing the true value, we simulated the removal of 5 adults and the release of between 5 and 18 juveniles, or replacement ratios of 1:1 to 3.6:1 juveniles to adults. The replacement ratio estimates the value of a single adult condor, and the intent of simulating the removal of five adults was to achieve greater resolution in our estimate of this ratio.

We assessed both random and precautionary removal in scenarios of current growth and no growth. Current growth approximates current conditions and consists of current lead mortality rates and the ongoing management of 10 nests and replacement of up to 1 failed egg per year and the ongoing release of 6 females per year. The effect of these management actions on population growth rate declines through time because the population grows and the proportional influence of management wanes. For the no growth scenario, all nest management and releases cease and anthropogenic (i.e., lead) mortality doubles after 2020. For both scenarios, we assume the southern flock begins feeding on marine mammals starting in 2020, reaching a maximum flock-wide average of three years of cumulative feeding, which we predict will depress hatching success because of exposure to DDE (Kurle et al. 2016). For our basic model assumptions with respect to lead mortality rate, management intensity, degree of feeding on marine mammals, etc., we used scenarios agreed upon through discussions in multiple workshops with the U.S. Fish and Wildlife Service (USFWS) Condor Recovery Team personnel from Bitter Creek National Wildlife Refuge, Pinnacles National Monument, and Ventana Wildlife Society (Bakker et al., unpublished). For each scenario, we ran 10,000 replicate simulations for 50 years (~ two condor generations) after the one-time removal of five adults in 2025 and release of juveniles in 2026 and tracked the number of total females and adult females through time. We chose 2025 as a plausible early time frame for potential condor mortalities at wind energy facilities to minimize the uncertainties about condor demographic rates and population dynamics as time frames extend into the future.

We simulated 13 removal and release scenarios for the random and precautionary removal of adults under no population growth and current population growth as follows:

1) No population growth (λ_{50}~0)
    a. *Estimated lower replacement value* – random removal: 5 adults (breeder classes) removed at random (proportional to breeder class abundance in the population) and a range of juveniles (0, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18) released into the flock in a single event the subsequent year. If a successful breeder is randomly selected for removal, its chick is also removed.
    b. *Estimated upper replacement value* – precautionary removal: 5 successfully breeding adults removed with their dependent chicks and a range of juveniles (0, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18) released into the flock in a single event the subsequent year.

2) Current population growth with releases (λ_{50}~1.032)
    a. *Estimated lower replacement value* – random removal: 5 adults (breeder classes) removed at random (proportional to breeder class abundance in the population) and a range of juveniles (0, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18) released into the flock in a single event the subsequent year. If a successful breeder is randomly selected for removal, its chick is also removed.
    b. *Estimated upper replacement value* – precautionary removal: 5 successfully breeding adults removed with their dependent chicks and a range of juveniles (0, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18) released into the flock in a single event the subsequent year.

Results

1) No population growth (Figures 1 and 2):
Replacement value of an adult is 3.0 juveniles under the precautionary scenario and 2.0 juveniles under the random removal scenario.

2) Current population growth (Figures 3 and 4):
Replacement value of an adult is 3.0 juveniles under the precautionary scenario and 2.0 juveniles under the random removal scenario.

Summary

We found that the loss of an adult condor could be offset by the release of between 2.0 to 3.0 captive-bred 1.5-year-old juveniles. This range reflects the output of two scenarios for future condor population growth and two types of breeder class removal (random and precautionary). Our replacement ratio was generally consistent but higher than the ratio of reproductive values of wild adults to wild 1.5-year-old juveniles. Reproductive value is a more traditional metric to quantify reproductive potential (Morris and Doak 2002), but this approach fails to account for stochasticity, management effects, and the lower survival of captive-bred released birds. Thus, our simulation-based replacement ratios represent a more accurate and unbiased estimate for quantifying the relative contribution of juveniles and adults to future condor population growth. Our model simulations include assumptions related to future conditions that were agreed upon during several workshops with USFWS California Condor Recovery Team personnel. Changing these assumptions could alter the projected condor population growth, which would affect our estimated replacement ratios. In addition, we conservatively assumed the removal of a breeding-age adult in estimating replacement ratios. Therefore, we feel that the replacement ratios presented here reflect reasonable bounds between current and no condor population growth.

Figure 1. No growth scenario (no nest management, no releases, and increased mortality). *Estimated lower replacement value*: random removal: 5 adults (i.e., breeder classes) removed at random (proportional to breeder class abundance in the population) and between 5 and 18 juveniles released into the flock the subsequent year. If a successful breeder is randomly selected for removal, their chick is also removed. Simulations depict change in population size with no wind turbine mortality, no release of juveniles (no replacement), replacement of 5 juveniles to 5 adults (1:1 replacement) increasing to replacement of 18 juveniles to 5 adults (3.6:1). Replacement value of 2.0 achieves a similar population growth trajectory to the population without removals. Panel 'a' depicts change in total number of females in the population while panel 'b' depicts change in the number of adult females (i.e., breeder classes).

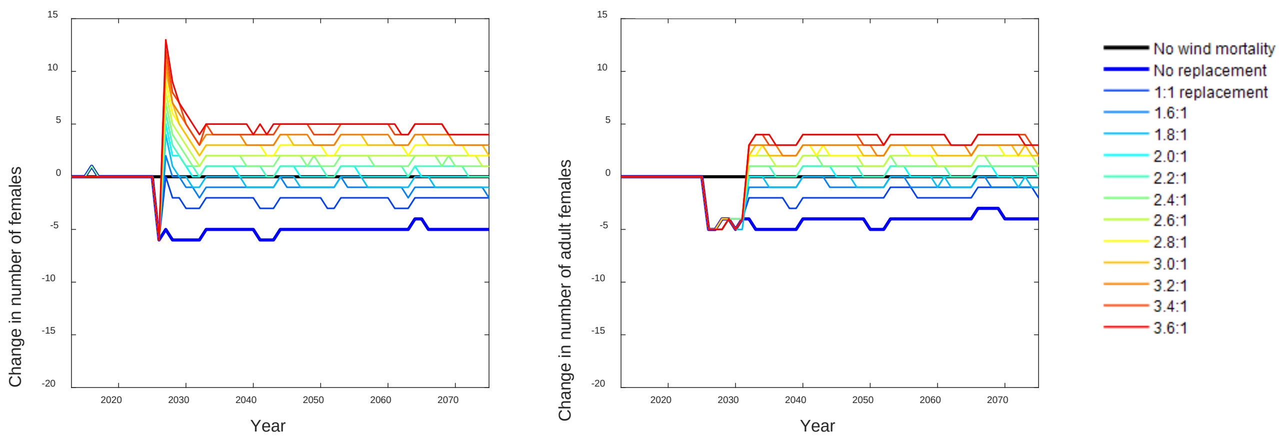


Figure 2. No growth scenario (no nest management, no releases, and increased mortality). *Estimated upper replacement value:* precautionary removal: 5 successfully breeding adults removed with their dependent chick and between 5 and 18 juveniles released into the flock the subsequent year. Simulations depict change in population size with no wind turbine mortality, no release of juveniles (no replacement), replacement of 5 juveniles to 5 adults (1:1 replacement) increasing to replacement of 18 juveniles to 5 adults (3.6:1). Replacement value of 3.0 achieves a similar population growth trajectory to the population without removals. Panel 'a' depicts change in total number of females in the population while panel 'b' depicts change in the number of adult females (i.e., breeder classes).

