Appendix F

Micrositing Assessment

Assessment of Proposed Wind Turbine Sites to Minimize Raptor Collisions at the Mulqueeney Ranch Wind Repowering Project in the Altamont Pass Wind Resource Area

July 2020

Prepared for:

Mulqueeney Wind, LLC

Prepared by:

ESTEP

Environmental Consulting

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Prepared for:

Mulqueeney Wind Energy, LLC
200 Liberty Street, 14th Floor
New York, NY 10281
Contact: Jonathan Kirby
213.212.0781

Prepared by:

Estep Environmental Consulting
3202 Spinning Rod Way
Sacramento, CA 95833
Contact: Jim Estep
916.921.2515

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Executive Summary

The Mulqueeney Wind Repowering Project (Mulqueeney Wind) is part of a regional wind turbine repowering effort in the Altamont Pass Wind Resource Area (APWRA) coordinated by Alameda County through the framework provided under the 2014 *Altamont Pass Wind Resource Area Repowering Final Program Environmental Impact Report* (PEIR). One of the mitigation measures required of repowering projects under the PEIR is Mitigation Measure BIO-11b: Site Turbines to Minimize Potential Mortality of Birds. To comply with BIO-11b, Mulqueeney Wind, the applicant for the repowering project, following decommissioning and removal of the original old-generation turbines by the previous owner (NextEra), has undertaken a turbine site assessment for the purpose of selecting a turbine layout for its new-generation turbines that reduces potential raptor mortality to the extent feasible.

The Mulqueeney Wind Project proposes 36 new turbines to replace 518 old-generation turbines and associated infrastructure. A total of 93 site locations were examined, including recommended and proposed alternative relocation sites. Using topographic features and other potential risk factors, each of the 36 initially proposed sites was assigned a risk designation. The designation was based on rationale that included the location of the turbine, the proximity of topographical features that influence raptor movement, grading for roads and turbine pads that can alter topography, wind patterns, observed and predicted raptor movement and behavior, and golden eagle use data and proximity to golden eagle nests. The recommended sites and the proposed alternative relocation sites, while also assigned a risk designation, were evaluated based on the 'change in risk' (decrease, increase, no change) from the risk category assigned to the initially proposed turbine site. This determination was made solely on the potential reduction of raptor collisions and did not address other possible constraints, such as construction feasibility or wake effects (proximity of neighboring turbines).

Of the 36 initially proposed turbines, 17 were considered High Risk locations, 11 were Moderate-High Risk locations, and 8 were Moderate Risk locations. Alternative sites were recommended for 31 of the 36 turbines to reduce potential collision risk. Primarily due to wake or proximity issues, Mulqueeney Wind provided proposed alternative relocation sites for 18 turbines. Overall, a decrease in risk was assigned to 12 turbines, a slight decrease in risk was assigned to 10 turbines, no change in risk was assigned to 13 turbines, and risk increased with one turbine.

Introduction

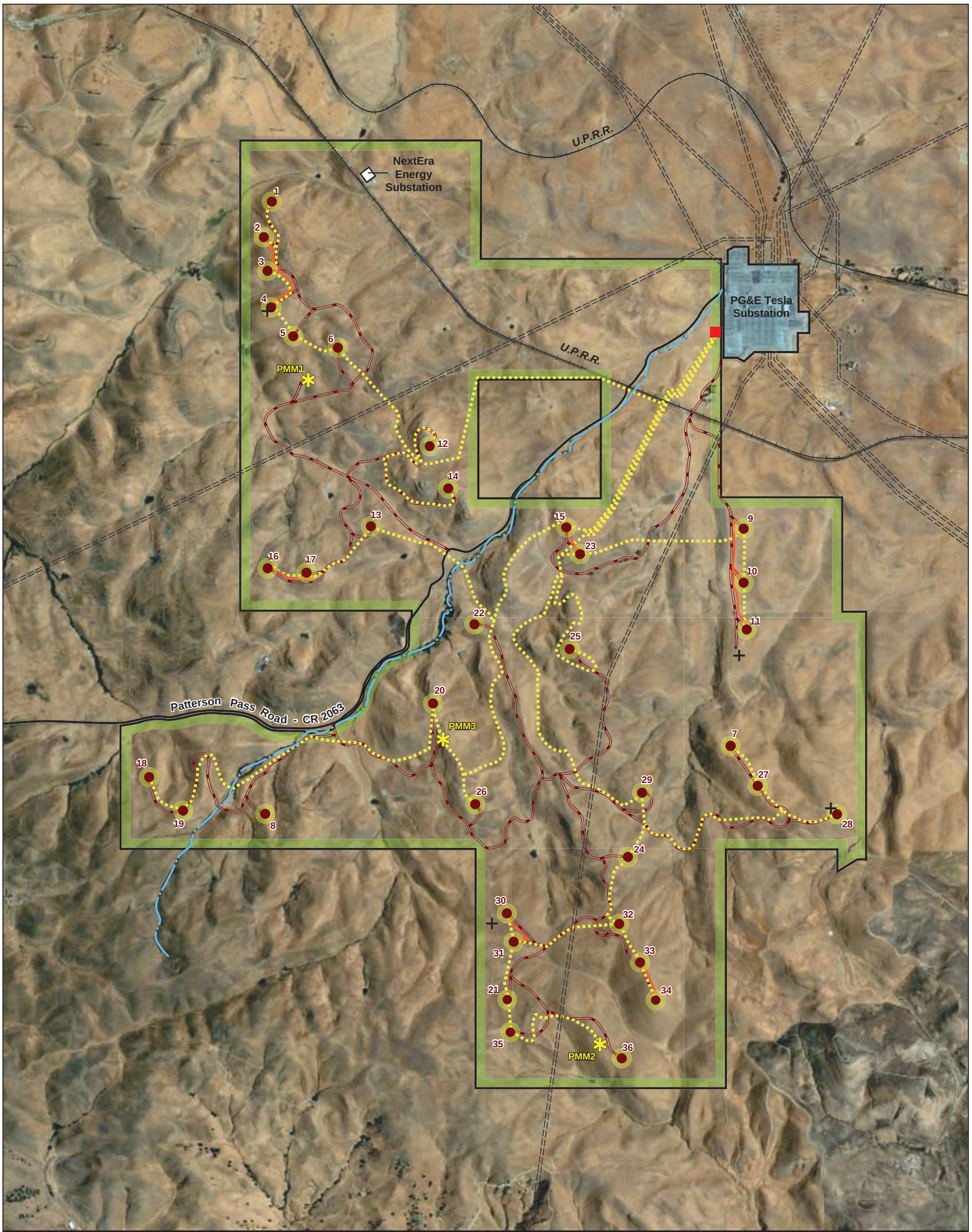
Mulqueeney Wind Energy, LLC (Mulqueeney Wind), a subsidiary of Brookfield Renewable, is proposing to repower a wind energy project along the eastern edge of the Altamont Pass Wind Resource Area (APWRA). The Mulqueeney Ranch Wind Repowering Project (project or Mulqueeney Ranch Project) includes the replacement of 518 old-generation wind turbines installed in the 1990s with 36 new wind turbines with a maximum production capacity of 80 megawatts (MW), using turbines rated between 2.2 and 4.2 MW per turbine, on twenty-nine contiguous parcels extending over approximately 4,590 acres (Figure 1).

Repowering the APWRA

Wind energy development in the APWRA, an approximately 50,000 acre area extending across the northeastern hills of Alameda County and a small portion of Contra Costa County, began in the early 1980s with the counties issuing Conditional Use Permits (CUPs) for privately-owned wind facilities. Installed primarily on open rangeland, a generally compatible land use, by the mid-1990s there were more than 7,200 operating wind turbines in the APWRA. Most of these facilities consisted of densely-spaced small turbines (referred to hereafter as old-generation turbines) situated along rows (turbine strings) that usually corresponded with ridgelines or other topographical features that maximized energy production via the typical prevailing wind patterns in the APWRA.

By the late-1980s, evidence of avian mortality resulting from collision with wind turbines began to surface (Estep 1989, Howell and Didonato 1991, Orloff and Flannery 1992) resulting in ongoing coordination between energy companies, the counties, and state and federal resource agencies to explore the extent and magnitude of the issue, and facilitating a variety of research projects in an attempt to determine causal relationships (Tucker 1996, Orloff and Flannery 1996, Howell 1997, Kerlinger and Curry 1999, McIssaac 2000, Hodos et al. 2000). The primary avian focus was on raptor species, particularly golden eagles (*Aquila chrysaetos*) and red-tailed hawks (*Buteo jamaicensis*), the two species that, from results of monitoring, appeared to be among the most susceptible to collision mortality.

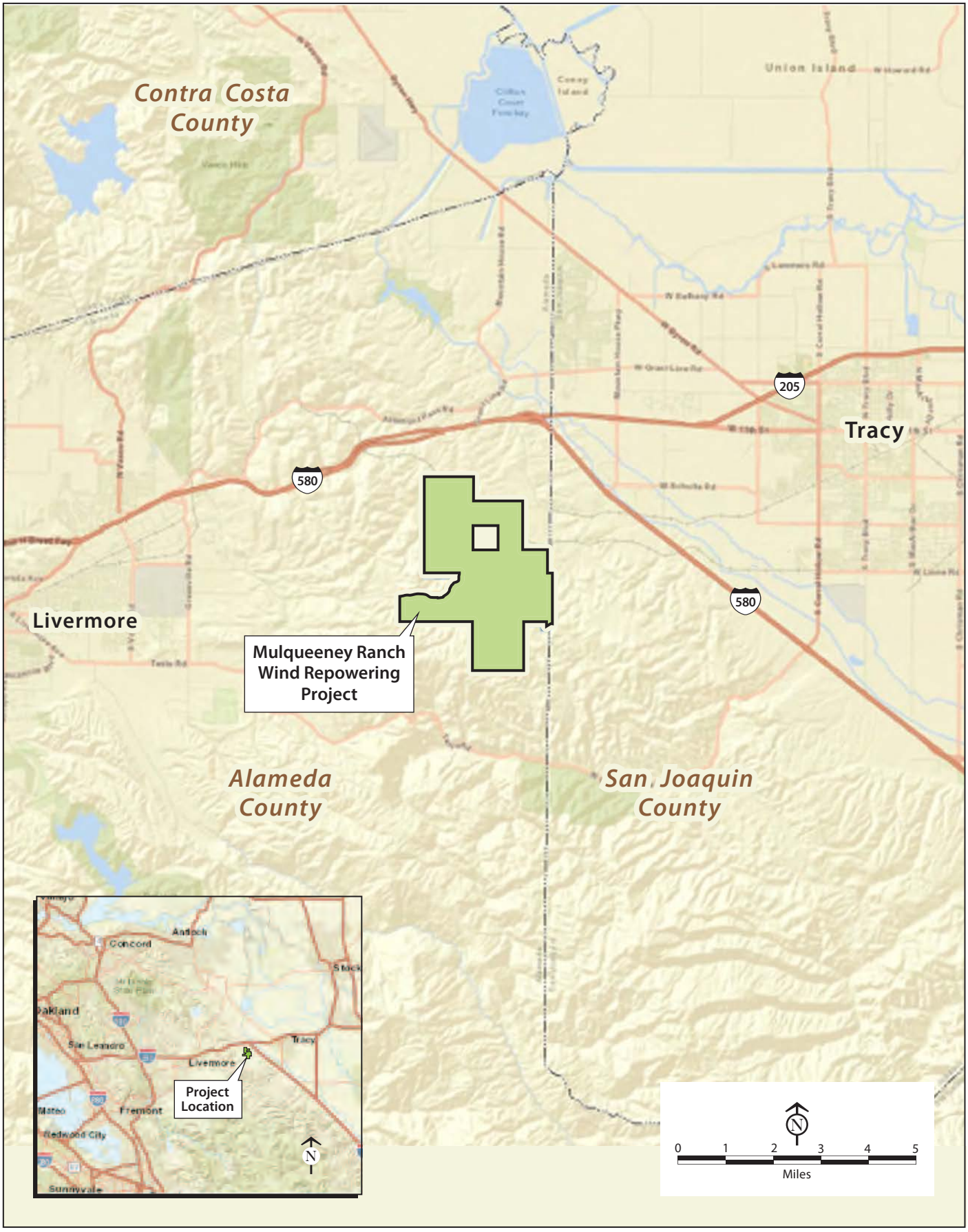
As monitoring and research efforts continued to expand but failed to provide meaningful results in terms of mortality reduction, wind turbine technology continued to advance. By the late 1990s, operators began to explore the potential for removing their old-generation turbines and replacing them with newer, higher capacity turbine models. New-generation turbines had substantially higher per turbine energy generation capacity, but were also significantly larger than their predecessors. They also required much more space between them, and thus with conversion to new-generation turbines, dense turbine strings, wind-walls, and other old-generation configurations would become obsolete, and fewer individual turbines would be required on the landscape in order to meet the permitted capacity.



07/08/2020

BASE MAP SOURCE: ICF 2019.

Figure 2
Mulqueeney Ranch Wind Repowering Project - Initially Proposed Turbine Layout



07/08/2020

SOURCE: ICF 2019.

Figure 1
Location of the Mulqueeney Ranch Wind Repowering Project

The larger, new-generation turbines also seemed to be more compatible with the increasing body of data that suggested certain structural and operational characteristics of turbines contributed to mortality (Orloff and Flannery 1996). The increased distance from the rotor-swept area to the ground, the tubular towers lacking perch sites, the slower rpms and more visible rotation of the rotors, undergrounding of power lines, and other factors were considered positive developments that could potentially reduce fatality rates. While continued investigation has not been entirely conclusive regarding the benefits of some of these structural and operational factors, perhaps the most anticipated change was the density and configuration of turbines on the landscape. Careful siting of new-generation turbines that included an assessment of avian collision potential, has been considered the most effective means of reducing fatality rates of targeted raptor species (Alameda County 1998, Smallwood 2006, ICF 2014). Although to date, post-construction monitoring results of repowered projects in the APWRA have not conclusively shown a substantial reduction in raptor mortality (HT Harvey 2018), avoidance of potentially risky conditions remains a primary objective of all repowering projects in the APWRA. Despite the lack of conclusive data, it is reasonable that avoiding landscape features that influence raptor flight and behavior and potentially increase occurrences within the rotor-swept area of turbines, can decrease the potential for collision events.

In the mid-1990s, Alameda and Contra Costa Counties began the process of developing a repowering program for a portion of the APWRA, culminating in the 1998 Alameda County Repowering EIR (Alameda County 1998), which included a Biological Resources Management Plan that included turbine siting recommendations to reduce avian mortality. However, as CUPs for projects initially permitted in the 1980s were nearing their end date, their renewal became the source of additional controversy ultimately resulting in a settlement agreement that, among other things, required a new programmatic EIR that addressed all future repowering in the APWRA.

In November 2014, the Alameda County Community Development Agency certified the *Altamont Pass Wind Resource Area Repowering Final Program Environmental Impact Report* (PEIR). The PEIR includes a detailed account of the history and legal activities culminating in preparation of the PEIR, and provides a framework for consideration of subsequent projects to remove the old generation turbines and related infrastructure and repower with new-generation turbines, provided they are consistent with the PEIR and would be developed to be consistent with the County's goals, objectives, and conditions.

The Mulqueeney Ranch Project is planned within the framework of the PEIR. However, due to recent updates of the PEIR, Alameda County has determined that the project will be reviewed through a subsequent EIR to ensure that the project both conforms to the framework of the PEIR and is in compliance with the requirements of the California Environmental Quality Act (CEQA).

Purpose

With the approval of the PEIR, the County included several Conditions of Approval for the subsequent CUPs, including the formation of a technical advisory committee (TAC) to oversee implementation of specific mitigation measures in the EIR. Among these is BIO-11b*: Site Turbines to Minimize Potential Mortality of Birds*. As a result of ongoing coordination with the TAC, the micro-siting of wind turbine locations is being integrated into the turbine layouts of repowering projects in the APWRA, along with other physical and operational constraints, in order to further reduce the potential for raptor collisions.

To ensure compliance with BIO-11b and to address the recommendations of the TAC, the Mulqueeney Ranch Project has undertaken additional site review to micro-site each of their proposed turbine locations. The purpose of this report is to examine each of the proposed turbine locations and provide a clear and rationale basis for recommendations.

Project Location

The Mulqueeney Ranch project area is located at the far eastern edge of the APWRA, south of Interstate 580, north of Tesla Road, 4 miles east of Livermore. The eastern border of the project area is the Alameda/San Joaquin County line. Patterson Pass Road, the only public and only paved road in the project area, extends east-west through the center of the project area (Figure 1).

Project Description

The Mulqueeney Ranch Project includes the removal of 518 old-generation turbines and related infrastructure, and the installation of 36 new-generation wind turbines with generating capacities between 2.2 and 4.2 MW to develop a maximum production capacity of 80 MW. With the exception of four meteorological towers (Met towers), all of the old-generation turbines and associated infrastructure, including turbine pads, transformers, and overhead power lines, were removed in 2016 in anticipation of repowering. The new turbines would be distributed across 29 contiguous parcels totaling approximately 4,590 acres under a single ownership. For purposes of environmental review, Mulqueeney Wind initially identified 36 turbine sites (Figure 2) and a range of potential turbine specifications. The final configuration will be determined on the basis of site constraints, data obtained from meteorological monitoring of the wind resources, results of bird use surveys and avian micro-siting considerations, turbine availability, and energy production cost. The project will use existing roads, most constructed during the development of the original old-generation turbine layout; however, most of these roads will require widening and other improvements to accommodate material deliveries for the larger new-generation turbines. Construction of some new roads, mostly smaller spur roads extending from the existing primary road network, would also be necessary to access some turbine sites. The project would also require the installation of underground electrical lines connecting the turbines to a new substation that would be built adjacent to the Pacific Gas and Electric Company (PG&E) Tesla

substation. Other than the short connection to the Tesla substation, the project would not require any high-voltage overhead transmission lines.

Approaches to Site Evaluation to Reduce Avian Mortality in the APWRA

Although structural and operational changes that result from the repowering of wind turbine facilities, and land management procedures that influence prey populations and distribution can potentially contribute to mortality reduction, probably the most effective means of mortality reduction is through the careful siting of turbines at the onset of project design. The siting of wind turbines to reduce avian mortality, particularly raptor mortality, is thought to be primarily a function of topography, wind patterns, and proximity to certain topographical features or other risk factors (e.g., high prey density, proximity to overhead power lines and other perches, extent and location of grading for roads and turbine pads) (Howell and Noone 1992, Orloff and Flannery 1992, 1996, Alameda County Community Development Agency 1997, Kerlinger and Curry 1999, Strickland et al. 2000, Thelander and Rugge 2001, Smallwood and Thelander 2004, Alameda County Scientific Review Committee 2010, Smallwood et al. 2017). This is particularly important in the APWRA, an area that supports abundant raptor nesting and wintering raptor populations and complex topography.

In general, these and other studies suggest that turbines sited along the edges of steep slopes, on downslope benches, within depressions such as swales, saddles, and notches, or along descending ridge slopes following a slope break, may contribute to increased raptor mortality. Flight patterns of many birds, particularly hunting raptors, use topographical features and corresponding wind patterns that help to conserve energy or aid in prey capture (Kerlinger and Curry 1999, Smallwood and Thelander 2004). Some raptors, including golden eagles, often fly along slope contours and rapidly cross over ridges or fly across slope benches where they may encounter wind turbines. Other species, particularly red-tailed hawks and American kestrels (*Falco sparverius*), often use slope-accelerated winds to hover or kite while hunting, requiring them to back up or rapidly turn and re-position along the ridgeline above the slope. Raptors also often use deep saddles or notches in ridges or descending slopes following a slope break to cross ridges. Using information about bird behavior and topography/wind patterns (and integration with other possible risk factors), it is possible to establish a general risk assessment approach to turbine siting. Recognition and avoidance of high-risk conditions could therefore potentially reduce raptor collisions with wind turbines within a wind energy project.

It is important to acknowledge, however, that despite the attention and level of effort to this problem over the last several decades, our ability to prevent or substantially reduce fatality rates at large wind energy facilities remains limited. Through numerous observational studies in the APWRA, general movement and behavior patterns of raptors have been thoroughly documented, but the data remains insufficient to detect the more subtle, unpredictable patterns that can result in collisions with turbines. As a result, regardless of where they are sited in the APWRA, all turbines pose a collision risk to birds in flight. Although attempts at quantifying fatality rates have been reasonably successful, particularly using new and evolving techniques for gathering

and analyzing data (Paula et al. 2011, Huso et al. 2017, H.T. Harvey 2018, Smallwood et al. 2020), the results of siting or other measures to reduce fatality rates have been less clear, particularly in the APWRA where the entire turbine landscape is being transformed using turbines with increasingly larger rotor diameters. Nonetheless, although raptor movement and behavior will always remain to some extent unpredictable and based on real-time conditions and influences related to foraging, territorial defense, predator avoidance, courtship, habitat conditions, etc., wind patterns and topography in the APWRA are key to understanding general movement patterns, and identifying and avoiding to the extent possible (given the large rotor diameters of new generation turbines) high risk conditions may contribute to a reduction in potential collision-related mortality.

SRC Siting Guidelines and High-Risk Turbine Ranking Procedures

Using information initially described in earlier studies in the APWRA and the nearby Montezuma Hills Wind Resource Area (Howell and Noone 1992, Kerlinger and Curry 1999), the Alameda County Scientific Review Committee (SRC) developed a method to assign a numeric relative risk category to old-generation turbines in the APWRA (Smallwood and Estep 2010). The objective was to identify high risk turbines (HRTs) or turbine sites for removal or relocation for purposes of reducing the potential for collision-related mortality of raptors. The variables used in the assignment of a risk category included topographic and wind conditions and corresponding knowledge of raptor flight behavior, reported raptor fatalities, and to a lesser extent other risk factors such as proximity to perches, rock piles, and areas of high ground squirrel density.

The development of the hazard rating procedures then led to the development by the SRC of guidelines for siting wind turbines recommended for relocation (SRC 2010). The guidelines included examples of preferred and discouraged site conditions. Although initially developed as procedures for relocation of old generation turbines, elements of the guidelines that are related to topographical conditions may be also applicable to turbine siting of new wind energy developments to reduce the potential for collision-related mortality of raptors. However, it is important to note that the turbine landscape, including the number, distribution, and size of turbines is vastly different from the old-generation turbine landscape for which the guidelines were initially developed. Flight behavior and mortality data were more clearly linked with topographic conditions with smaller, closely-spaced, old-generation turbine strings. The size, height, and distribution on the landscape of the risk zone (rotor-swept area) of new-generation turbines is substantially different and the relationship to topographic conditions less clear. For example, the risk to raptors using a small notch or saddle to cross a ridgeline is likely quite different when encountering a rotor-swept area from multiple closely-spaced turbines 9 to 10 meters above the ground compared with a rotor-swept area of a single large turbine nearly 30 meters above the ground. Topographic features and wind patterns do influence raptor movement and behavior in the APWRA, so to the extent possible, topography-related siting guidance should be adapted to the different obstructions of the airspace posed by new-generation turbines.

Guidance elements in the SRC guidelines that are related to topographic conditions and are applicable to the Mulqueeney Ranch Project include:

Preferred Relocation Sites or Settings

- Hill peaks, ridge crests, and relatively even terrain. With regard to new generation turbines, a key issue is maintaining the maximum distance between the bottom of the rotor-swept-area and the ground. Fairly subtle topographic conditions on hills and ridges can affect this distance. Features that reduce this distance, such as notches created by old-generation turbine pads, or ridge slopes, should be carefully considered during siting so that maximum distance below the rotor-swept area is achieved.

- Slopes that are leeward to one or two prevailing wind directions or that are set back from slopes facing prevailing wind directions. Raptors, primarily American kestrels and red-tailed hawks, often kite – or hover – in the slope-accelerated wind above a ridgeline. Setting back the turbine from the edge of the slope reduces risk. Turbines sited on narrow ridges have less opportunity to set back from slopes and pose a greater risk.

Discouraged Relocation Sites or Settings

- Saddles of ridges or saddles between ridges, and especially where saddles form the apex of ravines that face a prevailing wind direction or especially where these types of slope conditions occur in combination with nearby electric distribution lines or other tall structures;

- On benches of hill slopes or ridges, or just at the base of shoulders of hills, i.e., in locations of sudden elevation changes, where a raptor more often decides to fly while contouring around the slope;

- On or immediately adjacent to steep slopes, where raptors, particularly golden eagles, contour the slope while hunting; turbines sited on slopes will also reduce the distance between the ground the RSA; the rotors of turbines sited to close to steep slopes could potentially extend far over the slope;

- Next to artificial rock piles or natural rock formations that may encourage ground squirrel occurrence, which are common prey for golden eagles and red-tailed hawks in the APWRA;

- Next to streams or ponds;

- Next to transmission towers, electric distribution poles, or fences that provide perching opportunities for raptors;

- Where slope-accelerated winds would likely position a raptor at the height domain of the RSA of functional turbines, including where lips in the slope can locally accelerate winds used by hovering or kiting American kestrels and red-tailed hawks.

Collision Hazard Model

A more recent alternative approach to analyzing collision risk for purposes of micro-siting new-generation turbines was developed and applied to several projects in the APWRA by Smallwood and Neher (2010a, 2010b, 2016, 2015, 2018). Their collision hazard model incorporates three primary variables: fatality monitoring data, flight behavior data, and the topographic landscape using a digital elevation model (DEM) they developed for a large portion of the APWRA. By providing more precise information using field observation data on bird flight patterns, a detailed DEM, and existing data on raptor collision-related fatalities within the project area, their objective was to provide greater certainty and more precise recommendations with regard to turbine siting.

The model is an interesting and data-rich attempt to characterize the relationship between site conditions and bird behavior for purposes of predicting and minimizing risk of collision events. The general approach makes sense, the model attributes are appropriate, and the outcomes may be reasonably accurate in the larger sense of identifying high risk sites. But it is unclear how the specificity of the model outcomes corresponds to higher certainty with regard to a potential reduction in fatalities of target species compared with a field assessment. This may be due, in part, to the reliance on fatality data that were collected primarily at old generation turbines. Using past fatality data is appropriate insofar as those data may be associated with physical conditions that may contribute to fatalities and that are important in risk assessment. But turbine size, operation, and distribution are substantially different in the repowered landscape, which would influence risk and call into question the validity of using fatality data collected from old-generation turbines in the collision hazard model. What may be regarded as a high-risk site for old generation turbines may be less risky in a repowered landscape with fewer, larger turbines and with the vastly different structural and operational aspects between old- and new-generation turbines. Conversely, the repowered landscape in the APWRA may introduce new risks not yet fully explored through avian behavior and mortality monitoring studies.

