EXHIBIT B

December 14, 2018

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Subject: RESPONSE to Comments for the Painted Hills Wind Repowering Project Initial Study, Commercial WECS Permit No. 180001 / Variance Case No. 180003 – Intent to Adopt a Mitigated Negative Declaration – CEQ180059.

Dear Mr. Jones,

This letter contains my responses to the County/ DUDEK's replies to my comments on the biological resource impact analysis for the Painted Hills Wind Repowering Project (Project) Initial Study and Mitigated Negative Declaration (IS/MND).

The following is a response to comments in a Memorandum ("Bio Memo") written by DUDEK's Collin Ramsey, provided by the County as response to comments regarding the biological impact analysis of the Project. It is important to preface these comments by noting that for the County to rely on the opinionated response of a DUDEK employee as any part of the County's argument or justification for the approval of this Project's MND is inappropriate. As the primary environmental consultant, DUDEK is a paid contractor for the Project Applicant. As such DUDEK has a conflict of interest and cannot be relied upon for an independent or unbiased scientific response to an IS/MND that they scripted; if there is to be any such response it should come from the County staff as the lead decision-makers for the permitting process.

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1. The Bio Memo states that the assertion that the Project description is incomplete is erroneous by claiming that "no data is[*sic*] submitted that shows that shorter turbines than the maximum height with smaller rotor diameter would have a greater impact on avian species than assumed for the project." First, this claim lacks clarity in its expository goal to negate claims that were not made. Nowhere in my previous comment did I refer to "shorter turbines

than the maximum height with smaller rotor diameter"; an irrelevant statement in respect to the subject, which is the fact that regardless of the conclusions to be made about turbine size, the Project description by default is indeed incomplete because it does not establish clearly what the turbine size to be used will be. It bears repeating that without turbine specifics, adequate baseline determinations regarding the impact by the new turbines is prohibited, thus resulting in speculation in lieu of reliable scientific analysis, and an inability by the public to accurately analyze what exactly is being proposed with this repowering project.

The Bio Memo references the U.S. Fish and Wildlife Service's Shiloh IV Wind project Environmental Assessment (SWEA)[1] saying that since there were no eagle take at Shiloh IV Wind "at all since the repowering with fewer taller turbines occurred" that this somehow justifies their claim that there will no significant impact to eagles from this Project, while in the same breath claiming that my observations from Ocotillo Wind are "inapposite" because it is not a repowering Project.

a. First, my hundreds of direct observations of raptor species, including golden eagles and the California ESA Threatened Swainson's hawk, over the course of several years at the Ocotillo Wind site, pre- and post-construction, confirms that eagles are seen repeatedly flying within higher altitudes that are the altitudes relevant to the Project's new presumably taller turbines. These observations are revelatory of species behavior and are thus relevant wherever (a) the species occurs as residents or migrants, and (b) taller turbines exist that can pose a barrier / injury to the species. Behavioral proclivities are relevant regardless of eagle take data statistically analyzed from a few years from some other Project (as is the case with Shiloh IV project referenced in the Bio Memo), and whether take occurred in a repowering site or non-repowered wind farm. It is important to note that both golden eagles and Swainson's hawks have been observed in the Project area as part of studies funded by Southern California Edison to measure the activity of birds in these areas where wind farms are now distributed.[2]

b. Second, Shiloh IV Wind farm's mortality report mentioned in the SWEA, referenced in the Bio Memo, falls far short of a complete picture of (a) what degree of eagle take may have occurred on that project site since the study was completed, and (b) what can and may

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[1] USFWS. (June 2014). Final Environmental Assessment Shiloh IV Wind Project Eagle Conservation Plan. p. 33. Retrieved from: https://www.fws.gov/cno/conservation/MigratoryBirds/ShiloIV-FONSI/Attachment1-FEA-ShilohIV-June2014.pdf

[2] McKernan, R. Wagner, W., Landry, R. and McCrary, M. (1984). Utilization by Migrant and Resident Birds of the San Gorgonio Pass, Coachella Valley, and Southern Mojave Desert of California. Prepared for Research and Development Southern California Edison. 242 pp.

happen at this Project over the course of this Project's lifetime. As iterated in my original comments, the reviewer has no way of knowing what impact *this Project in this location* with taller turbines *that exists in proximity to various historical eagle nesting territories* (as per the Bittner/WRI report cited in the IS/MND) may have on nesting, since it provides no valid, or current baseline (see my original comments) information on how many eagles may occur within this given location whatsoever. As iterated with evidence in my original comments, the WRI eagle report is so outdated to be irrelevant regarding population status, the data was collected illegally, and is invalid in its determinations of eagle nesting status. However, the fact that golden eagles have a historical record of nesting in proximity to the Project site is as relevant today as it was ten and twenty years ago. What remains unknown, and un-surveyed, is how many eagles may be impacted via impacts to nesting, breeding, and foraging, by the new Project turbines.

c. Third, the inference that the Bio Memo repeatedly relies on, specifically that the term 'repowering' equates the one and only relevant outside project comparison for this Project's impacts to eagles - or other avian species - is unscientific, a logical fallacy. In fact, the SWEA states that, in respect to accuracy of impact analysis for Shiloh IV, "we believe that the number of eagle fatalities in the WRA could be higher than the currently reported from post-construction monitoring or other incidental detections in view of limited search intervals, limited search areas, and existing land use /cropping patterns."[3] USFWS eagle biologists go on to state that "The effect of turbine-related golden eagle fatalities on the local population is dependent on the age, status, and origin of the individual eagle. Direct mortality of golden eagles could adversely affect local survival and fecundity, and could thereby affect local and possibly regional populations. **The biological impact of killing an eagle within the WRA on the overall population depends on the type of eagle killed: a breeding adult, a juvenile, or a floater**.[Emphasis added.]" In other words, risk, take, and thus significant impacts from the Project could come down to a few or even one eagle. The fact is the IS/MND has provided no valid, current information on the local eagle population relevant to the Project site, its nesting or foraging status, nor on any changes that may have occurred (i.e. increased nesting activity) in recent years in proximity to the Project, therefore no valid or accurate comparison can be made regarding an unknown site baseline and impacts that may occur in the near and projected future life of the Project.

d. The inference of the Bio Memo is that a mortality report snapshot of zero eagle take at Shiloh IV - which apparently is what Mr. Ramsey is referring to when he erroneously claims

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[3] McKernan, R. Wagner, W., Landry, R. and McCrary, M. (1984). Utilization by Migrant and Resident Birds of the San Gorgonio Pass, Coachella Valley, and Southern Mojave Desert of California. Prepared for Research and Development Southern California Edison. P. 32

there has been no eagle take "at all since repowering" (for which the Bio Memo provides no conclusive evidence of to present, since the data referenced in the EA does not include the past six years) - is not the entire picture represented by Shiloh IV. USFWS also states in the SWEA, "Because the Shiloh IV was largely a repowering project...the project resulted in vastly greater spacing between turbines and the removal of lattice towers that provided perches for eagles and other birds. However, the total risk area to eagles also increased because of the larger size of the turbine blades. Under all alternatives, Shiloh IV will actively discourage establishment of an increased prey base through project design and maintenance and will coordinate with landowners to encourage responsible livestock husbandry and immediate removal of livestock carcasses to avoid attracting eagles into the project area."[4]

In respect to reducing eagle take after the repowering phase, the SWEAs also says, "Four active nests and territories have been identified within 10 miles of the project area: one nest approximately 1 mile east of the project area, one approximately 5 miles northeast of the project area, and two 10 miles southwest and south of the project area (Figure 3-1). Nesting adults and juveniles from these nests are at risk from project operations. We have evaluated these risks in the context of existing foraging and operational conditions and find that the nest nearest to the project area is at greatest risk. However, due to existing farming operations and a limited prey base, foraging throughout the project area is of lower quality than in nearby grassland areas. Ongoing farming operations have been observed to reduce or eliminate prey such as ground squirrels, because they are killed or their burrows are removed during agricultural operations. Nearby unfarmed areas likely support higher prey populations because of this decreased disturbance, which allows populations to persist and reproduce more readily without periodic fatalities from farming operations."[5]

This underscores three points ignored by the IS/MND and the Bio Memo when it refers to the SWEA: (a) USFWS asserts that by design a repowering project can increase risk of impacts to eagles, (b) it is quite likely that minimization of eagle take by the repowered Shiloh IV occurred thanks to Shiloh IV following the recommendations made by USFWS for reducing take, including those mentioned above, in addition to proximity to agricultural operations, and (c) knowing the current status of nearby eagle territories is essential for accurate impact analysis. In summary, USFWS acknowledges that the repowering project can increase take despite a reduction in turbines overall, and that other variables are

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[4] McKernan, R. Wagner, W., Landry, R. and McCrary, M. (1984). Utilization by Migrant and Resident Birds of the San Gorgonio Pass, Coachella Valley, and Southern Mojave Desert of California. Prepared for Research and Development Southern California Edison. p. 33

[5] *Ibid.* p. 32

equally and more relevant to reduced eagle take than reduced turbine numbers. This third point is reiterated elsewhere for other repowered wind farms as well.[6] It is important to note that while the Bio Memo is referring to the repowered Shiloh IV project as an equivalent standard for eagle take comparison, the USFWS state in the SWEA that there could be no significant adverse cumulative impacts to eagles *if* the Applicant offsets them with compensatory mitigation unlike any mentioned in the IS/MND, and "through the implementation of experimental ACPs (Advanced Conservation Practices" ("e.g. visual and auditory deterrence procedures, and monitoring flight patterns in the WRA.)"[7] No such mitigation protocols are suggested by the IS/MND to reduce significant cumulative take of eagles over the life of the Project, and the IS/MND does not provide adequate or substantial evidence that such impacts will not occur. Therefore assumptions of equivalent risk and thus impacts to eagles between Shiloh IV and this Project being very similar are erroneous.

e. The Bio Memo relies heavily on its assertion that the (ill-defined) current environmental baseline contributes to greater impacts than the Project will purely by default of the number of turbines being reduced, and yet provides no concrete evidence to support this. On the other hand, abundant evidence exists that challenges the persistence of the assumption that numbers of turbines are the only factor, or only relevant factor, impacting mortality rates:

In their year 1 report of bird and bat mortalities of the Golden Hills Wind Energy Center, a repowered region of Altamont Pass Wind Resources Area (APWRA), H.T. Harvey and Associates used dogs to aid in the detection of carcasses. Their improved search methodology resulted in findings where they concluded that, compared to the pre-repowering bird years of the APWRA-wide avian fatality monitoring study, mortality estimates were higher for golden eagles and red-tailed hawks.[8] In their two-year study of the APWRA in 2003-2004, the researchers designed the study to perform spatial analysis of raptor flight heights in order to elucidate flight patterns in response to topographic features and wind conditions. The study goal was to forecast avian mortality in the repowered APWRA under two scenarios, and included observations of bird behaviors recorded during study in the APWRA, in order to analyze the effect of attributes of the proposed new wind turbines and their spatial locations and arrangements in the repowered APWRA. Their

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[6] H.T. Harvey and Associates. (2017). Golden Hills Wind Energy Center Postconstruction Fatality Monitoring Report: Year 1. Prepared for Golden Hills Wind LLC. 97 pp.
[7] USFWS. (June 2014). Final Environmental Assessment Shiloh IV Wind Project Eagle Conservation Plan. Retrieved from: https://www.fws.gov/cno/conservation/MigratoryBirds/ShiloIV-FONSI/Attachment1-FEA-ShilohIV-June2014.pdf. pp. 17, 39
[8] H.T. Harvey and Associates. (2017). Golden Hills Wind Energy Center Postconstruction Fatality Monitoring Report: Year 1. Prepared for Golden Hills Wind LLC. 97 pp.

conclusions from over a thousand observations were several, including the fact that golden eagles and other raptors (i.e. red-tailed hawks) were consistently observed flying at varying heights between 50 and 200 m (164 and 656 feet). They also found that golden eagles flew over flat terrain nearly 7 times more often than expected by chance, and otherwise favored west- and south-facing slopes, and most strongly avoided southwest and east slopes.[9] A systematic study by Loss *et. al.*[10] looked at mortality rates and risk to birds by monopole turbines (similar to those proposed for the Project) throughout the U.S., concluding that "between 140,000 and 328,000 (mean = 234,000) birds are killed annually by collisions with monopole turbines in the contiguous U.S. **We found support for an increase in mortality with increasing turbine hub height... Evaluation of risks to birds is warranted prior to continuing a widespread shift to taller wind turbines**. Regional patterns of collision risk...may inform broad-scale decisions about wind facility siting."[11] Other studies similarly conclude that, as asserted in my original comments, size of turbines matter when it comes to mortality rates of birds as well as bats.[12] Indeed, the SWEA that the Bio Memo mentions refers to differential mortalities among both birds and bats based upon differential turbine heights.[13] In Hotker's research on the impact of repowering of wind farms on birds and bats, the overriding conclusion was that, "the results of modelling show that in all cases repowering has a negative impact on birds – larger wind turbines have higher collision rates than smaller ones (see also chapter 4.2)."[14]

These findings support the reality that impacts from wind farms to raptors involve a host of variables, including size, design, height, the micro-siting of turbines, location in respect to slope, habitat, ecotones, hills, breeding territories, and migratory pathways. Therefore for the IS/MND and the Bio Memo to conclude the

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[9] Smallwood, K. S., and L. Neher.(2004). *Repowering the APWRA: Forecasting and Minimizing Avian Mortality Without Significant Loss of Power Generation.* California Energy Commission, PIER Energy-Related Environmental Research. CEC-500-2005-005. 21 pp.

[10] Loss, S. R., T. Will, and P. P. Marra. (2013). Estimates of bird collision mortality at wind facilities in the contiguous United States. *Biological Conservation* 168:201–209.

[11] *Ibid.* p. 1

[12] Smallwood, K. S. (2007). Estimating wind turbine-caused bird mortality. *Journal of Wildlife Management* 71:2781–2791.

[13] USFWS. (June 2014). Final Environmental Assessment Shiloh IV Wind Project Eagle Conservation Plan. Retrieved from: https://www.fws.gov/cno/conservation/MigratoryBirds/ShiloIV-FONSI/Attachment1-FEA-ShilohIV-June2014.pdf. pp. 17, 39

[14] Hotker, H. (2006). The Impact of Repowering of Wind Farms on Birds and Bats. Nature and Biodiversity Conservation Union. p. 24. Retrieved from: https://bergenhusen.nabu.de/imperia/md/images/bergenhusen/impact_of_repowering.pdf

Project will have no significant impacts based solely on the theory that reduced number of turbines will reduce impacts is not only unproven and negated by the evidence at hand, but ignores the purpose and scope of these studies that seek to better inform repowering projects about how to truly reduce impacts with the assistance of advanced conservation best practices elucidated in their findings.

2. Despite the detailed evidence provided in my original comments,[15] the Bio Memo claims that the IS/MND's purported amount of habitat disturbance of "36.33 acres" as proposed is not underestimated. First, in making this claim Mr. Ramsey ignores the fact that in my comments I provided extensive evidence supporting how the IS/MND underestimates and mischaracterizes permanent (2.59 according to the IS/MND) vs. temporary impacts; he makes no argument to counter my evidence and thus my argument stands as presented. Neither does the Bio Memo – or the IS/MND – explain with any clarity how they came to the conclusion of what all impact disturbances will be, what habitats (or resident species) comprise the 36.33 acres of "disturbance" specifically, or exactly what the sum total of temporary and permanent impacts are in relation to types of "disturbance". For instance, the IS/MND states that "For purposes of overseeing compliance with CVMSHCP requirements and with the Implementing Agreement (IA), a Joint Project Review (JPR) process shall be instituted by the CVCC for Project impacts within the Upper Mission Creek/Big Morongo Canyon Conservation Area to address 2.59 acres of permanent disturbances within the Conservation Area."[16] The IS/MND also states that "The Project will have 0.25 acres of permanent impacts and 2.20 acres of temporary impacts to potential non-wetland USACE waters of the U.S., and 0.25 acres of permanent impacts and 2.20 acres of temporary impacts to CDFW streambed." [17] Yet no impacts are described or broken down in detail for this purported 2.59 acres of "disturbance" or wetland impacts. Without clarification of what habitat is impacted in totality of the Project site, where, and how, what species may be present on this habitat, once again it is impossible for the reviewer to make any accurate analysis of the nature of the direct, indirect, or cumulative impacts these disturbances will have in respect to significant impacts, not to mention any clarity on how they are proposed to be successfully mitigated.

Instead, the Bio Memo defends the IS/MND's disturbance values by stating, vaguely, "the surveys coincide with the disturbance area of 36.33 acres and do not underestimate impacts." It goes on to say it is a "covered project" under the CVMSCHP and the habitat "disturbance" was vetted (despite the fact that the IS/MND repeatedly refers to JPR as a process to occur in

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[15] R. Owens, Letter from Renée Owens to Kyle Jones (Nov. 27, 2018) Comments for the Painted Hills Wind Repowering Project Initial Study, Commercial WECS Permit No. 180001 / Variance Case No. 180003 – Intent to Adopt a Mitigated Negative Declaration – CEQ180059

[16] LSA Biological Resources Assessment (BRA) p. 15

[17] *Ibid.* p. 14

the future). First, the JPR provided upon request by CURE – not within the IS/MND – is referred to as incomplete, and it is submitted as a "draft", thus not finalized. Second, the JPR states the there are "45 acres of proposed new disturbance". Third, the JPR characterizes impacts further as applying to the Jerusalem Cricket (5.50 acres), Desert Tortoise (43 acres), and Sand Source areas (43 acres). These impacts are not identified or clarified in the IS/MND. Fourth, simply because a Project is "covered" under a Plan, by definition of its location, does not certify that impacts have been accurately estimated, described, or mitigated by the IS/MND, indeed they have not as iterated by the evidence above and in my original comments.

3. The Bio Memo says that CURE comments find fault with survey protocols and methods. This is an inaccurate assessment, the IS/MND is devoid of current ground-truthing surveys and any other current, comprehensive protocol surveys for wildlife or rare plants; therefore it is impossible to analyze (and thus describe faults) with protocols and methods of surveys that do not - but should – exist in order to assess impacts appropriately. What CURE finds fault with is this complete lack of valid and applicable surveys to establish any coherent picture of the Project's baseline biological resources beyond generic habitat types and species that "may" occur based on databases and highly outdated surveys.

The Bio Memo asserts that no evidence is provided that sensitive avian species "must" occur on site, and as with the IS/MND claims that if sensitive species do occur impacts will be "covered" under the CVMSCHP. In actuality, my original comments stated that in order for the IS/MND to assess impacts it should show a moderate / high likelihood of species to occur based on surveys to assess risk. To ask for evidence that they "must" occur is not what is required by the reviewer nor what my comments detailed. The need for specific, thorough, current information to assess degree, type, and duration of impacts to sensitive birds (as well as other species) has already been spelled out in evidentiary detail in the original comments on biological resources; such detail on impacts as well as mitigation protocols are lacking, as already iterated extensively. DUDEK's response opinion repeatedly ignores this argument presented, so much so that one wonders if Mr. Ramsey actually read the comment letter in its entirety.

The onus is on the IS/MND to demonstrate that sensitive species do not and will not occur onsite. With zero focused, current species surveys of any kind they failed to meet this burden. Meanwhile, the existence of a Habitat Conservation Plan does not preclude the IS/MND's requirement to adequately describe exactly how (as of yet unknown) baseline conditions that include impacts to sensitive birds will be mitigated. Simply referring to the HCP does not fulfill the requirement for a clear description of what impacts will be, not just for the short-term impacts as may be addressed by pre-construction surveys for burrowing owls or other nesting species, but also for the long term impacts due to habitat disturbances (temporary and permanent), and due to the presence of turbines of new designs and in new locations.

Saying "most sensitive bird species that may be present on site are covered under the Plan" is, as clarified in evidentiary detail in my original comments, completely unsatisfactory for CEQA. In addition to those arguments posed, "most" is not good enough. Which species are not covered? For those that are even mentioned in the CVMSHCP, how will any loss of foraging and breeding habitat, or injury and deaths from permanent direct, indirect, and cumulative disturbance to habitat actually mitigated? None of these questions are answered by the IS/MND, indeed neither are they addressed – for this Project - by the CVMSCHP either. How will turbine related deaths from purportedly taller turbines, constructed in new sites that may have greater impacts based on locations in respect to slope, hillsides, proximity to raptor nesting territories, etc. than previously in existence be mitigated?

New turbines are proposed for construction closer to the north end of the Project site in the mountain foothills where none have been in existence prior. As mentioned above, numerous studies have demonstrated that multiple variables affect bird behavior and resultant mortalities around turbines, including where turbines are located in respect to slope degree and position, proximity to other turbines, proximity to certain habitats, and proximity to nest territories. Additionally, the scientific literature is replete with data revealing that most bird species studied, including golden eagles and other raptors, have a high natal site fidelity.[18,19,20,21] As such, their evolutionary proclivities dictate that regardless of new, anthropogenic constructs that may pose impacts or otherwise create a negative disturbance, they retain a high affinity for their location of hatching, not just for breeding but also foraging, even if they are long distance

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[18] DeSorbo, C. R., D. Riordan, J. Tash, R. B. Gray and Hanson, W. (2015). Documenting Areas of Importance to Maine Subadult Bald Eagles: Insights from Satellite Telemetry. Report #2014-24 prepared for the Maine Outdoor Heritage Fund, Portland, ME, The Bailey Wildlife Foundation, Cambridge MA, and the Maine Department of Inland Fisheries & Wildlife, Bangor ME. 38 pp.

[19] Beringia South. (2013). Golden Eagle Breeding Ecology and Resource Selection in South Central Montana. https://static1.squarespace.com/static/528f911de4b01f2a31514e96/t/56e9c5fa62cd94b74de00845/1458161149635/2013_Livingston_GOEA_AnnualReport.pdf

[20] Pagel, J.E., D.M. Whittington, and G.T. Allen 2010. Interim Golden Eagle inventory and Monitoring protocols; and other recommendations. Division of Migratory Bird Management. U.S. Fish and Wildlife Service. https://www.fws.gov/southwest/es/oklahoma/documents/te_species/wind%20power/usfws_interim_goea_monitoring_protocol_10march2010.pdf.

[21] Driscoll, D.E. 2010. Protocol for golden eagle occupancy, reproduction, and prey population assessment. American Eagle Research Institute, Apache Jct., AZ. 55pp. Https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83955&inline

migrants. When conducting research of banded birds that migrate thousands of miles, I have observed first year offspring return to the same branch of the same tree to construct a nest within inches of the one from the previous year where they hatched. I have observed raptors (golden eagles, re-tailed hawks, Swainson's hawks) return to the same grove, tree, or cliff face to nest where they hatched. It is also abundantly documented that birds' avoidance of human activities and constructs may have significant adverse effects on their distribution and abundance.[22] This response can have adverse influences on their breeding success, feeding success, range use, reproduction, fecundity, survival, and abundance at the population level.[23, 24,25,26,27,28,29] And yet the IS/MND and the Bio Memo make no mention of the potential for new impacts to raptors and other protected bird species by the Project based upon the siting and location variables relevant to new turbines proposed.

Golden Eagles

Despite the specious claims to the contrary in the Bio Memo, the IS/MND ignores the evidence provided in comments, and the onsite reality, that the Project poses a risk of significant impacts to various sensitive bird species. The IS/MND does infer that golden eagles will be impacted by the Project by its referral to an eagle survey by WRI. However, as my comments demonstrate in detail, that survey is completely inadequate for several reasons, not the least of which being it

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[22] Ruddock, M. and Whitfield, D. (2007). A Review of the Disturbance distances in Selected Bird Species. A Report from the Natural Research Project Ltd. To Scottish Natural Heritage. Retrieved from: https://www.nature.scot/sites/default/files/2018-05/A%20Review%20of%20Disturbance%20Distances%20in%20Selected%20Bird%20Species%20-%20Natural%20Research%20Ltd%20-%202007.pdf

[23] Burger, J. & Gochfeld, M. (1991). Human distance and birds: tolerance and response distances of resident and migrant species in India. *Environmental Conservation*, 18, 158–165.

[24] Fernández, C. & Azkona, P. (1993). Human disturbance affects parental care of marsh harriers and nutritional status of nestlings. *Journal of Wildlife Management*, 57, 602-608.

[25] Madders, M & Whitfield, D.P. (2006). Upland raptors and the assessment of wind farm impacts. *Ibis*, 148, 43–56.

[26] Walker, D., McGrady, M., McCluskie, A., Madders, M. & McLeod, D. (2005). Resident Golden eagle ranging behaviour before and after construction of a windfarm in Argyll. *Scottish Birds*, 25, 24-40.

[27] Fraser, J.D. (1983). The impact of human activities on bald eagle populations - a review. Pages 68-84 in Gerrard, J.M. and T.N. Ingram, Eds. *The bald eagle in Canada*. White Horse Plains Publishers, Headingley, Manitoba.

[28] Gill, J.A., Norris, K. & Sutherland, W. (2001). Why behavioural responses may not reflect the population consequences of human disturbance. *Biological Conservation*, 97, 265-268.

[29] Winkelman, J.E. (1992). Effects of the Sep wind farm at Oosterbierum (Fr.) on birds, 1-4, collision victims, nocturnal collision risks, flight behaviour during daylight, and disturbance. *RIN-Report* 92/2-5. Instituut voor Bos- en Natuuronderzoek (IBN-DLO), Arnhem, The Netherlands.

is far too old to represent the current baseline for the Project.[30] What the WRI survey does reveal that is relevant to the Project is that the Project site is in close proximity to several historical nesting golden eagle territories, and given the natal site fidelity mentioned above, a new survey is essential to establish the baseline conditions and assess impacts from new towers - including those to be located closer to some of the nest territories than any turbines already in existence – to local eagle individuals and the population. This necessity is underscored by the fact that both the USGS and USFWS have more recently determined that "take" by a wind farm of more than even one eagle per year to be potentially significant to the population level.[31,32,33] This reality reinforces the potential of the Project to have significant long term, cumulative impacts to eagles as new information is gathered regarding eagle mortalities at wind farms, including in the Project regions, where USFWS "estimates that on average more than 20 golden eagles are probably killed each year among the wind turbines of San Gorgonio Pass."[34]

Burrowing owls

The IS/MND acknowledges that there is a **moderate** potential for burrowing owls to be impacted by the Project. In actuality the potential for them to occur is **high** based upon (a) CNDDB accounts for the burrowing owl for this area, (b) the habitat types on and near the site are preferred by burrowing owls, and (c) the CVMSHCP (Plan) has observed them throughout almost every site noted in their species account report, including those in close proximity to the Project site, which is a primary reason why they are a species protected under the Plan for this region.[35] However, it does not come close to offering adequate mitigation since it only

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[30] USGS. (Sept 2016.) Roughly over a quarter of the golden eagles killed at the Altamont Pass Wind Resource Area in Northern California from 2012-2014 were recent immigrants to the local population. Retrieved from: https://www.usgs.gov/news/local-wind-energy-development-has-broad-consequences-golden-eagles

[31] USFWS (2018). Retrieved from: https://www.fws.gov/cno/conservation/MigratoryBirds/EaglePermits.html

[32] Pagel, J.E., D.M. Whittington, and G.T. Allen (2010). Interim Golden Eagle inventory and Monitoring protocols; and other recommendations. Division of Migratory Bird Management. U.S. Fish and Wildlife Service.

[33] Katzner, T., Nelson, D., Braham, M., Doyle, J., Fenandez, N., Duerr, A., Bloom, P., fitpatcik, M., Miller, T., Culber, R., Braswell, L., and DeWoody, J. (2016). Golden Eagle fatalities and the continental-scale consequences of local wind-energy generation. *Conservation Biology*. 31 (2): 406-415. Retrieved from: https://www.usgs.gov/news/local-wind-energy-development-has-broad-consequences-golden-eagles

[34] James, I. (July 3, 2014). Groups raise concerns about eagle deaths at California wind farms. *The Desert Sun / USA Today*. Retrieved from: https://www.desertsun.com/story/news/environment/2014/07/03/palm-springs-bald-eagles-dying-windmills/12205617/

[35] Coachella Valley Association of Governments. August 2016. Species Accounts and Conservation Measures. Final major Amendment to the CVSMHCP.

addresses the potential for impacts during the construction phase, and ignores addressing the Project baseline, scope, or mitigation of impacts to burrowing owls for cumulative, direct, and indirect impacts for the life of the Project other than those that may occur during construction.

4. The Bio Memo attempts to justify a lack of relevant, current surveys by stating that "many days" were spent for the vaguely described "jurisdictional delineations". Since the term jurisdictional delineations is used in the IS/MND to be synonymous with wetland delineations, one must assume it is intended to be the same here. To that end, it clearly does not support my comments demonstrating the lack, and necessity, of focused, protocol, or otherwise established method searches for any and all relevant vertebrate and invertebrate taxa. To state what is usually obvious, wetland delineations are very specific protocols for identifying and mapping wetlands and reporting them in a way the jurisdictional agencies have designated. They involve no aspect of methodically searching for, detecting, mapping, recording, or observing any species of animal, fungi, or plants aside from any onsite plants relevant that assist in the wetland delineation process. ESA species searches require permits, MOUs, and/or certifications; they also require special training and methodologies that necessitate very specific "focus" on the species/ taxa at hand in order to make a comprehensive and scientific search (hence the term, focused surveys) while minimizing the potential for the observing biologist (as opposed to a hydrologist) to harass protected species. It is absurd to suggest that wetland delineations can and do replace wildlife surveys of any kind. It is equally specious to infer that "many hours" spent looking at the literature can replace ground-truthing to establish baseline conditions, especially when that literature is not from the Project site and / or is several years old and thus not necessarily representative of what exists at present onsite.