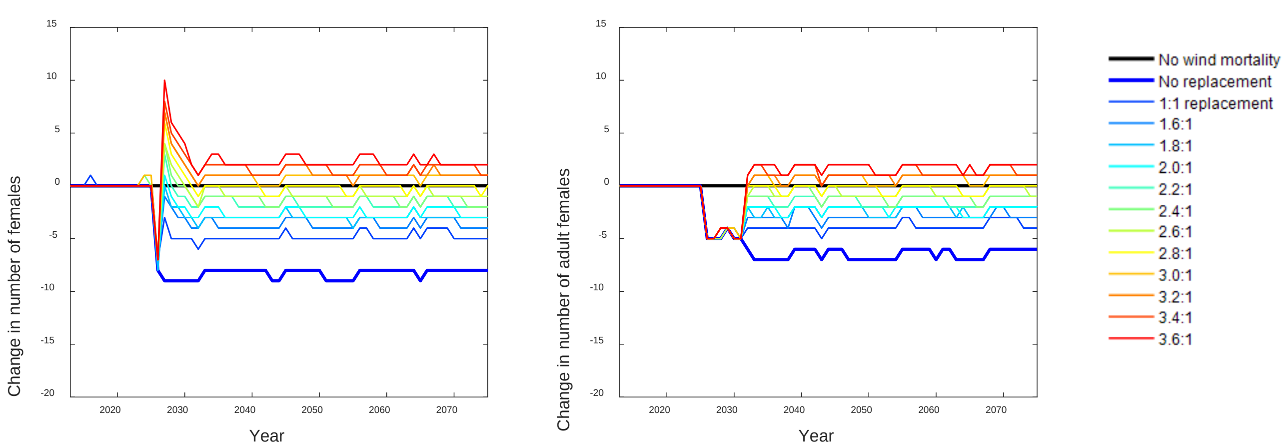


Figure 3. Current growth scenario (current management and ongoing releases). *Estimated lower replacement value*: random removal: 5 adults (i.e., breeder classes) removed at random (proportional to breeder class abundance in the population) and between 5 and 18 juveniles released into the flock the subsequent year. If a successful breeder is randomly selected for removal, their chick is also removed. Simulations depict change in population size with no wind turbine mortality, no release of juveniles (no replacement), replacement of 5 juveniles to 5 adults (1:1 replacement) increasing to replacement of 18 juveniles to 5 adults (3.6:1). Replacement value of 2.0 achieves a similar population growth trajectory to the population without removals. Panel ‘a’ depicts change in total number of females in the population while panel ‘b’ depicts change in number of adult females (i.e., breeder classes).

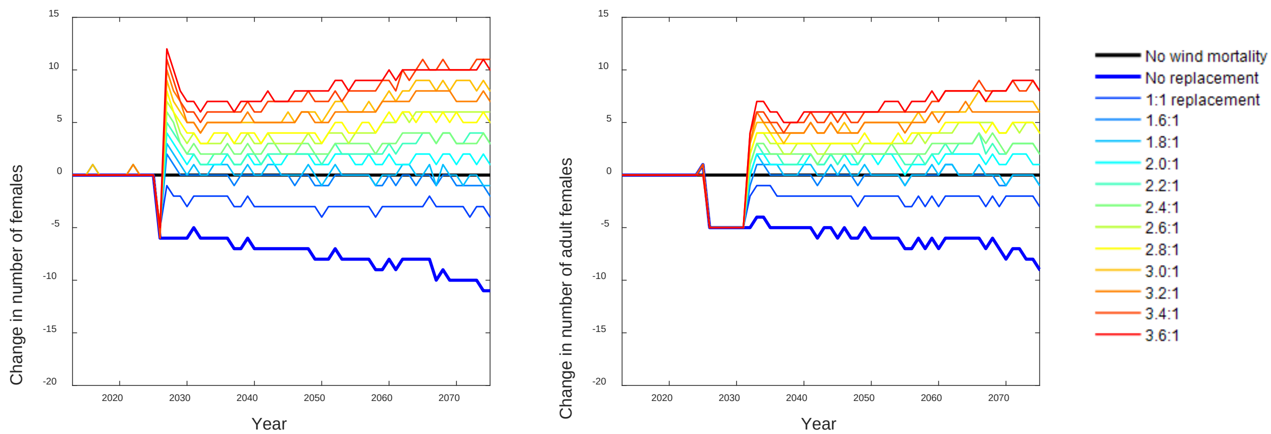
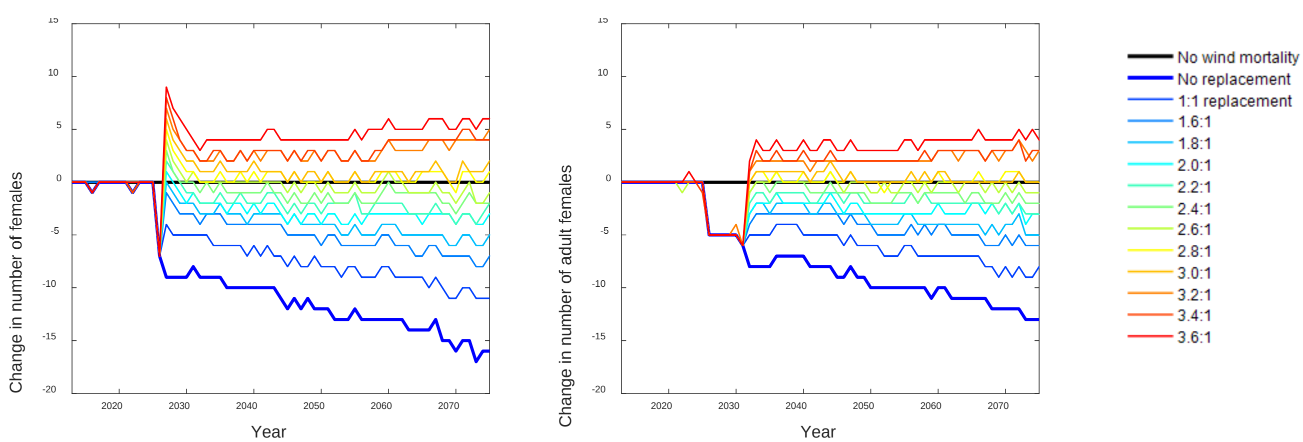


Figure 4. Current growth scenario (current management and ongoing releases). *Estimated upper replacement value:* precautionary removal: 5 successfully breeding adults (≥ 8 years of age) removed with their dependent chick and between 5 and 18 juveniles released into the flock the subsequent year. Simulations depict change in population size with no wind turbine mortality, no release of juveniles (no replacement), replacement of 5 juveniles to 5 adults (1:1 replacement) increasing to replacement of 18 juveniles to 5 adults (3.6:1). Replacement value of 3.0 achieves a similar population growth trajectory to the population without removals. Panel ‘a’ depicts change in total number of females in the population while panel ‘b’ depicts change in number of adult females (i.e., breeder classes).



Analysis 2. Quantify the relative population-level impact of potential California condor mortality associated with wind energy facilities in southern California

Introduction

In order to assess the relative impact to population growth of the southern condor flock from potential mortalities associated with wind energy facilities (wind mortalities) in the absence of mitigation in southern California, we used a population viability analysis (PVA) based upon existing survival data (Bakker et al. 2017) to estimate relative changes in the condor population growth rate and number of birds under a wide range of scenarios as explained below.