In addition to examining the topographic landscape, a key element of the model is the use of bird flight data to evaluate risk based on behavior, altitude, and how birds negotiate the landscape. But relying on altitude and behavior data in the model that is presumably based on imprecise field observations and that may not account for behavioral or flight deviations could create some uncertainty in model outcomes. Still, the use of abundance and distribution data to assess high use areas versus low use areas, although perhaps not providing the specificity required for the model, can be an important risk factor used in the assessment of proposed turbine sites.

Although the collision hazard model approach seems to include the necessary model attributes, to date there have been few opportunities to test its effectiveness. The model has been applied mainly to repowered projects in the APWRA where the entire turbine landscape has changed from old to new generation turbines. Variable success in reducing mortality has been reported at these projects (H.T. Harvey 2018), and reported reductions (Smallwood and Neher 2017) may have been largely a result of this change in the turbine landscape and not necessarily attributable to model-based micro-siting. Although the continued refinement and development of the collision hazard model may be an important contribution to understanding collision risk in the APWRA and to aid in the micro-siting of turbines to reduce collision mortality, there are limitations in the current application of the model that potentially reduce its effectiveness and may restrict its utility. Incorporating fatality and bird flight data collected at repowered projects is likely to enhance the utility of the model.

Micro-siting and Bats

Many bat species are also susceptible to collision with wind turbines. Although there are data that indicate operational modifications (Arnett et al. 2010) and avoidance of bat roosts (e.g., caves, trees), habitats known to support greater concentrations of bats (e.g., riparian corridors, wetlands), or physical objects that attract large concentrations of insects (e.g., lights) (Johnston et al. 2013), may reduce potential bat mortality, there is little information that would suggest micro-siting of turbines in an otherwise monotypic landscape, even one with complex topography like the APWRA, would influence potential bat mortality. As a result, minimizing potential bat mortality has not been a focus of micro-siting efforts in the APWRA.

Methods

Mulqueeney Wind initially proposed 36 turbine sites within the project area (Figure 2). Turbine site locations were initially selected on the basis of meteorological monitoring of wind resources, wake effects, and construction feasibility. Following the field assessment of the initially proposed sites, I made recommendations for relocation of turbines if there were local sites that would reduce collision potential. After reviewing these preliminary results, Mulqueeney Wind proposed alternative relocation sites for 18 of the 36 turbines. They also removed 3 turbines from consideration and added 3 new sites to maintain a total of 36 turbines in the project (as a result, a total of 39 turbine locations are evaluated). I subsequently conducted a field assessment of the proposed alternative and new sites and made additional recommendations, as needed. As a result, turbine locations were organized and characterized as follows:

- Initially proposed sites
- Recommended relocation sites
- Proposed alternative relocation sites
- Recommended relocation for alternative relocation sites

Using the general approach described in the SRC turbine siting guidelines (SRC 2010), but in consideration of a new-generation turbine landscape, each turbine site was examined, focusing primarily on topographic and wind conditions, the extent and location of grading for roads and turbine pads, proximity to other risk factors, and how these conditions influence raptor movement and behavior that may correspond with collision events. In addition to physical factors, the assessment also incorporated information on observed golden eagle use areas and proximity to nests (see below).

Although ultimately characterized by one of three risk categories, the objective of this exercise was not to provide a precise numerical score, but instead to explore risk factors associated with each initially proposed turbine location, and then if possible, make recommendations that would reduce risk. Proposed alternative relocation sites were then evaluated similarly to determine if risk was reduced relative to the originally proposed site or recommended site.

Field Methods

I visited each of the 36 initially proposed turbine site locations on February 11, 12, 17, and 19, 2020. On April 27 and 28, I visited each of the proposed alternative relocation sites and three new sites that replaced three of the initially proposed sites. All sites were accessed using ranch roads or other existing roads originally constructed to access the previous old-generation turbine strings. Where roads were not available, I walked to the site. Each site was evaluated with regard to its specific location and the surrounding topographic and wind conditions that could influence raptor movements. Each site was also examined for recommended relocation sites if there was potential to reduce risk. Field data collected include:

- Percent Slope (using a hand-held slope meter)
- Position on Slope (ascending and descending distances)
- Slope face characteristics relative to prevailing winds
- Proximity to ridge or hill top
- Position on ridges and ridge slope characteristics
- Presence of or proximity to saddles, notches, and dips
- Presence of or proximity to swales, ravines, and canyons
- Presence of or proximity to slope breaks, slope shoulders, and slope benches
- Presence of other topographical features such as converging swales or ravines, convergence of descending ridges
- Visual assessment of ground squirrel activity
- Active raptor nests
- Proximity to rock and debris piles
- Proximity to overhead distribution lines, transmission lines, Met towers, and fence lines
- Assessment of the extent of grading disturbance to construct roads and new turbine pads and how this might alter the configuration of ridges or slopes (e.g., create berms or

notches along ridgelines or create new benches on slopes) that would result in additional risk.

Data were recorded on a standardized field form and mapped on aerial photographs. GPS coordinates were taken to confirm field locations for each site and a series of representative photographs taken of each site.

Assessment Methods

Each site was plotted on Google Earth Pro (2018) to examine the overall relationship to the topographical landscape, and to verify topographical characteristics and recorded distances from the field survey. Each site was carefully examined to determine the presence of conditions that are thought to contribute to potential collision risk. In addition to the field data collected as described above, this also included proposed road and turbine pad construction, placement of new met towers, and golden eagle use and nest proximity.

Three risk categories, Moderate Risk, Moderate-High Risk, and High Risk, were used to assign risk designations to each of the 36 initially proposed sites. The assignment of risk designations was based on the presence or absence of the risk factors or conditions noted above, and the application of those factors to each site-specific assessment. Although the variables were not equal – mainly the absence of fatality data and the use of eagle nest and eagle use proximity – the three risk designations can be thought of as generally corresponding to the HRT risk rankings (High Risk designation equates to HRT rankings of 9 and 10; Moderate-High Risk to HRT rankings of 7 and 8; and Moderate Risk Turbines correspond to rankings of less than 7).

In addition to using precise measurements with regard to slopes, distances, and other specific risk factors, on-the-ground interpretation and professional judgement were employed to evaluate the potential magnitude of risk. The risk designations are based entirely on an individual interpretation of conditions at each site as well as the presence/absence of risk factors. They are based on our current understanding of conditions that lead to turbines and raptors interacting at the same location in space, and that as a result may contribute to higher rates of collision events. They do not otherwise indicate that a site *will* have more or less collision events than another, only that based on these factors, the *potential for* more or less collision events is assumed.

Each site was further examined for possibility of local relocation of the turbine site that would reduce potential mortality. For example, a turbine that was sighted on a steep slope or at the bottom of a deep swale may be designated as a high-risk site, and a recommendation would be to relocate the turbine off of the slope or out of the deep swale. The relocated site was measured in terms of whether or not it would reduce risk compared with the original site. Some recommendations might slightly reduce risk but still be regarded as a high-risk site. Mulqueeney Wind's proposed relocation alternative sites were assessed similarly – comparing risk with the initially proposed site and with my recommended relocation site. Thus, the recommended sites and the proposed alternative relocation sites, while also assigned a risk designation, were also

evaluated based on the 'change in risk' (decrease, increase, no change) from the risk category assigned to the initially proposed turbine site. These determinations were based solely on the potential reduction of raptor collisions and did not address other possible constraints, such as construction feasibility or wake effects (proximity of neighboring turbines).

Grading for Roads and Turbine Foundations

Although a formal grading plan was not available, preliminary information was provided on the construction of new access roads and expansion of existing roads. In most cases, existing roads were available to access proposed turbine locations. However, to accommodate delivery of materials to the turbine site, most existing roads require upgrading in the form of additional width or broader turning radius. Where the existing road gradient or turning radius cannot be sufficiently upgraded, new spur roads are required to access turbine sites. Existing road widths vary from approximately 12 to 20 feet. New roads and upgraded roads are expected to be approximately 24 feet wide. Using information on possible road upgrades or new road construction, potential risk was assessed on the basis of possible changes to the topography that could influence raptor movement and behavior. For example, a new road or expansion of an existing road on a slope could potentially create an ascending linear mid-slope bench, potentially directing raptor movement toward the turbine. In contrast, in most cases, the expansion of existing roads along the ridgetop are less potentially risky since they are less likely to result in physical changes to the topographical profile.

Proposed turbine foundations are 18 feet in diameter with a 20-foot-wide gravel access area surrounding the concrete foundation, for a total 58-foot diameter footprint. Placement of turbine foundations can also alter topography and raptor flight. Sited on a slope or along a narrow ridge, the foundation can create notches in the ridgeline or benches on the slope. In contrast, turbines sited on broad ridges sufficient to accommodate the 58-foot diameter footprint, particularly with sufficient space to be set back from the ridge slopes, are considered less risky.

Proximity to Perches

Raptors commonly use electrical distribution and other utility poles, transmission line towers, meteorological towers, trees, and fences for perching and roosting. These features are an attractant to raptors and their proximity to proposed turbine sites is considered a risk factor. All collector lines and poles from the old-generation project have been removed. Also, relatively few trees occur anywhere in the project area with the majority occurring along the narrow riparian corridor paralleling Patterson Pass Road. Perches in the project area are thus limited to transmission line corridors, several residual meteorological towers (that presumably would be removed), and the few trees that occur.

Ground Squirrel Abundance

California ground squirrel (*Otospermophilus beecheyi*) is the principal prey of golden eagles in the Diablo Range and an important prey item for red-tailed hawks. The abundance of ground squirrels is closely associated with the occurrence of golden eagles. Although a formal assessment of ground squirrel abundance was not conducted, a general visual assessment was conducted throughout the project area. Proximity to one of only three ground squirrel concentration areas noted during the field assessment was used as a risk factor.

Raptor Use, Concentration Areas, and Nesting Distribution

As described above, data on bird abundance and distribution are important factors in assessing risk. For purposes of this assessment, ICF conducted point count raptor surveys at eight observation points spaced throughout the project area. Data were collected over a one-year period and summarized as flight minutes per survey hour. Use areas were then characterized within the project area using a kernel density approach to identify use and concentration areas into three zones. For purposes of this assessment, data for golden eagle occurrence was used as a risk factor. Higher risk was associated with higher eagle concentration. In addition, U.S. Geological Survey (USGS) has been conducting surveys for nesting golden eagles throughout the Diablo Range for several years. In addition to data collected during this study, USGS also provided recent golden eagle nesting data for the area surrounding the project. As a result, proximity to golden eagle nests is also used as a risk factor.

Results

Physiographic and Land Use Characteristics

The Mulqueeney Ranch project area is located on the easternmost edge of the Diablo Ranch along the western edge of the Central Valley. The area is characterized by relatively low-profile foothills along the eastern edge of the project area where it transitions toward the floor of the Central Valley, and a gradual increase in elevation and topographic complexity westward (Plate 1). Elevation ranges from approximately 500 feet to 1,780 feet above mean sea level. Topography is typical of the Diablo Range caused by active uplift and folding associated with thrust faults and the San Andreas fault/plate boundary system. The higher elevation ridges are generally oriented northwest-southeast, with numerous lateral ridges and intersecting canyons, ravines, and broad, deep swales (Plates 2 through 5). Predominate wind direction, particularly during the spring and summer months, is from the southwest between 230 and 250 degrees. The landscape is nearly all open grazed annual grassland devoid of trees or shrubs, even at the lower elevations along narrow intermittent stream corridors (Plate 6). The exception is the stream that parallels Patterson Pass Road, which extends west-east through the center of the project area and supports a narrow band of cottonwood-willow riparian woodland. There are also stock ponds in several locations at the lower elevations.

With the exception of four Met towers, all old-generation turbines and related infrastructure had been removed at the time of the site assessment, including concrete footings and foundations, transformers, collection lines, and debris piles. The remaining met towers are also scheduled to be removed. Remains of old-generation turbine strings are seen as notches and benches in ridgelines where the turbine pad was constructed. Dirt and gravel access roads occur throughout the project area, most of which were constructed to access the previous project. They have been maintained and will be used and expanded, in order to access new turbine sites and to accommodate the vehicles used to deliver and construct the new project turbines (Plate 7).

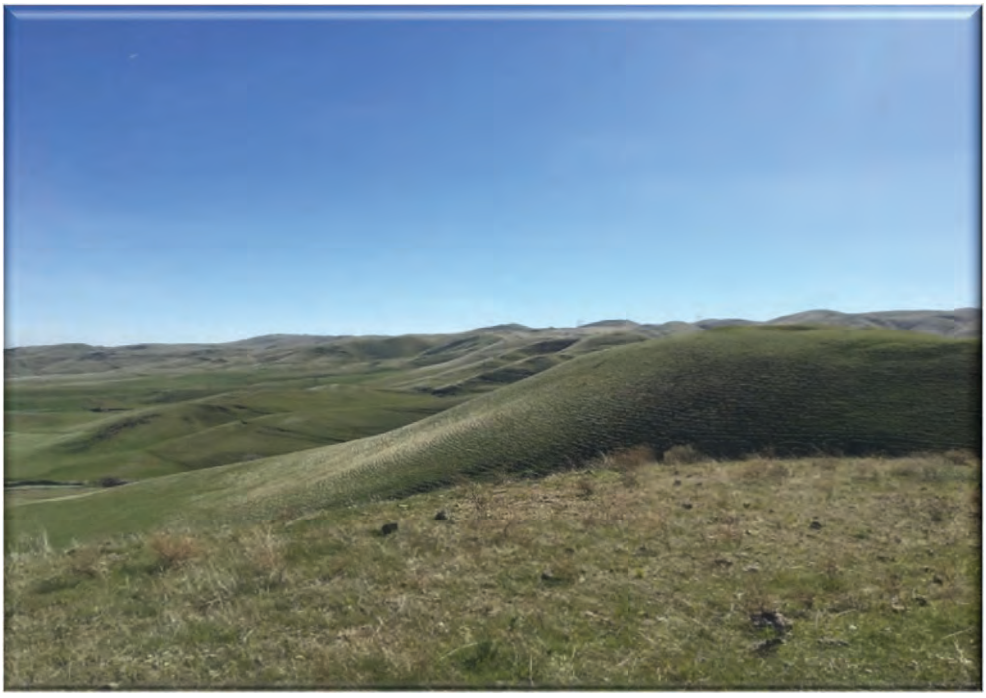


Plate 1. Looking south from the vicinity of Turbine 12 along the transition from the low foothills on the east that lead into the Central Valley to the higher hills of the Diablo Range.

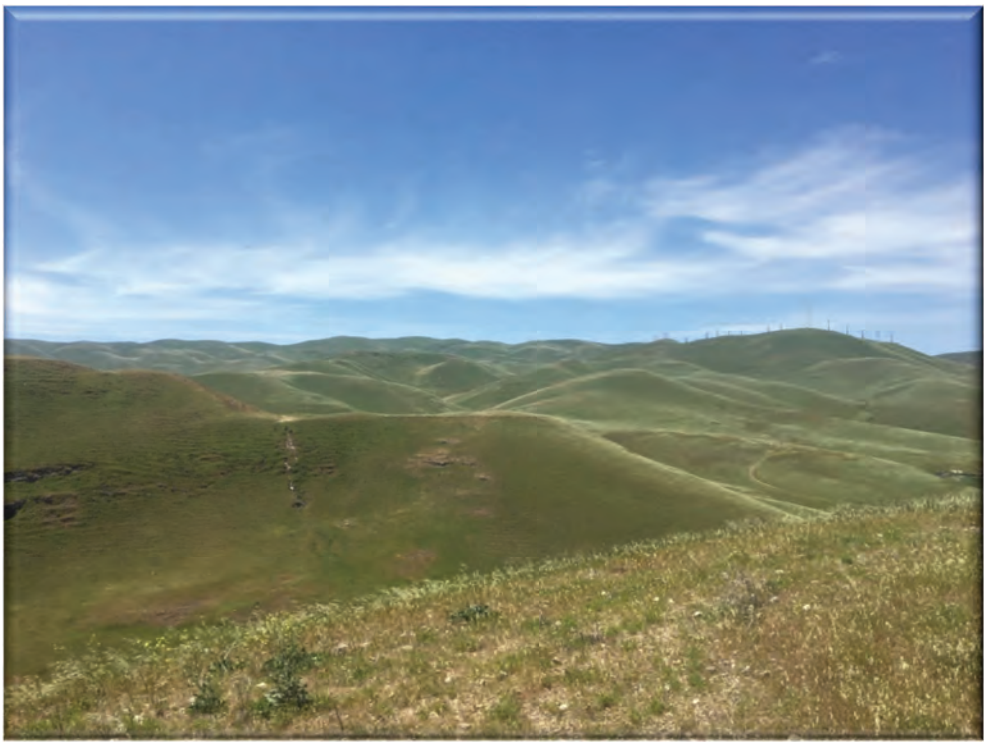


Plate 2. Looking west from the interior of the project area. This landscape is typical of most of the project area, complex hill and valley topography mostly devoid of trees.

Plate 3. Looking south from the vicinity of Turbine 35 toward deep ravine, high ridges with lateral ridges and converging swales.

Plate 4. Looking north from the vicinity of proposed Turbines 16 and 17. The ridge on the far right is the location of Turbines 1 through 6. Note the folding and uplift that has resulted in parallel ridges and swales/ravines.

Plate 5. Looking east from the vicinity of Turbine 20 with ridges descending to a narrow valley.

Plate 6. Looking southwest from the vicinity of Turbine 22. Note the steep slopes and deep ravines.

Plate 7. Looking north from the vicinity of proposed Turbine 5 toward existing access roads and benches on the slope to the left that remain from the previous old-generation turbine string. These features, along with the complex natural topography, influence raptor movement through the area.

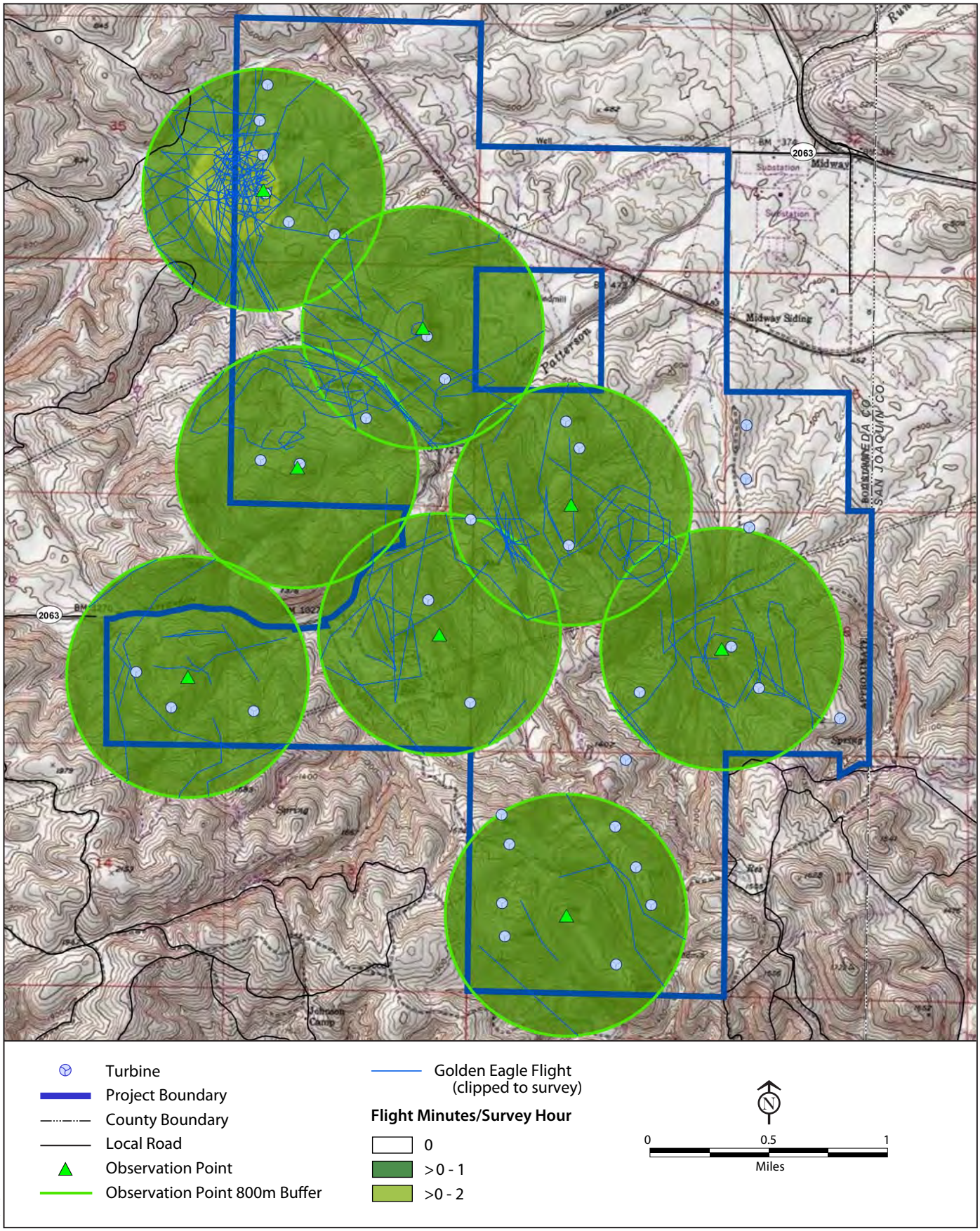
Golden Eagle and Other Raptor Use of the Project Area

The kernel density analysis conducted by ICF indicates that the northernmost portion of the project area receives the greatest amount of golden eagle use (>1-2 flight minutes per survey hour), particularly in the vicinity of Turbines 3 and 4 (Figure 3) (ICF 2020). Lower overall eagle use was recorded throughout the rest of the project area (>0-1 flight minutes per survey hour); however, flight paths indicate the lowest use lowest use occurred in the southern portion. To provide context with the greater APWRA, ICF compared this with data collected between 2005 and 2014 using a similar point count approach (ICF 2016). Figure 4 illustrates the long-term monitoring results of golden eagle use throughout the APWRA, and indicates the relatively low eagle use of the project area compared with the surrounding region. Although eagle use is relatively low throughout the project area, higher eagle use as determined by the kernel density analysis (primarily in the northern portion of the project area), was considered a risk factor.

USGS reports two golden eagle nests and four golden eagle pair activity centers (PACs) (eagle use suggesting the presence of a nest but nesting not confirmed) within 2 miles of the project area boundary. All were reported active as recent as 2019. A third nest was located this year within the project area boundary along the creek that parallels Patterson Pass Road (Figure 5). Five of the 7 nests or activity centers are within 2 miles of proposed turbine sites. The Patterson Pass Road nest is in closest proximity to a proposed turbine site (650 feet northwest of Turbine 22) and is within 0.5 miles of three of the initially proposed turbines and within 1 mile of 11 of the initially proposed turbines. Five of the six other nests or activity centers are greater than 1 mile from the nearest turbine, and one is 0.82 miles from the nearest turbine (Figure 5).

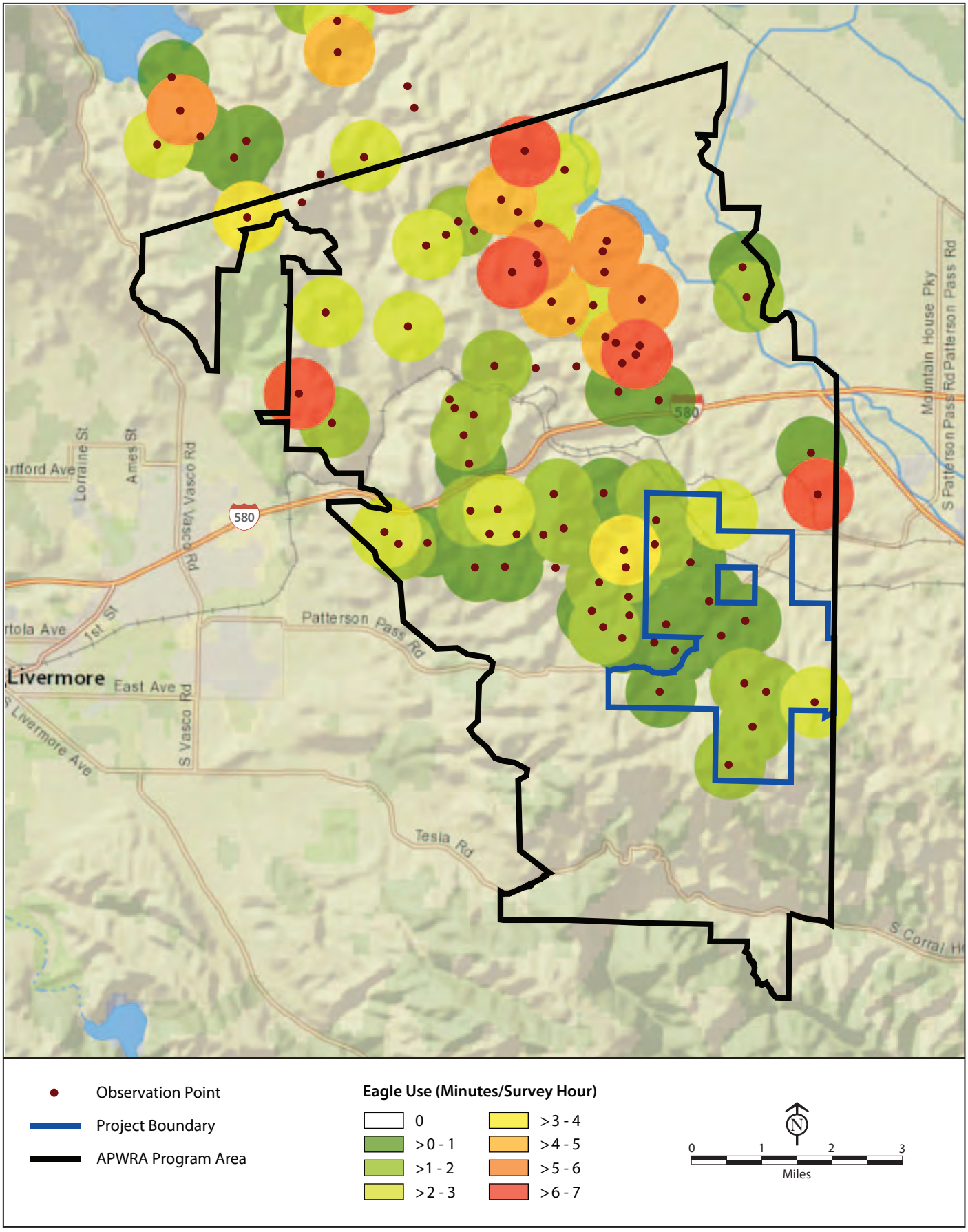
Because ground squirrels are a key prey item of golden eagles and red-tailed hawks in the APWRA, their distribution and abundance are associated with the occurrence of these species. Ground squirrel abundance was not examined area-wide during the surveys; however, presence/absence of ground squirrel activity was noted in the immediately vicinity of each turbine site. In addition, incidental observations were made throughout the project area. I incidentally noted very low ground squirrel abundance, particularly south of Patterson Pass Road, and only three areas where concentration of ground squirrel activity was present, in the narrow valley just west of Turbines 1 through 5, within a swale and small drainage between Turbines 18 and 19, and along a drainage east of Turbine 26.