The Bio Memo also points to the NREL study to conclude that risks to avian species in the San Gorgonian Pass are low. This is an erroneous conclusion for several reasons:

a) My original comments provide evidence that this has not been confirmed due to a lack of baseline evidence, as well as my referral to the long list of bird species in the CNDDB observed for the Project region.[36] And as noted above, USFWS and USGS have noted an

[36] R. Owens, Letter from Renée Owens to Kyle Jones (Nov. 27, 2018) Comments for the Painted Hills Wind Repowering Project Initial Study, Commercial WECS Permit No. 180001 / Variance Case No. 180003 – Intent to Adopt a Mitigated Negative Declaration – CEQ180059

increase in observations of eagles, including mortalities, in the San Gorgonio Pass region near the Project.[37,38]

b) Two detailed studies were prepared for, and funded by, the Southern California Edison Company to assess the use and abundance of birds in the San Gorgonio Wind Resources Study Area (WRA). This research was requested to analyze use of the area where this Project and neighboring wind farms are now located for the specific purpose of analyzing the potential for wind farm impacts to avian species.[39,40,41] The research studied both daytime and nocturnal use of the region by resident and migrant species. The studies identified the region as comprising major routes of migration for a host of species and a major route for migrating birds crossing the desert.[42] Additionally, the two-year census involved 24 observation sites – several within 1 - 2 km of the Project – that concluded the area to be a flyway with high species richness. The also state that "of the approximately 535 species of birds that have been recorded in California, 306 of these were observed during this study, with 217 species in San Gorgonio Pass, and 262 species in the Coachella Valley. A greater percentage of migrant birds vs. resident birds were recorded in all areas."[43] Protected species detected included golden eagle, burrowing owl, Swainson's hawk (CESA listed), yellow warbler, and southwestern willow flycatcher (ESA listed). These findings are significant not only because they demonstrate an abundance of bird use in the Project area, but also that migrants that may not use the habitat for breeding – **and thus not normally**

[37] James, I. (July 3, 2014). Groups raise concerns about eagle deaths at California wind farms. *The Desert Sun / USA Today*. https://www.desertsun.com/story/news/environment/2014/07/03/palm-springs-bald-eagles-dying-windmills/12205617/

[38] Lovich, J. USGS. (2015). Golden Eagle mortality at a wind-energy facility near Palm Springs, California. Western Birds. Western Birds 46:76–80. https://www.westernfieldornithologists.org/archive/V46/46(1)-p076-p080.pdf

[39] McCrary, M., McKernan, R., Landry, R., Wagner, W., and Schreiber, R. 1983. Nocturnal Avian Migration Assessment of the San Gorgonio Wind Resource Study Area, Fall 1982. Report Prepared for Research and Development Southern California Edison Company by the L.A. County natural history Museum Foundation. 142 pp.

[40] McKernan, R., Wagner, W., Landry, R. And McCrary, M. 1984. Utilization by Migrant and Resident Birds Of the San Gorgonio Pass, Coachella Valley, and Southern Mojave Desert of California. Report Prepared for Research and Development Southern California Edison Company by the L.A. County natural history Museum Foundation. 254 pp.

[41] McCrary, M. D., R. L. McKernan, and R. W. Schreiber. 1986. San Gorgonio wind resource area: Impacts of commercial wind turbine generators on birds, 1985 data report. Prepared for Southern California Edison Company.

[42] *Ibid.*

[43] *Ibid.* p. 86

detected by breeding bird surveys, or anticipated by habitat type onsite – could be significantly impacted throughout the life of the Project.

Swainson's hawk

c) It is also important to note that the risk of the Project impacts to the Swainsons' hawk, a California ESA threatened species, is ignored by the IS/MND and the Bio Memo. However, the IS/MND's own eagle report notes sightings of the Swainson's hawk in the vicinity as does the McKernan *et. al.* census.[44] The risk of impacts by turbines to this species even when a species is a migrant (non-resident), is underscored by the fact that the mitigation protocols for the Ocotillo Wind facility in the Sonoran desert, hundreds of miles from Swainson's hawk breeding grounds, include turbine curtailment upon sighting of Swainson's hawks during standard operation throughout the life of the project.[45]

d) Upon careful review of the NREL study - touted by the Bio Memo as primary evidence to disregard project impacts to birds - it can be determined that the findings are suspect in their relevance, and worse, statistically invalid, according to experts and by the study authors' own admission: The NREL study states,

"This study was not specifically designed to provide standardized estimates of avian fatalities. The wide interval between searches (90 days) led to a high level of uncertainty in the fatality estimates. The unknown impact of scavenging on the fatality estimates could greatly impact them...The lack of random assignment of treatments to experimental units may have caused some variables to be confounded. For example, there were no lattice structures in the Phase II geographic locations, possibly confounding the effect of turbine type with geographic location. Differences in overall fatality rates or risk index between tubular towers and lattice towers may be due to differences in geographic location and not differences due to turbine type. Scavengers, predators, and other removal sources (e.g., oiled carcass sinking in water, carcasses plowed into field) may remove carcasses between the time the casualty occurs and the time the next search is conducted. Estimating scavenging rates is vital to providing good fatality rates (Erickson et al. 2000)...Due to the low fatality rates [observed], strong patterns in comparison results of fatality and the risk

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[44] McCrary, M. D., R. L. McKernan, and R. W. Schreiber. 1986. San Gorgonio wind resource area: Impacts of commercial wind turbine generators on birds, 1985 data report. Prepared for Southern California Edison Company.

[45] BLM. 2012. Avian Bat and Bird Protection Plan for the Ocotillo Wind Energy Facility. http://www.ocotilloeccmp.com/Wild_1p_Avian%20and%20Bat%20Protection%20Plan.pdf

index among levels of factors such as geographic location and type of turbine were not very apparent."

The authors go on to say that, "This was a mensurative study (Hurlbert 1984, Morrison *et al.* 2001) designed to provide statistical evidence regarding differences in use, fatality rates, and the risk index among levels of multiple factors. In addition, confounding of some factors existed. For example, the *Medium* elevation area for Phase I had no large tubular towers when studied. Therefore, geographic location was confounded with turbine type, and significant differences observed may be due to geographic location or to turbine type. The basic study design was a stratified random design, with geographic location, turbine sizes, and tower types used in defining strata (p. 4)".[46]

It is ironic that the authors reference Hurlbert's article that is an excerpt from his seminal text, The Design of Experiments, with associated statistical analysis. As a graduate student of Dr. Hurlbert's, I became very familiar with the fatal flaw of pseudoreplication highlighted in his book, which by the NREL's own admission they reveal to have committed in their study. Specifically, they state that they "confounded" location with turbine type. This a fundamental flaw that amounts to pseudoreplication, a profound design error that invalidates the entire experiment's statistical conclusions based upon the fact that the design assumptions used for the statistical analyses -namely of replication of treatments, and in this case additionally the assumptions of randomness (for a stratified random design) - were not met; the authors acknowledge both lack of randomly assigned treatments, and lack of equivalent treatments. To be clear, pseudoreplication is no minor detail or experimental minutiae; when committed it invalidates conclusions about the data's relevance to the population they purport to represent (one main reason why Hurlbert devoted so much time in his expository text and research defining the problem and how to avoid it). It is further defined as the use of inferential statistics to test for treatment effects with data from experiments where either treatment is not accurately replicated or replicates are not statistically independent.[47] Put simply, it involves incorrectly defining and thus artificially inflating the number of samples or replicates. As a result, statistical tests performed on the data are rendered invalid.

In other words, pseudoreplication can be described as is the testing for treatment effects with an error term inappropriate to the hypothesis being considered. Hurlbert defines this as unwanted nondemonic intrusion quite specifically; where it results in impingement of

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[46] IS/MND p. 760

[47] Hurlbert, S.J. 1984. Pseudoreplication and the design of ecological field experiments. *Ecological Monographs* 54:187-211.

chance events on an experiment in progress. As a safeguard against it – as well as preexisting gradients – appropriate assignation and interspersion of treatments is considered not to be preferential, but an obligatory feature of essential design. Comprehension of the conflict between interspersion and randomization is aided by distinguishing pre-layout (or conventional) and layout-specific alpha (probability of type I error).[48] In the case of this NREL study, by the author's own admission of lack of appropriate treatment identification and invalid randomness assignations they have committed pseudoreplication, and more. This invalidates the referential conclusions of the study since the experimental design does not match the assumptions the statistics are based upon. As such, the veracity of the report is in serious question, since this report would not be accepted to a peer review journal due to its fatally flawed statistics and lack of statistical power. Additionally, assumptions about relevance to the regional scenario and population as a whole that are theoretically represented are also invalid.

e) It is also ironic that the IS/MND has chosen as their *other* document supporting their claim of less than significant impacts to birds a summary report ("Report") by a wind project's contracted environmental consultant (CH2M Hill), to support this IS/MND's theory of minimal Project impacts to birds. Once again, the cited Report fails to contribute to the required baseline for this Project, since it is too old to be relevant for reporting the current baseline of resident and breeding species in proximity to and within the Project site, and more to the point the studies it refences are not directly related to the Project.[49] As importantly, the CH2M report is a summary of other studies, it is not a survey of the Project site as the IS/MND infers from its conclusions.

The IS/MND cites the Report as evidence that their new monopole turbines will unquestionably have reduced impact, yet (a) the summary of the findings of the Report as stated in IS/MND is incomplete and deliberately misleading; (b) the findings of the Report are not in agreement with has been determined by several studies of repowered wind farms conducted by independent researchers across the U.S. (noted in detail and citations above), and (c) the Report's singular conclusions are based upon experimental assumptions of like comparisons where these assumptions are erroneous. The Report treats various studies of differing variables and different treatments from different sites and locations as equitable when they are not; from bird studies using a wide variety of methodologies and

[48] Hurlbert, S.J. 1984. Pseudoreplication and the design of ecological field experiments. *Ecological Monographs* 54:187-211.

[49] CH2M Hill. 2011. Painted Hills IV Wind Energy Project, Avian Use. Prepared by Patti Murphy and David Phillips. May 31, 2011.

experimental rigor; some at wind sites, some at repowered wind sites, some with no structures; all studying different variables, some experimental, others observational. These studies are informative, but only so far as their discussion and conclusions accurately reflect the individual study's goals and theories being tested/observed. However, the Report cherry-picks data they choose as relevant, and pool the data into a singular summary conclusion. To do this with any statistical significance or scientific integrity, such a report should conduct a meta-analysis with appropriate statistical design and analysis. However, the Report made no attempt to do this, choosing instead to loosely describe different studies and then conveniently draw the conclusion that based, upon their "analysis", the proposed project they have been contracted to analyze will result in no significant impacts to birds.

Further, the Report makes subjective, vague, and unsupported determinations upon which the IS/MND extrapolates and relies upon for *their* impact analysis claims of low impacts to birds as well. For instance, the CH2M Report claims that "during the surveys" – though not citing exactly which study or surveys they are referring to - one area had "low" numbers of avian species. However, they do not attempt to describe or otherwise indicate what "low" means in respect to any sort of baseline, population, or comparison, or by what measure or relevant to what variable "low" is being assessed. They also assume that "low" species numbers are indicative of low mortality, confusing variables of richness with other unmentioned characteristics that may be equally important, including density, abundance, and whether or not species in question are rare, protected, etc. Elsewhere in the Report CH2M subjectively chooses studies – and more importantly, subjectively summarizes the findings from these reports - about other potentially relevant variables, such as bird flight height. For instance, based upon one study they claim that birds fly too high to be impacted significantly by *their* proposed project's turbines. One of several distinctions that they blur in drawing such a conclusion is that migratory birds may tend to fly higher than resident birds on average, since residential birds are foraging, breeding, perching, nesting, etc., whereas migrants tend to be doing just that, migrating from wintering to breeding grounds or vice-versa. However, this does not preclude the fact that different species fly at highly variable heights, and resident bird abundance, richness, density, and use of habitat for foraging in and around turbines all play a role in the risks to resident species; risks not actually addressed in the CH2M summary.[50,51,52]

The CH2M Report also states that, "Though focused bird use counts have not been conducted for Painted Hills IV or for many of the recently proposed wind energy projects in the vicinity, some information is available based on incidental sightings recorded as part of more general wildlife survey reports. The information is presented here to further qualitatively characterize avian use in the area."[53] Incidental sightings are anecdotal by definition, and not part of scientific evidence that can be used to make quantitative and qualitative declarations that the Report sets out to do, drawing major conclusions about the Painted Hills IV site as a "low impact" project based upon these inferences and anecdotes. Additionally, the Report claims that taller turbines would not pose a "greater" risk to birds because one of McCrary's cited nocturnal surveys stated that the "majority" of nighttime migrants flew well above the height of the proposed turbines. However, they make no mention of other studies (one of which they cite elsewhere for other conclusions) conducted during the daytime that show variable flight height results, nor do they make note of how sensitive resident species including burrowing owls and American kestrels are observed to fly at lower heights.[54] CH2M authors have a penchant for using terms like "most, many, high, low, majority" without assigning definitive statistical, numerical, or contextual meaning to these terms relative to the actual studies they are being drawn from. In addition to these omissions, for the most part the Report does not disclose the specifications of the turbines they are referring to in most of the studies they cite that involved turbines, instead they pose the turbines specifications for the future project they have been assigned to discuss, with the erroneous assumption that they can make comparisons across any repowering wind farm studies as relevant to their proposed project simply by default.

As if these omissions and errors weren't enough to raise doubt about the equanimity and resultant applicability of comparisons the Report makes, CH2M's broad-based, definitive

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[50] H.T. Harvey and Associates. (2017). Golden Hills Wind Energy Center Postconstruction Fatality Monitoring Report: Year 1. Prepared for Golden Hills Wind LLC. 97 pp.
[51] Arnett, E.B. and May, R. F. (2016). Mitigating Wind Energy Impacts on Wildlife: Approaches for Multiple Taxa. *Human–Wildlife Interactions* 10(1):28–41
[52] Loss, S. R., T. Will, and P. P. Marra. (2013). Estimates of bird collision mortality at wind facilities in the contiguous United States. Biological Conservation 168:201–209.

[53] IS/MND p. 735
[54] H.T. Harvey and Associates. (2017). Golden Hills Wind Energy Center Postconstruction Fatality Monitoring Report: Year 1. Prepared for Golden Hills Wind LLC. 97 pp.

conclusions include statements like "Studies of the San Gorgonio Pass, including data from the Painted Hills IV site, have documented relatively low numbers of avian species, including few observations of raptors". One cannot be sure which "studies" they are referring to, since their same Report cites studies by McCray and McKernan that find just the opposite.[55,56] The Report fails to conduct *any* of statistical analyses necessary in order to draw the broad conclusions they do. For instance, CH2M refers to point count data from a study that conducted very few observations overall (approximately 4- 6 per location, totally fewer than 8 hours of observations per site) and lumps it in with another study that created a model based on wholly different variables and assumptions, and then compiles the findings from these studies to singular conclusions of low impacts to birds by wind farms. It is one thing to present and discuss these findings in a descriptive summary for the sake of exposition or adding to a database, it is entirely another for the Report to take these findings and draw a singular conclusion from them as if they are comparable in design or statistical approach, especially when such a conclusion has the risk of allowing impacts to many species going unmitigated over decades. As the Report claims, "Based on the data available for the region and the turbine specifications and design elements incorporated into the Painted Hills IV Project, it is reasonable to assume that the Project would not contribute to significant adverse impacts to any avian species potentially present in the area."[57] Actually, based upon the erroneous comparisons and other errors described above, such a conclusion is not reasonable. This Report would never be accepted to a peer reviewed journal, and its findings cannot be taken as well-vetted science or evidentiary for something as important as impact analysis extrapolated two-fold for this Project.

5. The Bio Memo ignores the analysis and evidence put forth in my original comments regarding the lack of appropriate baseline data available to assess impacts to the golden eagle. (See also comments above establishing evidence of the presence of golden eagles in the region, and a potential increase in breeding and mortality of eagles.) In fact in the Bio memo Mr. Ramsey erroneously argues that CURE provides no evidence that the Project will increase impacts to eagles; I propose once again the burden is on the IS/MND to prove that the Project will *not* impose significant impacts to eagles (or present how impacts will be successfully mitigated), a burden they have clearly not met with their outdated, invalid, illegal eagle surveys.

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[55] McCrary, M. D., R. L. McKernan, and R. W. Schreiber. (1986). San Gorgonio wind resource area: Impacts of commercial wind turbine generators on birds, 1985 data report. Prepared for Southern California Edison Company.

[56] McCrary, M., McKernan, R., Landry, R., Wagner, W., and Schreiber, R. (1983). Nocturnal Avian Migration Assessment of the San Gorgonio Wind Resource Study Area, Fall 1982. Report Prepared for Research and Development Southern California Edison Company by the L.A. County natural history Museum Foundation. 142 pp.

[57] IS/MND p. 736

In fact, one wonders why the IS/MND would bother presenting a survey of eagles as part of their analysis if they did not consider eagles to be potentially impacted by the project.

6. See my responses above and below.

7. The Bio Memo claims that, "CURE alleges that the Plan (CVMSHCP) is inadequate because it was prepared at a plan level." No, that is not what is alleged; my comments stated that the IS/MND's descriptions of mitigated impacts are lacking due to the IS/MND's reliance on simply pointing to the existence of the Plan as all they deem necessary for their explanation (or lack thereof) of how Project impacts will be mitigated for different species, for different impacts (direct, indirect, cumualtive impacts?) from which kind of disturbances (temporary, permanent?), and what kind of mitigation would be applied (compensatory, off-site, best management practices, adaptive management practices, monitoring followed by consult, etc?). Specifically, my comments[58] stated,

> "The CVMSCHP is not a document that provides a host of clearly defined, species-specific, Project-specific mitigation protocols as the IS/MND would have the reviewer believe. Neither does it make review of said "protocols" available to the public, as is required under CEQA. And yet it bases its conclusions of successful mitigation on the assumption that "consistency" with the CVMSCHP equates successful mitigation analyzed and described. It does not, and these conclusions are wholly unsupported. The CVMSHCP is comprised of thousands of pages of discussion regarding umbrella topics including goals of research monitoring, conservation, FAQ's, and suggestions for adaptive management for species. It does not provide specific protocols unique to specific developments with their unique array of habitats, species, and development threats. And yet the IS/MND relies on generic statements for impacts to entire taxa, such as stating, "The Project is subject to the requirements of the CVMSHCP. Based on the recommendations outlined above, the Project is consistent with the CVMSHCP...."[59] and yet do not actually spell out what these recommendations are, or how they apply. The burden is on the Applicant to provide the details they are referring to. They fail to meet this burden, instead merely pointing to the existence of the CVMSHCP, and saying in essence they will follow undescribed, indeterminate CVMSHCP "protocols" and therefore be "consistent" and therefore reduce impacts to below significant. This is completely unsatisfactory, especially when one conducts a review of the actual content of the CVMSHCP: no such specific mitigation protocols exist as the IS/MND infers, certainly not for a wind farm in this region, in this mix

[58] R. Owens, Letter from Renée Owens to Kyle Jones (Nov. 27, 2018) Comments for the Painted Hills Wind Repowering Project Initial Study, Commercial WECS Permit No. 180001 / Variance Case No. 180003 – Intent to Adopt a Mitigated Negative Declaration – CEQ180059

[59] IS/MND Exhibit S p. 15.

of habitat, with this (yet to be determined) combination, density, abundance, richness, etc. of species present.

For instance, their mitigation details for impacts to the protected Desert tortoise are comprised primarily of the statement that "During construction-related activities, contractors will comply with the mitigation and minimization measures contained in the CVMSHCP protocol." However, they do not provide any details about this protocol, nor do they discuss how indirect impacts will be mitigated, and do not acknowledge the reality of cumulative impacts onsite for the Desert tortoise, despite the fact that the CVMSHCP concludes one of the reasons for its existence is to address concerns regarding the high potential for cumulative impacts to regional sensitive species including the Desert tortoise."[60]

In summary, my comments do not question the validity or integrity of the Plan, they question its ability as a *guideline* to dictate and describe *specific* mitigation actions that will be appropriate and relevant to this Project's specific design, biological resources, and related disturbances. If such actions and protocols exist already scripted in the Plan, it would be more than appropriate for the IS/MND to reiterate these protocols in the IS/MND so that in order to assess the appropriateness of how impacts will be mitigated the reviewing public need not mind-read what the IS/MND authors are thinking. For example: if one visits the Plan website, www.cvmshcp.org, one will find links to thousands of pages including web page links titled "Fact sheet / FAQ's / Plan Documents / Plan Maps / Final permit/ NCCP Permit and Findings / Management and Monitoring / GIS Data / BWG Materials." If one clicks on the link "Plan Documents" they will then be presented with another page that has no fewer than 68 new links of topics to search, many not explanatory (i.e. Appendices labelled by letter, EIR sections labeled by number, other headings simply labeled "Section" and number). If one clicks on the "Management and Monitoring" link, they will be presented with 15 large documents titled by habitat, species, action, Unit Plan, etc. One must therefore ask how the reviewing public is expected to know exactly which of these documents contains the appropriate information for mitigation that applies to this Project, and what it says. If the actual mitigation protocol for each and any Project species impact is outlined somewhere herein, it behooves the IS/MND to repeat those protocols in the IS/MND.

8. The Bio Memo attempts to defend the IS/MND's numerous baseline omissions, poorly defined impacts, inadequate description of how impacts will be mitigated, and resultant ineffectiveness of purported mitigation by not addressing these issues as raised. It instead

[60] See http://www.cvmshcp.org/Monitoring_Management.htm Retrieved 11-25-2018.

proffers a red herring by defending the validity of the CVMSHCP (Plan). My comments did not question the validity or integrity of the Plan. However, it is also true that the Plan is a complicated and obtuse set of thousands of pages of documents that define species and conservation goals for the broad region in which the Project falls, but does not define specific protocols required for this Project. Neither does the existence of the Plan, nor its documentation therein, guarantee that any mitigation protocols will be implemented appropriately and adequately as required, including exactly where, when, and how, and in respect to which types of impacts. Reports on the long history of the Plan's development underscore this reality, including the historical research that states, "The CVMSHCP process became bogged down—despite strong scientific input and many political advantages—due to problematic relationships between the Plan's local supporters, its municipal signatory parties, and officials from the state and federal wildlife agencies, particularly the regional office of the US Fish and Wildlife Service, with some detail regarding monitoring of the species in various locales and habitats" and "those charged with actually executing the Plan after its passage will encounter a political, economic, and ecological environment much more complicated, and perhaps less amenable, to comprehensive regional biodiversity conservation than the one that existed when the process began 13 years ago. Enacting a habitat conservation plan should be considered just the beginning—not the end—of a scientifically informed… and openly democratic political process."[61] In summary, the Plan is a complex package of research and resultant guidelines, not the required script necessary for a project IS/MND.

9. The Bio Memo once again attempts to mislead by erroneously claiming that my comments provide "no evidence" that there will be significant impacts to bats, and criticizing CURE for relying on research applicable to "other wind projects". To begin with, I would be quite willing to assess research on bats from *this proposed* Project and its site to use as evidence for the baseline conditions and resultant potential impacts, however since the IS/MND provides zero such evidence this is impossible. Second, I refer Mr. Ramsey back to my comments so that he may actually review them in detail, while I reiterate that once evidence demonstrating that bats may be present in the area and impacted by the project, the burden is on the IS/MND, not the reviewer, to clearly demonstrate that the Project will *not* incur significant impacts to bats or that any significant impacts will be mitigated, and how. By hardly alluding to the existence of bats at all, clearly the IS/MND has not met this burden of describing and establishing a baseline for discussion. Equally surprising is Mr. Ramsey's assertion in the Bio Memo that "there are no listed bat species in California and the lack of roosting habitat on site did not warrant more surveys." He goes on to say that mortality studies at other wind facilities in California have shown low impacts to bats. It appears Mr. Ramsey is confused on the subject of bats and wind

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[61] Alagona, S. and Pincetl, S. (2008). The Coachella Valley Multiple Species Habitat Conservation Plan: A Decade of Delays. Environmental Management, 41:1–11.

farms altogether. To this end, I will reiterate my original comments here, followed by further evidence that contradicts the Bio Memo's assertions:

> "...it is widely accepted by scientists and wildlife agencies that wind facilities cause significant mortalities to bats, and do not discriminate between common, sensitive, or endangered species by design.[62,63,64] This results in the conclusion by researchers of a multi-faceted study of bat mortality at different wind facilities that, "we recommend that individual wind facilities conduct project-specific pre- and postconstruction monitoring rather than infer mortality effects based on published results from other wind facilities."[65] However, the IS/MND ignores this fact by conducting no surveys, no analysis, and thus no mitigation for bats. The IS/MND fails to assess or discuss an entire taxon of species, namely bats, in its analysis of impacts, despite the fact that the CVMSCHP and CNDDB identifies several protected bat species, including the Southern yellow bat (a primary conservation "covered species" for the CVMSCHP)[66], and the Townsend's big-eared bat (*Corynorhinus townsendii*), as occurring in the region. Even the DRECP, the massive Desert Renewable Energy Conservation Plan for the desert southwest that includes the Project site region, focuses on bats as part of their conservation priority species. According to U.S. Geological Survey (USGS) biologists, "North American bats face unprecedented threats including habitat loss and fragmentation, white-nose syndrome, wind energy development, and climate change."[67] They also state that "It is difficult to evaluate impacts of these threats because there is a lack of basic information about the distribution and abundance of bats across the continent. A statistically robust and standardized bat monitoring program across North America would help managers estimate extinction risk, set conservation priorities and evaluate the effectiveness of conservation actions."[68] Indeed, if project biological consultants including LSA

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[62] Wellig, S. D., Nusslé, S., Miltner, D., Kohle, O., Glaizot, O., Braunisch, V., Obrist, M. K., Arlettaz, R. (2018). Mitigating the negative impacts of tall wind turbines on bats: Vertical activity profiles and relationships to wind speed. *PloS one*, 13(3), e0192493. doi:10.1371/journal.pone.0192493

[63] David Drake, Christopher S. Jennelle, Jian-Nan Liu, Steven M. Grodsky, Susan Schumacher, and Mike Sponsler. Regional Analysis of Wind Turbine-Caused Bat Mortality, *Acta Chiropterologica.* Jun 2015 : Vol. 17, Issue 1, pp 179- 188 https://doi.org/10.3161/15081109ACC2015.17.1.015

[64] USFWS. 2012. Land Based Wind Energy Guidelines. OMB Control No.10-18-0148 https://www.fws.gov/ecological-services/es-library/pdfs/WEG_final.pdf

[65] *Ibid.*

[66] See http://www.cvmshcp.org/Plan_Documents_old.htm Retrieved Nov 25, 2018

[67] See https://www.usgs.gov/ecosystems/status-and-trends-program/science/bats?qt-science_center_objects=0#qt-science_center_objects Retrieved No 14, 2018.

[68] *Ibid.*

would embrace the scientific reality that bats are an essential component of ecosystem biodiversity and viability by conducting the necessary surveys for CEQA and similar analyses - which they could then contribute to CNDDB and elsewhere – databases would be more complete, allowing for more efficacious conservation planning as development increases and spreads throughout the desert southwest. And yet the IS/MND makes no attempt to analyze impacts to bats, not to mention to present a Bird and Bat Monitoring Program that should be part and parcel to every wind facility that proposes to mitigate injuries and deaths that are incurred during the life of a wind development, as recommended by USFWS official wind energy guidelines for wildlife monitoring and mitigation.[69]

Finally, it should be noted that although it is important for data collection that drives best management practice, a bat monitoring program does not actually reduce impacts to bats. As such a conservation plan, including compensatory mitigation, should be part of the IS/MND's analysis to reduce potential significant impacts to bird and bat species that will be incurred throughout the life of the project. However, the IS/MND completely fails to offer any such mitigation, and thus fails once again to meet the requirements for a MND.

Not only is there abundant evidence that wind turbines kill bats, research has demonstrated that artificial light and noise can increase the risk of mortality and reduce foraging success by bats in both urban and rural settings.[70,71] As such, bats could be impacted by the presence of artificial lighting by the Project, throughout the life of the Project, as well as by its other various anthropogenic disturbances in the form of noise, light, dust, barriers, negative attractants, etc.

The necessity of detailed, baseline data for bats (as well as other sensitive species mentioned above) is underscored by the fact that the definition of a substantial impact analyses under CEQA as used in the significance criteria has

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[69] USFWS. 2012. Land Based Wind Energy Guidelines. OMB Control No.10-18-0148 https://www.fws.gov/ecological-services/es-library/pdfs/WEG_final.pdf

[70] Warner, K. A. (2016). *Investigating the effects of noise pollution from energy development on the bat community in the Piceance basin* (Order No. 10149854). Available from ProQuest Central; ProQuest Dissertations & Theses Global. (1815584239).