Methods

Population Model. We based our simulations of the effects of different levels of wind mortalities on our established condor demographic model. The model uses a female-only stochastic demographic matrix population model with demographic rates driven by statistical relationships with ecological and intrinsic covariates and by additional stochastic variance not explained by these covariates (Bakker et al. 2009) using Matlab (R2016b. Natick, MA: The MathWorks Inc., 2016). The population model is a stage + age-based projection matrix with a fledging-time census beginning at 0.5 year and seven pre-breeder age classes as follows (see also Figure 5):

- Hatch year (age 0, fledging – age 1.5) through age 4 (4.5 – 5.5): wild-hatched and captive-reared juveniles were tracked separately as they have different survival rates (Bakker et al. 2017).
- Age 5 (5.5 – 6.5) through 7 (7.5 – 8.5): wild-hatched and captive-reared juveniles tracked together. Condors start recruiting into the breeder class after age 4 with individuals having an increasing probability of recruitment with age.
- Four breeder stages. We used data on state-dependent breeding probabilities that allowed separation of recruited breeders into four classes: successful breeders (breeding-age birds that successfully fledged a chick in the most recent breeding season), failed breeders (breeding-age birds that attempted but failed to fledge a chick in the most recent breeding season), widows (unpaired breeding-age birds whose most recent mate has died), and skippers (breeding-age birds that skipped breeding activities in the most recent breeding season, which typically occurs in the year following successful breeding) (e.g., Bakker et al. 2018). Depending on their breeding fate in the immediately preceding year, and thus their breeding class, birds have different probabilities of breeding in a given year (e.g., last year's successful breeders and widows have a lower probability of breeding).

Because we used a female-only model, we assumed for this monogamous species with shared parental investment, that the results apply to birds of either sex.

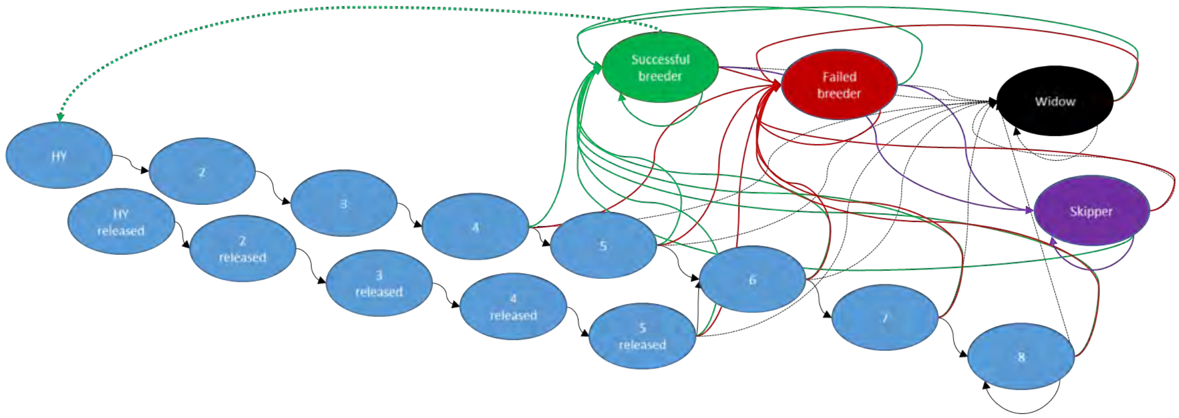


Figure 5. Life cycle diagram of the California condor population model used for model simulations to assess impacts from potential wind mortalities. As the hatch year (HY) age class is 0.5 -1.5 years, the one year increments in the model results in age classes being 0.5–1.5 years, 1.5-2.5 years, 3.5-4.5 years, etc. Lines represent transition probabilities based on empirical data (Bakker et al. 2017).

Scenarios. Multiple model scenarios were analyzed to explore the range of potential impacts to population growth of the southern condor flock from different levels of simulated wind mortalities. The scenarios and model assumptions were developed in collaboration with the USFWS Palm Springs Office and Condor Recovery Program team at the Hopper Mountain National Wildlife Refuge Complex (USFWS). Avangrid Renewables (Avangrid) and Los Angeles Department of Water and Power (LADWP) were given the opportunity to review and comment on model scenarios and assumptions but final model inputs, scenarios, and assumptions were decided upon by Drs. Bakker and Finkelstein. Note that the different levels of simulated mortality rates we investigated were not based on actual predictions of wind mortalities but instead were intended to assess potential impacts to the future growth of the southern condor flock from a range of wind mortality levels. All scenarios simulated wind-related mortalities in the absence of mitigation specifically intended to offset such losses (i.e., additional rearing and releases of captive birds) and included a range of captive release scenarios as detailed below.

Scenarios conservatively assumed wind mortalities were breeding age adults and the breeding class of the individuals – successful breeder, failed breeder, widow, or skipper – was selected at random in proportion to the prevalence of each breeding class present in the population at the time of mortality. Chicks are generally dependent on two parents at least until fledging and require extended post-fledgling care (Finkelstein et al. 2015). As such, we conservatively assumed that if a successful breeder was killed at any time throughout the year, their progeny of that year also died.

<u>Model assumptions for all scenarios:</u> We assumed that the effects of USFWS condor program management actions on condor survival and reproduction in the southern condor flock remained constant throughout the analysis timeframe including the ongoing management of 10 nests and replacement of up to one failed egg per year. Based on our prior work in collaboration with condor biologists and managers, we also assumed that the southern condor flock started feeding on marine mammals in 2020 and this feeding rate stabilized at a flock-wide mean rate of 3 years cumulative feeding on marine mammals, which we predict will depress hatching success because of exposure to DDE (Kurle et al. 2016).

Wind mortality rates (3 scenarios): The analysis included three different levels of wind mortalities (i.e., incidental take) of adult condors and their associated young over a 30-year period: lower, intermediate, and upper. The mortality rates described below were selected to assess impacts from different levels of simulated wind mortality and inform decisions on conservation planning and incidental take permits.

Lower = 4 adult condors taken over 30 years. This scenario evaluated the potential cumulative incidental take of condors at a small number of individual wind energy facilities (i.e., 2 facilities). Because we used a female-only model, this scenario involved removal of 2 females.

Intermediate = 15 adult condos taken over 30 years. This scenario evaluated the potential cumulative incidental take of condors at a small number of individual wind facilities (i.e., 2 facilities), as well as potential incidental take of condors associated with a larger group of wind energy facilities in the region. Because we used a female-only model, for each year we randomly removed either 7 or 8 females.

Upper = 25 adult condors taken over 30 years. This scenario evaluated the potential cumulative incidental take of condors at a small number of individual wind facilities (i.e., 2 facilities), as well as the potential incidental take of condors associated with a larger number of wind energy facilities in the region. Thus, this 'upper' level was intended to bracket the results and to some extent address the scenario where multiple wind facilities in the region seek separate incidental take permits. Because we used a female-only model, for each year we randomly removed either 12 or 13 females.

Wind mortality timing (3 scenarios): We explored scenarios in which wind mortalities occurred at three different time points over a 30-year period. These scenarios all assume that any permitted incidental take would occur in full (see above 'removal rate' scenarios) and do not account for minimization programs expected to influence the level and timing of when take might actually occur during each scenario. The 'early focus' scenario assumed mortalities occurred mainly within the first 10 years, the 'late focus' scenario assumed mortalities occurred mainly in the last ten years, and the 'even spread' scenario assumed mortalities occurred evenly throughout the 30-year analysis period. For each of these scenarios we used a probabilistic method that randomized when mortalities occurred across the thirty-year time frame (Table 1).

To allow time for the model simulations to capture the impacts of removals for the late focus timing, we ran simulations for 60 years and report results after 40 years, 10 years beyond the 30-year time window for when removals occurred.

Table 1. Distribution of removal across the 30-year time frame for three scenarios: late focus, in which probability of removal is highest late in the simulation time frame, even spread, in which the probability of removal is distributed across the time frame, and early focus, in which probability of removal is highest early in the simulation time frame.