Potential raptor nesting habitat in the project area is scarce, limited to the cottonwood-willow riparian along the creek paralleling Patterson Pass Road, a small group of trees near the northern end of the project area, and 3 isolated trees near the east side of the project area. In addition, transmission towers along two transmission line corridors also provide opportunities for nesting raptors. Although I searched for raptor nests incidentally during the field surveys, very few active nests were located, including one red-tailed hawk nest in a transmission tower near Turbine 32, a burrowing owl nest east of Turbine 26 – in one of the three areas where ground squirrels were noted – and the Patterson Pass Road golden eagle nest near Turbine 22. An inactive raptor nest, most likely a red-tailed hawk nest was also noted along the riparian corridor



SOURCE: ICF 2020.

Figure 3
Mulqueeney Ranch Wind Repowering Project
Golden Eagle Flight Kernel Density - Clipped to Survey Areas



SOURCE: ICF 2020.

Figure 4
Mulqueeney Ranch Wind Repowering Project – APWRA-Wide Eagle Use 2005–2014

Project Boundary

Project Boundary -- 2-Mile Buffer

Golden Eagle Nest (USGS)

Golden Eagle Pair Activity Center

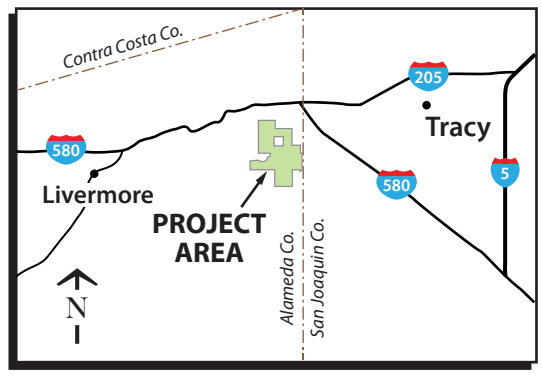
Proposed Turbine

2-Mile Turbine Buffer

Transmission Tower

Tree

Nesting Habitat/Tree Stand



N

0 0.5 1 1.5 2

Miles

07/08/2020

BASE MAP SOURCE: ICF 2019.

Figure 5

Mulqueeney Ranch Wind Repowering Project - Location of Golden Eagle Nests and Pair Activity Centers

paralleling Patterson Pass Road west of Turbine 20. Because of the overall lack of raptor nesting within the project area, proximity to raptor nests (with the exception of golden eagle) was not used as a risk factor.

Figure 5 also illustrates the location of transmission line corridors in the project area. These represent the primary perching and possible nesting opportunities for raptors in the project area. Proximity to transmission towers was used as a risk factor.

Incidental observation of raptors during six survey days also suggest that raptor use of the project area was fairly low. I attributed this to the overall lack of nesting habitat and the low abundance of ground squirrels, particularly in the southern portion of the project area.

Turbine Site Assessment

A total of 93 turbine site locations were assessed, including 36 initially proposed turbine sites, three replacement sites, and 54 recommended or proposed alternative relocation sites.

Appendices A-1 through A-4 provide the detailed assessments of each of the 36 turbine locations (plus the three replacement locations) and each recommended or alternative location along with aerial figures depicting the topographical landscape and representative photographs of each site. Table 1 summarizes the risk determination, alternatives, and recommendations for each turbine.

Of the 36 initially proposed turbines, 17 were considered High Risk locations, 11 were Moderate-High Risk locations, and 8 were Moderate Risk locations (Table 1). I recommended alternative sites for 31 of the 36 turbines to reduce potential collision risk. Of these, Mulqueeney Wind accepted 10. Primarily due to wake or proximity issues, they provided a proposed alternative relocation site for 18 turbines. Five turbines remain in their initially proposed locations because they were already in the least risky location or because of the lack of alternatives that would reduce risk. Three of the initially proposed turbines (Turbines 8, 9 and 13) were removed from the project and replaced with three new sites (Turbines 37, 38, and 39), so the total number of turbines remains at 36. I recommended relocation of one of these, but there were no suitable alternatives for the remaining two.

By selecting the recommended or proposed alternative location, potential risk decreased at 21 of the 36 initially proposed turbines (excluding the three that were removed), although 10 of these were considered to have only a slight decrease and where the risk determination remained the same as the initially proposed turbine.

No change in potential risk was determined for 11 of the initially proposed turbines. Of these, 6 were proposed alternative relocation sites, and 5 were sites where the initially proposed location was accepted due to the lack of relocation options. Of the turbines with no change, 3 were initially designated Moderate Risk and therefore were already in the safest location possible; 2 were designated Moderate-High risk; and 6 were designated High Risk.

Table 1. Risk Determination and Recommendations for 39 Proposed Turbine Locations at the Mulqueeney Wind Turbine Repowering Project.

Turbine	Initial Location		Risk Determination	Recommended Location		Risk Determination	Response to Recommended Location	Relocation Alternative		Risk Determination	Change in Risk
	Lat	Long		Lat	Long			Lat	Long		
1	37.718619°	-121.602677°	High	none	none	High	Initial location accepted	none	none	High	No change
2	37.716466°	-121.603251°	High	37.716680°	-121.602054°	Moderate-High	Proposed relocation	37.716547°	-121.602481°	Moderate-High	decrease
3	37.714408°	-121.602978°	High	37.714516°	-121.603055°	Moderate-High	Recommended location accepted	none	none	Moderate-High	decrease
4	37.712137°	-121.602730°	Moderate-High	37.712126°	-121.602475°	Moderate-High	Recommended location accepted	none	none	Moderate-High	Slight decrease
5	37.710440°	-121.600994°	High	37.709081°	-121.600602°	Moderate-High	Proposed minor relocation	37.710142°	-121.601233°	High	No change
6	37.709722°	-121.597542°	Moderate	37.709722°	-121.597542°	Moderate	Proposed minor relocation	37.709563°	-121.597328°	Moderate	No change
7	37.685409°	-121.567394°	Moderate-High	37.684340°	-121.566753°	Moderate	Recommended location accepted	none	none	Moderate	Decrease
8	37.681245°	-121.603173°	Moderate-High	37.680761°	-121.603273°	Moderate	Removed from project				
9	37.698646°	-121.566436°	Moderate	37.698741°	-121.567124°	Moderate	Removed from project				
10	37.695423°	-121.566417°	Moderate-High	37.695281°	-121.567223°	Moderate	Recommended location accepted	none	none	Moderate	Decrease
11	37.692548°	-121.566138°	Moderate	37.692514°	-121.565623°	Moderate	Recommended location accepted	none	none	Moderate	Slight decrease
12	37.703720°	-121.590505°	High	37.703964°	-121.590629°	High	Proposed minor relocation	37.704078°	-121.590844°	High	Slight decrease
13	37.698788°	-121.594993°	High	37.698676°	-121.594693°	Moderate-High	Removed from project				
14	37.701178°	-121.589115°	Moderate-High	37.701094°	-121.588995°	Moderate-High	Proposed minor relocation	37.700956°	-121.589138°	Moderate-High	Slight decrease
15	37.698750°	-121.579996°	Moderate	37.698758°	-121.579847°	Moderate	Proposed minor relocation	37.698729°	-121.579914°	Moderate	Slight decrease
16	37.696214°	-121.602874°	High	37.696214°	-121.602874°	High	Proposed relocation	37.696952°	-121.602512°	High	No change
17	37.696022°	-121.599923°	Moderate	37.695923°	-121.599996°	Moderate	Proposed minor relocation	37.695822°	-121.599983°	Moderate	Slight decrease
18	37.683496°	-121.612027°	Moderate-High	37.683212°	-121.612009°	Moderate-High	Proposed minor relocation	37.682827°	-121.611872°	Moderate-High	Slight decrease
19	37.681412°	-121.609362°	Moderate-High	37.681333°	-121.609570°	Moderate-High	Recommended location accepted	none	none	Moderate-High	Slight decrease
20	37.687990°	-121.590188°	High	none	none	High	Proposed relocation	37.686347°	-121.592045°	Moderate-High	Decrease
21	37.669945°	-121.584378°	High	none	none	High	Initial location accepted	none	none	High	No change
22	37.692812°	-121.587049°	High	37.693109°	-121.586942°	High	Proposed relocation	37.694853°	-121.584280°	Moderate-High	Decrease
23	37.697147°	-121.578960°	Moderate	none	none	Moderate	Initial location accepted	none	none	Moderate	No change
24	37.678585°	-121.575195°	High	37.677488°	-121.576626°	Moderate	Proposed relocation	37.680816°	-121.573633°	High	No change
25	37.691347°	-121.579662°	Moderate-High	37.690993°	-121.579242°	Moderate	Proposed relocation	37.691306°	-121.582308°	Moderate-High	No change
26	37.681894°	-121.586919°	High	37.681677°	-121.587503°	Moderate	Proposed minor relocation	37.681502°	-121.587488°	Moderate	Decrease
27	37.682973°	-121.565271°	Moderate-High	37.682973°	-121.565271°	Moderate	Proposed minor relocation	37.682258°	-121.564904°	Moderate	Slight decrease
28	37.681214°	-121.559163°	Moderate	37.682042°	-121.559671°	Moderate	Proposed relocation	37.680653°	-121.561869°	Moderate-High	Increase[1]
29	37.682636°	-121.574206°	Moderate	none	none	Moderate	Initial location accepted	none	none	Moderate	No change
30	37.675241°	-121.584486°	High	37.674801°	-121.584927°	Moderate	Recommended location accepted	none	none	Moderate	Decrease
31	37.673472°	-121.583879°	High	37.671805°	-121.585696°	Moderate	Recommended location accepted	none	none	Moderate	Decrease
32	37.674594°	-121.575934°	High	37.673823°	-121.575557°	Moderate-High	Recommended location accepted	none	none	Moderate-High	Decrease
33	37.672205°	-121.574347°	Moderate-High	37.671715°	-121.573939°	Moderate-High	Recommended location accepted	none	none	Moderate-High	Slight decrease
34	37.669951°	-121.573168°	Moderate-High	none	none	Moderate-High	Initial location accepted	none	none	Moderate-High	No change
35	37.667972°	-121.584146°	High	37.667987°	-121.583324°	Moderate	Proposed relocation	37.666529°	-121.586167°	Moderate-High	Decrease[2]
36	37.666370°	-121.575737°	High	37.665531°	-121.574653°	Moderate-High	Proposed minor relocation	37.666755°	-121.576997°	High	No change[3]
37[4]	37.701707°	-121.591749°	High	37.701374°	-121.590741°	Moderate-High	None yet				Decrease
38[4]	37.690233°	-121.586486°	High	none	none	High	None yet				No change
39[4]	37.678915°	-121.584444°	High	none	none	High	None yet				No change

[1]to reduce risk of proposed relocation alternative for Turbine 28, the recommendation is to move the turbine 70 feet northeast to 37.680824° -121.561747°, and reducing to Moderate Risk
[2]to reduce risk of proposed relocation alternative for Turbine 35, the recommendation is to move the turbine 150 feet northwest to 37.666690° -121.586635°, and reducing to Moderate Risk
[3]to reduce risk of proposed relocation alternative for Turbine 36, the recommendation is to move the turbine 590 feet northwest to 37.668147° -121.578077°, and reducing to Moderate-High Risk
[4]Turbines 37, 38, and 39 were added to replace Turbines 8, 9 and 13, which were removed. Not yet reviewed by Brookfield – Change in Risk is preliminary

High Risk turbine locations that remain High Risk following relocation or if no relocation options
Moderate-High Risk turbine locations that remain Moderate High following relocation or if no relocation options
High Risk turbine locations with decreased risk following relocation
Moderate-High Risk turbine locations with decreased risk following relocation
Moderate Risk turbine with slight decreased risk following relocation or no change
Moderate Risk turbine with increased risk following relocation

Potential risk increased at only one turbine (Turbine 28); however, I recommended an additional relocation to reduce risk at the proposed alternative relocation site.

Of the 17 initially proposed High Risk locations, 7 remain High Risk, 5 at proposed alternative relocation sites, and 2 that remain at their initially proposed site due to lack of relocation options. Nine of the 17 initially proposed High Risk locations decreased risk following relocation, and one (Turbine 13) was removed from the project. The three newly added turbines (37, 38, and 39) are all designated as High Risk. I recommended an alternative location for Turbine 37, which would reduce risk, and the other two have no options for reducing risk.

Of the final selected turbine locations, 7 are designated High Risk, 14 are designated Moderate-High Risk, and 12 are designated Moderate Risk (Table 1).

Recommendations focused primarily on moving turbines off of slopes, out of swales and ravines, and away from saddles and notches along ridges; and onto hill or ridge tops and generally flat terrain away from other risky topography including proximity to slope-accelerated winds and areas where the construction of turbine pads or roads would not substantially alter the local topography. Recommendations also focused on proximity to golden eagle nests and high use areas, and raptor perching and nesting habitat.

Conclusion

It's important to note that raptor collisions with wind turbines remain an infrequent event, and thus assessing predictability or assigning cause continues to be problematic. Where wind turbines share the same air space as birds in flight, collision incidents will likely always occur at some level despite our best mitigating efforts; and because the precise causal relationships that contribute to collision incidents remains uncertain, it remains possible that raptor collisions with wind turbines could in fact be more related to unpredictable behaviors that deviate from observed patterns. However, data derived from mortality monitoring surveys and field observation of flight patterns and behavior reveal possible relationships related to topography, wind patterns, land use, prey availability, and other structures on the landscape. These relationships can then be used to develop assessment approaches to aid in siting of turbines for purposes of reducing potential mortality. But the extent to which these approaches are effective remains unclear based on monitoring results of repowered projects in the APWRA. To date, there has been no way to reasonably differentiate the potential benefits of micro-siting new-generation turbines from the possibility that any reported changes in collision-related mortality are instead a function of the change from an old-generation to a new-generation turbine landscape. Identifying and avoiding high risk locations and relocating turbines to further minimize potential mortality based on current knowledge is certainly valid, but the effectiveness of these approaches may only be determined through ongoing monitoring of repowered projects.

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Appendix A-1. Assessment of Mulqueeney Wind Turbines 1 through 10

Included as separate document

Appendix A-2. Assessment of Mulqueeney Wind Turbines 11 through 20

Included as separate document

Appendix A-3. Assessment of Mulqueeney Wind Turbines 21 through 30

Included as separate document

Appendix A-4. Assessment of Mulqueeney Wind Turbines 31 through 39

Included as separate document

Mulqueeney Ranch Wind Repowering Project

Appendix A-1. Assessment of Turbines 1 through 10

May 2020

Turbine 1

Topographical Description

The Turbine 1 site is at the northern end of a north-south-oriented descending ridge (Figure A1). The site is at the top of the narrow ridge, at the northern-most bench, above a deep east-west-oriented ravine, perpendicular to the ridge and over 200 feet below the Turbine 1 site (Plates 1 and 2). The ridge gently ascends southward along an old-generation turbine string with the turbine pads creating small benches in the slope (Plate 3). Although numerous lateral ravines extend upslope to the top of this ridge from the west, creating complex hilly topography, at the location of the Turbine 1 site, the ridge feature curves eastward, creating a steep (50%) west and northwest slope as the ridge line descends eastward toward the bottom of the ravine. The eastern slope of the ridge is less steep (20%), extending into a deep, broad, swale, which continues upslope on the east where it intersects with the ridge just south of the Turbine 1 site. The proposed site is flat, but space is limited. The turbine pad would likely extend across all or most of the narrow ridge. Turbine rotors would extend beyond the ridge line and extend out over the steep slopes.

Topographical features that may influence raptor movement are the steep slopes and ravines surrounding the proposed site on three sides. West-southwest prevailing winds through this complex topography of intersecting ridges and valleys create conditions that golden eagles and other raptors find ideal for circling and gaining altitude. There is likely substantial raptor movement through and around this confluence of deep ravines and steep slopes. During the site visit, a golden eagle was observed circling up from the ravine into the proposed rotor airspace above the ridgeline.

Proximity to Other Potential Risk Factors

There are no powerlines or other potential perching or nesting structures in the immediate vicinity, or conditions that encourage ground squirrel activity (e.g., rockpiles, spoils sites, fence lines), with the exception of a small rock pile 50 feet from the site. However, the drainage just west of the ridge is only one of three areas within the project area where substantial ground squirrel activity was noted. The nearest potential raptor nesting habitat, a small group of trees along the same narrow drainage, is 0.42 miles southwest. The nearest reported golden eagle nests are 1.4 miles northeast and 1.7 miles west of the site. The site is also in close proximity to the highest concentration of golden eagle activity reported during raptor use surveys.

Risk Determination and Recommendation

Risk is considered High at the proposed Turbine 1 site due to its close proximity to steep slopes on three sides, and its location in what may be a relatively high raptor use area due to the circulation of prevailing winds. Turbine pad construction would be an expansion of an existing old-generation turbine pad. This would enlarge the lower bench at the end of the ridge. There is existing road access to the site along the ridgeline, however, the road will likely require significant improvement to accommodate construction of the new turbine. But because the road is along the ridgeline, expansion and other improvements are not expected to significantly alter topography and influence raptor movement through the area.

There are no recommendations for relocation of this turbine. The ridgeline is too narrow for possible movements further from the slopes and relocation southward would potentially place the turbine on a

descending ridge slope and in the vicinity of ridge saddles extending toward the ridge top from the east and west.

Response to Recommendation and Alternative Relocation

Due to the lack of suitable alternative locations, Mulqueeney Wind selected the initially proposed site for Turbine 1.

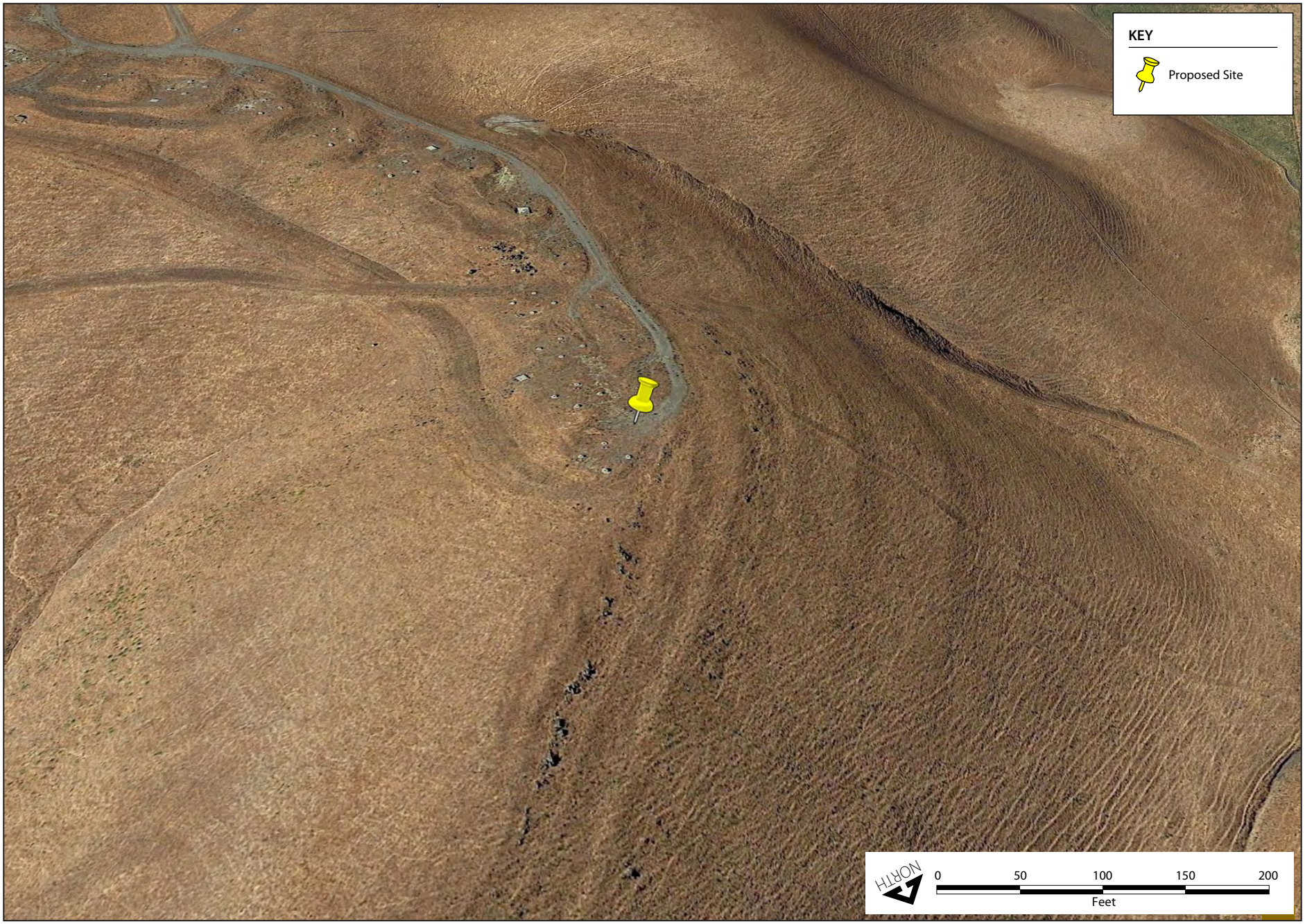
Risk Determination and Recommendation for Alternative Relocation

Same as original location.

Plate 1. Looking north from proposed Turbine 1 location. The site is at the far northern end of a north-south-oriented ridge.

Plate 2. Looking north-northeast toward the proposed Turbine 1 site. This is the lower bench at the far northern end of the ridge. Note the steep drop-off to the north and west and the ascending swale on the east.

Plate 3. Looking south from the Turbine 1 site along the north-south-oriented ridge and the old generation turbine string. Note the swale extending upslope on the left toward the ridge top.



05/02/2020

SOURCE: Google Earth 2020.

Figure A-1
Location of Proposed and Recommended Sites for Turbine 1 at the Mulqueeney Wind Project

Turbine 2

Topographical Description

The Turbine 2 site is west of and below the same north-south-oriented ridge as Turbine 1 (Figure A-2). The site is below the ridge line (Plate 4) and at the confluence of two swales, one ascending from the northwest and one ascending from the southwest (Plate 5). The site is also on the lower slope of a hill to the south. As a result, although elevation continues to descend to the north and west, the site is below the elevation of the ridge and the hill to the south.

Topographical features that may influence raptor movement are the two swales that converge near the proposed site and the north-south ridge, all of which promote contour hunting and movement through the low elevation swales, and the descending ridge to the east with multiple small notches created from the previous old-generation turbine string.

Proximity to Other Potential Risk Factors

There are no powerlines or other potential perching or nesting structures in the immediate vicinity, or conditions that encourage ground squirrel activity (e.g., rockpiles, spoils sites, drainages). However, the drainage just west of the ridge is only one of three areas within the project area where substantial ground squirrel activity was noted. The nearest potential nesting habitat, a small group of trees along this same narrow drainage, is 0.3 miles southwest. The nearest reported golden eagle nests are 1.5 miles northeast and 1.6 miles west of the site. Highest concentration of golden eagle activity was reported near this site during raptor use surveys.

Risk Determination and Recommendation

Risk is considered High at the proposed Turbine 2 site due to its location on a slope, below the elevation of adjacent features, and at the confluence of two swales. The turbine pad would create a bench in the slope and extend across the swale to the north. The rotors would extend across the swales. Primary road access will be along the existing ridge top road that would be expanded to accommodate moving materials to the new turbine site; however, a new, approximately 250-foot-long spur road would be required off of the existing road to directly access the new turbine site. This spur road would create a bench in the west-facing and north-facing slopes of the ridge, potentially influencing raptor movement through the site. It is also considered high risk due to the proximity to the highest concentration of golden eagle activity reported from the project area.

Although still considered a Moderate-High risk location because of the descending slope and high concentration of golden eagle activity, risk may be reduced from the proposed location by moving the site 347 feet to the ridge top on the east along the old-generation turbine string at 37.716680° -121.602054°.

Response to Recommendation and Alternative Relocation

Due to wake issues, Mulqueeney Wind selected an alternate site 132 feet west of the recommended location at 37.716547°-121.602481° (Figure A-2).

Risk Determination and Recommendation for Alternative Relocation

The relocated site is off of the slope and on top of a lateral ridge that converges with the north-south ridge (Figure A-2) (Plate 6). Although still considered a Moderate-High risk site due to converging swales and proximity to high concentration of golden eagle activity, this is considered a less risky location than the original site and similar to the recommended site.

Plate 4. Looking north-northeast toward the initially proposed Turbine 2 location. The staked location can be faintly seen just below the center of the photo. Note the confluence of the swales ascending from the southeast and northwest.

Plate 5. Looking upslope eastward from the initially proposed Turbine 2 site toward the ridgeline.