[71] Cravens, Z. M., Brown, V. A., Divoll, T. J., & Boyles, J. G. (2018). Illuminating prey selection in an insectivorous bat community exposed to artificial light at night. *The Journal of Applied Ecology*, 55(2), 705-713. doi:http://dx.doi.org.jerome.stjohns.edu:81/10.1111/1365-2664.13036

three principal factors: magnitude or intensity and duration of the impact; rarity and context of the affected resource; and susceptibility of the affected resource to disturbance. The evaluation of significance must also consider the interrelationship of these three factors. For example, a relatively small-magnitude impact on a state or federally listed species could be considered significant if the species is rare and highly susceptible to disturbance. This is true not only for determining significance of impact, but degree of significance in respect to what mitigation measures would be adequate. One cannot determine factors such as context and susceptibility of an entire population regarding impacts of the development of the Project if one does not know whether there may be one, ten, or one hundred or more individuals of a special status species present. It is therefore impossible to determine, without such data, if any given mitigation measure – during construction impact reduction protocol, restoration, relocation, or compensatory mitigation will reduce the Project impacts to below significant. It is especially difficult to determine the efficacy of mitigation protocols when they are not even provided, as is the case with this IS/MND. Given all of these factors, and the complete lack of any discussion regarding presence or impacts to bats, the IS/MND has completely failed to describe how and to what extent bats may likely be impacted by the Project, and as it stands any impacts to bats remain significant and unmitigated by the Project."

In addition to these facts regarding the high potential of sensitive bat species to occur onsite, it is important to note that the USGS has designated that the Project site location is a high priority for data acquisition in respect to bat surveying.[72] Also, the CVMSHCP itself describes the protected yellow bat as occurring in the Whitewater canyon area in close proximity to the site. Although it is correct that there are no bats listed under the ESA or CESA as protected, the inference by Mr. Ramsey that the status of a threatened or endangered bat is the only reason for surveying them to determine baseline and resultant impacts to populations demonstrates an irresponsible disregard and /or gross lack of comprehension of the ecological importance of the bat species and populations that exist in California, including those mentioned above as occurring on and near the Project, and protected under the CVMSCHP. Indeed, if bats were only significant by default of having a C/ESA listed status, one would question why dozens of bird and bat monitoring and mitigation plans have been scripted for wind projects statewide, with assistance from CDFW and USFWS. And it should go without saying that one of the main

[72] USGS bat Sampling Grid Priorities. Conservation Biology Institute Data Basin. Retrieved from: https://drecp.databasin.org/maps/new#datasets=f9d248d688e04d55ac423de5bac7bec6

reasons for avoiding and minimizing significant impacts to sensitive and rare species is to prohibit them from becoming so vulnerable in their population status as to necessitate the need to be protected under the C/ESA, accompanied by the obligatory costly and long-term endeavor to Recover the endangered population.

Further, for the Bio Memo to state that a lack of roosting habitat did not warrant more surveys is absurd. First, one cannot have "more" surveys for bats when none were conducted to begin with. Second, apparently it is necessary to point out that much like most birds, bats fly. In fact, it is not unusual for them to fly miles in search of food, mates, breeding habitat, and when migrating; therefore, proximity to roosts is just one of many factors that influence potential for bats to occur and to thus be potentially significantly impacted by developments wind turbines.

More the point of this Project, there is abundant evidence in the peer reviewed literature that demonstrates that taller turbines – similar to those proposed for the Project – are known to increase risk and rate of mortality of bats around wind farms, as are other factors (such as turbine micro-siting) that may be imposed by this Project but are yet to be discussed or mentioned by the IS/MND. In their studies of bat mortalities at many different wind facilities, including repowered wind farms, Barclay *et. al.* concluded that, "There is considerable variation in the fatality rates of birds and bats among sites that is not explained by the size of the turbines alone. Turbines differ in other ways that may influence fatality. For example... monopoles [part of taller, newer turbines] have been hypothesized to mimic potential roost trees for bats (Kunz et. al. 2007). Our analysis indicates that fatalities of bats per megawatt of installed energy capacity are greater at some of the new, larger turbines, and overall, bat fatalities increase per megawatt....therefore, the potential impact on bat populations may be greater [as a result]." In summary, "bat fatalities increased exponentially with tower height. Minimizing tower heights may minimize bat fatalities."[73] Smallwood and Karas's research on repowered wind farms also concluded that repowering wind facilities may result in greater bat mortality,[74] as did the research finding summaries provided by Arnett and May,[75] Loss *et. al.*,[76]

[73] Barclay, R. M. R., E. F. Baerwald, and J. C. Gruver. (2007). Variation in bat and bird fatalities at wind energy facilities: assessing the effects of rotor size and tower height. *Canadian Journal of Zoology*. 85:381–387.

[74] Smallwood, K. S., and B. Karas. (2009). Avian and bat fatality rates at old-generation and repowered wind turbines in California. *Journal of Wildlife Management* 73:1062–1071.

[75] Arnett, E.B. and May, R. F. (2016). Mitigating Wind Energy Impacts on Wildlife: Approaches for Multiple Taxa. *Human–Wildlife Interactions* 10(1):28–41

[76] Loss, S. R., T. Will, and P. P. Marra. (2013). Estimates of bird collision mortality at wind facilities in the contiguous United States. *Biological Conservation* 168:201–209.

Baerwald et. al.,[77] and Arnett *et. al.* (2008, 2013)[78,79] As significantly, Frick *et. al.*'s recent study concludes that fatalities at wind turbines may threaten[80] the population viability of a migrating (as opposed to roosting, resident) bat. Simply put, to adequately and thoroughly analyze the potential impacts a repowering project such as this Project may have on bats, the minimum requirement is for the Applicant to conduct current, thorough surveys of both resident and migrating bats. It is important to note that in order to adequately asses the long term, cumulative impacts of the Project in operation (if permitted), the research demonstrates that not only is a mortality monitoring program essential (despite the fact that monitoring does not actually mitigate any impacts), it should include a mitigation and monitoring plan that incorporates the use of dogs to detect fatalities of birds and bats. Where dogs have been used for mortality monitoring on wind facilities, the bird and bat fatalities discovered have been exponentially higher.[81,82,83,84] Such a methodology is essential to adapt best management practices to be applied to mitigate mortalities. On the subject of monitoring and the need for appropriate mitigation, Arnett and May summarize important, relevant recommendations as follows:

> "Mitigating impacts of wind energy development on wildlife is important for conservation and public acceptance of this energy source...Planning and avoiding predicted high-risk areas is fundamental to reduce impacts on birds and bats. Contrary to avoidance, once facilities are built, options to minimize impacts need to be tailored to species at the specific

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[77] Baerwald. E. F., and R. M. R. Barclay. (2011). Patterns of activity and fatality bats at a wind energy facility in Alberta. *Journal of Wildlife Management* 75:1103–1114.

[78] Arnett, E. B., K. Brown, W. P. Erickson, J. Fiedler, T. H. Henry, G. D. Johnson, J. Kerns, R. R. Kolford, C. P. Nicholson, T. O'Connell, M. Piorkowski, R. Tankersley Jr. (2008). Patterns of fatality of bats at wind energy facilities in North America. *Journal of Wildlife Management* 72:61–78.

[79] Arnett E. B., E. F. Baerwald. (2013). Impacts of wind energy development on bats: implications for conservation. Pages 435–456 *in* R. A. Adams, S. C. Peterson, editors, Bat Evolution, Ecology, and Conservation.Springer, New York, New York.

[80] Frick, W.F., E.F. Baerwald, J.F. Pollock, R.M.R. Barclay, J.A. Szymanski, T.J. Weller and A.L. Russell, S.C. Loeb, R.A. Medellin, and L.P. McGuire. (2017). Fatalities at wind turbines may threaten population viability of a migratory bat. *Biological Conservation*. 209: 172–177.

[81] Huso, M. M. P., and D. H. Dalthorp. (2014). Accounting for unsearched areas in estimating wind turbine-caused fatality. *Journal of Wildlife Management* 78:347–358.

[82] Mathews, F., M. Swindells, R. Goodhead, T. A. August, P. Hardman, D. M. Linton, and D. J. Hosken. (2013). Effectiveness of search dogs compared with human observers in locating bat carcasses at wind-turbine sites: a blinded randomized trial. *Wildlife Society Bulletin* 37:34–40.

[83] Paula, J., M. C. Leal, M. J. Silva, R. Mascarenhas, H. Costa, and M. Mascarenhas. (2011). Dogs as a tool to improve bird-strike mortality estimates at wind farms. *Journal for Nature Conservation* 19:202–208.

[84] Reyes, G. A., M. J. Rodriguez, K. T. Lindke, K. L. Ayres, M. D. Halterman, B. B. Boroski, and D. S. Johnston. (2016). Searcher efficiency and survey coverage affect precision of fatality estimates. *Journal of Wildlife Management* 80:1488–1496.

site, and can be limited especially for bats. Curtailing wind turbine operations is the only approach proven effective at reducing bat mortality... Compensation should be considered only as part of the mitigation hierarchy when unforeseen or unavoidable impacts remain. **Offsite habitat-based compensatory measures may provide the best offsets for incidental bird and bat mortality.** While the conceptual framework and predictive modelling for compensatory measures are well-established, empirical evidence demonstrating effectiveness and achievement of no-net loss for wildlife populations is lacking. Similarly, few studies have evaluated effectiveness of minimization measures and other forms of mitigation. Evaluating effectiveness of preconstruction wildlife assessments and habitat modeling in predicting wildlife mortality at wind facilities remains a research need. Additionally, lack of population data for many species of wildlife hinders knowledge of population-level impacts and effectiveness of mitigation measures. [Emphasis added]."[85]

10. It is worth reiterating that the Bio Memo's assertion that the Project was vetted by the CVCC via the Joint Project Review is misleading. The JPR report for this Project (October 30, 2018) as provided is titled a draft, and thus review is incomplete. However, it does state the following, "The Project footprint crosses through an MWD owned parcel, (as shown in Map 3) that is not a participate in the multiple species plan. The Project also has species and natural impacts, (Map 4a) CV Jerusalem Cricket (5.50 acres), (Map 4b) Desert Tortoise (43 acres), (Map 4c) Sand Source areas (43 acres)." The Bio Memo, nor the IS/MND, makes no mention of these "new" impacts, nor how they will be mitigated.

Finally, in respect to the Jerusalem cricket mitigation, "Attachment 1", the Riverside County-Environmental Programs Department (EPD) Conditions provided by the County states that Prior to issuance of any grading permit, a biologist with a Memorandum of Understanding with Riverside County will prepare a Restoration Plan to cover the restoration of, at minimum, 3.74 acres of new temporary disturbance found in Coachella Valley Jerusalem cricket habitat on site." It appears yet another oversight by the IS/MND that no such mitigation plan for the cricket is even mentioned or detailed.

CONCLUSION

For the reasons outlined above, despite the claims put forth by the Bio Memo, the Project IS/MND fails to meet the requirements of impact analysis and mitigation under the California Environmental Quality Act (CEQA). Based on my responses in this letter, and my original

[85] Arnett, E.B. and May, R. F. (2016). Mitigating Wind Energy Impacts on Wildlife: Approaches for Multiple Taxa. *Human–Wildlife Interactions* 10(1):28–41

comments to the Project not being adequately addressed, it is my professional opinion that the IS/MND has not met the obligations of CEQA and that the Project would result in significant and unmitigated impacts to several sensitive biological resources. The IS/MND must be revised and resubmitted to disclose, adequately analyze, and mitigate the significant impacts. If the impacts cannot be reduced to less than significant, they are unavoidable. No further consideration should be given to the proposed Project until a complete IS/MND or Environmental Impact Report is prepared and circulated that fully complies with CEQA.

Sincerely,

Renée Owens, M.S.
Conservation Ecologist

Professional Background

I am a conservation biologist and environmental consultant with 25 years of professional experience in wildlife ecology and natural resource management. I have managed an independent environmental consultancy since 1993, contracted for work in the U.S. and Latin America. Since 1994 have maintained U.S. Fish and Wildlife (USFWS) Recovery permits for listed species under the federal Endangered Species Act (ESA), including species discussed herein. I also hold several California state and federal certifications for surveys and monitoring of protected and special status species. I have extensive experience monitoring and studying many species across several taxa, including reptiles and amphibians, passerines and raptors, and marine and terrestrial mammals. I have served as a biological resource expert on over a hundred projects involving water, urban and rural residential developments, mines, and industrial scale energy projects; on private, public, and military lands; in California, the southwest, and Latin America. I have extensive experience observing the species and habitats located within and in proximity to the Project presented in the DEIR.

The scope of work I have conducted as an independent environmental contractor, supervisor, and full time employee has included assisting clients to evaluate and achieve environmental compliance, restoration, mitigation, and research as related to biological resources; as well as submitting written reports and comments for such work to oversight agencies. This work includes analyzing and reviewing actions pursuant to the California Environmental Quality Act, the National Environmental Policy Act, the Endangered Species Act, the Clean Water Act, the Migratory Bird Treaty Act, and other regulations, along with surveying for and preparing Biological Technical Reports and Assessments. I have been contracted as an environmental consultant by the USFWS, the USDA Forest Service, Ultrasystems, ICF, Helix Environmental, URS, AECOM, AMEC, GeomorphIS, DUDEK, ESA, Tetra Tech, Bridgenet, Bioacoustics, among others. I am a member of the National Sierra Club's Wildlife and Endangered Species Committee and Marine Advisory Committee.

My conservation and natural history research on endangered vertebrate species in Latin America have received various awards including the National Geographic Research and Exploration Award and the National Commission for Scientific and Technological Research Award. My research has been featured on National Geographic Television and Discovery Channel documentaries, and I have served as technical consultant for wildlife documentaries filmed by National Geographic Television, Discovery Channel, BBC, and Animal Planet; in 2017 I received a Special Commendation for contributions to environmental conservation from the City of San Diego.

I have a Master's degree in Ecology; my teaching experience includes college instruction since 1991. I have been an adjunct instructor in Biology, Zoology, Botany, and Environmental Science at Palomar Community College, San Diego State University, and Imperial Valley College. I taught field courses in Tropical Ecology in Ecuador and the Galapagos for Boston University, and was a Visiting Full Time Professor in Environmental Science and Botany at Imperial Valley College. At present I am completing a second MS degree in Environmental Studies from Green Mountain College, focusing on Environmental Education and Communication.

I have gained particular knowledge of the biological resource issues associated with the Project through my extensive work on numerous research and consulting projects throughout southern California. My comments are based upon first-hand observations, review of the environmental documents prepared for the Project, review of scientific literature pertaining to biological resources known to occur in and near the Project area, consultation with other biological resource experts, and the knowledge and experience I have acquired throughout my 25 years of working in the field of natural resources research and management.

EXHIBIT C

Coachella Valley Conservation Commission
FINAL Joint Project Review (JPR)

Date: December 17, 2018

Project Information

Applicant/Project Name: Painted Hills Wind Energy Repowering Project

CVCC ID: 18-004

Conservation Area: Upper Mission Creek/Big Morongo Canyon Conservation Area

Total Project Disturbance Acreage: 45 Acres

Project Disturbance Acreage within Conservation Area: 45 Acres

Project Location: APN's 516030004, 516030008, 516030014, 516030015 (total acreage 603 acres)

Project Summary:
The Project comprises the following components and activities:

- Decommission and remove the approximately 291 existing, antiquated turbines from the Project site.
- Install up to 14 new wind turbines and related infrastructure with a per-turbine generating capacity of between 2.0 MW and 4.2 MW on land within the County's Wind Energy Resource (W-E) Zone.
- Install up to 2 new permanent, lattice meteorological towers to support operations of the wind development.
- Install up to 3 new temporary, guyed lattice meteorological towers to support the power curve testing of the wind development.
- Installation of WECS and met tower foundations and erection of the WECS and met towers.
- Construct pad areas for individual turbines and met towers to accommodate cranes and heavy equipment needed for turbine and met tower installation.
- Construct a temporary expansion of the existing laydown yard for use during the decommissioning of existing turbines and the construction of the Project.
- Temporarily widen and improve portions of the existing internal road system.
- Construct new, temporary and permanent roads outside of the existing road system footprint to accommodate cranes and heavy equipment needed for turbine and met tower installations and access to the proposed turbine and met tower foundations. Temporary new roads and existing roads that will not be used by the Project will be restored after the construction phase and permanent new roads will be reduced to a width of 16 feet.

- Install new 12 kV underground and/or overhead electrical collection lines to collect energy from the Project's new turbines. All, or a portion of these lines may interconnect directly into the Southern California Edison (SCE) 115 kV Ven wind substation located inside the Project boundary. Alternatively, one or more of these collection lines may tie directly into the existing, SCE-owned, 12 kV overhead collection lines inside the Project boundary that are used by the existing wind farm to interconnect into Ven wind.
- Decommissioning and removing the new wind turbines at the end of their useful life cycle.

The Project footprint crosses through an Metropolitan Water District owned parcel, (as shown in Map 3) that is not a participate in the CVMSHCP. The Project also has covered species and natural community impacts, (Map 4a) CV Jerusalem Cricket (3 acres), (Map 4b) Desert Tortoise (41 acres), (Map 4c) Sand Source areas (41 acres).

Acres of Proposed New Disturbance: 45 Acres

Acres of Proposed Conservation: 0 Acres

Project Location

Conservation Objectives Review

Painted Hills Wind Repowering Project Upper Mission Creek/Big Morongo Canyon Conservation Area							
Conservation Objective	Total Acres of Proposed Disturbance	Acres of Disturbance Authorized by Plan	Proposed Disturbance as a Percentage of Authorized Disturbance	Rough Step (*If project is approved as submitted)*	Acres Conserved by Project	Acres to be Conserved by Plan	% Required Conservation
Conserve Other Cons. Habitat for CV Jerusalem cricket	3	47	8.50%	-4	0	419	0
Conserve Core Habitat for desert tortoise	41	882	4.75%	634	0	7984	0
Conserve sand source areas	41	721	5.75%	476	0	6488	0

Rough Step

If the County approves this project as submitted, it will exceed Rough Step for Coachella Valley Jerusalem cricket by 4 acres and will not be able to approve any future project that impacts this species until more land containing this species is conserved within this unit of the Conservation Area. CVCC is actively seeking such land but cannot guarantee when this will occur. The County will condition the project to do restoration as described in the Legal Agreement. A Transfer of Conservation Objectives may be possible but that would require Wildlife Agency approval. Full details on Rough Step can be found beginning on page 6-13 of the following link

http://www.cvmshcp.org/Plan%20Documents/13.%20CVAG%20MSHCP%20Plan%20Section%206.0.pdf

Legal Agreement

This project is covered under a legal agreement, attached as Exhibit A, which details the requirements for restoration on this site. The County should contact CVCC at the issuance of the grading permit to begin the restoration process.

Biological Resources Assessment

The applicant submitted a biological assessment of the site which is attached as Exhibit B.

Section 4.4: Avoidance, Minimization, and Mitigation Measures

The following are excerpted from Section 4.4 of the CVMSHCP.

Burrowing Owl. This measure does not apply to single-family residences and any non-commercial accessory uses and structures including but not limited to second units on an existing legal lot, or to O&M of Covered Activities other than levees, berms, dikes, and similar features that are known to contain burrowing owl burrows. O&M of roads is not subject to this requirement. For other projects that are subject to CEQA, the Permittees will require burrowing owl surveys in the Conservation Areas using an accepted protocol (as determined by the CVCC in coordination with the Permittees and the Wildlife Agencies). Prior to Development, the construction area and adjacent areas within 500 feet of the Development site, or to the edge of the property if less than 500 feet, will be surveyed by an Acceptable Biologist for burrows that could be used by burrowing owl. If a burrow is located, the biologist will determine if an owl is present in the burrow. If the burrow is determined to be occupied, the burrow will be flagged and a 160-foot buffer during the non-breeding season and a 250-foot buffer during the breeding season, or a buffer to the edge of the property boundary if less than 500 feet, will be established around the burrow. The buffer will be staked and flagged. No Development or O&M activities will be permitted within the buffer until the young are no longer dependent on the burrow.

If the burrow is unoccupied, the burrow will be made inaccessible to owls, and the Covered Activity may proceed. If either a nesting or escape burrow is occupied, owls shall be relocated pursuant to accepted Wildlife Agency protocols. A burrow is assumed occupied if records indicate that, based on surveys conducted following protocol, at least one burrowing owl has been observed occupying a burrow on site during the past three years. If there are no records for the site, surveys must be conducted to determine, prior to construction, if burrowing owls are present. Determination of the appropriate method of relocation, such as eviction/passive relocation or active relocation, shall be based on the specific site conditions (e.g., distance to nearest suitable habitat and presence of burrows within that habitat) in coordination with the Wildlife Agencies. Active relocation and eviction/passive relocation require the preservation and maintenance of suitable burrowing owl habitat determined through coordination with the Wildlife Agencies.

Desert tortoise. This measure does not apply to single-family residences and any non-commercial accessory uses and structures, including but not limited to second units on an existing legal lot, or to O&M of Covered Activities for Permittee infrastructure facilities. Within Conservation Areas, the Permittees will require surveys for desert tortoise for Development in modeled desert tortoise Habitat. Prior to Development, an Acceptable Biologist will conduct a presence/absence survey of the Development area and adjacent areas within 200 feet of the Development area, or to the property boundary if less than 200 feet and permission from the adjacent landowner cannot be obtained, for fresh sign of desert tortoise, including live tortoises, tortoise remains, burrows, tracks, scat, or egg shells. The presence/absence survey must be conducted during the window between February 15 and October 31. Presence/absence surveys require 100% coverage of the survey area. If no sign is found, a clearance survey is not required. A presence/absence survey is valid for 90 days or indefinitely if tortoise-proof fencing is installed around the Development site.

If fresh sign is located, the Development area must be fenced with tortoise-proof fencing and a clearance survey conducted during the clearance window. Desert tortoise clearance surveys shall be conducted during the clearance window from February 15 to June 15 and September 1 to October 31 or in accordance with the most recent Wildlife Agency protocols. Clearance surveys must cover 100% of the Development area. A clearance survey must be conducted during different tortoise activity periods (morning and afternoon). All tortoises encountered will be moved from the Development site to a specified location. Prior to issuance of the Permits, CVCC will either use the Permit Statement Pertaining to High Temperatures for Handling Desert Tortoises and Guidelines for Handling Desert Tortoises During Construction Projects, revised July 1999, or develop a similar protocol for relocation and monitoring of desert tortoise, to be reviewed and approved by the Wildlife Agencies. Thereafter, the protocol will be revised as needed based on the results of monitoring and other information that becomes available.

For O&M activities in the Conservation Areas, the Permittees shall ensure that personnel conducting such activities are instructed to be alert for the presence of desert tortoise. If a tortoise is spotted, activities adjacent to the tortoise's location will be halted and the tortoise will be allowed to move away from the activity area. If the tortoise is not moving, it will be relocated by an Acceptable Biologist to nearby suitable Habitat and placed in the shade of a shrub. To the maximum extent Feasible, O&M activities will avoid the period from February 15 and October 31.

Utility development protocols have been developed to avoid or minimize potential adverse impacts to the desert tortoise in the Conservation Areas from utility and road right of-way projects, such as the installation and maintenance of water, sewer, and electric lines and roadway maintenance. The objectives of these protocols are to provide reliable and consistent direction on utility development within the Conservation Areas. Two utility development protocols, inactive and active season, provide specific direction on site preparation and construction phases of utility projects in the Conservation Areas. The protocols include steps to be followed during the desert tortoise active and/or inactive season. The inactive season protocol must be used for utility maintenance or development within the November 1 to February 14 time frame; the active season protocol must be used for utility maintenance or development within the February 15 to October 31 time frame. Deviations from these time frames must be presented to the RMOC.

Inactive Season Protocol. This protocol is applicable to pre-construction and construction phases of utility Covered Activity projects occurring between November 1 and February 14. These protocols apply only to the site preparation and construction phases of projects. The project proponent must follow the eight pre-construction protocol requirements listed below.

1. A person from the entity contracting the construction shall act as the contact person with the representative of the appropriate RMUC. He/she will be responsible for overseeing compliance with the protective stipulations as stated in this protocol.

2. Prior to any construction activity within the Conservation Areas, the contact person will meet with the representative of the appropriate RMUC to review the plans for the project. The representative of the appropriate RMUC will review alignment, pole spacing, clearing limits, burrow locations, and other specific project plans which have the potential to affect the desert tortoise. He or she may recommend modifications to the contact person to further avoid or minimize potential impacts to desert tortoise.

3. The construction area shall be clearly fenced, marked, or flagged at the outer boundaries to define the limits of construction activities. The construction right-of way shall normally not exceed 50 feet in width for standard pipeline corridors, access roads

and transmission corridors, and shall be minimized to the maximum extent Feasible. Existing access roads shall be used when available, and rights-of way for new and existing access roads shall not exceed 20 feet in width unless topographic obstacles require greater road width. Other construction areas including well sites, storage tank sites, substation sites, turnarounds, and laydown/staging sites which require larger areas will be determined in the preconstruction phase. All construction workers shall be instructed that their activities shall be confined to locations within the fenced, flagged, or marked areas.

4. An Acceptable Biologist shall conduct pre-construction clearance surveys of all areas potentially disturbed by the proposed project. Any winter burrows discovered in the Conservation Areas during the pre-construction survey shall be avoided or mitigated. The survey shall be submitted to the representative of the appropriate RMUC as part of plan review.

5. All site mitigation criteria shall be determined in the pre-construction phase, including but not limited to seeding, barrier fences, leveling, and laydown/staging areas, and will be reviewed by the representative of the appropriate RMUC prior to implementation.

6. A worker education program shall be implemented prior to the onset of each construction project. All construction employees shall be required to read an educational brochure prepared by the representative of the appropriate RMUC and/or the RMOC and attend a tortoise education class prior to the onset of construction or site entry. The class will describe the sensitive species which may be found in the area, the purpose of the MSHCP Reserve System, and the appropriate measures to take upon discovery of a sensitive species. It will also cover construction techniques to minimize potential adverse impacts.

7. All pre-construction activities which could Take tortoises in any manner (e.g., driving off an established road, clearing vegetation, etc.) shall occur under the supervision of an Acceptable Biologist.

8. If there are unresolvable conflicts between the representative of the appropriate RMUC and the contact person, then the matter will be arbitrated by the RMOC and, if necessary, by CVCC.

The following terms are established to protect the desert tortoise during utility related construction activities in the Conservation Areas and are to be conducted by an Acceptable Biologist.

- An Acceptable Biologist shall oversee construction activities to ensure compliance with the protective stipulations for the desert tortoise.

- Desert tortoises found above ground inside the project area during construction shall be moved by an Acceptable Biologist out of harm's way and placed in a winter den (at a distance no greater than 250 feet). If a winter den cannot be located, the USFWS or

CDFG shall determine appropriate action with respect to the tortoise. Tortoises found above ground shall be turned over to the Acceptable Biologist

- No handling of tortoises will occur when the air temperature at 15 centimeters above ground exceeds 90 degrees Fahrenheit.

- Desert tortoise burrows shall be avoided to the maximum extent Feasible. An Acceptable Biologist shall excavate any burrows which cannot be avoided and will be disturbed by construction. Burrow excavation shall be conducted with the use of hand tools only, unless the Acceptable Biologist determines that the burrow is unoccupied immediately prior to burrow destruction.

- Only burrows within the limits of clearing and surface disturbance shall be excavated. Burrows outside these limits, but at risk from accidental crushing, shall be protected by the placement of deterrent barrier fencing between the burrow and the construction area. Installation and removal of such barrier fencing shall be under the direction and supervision of an Acceptable Biologist.

- For electrical transmission line and road construction projects, only burrows within the right-of-way shall be excavated. Burrows outside the right-of-way, but at risk from accidental crushing, shall be protected by the placement of deterrent barrier fencing between the burrow and the right-of-way. Installation and removal of such barrier fencing shall be under the direction and supervision of an Acceptable Biologist.

- Tortoises in the Conservation Areas are not to be removed from burrows until appropriate action is determined by USFWS or CDFG with respect to the tortoise. The response shall be carried out within 72 hours.

- Blasting is not permissible within 100 feet of an occupied tortoise burrow.

During construction, contractors will comply with the mitigation and minimization measures contained within this protocol. These measures are:

- All trenches, pits, or other excavations shall be inspected for tortoises by an Acceptable Biologist prior to filling.

- All pipes and culverts stored within desert tortoise Habitat shall have both ends capped to prevent entry by desert tortoises. During construction, all open-ended pipeline segments that are welded in place shall be capped during periods of construction inactivity to prevent entry by desert tortoises.

- Topsoil removed during trenching shall be re-spread on the pipeline construction area following compaction of the backfill. The area shall be restored as determined during the environmental review.

- All test pump water will be routed to the nearest wash or natural drainage. The route will be surveyed by an Acceptable Biologist. If tortoises are found in the drainage area the Acceptable Biologist will remove the tortoises.

- Powerlines associated with water development, such as to provide power for pumps, should be buried underground adjacent to the pipe. All above ground structures deemed to be necessary shall be equipped with functional anti-perching devices that would prevent their use by ravens and other predatory birds and shall adhere to the electrical distribution protocol which follows.