	Probability of wind mortality 5-year (annual)					
Timing of mortalities	Years 1-5	Years 6-10	Years 11-15	Years 16-20	Years 21-25	Years 26-30
Late focus	0.010 (0.002)	0.020 (0.004)	0.030 (0.006)	0.040 (0.008)	0.300 (0.060)	0.600 (0.120)
Even spread	0.167 (0.033)	0.167 (0.033)	0.167 (0.033)	0.167 (0.033)	0.167 (0.033)	0.167 (0.033)
Early focus	0.600 (0.120)	0.300 (0.060)	0.040 (0.008)	0.030 (0.006)	0.020 (0.004)	0.010 (0.002)

Lead and other anthropogenic-related mortality rates (3 scenarios): To account for uncertainty with respect to future condor mortality rates we considered three scenarios of mean mortality rates associated with lead and other anthropogenic sources of mortality: current, higher, and lower. Mortality rates were based upon a published survival analysis using six years of data from 2008-2013 (Bakker et al. 2017) that separated mortalities into those known or suspected to be lead associated, referred to as lead mortality, and all other mortalities, referred to as natural mortality.

Current anthropogenic mortality: The current or baseline mortality rate scenario that included lead mortality.

Low and high anthropogenic mortality: The low and high mortality rates were based on the variance in lead mortality from Bakker et al. (2017) and used the upper 75% and lower 25% values. This equated to a 'low' mortality rate equal to 0.58 time the current rate, or ~1.3% increase in annual survivorship from the current rates and 'high' mortality rate equal to 1.5 time the current rate, or ~1.5% decrease in annual survivorship from current rates. These low and high values attempt to explore the ramifications of future unknowns on condor survival. Substantial stochastic variance in lead mortality rates occurs across all scenarios.

Captive releases (3 scenarios): We considered three scenarios of annual captive release levels: current, discontinued, and no releases. For all scenarios, individuals were assumed to be 1.5 years of age when released (i.e., 1-year post-fledging). We selected the sex of released individuals based on binomial proportions assuming a mean sex ratio of 0.5.

Current captive release rates: Based on current rates of release of captive individuals, this scenario assumed the release of 12 individuals (i.e., 6 females as model is female-only) into the southern flock each year for the entire timeframe of model simulations.

Discontinued releases: Assumed the current release rate of 12 individuals per year for the first 15 year of the simulations and then the cessation of release efforts starting in year 16. This scenario explores the influence of wind energy mortality if future captive rearing and release efforts cease because the focus of recovery efforts change, available funding decreases, or some other unknown factor.

No releases: We also included a scenario with no releases to bracket results and assess the impact of mortalities on natural demographic processes because the condor population is currently reliant upon captive-bred released birds for population growth (Finkelstein et al. 2012), and these releases dominate population dynamics.

Evaluation. For each scenario, we ran 10,000 population trajectories, starting in 2018 with the population initialized at its current size and age distribution. Simulated wind mortalities began in 2020 and ended in 2050. We summarized the predicted median population dynamics from the 82 scenarios described above. We assessed the difference in median numbers of total condors after 40 years (2020 – 2060). Finally, we calculated the percent difference in the mean short-term realized stochastic growth rate, denoted as λ_t where t is the number of years over which the growth rate is summarized (i.e., $(N_t/N_0)^{1/t}$). The average of λ_t values across multiple simulations was calculated as $e^{\text{mean}[\log(\lambda_t)]}$. We present impacts from wind energy mortalities as a function of reduction in condor stochastic growth rate over 40 years, λ_{40}.

Summary of results

Wind mortality rates. As expected, the higher the number of condors removed from the population due to simulated wind energy mortality, the stronger the reduction in 40-year stochastic population growth (λ_{40}, Figure 6). In simulations with no releases and current mortality rates, early focus mortality of 4 condors lowered λ_{40} by 5% while early focus mortality of 25 birds lowered λ_{40} by 38% (Figure 6). For scenarios in which the population is growing (current and reduced lead mortality scenarios), the lost growth potential in terms of numbers of condors continues to accrue over time beyond the evaluation year of 2060 (Figure 7, a-f).

Wind mortality timing. The early focus mortality scenario resulted in both greater numbers of condors lost (higher net difference in condors) after 40 years and a greater reduction in stochastic growth rates (λ_{40}). This occurs because timing of mortality influences both the relative size of the population from which wind mortalities occur and the number of years over which lost growth potential occurs. The influence of timing of mortality on numbers lost was greatest when the lead mortality rate was lowest and the influence on stochastic lambda (λ) was greatest when release rate was lowest (Figures 6-7).

Lead and other anthropogenic-related mortality rates. Increasing the mortality rate associated with lead or other anthropogenic-related factors increased the percent change in stochastic growth rate due to simulated wind energy associated mortalities but was inversely related to the net difference in numbers of condors after 40 years (Figure 7) (Table 3). The greater the lead mortality rate, the greater the impact of wind-associated mortality on stochastic growth rate because each individual represents a greater proportion of the population when populations are small. For the no release scenario, increasing lead mortality approximately doubles the impact of wind mortalities on λ_{40}. In contrast, the lower the lead mortality rate the greater the lost growth potential in terms of numbers of condors because the net difference in numbers is driven by demographic rates; the individual contribution of each bird to future flock numbers is greater when the lead mortality rate is lower.

Captive release rate. As expected, the higher the release rate, the lower the effect of simulated wind energy mortalities on λ_{40} (growth rate; Figure 6). In contrast, net difference in numbers of condors after 40 years was insensitive to release rate (Figure 7) (Table 3). For the current release scenario, 480 individuals were released into the population over the 40-year evaluation window, and for the discontinued releases scenario, which continues the current release rate for 15 years, the number released was 180. With these release rates, the number of condors removed as a result of mortality at wind energy facilities is a relatively small proportion of the number added, and the impact of mortalities on λ_{40} is reduced. For example, with the current release rate, the early focus mortality of 25 birds reduces λ_{40} by 5%, while with no releases, the early focus mortality of 25 birds reduces λ_{40} by 38% (Table 2, Figure 6c).

Table 2. Percent change in mean stochastic growth rates over 40 years (λ_{40}) of California condors (condors) in the southern flock in the presence of simulated wind mortalities. Shown are results for three wind mortality scenarios (lower, intermediate, and upper) and three timing scenarios for wind mortalities (late, even, early, see Table 1) as well as three ongoing management release scenarios and three lead mortality rate scenarios. Results shown graphically in Fig. 6. Changes are expressed at a percent change in predicted stochastic growth rate (e.g., a change from 1.022 to 1.020 is -0.002/0.022 = -9.0%). All scenarios simulated wind-related mortalities in the absence of mitigation specifically intended to offset such losses (i.e., additional rearing and releases of captive birds).

Ongoing management release rate		Lower removal rate: 4 adult condors			Intermediate removal rate: 15 adult condors			Upper removal rate: 25 adult condors		
Wind mortality timing		*Late*	*Even*	*Early*	*Late*	*Even*	*Early*	*Late*	*Even*	*Early*
	Mortality rate									
Current (12 condors annually)	reduced	-0.4	-0.5	-0.7	-1.7	-2.1	-2.6	-3.0	-3.5	-4.2
	current	-0.5	-0.5	-0.7	-1.9	-2.3	-2.6	-3.3	-3.9	-4.5
	increased	-0.8	-0.6	-0.7	-2.6	-2.7	-3.0	-4.4	-4.6	-5.1
Discontinued (12 condors annually stopping 2035)	reduced	-0.9	-1.1	-1.2	-3.4	-4.1	-4.9	-5.8	-6.9	-8.5
	current	-1.1	-1.3	-1.6	-4.3	-5.3	-5.8	-7.9	-9.0	-10
	increased	-1.8	-2.1	-2.0	-6.9	-7.6	-7.9	-12	-13	-14
None	reduced	-2.2	-2.9	-3.4	-9.9	-12	-15	-18	-22	-27
	current	-4.3	-4.9	-5.4	-17	-19	-22	-30	-33	-38
	increased	-9.5	-10	-11	-37	-38	-40	-63	-66	-70

Table 3. Percent reduction in total population size of California condors (condors) in the southern flock in the presence of simulated wind mortalities as a proportion of population size with no wind mortalities in evaluation year 2060. Shown are results for three wind mortality scenarios (low, medium, and high) and three timing scenarios for wind mortalities (late, even, early, see Table 1) as well as three ongoing management release scenarios and three lead mortality rate scenarios. Results shown graphically in Fig. 7. All scenarios simulated wind-related mortalities in the absence of mitigation specifically intended to offset such losses (i.e., additional rearing and releases of captive birds).