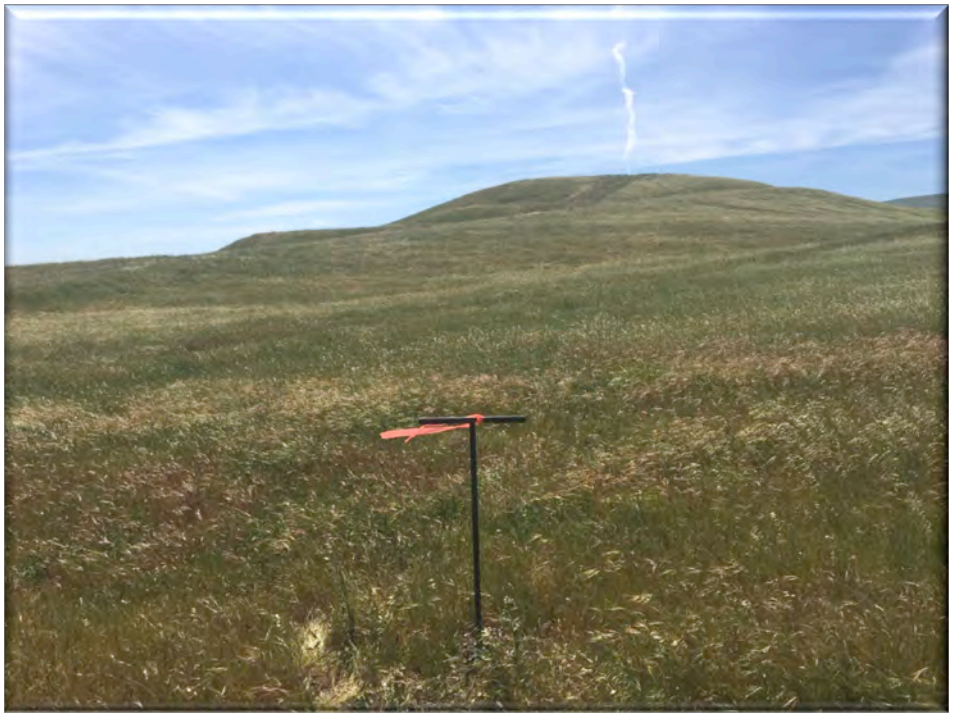


Plate 6. Looking southeast from Turbine 2 alternative relocation site toward top of the north-south ridge. The recommended location is left of the photo along the ridgeline.

05/02/2020

SOURCE: Google Earth 2020.

Figure A-2
Location of Proposed and Recommended Sites for Turbine 2 at the Mulqueeney Wind Project

Turbine 3

Topographical Description

The Turbine 3 site is along a lateral east-west-oriented ridge extending off of the same north-south-oriented ridge where proposed Turbines 1 and 2 are located (Figure A-3). The lateral ridge extends west for approximately 900 feet to the end of the ridge and where three additional old-generation turbines previously occurred. There is an existing road along the top of ridge used to access these former turbine sites. The proposed site is mid-way along this lateral ridge and slightly down slope from the ridge top on the south-facing slope. The ridge is generally flat with one shallow swale extending upslope from the south approximately 100 feet west of the proposed site and creating a shallow saddle in the ridgeline. Otherwise, there are no intersecting features that create notches or saddles. The mostly flat ridge top is from 60- to 70-feet-wide along its length before dropping off to a fairly steep slope (50%) on the north extending into a deep ravine, and a less steep 10% slope on the south for approximately 200 feet before dropping more steeply into a deep ravine. The proposed turbine location is at the approximate elevation as the surrounding ridges (Plates 7, 8, and 9).

Topographical features that may influence raptor movement are the slopes north and south of the proposed site, which promote contour hunting. Movement likely concentrates through the ravines and swales and across them ridgeline to ridgeline.

Proximity to Other Potential Risk Factors

There is a meteorological tower 900 feet south of Turbine 3, which would be removed, but otherwise there are no powerlines or other potential perching or nesting structures in the immediate vicinity. The nearest transmission line with towers capable of supporting raptors nests is 0.72 miles southeast. The site also does not support conditions that encourage ground squirrel activity (e.g., rockpiles, spoils sites, drainages). However, the drainage just west of the ridge is only one of three areas within the project area where substantial ground squirrel activity was noted. The nearest potential tree-nesting habitat, a small group of trees along this same narrow drainage, is 0.3 miles southwest. The nearest reported golden eagle nests are 1.6 miles northeast and 1.6 miles west of the site. The site is also within the highest concentration of golden eagle activity reported during raptor use surveys. Kernel density analysis places it in the highest use zone.

Risk Determination and Recommendation

Risk is considered High at the proposed Turbine 3 site due to its proximity to steep slopes, particularly on the south side, and because the site is within the highest concentration of reported golden eagle activity. The turbine pad would create a bench in the slope and rotors would extend across the slopes on the north and south sides of the ridge. There are otherwise no substantial topographic risk factors. The existing access road along the north-south ridge and the lateral ridge would be expanded in order to accommodate movement of materials to the site. But because these roads are along the ridge top, this work is not expected to influence raptor movement through the site.

To decrease the risk to birds flying through the ravines and using the slope contours, the site could be moved 50 feet north of the proposed location and centered on the top of the ridge at 37.714516° -

121.603055°. This would reduce risk by mitigating the primary topographic risk factor, the site is still considered Moderate-High risk due to the high concentration of golden eagle use.

Response to Recommendation and Alternative Relocation

Mulqueeney wind selected the recommended location for Turbine 3.

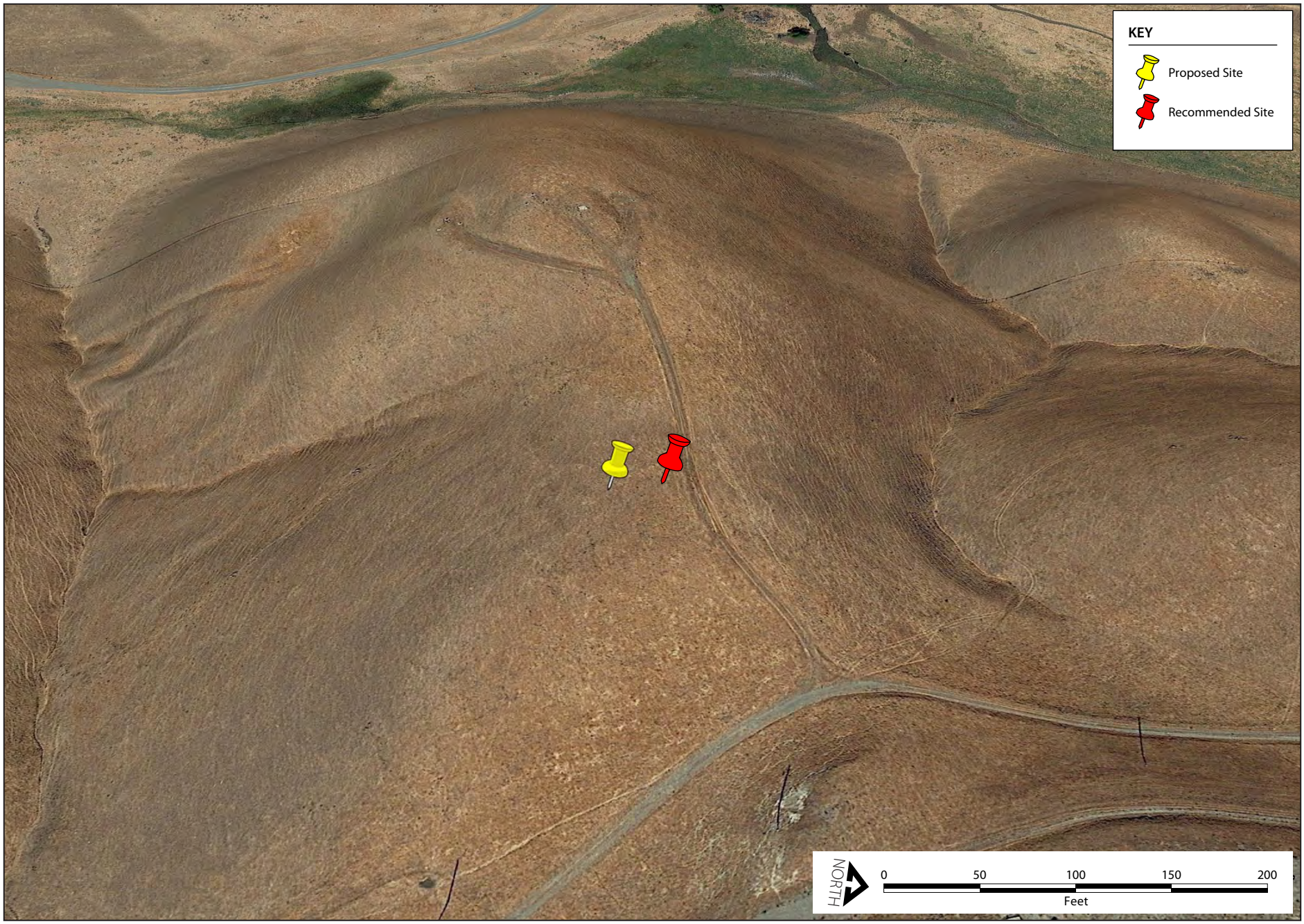
Risk Determination and Recommendation for Alternative Relocation

None.

Plate 7. Looking west-southwest along the ridge top from the proposed Turbine 3 location. Note the knoll further west, which represents the far western end of the ridge, about 400 feet from the proposed site.

Plate 8. Looking east from the proposed Turbine 3 site along the lateral ridge toward the north-south-oriented ridge in the background. The peak represents the highest elevation on this ridge, sloping downward to the north and south.

Plate 9. Looking south from the proposed Turbine 3 site. The slope is slight toward the south for at least 50 feet before dropping more steeply into a deep ravine.



05/02/2020

SOURCE: Google Earth 2020.

Figure A-3
Location of Proposed and Recommended Sites for Turbine 3 at the Mulqueeney Wind Project

Turbine 4

Topographical Description

The Turbine 4 site is located near the top of a broad, hill at the north end of an old-generation turbine string (Figure A-4). Like Turbine 3, it is also a short, lateral ridge extending south from the same north-south-oriented ridge. The top of the hill is relatively flat and broad, between 200 and 300 feet in all directions. The proposed turbine site is about 30 feet southeast of a steep downslope (30-40%) on the northwest. The top of the hill extends further to the west before a steep drop-off to the valley below. Eastward, the site is relatively flat for nearly 300 feet and continues eastward along a slight slope; and southward the site remains relatively flat for about 100 feet before descending along a 25-30% slope to the ravine at the base of the hill (Plates 10 and 11).

Topographical features that may influence raptor movement are the slopes north and south of the proposed site, and the deep ravines at their base. Movement likely concentrates through the ravines and swales and ridgeline to ridgeline.

Proximity to Other Potential Risk Factors

The site is about 80 feet from a meteorological tower, which would be removed. The nearest transmission corridor with towers that provide perching and nesting opportunities for raptors is 0.57 miles southeast. There are no other powerlines or other perches, or conditions that encourage ground squirrel activity (e.g., rockpiles, spoils sites, fence lines, drainages) in the immediate vicinity. However, the drainage just west of the ridge is only one of three areas within the project area where substantial ground squirrel activity was noted. The nearest potential nesting habitat, a small group of trees along this same narrow drainage, is 0.34 miles northwest of the site. The nearest reported golden eagle nests are 1.6 miles west and 1.6 miles northeast of the site. The site is also within the highest concentration of golden eagle activity reported during raptor use surveys. Kernel density analysis places it in the highest use zone.

Risk Determination and Recommendation

Risk is considered Moderate-High at the proposed Turbine 4 site. Topographically, the site is not in close proximity to risky features, although it is near steep slopes and deep ravines to the the north and south. However, the site is within the highest concentration of reported golden eagle activity. Existing roads would be improved and widened to access the site, but because they are along the ridge top, this work is not expected to influence raptor movement through the site. To slightly decrease risk, the site could be moved 73 feet east of the proposed location and centered on the top of the hill at 37.712126° -121.602475° (Plate 12). However, due to the level of golden eagle activity in the area, the site remains Moderate-High risk.

Response to Recommendation and Alternative Relocation

Mulqueeney Wind selected the recommended location for Turbine 4.

Risk Determination and Recommendation for Alternative Relocation

None.

Plate 10. Looking south from the proposed Turbine 4 site. One of the met tower anchors and guy wires can be seen in the upper left of the photo.

Plate 11. Looking north from the proposed Turbine 4 site. Note the relatively flat, broad hilltop before a steep descent into the ravine on the north.

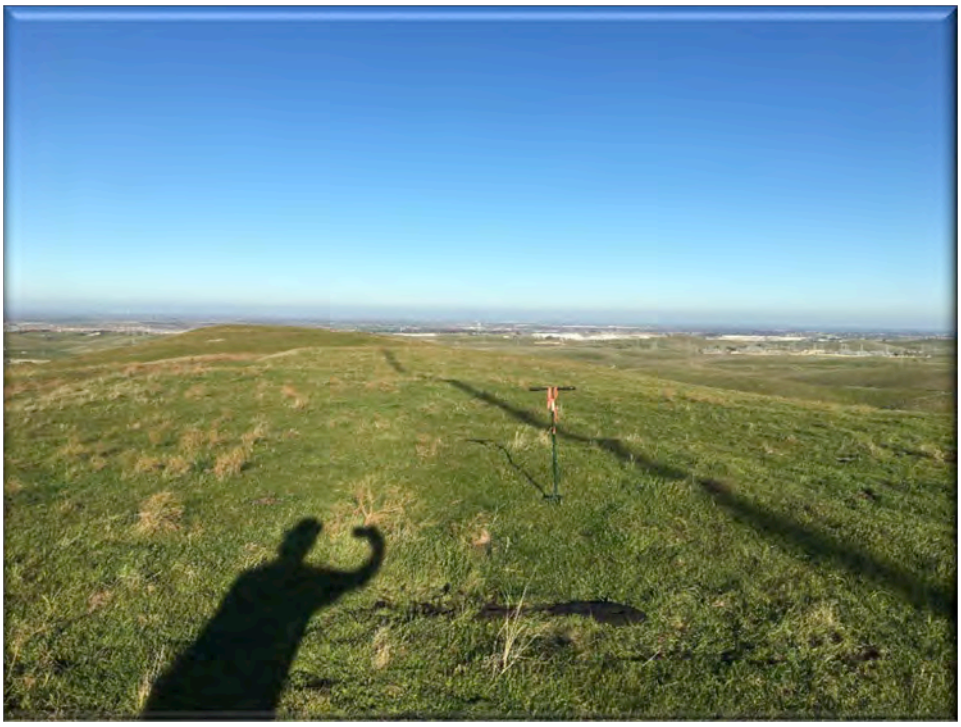
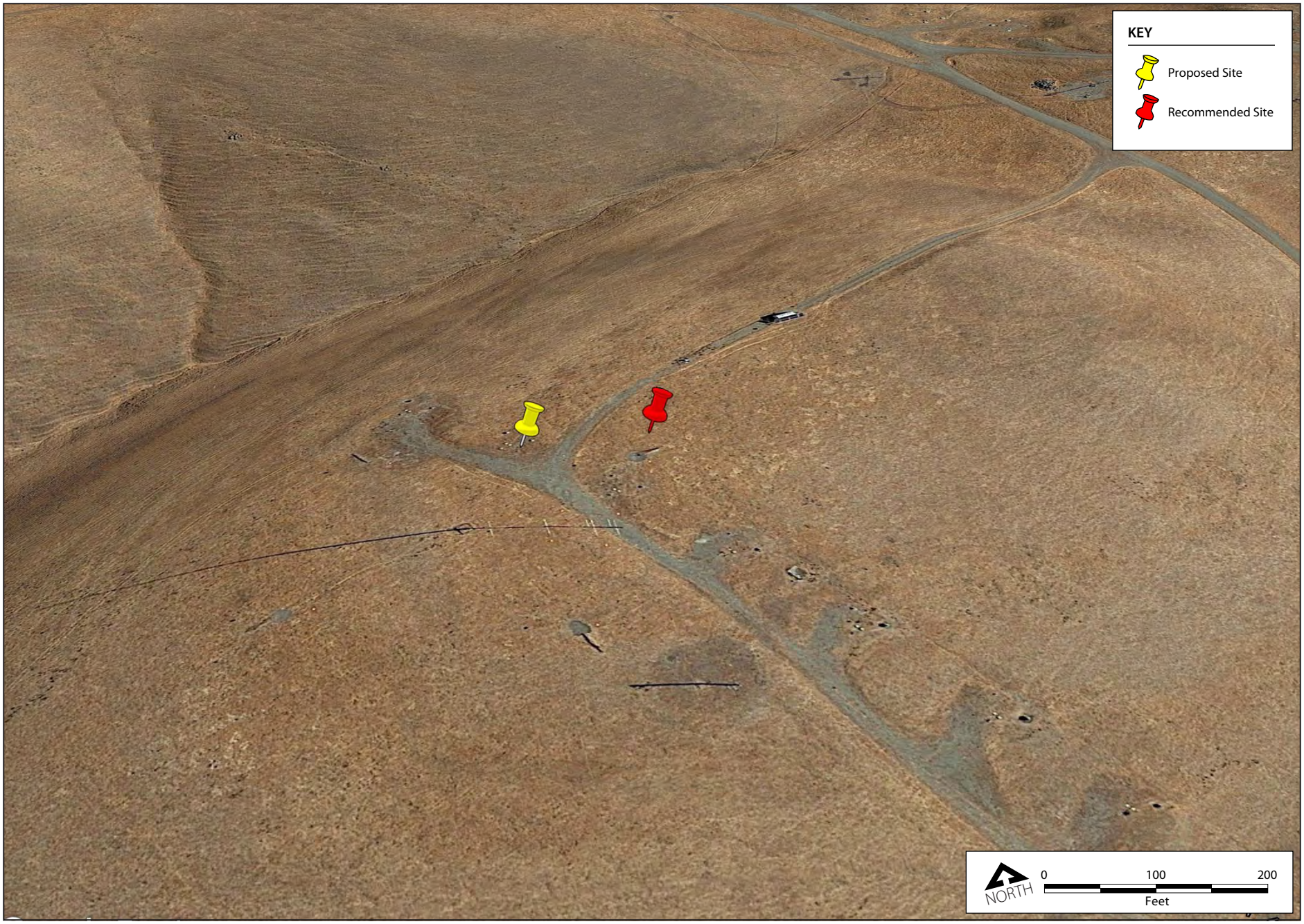


Plate 12. Looking east from the recommended alternate site for Turbine 4. This minor movement of approximately 73 feet centers the turbine on the hill/ridge top.



05/02/2020

SOURCE: Google Earth 2020.

Figure A-4
Location of Proposed and Recommended Sites for Turbine 4 at the Mulqueeney Wind Project

Turbine 5

Topographical Description

The Turbine 5 site is located near the bottom of a deep swale, on a slope near the base of southward ascending slope, and across a swale from a northward ascending slope (Figure A-5). The site is near the convergence of three swales, extending from the northeast, west, and southeast. As a result, the site is a low area surrounded by higher elevation landforms (Plates 13 and 14).

Topographical features that may influence raptor movement are the converging swales and the slopes of the hills to the north, south, and east. Movement likely concentrates through the ravines and swales extending east-west and north-south through the site, and along the slope contours surrounding the site.

Proximity to Other Potential Risk Factors

The site is approximately 750 feet southeast of a meteorological tower, which would be removed. However, the project also includes the installation of a new meteorological tower approximately 640 feet south of the site, which will provide perching opportunities for raptors. The site is also 0.42 miles northwest of a transmission line corridor with towers capable of supporting raptors nests. The nearest potential tree-nesting habitat, a group of trees along a small drainage, is 0.47 miles northwest. There are no other perching sites, powerlines, or conditions that encourage ground squirrel activity (e.g., rock piles, spoils sites, fence rows, drainages) in the immediate vicinity. However, the drainage just west of the ridge is only one of three areas within the project area where substantial ground squirrel activity was noted. The nearest reported golden eagle nests are 1.3 miles southeast and 1.7 miles northeast of the site. High level of golden eagle activity was recorded near this site during raptor use surveys. Kernel density analysis places it in the second highest use zone.

Risk Determination and Recommendation

The proposed Turbine 5 site is considered a High risk due to its location near the bottom of converging hills and swales and below the elevation of surrounding landforms. Primary road access will be along the existing east-west road between Turbines 4 and 5, which would be expanded to accommodate moving materials to the new turbine site; however, a new spur road would be required off of the existing road to directly access the new turbine site. Because the site is at low elevation below the surrounding hills, construction of the new turbine pad or access road is not expected to further influence raptor movement.

The are no alternatives for relocation in the immediate vicinity that would reduce risk. To reduce risk, the site would need to be moved a fairly substantial distance. The nearest recommended relocation site is approximately 500 feet southeast to the ridgetop along the old-generation turbine string at 37.709081° -121.600602° (Plate 15). This would place the turbine off of the slope on the high point along the relatively broad ridge to the south and at a higher elevation than the surrounding hills and ridges. However, due to the proximity to the high golden eagle concentration area, it would still be considered a Moderate-High risk site.

Response to Recommendation and Alternative Relocation

Due to wake issues, Mulqueeney Wind selected an alternative site for Turbine 5, 128 feet southwest of the initially proposed site at 37.710142° -121.601233° (Figure A-5).

Risk Determination and Recommendation for Alternative Relocation

At this location, the turbine would still be near the convergence of swales and near the base of a south-facing slope with higher surrounding elevations (Plate 16) and no substantial difference in risk from the initially proposed site. It would still be considered a High-risk turbine location.

Plate 13. Looking upslope southward from the initially proposed Turbine 5 site.

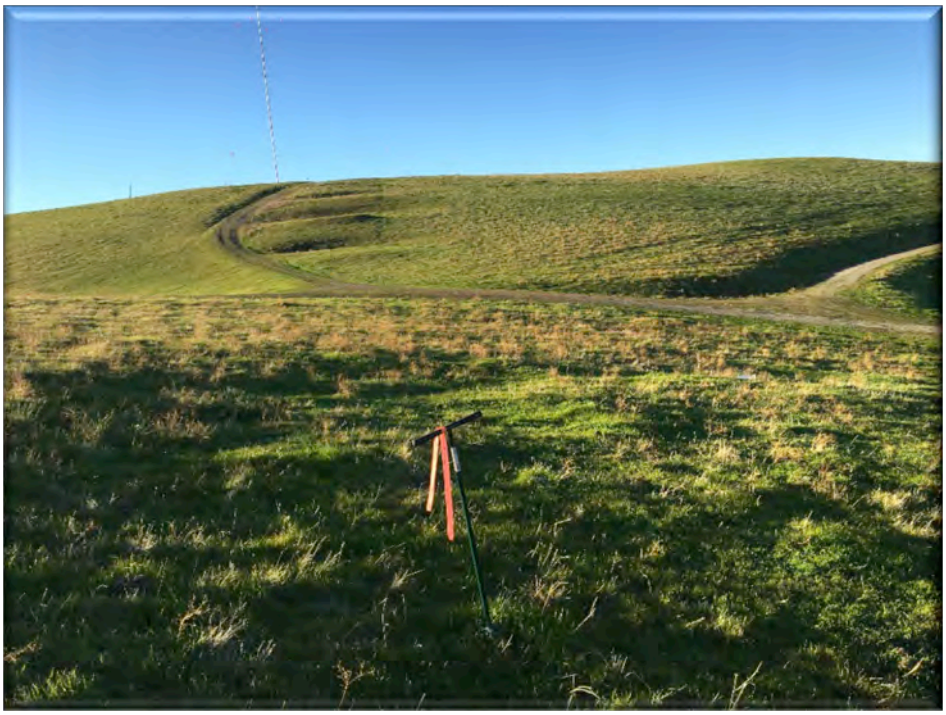
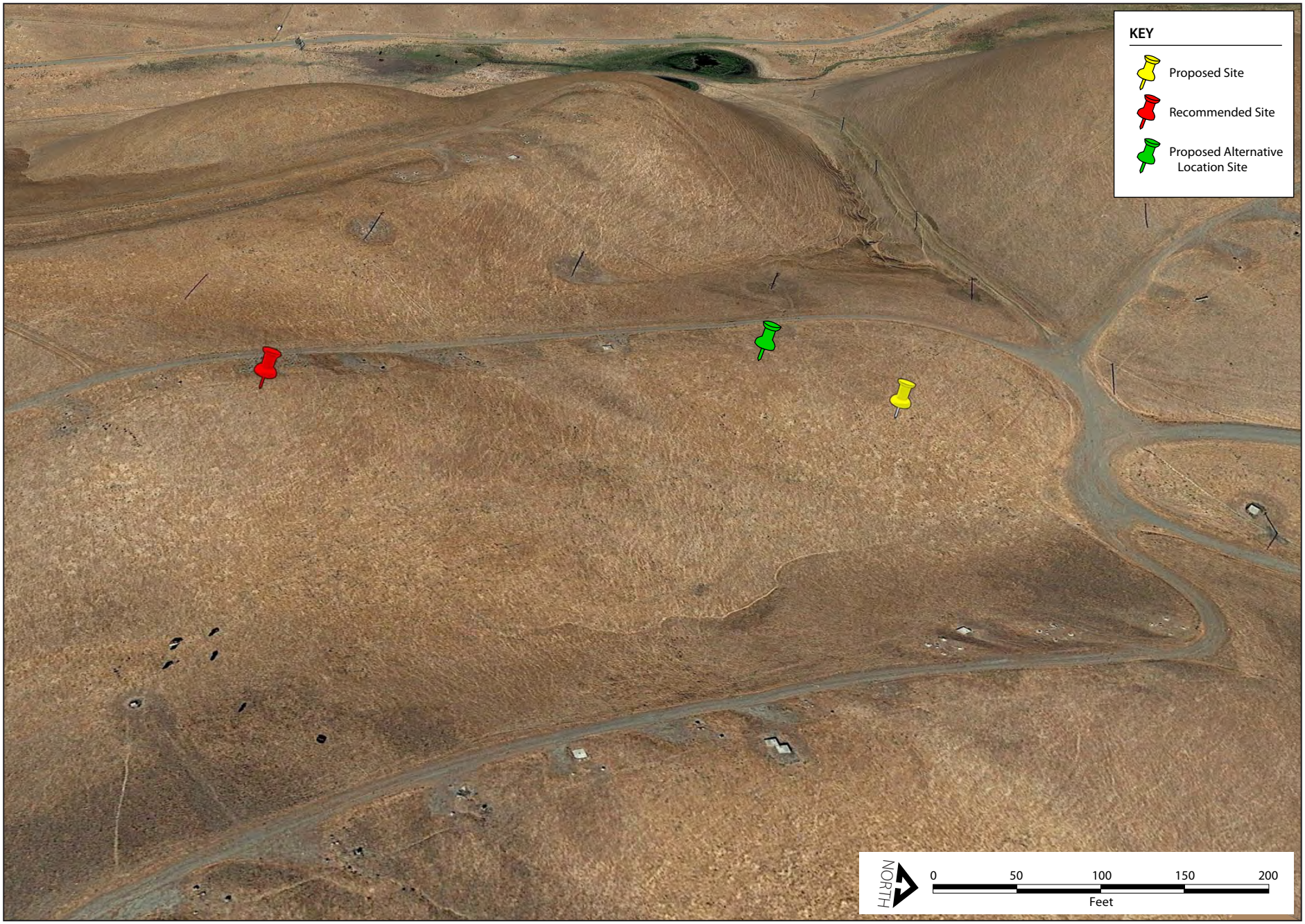


Plate 14. Looking north from the initially proposed Turbine 5 site.