- In order to perform routine O&M of the water systems such as wells, pumps, water lines and storage tanks, etc., employees are to be trained in the area of desert tortoise education. This training will be performed on a regular basis by an Acceptable Biologist for those personnel not previously trained. The training will include at a minimum the following: identification of tortoises, burrows, and other sign; and instructions on installing tortoise barrier fencing. During the course of basic O&M, desert tortoise will be avoided. Untrained employees shall not perform maintenance operations within the reserve.

- All disturbance areas around poles or concrete pads will be reduced to a size just large enough for the construction activity.

- Areas disturbed around poles or construction pads will be restored as determined during the pre-construction process.

- Poles or other above ground structures necessary for electrical distribution development shall be minimized as much as possible. All above ground structures shall be equipped with functional anti-perching devices that would prevent their use by ravens and other predatory birds.

- In order to perform routine O&M of the electrical distribution systems such as transmission lines and poles, substations, etc., employees are to be trained in the area of desert tortoise education. This training will be performed on a regular basis by a qualified biologist for those personnel not previously trained. The training will include at a minimum the following: identification of tortoises, burrows, and other sign; and instructions on installing tortoise barrier fencing. During the course of basic O&M, desert tortoise will be avoided. Untrained employees shall not perform maintenance operations within the non-Take areas.

- All trash and food items shall be promptly contained and removed daily from the project site to reduce the attractiveness of the area to common ravens and other desert tortoise predators.

- Construction activities which occur between dusk and dawn shall be limited to areas which have already been cleared of desert tortoises by the Acceptable Biologist and graded or located in a fenced right-of-way. Construction activities shall not be permitted between dusk and dawn in areas not previously graded.

Active Season Protocol. This protocol is applicable to pre-construction and construction phases of utility development projects occurring between February 15 and November 1. It is identical to the Inactive Season Protocol with the following additions:

- Work areas shall be inspected for desert tortoises within 24 hours of the onset of construction. To facilitate implementation of this condition, burrow inspection and excavation may begin no more than seven (7) days in advance of construction activities, as long as a final check for desert tortoises is conducted at the time of construction.

- All pre-construction activities which could Take tortoises in any manner (e.g., driving off an established road, clearing vegetation, etc.) shall occur under the overall supervision of an Acceptable Biologist. Any hazards to tortoises created by this activity, such as drill holes, open trenches, pits, other excavations, or any steep sided depressions, shall be checked three times a day for desert tortoises. These hazards shall be eliminated each day prior to the work crew leaving the site, which may include installing a barrier that will preclude entry by tortoises. Open trenches, pits or other excavations will be backfilled within 72 hours, whenever possible. A 3:1 slope shall be left at the end of every open trench to allow trapped desert tortoises to escape. Trenches not backfilled within 72 hours shall have a barrier installed around them to preclude entry by desert tortoises. All trenches, pits, or other excavations shall be inspected for tortoises by a biological monitor trained and approved by the Acceptable Biologist prior to filling.

- If a desert tortoise is found, the biological monitor shall notify the Acceptable Biologist who will remove the animal as soon as possible.

- Only burrows within the limits of clearing and surface disturbance shall be excavated. Burrows outside these limits, but at risk from accidental crushing, shall be protected by the placement of deterrent barrier fencing between the burrow and the construction area. The barrier fence shall be at least 20 feet long and shall be installed to direct the tortoise leaving the burrow away from the construction area. Installation and removal of such barrier fencing shall be under the direction and supervision of the biological monitor.

- If blasting is necessary for construction, all tortoises shall be removed from burrows within 100 feet of the blast area.

Disposition of Sick, Injured, or Dead Specimens. Upon locating dead, injured, or sick desert tortoises under any utility or road project, initial notification by the contact representative or Acceptable Biologist must be made to the USFWS or CDFG within three (3) working days of its finding. Written notification must be made within five (5) calendar days with the following information: date; time; location of the carcass; photograph of the carcass; and any other pertinent information. Care must be taken in handling sick or injured animals to ensure effective treatment and care. Injured animals shall be taken care of by the Acceptable Biologist or an appropriately trained veterinarian. Should any treated tortoises survive, USFWS or CDFG should be contacted regarding the final disposition of the animals.

Section 4.5 Land Use Adjacency Guidelines

The purpose of Land Use Adjacency Guidelines is to avoid or minimize indirect effects from Development adjacent to or within the Conservation Areas. Adjacent means sharing a common boundary with any parcel in a Conservation Area. Such indirect effects are commonly referred to as edge effects, and may include noise, lighting, drainage, intrusion of people, and the introduction of non-native plants and non-native predators such as dogs and cats. Edge effects will also be addressed through reserve management activities such as fencing. The following Land Use Adjacency Guidelines shall be considered by the Permittees in their review of individual public and private Development projects adjacent to or within the Conservation Areas to minimize edge effects and shall be implemented where applicable.

4.5.1 Drainage

Proposed Development adjacent to or within a Conservation Area shall incorporate plans to ensure that the quantity and quality of runoff discharged to the adjacent Conservation Area is not altered in an adverse way when compared with existing conditions. Storm water systems shall be designed to prevent the release of toxins, chemicals, petroleum products, exotic plant materials or other elements that might degrade or harm biological resources or ecosystem processes within the adjacent Conservation Area.

4.5.2 Toxics

Land uses proposed adjacent to or within a Conservation Area that use chemicals or generate bio-products such as manure that are potentially toxic or may adversely affect wildlife and plant species, Habitat, or water quality shall incorporate measures to ensure that application of such chemicals does not result in any discharge to the adjacent Conservation Area.

4.5.3 Lighting

For proposed Development adjacent to or within a Conservation Area, lighting shall be shielded and directed toward the developed area. Landscape shielding or other appropriate methods shall be incorporated in project designs to minimize the effects of lighting adjacent to or within the adjacent Conservation Area in accordance with the guidelines to be included in the Implementation Manual.

4.5.4 Noise

Proposed Development adjacent to or within a Conservation Area that generates noise in excess of 75 dBA L_{eq} hourly shall incorporate setbacks, berms, or walls, as appropriate, to minimize the effects of noise on the adjacent Conservation Area in accordance with the guidelines to be included in the Implementation Manual.

4.5.5 Invasives

Invasive, non-native plant species shall not be incorporated in the landscape for land uses adjacent to or within a Conservation Area. Landscape treatments within or adjacent to a Conservation Area shall incorporate native plant materials to the maximum extent Feasible; recommended native species are listed in Table 4-112. The plants listed in Table 4-113 shall not be used within or adjacent to a Conservation Area. This list may be amended from time to time through a Minor Amendment with Wildlife Agency Concurrence.

Table 4-112: Coachella Valley Native Plants Recommended for Landscaping[1]

BOTANICAL NAME	COMMON NAME
Trees	
Washingtonia filifera	California Fan Palm
Cercidium floridum	Blue Palo Verde
Chilopsis linearis	Desert Willow
Olneya tesota	Ironwood Tree
Prosopis glandulosa var. torreyana	Honey Mesquite
Shrubs	
Acacia greggii	Cat's Claw Acacia
Ambrosia dumosa	Burro Bush
Atriplex canescens	Four Wing Saltbush
Atriplex lentiformis	Quailbush
Atriplex polycarpa	Cattle Spinach
Baccharis sergiloides	Squaw Water-weed
Bebia juncea	Sweet Bush
Cassia (Senna) covesii	Desert Senna
Condalia parryi	Crucilllo
Crossosoma bigelovii	Crossosoma
Dalea emoryi	Dye Weed
Dalea (Psorothamnus) schottii	Indigo Bush
Datura meteloides	Jimson Weed
Encelia farinosa	Brittle Bush
Ephedra aspera	Mormon Tea
Eriogonum fasciculatum	California Buckwheat
Eriogonum wrightii membranaceum	Wright's Buckwheat
Fagonia laevis	(No Common Name)
Gutierrezia sarothrae	Matchweed
Haplopappus acradenius	Goldenbush
Hibiscus denudatus	Desert Hibiscus
Hoffmannseggia microphylla	Rush Pea
Hymenoclea salsola	Cheesebush
Hyptis emoryi	Desert Lavender
Isomeris arborea	Bladder Pod
Juniperus californica	California Juniper
Krameria grayi	Ratany
Krameria parvifolia	Little-leaved Ratany
Larrea tridentate	Creosote Bush
Lotus rigidus	Desert Rock Pea
Lycium andersonii	Box Thorn
Petalonyx linearis	Long-leaved Sandpaper Plant
Petalonyx thurberi	Sandpaper Plant
Peucephyllum schottii	Pygmy Cedar
Prunus fremontii	Desert Apricot
Rhus ovata	Sugar-bush
Salazaria mexicana	Paper-bag Bush
Salvia apiana	White Sage

BOTANICAL NAME	COMMON NAME
Salvia eremostachya	Santa Rosa Sage
Salvia vaseyi	Wand Sage
Simmondsia chinensis	Jojoba
Sphaeralcia ambigua	Globemallow (Desert Mallow)
Sphaeralcia ambigua rosacea	Apricot Mallow
Trixis californica	Trixis
Zauschneria californica	California Fuchsia
Groundcovers	
Mirabilis bigelovii	Wishbone Bush (Four O'Clock)
Mirabilis tenuiloba	White Four O'Clock (Thin-lobed)
Vines	
Vitis girdiana	Desert Grape
Accent	
Muhlenbergia rigens	Deer Grass
Herbaceous Perennials[2]	
Adiantum capillus-veneris	Maiden-hair Fern (w)
Carex alma	Sedge (w)
Dalea parryi	Parry Dalea
Eleocharis montevidensis	Spike Rush (w)
Equisetum laevigatum	Horsetail (w)
Juncus bufonis	Toad Rush (w)
Juncus effuses	Juncus (w)
Juncus macrophyllus	Juncus (w)
Juncus mexicanus	Mexican Rush (w)
Juncus xiphioides	Juncus (w)
Notholaena parryi	Parry Cloak Fern
Pallaea mucronata	Bird-foot Fern
Cacti and Succulents	
Agave deserti	Desert Agave
Asclepias albicans	Desert Milkweed (Buggy-whip)
Asclepias subulata	Ajamete
Dudleya arizonica	Live-forever
Dudleya saxosa	Rock Dudleya
Echinocereus engelmannii	Calico Hedgehog Cactus
Ferocactus acanthodes	Barrel Cactus
Fouquieria splendens	Ocotillo
Mamillaria dioica	Nipple Cactus
Mamillaria tetrancistra	Corkseed Cactus
Nolina parryi	Parry Nolina
Opuntia acanthocarpa	Stag-horn or Deer-horn Cholla
Opuntia bigelovii	Teddy Bear or Jumping Cholla
Opuntia basilaris	Beavertail Cactus
Opuntia echinocarpa	Silver or Golden Cholla
Opuntia ramosissima	Pencil Cholla, Darning Needle Cholla
Yucca schidigera	Mojave Yucca, Spanish Dagger
Yucca whipplei	Our Lord's Candle

[1] Source: "Coachella Valley Native Plants, Excluding Annuals (0 ft. to approximately 3,000 ft. elevation)." Compiled by Dave Heveron, Garden Collections Manager, and Kirk Anderson, Horticulturist, The Living Desert, May, 2000, for the Coachella Valley Mountains Conservancy.
[2] Common names for herbaceous perennials that are followed by "(w)" indicate a water or riparian species.

Table 4-113: Prohibited Invasive Ornamental Plants[1]

BOTANICAL NAME	COMMON NAME
Acacia spp. (all species except A. greggii)	Acacia (all species except native catclaw acacia)
Arundo donax (✓)	Giant Reed or Arundo Grass
Atriplex semibaccata (✓)	Australian Saltbush
Avena barbata	Slender Wild Oat
Avena fatua	Wild Oat
Brassica tournefortii (✓✓)	African or Saharan Mustard
Bromus madritensis ssp. *rubens (✓)*	Red Brome
Bromus tectorum (✓✓)	Cheat Grass or Downy Brome
Cortaderia jubata [syn.*C. atacamensis*]	Jubata Grass or Andean Pampas Grass
Cortaderia dioica [syn. *C. selloana*]	Pampas Grass
Descurainia sophia	Tansy Mustard
Eichhornia crassipes	Water Hyacinth
Elaegnus angustifolia	Russian Olive
Foeniculum vulgare	Sweet Fennel
Hirschfeldia incana	Mediterranean or Short-pod Mustard
Lepidium latifolium	Perennial Pepperweed
Lolium multiflorum	Italian Ryegrass
Nerium oleander	Oleander
Nicotiana glauca (✓)	Tree Tobacco
Oenothera berlandieri (#)	Mexican Evening Primrose
Olea europea	European Olive Tree
Parkinsonia aculeata (✓)	Mexican Palo Verde
Pennisetum clandestinum	Kikuyu Grass
Pennisetum setaceum (✓✓)	Fountain Grass
Phoenix canariensis (#)	Canary Island Date Palm
Phoenix dactylifera (#)	Date Palm
Ricinus communis (✓)	Castorbean
Salsola tragus (✓)	Russian Thistle
Schinus molle	Peruvian Pepper Tree or California Pepper
Schinus terebinthifolius	Brazilian Pepper Tree
Schismus arabicus	Mediterranean Grass
Schismus barbatus (✓✓)	Saharan Grass, Abu Mashi
Stipa capensis (✓✓)	No Common Name
Tamarix spp. (all species) *(✓✓)*	Tamarisk or Salt Cedar
Taeniatherum caput-medusae	Medusa-head
Tribulus terrestris	Puncturevine
Vinca major	Periwinkle
Washingtonia robusta	Mexican fan palm
Yucca gloriosa (#)	Spanish Dagger

[1] Sources: California Exotic Pest Plant Council, United States Department of Agriculture-Division of Plant Health and Pest Prevention Services, California Native Plant Society, Fremontia Vol. 26 No. 4, October 1998, The Jepson Manual; Higher Plants of California, and County of San Diego Department of Agriculture.

Key to Table 4-113:
indicates species not on CalEPPC October 1999 "Exotic Pest Plants of Greatest Ecological Concern in California" list
✓   indicates species known to be invasive in the Plan Area
✓✓   indicates particularly troublesome invasive species

4.5.6 Barriers

Land uses adjacent to or within a Conservation Area shall incorporate barriers in individual project designs to minimize unauthorized public access, domestic animal predation, illegal trespass, or dumping in a Conservation Area. Such barriers may include native landscaping, rocks/boulders, fencing, walls and/or signage.

4.5.7 Grading/Land Development

Manufactured slopes associated with site Development shall not extend into adjacent land in a Conservation Area.

Comments Received

Dear Mr. Sullivan:

The Department of Fish and Wildlife (CDFW) has reviewed the draft Joint Project Review (draft JPR) 18-004 for the County of Riverside's (County) for the Painted Hills Repowering Project (Project), which we received on November 1, 2018. The draft JPR included a Biological Resources Assessment and CVMSHCP Consistency Analysis (Consistency Report) and CH2M Hill 2012 Avian Use Memo (Avian Use Memo). The County provided Conditions of Approval for the Project on October 24, 2018 (Conditions of Approval). The draft JPR was prepared to evaluate the Project's consistency with the Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP). CDFW is providing the following comments as they relate to the Project's consistency with CVMSHCP Section Upper Mission Creek/Big Morongo Canyon Conservation Area (Section 4.3.7 of the CVMSHCP), Avoidance, Minimization, and Mitigation Measures for Burrowing Owl and Desert Tortoise (Section 4.4 of the CVMSHCP), and Land Use Adjacency Guidelines (Section 4.5 of the CVMSHCP). In addition, CDFW provides comments separate from the CVMSHCP consistency review on aspects of the project that are not covered by the CVMSHCP such as potential aerial impacts to avian and bat species.

Project Location

The Painted Hills Project site is located in the Upper Mission Creek/Big Morongo Canyon Conservation Area of the CVMSHCP, Riverside County. The Project lies north of Interstate 10, west of State Route 62, and east of Whitewater Canyon between Whitewater and Painted Hills communities. The project site consists of four parcels, Assessor's Parcel Numbers 516030004,516030008, 516030014, and 516030015.

Project Description

The Project proposes to decommission and replace 291 existing wind turbines with 14 taller wind turbines. Additionally, the Project includes construction of two new permanent, lattice meteorological towers, new access roads, and the rehabilitation of existing access roads. Temporary new roads and existing roads that will not be used by the Project will be restored after the construction phase and permanent new roads will be reduced to 16-ft wide. The project description includes installation of new 12kv underground and/or overhead electrical collection lines to collect energy from the new turbines. The project area includes placement of new turbines on the valley floor and ridge tops. The Project is covered by a legal settlement which requires onsite restoration.

Coachella Valley MSHCP Comments

CDFW agrees conceptually the ground disturbance project impacts described in Coachella Valley Conservation Commission's (CVCC) analysis in the draft JPR may be consistent with the quantitative acreage requirements outlined for the Upper Mission Creek/Big Morongo Canyon Conservation Area. However, there is insufficient information to determine if the project is consistent with all CVMSHCP requirements such as the Avoidance, Minimization, and Mitigation Measures for Burrowing Owl and Desert Tortoise (Section 4.4 of the CVMSHCP) and Land Use Adjacency Guidelines (Section 4.5 of the CVMSHCP). We recommend addressing the comments below and submitting a revised draft JPR and Consistency Report to facilitate completion of the CDFW review. The following information needs to be addressed:

Project Acres and Rough Step

There was conflicting information on the acres of disturbance and area of the project. CVCC's draft JPR project information identified the total project acreage as 45 acres, Riverside County Environmental Planning Department's cover sheet to the Consistency Report, titled "Western Riverside County MSHCP Biology Report Review/Intake" identified 492 acres for the project size, and the Consistency Report identified a project survey area of 492 acres with a net new permanent impacts of 3.50 acres (page 9). CVCC's draft JPR analysis identified proposed disturbance for 3 acres of Other Conserved Habitat for Coachella Valley Jerusalem Cricket, 41 acres for Core Habitat for desert tortoise, and 41 acres for sand source areas. In addition, the project description includes installation of new 12kv underground and/or overhead electrical collection lines to collect energy from the new turbines. It is unclear if the underground impacts were accounted for in the total project impacts. Please clarify how impacts from the new collection lines were accounted for. CDFW recommends the Project impact numbers are reconciled between CVCC's draft JPR and the Consistency Report so that Project impacts are clearly identified.

Sand source areas and Core Habitat for desert tortoise will remain in Rough Step, however, for Other Conserved Habitat for Coachella Valley Jerusalem Cricket Rough Step will be exceeded by 4 acres. If the County approves this project as described, Rough Step will be exceeded for Other Conserved Habitat for Coachella Valley Jerusalem Cricket and the County will not be able to approve future projects requiring Acres of Disturbance in this category. CDFW recommends that the project restoration plan include efforts to remedy the Rough Step shortfall by including measures to restore Coachella Valley Jerusalem Cricket Other Conserved Habitat.

Desert Tortoise

Avoidance, Minimization, and Mitigation measures are required for Desert tortoise (Section 4.4 of the CVMSHCP) but specific measures were not identified in County's Conditions of Approval for the project or in the CVMSHCP Consistency Report; and were not evaluated in CVCC's draft JPR analysis. CDFW requests that the draft JPR and County's Conditions of Approval are revised to incorporate the required desert tortoise measures in Section 4.4 of the CVMSHCP.

Burrowing Owl

Conservation Objective 5 for the Upper Mission Creek/Big Morongo Canyon Conservation Area is to "conserve occupied burrowing owl burrows as described in Section 4.4 for burrowing owl avoidance, minimization, and mitigation measures." However, the Consistency Report only identifies a pre-construction survey for burrowing owls and does not include the other required avoidance, minimization, and mitigation measures. Riverside County's Conditions of Approval include burrowing owl measures for the Western Riverside County Multiple Species Habitat Conservation Plan not the Coachella Valley MSHCP. The Project should demonstrate consistency with the required CVMSHCP burrowing owl measures, which include at a minimum surveying for burrowing owls, avoiding occupied burrowing owl burrows if at all possible, and if not possible then following the required minimization and mitigation measures. CDFW requests that the draft JPR, Conditions of Approval, and Consistency Report are revised to incorporate the required CVMSHCP burrowing owls avoidance, minimization, and mitigation measures.

Coachella Valley Milkvetch
The Consistency Report (page i) states that the Project Survey Area lies in the Other Conserved Habitat for the Coachella Valley milkvetch (*Astragalus lentiginosus*), however CVCC's draft JPR does not identify any impacts in this habitat. Figure 3 in the Consistency Report has triple-ribbed milkvetch (*Astragalus tricarinatus*). Please clarify if the Project is within Other Conserved Habitat for the Coachella Valley or triple-ribbed milkvetch.

Land Use Adjacency Requirements
The purpose of Land Use Adjacency Guidelines is to avoid or minimize indirect effects from Development within the Conservation Areas, such as noise, lighting, drainage, intrusion of people, and the introduction of non-native plants and non-native predators. Permittees to the CVMSHCP are required to consider Land Use Adjacency Guidelines when evaluating projects, however, this information was not provided or considered in draft JPR, the Consistency Report, or the County's Conditions of Approval for the project. CDFW requests that sufficient information is provided on specific project design elements and features that address noise, lighting, drainage, intrusion of people (access control), and control of non-native species to evaluate whether the project is consistent with Land Use Adjacency Guidelines. The specific land use adjacency measures for the project should be incorporated into draft JPR, the Consistency Report, and the County's Conditions of Approval for the project

Non-CVMSHCP Comments

Avian Impacts
The Consistency Report concludes that based on previous studies conducted for golden eagle (*Aquila chryseatos*) and general avian use and the current project design, the Project is not anticipated to have substantial effect on the species. This assessment is based the rationale that, the replacement of 291 wind turbines with up to 14 wind turbines would reduce risks to avian species by reducing the total number of rotor swept area, reducing rotor speeds, and increasing turbine spacing. The CDFW agrees that these factors may reduce the potential for impacts to a less than significant impact. However, CDFW does not agree that the risks to golden eagles and large raptors have been adequately assessed.

Project evaluation of avian impacts relies on 2011 avian use surveys and 2012 CH2M Hill Avian Use Memo. The survey data is over 7 years old and should be updated. The Avian Use Memo relies primarily on information from 2005 and the 1980's. Interestingly, the Avian Use Memo identifies the elimination of lattice structures as beneficial because it reduces perching attractants, however, this Project includes the addition of two lattice towers. The information provided to assess the impacts of the proposed Project on avian and bat species was insufficient and outdated and does not support the statement that the project will not have a substantial effect.

Information was not provided on the height of the new wind turbines or the length of the blades. In addition, the volumes of the rotor-swept areas of both the existing (baseline conditions) and proposed, larger wind turbines were not provided. Finally, the annual rotor-swept area for the baseline conditions and the proposed project are not provided. A comparison of the rotor-swept area and the annual rotor-swept area between the existing baseline conditions and the proposed project conditions is essential. For each doubling of blade length, the rotor swept area quadruples. The relevant information has not been provided but the rotor-swept area of the proposed taller towers may be several times larger than the rotor-swept area of the much smaller existing towers. Without this information, it is impossible to determine if the potential volume of area where raptors may be impacted will decrease, stay the same, or increase. Information is needed to quantify the change from baseline conditions that will result from the implementation of the proposed project. CDFW recommends that the Project description be revised to incorporate this critical information.

Another point that needs to be addressed is that the increase in height may bring the rotor-swept area into the range of the foraging flight height of golden eagles and other large raptors. Resident golden eagles may fly as low as 150-450 feet above the ground while foraging. The possibility that an increase in turbine height may increase probability of impacting foraging large raptors has not been adequately addressed.

Section 3503.5 states that is it unlawful to take, possess, or destroy any birds in the orders Falconiformes or Strigiformes (birds-of-prey) or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by FGC or any regulation adopted pursuant thereto.

The CDFW recommends that a Risk Assessment for take of birds and bats be performed that includes: 1) changes in volume of rotor-swept area between existing and proposed project conditions, 2) changes in annual rotor-swept area between existing and proposed project conditions, and changes in probability of impact with large raptors with increased tower height. These factors need to be incorporated into a Risk Assessment along with the change in numbers of turbines and spacing of turbines currently discussed in the IS. If the Risk Assessment indicates that the proposed Project will increase risk of impacts to raptors in comparison to baseline conditions, suitable avoidance and minimization measures should be included as Mitigation Measures in the IS/MND to reduce impacts to the level of baseline conditions. In the event that risk of impacts cannot be reduced to baseline levels, suitable compensatory mitigation should be proposed.

Migratory Birds

The CDFW recognizes that the reduction in number of turbines, greater height of turbines from the ground, and wider spacing of turbines incorporated into the proposed project design may reduce impacts to some avian species in comparison to the existing conditions. However, the CDFW does not agree the assessment that the Project is not anticipated to have a significant effect "due to removal of numerous existing turbines and their replacement with fewer new turbines, avian impacts are expected to be reduced from existing conditions" (Consistency Report, p. 14). This assessment is not considered to be adequately supported by the available information. A reduction in risk to some species may also be associated with an increase in risk to other species. Without the Risk Assessment recommended in the previous comment, it is impossible to determine if the potential volume of area where birds (and bats) may be impacted will decrease, stay the same, or increase. FGC Section 3513 states that it is unlawful to take or possess any migratory nongame bird as designated in the MBTA or any part of such migratory nongame bird except as provided by rules and regulations adopted by the Secretary of the Interior under provisions of the MBTA. The Risk Assessment recommended in the previous comment is also recommended to assess impacts to migratory birds. If the Risk Assessment indicates that the proposed Project will increase risk of impacts to migratory birds in comparison to baseline conditions, suitable avoidance and minimization measures should be included as Mitigation Measures in the IS/MND to reduce impacts to the level of baseline conditions. In the event that risk of impacts cannot be reduced to baseline levels, suitable compensatory mitigation should be proposed. The CDFW does not agree that the risks to migratory birds have been adequately assessed.

Bats

Bats also need to be included in any assessment of the impacts of the proposed project. Voluntary guidance for performing surveys for pre-permitting assessment is available at https://www.wildlife.ca.gov/Conservation/Renewable-Energy/Activities/Wind from California Guidelines for Reducing Impacts to Birds and Bats from Wind Energy Development (California Energy Commission and California Department of Fish and Game. 2007).

CDFW Conclusions and Further Coordination

CDFW appreciates the opportunity to provide comments on this draft JPR, and look forward to working with you, the County, and the Project applicant on the JPR for the Painted Hills Wind Energy Repowering Project. If you should have any questions pertaining to the comments provided in this letter, please contact Heather Pert: heather.pert@wildlife.ca.gov.

Please note this communication is being sent from Joanna, as Heather's email account is currently non-functional.

Joanna Gibson
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From: McBride, Jenness <jenness_mcbride@fws.gov>
Sent: Friday, November 30, 2018 12:14 PM
To: Jim Sullivan <jsullivan@cvag.org>; Katie Barrows <kbarrows@cvag.org>
Cc: Pert, Heather@Wildlife <Heather.Pert@wildlife.ca.gov>; Gibson, Joanna@Wildlife <Joanna.Gibson@wildlife.ca.gov>
Subject: JPR Comments -- Painted Hills Wind Energy Repowering Project

In Reply Refer To:

FWS-ERIV-09B0023-19TA0255

Mr. Jim Sullivan
GIS Program Manager
Coachella Valley Conservation Commission
73-710 Fred Waring Drive, Suite 200
Palm Desert, California 92260

Subject: Draft Project Review, Painted Hills Wind Energy Repowering Project, Upper Mission Creek/Big Morongo Canyon Conservation Area, Riverside County, California

Dear Mr. Sullivan:

The U.S. Fish and Wildlife Service (Service) has reviewed the Coachella Valley Conservation Commission's (CVCC) Draft Joint Project Review (JPR) for the Painted Hills Wind Energy Repowering Project (Project), dated October 30, 2018, and received in our office on November 1, 2018. The proposed Project includes the removal of approximately 291 existing wind turbines and installation of 14 new turbines; and construction of related access roads and infrastructure, including up to two new permanent lattice meteorological towers and up to three new temporary, guyed lattice meteorological towers.

The Project will result in disturbance to approximately 41 acres of desert tortoise core habitat and 41 acres of sand source areas, which are within the acres of disturbance authorized by the Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP) and within Rough Step requirements for the Upper Mission Creek/Big Morongo Canyon Conservation Area. In addition, 3 acres of other conserved habitat for Coachella Valley Jerusalem cricket will be disturbed, which would result in a Rough Step deficit of -4 acres. The applicant will be required to restore to pre-disturbance condition at least 3 acres of Coachella Valley Jerusalem cricket habitat that will be temporarily disturbed by Project activities. Prior to issuance of any grading permit, the applicant will prepare and implement a restoration plan according to the requirements of a separate settlement agreement, which outlines the process, content, and timeline for the restoration plan. In addition to the habitat restoration plan, we recommend that bird flight diverters or other type of high visibility marking devices be placed on the guy wires of the temporary meteorological towers to minimize the risk of bird collisions.

Based on CVCC's analysis, the Service has no comment on the Project's decommissioning of old turbines and construction of new ones, and we consider the restoration plan for temporarily disturbed areas is appropriate.

For your information, we note the following issues in the JPR application materials that should be clarified:

- The Biological Resources Assessment and CVMSHCP Consistency Analysis prepared by LSA Associates, Inc., states on page 9 that a streamlined section 7 consultation under the Endangered Species Act may be necessary for potential Project-related effects to the desert tortoise. In fact, a section 7 consultation is not required to evaluate the effects of Permittee Covered Activities to Covered Species.