Ongoing management release rate		Lower removal rate: 4 adult condors			Intermediate removal rate: 15 adult condors			Upper removal rate: 25 adult condors		
Wind mortality timing		*Late*	*Even*	*Early*	*Late*	*Even*	*Early*	*Late*	*Even*	*Early*
	Mortality rate									
Current (12 condors annually)	reduced	0.6	0.8	1.1	2.8	3.4	4.5	5.1	5.9	7.4
	current	1.0	1.0	1.4	3.1	3.8	4.4	5.5	6.5	7.2
	increased	0.8	0.8	1.3	3.8	3.8	4.2	6.4	6.8	7.2
Discontinued (12 condors annually stopping 2035)	reduced	1.3	1.7	2.2	4.8	5.6	6.9	8.2	9.1	11
	current	1.1	1.6	2.2	4.9	6.0	6.6	8.8	9.9	12
	increased	2.2	2.2	2.2	6.5	7.2	7.2	11	12	12
None	reduced	1.6	2.4	2.4	7.9	9.5	12	14	17	20
	current	2.0	3.0	3.0	9.1	11	12	16	18	21
	increased	2.7	4.0	4.0	12	12	13	20	21	21

Figure 6 (see also Table 2): Predicted percent change (±95% CI) in mean stochastic growth rates over 40 years (λ_{40}) (2020 – 2060) of the southern flock of California condors (condors) in the presence of simulated mortality at wind energy facilities. Shown are results for three wind mortality scenarios (a) 4 adult condors, (b) 15 adult condors, or (c) 25 adult condors. For each, simulations considered three timing scenarios for mortalities (late, even, early, see Table 1) as well as three ongoing management release scenarios and 3 lead mortality rate scenarios. All scenarios simulated wind-related mortalities in the absence of mitigation specifically intended to offset such losses (i.e., additional rearing and releases of captive birds).

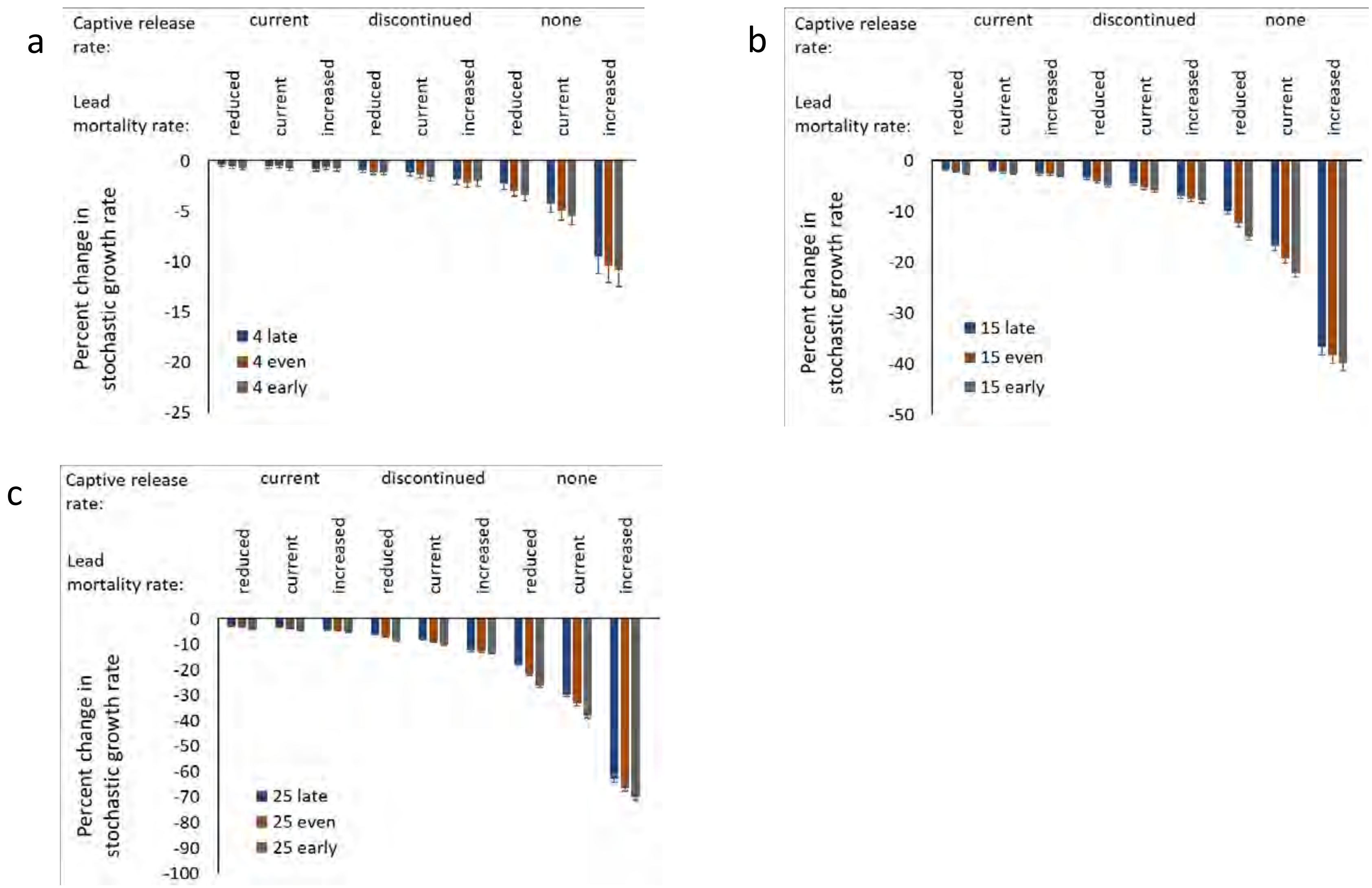
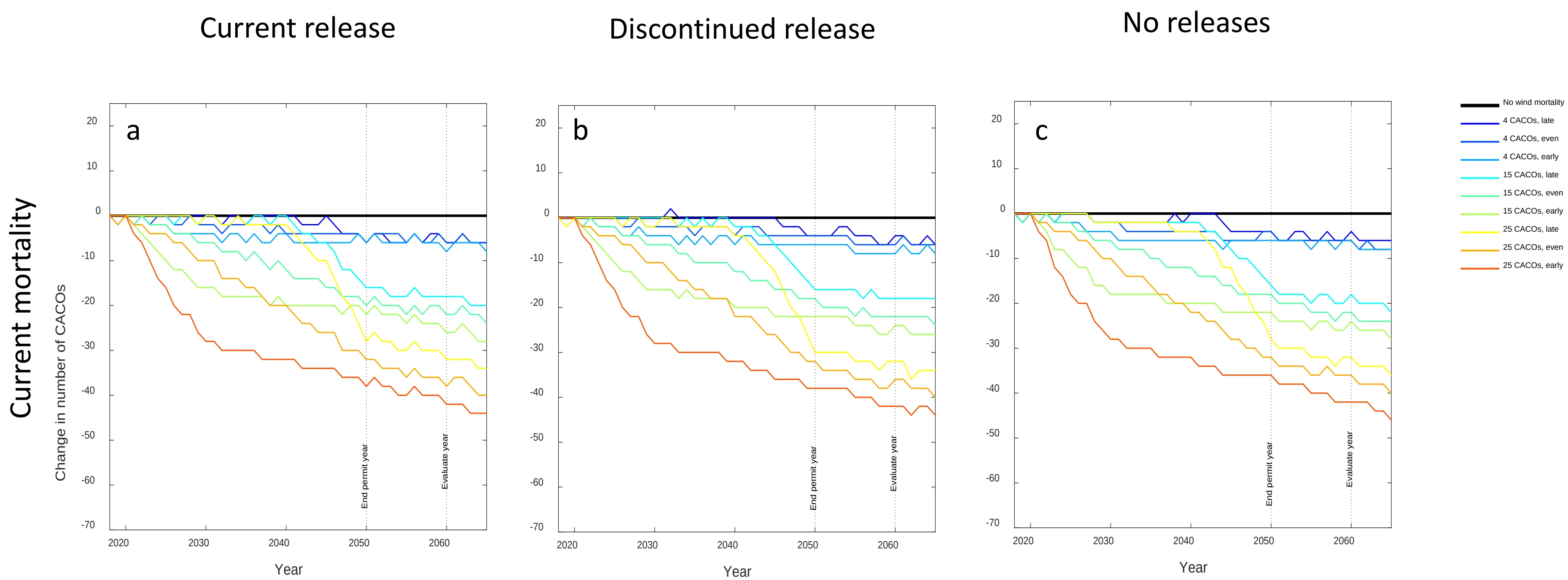
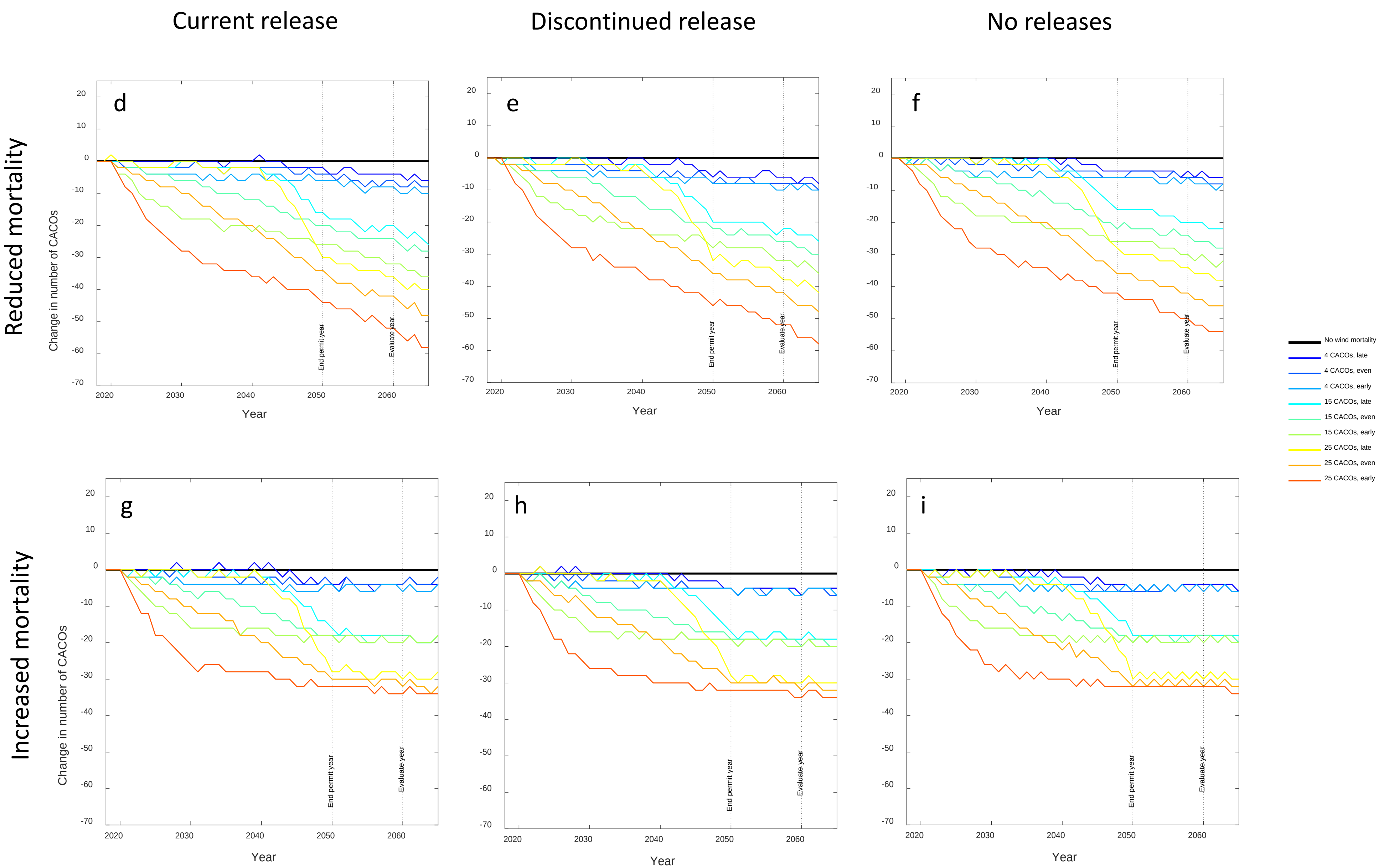