Plate 15. Looking east from the recommended location for Turbine 5.

Plate 16. Looking south toward ascending slope from the proposed alternative relocation site. The recommended site is in the background at the top of the hill.



05/02/2020

SOURCE: Google Earth 2020.

Figure A-5
Location of Proposed and Recommended Sites for Turbine 5 at the Mulqueeney Wind Project

Turbine 6

Topographical Description

The Turbine 6 site is located at the top of a hill along a short, old-generation turbine string (Figure A-6). The top of the hill is fairly flat for approximately 115 feet north-south and 65 feet east-west. All sides of the hill have slopes between 25 and 30%, the west toward a deep north-south swale, and the east toward a deep ravine (Plates 17, 18, and 19). Topographical features that may influence raptor movement are the slopes that surround the hill and that promote contour hunting, and the swales and ravines that concentrate movement.

Proximity to Other Potential Risk Factors

The site is approximately 0.3 miles northwest of a transmission line corridor with towers capable of supporting raptor nests, including golden eagles. The project also includes the installation of a new meteorological tower 0.19 miles southwest of the site, which will provide perching opportunities for raptors. The nearest tree-nesting habitat, a small group of trees along a narrow drainage, is 0.67 miles northeast. There are no other perching sites, powerlines, or conditions that encourage ground squirrel activity (e.g., rock piles, spoils sites, fence rows, drainages) in the immediate vicinity. The nearest reported golden eagle nests are 1.2 miles southeast and 1.5 miles northeast of the site. Low to moderate level of golden eagle activity was recorded near this site during raptor use surveys.

Risk Determination and Recommendation

Risk is considered Moderate at the proposed Turbine 6 site due to its proximity to steep slopes and deep ravines. Its location on the top of the hill is the safest location in the immediate vicinity, but because the hill top is small, the rotors will extend over the steep slopes and above the swales and ravines. Existing roads would be improved and widened to access the site, but because there are currently multiple spur roads along the west-facing slope, this is not expected to further influence raptor movement through the area.

Space is limited at the top of this hill, so there are no alternatives to reduce risk at this site.

Response to Recommendation and Alternative Relocation

Due to wake issues associated with the recommended site, Mulqueeney Wind selected an alternative location 82 feet southeast of the initial location at 37.709563° -121.597328° (Figure A-6).

Risk Determination and Recommendation for Alternative Relocation

The site is on the same hill top with similar surrounding topographic conditions, and thus is considered similarly risky as the initially proposed site.

Plate 17. Looking southeast from the initially proposed Turbine 6 location.

Plate 18. Looking northwest from the initially proposed Turbine 6 location.

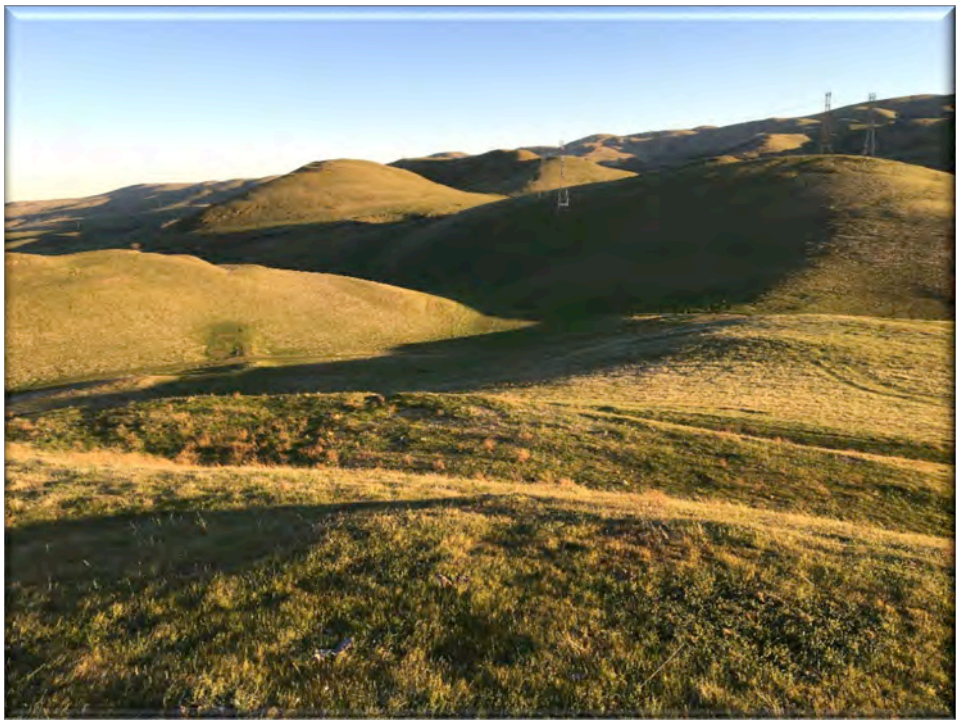


Plate 19. Looking southeast and downslope from the initially proposed Turbine 6 location. The top of the hill is fairly small and drops off with 25 to 30 percent slopes in all directions. The slope bench in the foreground was created for the pad of the old-generation turbine.

05/02/2020

SOURCE: Google Earth 2020.

Figure A-6
Location of Proposed and Recommended Sites for Turbine 6 at the Mulqueeney Wind Project

Turbine 7

Topographical Description

The Turbine 7 site is located near the northwest end of a northwest-southeast-oriented ridge downslope from an old-generation turbine string (Figure A-7). The site is on a northeast-facing 35% slope, which continues eastward into a broad basin eastward-descending basin. The ridge descends northwestward into a deep swale. The west and southwest-facing slope is steeper, descending rapidly into a deep gorge that parallels and extends the length of the ridge (Plates 20, 21, and 22). To the southeast the ridge descends along the old-generation turbine string.

Topographical features that may influence raptor movement are the slopes, particularly on the east side of the ridge, the broad gently-sloped basin on the east, the descending ridgeline to the southeast, and steep southwest-facing slope with an access road below the ridgetop that creates a berm just below the apex that can promote slope-accelerated winds and create conditions suitable for kiting (hovering) into the wind above the ridgeline.

Proximity to Other Potential Risk Factors

There are no perching sites, powerlines, or conditions that encourage ground squirrel activity (e.g., rock piles, spoils sites, drainages) in the immediate vicinity. The nearest transmission corridor with towers capable of supporting raptor nests is 0.55 miles northwest. The nearest potential tree-nesting habitat is 1.3 miles northeast along the riparian corridor that parallels Patterson Pass Road. The nearest reported golden eagle nest is 1.3 miles northeast of the site along the same riparian corridor. Low level of golden eagle activity was recorded near this site during raptor use surveys. Kernel density analysis places it in the lowest use zone.

Risk Determination and Recommendation

Risk is considered High at the proposed Turbine 7 site due to its location on a steep slope below the ridgeline. Raptors contour hunting along this slope, hunting in the basin to the east, or crossing the ridge from west to east could encounter this turbine. Placement of the turbine at this location would require the construction of a large bench in the slope, and because the turbine is on the slope, the ground to rotor plane distance toward the top of the ridge would be reduced. Primary road access will be along the existing ridge top road that would be expanded to accommodate moving materials to the new turbine site; however, a new, approximately 600-foot-long spur road would be required off of the existing road to directly access the new turbine site. This spur road, along with the new turbine pad, would create a bench in the east-facing slope of the ridge, potentially influencing raptor movement through the site.

To decrease the risk to birds flying through the basin and using the slope contours, the site could be moved 428 feet southeast to the high point on the top of the ridge along the old-generation turbine string at 37.684338° -121.566754°. Placement of the turbine at this location would move the turbine off of the slope, onto the ridgetop, and would increase the ground-to-rotor plane distance. Slope accelerated winds would remain an issue at this location, but this site would be considered Moderate risk.

Response to Recommendation and Alternative Relocation

Mulqueeney Wind selected the recommendation location for Turbine 7.

Risk Determination and Recommendation for Alternative Relocation

None.

Plate 20. Looking southeast from proposed Turbine 7 location. Note the location on a steep slope.

Plate 21. Looking northwest from proposed Turbine 7 location.

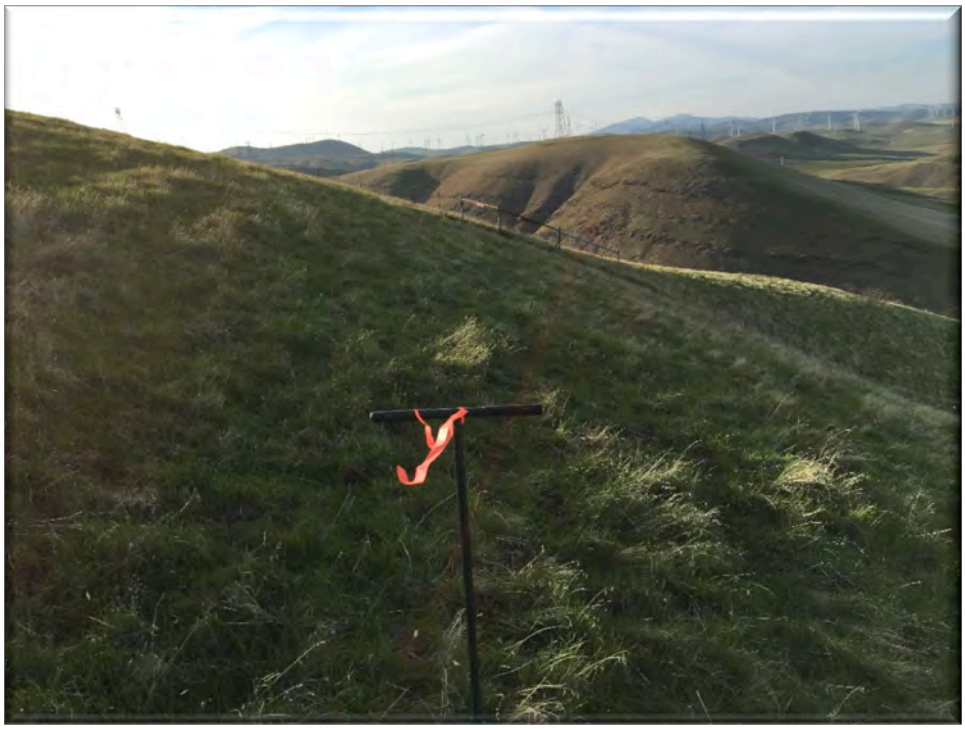
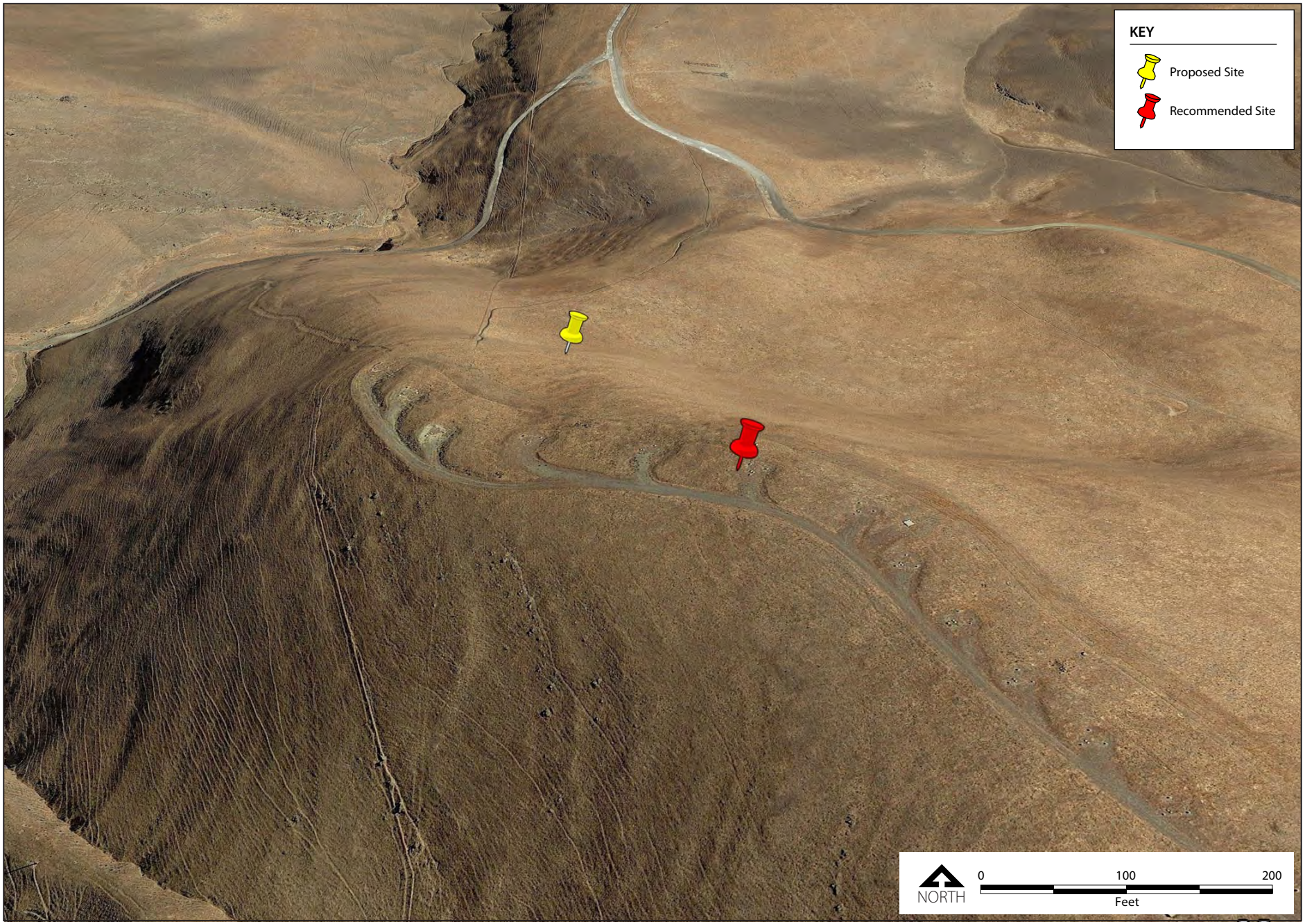


Plate 22. Looking northwest from proposed Turbine 7 location.



05/02/2020

SOURCE: Google Earth 2020.

Figure A-7
Location of Proposed and Recommended Sites for Turbine 7 at the Mulqueeney Wind Project

Turbine 8

Topographical Description

The Turbine 8 site is located on the east-facing slope of a north-south-oriented ridgeline (Figure A-8). The ridge is descending northward along an approximately 20% slope and drops into steep (35%) slopes to the east and west toward deep ravines. The proposed site is slightly downslope on the east side of the descending ridge (Plates 23 and 24). Topographical features that may influence raptor movement are the slopes along the ridge, the deep ravines on the east and west sides of the ridge, and the descending ridgeline.

Proximity to Other Potential Risk Factors

The proposed site is from 700 to 1,500 feet from suitable raptor nesting habitat along a riparian corridor to the north and northwest, and 380 feet north of a transmission corridor with towers capable of supporting raptors nests. The site is also 0.39 miles from only one of three areas within the project area where substantial ground squirrel activity was noted, which likely attracts hunting golden eagles and red-tailed hawks. The nearest reported golden eagle nest is 1.1 miles northeast of the site. Low level of golden eagle activity was recorded near this site during raptor use surveys. Kernel density analysis places it near the lowest use zone.

Risk Determination and Recommendation

Risk is considered Moderately-High at the proposed Turbine 8 site due to its location on a slope below the ridgeline above a deep swale on the east side of the ridge. Rotors would extend across a large portion of the swale and because the turbine is on the slope, the ground to rotor plane distance toward the top of the ridge would be reduced. Raptors moving up and down through the swale, contour hunting along the slope, and crossing the descending ridge would be at risk. Placement of the turbine at this location would also require the construction of a large bench in the slope. Existing roads would be improved and widened to access the site, but a small spur road would be required to access the new turbine pad downslope, connecting with the bench from the turbine pad and creating additional potential risk.

To reduce the risk to birds flying through the swale and using the slope contours, the site could be moved 117 feet west to the top of the ridge at 37.681104° -121.603540° (Plate 25). This still places the turbine along a descending ridge, but a slight improvement from the proposed location. This location is considered Moderate risk. Alternatively, the turbine could be moved further south along the ridge; however, this places the turbine closer to the transmission line corridor.

Response to Recommendation and Alternative Relocation

Mulqueeney Wind removed Turbine 8 from the project due to close proximity to the nearby transmission line.

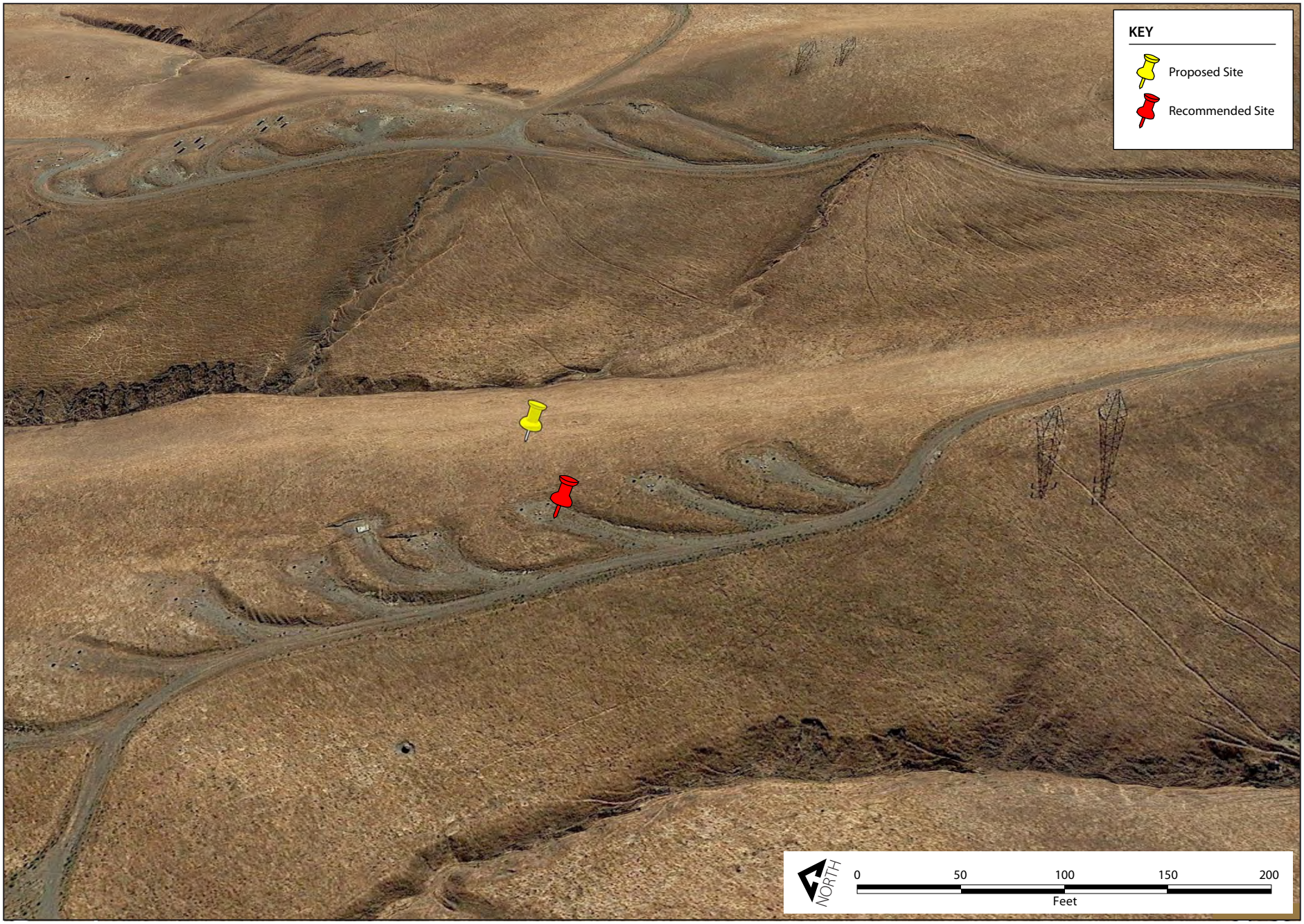
Risk Determination and Recommendation for Alternative Relocation

None.

Plate 23. Looking south from proposed Turbine 8 site. Note the east-facing slope and the deep swale to east.

Plate 24. Looking east from proposed Turbine 8 site.

Plate 25. Looking north from the recommended location on the ridgetop toward the proposed Turbine 8 site, which is 176 feet north, downslope, on the right-center of the photo.



05/03/2020

SOURCE: Google Earth 2020.

Figure A-8
Location of Proposed and Recommended Sites for Turbine 8 at the Mulqueeney Wind Project

Turbine 9

Topographical Description

The Turbine 9 site is located at the eastern edge of the project area where the lower elevation, rolling hills transition toward the flat, cultivated lands of the Central Valley (Figure A-9). The site is just east of a low elevation, narrow, north-south oriented ridge, on an approximately 10% east-facing slope, which extends eastward into a broad swale. A swale also parallels the west side of the ridge before extending westward into higher elevation and more diverse topography (Plates 26 - 28). Due to the low and less differential elevation, and slight slopes, bird movement through this area is likely less influenced by topographical conditions. However, use of swales as movement corridors and contour hunting along slopes are still considered important factors.

Proximity to Other Potential Risk Factors

The proposed site is approximately 0.58 miles from an electrical transmission corridor, the towers of which provide potential perching and nesting habitat for raptors, including golden eagles. The nearest potential tree-nesting habitat is approximately 0.9 miles west. There are no other perching sites, nesting habitat, or conditions that encourage ground squirrel activity (e.g., rock piles, spoils sites, drainages) in the immediate vicinity. The nearest reported golden eagle nest is 1.5 miles west of the site. Low level of golden eagle activity was recorded near this site during raptor use surveys. Kernel density analysis places it in the lowest use zone.

Risk Determination and Recommendation

Risk is considered Moderate at the proposed Turbine 9 site due to its location in relatively flat terrain and the lack of significant topographical features that influence raptor movement. However, the elevation difference between the ridge top and the proposed site (about 5 meters) would place birds crossing the ridge closer to the rotor plane of the turbine. Existing roads would be improved and widened and a short spur road constructed to access the site, but this is unlikely to influence raptor movement or behavior.

To slightly reduce the risk, the site could be moved upslope 196 feet west to the top of the ridge at 37.689741° -121.567124°. This would move the turbine off of the slope and increase the distance between the ground and rotor plane.

Response to Recommendation and Alternative Relocation

Mulqueeney Wind removed Turbine 9 from the project due to low wind projections.

Risk Determination and Recommendation for Alternative Relocation

None.

Plate 26. Looking east from the proposed Turbine 9 location. Note the slight eastward downslope and the broad swale beyond.

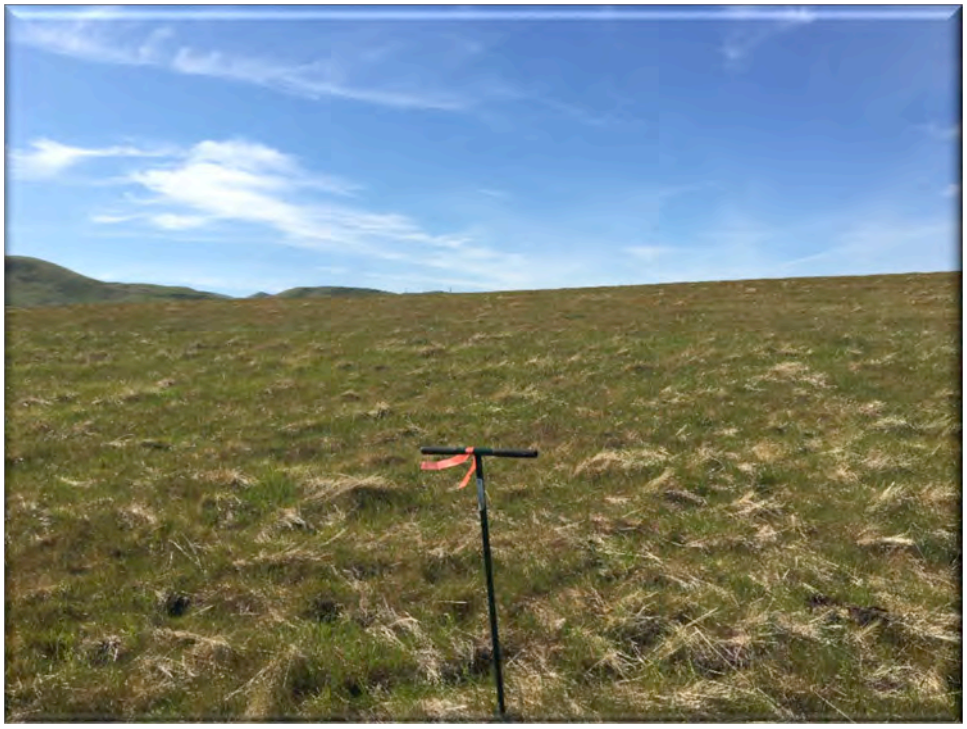


Plate 27. Looking west from the proposed Turbine 9 location, upslope toward the top of the ridge approximately 250 feet away.