- The Riverside County Environmental Programs Department (EPD) conditions for the Painted Hills Wind Energy Project (Attachment 1 to CVCC's October 31, 2018, email to us) refers to burrowing owl survey requirements in the Western Riverside County Multiple Species Habitat Conservation Plan. This should be corrected to include the burrowing owl requirements of the CVMSHCP.

- The cover sheet to the Biological Resources Assessment and CVMSHCP Consistency Analysis is headed "Western Riverside County MSHCP Biology Report Review/Intake." We question why the Western Riverside County MSHCP is involved in the CVMSHCP JPR application process. We recommend that Riverside County clearly mark all future JPR materials as pertaining to the CVMSHCP and remove any reference to the Western Riverside County MSHCP.

Spinning turbine rotors at wind energy facilities are typically considered a collision risk to birds. Whereas new ground disturbance associated with construction (including repowering) of wind energy facilities is a Covered Activity under the CVMSHCP, disturbance to Covered Species from operation of wind facilities is not (see Section 7.3.1 of the CVMSHCP). We are not considering turbine operation as part of CVCC's JPR consistency determination. However, the golden eagle (*Aquila chrysaetos*), which is not a Covered Species under the CVMSHCP, is protected by the Bald and Golden Eagle Act (16 U.S.C. 668-668d) and occurs near the Project site in the San Jacinto Mountains and Little San Bernardino Mountains. In addition, we are aware of two recent eagle fatalities that likely resulted from collision impacts at wind facilities near Cabazon. For these reasons, we are concerned that golden eagles may be at risk of turbine collisions at the Project site, and we offer the following comments for consideration by the County and applicant outside of the JPR process.

According to the Biological Resources Assessment (LSA 2018) for the currently proposed Project and an Avian Use Memo (CH2M Hill 2012) for a previous repowering proposal in the Project survey area, the Painted Hills Wind Energy Repowering Project is designed to avoid impacts to birds. The Project is located in a mid-elevation area with consistently low numbers of avian species year-round (Anderson et al. 2005) and is located near other wind energy sites with estimated low avian risk (CH2M Hill 2012). The new turbines will be sited away from open water and riparian vegetation, and new tubular monopoles to replace existing lattice-type towers will reduce bird perching sites.

The number of turbines will be significantly reduced, which will reduce the total rotor-swept area on the Project site, and the turbines will be spaced farther apart (LSA 2018).

We agree the Project design may reduce impacts to birds compared to existing conditions. Nonetheless, we encourage the County and applicant to further consider, before a grading permit is issued, the potential impacts of turbine operation on golden eagles. We would be glad to assist the County and applicant to assess the risk of collision to golden eagles, and request CVCC to forward our attached comments and recommendations to the County and applicant; adoption of our recommendations by the County and applicant is voluntary.

We appreciate the opportunity to comment on this JPR application. If you have any questions regarding these comments, please contact me at 760-322-2070.

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Anderson, R., J. Tom, N. Neumann, W.P. Erickson, M.D. Strickland, M. Bourassa, K.J. Bay, and K.J. Sernka. 2005. Avian monitoring and risk assessment at the San Gorgonio Wind Resource Area. Prepared for National Renewable Energy Laboratory, August 2005. Subcontract Report NREL/SR/500-38054. Golden, CO.

CH2M Hill. 2011. Avian Use Memo, Painted Hills IV Wind Energy Project. Prepared for First Wind, May 2011. Appendix D of LSA Associates, Inc., Biological resources assessment and CVMSHCP consistency analysis, Painted Hills Wind Energy Repowering Project, Riverside County, California, June 2018. Ramona, CA.

[LSA] LSA Associates, Inc. 2018. Biological resources assessment and CVMSHCP consistency analysis, Painted Hills Wind Energy Repowering Project, Riverside County, California. Prepared for Dudek, Encinitas, CA, June 2018. Palm Springs, CA.

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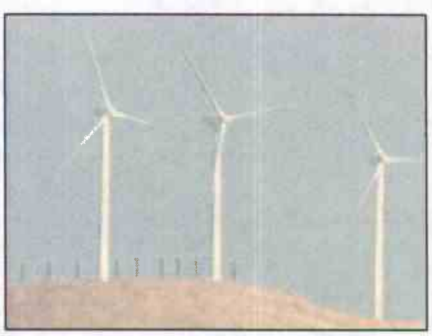
EXHIBIT D



H. T. HARVEY & ASSOCIATES
Ecological Consultants

Golden Hills Wind Energy Center Postconstruction Fatality Monitoring Report: Year 2

Project 3926-01

Prepared for:

Golden Hills Wind, LLC
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Attention: Renee Culver

Prepared by:

H. T. Harvey & Associates

DRAFT REPORT – December 17, 2018

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Executive Summary

The Golden Hills Wind Energy Center (GHWEC) is an 85.92-megawatt (MW) wind-energy facility comprising 48 1.79-MW General Electric turbines located in the Altamont Pass Wind Resource Area (APWRA) of Alameda County, California. The facility is owned and operated by Golden Hills Wind, LLC, a subsidiary of NextEra Energy Resources, LLC, and began commercial operation in December 2015. This report summarizes the results of the second of three years of postconstruction bird and bat fatality monitoring (Project) required to meet the conditions of approval outlined in the Conditional Use Permit (PLN201-00032) issued for the GHWEC by the East County Board of Zoning Adjustments in 2014. The implemented monitoring plan was approved by the Alameda County Technical Advisory Committee (TAC) and began on September 19, 2016. These results are preliminary and any apparent trends or patterns will be better defined as the monitoring continues through Year 3.

In brief, the primary Project components in Year 2 were as follows:

1) Bat and bird fatality surveys covering 105-meter (m) radius search areas around all 48 turbines
2) Spatially balanced, randomized selection of 16 turbines at which 7-day-interval searches were conducted using scent-detection dogs (non-overlapping selection of turbines compared to Year 1)
3) Searches conducted by humans at 28-day intervals at the remaining 32 turbines
4) Integrated carcass detectability bias trials ("Big D" approach) conducted to provide a basis for deriving adjusted annual fatality estimates

Field Methods

Field biologists used iPads® equipped with a Geographic Positioning System and GIS Pro® software to record and map all survey data and fatality locations. Data recorded during the surveys generally followed standards previously applied by the Altamont Monitoring Team. All bats and volant birds found injured/debilitated or dead within the standardized survey plots contributed to adjusted fatality estimates, with no consideration given to accounting for non-turbine-related background mortality (an issue that the high search efficiency of detection dogs could inflate to an unknown degree for at least bats and small birds) or the possibility that injured/debilitated animals could have been harmed elsewhere (whether by another turbine or by unrelated factors outside of any survey plots) and wandered onto a survey plot while still mobile.

We conducted bias trials to estimate carcass detectability using freshly dead (frozen and thawed prior to placement) bat and bird carcasses placed in small numbers during most weeks of the survey year in a spatially balanced manner across all turbines. Subject to the availability of suitable carcasses and permit restrictions, we strove to place at least 30 bats, 40–50 small birds (<100 gram [g] average body mass), and 40–50 medium (100–500 g) or large (>500 g) bird carcasses across the 7-day-interval survey plots (hereafter 7-day plots and surveys), and a similar array of specimens across the 28-day-interval survey plots (hereafter 28-day plots and surveys). We used primarily species known or with the potential to occur in the study area, including native as well as some nonnative species that routinely occur in the study area. Unlike in Year 1 when we adopted an approach that produced independent assessments of searcher efficiency, carcass persistence, and bleed-through (i.e., carcasses that are missed and persist across more than one search interval), during Year 2 we adopted the TAC-approved "Big D" approach to conducting carcass detectability bias trials, wherein (1) trial carcasses are randomly (spatially and temporally) placed throughout the study period irrespective of when surveys are scheduled, (2) detections are recorded whenever they occur (i.e., bleed-through accommodated) and carcasses are collected upon discovery (as with all actual fatalities), (3) carcasses are not otherwise monitored for persistence or to determine presence/absence prior to surveys, and (4) single taxon- and survey-specific estimates of carcass detectability are generated that integrate the influences of imperfect searcher efficiency and removal of carcasses by scavengers and abiotic factors (*D*), and are based on relationships between carcass detectability and the average masses of fatality species.

Analytical Methods

For purposes of estimating carcass detectability rates and generating adjusted fatality estimates, we followed guidance provided in recent publications and technical reports derived from work in the APWRA. The basic fatality estimation procedure involved application of a modified version of the original Horvitz-Thompson estimator:

$$F_A = \frac{F_U}{D \times d}$$ **Equation 1**

where F_A = adjusted fatality estimate, F_U = raw count of fatalities over a given monitoring period, D = proportion of placed carcasses detected by searchers conducting standard fatality surveys during the monitoring period (Big D), and d = search-radius bias adjustment factor (also known as the distance weighted proportion [DWP] adjustment).

Developing unbiased estimates of *D* to incorporate in the above equation requires tailoring estimates to represent the influence of carcass size, which affects both the ability of searchers to detect carcasses and the probability of removal by scavengers. To predict carcass detectability based on the average mass of relevant species, we developed logistic generalized linear models (GLMs) based on the bias-trial detection data for birds collected during Year 2, developing independent models for the 7-day dog surveys and the 28-day human surveys. We also evaluated whether season or substrate covariates improved the estimation models. We did not develop similar models for bats, because (1) we were unable to represent a sufficient range of bat species of different sizes to compose a robust prediction model, (2) variation in the ability of scent-detection dogs to find smaller species such as Mexican free-tailed bats (scientific names of all taxa referred to in this report are provided in Appendix A) and *Myotis* spp. versus larger hoary bats is insubstantial, and (3) estimating adjustment factors for human surveyors was unnecessary, because they detected few bat fatalities and did not find any of the bat trial carcasses placed on the 28-day plots. Instead, to develop adjusted bat fatality estimates for the 7-day plots in Year 2, we applied season-specific carcass detectability correction factors (*D*) representing the non-modeled proportions of placed bats found by the detection-dog teams during each quarterly season.

To estimate standard errors (SEs) and confidence intervals (CIs) to accompany the bird fatality estimates adjusted for mass-dependent carcass detectability, we adopted the approach advocated in the final report for the Vasco Winds study. This approach involved using trial placement and detection data as a "training dataset" to simulate the probability of detecting actual fatalities and variation related to carcass size, and to support parameterizing the following model:

$$\widehat{SE}[P_A] = a + \frac{1}{b * M} + c * SE[P_U] \qquad \textbf{Equation 2}$$

where $\widehat{SE}[P_A]$ = estimated standard error of the adjusted (for carcass size) placed-carcass detection rate (adjusted detections of placed carcasses per turbine for a given species); M = average body mass (g) of a given placed species; $SE[P_U]$ = estimated standard error of the unadjusted placed-carcass detection rate (unadjusted detections of placed carcasses per turbine for a given species); and *a*, *b*, and *c* are parameter values optimized using quasi-Newton methods to minimize the root-mean-square error and maximize the coefficient of determination (R^2) of the best-fit nonlinear regression models. We developed independent predictive models based on Equation 2 for birds of all sizes for 7-day and 28-day plots. Once the training dataset models were optimized, we used the resulting *a*, *b*, and *c* parameter values and SE estimates representing variation in the unadjusted per turbine fatality detection rates for individual species to predict the SE of the adjusted fatality estimate based on the following equation:

$$\widehat{SE}[F_A] = a + \frac{1}{b * M} + c * SE[F_U] \qquad \textbf{Equation 3}$$

where $\widehat{SE}[F_A]$ = estimated SE of adjusted fatality estimate; $SE[F_U]$ = estimated SE of unadjusted fatality estimate, and all other parameters are as in the previous equation.

We generated separate adjusted fatality estimates for the 7-day and 28-day surveys using the unique adjustment methodologies applied in Years 1 and 2, and then averaged the adjusted rates for the two survey types to generate facility-wide estimates. For bats in Year 2, a dearth of documented fatalities and the surveyors failing to find any of the bat trial carcasses precluded developing adjusted fatality estimates for the 28-day human surveys. Therefore, we extrapolated the 7-day survey estimates for bats to represent the entire facility.

For perspective similar to Year 1, we produced three other sets of fatality estimates for bats, all raptors, and the four focal raptor species. *Naive estimates* represented the unadjusted fatality totals (summed across all plots) translated to average per MW estimates for the facility, with and without off-plot incidental finds included. We also calculated comparative estimates for all raptors combined and the four focal raptor species using Equation 1, but replacing modeled estimates of *D* with non-modeled, season-specific (quarterly) estimates of *D* calculated for medium and large birds as groups. This was analogous to the approach we used to generate adjusted fatality estimates for bats in Year 2, and comparable to the *BT H-T* (bleed-through Horvitz-Thompson) alternative estimates we generated for Year 1 (H. T. Harvey & Associates 2018). In Year 1, we also generated *NoBT H-T* (no bleed-through H-T) estimates for comparison; however, generating comparable estimates for Year 2 was not possible, because the Big D integrated bias-trial approach does not support generating estimates of carcass detectability that are based on searchers having only one opportunity to detect trial carcasses.

Results

The 2016/2017 winter/spring period was unusually wet, especially following on the heels of a severe 4-year drought, and as a result the vegetation growth was relatively extreme during spring 2017. In contrast, the

2017/2018 winter/spring period reverted to drought conditions and as a result the spring vegetation growth was comparatively limited. The variability in landscape condition undoubtedly contributed to substantial variation in the regional population dynamics of relevant birds and bats, as well as to interannual and seasonal variation in the fatality search efficiency of our survey teams and relevant carcass scavenging and predation rates in the Project area.

Composition of Fatalit y Incidents

In Year 1, we documented 229 bat fatalities and 332 fatalities of volant birds using exclusively detection-dog teams as the searchers. In Year 2, we documented 124 bat fatalities and 237 fatalities of volant birds based on surveys conducted by both detection-dog teams (7-day plots) and human searchers (28-day plots). Of the Year 1 fatalities, we classified 221 bat and 286 bird (180 small, 19 medium, and 87 large) fatalities as having been found on a specific 7-day or 28-day plot, and 4 bat and 7 bird (5 small and 2 large) fatalities as incidental off-plot finds outside of the 105-m-radius survey plots. Of the Year 2 fatalities, we classified 120 bat and 218 bird (127 small, 39 medium, and 52 large) fatalities as having been found on a specific survey plot, and 4 bat and 18 bird (12 small, 4 medium, and 2 large) fatalities as incidental off-plot finds. In Year 2, the detection-dog teams found most of the bats and small birds on the 7-day plots, whereas the human surveyors and detection-dog teams averaged similar numbers of large-bird fatality finds (1.0–1.1 fatalities per turbine).

We excluded the incidental off-plot carcasses from most fatality estimates; however, both the Year 1 and Year 2 tallies above of large birds assigned to specific survey plots included one large raptor (a ferruginous hawk in Year 1 and a golden eagle in Year 2) that was found outside of any specific survey plot, alive but with a damaged wing. Because both birds had suffered what appeared to be an ultimately fatal blade-strike injury (both were later euthanized), we included both incidents in all fatality estimates per standard practice for other incidental finds discovered on surveys plots. For relevant estimation purposes, we randomly assigned the ferruginous hawk to one of the two turbines (WTG-22) close to where it was found and the golden eagle to one of the four turbines (WTG33) close to where it was found. We documented no other injured animals in Year 2, whereas the Year 1 fatalities also included three injured/debilitated Mexican free-tailed bats (all later died or were euthanized) found on survey plots during standard surveys, which were automatically assigned to a specific turbine and included in the fatality estimates.

The Year 2 bat fatalities involved four species, comprising mostly Mexican free-tailed bats (57%) and hoary bats (37%), but including four western red bats (a California species of special concern [CA-SSC]), and a single California myotis (a new species for the Project). The Year 2 bird fatalities involved 37 native species and 1 nonnative species (European starling), including 11 species of raptors and vultures, four of which are afforded special-status protection in California: golden eagle (California fully protected [CFP] and protected under the federal Bald and Golden Eagle Protection Act; n = 14 confirmed on- and off-plot injuries/fatalities), white-tailed kite (CFP; n = 1), burrowing owl (CA-SSC; n = 25), and northern harrier (CA-SSC; n = 1). The nonraptor bird fatalities included three other special-status species: loggerhead shrike (CA-SSC; n = 1), Vaux's swift (CA-SSC; n = 3), and yellow warbler (CA-SSC; n = 1). The number of confirmed nonraptor bird species documented as fatalities in Year 2 (27) was lower than in Year 1 (35), and only 19 species were common to both years. Species for which we documented more than 10 fatalities in Year 2 were horned lark (n = 34), red-tailed hawk

(n = 30), burrowing owl (n = 25), western meadowlark (n = 20), white-throated swift (n = 19), golden eagle (n = 14), and American kestrel (n = 11).

Carcass Detectability

In Year 2, we placed 2–4 bat carcasses, 2–4 small bird carcasses, and 2–4 medium or large bird carcasses on every 7-day plot, and we placed 1–3 bat carcasses, 1–2 small bird carcasses, and 1–2 medium or large bird carcasses on most of the 28-day survey plots. The trial carcasses involved 67 bats of 3 species, 93 small birds of 23 species, 32 medium birds of 9 species, and 69 large birds of 13 species. Of the carcasses used in Year 2 for bias trials, 48% of the bats, 14% of the small birds, 19% of the medium birds, and 17% of the large birds originated as fatalities during the study.

The detection-dog teams ultimately found 22 of 36 (61%) bats placed on the 7-day plots. In contrast, the human surveyors found none of 31 bats placed on the 28-day plots, which thereby precluded developing a detectability estimate for bats on those plots. The non-modeled probability of detection-dog teams detecting bats on 7-day plots was highest during fall (80%) and lower (50–60%) during other quarterly seasons. The duration between placement and discovery of bat carcasses by the detection-dog teams ranged from 1–40 days, with a median discovery age of 4 days. Based only on detected carcasses, the estimated bleed-through rate for detection-dog teams surveying for bats at 7-day intervals was 32%.

The detection-dog teams ultimately found 27 of 45 (60%) small birds, 16 of 19 (84%) medium birds, and 32 of 33 (97%) large birds placed as trial carcasses on the 7-day plots in Year 2. The probability of a detection-dog team detecting small birds on 7-day plots declined progressively from a high of 70% in fall to a low of 54% in summer. Detection of medium birds followed the opposite pattern, increasing progressively from a low of 75% in fall to a high of 100% in summer, and the probability of detecting large birds also was slightly lower in fall (83%; one carcass missed) than in other seasons (100%). The duration between placement and discovery of small bird carcasses by the detection-dog teams ranged from <1–63 days, with a median discovery age of 6 days and an estimated bleed-through rate of 41%. The duration between placement and discovery of medium bird carcasses by the detection-dog teams ranged from <1–15 days, and for large birds ranged from <1–36 days. For both those groups, the median discovery age was 4 days and the estimated bleed-through rate was 6%.

The human surveyors ultimately found 2 of 48 (4%) small birds, 6 of 13 (46%) medium birds, and 32 of 36 (89%) large birds placed as trial carcasses on the 28-day plots in Year 2. The estimated probability of human surveyors detecting small birds on 28-day plots was 7–11% in fall/winter and zero in spring/summer. The probability of human surveyors detecting large birds also declined from fall (100%) through summer (80%). The duration between placement and discovery of the two small bird carcasses by the human surveyors was 3 and 5 days. The duration between placement and discovery of medium bird carcasses by the human surveyors ranged from 1–13 days, with a median discovery age of 6 days and no confirmed bleed through. The duration between placement and discovery of large bird carcasses by the human surveyors ranged from <1–42 days, with a median discovery age of 6 days and an estimated bleed-through rate of 3% (n = 1).

For both the 7-day dog surveys and the 28-day human surveys, the best GLMs indicated significant relationships between the probability of detection and the average mass of bird species placed as trial carcasses, and neither season nor substrate covariates significantly improved the fit of either model. The final models translated to the following equations to predict carcass detectability (*D*) from average species mass for birds:

7-day:

$$D = \text{EXP}(0.01103 * \text{Average Mass} - 0.09202) / (1+\text{EXP}(0.01103 * \text{Average Mass} - 0.09202)) \quad \textbf{Eqn. 4}$$

28-day:

$$D = \text{EXP}(0.00607 * \text{Average Mass} - 2.78988) / (1+\text{EXP}(0.00607 * \text{Average Mass} - 2.78988)) \quad \textbf{Eqn. 5}$$

Then we used Equation 1 to develop an adjusted "count" for each documented fatality by plugging in a relevant value for *D*, predicted based on the appropriate equation above, and a value for *d* derived from available literature. Finally, we summed the fatality-specific adjusted counts as needed to produce adjusted fatality estimates for various taxa, individual turbines, and survey periods. Parameterizing the model equations needed to estimate SEs and CIs to accompany the adjusted fatality estimates for birds using Equations 2 and 3 resulted in the coefficient values represented in Table ES-1.

Table ES-1. Coefficients Derived to Parameterize Equation 3 Used to Predict Standard Errors Associated with Adjusted Fatality Estimates for 7-day and 28-day Surveys

	Coefficients				Root Mean
Survey Type	**a**	**b**	**c**	R^2	**Square Error**
7-day Dog	0.0167	-1.106E+09	0.5604	0.877	0.0006
28-day Human	0.0217	-8.422E+7	1.9022	0.338	0.0136

Fatality Estimates

The adjusted estimate for bats on 7-day plots in Year 2 was 10.4 fatalities per turbine, which yielded an extrapolated facility-wide adjusted total of 500 bats, including an estimated 277 Mexican free-tailed bats and 197 hoary bats (Table ES-2). The adjusted fatality totals for birds on 7-day plots were 194 small birds, 30 medium birds, 17 large birds, and 44 total raptors (included in medium and large bird tallies), while the adjusted fatality totals on 28-day plots were 223 small birds, 105 medium birds, 38 large birds, and 140 total raptors. The results for small birds suggested underestimation on the 28-day plots, whereas the opposite was true for medium birds and all raptors as a group. The high 28-day estimates for medium birds and all raptors primarily reflected a substantially higher adjusted fatality total for burrowing owls on the 28-day plots (84 owls) compared to the 7-day plots (15 owls); however, the high 28-day estimates also reflected approximately four times as many golden eagle fatalities than on the 7-day plots.

The method used to generate 95% CIs for the various adjusted fatality estimates appeared to produce reasonable results, with two prominent exceptions. Despite requiring minimal adjustments for carcass detectability (*D*) and DWP (*d*) for both the 7-day dog and 28-day human surveys, and despite the actual and adjusted fatality estimates being substantially similar, the estimated CIs for the 28-day adjusted fatality estimates for golden eagles and red-tailed hawks were inexplicably and unreasonably wide (Table ES-2).

Table ES-2. Facility-Wide Raw Fatality Counts, Totals Filtered for Analysis, and Adjusted Fatality Estimates (95% Confidence Interval) for Selected Species and Species Groups of Bats and Birds in Monitoring Years 1 and 2

	Year 1				Year 2			
Taxon	Raw / Filtered Fatality Counts[1]	Adjusted Fatalities Per Turbine[2]	Adjusted Fatalities Per MW[2]	Adjusted Total Fatalities[2]	Raw Fatality Counts[3]	Adjusted Fatalities Per Turbine[4]	Adjusted Fatalities Per MW[4]	Adjusted Total Fatalities[4]
All bats	221 / 154	9.73 (6.63–18.73)	5.45 (3.70–10.47)	468 (318–900)	120	10.41 (6.78–14.03)	5.82 (3.79–7.84)	500 (326–674)
Mexican free-tailed bat	129 / 89	5.34 (3.64–9.73)	2.99 (2.03–5.45)	257 (174–468)	68	5.77 (3.70–7.83)	3.22 (2.07–4.37)	277 (178–376)
Hoary bat	80 / 61	4.13 (2.57–8.63)	2.32 (1.43–4.83)	199 (123–415)	46	4.10 (3.10–5.11)	2.29 (1.73–2.86)	197 (149–245)
All birds	286 / 208	11.43 (8.86–16.29)	6.39 (4.95–9.10)	549 (425–782)	218	14.03 (10.81–17.24)	7.84 (5.37–10.30)	607 (464–750)
Small birds	180 / 1	8.85 (6.38–13.81)	4.95 (3.56–7.72)	425 (306–663)	127	10.02 (6.85–13.19)	5.60 (3.83–7.37)	417 (285–550)
Medium birds	19 / 17	0.46 (0.24–0.76)	0.27 (0.13–0.43)	23 (11–37)	39	2.80 (1.84–3.75)	1.56 (1.03–2.10)	134 (86–183)
Large birds	87 / 77	2.13 (1.58–2.86)	1.20 (0.87–1.61)	103 (75–138)	52	1.21 (0.00–2.51)	0.68 (0.00–1.40)	55 (0–126)
Raptors	94 / 79	2.32 (1.72–3.15)	1.30 (0.95–1.77)	112 (82–152)	86	3.88 (3.32–4.44)	2.17 (1.19–3.14)	184 (163–205)
Nonraptors	192 / 129	9.11 (6.58–14.05)	5.10 (3.67–7.86)	438 (315–675)	132	10.15 (7.49–12.81)	5.67 (4.19–7.15)	423 (300–545)
Golden eagle	10 / 6	0.21 (0.07–0.40)	0.13 (0.03–0.23)	11 (3–20)	13	0.31 (0.00–0.62)	0.17 (0.00–0.35)	15 (0–32)
Red-tailed hawk	60 / 49	1.62 (1.12–2.29)	0.91 (0.62–1.28)	78 (53–110)	28	0.66 (0.29–1.04)	0.37 (0.16–0.58)	30 (9–51)
American kestrel	4 / 3	0.10 (0.03–0.22)	0.06 (0.01–0.13)	5 (1–11)	9	0.48 (0.34–0.62)	0.27 (0.19–0.35)	19 (12–26)
Burrowing owl	2 / 2	0.07 (0.03–0.19)	0.05 (0.01–0.12)	4 (1–10)	23	1.97 (1.65–2.28)	1.10 (0.92–1.28)	99 (82–117)
Horned lark	43 / 29	1.95 (1.09–3.34)	1.09 (0.61–1.87)	94 (52–161)	34	2.66 (2.39–2.94)	1.49 (1.33–1.64)	111 (97–124)
White-throated swift	16 / 13	0.94 (0.42–1.74)	0.54 (0.23–0.98)	46 (20–84)	19	1.45 (1.21–1.70)	0.81 (0.68–0.95)	59 (48–70)
Western meadowlark	26 / 21	1.54 (0.94–2.66)	0.86 (0.52–1.49)	74 (45–128)	15	0.91 (0.69–1.12)	0.51 (0.38–0.63)	37 (27–48)
House wren	23 / 18	1.17 (0.58–2.23)	0.66 (0.31–1.26)	57 (27–108)	1	0.06 (0.03–0.10)	0.03 (0.01–0.05)	2 (1–3)

1 Excludes incidental off-plot finds. Filtering included removing carcasses aged as having been deposited more than one search-interval (either 7 days or 28 days) before a given survey occurred, consistent with the no bleed-through assumption of the Huso (2011, 2012) DS729 fatality estimator.
2 Adjusted estimates derived using the Huso DS729 estimator, based on independent estimates of searcher efficiency and carcass persistence.
3 Excludes incidental off-plot finds.
4 Adjusted estimates derived using the Big D estimation approach, based on integrated assessments of carcass detectability and, for birds, modeling of detectability in relation to the average body mass of relevant species.

Temporal Distribution of Fatalities

In Year 2, the detection-dog teams discovered one or more bat fatalities on the 7-day plots in every month except January and February; however, 57% of those fatalities were discovered during fall migration 2017, and 21% were discovered during spring migration in 2018. Across both monitoring years, the adjusted fatality counts for 7-day plots only (a different set of 16 plots for each annual period, all surveyed by detection-dog teams) indicated a major activity peak during fall 2017 that extended from mid-August through October, whereas the bat fatality estimates from August through mid-September 2018 were comparatively very low.

Across the first two monitoring years, the detection-dog teams documented raptor fatalities on 7-day plots in all but 4 months, and the detection-dog teams in Year 1 and the human searchers in Year 2 documented raptor fatalities on 28-day plots in every month. Red-tailed hawk fatalities peaked in fall and early winter and were lowest in summer, whereas golden eagle fatalities were more broadly distributed and comparatively common during late spring and early summer. Fatalities of American kestrels and burrowing owls were scarce during Year 1; however, kestrel fatalities were relatively common during late-fall/winter in 2017/2018 and we documented 2–3 burrowing owl fatalities every month from January through September 2018.

In Year 1, the detection-dog teams discovered one or more nonraptor bird fatalities on both the 7-day and 28-day plots in every month. In Year 2, the detection-dog teams continued to discover one or more nonraptor bird fatalities on the 7-day plots every month, whereas the human searchers working the 28-day plots detected nonraptor birds in only 8 of 12 months. To date, the most concentrated multi-species fatality activity for nonraptor birds occurred from spring through fall 2017, with the numbers and species diversity comparatively modest during the same period in 2018. In addition, for common winter residents, the estimated fatality rates were noticeably higher in late fall/winter 2017/2018 than they were during the same period in 2016/2017.