Figure 7. Predicted relative effects of California condor (condor, CACO) mortalities at wind energy facilities in southern California on the population dynamics of the southern California flock. Panels depict the difference in median numbers of total condors through time for lower (4), intermediate (15), and upper (25) wind-associated condor mortalities and early, even, and late timing of those mortalities, relative to no mortality, based on 10,000 replicate runs. Top panels show current lead mortality rate scenario, middle panels (d,e,f) show the reduced lead mortality rate (0.58 times current rate), and bottom panels (g,h,i) show the increased lead mortality rate (1.5 times current rate). Columns are grouped by release rate with the first column (a,d,g) for the current release scenario (12 condors released in southern flock annually), the second column (b,e,h) for the discontinued release scenario (12 condors released in southern flock annually until 2035, when releases cease), and the final column (c,f,i) for the no release scenario. Simulated wind-associated mortalities start in 2020 and end in 2050 (End permit year). All results are evaluated 10 years later, in 2060 (Evaluate year). See also Table 3. All scenarios simulated wind-related mortalities in the absence of mitigation specifically intended to offset such losses (i.e., additional rearing and releases of captive birds).





Current release
Discontinued release
No releases
Reduced mortality
Increased mortality
d
e
f
g
h
i
Change in number of CACOs
Year
End permit year
Evaluate year
20
10
0
-10
-20
-30
-40
-50
-60
-70
2020
2030
2040
2050
2060
No wind mortality
4 CACOs, late
4 CACOs, even
4 CACOs, early
15 CACOs, late
15 CACOs, even
15 CACOs, early
25 CACOs, late
25 CACOs, even
25 CACOs, early

Literature cited

Bakker, V.J., Doak D.F., Roemer, G.W., Garcelon, D.K., Coonan, T.J., Morrison, S.A., Lynch, C., Ralls, K., Shaw, M.R. 2009. Incorporating ecological drivers and uncertainty into a demographic population viability analysis for the island fox. Ecological Monographs 79, 77-108.

Bakker, V.J., Finkelstein, M.E., Doak, D.F., VanderWerf, E.A., Young, L.C., Arata, J.A., Sievert, P.R., Vanderlip, C. 2018. The albatross of assessing and managing risk for long-lived pelagic seabirds. Biological Conservation 217, 83-95.

Bakker, V.J., Smith, D.R., Copeland, H., Brandt, J., Wolstenholme, R., Burnett, J., Kirkland, S., Finkelstein, M.E. 2017. Effects of lead exposure, flock behavior, and management actions on the survival of California condors (*Gymnogyps californianus*). EcoHealth 14, 92-105.

Caswell, H. 2001. Matrix Population Models: Construction, analysis and interpretation, 2nd edition. Sinauer Associates.