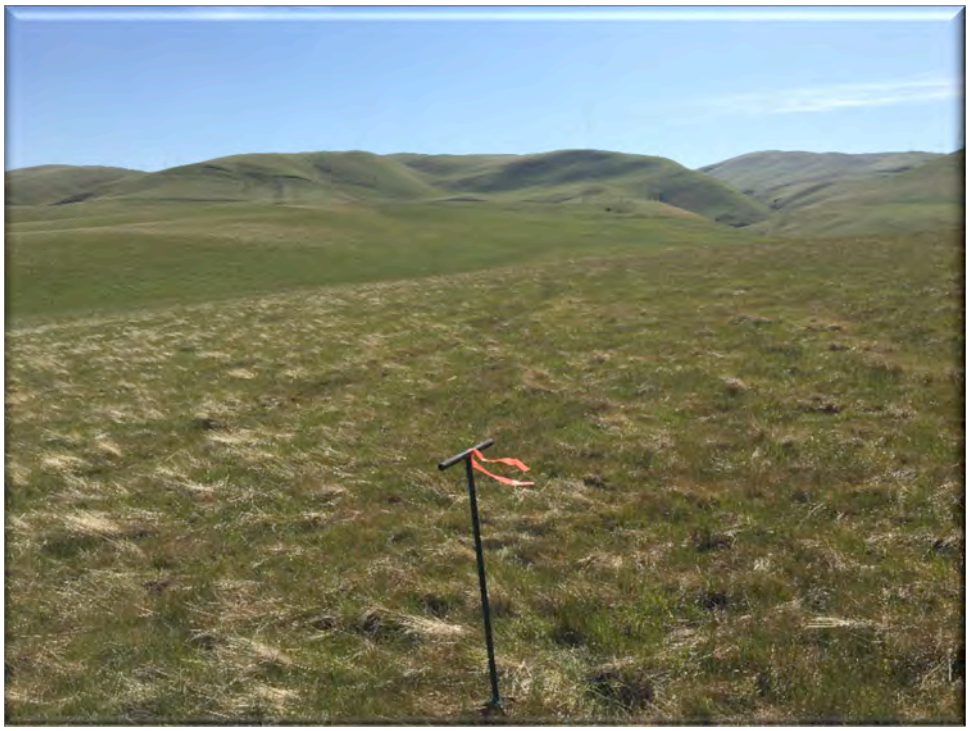
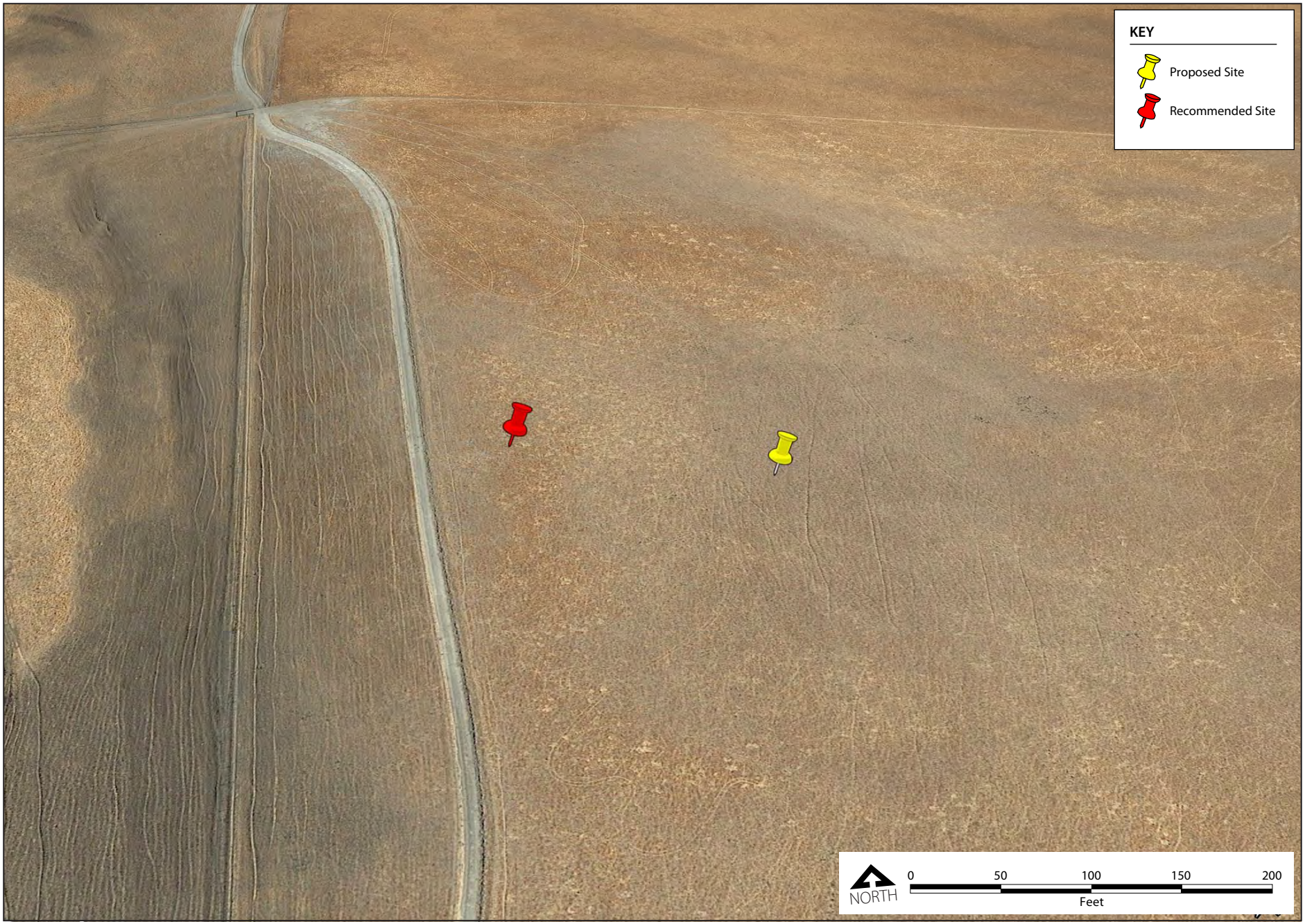


Plate 28. Looking south from the proposed Turbine 9 location.



05/03/2020

SOURCE: Google Earth 2020.

Figure A-9
Location of Proposed and Recommended Sites for Turbine 9 at the Mulqueeney Wind Project

Turbine 10

Topographical Description

The Turbine 10 site is also located at the eastern edge of the project area where the lower elevation, rolling hills transition toward the flat, cultivated lands of the Central Valley (Figure A-10). The site is located within and near the south, narrowing end of a broad swale at the base of a 25% west-facing slope, extending upward to a south-north descending ridge. Elevation increases southward from the site (5 to 10 % slope) and slightly to the west toward the north-south ridge that is the western edge of the swale (Plates 29, 30, and 31). Topographical features that may influence raptor movement are the swale and the surrounding slopes. But, as with Turbine 9, the landscape is less hilly and more open than the higher elevation areas to west and probably has less influence on raptor movement.

Proximity to Other Potential Risk Factors

The proposed site is approximately 0.37 miles north of an electrical transmission corridor and 0.82 miles west of another electrical transmission corridor, the towers of which provide potential perching and nesting habitat for raptors, including golden eagles. There is also a meteorological tower 0.3 miles north of the site, which provides perching opportunities for raptors. The nearest tree-nesting habitat is approximately one-mile northwest. There are no other perching sites, nesting habitat, or conditions that encourage ground squirrel activity in the immediate vicinity. The nearest reported golden eagle nest is 1.3 miles west of the site. Low level of golden eagle activity was recorded near this site during raptor use surveys. Kernel density analysis places it in the lowest use zone.

Risk Determination and Recommendation

Risk is considered moderately high at the proposed Turbine 10 site due to its location within a swale and at the base of slopes extending upward to the east, south, and to a lesser extent to the west. Existing roads would be improved and widened and a short spur road constructed to access the site, but this is unlikely to influence raptor movement or behavior.

To reduce the risk, the site could be moved upslope 693 feet southeast to the top of the ridge at 37.694275° -121.564466°. This would move the turbine out of the swale and away from the base of slopes. Alternatively, risk could also be reduced by moving the site 234 feet to the top of the ridge to the west at 37.695281° -121.567223°. These locations are considered moderate risk.

Response to Recommendation and Alternative Relocation

Mulqueeney wind selected the recommended location for Turbine 10.

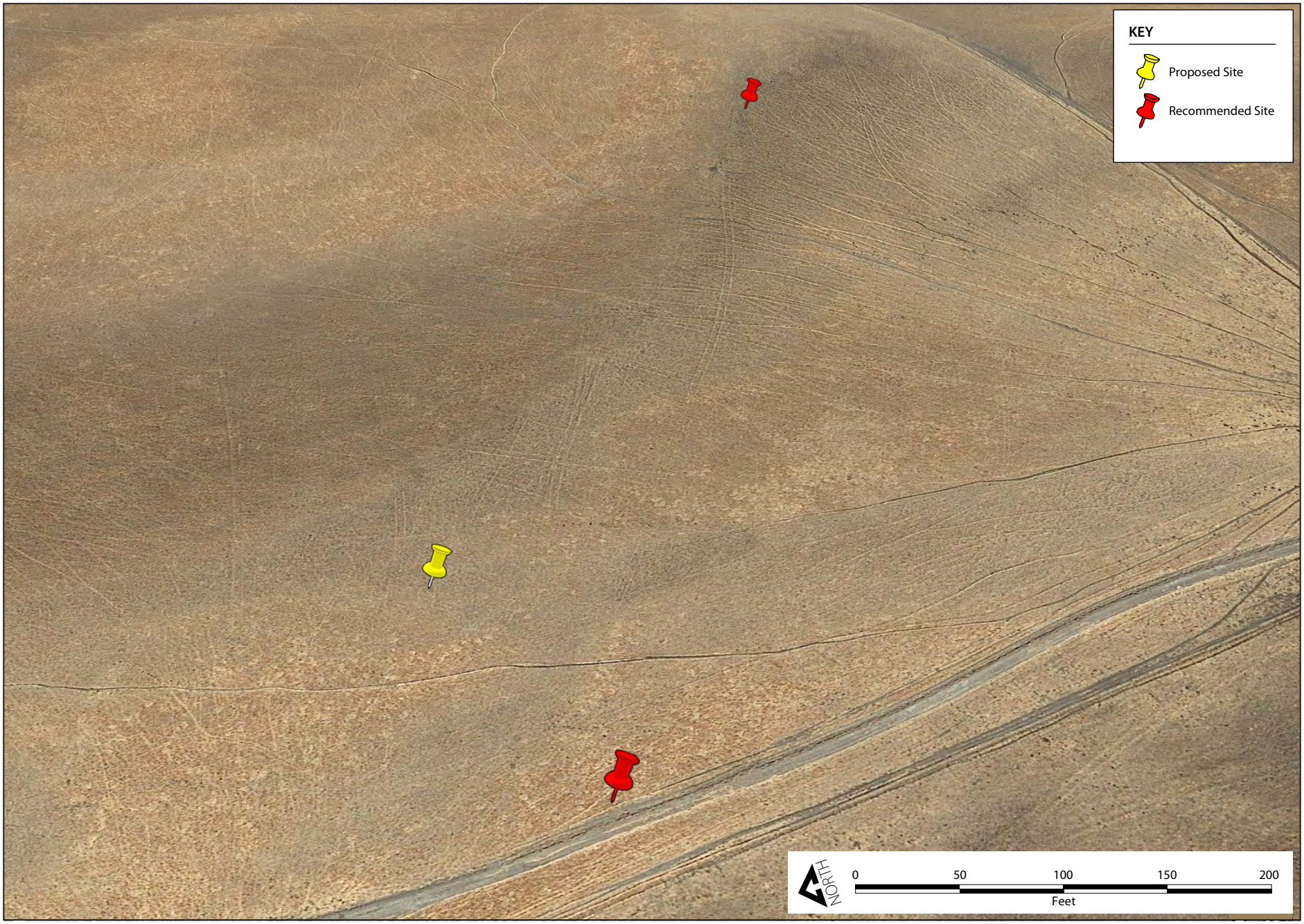
Risk Determination and Recommendation for Alternative Relocation

None.

Plate 29. Looking north from the proposed Turbine 10 site. Note the location within the broad swale.

Plate 30. Looking east from the proposed Turbine 10 site. Not the location at the base of a west-facing slope extending upward toward the ridge top in the background.

Plate 31. Looking west from the recommended location at 37.694275° -121.564466°.



05/03/2020

SOURCE: Google Earth 2020.

Figure A-10
Location of Proposed and Recommended Sites for Turbine 10 at the Mulqueeney Wind Project

Mulqueeney Ranch Wind Repowering Project

Appendix A-2. Assessment of Turbines 11 through 20

May 2020

Turbine 11

Topographical Description

The Turbine 11 site is located at the eastern edge of the project area where the lower elevation, rolling hills transition toward the flat, cultivated lands of the Central Valley (Figure A-11). The site is on the edge of a broad ridge/plateau approximately 700-feet-wide. The ridge ascends slightly to the south and slowly descends to the east toward a deep swale. On the west, the slope is steeper, descending into a deep ravine. The surrounding topography consists of low elevation foothills, with decreasing elevation eastward toward the floor of the Central Valley, and increasing elevation westward (Plates 32 to 35). Bird movement through this area is likely less influenced by topography due to the less hilly and more uniform landscape. Movement patterns are expected to be more broadly dispersed compared with the higher elevation areas to the west.

Proximity to Other Potential Risk Factors

The site is 565 feet south of a meteorological tower, which would be removed, and 978 feet south of a transmission line corridor, the towers of which provide nesting opportunities for raptors. The nearest potential tree-nesting habitat, a patch of riparian trees along the creek that parallels Patterson Pass Road, is 1.1 miles northwest. There are no other perching sites, nesting habitat, or conditions that encourage ground squirrel activity (e.g., rock piles, spoils sites, drainages) in the immediate vicinity and little to no ground squirrel activity was noted near the site. The nearest reported golden eagle nest is 1.3 miles west of the site. Low level of golden eagle activity was recorded near this site during raptor use surveys. Kernel density analysis places it in the lowest use zone.

Risk Determination and Recommendation

Risk is considered Moderate at the proposed Turbine 11 site due to its location on a mostly flat ridge/plateau. Raptor use and movement in this area is expected to be widely dispersed and not concentrated based on land forms or topographical features. With use of the existing road west of the site and the mostly flat terrain, turbine pad construction and road improvements in this area – including an approximately 250-foot-long spur road to the site, are not expected to influence raptor movement.

A slight improvement in potential collision risk would be the relocation of the turbine upslope to the southeast for approximately 142 feet. This places the turbine slightly higher nearer the ridge top at 37.692514° -121.565623°.

Response to Recommendation and Alternative Relocation

Mulqueeney Wind selected the recommended location for Turbine 11.

Risk Determination and Recommendation for Alternative Relocation

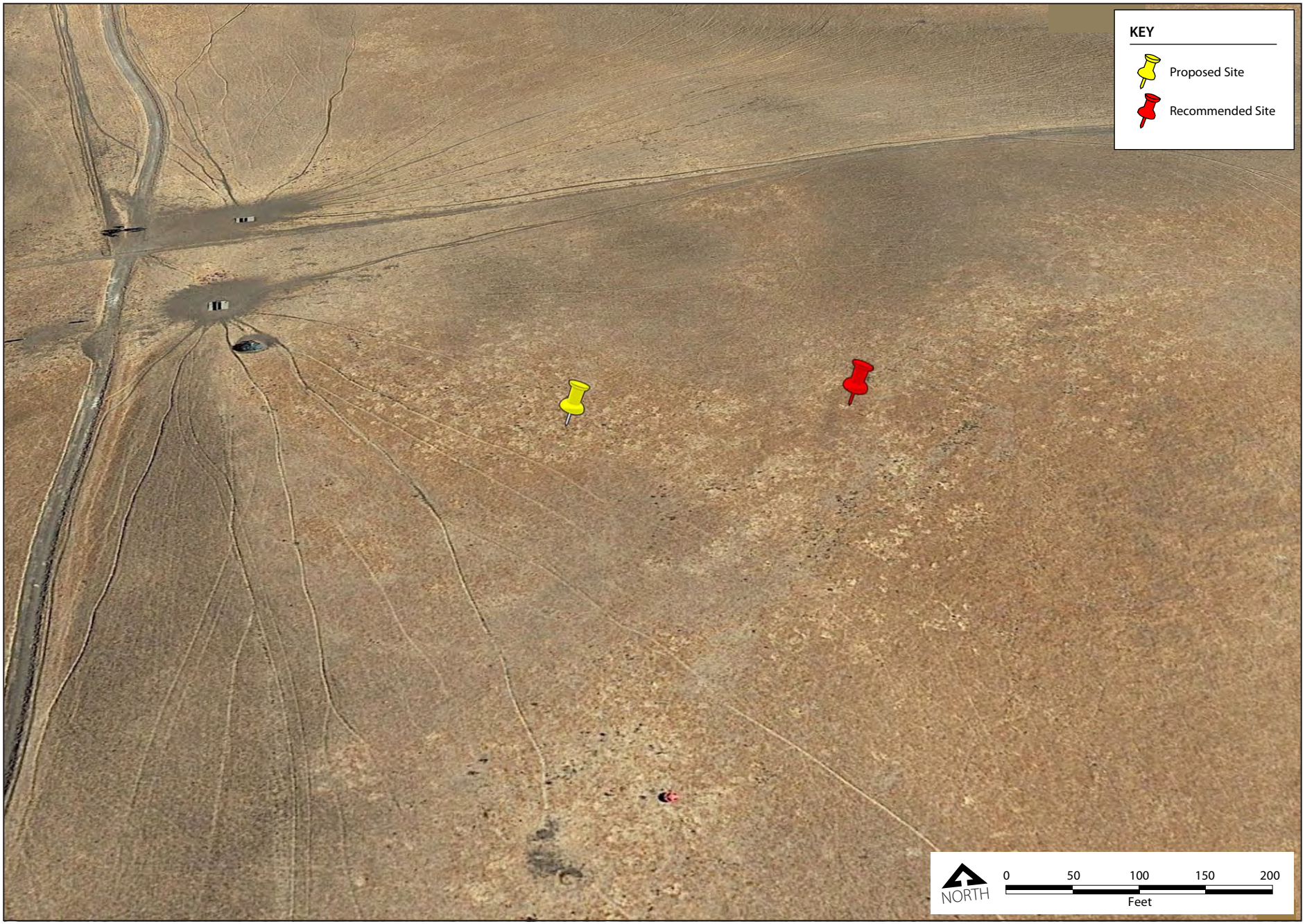
None.

Plate 32. Looking west from the proposed Turbine 11 location. Note the generally flat terrain on the broad ridge/plateau.

Plate 33. Looking north from the proposed Turbine 11 location. Note the slight northward descending slope toward the broad swale in the background (where the proposed Turbine 10 is sited).

Plate 34. Looking south from the proposed Turbine 11 location. Note the very slight ascending slope southward along this broad ridge top.

Plate 35. Looking east from the proposed Turbine 11 location. The site is on a slight slope eastward and southward. A slight improvement in risk can be achieved by moving upslope to the southeast in the right corner of the photo.



05/03/2020

SOURCE: Google Earth 2020.

Figure A-11
Location of Proposed and Recommended Sites for Turbine 11 at the Mulqueeney Wind Project

Turbine 12

Topographical Description

The Turbine 12 site is located on an isolated hilltop surrounded by steep slopes and deep gorges (Figure A-12). The turbine is sited at the far southern end of the hill top at the end of an old-generation turbine string. The site is below the highest point on the hilltop on a small bench created for the southernmost old-generation turbine, and is within several feet of the south-facing slope of the hill. Slopes on the east, south, and west, range from 40% to 60% and rapidly descend into deep gorges. To the north, the hilltop gradually descends along the old-generation turbine string before also dropping steeply into a deep gorge (Plates 36 and 37).

Topographical features that likely influence bird movement in the area are the steep slopes and deep gorges surrounding and immediately adjacent to the proposed turbine location. Flight through the deep gorges, ridge to ridge flight above the gorges, and circling flight patterns to gain altitude above the ridgelines are all expected behaviors.

Proximity to Other Potential Risk Factors

The proposed turbine site is 0.23 miles south of a transmission line corridor, the towers of which provide perching and nesting habitat for raptors, including golden eagles. The nearest potential tree-nesting habitat, riparian trees along the drainage paralleling Patterson Pass Road, is 0.4 miles southeast. There are no other perching sites, nesting habitat, or conditions that encourage ground squirrel activity (e.g., rock piles, spoils sites, fence rows, drainages) in the immediate vicinity and little to no ground squirrel activity was noted near the site. The nearest reported golden eagle nest is 0.7 miles south of the site. Moderate to high level of golden eagle activity was recorded near this site during raptor use surveys. Kernel density analysis places it in the second highest use zone.

Risk Determination and Recommendation

Risk is considered High at the proposed Turbine 12 site due to its location on the edge of a steep slope and on an isolated, narrow hilltop. Rotors will extend out over the steep slopes on all sides. Raptor movement in the area is likely to be higher altitude as birds fly up out of the surrounding deep gorges and continue to gain altitude above the ridgelines. Use of the existing road up to the hill top will require additional earth-moving, creating a larger notch in the slope. Although this may influence raptor movement along the slope, because the turbine is located on the top of the hill, it is not expected to create additional collision risk. Pad construction on the hilltop will require additional earth-moving and modification to the hilltop topography, and would likely create a substantial bench on the southern end of the hilltop.

A slight improvement in potential collision risk would be the relocation of the turbine upslope to the north 95 feet at 37.703964° -121.590629°. This places the turbine at the highest point on the hilltop and moves it away from the edge of the steep, south-facing slope (Plate 38). However, risk would still be considered High at this location.

Response to Recommendation and Alternative Relocation

To adjust to possible wake effects from neighboring turbines, Mulqueeney Wind selected an alternative site 74 feet northwest of the recommended site at 37.704078° -121.590844° (Figure A-12).

Risk Determination and Recommendation for Alternative Relocation

The new site remains on the top of the hill, although slightly closer to the southwest-facing slope. The difference in risk between the recommended and the alternative relocation site is minimal. The location would still be considered High risk.

Plate 36. Looking north toward the proposed Turbine 12 location. The site is on the top of the hill in the center of photo, toward the southern end of the hill top. Note the steep slopes and deep gorges surrounding the site.

Plate 37. Looking west from the initially proposed Turbine 12 location. Note the close proximity of the site to the steep slope.

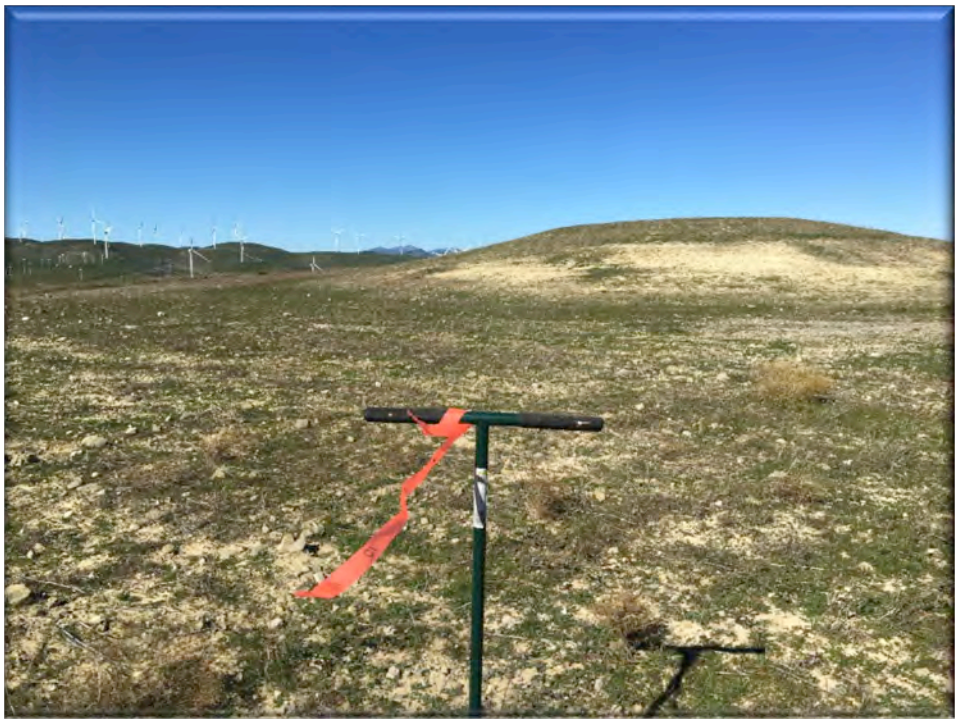
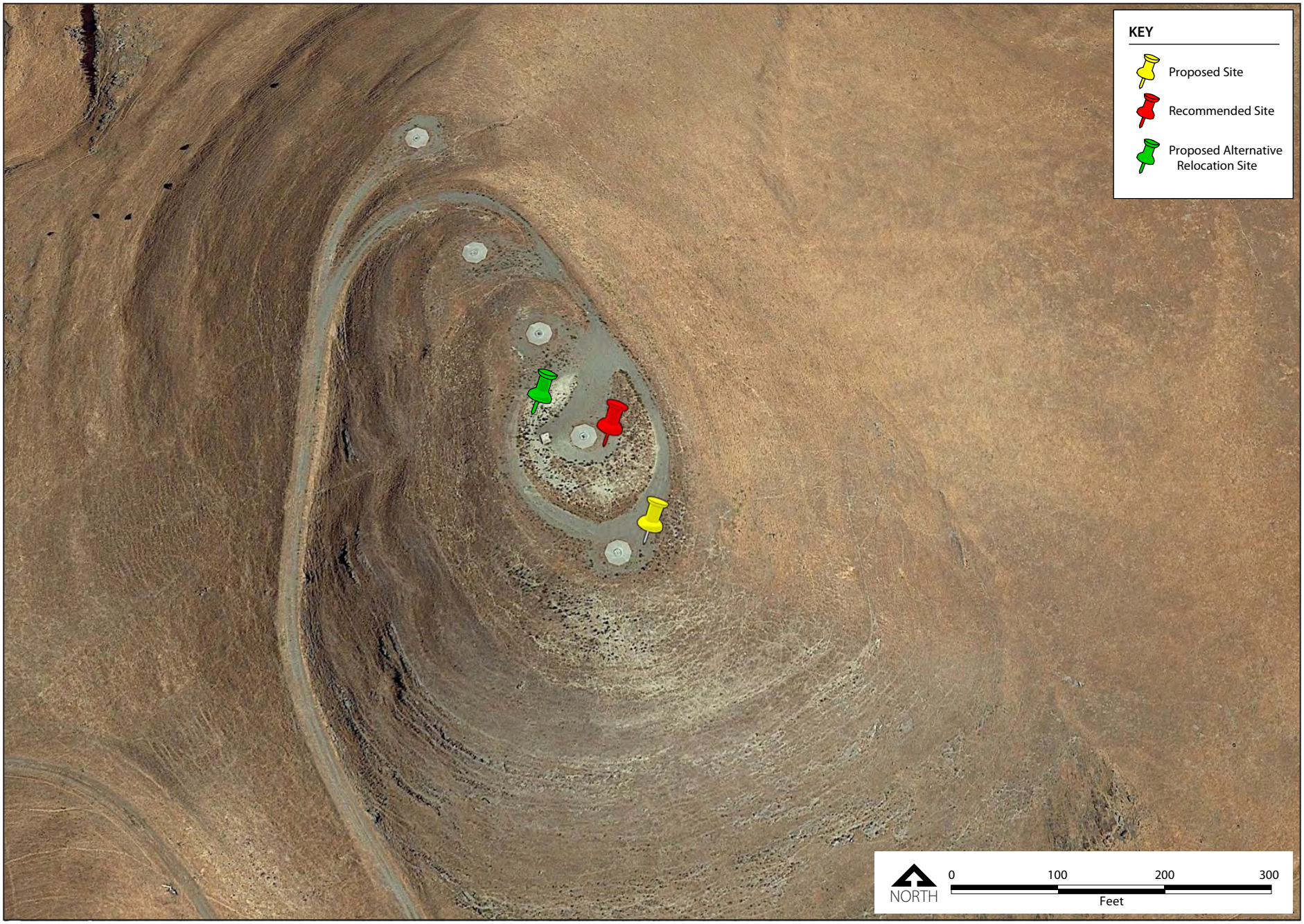


Plate 38. Looking south from the proposed Turbine 12 site toward the recommended location on the top of the hill. The proposed alternative relocation site is just beyond the hilltop.