Spatial Distribution of Fatalities

The detection-dog teams found at least one bat fatality on every turbine plot in Year 1 and at least one additional bat fatality on each of the 7-day plots in Year 2 (Figure ES-1), whereas the human surveyors found only four bats in Year 2, each on a different 28-day plot. In Year 1, the detection-dog teams detected ≥10 bat fatalities on half of the 48 survey plots, and in Year 2 they discovered ≥10 bat fatalities on 7 of the 16 7-day plots. The adjusted per-turbine fatality rate on 7-day plots was nonsignificantly higher in Year 1 (12.6 fatalities per turbine) than in Year 2 (10.4 fatalities per turbine). The adjusted turbine-specific fatality estimates most often indicated that the detection-dog teams found more bat fatalities on 7-day plots in Year 2 than they did surveying the same plots at 28-day intervals in Year 1 (Figure ES-1). Otherwise, the only partially matched, adjusted per-turbine fatality estimates from the 2 years did not emphasize any obvious multi-year hotspots, except for perhaps at wind turbine generator (WTG) 22 along the north-central edge of the facility.

For nonraptors, the first 2 years of monitoring revealed 28 turbines with one or more fatalities in both years, and 20 turbines with one or more fatalities in only 1 year. The adjusted fatality estimates were 9.3 ± 7.93 fatalities per plot in Year 1 and nonsignificantly lower at 8.2 ± 7.86 fatalities per plot in Year 2. The adjusted fatality totals were relatively high at WTGs 13, 37, and especially 42 in Year 2, whereas with the data aggregated across both monitoring years, WTGs 13 and 16 stood out with at least moderate adjusted fatality numbers in both years, while WTG 5 emerged as a notable concentration point, but only in Year 1 (Figure ES-1).

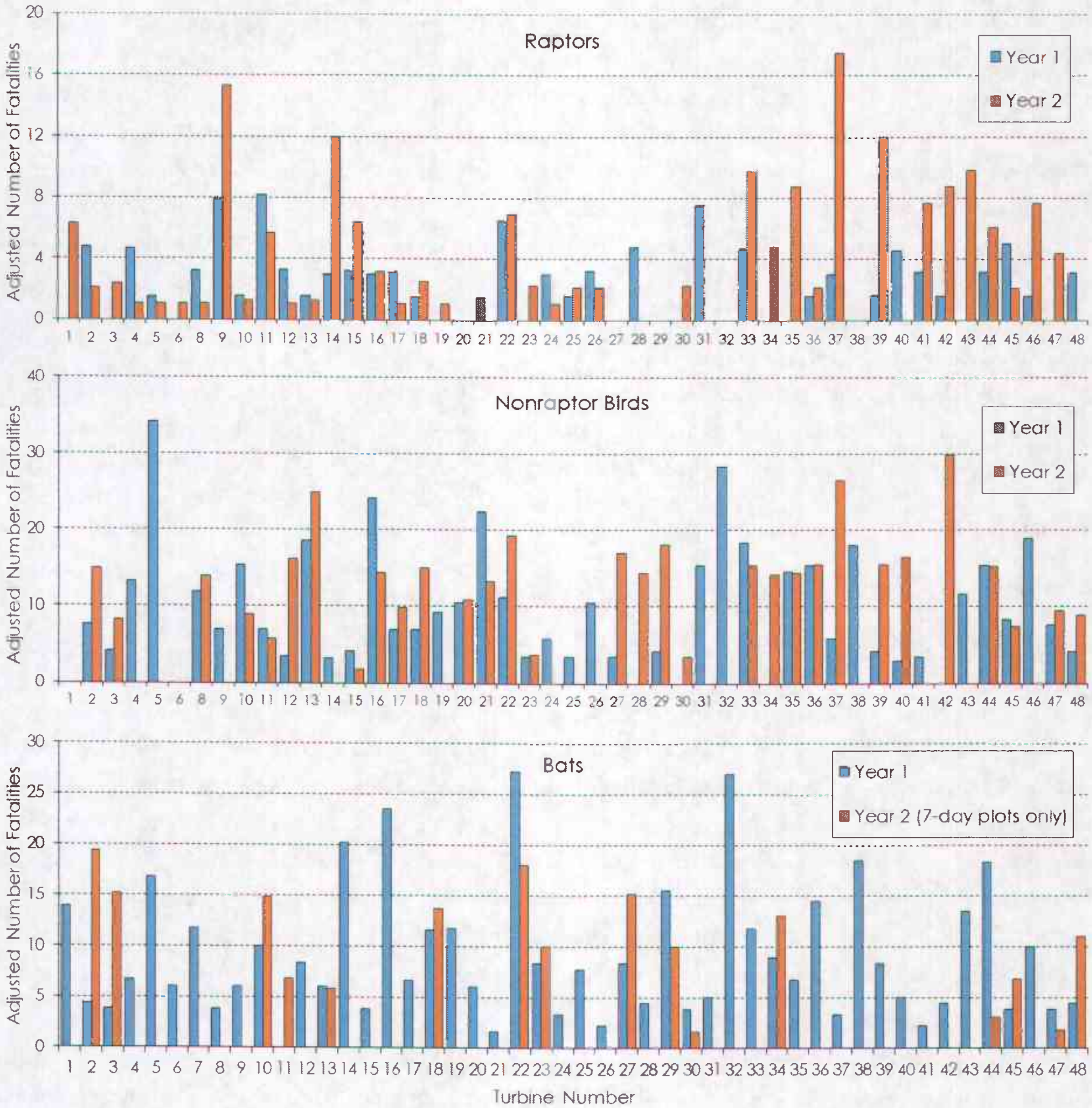

Figure ES-1. Adjusted Annual Estimates of Raptor, Nonraptor Bird, and Bat Fatalities by Turbine in Years 1 and 2

For raptors, 34 turbine plots had one or more fatalities in both monitoring years, 10 plots had one or more fatalities in only 1 year, and 4 plots have had no fatalities to date. The adjusted fatality estimates were 2.4±2.40 fatalities per plot (range 0–9) in Year 1 and a nonsignificantly higher 2.7±2.53 fatalities per plot (range 0–11) in Year 2. The adjusted annual fatality estimates varied across turbines, but overall remained relatively consistent in Years 1 and 2 in the western half to two-thirds of the facility, but were markedly higher in the eastern third of the facility in Year 2 compared to Year 1 (Figure ES-1). The adjusted fatality totals were relatively high at WTGs 14, 39, and especially 9 and 37 in Year 2, and the aggregated 2-year data did not modify the picture much, except that WTG 11 emerged as a moderate hot spot with multiple fatalities in both years.

For golden eagles, the integrated 2-year dataset identified WTGs 11 and 14 as relative hot spots, each with three documented fatalities and at least one fatality in both years. For red-tailed hawks, six turbines stood out as moderate hot spots in Year 2, with 2–3 estimated fatalities each, and WTGs 22 and 39 stood out as relatively strong hot spots with multiple fatalities in both years. In contrast, although WTGs 9, 11, and 31 emerged as a distinct raptor fatality cluster in the southeast sector in Year 1, and continued to be emphasized in the aggregated 2-year dataset, no red-tailed hawk fatalities occurred at these turbines in Year 2. With only four fatalities total and three suited to fatality estimation, evaluating the spatial distribution of American kestrel fatalities was not relevant for Year 1. Moreover, to date we have documented more than one kestrel fatality only at WTGs 11, 13, and 44, and we have documented a kestrel fatality in both years only at WTG 44. With only two burrowing owl fatalities documented, evaluating spatial distribution was also not relevant for that species in Year 1, whereas 25 documented fatalities in Year 2 warranted such attention. To date, we have documented two burrowing owl fatalities at seven turbines and three fatalities at WTG 44. The aggregated 2-year dataset emphasized a clustering of burrowing owl fatalities in the northeast sector; however, WTG 9 also emerged as a hot spot in Year 2.

Discussion

Composition of Fatality Incidents

Mexican free-tailed bats are abundant and mortality caused by wind turbines generally has not been identified as a significant concern for the species. Hoary bats commonly occur across much of North America and have been found as fatalities at most wind projects, and a recent study suggested that hoary bat populations may be declining because of mortality caused by wind turbines. The western red bat is a CA-SSC, is at risk because of widespread loss and degradation of the lowland, old-growth riparian woodlands it relies on for breeding habitat, and is probably most at risk of colliding with APWRA wind turbines when moving seasonally between the Central Valley and the San Francisco Bay Area. The heretofore novel discovery of a California myotis on an APWRA survey plot (much smaller than other species previously found as fatalities) clearly reflected the enhanced ability of scent-detection dogs to detect even small carcasses. California myotis are widespread throughout western North America, but are not typically at risk at wind projects because they are not open aerial foragers.

The 9-year APWRA-wide monitoring study revealed only two house wren and two white-throated swift fatalities, compared to our tallies of 16 white-throated swifts and 27 house wrens in Year 2. The unprecedented Year 1 wave of house wren fatalities during late summer/fall 2017 was not repeated in 2018, suggesting a novel confluence of annual productivity and unusual movement dynamics. In contrast, the fatality total for white-throated swifts was even higher in Year 2 than in Year 1. The long-term APWRA-wide study also revealed no confirmed fatalities of Vaux's swift, a California species of special concern; however, we documented three fatalities of this species in both monitoring years. Like for some bats, larger turbines may represent a greater problem for high-flying, aerial-foraging swifts, which also might be attracted to the tall towers as potential communal, night-time roosting options during winter when they aggregate to stay warm.

Newly documented species in Year 2 included rufous hummingbird and western kingbird, which were not previously represented among fatalities during the Vasco Winds, Buena Vista, Diablo Winds, and APWRA-wide studies, and tree swallow was previously confirmed as a fatality only during the Vasco Winds study.

Carcass Detectability

The Year 2 results continued to emphasize the value of using detection dogs to survey for bats, with carcass detectability sustained above 60% on the 7-day plots in both years. The detection-dog teams also continued to perform well in detecting all types of birds, but the human surveyors exhibited similar detection rates for large birds. Although based on different methods and potentially subject to unknown bias, comparing the Big-D-like detectability estimates for Year 1 and the Big D estimates from Year 2 suggested that carcass detectability on 7-day plots was similar in both years for bats (61–63%), medium birds (82–84%), and large birds (95–97%), but considerably lower in Year 1 (36%) than in Year 2 (60%) for small birds. In contrast, comparing the Year 1 and Year 2 values for 28-day plots clearly reflected the expected, significantly lower efficiency of humans compared to dogs in searching for bats and small birds (27–33% detectability for dogs in Year 1 versus 0–4% detectability for humans in Year 2). In contrast, for large birds the Year 2 carcass detectability estimate for the 28-day plots surveyed by humans (89%) was higher than for the 28-day plots surveyed by detection-dog teams in Year 1 (80%). The interplay of handler/dog-team dynamics and variable habitat cover, scavenger communities, and carcass degradation may have balanced out to similar overall detectability in both years for most groups, whereas no explanation for the increased detectability of small birds in Year 2 is readily apparent.

Big D carcass detectability estimates for the human searchers that conducted 28-day interval surveys during the 3-year Vasco Winds study averaged 0% for bats, 10% for small birds (defined as <280 g), 56% for large birds (defined as 280–2,048 g), and 80% for extra-large birds (≥2,048 g). Although based on different size classification standards and likely encompassing interannual and site-specific variation in scavenger activity, the Year 2 estimates for our study were similar to the Vasco Winds study: 0% for bats, 4% for small birds (defined as ≤100 g), 46% for medium birds (101–500 g), and 89% for large birds (>500 g).

Fatality Estimates

The Year 2 adjusted fatality estimates for 7-day and 28-day plots continued to demonstrate that the 28-day search interval appears to result in an underestimation of fatality rates for small birds and bats. This proved to be the case in Year 1 with dog teams searching all plots, as well as in Year 2 with dog teams searching the 7-day plots and humans searching the 28-day plots. Moreover, the estimated rates and proportional differences between the 7-day and 28-day estimates for small birds were substantially similar in both years, despite the differences in surveyors, bias trial approaches, and fatality estimation methods. In contrast, although the Year 1 estimates indicated at least slightly lower adjusted fatality rates on 28-day plots for all bird groups, the Year 2 results indicated higher fatality rates on the 28-day plots for medium and large birds and all raptors combined. These findings suggest that the Big D carcass detectability and fatality estimation approach might generally have performed better in rendering the adjusted 7-day and 28-day estimates more comparable; however, it appeared that the model derived to predict carcass detectability based on the average mass of relevant species overinflated the adjusted fatality estimates for burrowing owls and possibly American kestrels on 28-day plots.

Despite marked differences in the fatality estimation approaches used in the 2 years, the facility-wide adjusted fatality estimates independently generated for Years 1 and 2 for bats were similar in magnitude, although the estimated precision of the Year 2 estimates was notably higher (Table ES-2). This interannual similarity reflects the mid-September dividing line in 2017 between the two monitoring years, which resulted in both sampling periods encompassing a large proportion of the high activity peak that fall. After compiling the complete picture for fall 2018, we should be able to better discern the comparative patterns for two complete annual cycles.

The adjusted annual fatality estimates for all small birds and for all nonraptors also were markedly similar in Years 1 and 2, despite indications of substantially different overall species assemblages. Greater interannual differences and variation were evident for all large birds, all raptors, the four focal raptor species, and the four nonraptor species with sufficient fatalities in one or both years to warrant specific attention (Table ES-2). The comparative results emphasized that fatality rates increased slightly for golden eagles and markedly for American kestrels and burrowing owls, but declined by 60% for red-tailed hawks in Year 2. Relatively high regional productivity following the wet winter/spring in 2016/2017 might have contributed to the increases in Year 2, but the reason why red-tailed hawks exhibited the opposite pattern is unknown. It is also notable that the temporal distributions indicated that the Year 2 surge in American kestrel fatalities involved exclusively late-summer/fall transients and wintering birds, whereas the Year 2 surge in burrowing owl fatalities reflected activity throughout the year. Other burrowing owl breeding populations monitored annually in nearby Santa Clara Valley have been declining, but the average productivity of active pairs increased in 2018 and markedly reversed a strong declining trend that occurred from 2012 through 2016.

Compared to fatality estimates from other APWRA repowering projects, the adjusted per MW fatality estimates we generated using the Huso DS729 estimator for Year 1 ranked highest among the available estimates for all raptors, golden eagles, and red-tailed hawks; above average for bats; and well below average for American kestrels and burrowing owls (Table ES-3). The Year 2 Big D estimates remained roughly the same for bats, increased further and remained among the highest for golden eagles and all raptors combined, dropped to a moderate level for red-tailed hawks, and increased above both the previous pre- and post-repower estimates for American kestrels and especially burrowing owls. For the four focal raptor species, the primary conclusions from the first two monitoring years are a higher golden eagle fatality rate during both years than during other recent APWRA studies, and high interannual variability for the other three species. Higher fatality rates in this study compared to other APWRA repowering studies may partly reflect the influence of differing estimation methods, but probably primarily reflect substantial interannual variation in climate and landscape conditions and the attendant influence on wildlife populations, as well as the consequences of evaluating project impacts based on short-term studies that may inadvertently represent atypical conditions. In addition, the fact that 84% of the Year 2 burrowing fatalities were found as feather spots or carcass remnants, mostly around burrows and along erosion-control wattles, suggests that predation was the primary cause of fatalities for this species (which also may generally be true for other common resident species such as horned larks and western meadowlarks).

Although most previous studies suggested that bat fatalities were rare in the APWRA, this Project reflects the first use of scent-detection dogs for an extended period to conduct fatality searches in the area. In addition, shorter 7-day search intervals were only recently implemented as a standard practice in the APWRA. This combination resulted in our detecting far more bat fatalities than other projects in the APWRA; however, similar estimates of per-MW fatality rates in this study and the post-repowering Vasco Winds study suggest that repowering with larger, taller turbines also may have increased the fatality rate for bats, as has been demonstrated elsewhere. That said, the lack of comparable datasets generally preclude discerning differences in pre- and post-repowering fatality rates for bats in the APWRA.

Table ES-3. Comparison of Adjusted Facility-Wide Fatality Estimates (95% CIs) for Bats and Raptors (Fatalities per MW per Year) from This Study and Other Recent Monitoring Studies in the Altamont Pass Wind Resource Area

Study[1]	Bats	All Raptors	Golden Eagles	Red-tailed Hawks	American Kestrels	Burrowing Owls
This Project Year 1[1]	5.45 (3.70–9.75)	1.30 (0.95–1.77)	0.13 (0.04–0.23)	0.91 (0.62–1.28)	0.06 (0.01–0.13)	0.05 (0.01–0.12)
This Project Year 2[2]	5.82 (3.79–7.84)	2.17 (1.19–3.14)	0.17 (0.00–0.35)	0.37 (0.16–0.58)	0.27 (0.19–0.35)	1.10 (0.92–1.28)
Vasco Winds 3-year average[3]	6.22 (na)	0.79 (na)	0.04 (0.00–0.10)	0.44 (0.00–0.92)	0.21 (0.00–0.45)	0.05 (0.01–0.13)
Buena Vista 3-year average[3]	0.48–1.08 (na)	0.31–0.43 (na)	0.04 (0.01–0.07)	0.10 (0.05–0.15)	0.15 (0.06–0.24)	0.00 (0.00–0.00)
Diablo Winds 5-year average[3]	0.78 [4] (na)	1.21 (na)	0.02 (0.02–0.02)	0.28 (0.24–0.32)	0.07 (0.05–0.09)	0.58 (0.39–0.77)
APWRA-wide Study Pre-repower 2005–2013 average[3]	0.12–0.26 (na)	2.43[5] (na)	0.09 (0.07–0.10)	0.40 (0.33–0.47)	0.56 (0.37–0.74)	0.67 (0.44–0.90)

Notes: Data sources for other projects: Insignia Environmental 2012, Brown et al. 2016, ICF International 2016, and Alameda County Community Development Agency 2014.

[1] Values derived from application of Huso DS729 estimator to integrated 7-day and 28-day survey data.

[2] Values derived from application of the Big D integrated detection trials and fatality estimation approach.

[3] Values accompanied by confidence intervals (95% CI) are taken from ICF International (2016: Table 3-18). Values for bats and all raptors are derived from other sources, with no relevant CIs provided (na = not available).

[4] Based on data from 2005–2007 (Smallwood and Karas 2009).

[5] For bird years 2005–2011 only (Alameda County Community Development Agency 2014).

Spatial Patterns and Potential Fatality Hot Spots

Similar to Year 1, the detection-dog teams continued to find multiple bat fatalities at nearly all turbines they searched in Year 2, but without effective comparative data generated for the 28-day plots in Year 2, discerning overall spatial patterns and identifying potential multi-year bat fatality hot spots was not feasible. The hot spot assessments for birds based on 2 years of information generally emphasized that few turbines appeared to represent consistently high fatality concentration points on an interannual basis. For nonraptors, the northeast sector has produced a relative abundance of fatalities across at least six turbines; however, only two turbines in the west-central sector (WTGs 13 and 16) stood out as moderate hot spots in both years, while WTG 5 stood out as the only major hot spot based solely on a Year 1 accumulation. For raptors, WTGs 9, 37, and 39 in the east- and south-central sector and WTG 14 on the north-central edge of the facility currently represent noteworthy multi-year fatality accumulations. For golden eagles, if the pattern continues in Year 3, WTGs 11 and 14 may represent fatality hot spots for that species. Similarly, although greater variability has been observed thus far for red-tailed hawks, WTGs 22 and 39 may emerge as fatality hot spots for that species if accumulations continue there in Year 3. In contrast, with little data to compare between the 2 years, evaluating the potential for multi-year fatality hot spots is not yet practical for American kestrels and burrowing owls; however, it may be noteworthy that the primary fatality hotspot for kestrels in Year 2 was WTG 14, which is also a potential fatality hot spot for golden eagles.

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Section 1.0 Introduction

The Golden Hills Wind Energy Center (GHWEC) is an 85.92-megawatt (MW) wind-energy facility comprising 48 1.79-MW General Electric turbines located in the Altamont Pass Wind Resource Area (APWRA) of Alameda County, California (Figure 1). The facility is owned and operated by Golden Hills Wind, LLC, a subsidiary of NextEra Energy Resources, LLC, and began commercial operation in December 2015. The facility is situated in a mixed agricultural landscape where cattle grazing is the primary agricultural land use. The GHWEC occupies space that formerly supported 775 smaller, less-efficient, older-generation wind turbines that were previously operated for many years. The repowering of this facility represents the second phase of NextEra's efforts to repower their overall APWRA wind-energy operations, which in turn is a component of an overall APWRA repowering program designed to achieve greater and more efficient energy production, while reducing turbine-related fatalities of especially four focal raptor species: golden eagle (see Appendix A for scientific names of all bat and bird species documented as fatalities or otherwise relevant to this study), red-tailed hawk, American kestrel, and burrowing owl (Alameda County Community Development Agency 2014, CH2M Hill 2016).

As smaller, older-generation turbines have been replaced by much larger, new-generation turbines, concern has risen about the possibility that taller turbines will increase the probability of bat fatalities (Barclay et al. 2007). As a result, interest in accurately documenting bat fatality rates in the APWRA has grown recently, along with continuing concern over raptor fatality rates. From 2005–2013, only 23 bat fatalities were found in the APWRA during regular searches at monitored turbines (ICF International 2016). The dearth of previous bat fatalities may reflect primarily the use of long search intervals (e.g., 45 days). Bat fatalities were discovered at higher rates beginning in 2007 after shorter search intervals were used (ICF International 2016); however, that sampling also occurred primarily at larger, new-generation turbines (Smallwood and Karas 2009, Brown et al. 2016). The number of bat fatalities discovered subsequently increased by an order of magnitude when we used scent-detection dogs during Year 1 of the GHWEC monitoring effort (H. T. Harvey & Associates 2018a; also see Arnett 2006 and Paula et al. 2011). Due to the lack of credible information about previous bat fatality rates, it is not possible to be confident about what the bat fatality rates may have been during the pre-repowering period. Thus, there is no useful pre-repowering baseline against which to evaluate the effect of repowering with larger, new-generation turbines on bat fatality rates in the APWRA.

This report summarizes the second of 3 years of postconstruction bird and bat fatality monitoring (Project) required to meet the conditions of approval outlined in the Conditional Use Permit (PLN201-00032) issued for the GHWEC (East County Board of Zoning Adjustments 2014). The implemented monitoring plan was approved by the Alameda County Technical Advisory Committee (TAC) and began on September 19, 2016, with Year 2 monitoring extending from September 18, 2017, through September 14, 2018.

H. T. HARVEY & ASSOCIATES
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Figure 1. Study Area Map
Golden Hills Postconstruction Fatality Monitoring: Year 2 (3926-01)
December 2018

The primary Project components in Year 2 were as follows:

1. Bat and bird fatality surveys covered 105-meter (m) radius search areas around all 48 turbines:
    - Spatially balanced, randomized selection of 16 turbines at which 7-day-interval searches were conducted using scent-detection dogs (non-overlapping selection compared to Year 1)
    - Searches were conducted by humans at 28-day intervals at the remaining 32 turbines
2. Integrated carcass detectability bias trials to support deriving adjusted annual fatality estimates:
    - New freshly dead/frozen/thawed trial carcasses were placed during most weeks of the annual survey period without regard for the timing of scheduled surveys
    - Spatially balanced, randomized placement of bats, small birds, and medium/large birds
    - Diverse array of native and nonnative species representative of potential fatalities
    - Comparable, independently allocated sampling for 7-day-interval and 28-day-interval survey plots
    - Detections of trial carcasses were recorded whenever they occurred and all carcasses were collected upon discovery (as with all actual fatalities)
    - Carcasses were not monitored for persistence or to determine presence/absence prior to surveys
    - Observed fatality rates were adjusted using taxon-specific estimates of carcass detectability that integrated the influences of imperfect searcher efficiency and removal of carcasses by scavengers and abiotic factors in single correction factors, and were based on relationships between carcass detectability and the average masses of fatality species ("Big D" approach)

TAC-approved protocol changes in Year 2 included two facets: (1) dropping fall road/pad-only, 2–3-day-interval bat surveys at the turbines where 7-day-interval surveys were also conducted, because that extra effort yielded few fatalities in Year 1 and did not add value with scent-detection dogs used to conduct the overall surveys (see H. T. Harvey & Associates 2018a; not discussed further in this report); and (2) adopting the logistically simpler and potentially less-biased Big D approach (see Sections 2.3 and 2.4) to assessing carcass detectability (Brown et al. 2016, ICF International 2016, Smallwood and Neher 2016, Smallwood 2017) rather than investing in methods that allowed for independent estimation of searcher efficiency, carcass persistence, and bleed through (e.g., Huso 2011, Warren-Hicks et al. 2013, Wolpert 2015). In regard to the latter change, it is important to note that doing so precluded (1) generating additional, specific, quantitative insight about the comparative search efficiency of humans and scent-detection dogs, and (2) generating adjusted fatality estimates based on conventional approaches that require independently modeling and estimating searcher efficiency, carcass persistence, and in some cases bleed through. The shift in approach also precluded rendering the Year 1 and Year 2 fatality estimates based on the same estimation methodology.

Section 2.0 Methods

2.1 Study Site

The 48 GHWEC turbines have a hub height of 80 m and rotor diameter of 100 m, which translates to a rotor swept zone extending from 30–130 m above ground level. The habitat throughout the facility is rolling hills covered with grazed annual grassland. The turbines are situated on hilltops and ridgelines, with topographic variation between hill/ridge tops and intervening valleys mostly ranging from approximately 30–60 m, and occasionally up to as much as 100 m. The turbines are arranged in variable strings, with spacing between turbines typically 250–400 m and the maximum nearest-neighbor distance approximately 600 m (Figure 2).

2.2 Bird and Bat Fatality Surveys

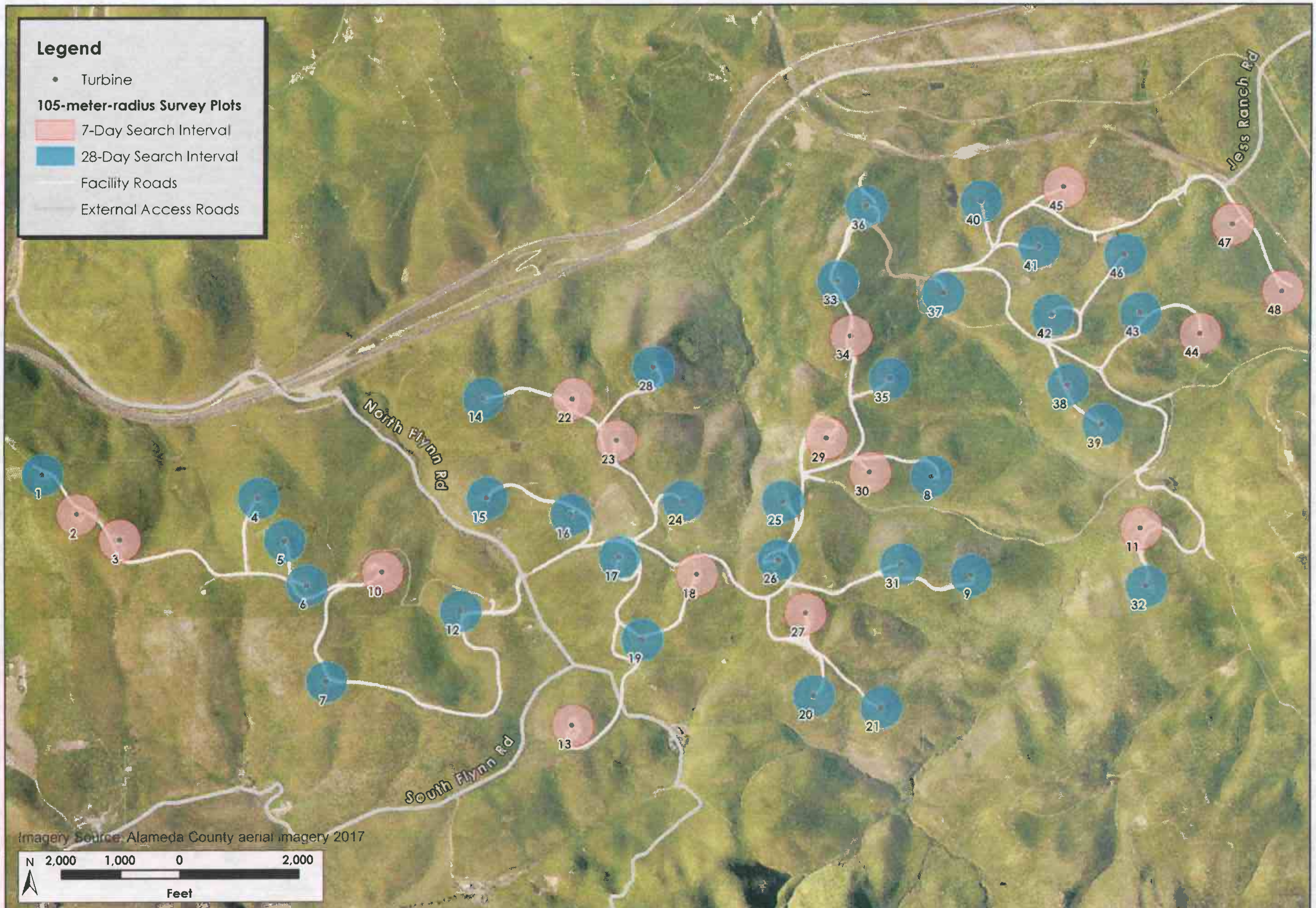
2.2.1 Sampling Design

Each year of this 3-year study will entail conducting bird and bat fatality surveys at 7-day intervals at 16 (33%) of the 48 turbines and at 28-day intervals at the remaining 32 (67%) turbines. Each year's 7-day-interval surveys (hereafter 7-day surveys, turbines, and plots) will be conducted at a different non-overlapping set of 16 turbines. To ensure representative distributions of turbines subject to 7-day surveys, we used generalized random-tessellation stratified (GRTS) sampling (Stevens and Olsen 2004) to select the 16 7-day turbines for Year 1. For Year 2, we used the same approach to select a new set of 7-day turbines from among the 32 turbines that had not yet been subject to 7-day surveys. We will conduct 7-day surveys at the remaining 16 turbines in Year 3. This sampling scheme will ensure that all turbines are subject to 7-day surveys during one annual period, while also ensuring both a balanced sampling design and spatially and temporally representative 7-day-interval sampling of all turbines over the course of the 3-year study. Figure 2 displays the 7-day/28-day survey array for Year 2.