Crowder, L.B., Crouse, D.T., Heppell, S.S., Martin, T.H. 1994. Predicting the impact of turtle excluder devices on loggerhead sea turtle populations. Ecological Applications 4, 437-445.

Finkelstein, M.E., Doak, D.F., George, D., Burnett, J., Brandt, J., Church, M., Grantham, J., Smith, D.R. 2012. Lead poisoning and the deceptive recovery of the critically endangered California condor. Proceedings of the National Academy of Sciences 109, 11449-11454.

Finkelstein, M., Z. Kuspa, N. F. Snyder, and N. J. Schmitt. 2015. California Condor (*Gymnogyps californianus*), version 2.0. In The Birds of North America (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.610

Kurle, C.M., Bakker, V.J., Copeland, H., Burnett, J., Jones Scherbinski, J., Brandt, J., Finkelstein, M.E. 2016. Terrestrial scavenging of marine mammals: Cross-ecosystem contaminant transfer and potential risks to endangered California condors (*Gymnogyps californianus*). Environmental Science and Technology 50, 9114–9123.

Lanciani, C.A. 1998. A simple equation for presenting reproductive value to introductory biology and ecology classes. Bulletin of the Ecological Society of America 79, 192-193.

Morris, W.H. & Doak, D.F. 2002. Quantitative Conservation Biology: Theory and Practice of Population Viability Analysis. Sinauer Associates, Oxford.

Rideout, B.A., Stalis, I., Papendick, R., Pessier, A., Puschner, B., Finkelstein, M.E., Smith, D.R., Johnson, M., Mace, M., Stroud, R., Brandt, J., Burnett, J., Parish, C., Petterson, J., Witte, C., Stringfield, C., Orr, K., Zuba, J., Wallace, M., Grantham, J. 2012. Patterns of mortality in free-ranging California condors (*Gymnogyps californianus*). Journal of Wildlife Diseases 48, 95-112.

Saether, B.E., Ringsby, T.H., Roskaft, E. 1996. Life history variation, population processes and priorities in species conservation: Towards a reunion of research paradigms. Oikos 77, 217-226.

Stearns, S.C. 1992. The evolution of life histories. Oxford University Press, Oxford.

U.S. Fish and Wildlife Service [USFWS]. 2013. California Condor (*Gymnogyps californianus*) 5-Year Review: Summary and Evaluation, Ventura, CA.

Enclosure 3

Quantitative Analyses to Inform Conservation Planning Efforts Associated with California Condors (*Gymnogyps Californianus*)

Frequently Asked Questions (FAQs)

Enclosure 3

QUANTITATIVE ANALYSES TO INFORM CONSERVATION PLANNING EFFORTS ASSOCIATED WITH CALIFORNIA CONDORS (GYMNOGYPS CALIFORNIANUS)

FREQUENTLY ASKED QUESTIONS (FAQS)

PALM SPRINGS FISH AND WILDLIFE OFFICE

U.S. FISH AND WILDLIFE SERVICE

JUNE 2020

BACKGROUND

The U.S. Fish and Wildlife Service (USFWS) is coordinating with wind energy companies on their development of conservation plans for California condors (*Gymnogyps californianus*) at existing wind energy projects in the Tehachapi Mountains in Kern County, California. An applicant must submit a conservation plan when applying for an incidental take permit under section 10(a)(1)(B) of the Endangered Species Act; the plan must specify the measures an applicant will carry out to mitigate the impacts of take to the maximum extent practicable and the impact resulting from the taking. Drs. Victoria Bakker at Montana State University and Myra Finkelstein at the University of California Santa Cruz, prepared a report titled "Quantitative analyses to inform conservation planning efforts associated with California condors, dated April 8th, 2020. The report presents the results of a population viability analysis (PVA) that Drs. Bakker and Finkelstein (hereafter researchers) conducted to help the USFWS and wind energy companies assess the level of mitigation needed to offset the impacts from the incidental take of a California condor (hereafter condor) and to evaluate the effects on the condor population from different levels of incidental take, in the absence of mitigation.

The purpose of this "Frequently Asked Questions" or FAQ document, is to summarize and respond to, the common questions that members of the public and various interested parties have asked regarding the PVA and the report prepared by the researchers.

QUESTIONS

1) Has a condor ever been injured or killed at a wind turbine?

No. To date, there are no documented cases of a wind turbine injuring or killing a condor. However, wind turbines have injured and killed other large soaring birds (e.g., raptors). Wind energy facilities occur within the current and historical range of condors; populations of condors are increasing in the wild and the geographic distribution of these birds is expanding. Therefore, there is the risk that a condor will encounter and potentially collide with a wind turbine and we expect that this risk will increase over time.

2) What specific questions did the USFWS and wind companies ask the researchers to investigate and why?

The goal of having the researchers prepare a quantitative analysis centered around two different questions:

1. How many captive-reared young condors need to be released into the wild to offset the death of one adult condor? We refer to this in the FAQ as Analysis #1.
2. How would different levels of human-caused mortality of adult condors in the wild, including potential mortality from wind turbines, affect future growth rates and the number of individuals in the population in the absence of mitigation? We refer to this in the FAQ as Analysis #2.

The researchers used existing information from wild and captive populations of condors to develop models to help answer these questions of interest. The model results provide important and useful information when developing conservation plans for the condor under section 10(a)(1)(B) of the Endangered Species Act and evaluating potential impacts to the species from the issuance of incidental take permits, as required by the National Environmental Policy Act (NEPA). Analysis #1 helps to identify appropriate mitigation strategies and estimate how many captive-reared juvenile condors USFWS would need to release into the wild to ensure that the loss of a breeding-age adult condor, and any dependent egg or chick, would not affect the long-term growth of the wild condor population. Analysis #2 provides an understanding of the potential population level implications from the added mortality of breeding age condors in the wild from human causes in the absence of mitigation; this information will help in evaluating impacts in the absence of required mitigation (e.g., 'no action' alternatives in NEPA) and understanding potential cumulative impacts from the potential issuance of additional incidental take permits for condor.

3) What types of analyses did the researchers use to answer the questions of interest?

The researchers used a demographic model to conduct what is commonly referred to as a population viability analysis, or PVA. A demographic model uses information on the reproductive and survival rates of a species to predict future population dynamics. A PVA is a specific type of demographic model that evaluates population growth rate and risk of extinction under different conditions. The researchers had already developed a demographic model for condors, using information collected over the past several decades by biologists studying condors in captivity and the wild; they have used this model to conduct a PVA for the USFWS to investigate various issues, including the impacts of lead in the environment on condor populations. Prior to the current PVA analysis, the researchers had published their survivorship rates that for the condor demographic model in a peer-reviewed scientific journal, along with several other PVAs based on a similar demographic model for other species (e.g., see below).

Therefore, the analyses that the researchers conducted for the USFWS and wind companies relied on a well-informed and established approach to answer the questions of interest that broadly addressed issues related to the recovery of the condor.

Bakker, V.J., Doak D.F., Roemer, G.W., Garcelon, D.K., Coonan, T.J., Morrison, S.A., Lynch, C., Ralls, K., Shaw, M.R. 2009. Incorporating ecological drivers and uncertainty into a demographic population viability analysis for the island fox. Ecological Monographs 79, 77-108.

Bakker, V.J., Finkelstein, M.E., Doak, D.F., VanderWerf, E.A., Young, L.C., Arata, J.A., Sievert, P.R., Vanderlip, C. 2018. The albatross of assessing and managing risk for long-lived pelagic seabirds. Biological Conservation 217, 83-95.

Bakker, V.J., Smith, D.R., Copeland, H., Brandt, J., Wolstenholme, R., Burnett, J., Kirkland, S., Finkelstein, M.E. 2017. Effects of lead exposure, flock behavior, and management actions on the survival of California condors (*Gymnogyps californianus*). EcoHealth 14, 92-105.