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SOURCE: Google Earth 2020.

Figure A-12
Location of Proposed and Recommended Sites for Turbine 12 at the Mulqueeney Wind Project

Turbine 13

Topographical Description

The Turbine 13 site is located on a west-facing 20% slope at the northwest end of a southeast-northwest-oriented ridge (Figure A-13). The ridge is a low-elevation feature with higher elevation ridges to the east and west. The ridge extends southeast along an old-generation turbine string. The west and north slopes extend down into a deep swale. The eastern slope gradually descends into a broad swale. To the southeast, the ridge line gradually descends to the southeast. The surrounding topography consists of low elevation foothills. Elevation increases to the west and south (Plates 39, 40, and 41). Topographic features that may influence raptor movement and use of the area include the broad, open swale west of the site and the slopes along the ridge, which are ideal for contour hunting at this location.

Proximity to Other Potential Risk Factors

The site is within 0.4 miles of the creek channel paralleling Patterson Pass Road that supports riparian habitat and suitable raptor nesting habitat. An active golden eagle nest is along this channel approximately 0.5 miles southeast of the turbine site. Moderate to high level of golden eagle activity was recorded near this site during raptor use surveys. Kernel density analysis places it in the second highest use zone. There is also a transmission line corridor 0.43 miles north of the site with towers capable of supporting raptor nests, including golden eagles. There are no other perching sites, nesting habitat, or conditions that encourage ground squirrel activity in the immediate vicinity and little to no ground squirrel activity was noted near the site.

Risk Determination and Recommendation

Risk is considered High at the proposed Turbine 13 site due to its location on the slope of a low elevation ridge that is surrounded by higher elevation topography. The site is on the upper edge of a deep swale that likely influences bird movement through the area. Rotors would extend over the swale and the ridgeline, and because the site is on the slope, the distance between the ground and rotor plane will be reduced over the ridgeline. Expansion of the existing access road and construction of the turbine pad at this location will require additional earth-moving, creating a bench on the slope. These features influence raptor movement and further increase potential collision risk.

Risk can be reduced by moving the site upslope to the southeast 92 feet to the ridgetop and off of the slope at 37.698676° -121.594693° (Plate 42). This location is considered Moderate-High risk.

Response to Recommendation and Alternative Relocation

Turbine 13 was removed from the project due to wake issues.

Risk Determination and Recommendation for Alternative Relocation

None.

Plate 39. Looking east from Turbine 13 location. The site is along the access road leading to the top of the ridge and an old-generation turbine string.

Plate 40. Looking northwest from Turbine 13 location. Note the deep swale at the base of the slope.

Plate 41. Looking west from Turbine 13 location. The swale continues downslope along the west and southwest base of the ridge.

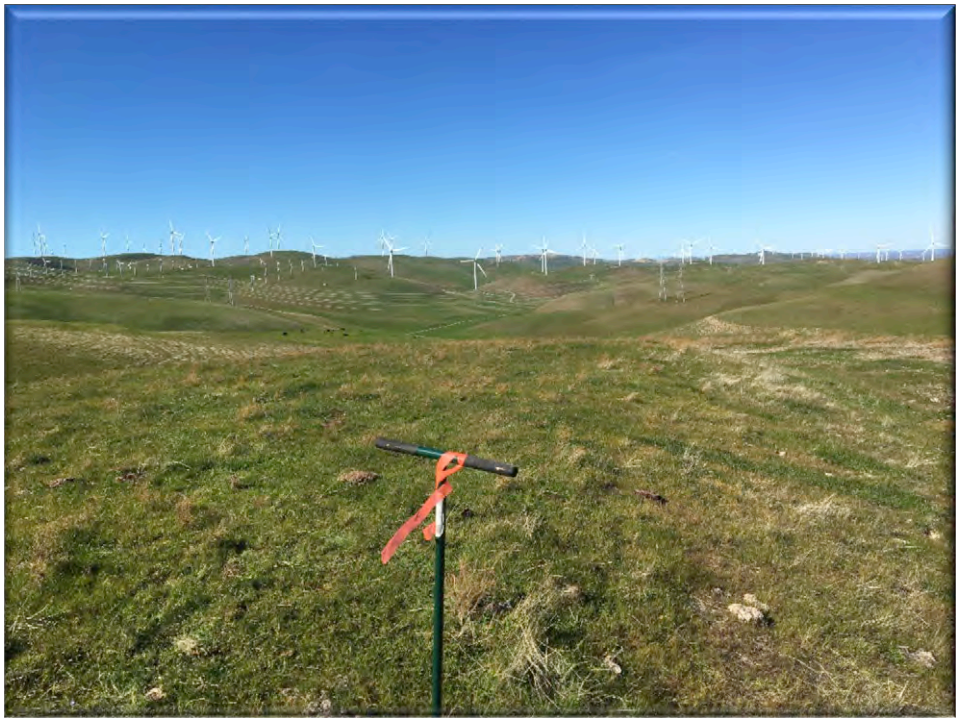
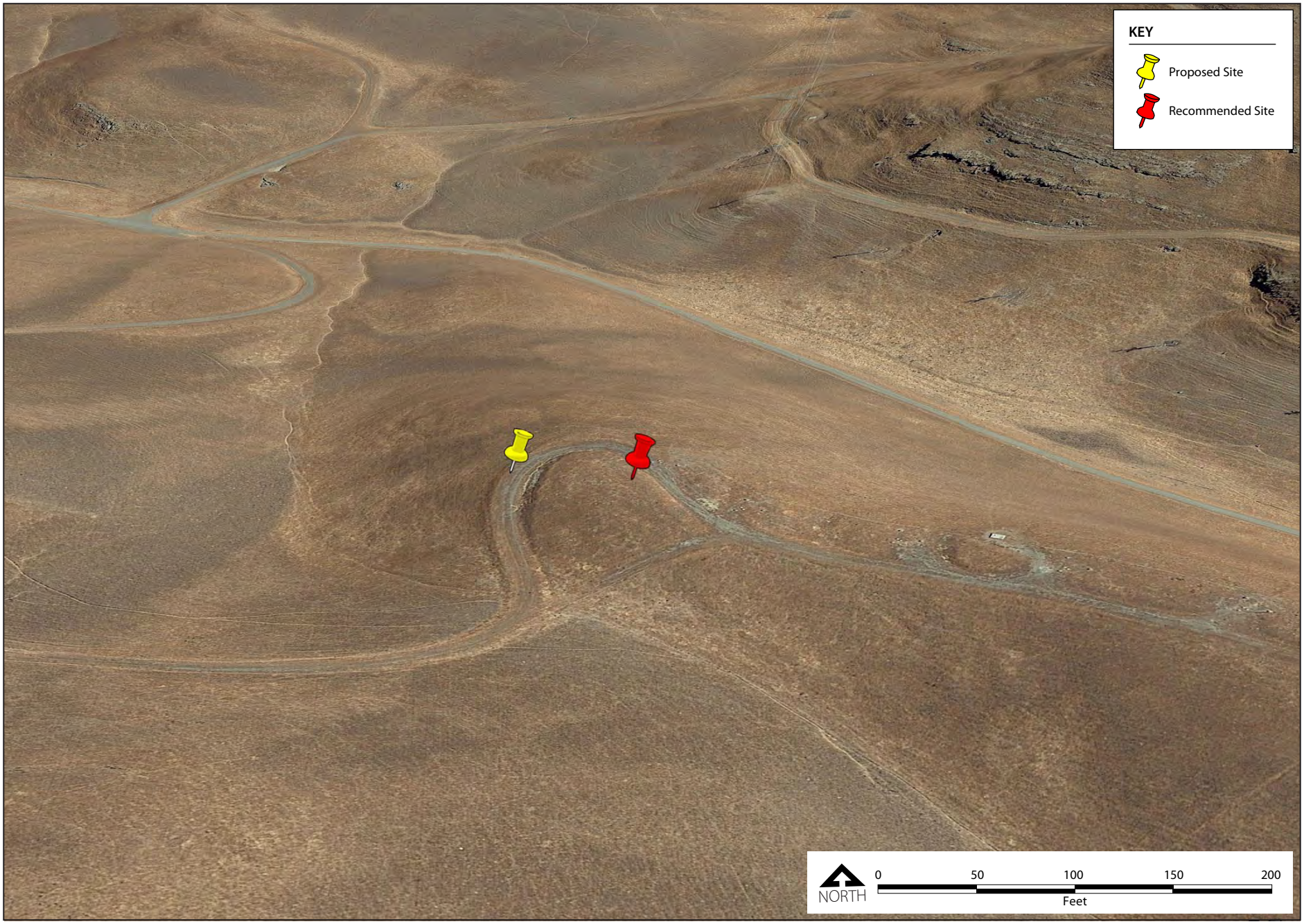


Plate 42. Looking north from the recommended relocation site on the top of the ridge.



05/03/2020

SOURCE: Google Earth 2020.

Figure A-13
Location of Proposed and Recommended Sites for Turbine 13 at the Mulqueeney Wind Project

Turbine 14

Topographical Description

The Turbine 14 site is located on a northwest-southeast-oriented ridgeline along an old-generation turbine string (Figure A-14). The turbine site is just below and northwest of the high point along the ridge between an access road and a bench in the slope created for the old-generation turbine pad. The site is within a small notch in the ridge created as a result of the old-generation turbine string. The ridgeline descends to the southeast and northwest. Southwest-facing and northeast-facing slopes are relatively steep, from 30 to 40 percent. There is an access road along the ridge that creates a berm just below the apex of the ridge, which promotes slope-accelerated wind along the southwest-facing slope. A deep, steep swale ascends upslope from the southwest about 140 feet northwest of the proposed site (Plates 43 and 44). Topographic features that may influence raptor use and movement in this area include the descending ridge slopes with numerous slope breaks caused by the notches in the ridgeline created by the old-generation turbine string, and the steep southwest-facing slope that may promote slope-accelerated winds.

Proximity to Other Potential Risk Factors

The site is east of and within 180 feet of a meteorological tower that can be used as a raptor perch, which would be removed. There is also a transmission line corridor 0.43 miles north of the site with towers capable of supporting raptor nests, including golden eagles. There are no other perching sites, nesting habitat, or conditions that encourage ground squirrel activity (e.g., rock piles, spoils sites, fence rows, drainages) in the immediate vicinity and little to no ground squirrel activity in the immediate vicinity. The nearest potential tree-nesting habitat is 0.3 miles southeast along the creek channel paralleling Patterson Pass Road. The nearest golden eagle nest is 0.54 miles south of the site along this same drainage. Moderate to high level of golden eagle activity was recorded near this site during raptor use surveys. Kernel density analysis places it in the second to highest use zone. On two occasions during site visits, an adult eagle was observed circling above this location and contour hunting along the west-facing slope.

Risk Determination and Recommendation

Risk is considered moderately-high at the proposed Turbine 14 site primarily due to its proximity to a steep southwest-facing slope that may also be subject to slope-accelerated winds, which may add additional risk to raptors using these winds to hover-hunt above the ridge. The site is also near the top of a deep swale ascending from the west side of the ridge. The rotors would extend above this swale feature. Existing roads would be used to access the site; however, substantial expansion of the road would be required to accommodate material deliveries, which will expand the slope bench from the existing road. The site is also in close proximity to the golden eagle nest along Patterson Pass Road and is within a high golden eagle use zone.

Risk can be reduced slightly by moving the site upslope and to the southeast 44 feet to the top of the ridge at an old-generation turbine pad at 37.701094° -121.588995° (Plate 45). This moves the site out of the notch in the ridgeline to the top of the ridge and off of the slope, and further away from the swale west of the site. However, due to eagle use of the area, the site is still considered Moderate-High risk.

Response to Recommendation and Alternative Relocation

To maintain sufficient distance between adjacent turbines, Mulqueeney Wind selected an alternative site 65 feet southwest of the recommended site at 37.700956° -121.589138° (Figure A-14).

Risk Determination and Recommendation for Alternative Relocation

Although slightly less risky than the initially proposed location, this places the turbine closer to the edge of the southwest-facing slope and could increase the risk to birds using the slope-accelerated winds to hunt above the ridgeline. This site is still considered Moderate-High risk. Also, the size of the turbine and the turbine pad may alleviate any substantial differences between the different proposed and recommended locations. It's likely that most of the area that encompasses the three alternative sites will be within the pad construction zone, and as long as the turbine is on the top of the ridge, the risk associated with the turbine would be the same for all three locations.

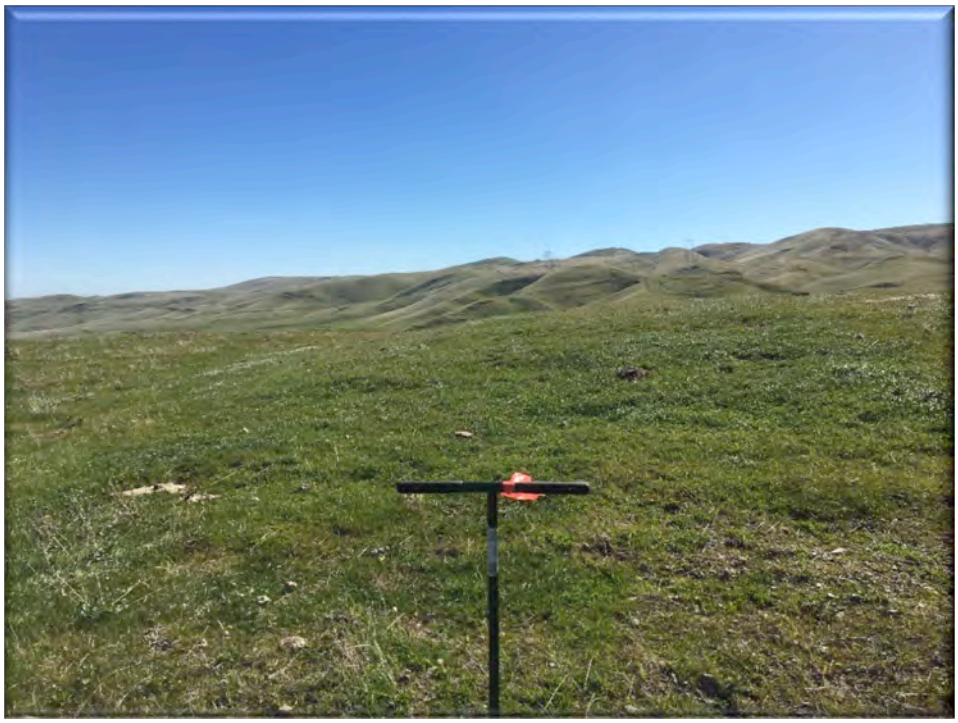
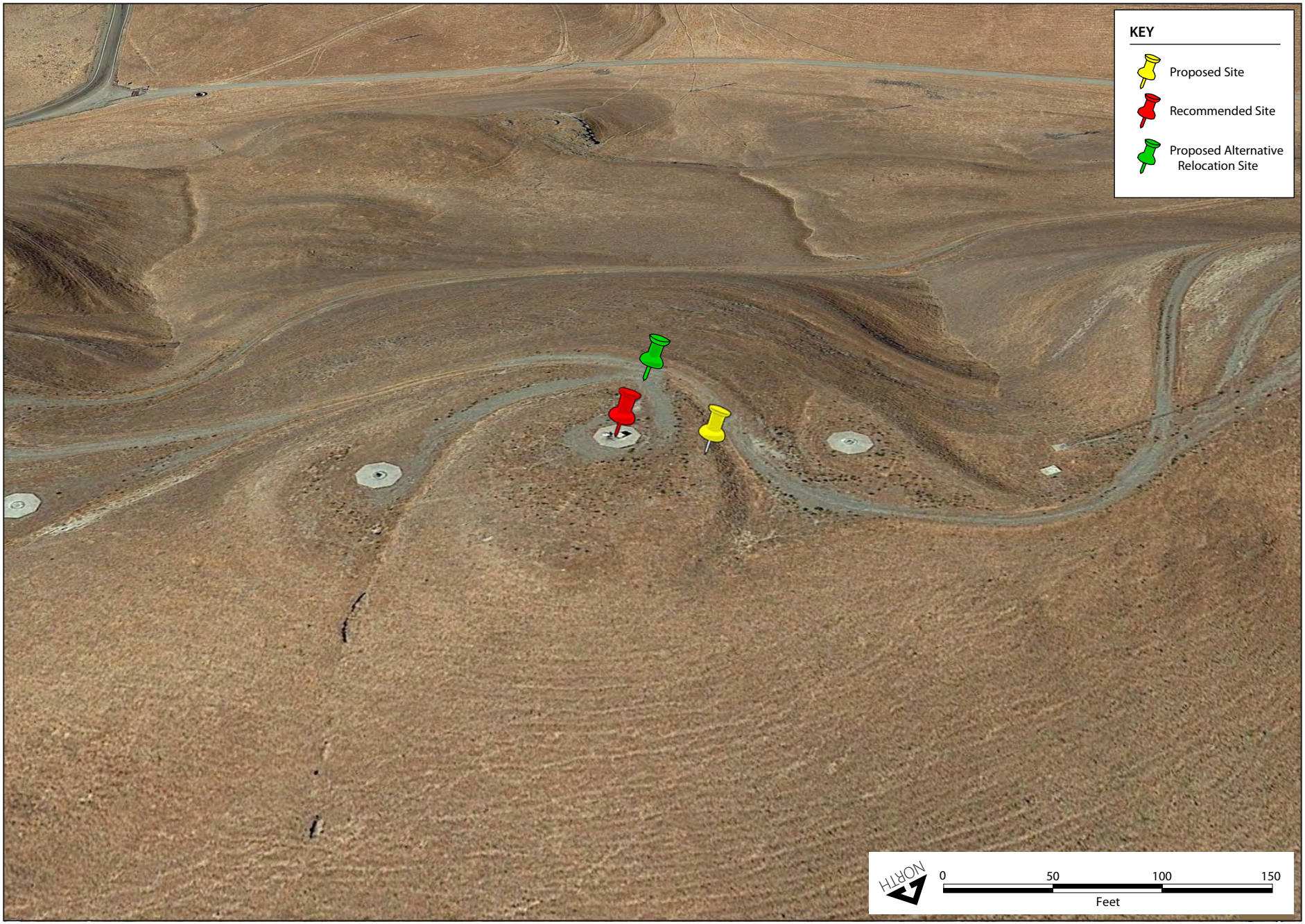


Plate 43. Looking south from the initially proposed Turbine 14 location, looking upslope to top of ridge.

Plate 44. Looking west from the initially proposed Turbine 14 location. Note the access road below the site, followed by an elevation drop to next old generation turbine pad on the edge of the deep swale.

Plate 45. Looking south from recommended site on top of the ridge.



05/03/2020

SOURCE: Google Earth 2020.

Figure A-14
Location of Proposed and Recommended Sites for Turbine 14 at the Mulqueeney Wind Project

Turbine 15

Topographical Description

The Turbine 15 site is located on a north-south-oriented ridgeline along an old-generation turbine string (Figure A-15). The ridge top, 40- to 50-feet wide, is relatively flat with slight descending slopes northward and southward from the proposed site. From the proposed site, the west-facing slope descends gently (10%) into a broad swale (Plate 46). On the east, the slope is greater (25% to 30%), descending into a broad basin. The site is along the access road, which extends along the ridgeline just below the top of the ridge (Plates 47 and 48). The surrounding topography is relatively low elevation and less hilly, particularly to the north and west. Elevation and topographical complexity increase further west, south, and northwest. Topographic features that may influence raptor movement and use of the area include the broad, open swale west of the site and the slopes along the ridge, which are ideal for contour hunting at this location.

Proximity to Other Potential Risk Factors

The site is within 0.2 miles of the creek channel paralleling Patterson Pass Road that supports riparian habitat and suitable raptor nesting habitat. An active golden eagle nest is along this channel approximately 0.63 miles southwest of the turbine site. Low level of golden eagle activity was recorded near this site during raptor use surveys. Kernel density analysis places it in the second lowest use zone. There is also a transmission line corridor 0.43 miles south of the site with towers capable of supporting raptor nests, including golden eagles. There are no other perching sites, nesting habitat, or conditions that encourage ground squirrel activity (e.g., rock piles, spoils areas, drainages) in the immediate vicinity and no ground squirrel activity was noted near the site.

Risk Determination and Recommendation

Risk is considered moderate at the proposed Turbine 15 site. Its location on a slope below the top of the ridgeline contributes to risk. Also, construction of the turbine pad at this location would result in a large slope bench or broad notch in the ridgeline, both of which contribute to risk. Existing roads will access the site, which will require expansion in order to accommodate material deliveries to the site; however, because the existing access road is on the ridgetop and no spur roads are necessary, this work is not expected to influence raptor movement through the site.

Risk can be reduced slightly by moving the site upslope and to the east 42 feet to the top of the ridge at and old-generation turbine pad at 37.698758° -121.579847°. This moves the site to the top of the ridge and off of the slope.

Response to Recommendation and Alternative Relocation

Mulqueeney Wind selected an alternative site approximately 21 feet west-southwest of the recommended site at 37.698729° -121.579914° (Figure A-15).

Risk Determination and Recommendation for Alternative Relocation

Risk is considered similar to the recommended site. Also, the size of the turbine and the turbine pad may alleviate any substantial differences between the different proposed and recommended locations. It's likely that the entire area that encompasses the three alternative sites will be within the pad construction zone, and as long as the turbine is on the top of the ridge, the risk associated with the turbine would be the same for all three locations.

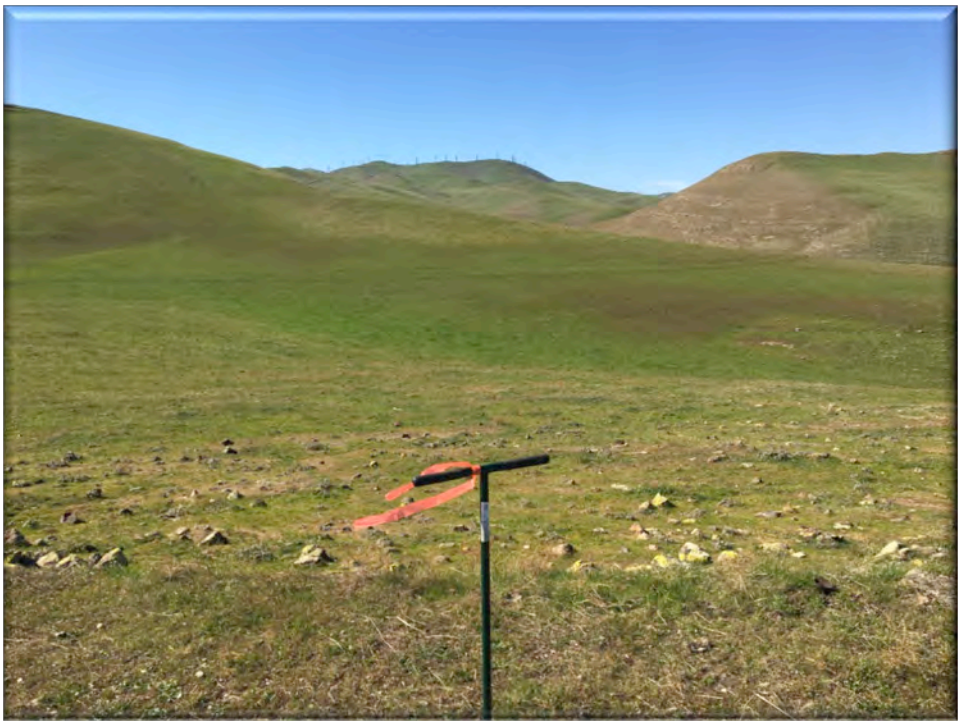


Plate 46. Looking west from the initially proposed Turbine 15 location toward a broad swale.

Plate 47. Looking north along the descending ridgeline. The recommended location is to the right (east) to the top of the ridge.

Plate 48. Looking south along descending ridgeline. The turbine was initially sited along the access road. The recommendation is to move the site to the top of the ridge on the left. The proposed alternative relocation site is on the left side of the photo, 21 feet from the recommended site.

05/03/2020

SOURCE: Google Earth 2020.

Figure A-15
Location of Proposed and Recommended Sites for Turbine 15 at the Mulqueeney Wind Project

Turbine 16

Topographical Description

The Turbine 16 site is located on a low-elevation, descending, southwest-northeast-oriented ridgeline surrounded by higher elevation features to the west, east, and south (Figure A-16). The rounded and shallow ridge descends from south to north with a 10% slope into an area of other low elevation foothills. The slopes on the west and east descend into swales before rising up into higher elevation hills and ridges (Plates 49, 50, and 51). Topographical features that may influence raptor movement include the descending ridge, the parallel swales on each side of the ridge, and the higher surrounding hills.