In Year 1, we conducted all surveys using variable teams of scent-detection dogs and their handlers. In Year 2, with TAC approval, we shifted to conducting the 28-day surveys with human searchers to bolster the financial sustainability of the effort.

All full-plot surveys covered a radial area extending out 105 m from the turbine base.

Federal and California state agencies recommend that fatality searches occur at some turbines most days each week, in part so that substantial episodic events are more likely to be detected regardless of the scheduled search intervals at individual turbines (U.S. Fish and Wildlife Service 2012, California Energy Commission and California Department of Fish and Game 2007). Our standard survey schedule for 7-day plots extended from Monday through Thursday, with four plots surveyed per day and individual turbines surveyed on the same day each week to maintain the required search intervals. Our standard survey schedule for 28-day plots included eight surveys per week for 4 weeks to constitute one complete round of coverage for 32 relevant turbines, with each specific plot covered on the same day during the same rotation week to maintain consistent search intervals for all such plots.



N:\Projects3900\3926-01\Reports\PostConst_FatalityMonitoring_Year2\Fig 2 Fatality Survey Sampling.mxd

H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 2. Fatality Survey Sampling Regime: Year 2
Golden Hills Postconstruction Fatality Monitoring: Year 2 (3926-01)
December 2018

To minimize the potential for spatiotemporal biases in the sampling of individual turbine plots, we preselected the daily survey arrays to variably disperse sampling across the facility within each weekly sampling period, while also ensuring reasonable logistical efficiency on a given day (i.e., minimizing back-and-forth travel across the facility). In addition, each day's surveys began at a randomly chosen (from among that day's relevant plots) start point and proceeded from there in a standardized, systematic order to cover the rest of that day's plots. Especially during the heat of summer, surveys often began early in the morning (subject to mandated sunset-to-sunrise access constraints designed to protect sensitive amphibians from November through mid-June), but also frequently extended into early or mid-afternoon.

Surveys proceeded as scheduled unless challenging weather precluded a safe and effective search effort (e.g., heavy rain, lightning, or excessive heat), other safety issues intervened (e.g., frequent livestock-related constraints, excessive wildfire smoke during summer, or occasional police activity), or a surveyor/handler or detection dog experienced a sudden illness or injury. When 7-day surveys could not be completed as scheduled, we either adjusted the scheduling of that week's surveys so that the missed surveys were conducted such that the search intervals for all surveys were not altered by more than 1–2 days, or we skipped the missed surveys. When 28-day surveys could not be completed as scheduled, they were conducted as quickly as possible during the same week, but generally without altering the planned schedule for other surveys that week.

2.2.2 Survey Protocols

2.2.2.1 Detection-Dog Teams

All handlers and detection dogs involved in this study had prior experience conducting bird and bat fatality surveys. During Year 1, five individual handlers and five individual detection dogs collectively accomplished all of the 7-day and 28-day surveys. During Year 2, a single handler and the same five detection dogs accomplished most of the 7-day surveys, with three other handlers periodically assisting.

Typically, four full-plot 7-day surveys were completed by the dog teams each day from Monday through Thursday throughout Years 1 and 2, with supplemental 28-day and road/pad surveys completed by a second handler and dog team during Year 1. Individual plot-specific surveys usually were accomplished by a single handler and single detection dog, but sometimes excessive heat, high numbers of fatalities, difficult vegetation, or other dog management issues (e.g., variable sensitivity to other people and livestock on the landscape) required using a second dog to finish a given plot. More generally, an individual handler typically alternated use of two dogs to complete four full-plot surveys in a given day.

Detection-dog surveys are performed by using and adjusting to wind patterns. The handler uses body movements, hand signals, verbal cues, and whistles to control the dog's movements relative to wind speed and direction to ensure full coverage of the designated survey plots. At the handler's discretion, the dog searches downwind of the intended survey area at a distance appropriate for the wind speed and direction. This technique creates a flexible search pattern, allowing the handler to adjust the dog's movements and ensure full coverage. The detection distances and number of survey passes required depend on the wind speed (i.e., more survey passes at closer spacing in light wind and fewer survey passes spaced farther apart in strong wind). The handler also discretionarily directs the detection dog to increase the search intensity in areas of high habitat complexity (e.g., uneven ground and thick vegetation).

The wind conditions within the Project survey area usually provided ideal search conditions for detection-dog teams. Studies performed by H. T. Harvey & Associates indicate the dogs can consistently identify a target scent up to 24 m from the transect line walked by the handler in light wind conditions (2–3 kilometers per hour [kph]), and will alert to target scent well over 30 m from the transect line in moderate to high wind conditions (16–24 kph) (also see Paula et al. 2011). Winds in excess of 40 kph may, however, hinder a dog's ability to detect target scent. Given that the wind conditions in the Project area were at least moderate most of the time, the dog teams typically were able to walk fewer transect lines than human surveyors would have needed to walk to provide similarly effective coverage.

Handlers generally operated with the expectation of completing a full-plot survey in 45 minutes to an hour, with additional time dedicated to recording data and collecting fatalities and bias trial carcasses when discovered. Difficult terrain and inclement conditions often required longer survey periods.

2.2.2.2 Human Surveyors

Three field biologists conducted most of the 28-day human surveys during Year 2, with two other individuals periodically assisting as needed. The human surveyors covered each survey plot by walking 10 concentric transects around the turbine, with the first transect located 10 m from the turbine base and 10-m spacing between all subsequent transects. To maintain appropriate distances while proceeding along transects, surveyors developed a systematic approach to using an angle-compensated laser rangefinder to periodically check and adjust their distance relative to the turbine tower, eventually developing a good visual sense of the distance bands from the turbine to minimize the need to use the rangefinder and increase their survey efficiency.

While walking along each transect, the surveyors scanned approximately 5 m to each side to achieve complete coverage out to approximately 105 m from the turbine base. However, except in areas where the ground surface is relatively smooth and unencumbered with vegetation, 10-m transect spacing typically achieves broadly effective coverage only for larger birds such as raptors, because the probability of human searchers detecting small birds and bats in heavily vegetated areas is generally low and diminishes quickly with distance from the transect (Morrison 2002, Smallwood 2007, H. T. Harvey & Associates 2013).

To help achieve consistent effort, surveyors sought to proceed along transects at an average pace of approximately 1 m (1 step) per second; however, complex terrain and substrate conditions resulted in a variable survey paces. The objective was to complete the plot-specific surveys in approximately 1–1.5 hours, with additional time dedicated to recording data and collecting fatalities and bias trial carcasses when discovered.

2.2.2.3 General Applicability

We followed guidelines for classifying avian fatalities typically applied in the APWRA (Altamont Monitoring Team 2007, California Energy Commission and California Department of Fish and Game 2007). To qualify as a fatality, finds must have included either ≥10 feathers total or at least five tail feathers or two primaries located within ≤5 m of each other. Upon finding a fatality, the handler or surveyor temporarily marked each location with flagging and then either returned after searching the entire plot to record data on all finds using a standard data form, or enlisted the help of another support biologist to collect the carcasses and record relevant data.

To record specimen data and digital photographs, biologists used iPads® equipped with a Geographic Positioning System (GPS), geographic information system (GIS) software (GIS Pro®, Garafa LLC, Provo, Utah), relevant aerial imagery, and Project infrastructure, turbine location, and transect overlays. Data recorded for every fatality incident included:

1. Unique incident number composed of the year, month, date, and a sequential fatality number for that day; e.g., the third specimen found on October 11, 2016, would be #20161011-03
2. Date and time found
3. Number of closest operational turbine (presumed to be the focal turbine if during a standard fatality search)
4. GPS coordinates: Universal Transverse Mercator (UTM), North American Datum 1983 (NAD83), accurate to $\pm$3–4 m
5. Distance (meters) and direction (degrees) from the nearest operational turbine
6. If closer to the carcass than the nearest turbine, distance (meters) and direction (degrees) from other nearby structure that could pose a fatality or injury risk for bats or birds
7. Description of other nearest non-turbine structure, if relevant
8. Description of substrate on which carcass was found, determined at the scale of approximately a few square meters centered on the carcass (i.e., turbine pad, road, bare dirt/disturbed soil, grazed/short grass, or tall fallow grass/forb)
9. Species or closest taxonomic group possible; e.g., red-tailed hawk, unknown buteo, or, as a last resort, unknown large raptor, or California myotis, unknown myotis, or, as a last resort, unknown small bat. If an unknown bird, specify unknown small, medium, or large bird, with size classes defined as follows:
    - *Small* = <100 grams (g); smaller than a mourning dove
    - *Medium* = 100–500 g; mourning dove/American kestrel up to American crow/northern harrier size
    - *Large* = >500 g; common raven/red-tailed hawk size or larger
10. Evidence for species identification; e.g., plumage, individual feathers, measurements, hair sample for bats, etc. If a recognized sensitive species, detailed notes, measurements, and extensive photos were recorded to substantiate ID
11. Age and sex, if known
12. Basis of age/sex determination; e.g., for birds—plumage, molt limits, fault bars, etc.
13. Carcass condition:

- *Intact – fresh*
- *Intact – partially decomposed*: stiff-flesh present; insects have begun to reduce carcass
- *Intact – decomposed:* intact/mummified/rotten carcass or feathers/fur and bones only
- *Scavenged – fresh*: fresh tissue and blood present; evidence of scavenging by vertebrates
- *Scavenged – partially decomposed*: stiff-flesh present; insects have begun to reduce carcass in addition to vertebrate scavenging
- *Scavenged – decomposed*: decomposed body parts/bones with or without flesh/feathers/fur; evidence of vertebrate scavenging
- *Scavenged – feather spot*: record notes about whether feathers are fresh, bleached, or decomposed
- *Injured*
- *Other, see notes*

Carcass condition notes: confirm complete carcass or list parts found versus missing, with specific reference to left and right parts and the kinds of feathers found (especially primaries, secondaries, and rectrices). Describe evidence of blunt-force trauma (i.e., broken bones, lacerations, severed body parts, major contusions, etc.), internal bleeding, electrocution (i.e., singed feathers, other burn marks, clenched talons, etc.), other injuries, emaciation, disease, etc.

14. Cause of death:
    - *Blade Strike/Turbine Collision*

      A. Intact carcass with injuries consistent with a turbine blade strike or tower collision

      B. Intact or scavenged carcass of rarely depredated large raptors and vultures with no discernable signs of trauma, found within the search radius

      C. Intact carcass of other birds and bats (no evidence of vertebrate scavenging/predation) with no apparent injuries, found within the search radius
    - *Electrocution*

      A. Carcass with obvious signs of electrocution; i.e., singed feathers, burn marks on feet or wrists, clenched talons, etc.

      B. Intact carcass with no apparent injuries found within 3 m of a power pole and >10 m from turbine string axis
    - *Line Strike*

      A. Intact carcass with injuries consistent with a line strike (i.e., blunt-force trauma, broken wings or neck, decapitation, etc.), but no evidence of electrocution, and found outside of turbine search radius and within 10 m of power lines or guy wires

      B. Intact carcass with no apparent injuries found outside of turbine search radius, within 10 m of power lines or guy wires, and >3 m from the nearest power pole
    - *Other Collision*

      Intact carcass with injuries consistent with having collided with fence, building, other equipment/structure, or vehicle (i.e., blunt-force trauma, broken wings or neck, etc.), but no evidence of blade strike, electrocution, or line strike, and found outside of turbine search radius and beneath (within 10 m) power lines or guy wires (vertebrate scavenging/predation may obscure or mimic line-strike injuries)

- *Unknown*

  Carcass condition or location precludes confident assessment

15. Estimated time since death: fresh, <1 week, <1 month, or >1 month.
16. Types of insects observed on/in carcass, if any, with brief description of kind and size.
17. Scavenger/predator: type of predator or scavenger (bird, large mammal, small mammal, or invertebrate), if possible to determine, and the effects of scavenging/predation.
18. Condition of flesh: fresh, gooey, dried, none.
19. Condition of eyes: round and fluid-filled, sunken, dried, none.
20. Condition of enamel, for birds: waxy covering on culmen and claws present or not.
21. Color, for birds: leg scales and/or cere have begun to fade or not.
22. Additional notes about special circumstances, carcass condition, details for identification of rare species, band numbers, obvious injuries, and potential cause of death if other than those listed above.
23. Unique image numbers for digital photographs of carcass confirming status (e.g., intact, scavenged, scattered parts, etc.) and portraying evidence of trauma where relevant, key facets required for positive species identification (e.g., distinct plumage or pelage features, illustration of size, bone structures, etc.), and the habitat in the immediate vicinity of the carcass. At least four initial photos are taken before the carcass is disturbed to clearly document the initial carcass disposition and the focal-area and landscape setting, with additional photos taken as needed to document other salient features of the specimen.

Other data recorded each time an area was searched, using standardized iPad data entry templates, included wind and weather conditions, groundcover conditions in the plot as a whole, turbine functionality, and any relevant search-area access issues (e.g., constraints related to livestock and facility/turbine maintenance activities).

After completing a given survey and recording data for each incident, the biologists placed all discovered carcasses or body parts in zip-locked plastic bags, and clearly labeled each bag with information about the collection circumstances, the species ID, and the relevant incident number. All carcasses were then transferred to the NextEra office facility in Livermore for further processing, specimen labeling conforming to the requirements of relevant state and federal permits, and storage in the designated freezer located there. Variants of this standard procedure were implemented when either selected special-status species or injured/debilitated bats or birds were found. Relevant agency permits required special authorizations and communications to handle and manage carcasses (or injured animals) of species listed as state or federally endangered, threatened, or candidates for listing, and/or as a California fully protected species. All such specimens typically were collected within 48 hours after confirming appropriate authorizations. If a biologist discovered an injured/debilitated bat or bird, appropriate arrangements were made to immediately secure the animal and a

NextEra representative transported the animal to a nearby wildlife rehabilitation facility for care. Although injured/debilitated animals could have been harmed elsewhere (whether by another turbine or by unrelated factors outside of any survey plots) and wandered onto a survey plot while still mobile, we assigned all such animals found within a survey plot to that turbine and recorded them as fatalities for estimation purposes. Conversely, as for all off-plot incidental fatalities, we generally excluded from fatality estimates any injured/debilitated animals found outside of the survey plots, because we could not confidently assign such incidents to a specific turbine (but see Section 3.3 concerning an exception for an injured golden eagle).

Our biologists also documented any bird or bat fatalities or injuries reported to us by others or that they found in the Project area incidentally outside of the standard survey areas. They recorded each such carcass or injured animal as an "incidental" find. If such a carcass was found on a survey plot by a biologist not involved in surveys of that plot, and the find did not involve a special-status species requiring immediate collection (e.g., a fully protected golden eagle), the biologist recorded initial data and photos as for any fatality, specially marked the carcass to distinguish it as previously found (similar to placed bias trial carcasses; see Section 2.3), and left the carcass in place to allow for potential detection during a subsequent standard survey. If such a carcass was never found during a standard survey, then we excluded it from estimating adjusted fatality rates; however, most such specimens contributed to evaluating carcass detectability. If the specimen was either a special-status species requiring collection prior to the next standard survey of that plot or was an injured bird or bat that was immediately collected and taken to a rehabilitation facility, we conservatively assumed that all such specimens would have been discovered as a fatality by a survey team during a subsequent survey and included them in the tally used to produce the adjusted fatality estimates (see Section 2.4).

Surveyors often find carcasses of large birds such as red-tailed hawks and golden eagles with body parts that appear to have been severed by a blade strike scattered in multiple locations on a given survey plot, which may or may not all be found during the same survey. In most such cases, it is relatively straightforward to match locations and parts and avoid duplicate fatality records, especially since large birds are relatively uncommon fatalities. However, where comparatively abundant bat and smaller bird fatalities are concerned, post-mortality scavenging frequently produces feather spots that are readily dispersed by wind and leaves behind other scattered, small bits and pieces of carcasses that mostly go unnoticed by human searchers, but are still readily detected by dogs over the course of multiple surveys. This greatly complicates efforts to match parts to minimize the potential for duplicate fatality reporting. Nevertheless, whenever the surveyors documented multiple incomplete carcasses of an individual species on a turbine plot, we compared the discovery locations, the carcass parts represented, and the relevant ages/degradation states of the different finds to support combining multiple records as single fatalities whenever justified by the available evidence. However, if such comparisons failed to confirm an obvious, justifiable parts match, we did not seek to apply other combining rules to further minimize the chance of duplicate fatality reporting.

2.3 Carcass Detectability Bias Trials

We conducted bias trials to estimate carcass detectability using freshly dead (frozen and thawed prior to placement) bat and bird carcasses placed in small numbers during most weeks of each survey year in a spatially balanced (GRTS-derived) manner across all turbines within each survey group (7-day versus 28-day). Subject to the availability of suitable carcasses and permit restrictions imposed by the California Department of Fish and Wildlife, during Year 2 we sought to place at least 30 bats, 40 small birds, and 40 medium/large birds on 7-day plots, and a similar array on the 28-day survey plots. Limited carcass availability and practical restrictions for placing multiple larger carcasses on the same plots at a given time precluded treating medium and large birds independently for analytical purposes.

We used species known or with the potential to occur in the study area, including primarily native species but also a few nonnative species that routinely occur in the study area, such as European starling, rock pigeon, and house sparrow (California Energy Commission and California Department of Fish and Game 2007, Smallwood 2007). We avoided using other surrogate animals because of evidence that scavenging rates for avian surrogates such as gamebirds and chickens, and for bat surrogates such as mice, can be much higher than for the species they are meant to mimic (Smallwood 2007, Hale 2010). All specimens used for bias trials during this study were either found as fatalities during the study or were recovered dead elsewhere as authorized by staff salvage permits (broad coverage for birds and bats), or were gathered from regional animal rescue/rehabilitation centers, avian control operations at regional airports, and other approved/permitted sources (e.g., local falconers and raptor trapping operations). All of the latter specimens either died naturally, were euthanized using only CO_2, or were shot with non-lead ammunition; showed no outward signs of disease; were never treated with medicines; and were frozen immediately after they died or were euthanized.

During Year 1, we placed and monitored bias trial carcasses in a manner that supported independent estimation of searcher efficiency, carcass persistence, and bleed through (Warren-Hicks et al. 2013). We do not reiterate herein the unique methodologies used to conduct the Year 1 bias trials (see H. T. Harvey & Associates 2018a). During Year 2 we adopted the TAC-approved Big D approach to conducting carcass detectability bias trials, wherein (1) trial carcasses are randomly (spatially and temporally) placed throughout the study period irrespective of when surveys are scheduled, (2) detections are recorded whenever they occur and carcasses are collected upon discovery (as with all actual fatalities), (3) carcasses are not otherwise monitored for persistence or to determine presence/absence prior to surveys, and (4) taxon-specific (bird and bat) estimates of carcass detectability (Big D) are generated that integrate the influences of imperfect searcher efficiency and removal of carcasses by scavengers and other abiotic factors (Brown et al. 2016, ICF International 2016, Smallwood and Neher 2016, Smallwood 2017).

A designated biologist not involved in fatality surveys placed trial carcasses according to a spatially and temporally balanced GRTS randomized allocation strategy that, within years, ensured (1) effective spatial representation among turbines subject to 7-day and 28-day surveys, (2) effective temporal representation across the seasons, and (3) effective randomization of placements relative to substrate variability. During Year 2, our objective was to place a sufficient number and diversity of bat and bird carcasses to enable estimating Big D based on modeling relationships between carcass detectability and the average body masses of individual species. We did not explicitly set out to represent season or substrate visibility classes as covariates in the bias-trial estimation models. Instead, we ensured that the carcass placements were well distributed throughout the annual survey periods in an attempt to effectively capture variation in detection probabilities across seasons, and that they were randomly distributed with respect to substrate types and conditions in an attempt to effectively capture relevant influences on the ability of detection-dog teams or human surveyors to move through the survey plots and detect relevant carcasses. Similarly, we did not explicitly model handler-dog search-team combinations or human surveyors as covariates in the models, but we ensured that all relevant surveyor combinations were presented with opportunities to detect diverse specimens of different types and sizes, so as to effectively capture potential variation in detection probabilities among the search teams.

The designated biologist placed specially marked bat and bird trial carcasses on the landscape in survey plots, without the fatality surveyors having knowledge of such placements. Before placing a trial carcass on the landscape, the biologist marked each trial carcass with a small piece of green electrical tape wrapped around a leg or bat wing, which included a unique trial ID number for reference if the specimen tag was large enough for such a marker to be placed and remain reasonably inconspicuous. The biologist also clipped off the tips of primaries, secondaries, and rectrices on all bird trial carcasses to facilitate identification when only a feather spot remained following a scavenging event. This marking scheme ensured that surveyors generally were able to distinguish trial specimens from new fatalities, without rendering the specimens unnaturally conspicuous (Smallwood 2007, U.S. Fish and Wildlife Service 2012). Upon placing each carcass, the designated biologist mapped the placement location, recorded relevant placement data (including a substrate classification), and took digital photographs of the placement using a standard iPad-based data entry form.

In Year 2, once a surveyor discovered a trial carcass and recorded relevant data, they collected whatever remained of the carcass, as per standard practice for all actual fatalities. Otherwise, placed carcasses were not monitored further and no attempt was made to recover undiscovered trial carcasses. Here it is important to note that heavy scavenging before a surveyor or detection-dog team has a chance to search for a trial carcass could effectively remove the specimen tag and evidence of clipped feathers, and thereby preclude ready identification of the specimen as a trial carcass. We minimized this possibility by always carefully crosschecking locations and other details when heavily scavenged, unmarked fatalities of species used as bias trial specimens were discovered on relevant plots.

Factors that influence searcher efficiency and carcass persistence include how fresh and intact the carcass is (Smallwood 2007). If multiple pieces of a depredated or scavenged carcass are scattered over a modest area, in some cases that may increase detectability of the fatality. More generally, the presence of only remnants of a carcass, carcass aging, and attendant degradation tend to decrease detectability for human surveyors (Smallwood 2007). Using detection dogs to search for carcasses obviates most such concerns, however, because the dogs rely almost exclusively on scent detection rather than visual cues. Open or dismembered carcasses also may increase scavenger attraction compared to intact carcasses (Smallwood 2007). We did not attempt to address or control for such influences. Instead, we used only largely intact specimens and carcasses that were freshly dead, frozen, and thawed. We acknowledge evidence that scavenging rates of fresh/frozen and thawed bats may be lower than for fresh/never frozen bats (Kerns et al. 2005, Strickland et al. 2011), and it is possible that this treatment may similarly influence the probability of a detection dog discerning a trial carcass. That said, state permitting requirements for using outside bat and bird specimens for bias trials dictated that all such specimens must have been frozen before deployment to help manage possible disease transmission.

To reduce possible biases related to leaving scent traces or visual cues that may unnecessarily alert potential scavengers, the designated biologist handled all trial specimens only with nitrile gloves and minimized handling time. We also attempted to ensure that carcass markings used to distinguish trial specimens from new fatalities were as inconspicuous as possible to minimize the chance of artificially attracting scavengers. In addition, when placing carcasses, the biologist took a circuitous route to the randomly selected placement location, then randomly tossed the carcass 2–3 m away (recording the direction and distance to the deposited carcass from the predetermined placement coordinates), and then departed using a different circuitous direction. These protocols minimized the chance that the detection dogs (as well as potential scavengers) could follow human scent trails to the trial specimens (Reyes et al. 2016).

2.4 Fatality Estimates

Producing accurate fatality estimates at wind-energy facilities requires addressing three primary sources of error that can result in underestimating true fatality rates if ignored or biased estimates if modeled improperly (Huso et al. 2016). These sources of error are imperfect searcher efficiency, carcasses being removed by scavengers or abiotic factors before searchers have a chance to discover the fatality, and the fact that some fatalities may fall outside of the area searched for carcasses. Each of these issues is customarily dealt with explicitly using variable approaches to adjust raw fatality counts to account for such factors.

The recent history of estimating bird and/or bat fatalities at wind-energy facilities involves use of primarily three estimators (Bernardino et al. 2013, Warren-Hicks et al. 2013, Huso et al. 2016). Erickson et al. (2000) and Johnson et al. (2000, 2003) used an estimator that assumed a Poisson process for the occurrence of bird deaths and scavenger removal (Shoenfeld 2004); however, this estimator proved to be severely biased low, after which Smallwood (2007) developed an estimator that incorporated an adjustment for periodic repetition of search events. In practice, however, periods between searches often are inconsistent, which violates a primary assumption motivating the logic behind Smallwood's estimator. Huso (2011, 2012) conducted thorough simulations and conceptualized the logic behind development of a third estimator representing a tailored version of the Horvitz-Thompson (H–T) estimator (Horvitz and Thompson 1952, Thompson 1992). Huso's estimator brought increased flexibility compared to the Shoenfeld and Smallwood estimators, because it allowed for unequal probability sampling and accounting for potential differences in searchability among plots and variation in detectability due to size of carcass or type of habitat. Based on simulations, Huso (2011) found that this estimator was also consistently less biased than were the other two estimators. Although the Schoenfeld (2004) estimator can perform similarly under certain conditions (e.g., when search intervals are relatively long [14–28 days] and mean carcass-persistence time is relatively short [<16 days]), Arnett et al. (2009) found that this estimator greatly underestimated fatality rates when searcher efficiency was low for certain species (e.g., 13% for some bats). However, subsequent evaluations revealed that the Huso estimator may overestimate fatalities when the search interval is short and the aging of carcasses uncertain, because the method requires excluding from consideration any carcasses not deposited during the preceding search interval (i.e., no bleed-through is allowed; Wolpert 2015).

All of the above methods implicitly impose rigid assumptions regarding carcass bleed-through; i.e., carcasses that are not discovered on one survey are either assumed to have a detection probability of zero (Huso 2011), one (Schoenfeld 2004), or a value determined by searcher efficiency (Erickson et al. 2000) in subsequent surveys. Wolpert (2015; and see Warren-Hicks et al. 2013: Appendix A) demonstrated that imposing assumptions regarding bleed-through results in estimator bias and presented an alternative Avian and

Chiropteran Mortality Estimator (ACME) that explicitly accounts for bleed-through by estimating a bleed-through parameter from carcass persistence trials. Wolpert also showed that ACME produced less-biased estimates compared to those generated by the estimators outlined by Erickson et al. (2000), Schoenfeld (2004), and Huso (2011), when search intervals were short (e.g., 7 days), and equivalent estimates otherwise.

ICF International (2016) noted that large discrepancies between two annual fatality estimates at the same APWRA wind farm were counterintuitive, likely spurious, and probably caused by differences in sampling and estimation methods. In particular, the differences may have been caused by the effects of bleed-through bias in the fatality estimators, and the use of different estimators in different years. As a result, they recommended pursuing methods that are robust to bleed-through bias. The Big D approach accomplishes this objective by reflecting detection success across multiple surveys, independent of the search-interval filtering constraints required to employ, for example, the Huso estimator (i.e., carcasses believed to represent bleed-through must be eliminated; Huso 2011). Moreover, the notion is that searcher efficiency and carcass persistence are not independent factors and, therefore, incorporating independent adjustment factors for the two influences inappropriately propagates excessive error and results in biased fatality estimates. The Big D approach also greatly simplifies the procedures and protocols required to generate the single Big D carcass detectability parameter, because no carcass monitoring is required.

Recent studies have demonstrated that human searcher efficiency decreases as a function of time for individual carcasses, because older degraded carcasses are more difficult for humans to find than fresh carcasses (Smallwood 2007, Korner-Nievergelt et al. 2011). Wolpert (2015) provided empirical evidence that a decreasing function better describes the data for human searchers than assuming searcher efficiency is constant, and explicitly reflected this facet in the ACME estimation routine by allowing search efficiency to decline depending on the estimated time since death for individual carcasses. However, carcass degradation may influence olfactory-driven detection dogs differently than it affects visually-oriented human searchers, with one study suggesting that trained dogs detected decomposed bird carcasses more readily than fresh carcasses (Paula et al. 2011). To accommodate either scenario, we sought to achieve representative variation in the ages of carcasses available for detection by placing small numbers of trial carcasses on both 7-day and 28-day plots opportunistically during most weeks and randomly with respect to survey schedules, and by allowing detections to occur at any time after a trial carcass was placed.