Finkelstein, M.E., Doak, D.F., George, D., Burnett, J., Brandt, J., Church, M., Grantham, J., Smith, D.R. 2012. Lead poisoning and the deceptive recovery of the critically endangered California condor. Proceedings of the National Academy of Sciences 109, 11449-11454.

4) Who was involved in the development of this PVA and what was the process in determining the model scenarios and assumptions for the analyses? Who provided the funding for this study?

The researchers developed the model scenarios and assumptions for the analyses, in collaboration with the USFWS Palm Springs Office and condor biologists at the Hopper Mountain National Wildlife Refuge Complex. The researchers had also previously worked on developing the model assumptions with other national and international condor biologists. Avangrid Renewables (Avangrid) and the City of Los Angeles Department of Water and Power (LADWP) own and operate wind projects in the Tehachapi Mountains and are developing condor conservation plans with the assistance of the USFWS. Both Avangrid and LADWP provided input on the model scenarios and assumptions for the PVA and also provided the funding for this current work. Ultimately, the researchers made the final determination on the inputs used for the analyses.

5) Are the results of these analyses specific to potential impacts to condors from wind energy facilities?

In short, no. A PVA can be used as a tool to investigate potential impacts to condors from various sources of mortality. In this case, the researchers developed model scenarios and assumptions to assist with conservation planning associated with existing operational wind energy facilities; however, the results of these analyses could be applicable for looking at potential impacts from other sources of human-caused mortality that are consistent with the model assumptions.

6) The researchers used a 'female only' model for the PVA. What does this mean for applying results of the analyses to both sexes of condor?

The analyses simulated the loss of adult females, and the release of captive-reared juvenile females for Analysis #1, for the following reasons: a) condors are a monogamous species (i.e., only one male and one female in each breeding pair) and the sex ratios in the population are approximately even; b) condors have shared parental investment with both adults in a breeding pair needed to successfully incubate an egg and care for a chick until it fledges; and c) both sexes have similar reproductive rates, survival rates, and behaviors. In other words, a model tracking only females or tracking both females and males would give the same results. Therefore, for simplicity nearly all demographic models are female-based.

7) Analysis #1 discussed using 'reproductive value' and 'replacement ratio' as ways to estimate the number of captive-reared young condors that would need to be released into the wild to offset the mortality of an adult condor in the wild. Why did the researchers include discussion of both these metrics if they ultimately determined that the replacement ratio was the preferred approach?

Traditionally ecologists have used reproductive values because it is easier to calculate based on some simplifying assumptions. However, given the advancement in these types of analyses and the degree of our understanding about complexities of condor populations, the replacement ratio is more appropriate in this case.

Specifically, the relative value of an adult or juvenile condor to population growth is related to the concept of reproductive value; therefore, this approach is the traditional metric that ecologists have used. However, the reproductive value does not account for the added complexities of condor population dynamics, such as the lower survival of captive-reared condors relative to wild condors of the same age and factors related to condor management actions. Therefore, the researchers determined that in this case the reproductive value underestimates the number of condor releases required to offset the loss of an adult in the wild and the replacement ratio is a more comprehensive and realistic metric for the analysis of interest. Ultimately, the results using each of these metrics in the analysis do not differ substantially.

8) Analysis #1 simulated the removal of 5 adult condors from the wild population in year 2025 and releases of captive-reared birds in 2026. Presumably, any mortalities and releases would occur over a more extended time frame so why did the analysis look at the removal and release of multiple condors within a single year's time?

The replacement ratio estimates the value of a single adult condor; however, analyzing the simulated removal of multiple adults and the release of multiple captive-reared birds as single events (i.e., in a single year) provided a simplified approach to achieve greater mathematical precision and resolution to estimate replacement ratio than if only one bird was removed in the analysis and if releases occurred over an extended period.

9) Why did Analysis #1 focus on the release of additional captive-reared condors into the wild population as the only mitigation option and not other approaches?

The USFWS previously identified the release of captive-reared condors as a priority action for recovering the species (e.g., U.S. Fish and Wildlife Service. 1996. California Condor Recovery

Plan, Third Revision. Portland, Oregon. 62 pp.), in large part because a) the condor population is still relatively small, and b) condors have a low reproductive rate with a breeding pair only producing one chick every 1-2 years. Therefore releasing captive-reared birds gives the population a 'boost' and more potential for increasing in numbers more quickly. The mitigation strategy in the current conservation plans follows the approach of working with condor breeding facilities to increase the number of captive reared young condors available for release into the wild. In addition, the PVA provides an objective and quantifiable approach to estimating appropriate mitigation levels associated with the release of captive-reared birds.

We considered other mitigation strategies for the conservation plans, such as habitat mitigation. However, because condors are not habitat limited, using habitat as a mitigation tool does not provide the same benefits to the population as releasing additional captive-reared birds into the wild and we excluded it from further consideration. We also considered educational outreach on the use of non-lead ammunition as a mitigation strategy by reducing impacts to condors from lead poisoning. However, there is currently no model for quantifying the amount of educational outreach on lead required to offset the incidental take of an adult condor in the wild. Therefore, based on available information, we determined that the best way for an applicant to meet the incidental take permit criteria of 'mitigating to the maximum extent practicable', as required under section 10(a)(1)(B) of the Endangered Species Act, was to utilize the PVA and focus the mitigation efforts on the breeding and release of additional captive-reared birds into the wild.

10) Why do the analysis time frames differ between Analysis #1 and Analysis #2?

In Analysis #1, the research team ran each simulation for a 50-year time period. The research team selected this time frame for the analysis because it represents approximately 2 condor generations and ensured that the analysis fully captured all impacts to future population growth.

In Analysis #2, the scenarios simulated removal of condors from the population over a 30-year period, which is frequently the duration of land leases and other permits for utility-scale renewable energy projects. Because these simulations included the removal of condors later in the 30-year period, the researchers extended the analysis an additional 10 years and reported the results after 40 years. As a precaution, the researchers ran the simulations for a full 60 years to check that the results did not indicate any unanticipated impacts to the population after the 40-year analysis period

11) Why did Analysis #2 look at impacts of condor removals on the population growth rate and numbers of condors 'in the absence of mitigation'?

The intent of the conservation plans is to mitigate at a level that would fully offset any impact from potential incidental take. The term 'incidental take' means that the death of the condor was accidental and incidental to otherwise lawful activities, such as operating a wind project. Analysis #1 provided this information on mitigation efforts, in the form of releasing young captive-reared condors, to offset the incidental take of an adult condor and any dependent eggs or chicks. However, evaluating potential impacts to the species from the issuance of incidental take permits is required by the National Environmental Policy Act (NEPA); Analysis #2 provided this information, as well as potential cumulative impacts from different levels of incidental take, and as a precautionary approach was conducted in the absence of mitigation, even though the current conservation programs will fully mitigate impacts.

12) Analysis #1 and Analysis #2 both included scenarios where lead ingested by condors contributes to current and future condor mortality rates (both lower and higher mortality rates). The State of California implemented a statewide ban on the use of lead ammunition for any shooting of wildlife (AB711) starting in July 2019. If there is a ban on use of lead ammunition, why does the PVA include model scenarios where lead mortality rates of condors increase over time?

We anticipate that the statewide ban on the use of lead ammunition for shooting wildlife (e.g., recreational hunting, varmint control, etc.) will ultimately reduce the amount of lead on the landscape and reduce the impact of lead on condor mortality rates. However, it is still an unknown if, and to what extent, the implementation of the lead ammunition ban or future condor behavior will affect the exposure of condors to lead from ammunition and other sources. Therefore, as a precautionary exercise the PVA considered scenarios where lead mortality rates of condors both decrease and increase over time.