Besides imperfect searcher efficiency and carcass removal, another factor that may bias raw fatality counts low is the fact that some turbine-related fatalities likely end up outside of the 105-m radius survey plots (Huso et al. 2016). This can occur if a bird or bat is hit and flung outside of the survey plot before falling to the ground; is mortally wounded but either continues flying for a bit before falling to its death outside the survey plot or falls down within the survey plot but hobbles off the plot before dying; or if a scavenger removes the carcass from the plot before surveyors have a chance to discover it (Smallwood et al. 2010, H. T. Harvey & Associates 2013). During the course of conducting fatality surveys, surveyors and other personnel often document incidental fatalities outside of the standard survey plots, and some projects have included in their fatality estimates carcasses found within "adjunct" zones extending for variable distances outside of the standard search radius (e.g., Brown et al. 2016). Including such carcasses in overall fatality estimates is fraught with potential biases, however, at least where human surveyors are concerned. Focusing attention on detecting adjunct carcasses could compromise the integrity of surveys in the outer margins of standard survey plots by causing human surveyors to expand their search area in those zones, and could produce augmented counts that are biased towards large birds that are easier for human surveyors to detect from a distance.

These potential biases may be less acute when using odor-driven detection dogs. Nevertheless, we did not incorporate any fatalities found outside the survey plots in our primary, adjusted fatality estimates, nor did we attempt to directly estimate the proportions of birds or bats that fell outside the survey plots. Instead, we used adjustment factors developed from data collected across other North American wind-energy facilities in grassland environments for survey plots of different radii (Huso and Dalthorp 2014): 0.95 for large birds, 0.98 for medium birds, and 1.00 (i.e., no adjustment) for small birds and bats.

Factors that may contribute to overestimating wind-turbine-related mortality based on surveys such as this include unrelated background mortality resulting from predation, fence-wire strikes, and other causes of natural mortality (Smallwood 2007, Erickson et al. 2014). Because many of the bat and bird carcasses found during fatality surveys around wind turbines have been variably dismembered or remain only as feather spots due to the action of predators, scavengers, or both, it is often impossible to accurately discern the cause of death and thereby distinguish between wind-turbine-related and background mortality. This issue is particularly acute with detection dogs as searchers, because they find many more bits and pieces of scavenged carcasses (especially bats) than typical human surveyors. For this reason, it is also possible that using detection dogs could inflate the contribution of background mortality to estimates of wind-energy fatalities. Nevertheless, because of the high cost and logistical complexity involved in conducting rigorous studies, few researchers have attempted to quantify and adjust for background mortality in the context of energy development (Erickson et al. 2014). Accordingly, per standard practice, we did not attempt to account or adjust for background mortality, nor did we exclude from the fatality estimates any carcasses discovered within the survey plots that may not have resulted from collisions with the wind turbines. The only exceptions were that we excluded 20 carcasses in Year 1 and 4 carcasses in Year 2 of juvenile birds that were clearly not yet capable of full flight (all mostly likely horned larks and western meadowlarks, which are common grassland breeders in the Project area).

For Big D fatality estimation purposes, we used the formula proposed by Smallwood (2013) and incorporated in Brown et al. (2016) and Smallwood and Neher (2016), which represents a modification of the original Horvitz-Thompson (H-T) estimator (Horvitz and Thompson 1952):

$$F_A = \frac{F_U}{D \times d} \qquad \textbf{Equation 1}$$

where F_A = adjusted fatality estimate, F_U = raw count of fatalities over a given monitoring period, D = proportion of placed carcasses detected by searchers conducting standard fatality surveys during the monitoring period (Big D), and d = search-radius bias adjustment factor (also known as the distance weighted proportion [DWP] adjustment; Huso and Dalthorp 2014).

Developing unbiased estimates of D to incorporate in Equation 1 requires tailoring estimates to represent the influence of carcass size, which affects both the ability of searchers to detect carcasses and the probability of removal by scavengers (Brown et al. 2016). Detection dogs operate based on their keen sense of smell, whereas human searchers rely on visual detection. For this reason, dogs are able to detect even small bits of carcasses relatively easily compared to humans. Nevertheless, in similar circumstances, large carcasses still present more overall odor than smaller carcasses of generally similar taxa (e.g., birds or bats) and degradation states. Therefore, developing tailored size-specific estimates of *D* remained a key objective for searches conducted by both detection dogs and humans.

We used a similar approach as that represented in ICF International (2016), Brown et al. (2016), and Smallwood and Neher (2016) to develop logistic generalized linear models (GLMs) based on the bias-trial detection data for birds collected during Year 2. We used the GLMs to predict relationships between the average masses of bird species we placed as trial carcasses (ranging in size from <10 g to >4,000 g) and the probability of detection during standard carcass surveys (*D*), developing independent models for the 7-day dog surveys and the 28-day human surveys. In considering candidate GLM models for predicting *D*, we evaluated the utility of incorporating season and substrate covariates in the models. We evaluated two classification options for season: quarterly seasons (fall = September – November, winter = December – February, spring = March – May, and summer = June – August) and two seasons (fall/winter and spring/summer). The substrate classes considered were loosely categorized reflections of the substrate on which a given trial carcass was placed (and the surrounding 2–3-m radius): gravel/dirt, grazed/short grass, and tall grass/forb.

We did not develop models for bats to predict carcass detectability based on the average mass of relevant species, because (1) we were unable to represent a sufficient range of bat species of different sizes to compose a robust prediction model, (2) variation in the ability of detection dogs to find smaller species such as Mexican free-tailed bats and *Myotis* spp. versus larger hoary bats is insubstantial, and (3) estimating adjustment factors for human surveyors was unnecessary, because they detected few bat fatalities and found none of the bat trial carcasses placed on the 28-day plots. Instead, to develop adjusted bat fatality estimates for the 7-day plots in Year 2, we applied season-specific estimates of *D* representing the non-modeled proportions of placed bats found by the detection-dog teams during each quarterly season.

We used a similar approach as Smallwood and Neher (2016) to generate estimated standard errors (SEs) and confidence intervals (CIs) to accompany the bird fatality estimates that were adjusted for mass-dependent carcass detectability. This approach involved using trial placement and detection data as a "training dataset" to simulate the probability of detecting actual fatalities and variation related to carcass size, and to support parameterizing the following model:

$$\widehat{SE}[P_A] = a + \frac{1}{b*\mathrm{M}} + c*SE[P_U] \qquad \textbf{Equation 2}$$

where $\widehat{SE}[P_A]$ = estimated standard error of the adjusted (for carcass size) placed-carcass detection rate (adjusted detections of placed carcasses per turbine for a given species); M = average body mass (g) of a given placed species; $SE[P_U]$ = estimated standard error of the unadjusted placed-carcass detection rate (unadjusted detections of placed carcasses per turbine for a given species); and *a*, *b*, and *c* are parameter values optimized using quasi-Newton methods to minimize the root-mean-square error and maximize the coefficient of determination (R^2) of the best-fit nonlinear regression models. We developed independent predictive models based on Equation 2 for birds of all sizes for 7-day turbines and 28-day turbines. Once the training dataset models were optimized, we used the resulting *a*, *b*, and *c* parameter values and standard error estimates representing variation in the unadjusted per turbine fatality detection rates for individual species to predict the standard error of the adjusted fatality estimate based on the following equation:

$$\widehat{SE}[F_A] = a + \frac{1}{b*M} + c * SE[F_U] \qquad \textbf{Equation 3}$$

where $\widehat{SE}[F_A]$ = estimated standard error of adjusted fatality estimate; $SE[F_U]$ = estimated standard error of unadjusted fatality estimate, and all other parameters are as in the previous equation.

For the two monitoring years, we generated separate adjusted fatality estimates for the 7-day and 28-day surveys using the adjustment methodologies relevant to each annual dataset. Then, to generate annual facility-wide estimates, we summed the adjusted 7-day and 28-day values to produce total fatality estimates for each year, and to generate average annual adjusted fatality rates per turbine and per MW for the entire facility. For bats in Year 2, however, a dearth of documented fatalities and the surveyors failing to find any of the bat trial carcasses precluded developing adjusted bat fatality estimates for the 28-day human surveys. Therefore, to generate facility-wide estimates for bats in Year 2, we instead extrapolated the 7-day estimates to represent the entire facility.

We generally represent adjusted fatality estimates as: (a) average fatalities per turbine per year, (b) average fatalities per MW of installed capacity per year, and (c) total estimated fatalities per year for the facility. We produced annual estimates for all individual bird and bat species documented ≥5 times in a given year as fatalities suited to estimating adjusted fatality rates, as well as combined estimates for bats, all birds, all nonraptors, and all raptors.

For perspective similar to Year 1 (H. T. Harvey & Associates 2018), we also produced three other sets of fatality estimates for bats, all raptors, and the four focal raptor species. *Naïve estimates* represented the unadjusted fatality totals (summed across all plots) translated to average per MW estimates for the facility, with and without off-plot incidental finds included. We also calculated comparative estimates for all raptors combined and the four focal raptor species using Equation 1, but replacing modeled estimates of *D* with non-modeled, season-specific (quarterly) estimates of *D* calculated for medium and large birds as a groups. This was analogous to the approach we used to generate adjusted fatality estimates for bats in Year 2, and comparable to the *BT H-T* (bleed-through Horvitz-Thompson) alternative estimates we generated for Year 1 (H. T. Harvey & Associates 2018). In Year 1, we also generated *NoBT H-T* (no bleed-through H-T) estimates for comparison; however, generating comparable estimates for Year 2 was not possible, because the Big D integrated bias-trial approach does not support generating estimates of carcass detectability that are based on searchers having only one opportunity to detect trial carcasses.

2.5 Comparing Fatality Estimates from Years 1 and 2

To evaluate differences in fatality estimates from Years 1 and 2, we did not attempt to rectify the potential influences of using different approaches to estimate bias correction factors and develop adjusted fatality estimates. Instead, we used the Huso DS729 modeling results to represent adjusted fatality estimates for Year 1 (including all filtering of fatalities believed to have been deposited before the surveys began and that did not meet the no-bleed-through assumption of the Huso estimator; H. T. Harvey & Associates 2018a) and the integrated Big D bias trial and estimation approach results to represent adjusted fatality estimates for Year 2.

2.6 Hot Spot Analyses

Previously we used the ArcGIS Hot Spot analysis routine in an attempt to quantify the degree to which bat and bird fatalities were spatially clustered among turbines in Year 1. Upon delving into using adjusted as opposed to unadjusted fatality estimates for this purpose and seeking to combine information from Years 1 and 2 in integrated assessments, we determined that this analytical routine does not work particularly well to identify specific hot and cold spots when the frame of reference is discrete spatial units rather than a broad, continuous landscape surface and, in particular, does not effectively represent isolated turbine-specific hotspots. Therefore, to illustrate the spatial distribution of fatalities accumulated in Year 2 and across the 2-year survey period, we instead simply present graphics that display the proportional representation of adjusted fatality numbers among the turbines, and subjectively evaluate the hot and cold spots suggested by these graphical comparisons. We conducted these assessments for bats, all birds, all raptors, all nonraptors, and the four focal raptor species.

Section 3.0 Results

3.1 Habitat and Climatic Conditions

In contrast to the very wet winter/spring of 2016/2017, which followed on the heels of a severe 4-year drought, winter 2017/2018 was drier than average (Accuweather 2018). For the water year beginning in October 2017, rainfall in Livermore was only 49% of normal through February 2018 and remained more than 25% below average through May (National Oceanic and Atmospheric Association 2018). Although a few substantial storms brought some late rainfall relief in March/April, the overall below-average winter/spring rainfall produced abnormally dry conditions in the Project area by February that persisted through the summer (National Drought Mitigation Center 2018). The low winter/spring rainfall resulted in comparatively moderate growth of annual vegetation in many areas compared to spring 2017, when the vegetation growth was particularly tall and dense and substantially hindered the fatality surveys (e.g., see Figure 3). In addition, as a result of residual fuel build-up since the wet winter of 2016/2017 and conducive dry, windy weather, the 2018 summer wildfire season in California was extreme, including the largest wildfire ever recorded in the state. The fires included several small local blazes, one of which approached but did not enter the Project site. Collectively, the extensive fire season and region-wide smoke accumulation frequently increased health and safety risks for surveyors during summer 2018, especially for the detection-dog teams. Unlike human surveyors who can don respirators and thereby continue working as long as the smoke is not so thick as to preclude effective visibility and damage eyes, protective respirators are not an option for the dog teams, because the handler must be able to communicate verbally with the dogs and the dogs themselves cannot be fitted with a respirator.

Figure 3. Detection Dog Immersed in Dense, Tall Spring Vegetation on a Year 1 Survey Plot

3.2 Survey Effort

The 7-day dog survey schedule remained consistent throughout the Year 2 survey period, with four plot surveys scheduled each day from Monday through Thursday. Minor schedule shifts were occasionally necessary to accommodate formal holidays, other personnel limitations, facility maintenance activities, livestock-related constraints, and the heat- and smoke-tolerance limits of the detection dogs and handlers. The 28-day human survey schedule remained consistent for most of the survey year, but in early November shifted from a Tuesday–Wednesday schedule (4 plots per day) to a Tuesday–Thursday schedule (2–3 plots per day) to support improved personnel logistics (see Appendix B for a summary of surveys and survey date ranges by turbine).

3.3 Composition of Fatality Incidents

In Year 1, we documented 229 bat fatalities and 332 fatalities of volant birds using exclusively detection-dog teams as the searchers (H. T. Harvey & Associates 2018). In Year 2, we documented 124 bat fatalities and 237 fatalities of volant birds based on surveys conducted by both detection-dog teams (7-day plots) and human searchers (28-day plots) (Table 1, Appendix C). Of the Year 1 fatalities, we classified 221 bat and 286 bird (180 small, 19 medium, and 87 large) fatalities as having been found on a specific 7-day or 28-day plot, and included those records in the adjusted fatality estimates (subject to other filtering criteria related to carcass aging; H. T. Harvey & Associates 2018). The Year 1 survey teams also documented 4 bat and 7 bird (5 small and 2 large) fatalities as incidental finds outside of the 105-m-radius survey plots, which we excluded from the adjusted fatality estimates. Of the Year 2 fatalities, we classified 120 bat and 218 bird (127 small, 39 medium, and 52 large) fatalities as having been found on a specific 7-day or 28-day plot (included in all fatality estimates) and 4 bat and 18 bird (12 small, 4 medium, and 2 large) fatalities as incidental finds outside of the 105-m-radius survey plots (excluded from most fatality estimates) (Table 1).

Table 1. All Bat and Volant Bird Fatalities Documented in Year 2 by Discovery Location, Survey Type, and Size Class

Taxon	Size Class	Off Plot Incidental[1]	On Plot – Survey Type			On Plot Subtotal	Total
			7-Day	28-Day	Incidental[2]		
Bat	–	4	116	4	0	120	124
Bird	Small	12	110	13	4	127	139
	Medium	4	24	13	2	39	43
	Large	2	16	32[3]	5	53	55
	Subtotal	18	150	58	11	219	237
Total		22	266	62	11	339	361

1 Fatalities excluded from estimates of adjusted fatality rates.
2 Fatalities included in estimates of adjusted fatality rates, except for one old, possible golden eagle bone fragment that clearly did not originate on any of the GHWEC study plots.
3 Includes one injured-euthanized golden eagle found with a partially severed wing by a windsmith who reported the location only as in the vicinity of four turbines.

We excluded all of the incidental off-plot fatalities listed above from most fatality estimates (see Section 2.4). However, we included in both the Year 1 and Year 2 tallies of large birds assigned to specific survey plots one large raptor (a ferruginous hawk in Year 1 and a golden eagle in Year 2) that was found outside of any specific survey plot, alive but with a damaged wing. Because both birds had suffered what appeared to be an ultimately fatal blade-strike injury (both later euthanized), we included both incidents in all fatality estimates per standard practice for other incidental finds discovered on surveys plots. For relevant estimation purposes, we randomly assigned the ferruginous hawk to one of the two turbines (WTG-22) close to where it was found and the golden eagle to one of the four turbines (WTG33) close to where it was found. We documented no other injured animals in Year 2, whereas the Year 1 fatalities also included three injured/debilitated Mexican free-tailed bats (all later died or were euthanized) found on survey plots during the course of standard surveys, which were automatically assigned to a specific turbine and included in the fatality estimates.

Of the carcasses found on survey plots, we included nine other incidental bird finds in the fatality estimates, but we excluded one partial sternum of a possible golden eagle that was old, weathered, and we suspect dropped on the turbine plot by a raven. We documented no other large raptor fatalities during the surveys from which this scrap of bone could have originated. After filtering out the off-plot carcasses and this bone scrap, 120 bats (97% of all documented bat fatalities) and 219 birds (92% of all bird fatalities) remained as a basis for estimating fatality rates during the Year 2 survey period (Table 2, Appendix C). The detection-dog teams found most of the bats and small birds on the 7-day plots; the human surveyors found only 4 of 124 bats and 16 of 127 small birds on the 28-day plots (Table 1). In contrast, the human surveyors found a slightly higher average number of large-bird fatalities per turbine on the 28-day plots (1.1 per turbine) than the detection-dog teams found on the 7-day plots (1.0 per turbine).

We ultimately classified 14 individual Year 2 finds as duplicates representing previously discovered fatalities. These included two cases pertaining to two individual bats, two cases pertaining to two small birds, five cases pertaining to two burrowing owls, and the rest pertaining to five golden eagles and a turkey vulture. Of the 120 documented Year 2 bat fatalities, 17% were found as intact, freshly dead (~1–3 days old) carcasses; 45% as intact carcasses in early stages of decomposition (including insect activity); and 38% as incomplete, scavenged carcasses in various states of decomposition (Table 3). Of 127 small-bird fatalities, 9% were intact and freshly dead, 18% were intact and in various stages of decomposition, 27% were scavenged combinations of body parts and feathers in various states of decomposition, and 46% were feather spots (Table 3). Of 39 medium-bird fatalities, 15% were intact and freshly dead, 10% were intact and in early stages of decomposition, 21% were scavenged combinations of body parts and feathers in various states of decomposition, and 54% were feather spots (Table 3). Of 52 large-bird fatalities, 2% were found injured and were later euthanized (one golden eagle), 15% were intact and freshly dead, 42% were intact and in various stages of decomposition, 15% were found as individual or multiple dismembered parts in various stages of decomposition (all raptors, not obviously scavenged), 15% were scavenged combinations of body parts and feathers in early stages of decomposition, and 10% were feather spots (Table 3).

Table 2. Bat and Bird Fatalities Found on Survey Plots in Year 2 Considered Eligible for Inclusion in Adjusted Fatality Estimates, by Size Class for Birds, Survey Type, and Season

			Season[1]				
Taxon	**Size Class**	**Survey Type**	**Fall**	**Winter**	**Spring**	**Summer**	**Total**
Bats		7-day	76	2	16	22	116
		28-day	3	0	0	1	4
Subtotal			79	2	16	23	120
Birds	Small	7-day	32	24	29	26	111
		28-day	8	6	2	0	16
		Subtotal	40	30	31	26	127
	Medium	7-day	10	4	2	8	24
		28-day	5	5	4	1	15
		Subtotal	15	9	6	9	39
	Large	7-day	5	6	2	3	16
		28-day	13	5	9	9	36
		Subtotal	18	11	11	12	52
Subtotal			73	50	48	47	218
Total			152	52	64	70	338

[1] Fall = September – November (combines data for 2017 and 2018); winter = December – February; spring = March – May; summer = June – August.

Table 3. Proportions of Documented Bat and Bird Fatalities Found Intact Versus Dismembered or Scavenged and In Various States of Decomposition

	Bats		Small Birds		Medium Birds		Large Birds	
Carcass Condition	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**
Injured-euthanized	0	–	0	–	0	–	1	2
Intact-fresh	20	17	11	9	6	15	8	15
Intact-early decomposition	54	45	20	16	4	10	20	38
Intact-decomposed	0	–	3	2	0	–	2	4
Dismembered	0	–	0	–	0	–	8	15
Scavenged-fresh	5	4	4	3	2	5	0	–
Scavenged-early decomposition	37	31	28	22	5	13	8	15
Scavenged-decomposed	4	3	3	2	1	3	0	–
Scavenged-feather spot	0	–	58	46	21	54	5	10
Total	120	–	127	–	39	–	52	–

The bat fatalities involved four confirmed species (Table 4, Appendix C). Mexican free-tailed bats (57%) and hoary bats (37%) accounted for most of the bat fatalities. The rest comprised 4 (3%) western red bats (a California species of special concern [CA-SSC]), 1 (<1%) California myotis, and 2 (2%) unknown bats that could not be identified to species based on the residual fragments found by the detection dogs. The California myotis was a new species for the Project.

The bird fatalities involved 37 native species and 1 nonnative species (European starling) (Table 4, Appendix C). The native species included 11 species of raptors and vultures, four of which are afforded special-status protection in California: golden eagle (California fully protected [CA-FP] and protected under the federal Bald and Golden Eagle Protection Act; n = 14 confirmed on- and off-plot fatalities, plus a possible sternum bone fragment not considered assignable to the Project), white-tailed kite (CA-FP; n = 1), burrowing owl (CA-SSC; n = 25), and northern harrier (CA-SSC; n = 1) (Table 4). The harrier was the only new Year 2 raptor species for the Project, whereas rough-legged hawk and short-eared owl were recorded in Year 1 but not Year 2 (Appendix C). The nonraptor bird fatalities included three other special- status species: loggerhead shrike (CA-SSC; n = 1), Vaux's swift (CA-SSC; n = 3), and yellow warbler (CA-SSC; n = 1). The number of confirmed non-raptor bird species documented as fatalities in Year 2 (27) was lower than in Year 1 (35), and only 19 species were common to both years (Appendix C). Species for which we documented more than 10 fatalities during Year 2 were horned lark (n = 34), red-tailed hawk (n = 30), burrowing owl (n = 25), western meadowlark (n = 20), white-throated swift (n = 19), golden eagle (n = 14), and American kestrel (n = 11). The only other confirmed non-raptor species for which we documented at least five fatalities in Year 2 were Wilson's warbler (n = 5) and European starling (n = 5), but five unidentified blackbirds also could have been the same species (Table 4).

Table 4. Unadjusted Bat and Bird Fatality Totals in Year 2 by Species (With Special-Status Designations) and Location Relative to Standard Survey Plots

Group	Species	On Plot	Off Plot	Total	Special Status[1]
Bats	Mexican free-tailed bat	68	3	71	–
	Hoary bat	46	0	46	–
	Western red bat	3	1	4	CA-SSC
	California myotis	1	0	1	–
	Unknown bat	2	0	2	–
	All bats	120	4	124	–
Raptors	Red-tailed hawk	28	2	30	–
	Burrowing owl	23	2	25	CA-SSC
	Golden eagle	13	1[2]	14	CA-FP
	American kestrel	9	2	11	–
	Ferruginous hawk	3	0	3	–
	Barn owl	3	0	3	–
	Turkey vulture	2	0	2	–
	Prairie falcon	1	0	1	–
	White-tailed kite	1	0	1	CA-FP

Group	Species	On Plot	Off Plot	Total	Special Status[1]
	Sharp-shinned hawk	1	0	1	–
	Unknown large raptor [3]	1	0	1	–
	All raptors	86	7	93	–
Other Birds	Horned lark	34	0	34	–
	Western meadowlark	15	5	20	–
	White-throated swift	19	0	19	–
	European starling	5	0	5	–
	Unknown blackbird	4	1	5	–
	Wilson's warbler	3	2	5	–
	Hermit warbler	2	0	2	–
	Townsend's warbler	1	0	1	–
	Yellow warbler	1	0	1	CA-SSC
	Unknown warbler	4	0	4	–
	Ruby-crowned kinglet	4	0	4	–
	Warbling vireo	3	0	3	–
	Unknown vireo	1	1	2	–
	Vaux's swift	3	0	3	CA-SSC
	American pipit	3	0	3	–
	Western flycatcher	1	0	1	–
	Unknown flycatcher	2	1	3	–
	Mallard	2	0	2	–
	Common raven	2	0	2	–
	Hermit thrush	1	0	1	–
	House finch	1	0	1	–
	House wren	1	0	1	–
	Killdeer	1	0	1	–
	Loggerhead shrike	1	0	1	CA-SSC
	Mountain bluebird	1	0	1	–
	Mourning dove	1	0	1	–
	Rufus hummingbird	1	0	1	–
	Savannah sparrow	1	0	1	–
	Tree swallow	1	0	1	–
	Western kingbird	1	0	1	–
	Western tanager	1	0	1	–
	Unknown small bird	11	1	12	–
	All other birds	132	12	144	–
All birds and bats		338	23	361	–

[1] CA-FP = California fully protected; CA-SSC = California species of special concern

[2] An injured eagle with a damaged wing found off-plot but assigned as a fatality to one of three nearby 28-day turbines.

[3] Old, weathered sternum fragment identified as a possible golden eagle, but excluded from fatality estimates because it clearly did not originate on any of the study plots.

3.4 Carcass Detectability

To evaluate carcass detectability in Year 2, beginning in week 2 we sought to place (or otherwise take advantage of opportunities to collect relevant information using natural fatalities) at least 1 new bat, 1 small bird, and 1 medium or large bird on the 7-day plots, and at least one of each type of carcass on the 28-day plots during each week of the survey period. We succeeded in accomplishing this placement objective for birds on 7-day plots in all but 1 week (none placed in week 7) and for birds on 28-day plots in all but 2 weeks (only one placed in week 7 and one in week 8) (Appendix D). In contrast, a temporary shortage of suitable bat carcasses caused us to forego placing any new bats on 7-day plots from weeks 20–28 (late January through March) and on 28-day plots from weeks 20–36 (late January through May). For the 7-day surveys, the placement gap corresponded to the late winter/early spring period when bat fatalities are uncommon. The placement gap for the 28-day surveys extended further into the onset of spring migration and the secondary activity peak for bat fatalities; however, we prioritized spring placements on the 7-day plots where the probability of bat fatality and trial carcass detection was non-negligible. Otherwise, we placed at least one bat on the 7-day plots in all but four other weeks and on the 28-day plots in all but one other week of the Year 2 survey period (Appendix D).

The trial carcasses involved a total of 67 bats of 3 species, 93 small birds of 23 species, 32 medium birds of 9 species, and 69 large birds of 13 species (Tables 5 and 6, Appendix D). Most of the bats we were able to place were Mexican free-tailed bats (81%) and hoary bats (18%). For birds, red-tailed hawk was the only species that accounted for more than 10% of the total placements, most of which originated as fatalities on the Project site. Other species that accounted for ≥5% of the total bird placements were nonnative house sparrows, European starlings, and rock pigeons, and native California gulls, cedar waxwings, and house finches (Appendix D). Of the carcasses used in Year 2 for bias trials, 48% of the bats, 14% of the small birds, 19% of the medium birds, and 17% of the large birds originated as fatalities found during the study.

Table 5. Placements of Bats by Season and Results of Carcass Detectability Trials in Year 2

	7-day Dog Survey Plots				28-day Human Survey Plots			
Season	Number Placed	Number of Species	Found	% Found	Number Placed	Number of Species	Found	% Found
Fall	10	3	8	80	9	2	0	0
Winter	8	1	4	50	9	1	0	0
Spring	5	2	3	60	0	–	–	–
Summer	13	2	7	54	13	2	0	0
Annual	36	3	22	61	31	2	0	0

Over the course of the annual survey period, we placed 2–4 bat carcasses, 2–4 small bird carcasses, and 2–4 medium or large bird carcasses on every 7-day plot (Figure 4). For the 28-day plots, we placed 1–3 bat carcasses on 22 of the 32 plots, 1–2 small bird carcasses on all plots, and 1–2 medium or large bird carcasses on all but one plot (Figure 5).

Table 6. Placements of Birds by Size Class and Season, and Results of Carcass Detectability Trials in Year 2

Survey Type	Size Class	Season	Number of Carcasses Placed	Number of Species	Number of Carcasses Found	% Found
7-Day Dog	Small	Fall	10	9	7	70
		Winter	11	5	7	64
		Spring	11	8	6	55
		Summer	13	7	7	54
		Annual	45	17	27	60
	Medium	Fall	4	3	3	75
		Winter	5	4	4	80
		Spring	6	4	5	83
		Summer	4	2	4	100
		Annual	19	9	16	84
	Large	Fall	6	4	5	83
		Winter	10	7	10	100
		Spring	8	5	8	100
		Summer	9	5	9	100
		Annual	33	11	32	97
	All Birds	Annual	97	37	75	77
28-day Human	Small	Fall	9	7	1	11
		Winter	14	6	1	7
		Spring	12	7	0	0
		Summer	13	6	0	0
		Annual	48	13	2	4
	Medium	Fall	3	3	1	33
		Winter	2	1	1	50
		Spring	5	3	1	20
		Summer	3	2	3	100
		Annual	13	5	6	46
	Large	Fall	7	5	7	100
		Winter	12	7	11	92
		Spring	7	5	6	86
		Summer	10	3	8	80
		Annual	36	11	32	89
	All Birds	Annual	97	29	40	41
All Surveys and Seasons Combined			194	45	115	59