Proximity to Other Potential Risk Factors

There are no perching sites, nesting habitat, or conditions that encourage ground squirrel activity in the immediate vicinity of the site, and no areas of ground squirrel concentration was noted near the site. There is a transmission line corridor 0.4 miles north of the site, with towers that provide potential perching and nesting habitat for raptors, including golden eagles. The nearest potential tree-nesting habitat is 0.63 miles southeast of the site along the creek that parallels Patterson Pass Road. The nearest golden eagle nest is also along this creek, 0.78 miles southeast of the site. Low level of golden eagle activity was recorded near this site during raptor use surveys. Kernel density analysis places it in the second lowest use zone.

Risk Determination and Recommendation

Risk is considered High at the proposed Turbine 16 site due to its location below the elevation of surrounding hills, and its location on a descending slope. Raptor movement is expected to be downslope from the higher elevations, ridge to ridge flight, and ascending flight patterns to gain altitude, all of which potentially increase the opportunity for birds to fly at the altitude of the rotor plane. Because the turbine would be below the elevation of the surrounding hills, birds flying above the surrounding hills to cross through this area would be within the rotor plane of the turbine. Construction of the turbine pad would result in a large bench in the slope of the ridge, and new road construction would be required to access the site, both of which could influence local raptor movement across the ridge and along the slopes.

There is no recommendation for local movement of this turbine site that would be expected to decrease risk.

Response to Recommendation and Alternative Relocation

Due to wake issues associated with the recommended site, Mulqueeney Wind selected an alternative site 286 feet north-northeast of the initial site at 37.696952° -121.602512° (Figure A-16).

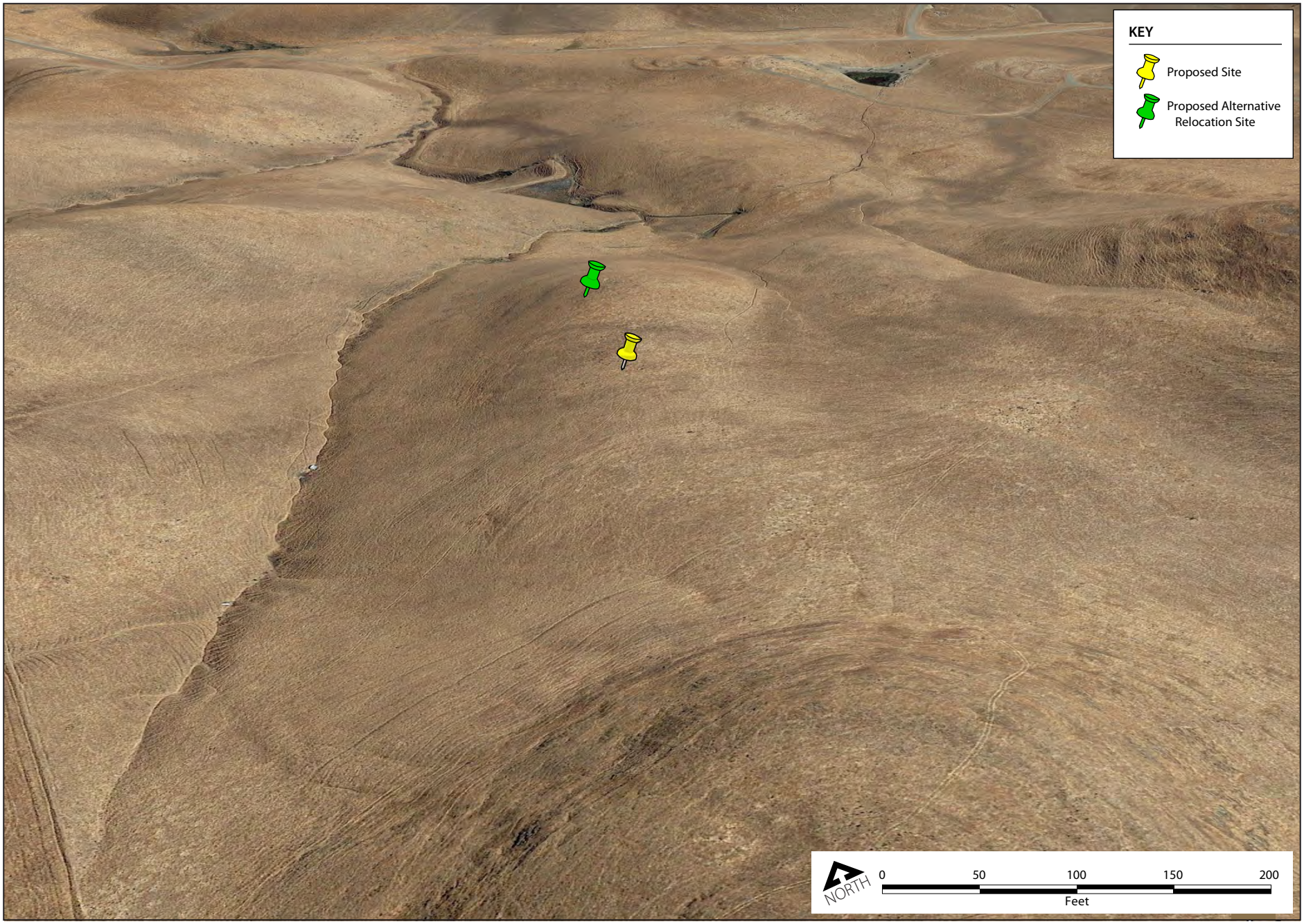
Risk Determination and Recommendation for Alternative Relocation

The alternative relocation site is further downslope along the descending ridge and closer to converging swales (Figure A-16). The selected site is also considered a High-risk location. There is no recommendation for local movement of this alternative turbine site that would be expected to decrease risk.

Plate 49. Looking upslope from the initially proposed Turbine 16 location along the south-north-oriented ridge. Note the higher elevation surrounding hills.

Plate 50. Looking west from the initially proposed Turbine 16 site. Note the sloping ridge, and the higher surrounding topography.

Plate 51. Looking west toward the Turbine 16 location. The initially proposed site is on the descending slope in the center of photo. The proposed alternative relocation site is further down this ridge slope on the right.



05/03/2020

SOURCE: Google Earth 2020.

Figure A-16
Location of Proposed and Recommended Sites for Turbine 16 at the Mulqueeney Wind Project

Turbine 17

Topographical Description

The Turbine 17 site is located on the top of a hill along a short (five turbines) old-generation turbine string (Figure A-17). The site is on the top of the hill with the old turbine string extending downslope to the north and south. The site is surrounded on all sides by steep slopes from 25% to 40%. To the west and south, the slopes are steeper and descend toward deep ravines. To the north, the slighter slope extends into a broader, low elevation basin. The existing access road ascends the hill along the south and west sides creating a narrow bench in the slope (Plates 52 to 54). Topographical features that may influence raptor movement include the slopes surrounding the hill, the adjacent ravines, and the lower elevation landforms to the north, which likely provide more abundant prey resources and receive greater use by raptors.

Proximity to Other Potential Risk Factors

There are no perching sites, nesting habitat, or conditions that encourage ground squirrel activity in the immediate vicinity of the site and no areas of ground squirrel concentration was noted near the site. There is a transmission line corridor 0.48 miles north of the site, and the nearest suitable nesting habitat is approximately 0.5 miles southeast of the site along the drainage that parallels Patterson Pass Road; the nearest golden eagle nest is about 0.61 miles southeast of the site along this same drainage. Low level of golden eagle activity was recorded near this site during raptor use surveys. Kernel density analysis places it in the second lowest use zone.

Risk Determination and Recommendation

Risk is considered Moderate at the proposed Turbine 17 site due to its proximity to steep slopes surrounding the site. The rotors will extend over the slopes in all directions. Access to the site would require road improvements along the existing road and an approximately 400-foot-long spur road, which would create a bench on the east-facing slope, potentially influencing raptor movement through the site. A slight improvement to risk can be achieved by moving the turbine 41 feet northeast to center the turbine onto the flat area of the hill top further away from steep slopes.

Response to Recommendation and Alternative Relocation

Due to wake issues associated with the recommended site, Mulqueeney Wind selected an alternative site approximately 37 feet south of the recommended site at 37.695822° -121.599983° (Figure A-17).

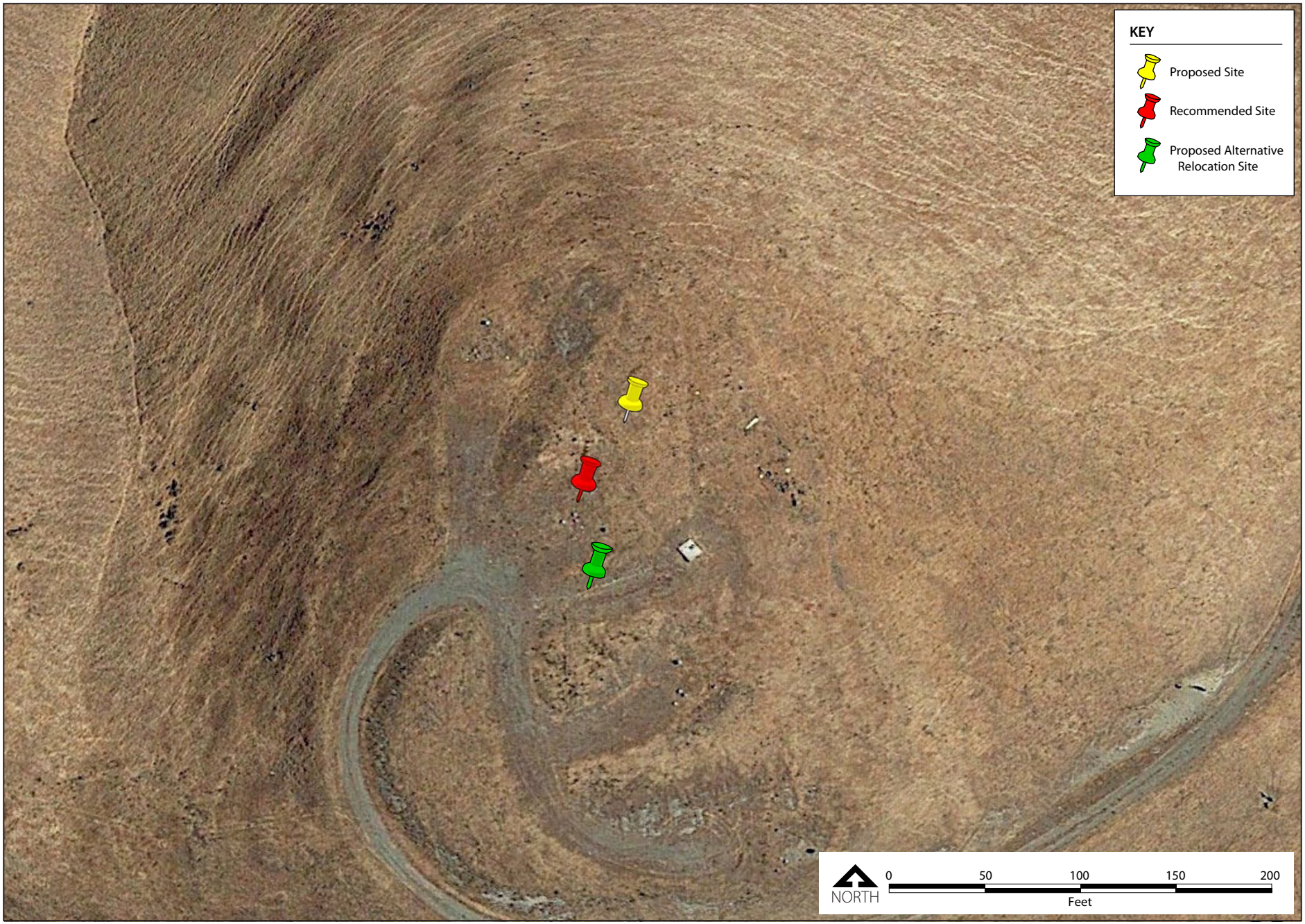
Risk Determination and Recommendation for Alternative Relocation

Risk is considered similar to the recommended site.

Plate 52. Looking south from the initially proposed Turbine 17 location.

Plate 53. Looking east from the initially proposed Turbine 17 location.

Plate 54. Looking southeast along the east-facing slope.



05/03/2020

SOURCE: Google Earth 2020.

Figure A-17
Location of Proposed and Recommended Sites for Turbine 17 at the Mulqueeney Wind Project

Turbine 18

Topographical Description

The Turbine 18 site is located along a south-north-oriented descending ridge along an old-generation turbine string (Figure A-18). The top of the ridge is fairly broad, between 200 and 300-feet-wide, and descending northward along most of its length. Small benches in the ridge slope occur at regular intervals where the pads for the old generation turbine string were constructed. The proposed site is just below (north of) the high point on the ridge. The ridge slopes steeply (30 to 40%) on the east toward a deep swale. On the west, the slope is less steep, gradually descending into a shallow ravine. The immediately surrounding area is characterized by multiple similar, parallel south-north descending slopes. Elevation increases rapidly to the south and west (Plates 55-57). Topographical features that may influence raptor movement include the higher elevation hills to the south and west, descending slope along the ridge, slopes on the west and east of the ridge, and the adjacent parallel swales, which converge at the south end of the ridge.

Proximity to Other Potential Risk Factors

There is a meteorological tower 112 feet east of the proposed turbine location that provides perching opportunities for raptors, which would be removed. The nearest potential nest trees are along small drainages 0.2 miles west and 0.36 miles east of the site. A transmission line corridor, which provides perching and nesting opportunities for raptors, is 0.38 miles south of the site. There are no other perching sites, nesting habitat, or conditions that encourage ground squirrel activity in the immediate vicinity of the site. However, the small basin just east of the site was one of only three areas within the project area that ground squirrels were documented during the assessment. The nearest reported golden eagle nests are 1.4 miles east of the site and 1.8 miles west of the site. Low to moderate level of golden eagle activity was recorded near this site during raptor use surveys.

Risk Determination and Recommendation

Risk is considered Moderate-High at the proposed Turbine 18 site due to its location on a descending ridgeline and on a slope below the top of the ridge. The broad, generally flat ridge top moderates the risk somewhat. More importantly, however, is the proximity to the higher elevation hills to the west and south. Birds flying across these hills eastward or northward will fly at the altitude of the rotor plane. An existing road would be used to access the site, which would require expansion to accommodate material deliveries. This would require substantial earth moving and an expansion of the existing slope bench, which could influence raptor movement and may increase risk.

A slight improvement can be achieved by moving the turbine south 102 feet to the high point on the ridge at 37.683212° -121.612009°. However, risk would still be considered Moderate-High.

Response to Recommendation and Alternative Relocation

Due to wake issues associated with the recommended site, Mulqueeney Wind selected an alternative site approximately 144 feet south of the recommended site at 37.682827° -121.611872° (Figure A-18).

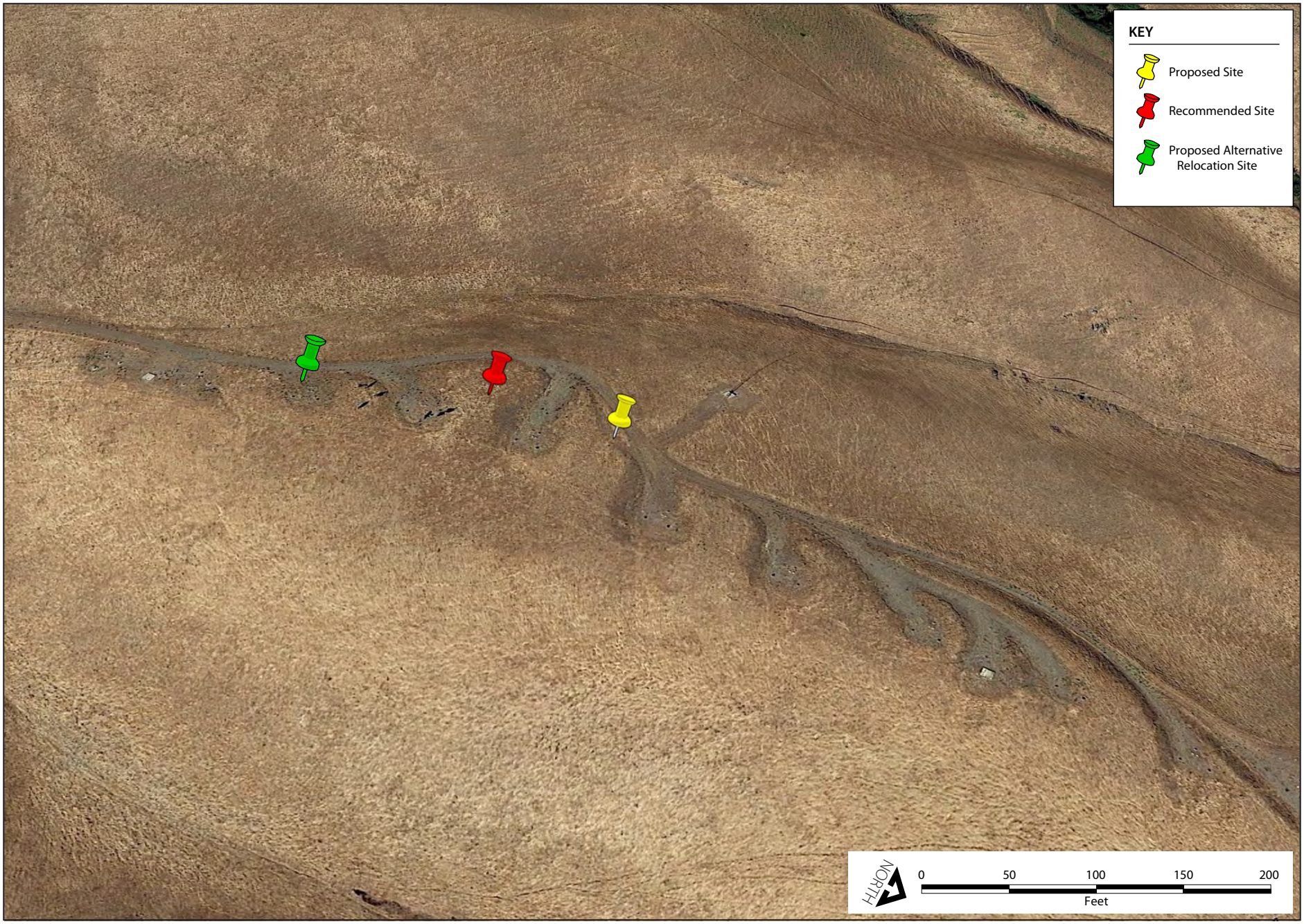
Risk Determination and Recommendation for Alternative Relocation

The new site remains on the ridgetop with risk considered similar to the recommended site.

Plate 55. Looking northwest from the initially proposed Turbine 18 location. Note the location on a descending slope; however, the ridge top is generally flat and broad. A meteorological tower is in the background. Also note the higher elevation hills to the west. As birds fly eastward over these hills, they will fly at the altitude of the rotor plane.

Plate 56. Looking northeast from the initially proposed Turbine 18 location. Beyond the edge of the ridge top, the steep slope descends into a deep swale.

Plate 57. Looking south from the initially proposed Turbine 18 location. Note the higher elevation hills to the south. Birds flying northward across these hills will fly at the altitude of the rotor plane.



05/03/2020

SOURCE: Google Earth 2020.

Figure A-18
Location of Proposed and Recommended Sites for Turbine 18 at the Mulqueeney Wind Project

Turbine 19

Topographical Description

The Turbine 19 site is located near the upper south end of a south-north descending ridge along an old-generation turbine string (Figure A-19). The ridge descends northward at about 10%. The east slope of the ridge is fairly steep with a 35% slope, descending into a deep gorge. The west slope is slightly less steep (30%) and descends into a deep swale that parallels the ridgeline. The proposed turbine location is just below the highest point on the ridge. Similar to Turbine 18, the surrounding topography consists of low elevation ridges and ravines/swales that descend northward toward Patterson Pass Road, with higher elevation lands eastward (Plates 58, 59, and 60). Similar to Turbine 18, topographical features that may influence raptor movement include the descending slope along the ridge, slopes on the west and east of the ridge, and the adjacent parallel swales/ravines, which converge at the south end of the ridge.

Proximity to Other Potential Risk Factors

There is a meteorological tower 0.22 miles northwest, which would be removed, and a transmission line corridor 0.19 miles south of the proposed turbine location that provide perching and potential nesting opportunities for raptors. The nearest potential nest trees are along a small drainage 0.22 miles east of the site. There are no other perching sites, nesting habitat, or conditions that encourage ground squirrel activity in the immediate vicinity of the site. However, the small basin just west of the site was one of only three areas within the project area where multiple ground squirrels were documented during the assessment. The nearest reported golden eagle nests are 1.3 miles northeast and 1.8 miles southeast of the site. Low-to-moderate level of golden eagle activity was recorded near this site during raptor use surveys.

Risk Determination and Recommendation

Risk is considered Moderate-High at the proposed Turbine 19 site due to its location on a slightly descending ridgeline on a slope below the top of the ridge; but mainly because, like Turbine 18, the site is at the base of a rapid elevational increase to the west and south. Raptors flying northward or eastward over these hills will be at the altitude of the rotor plane. Construction of the turbine pad would result in a bench in the upper part of the southeast-facing slope just below the ridgetop. Access to the site would require road improvements along the existing road, which would require substantial earth moving and an expansion of the existing slope bench, which could influence raptor movement. A slight improvement to risk can be achieved by moving the turbine southwest 62 feet to the high point on the ridge at 37.681333° -121.609570°. However, risk would still be considered Moderate-High.

Response to Recommendation and Alternative Relocation

Mulqueeney Wind selected the recommended location for Turbine 19.

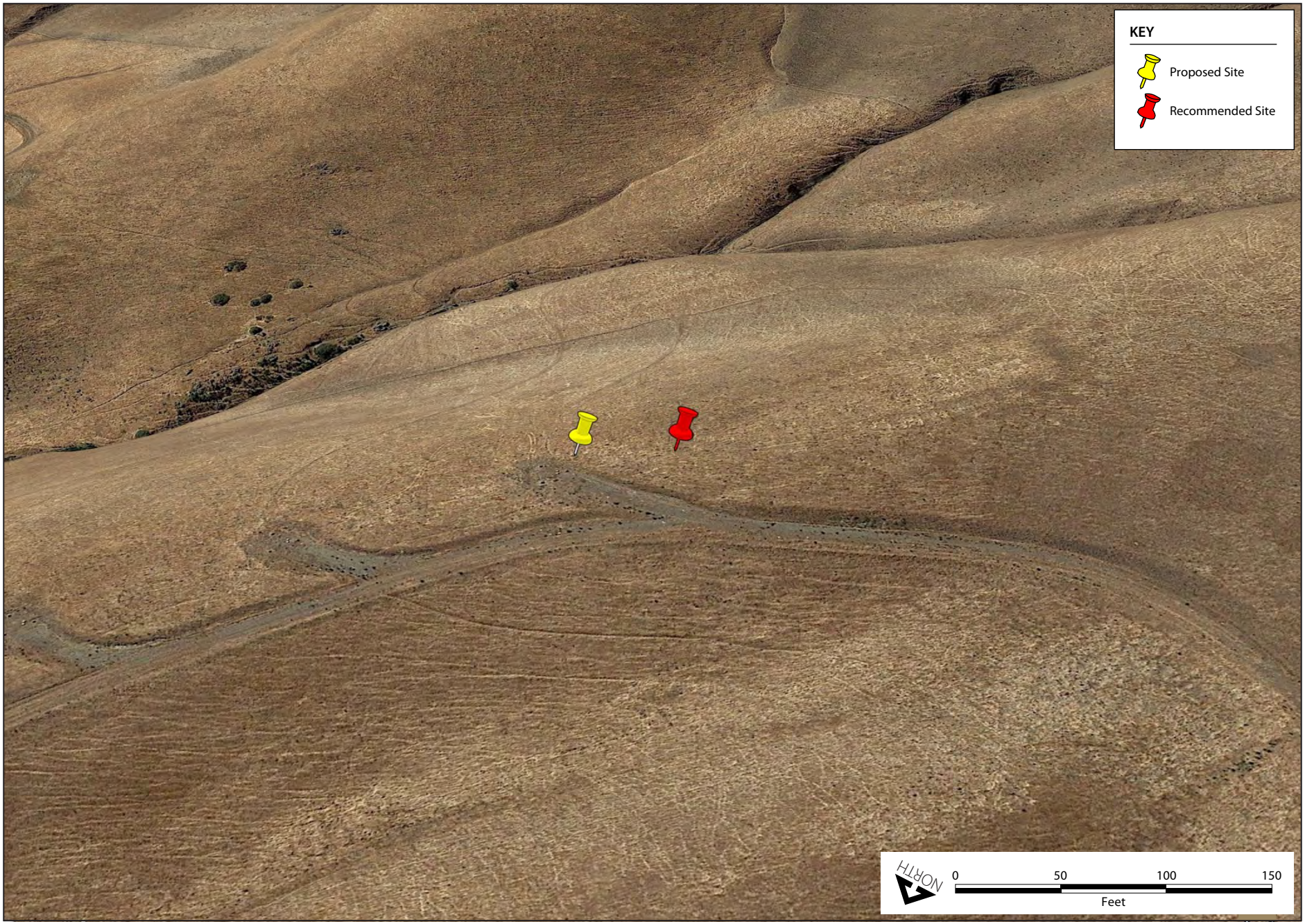
Risk Determination and Recommendation for Alternative Relocation

None.

Plate 58. Looking south from the initially proposed Turbine 19 location. The recommended location is to the right of the livestock. Note the higher elevation hills to the south and southwest.

Plate 59. Looking northwest from the initially proposed Turbine 19 location. Note the higher elevation hills immediately west of the site. Birds flying eastward across these hills will be at the altitude of the rotor plane.

Plate 60. Looking north-northeast from the initially proposed Turbine 19 location.



05/03/2020

SOURCE: Google Earth 2020.

Figure A-19
Location of Proposed and Recommended Sites for Turbine 19 at the Mulqueeney Wind Project

Turbine 20

Topographical Description

The Turbine 20 site is located on a generally flat ridge along an old-generation turbine string, and near the convergence of several deep swales, each of which ascends to the ridge top (Figure A-20). The site is on a flat, fairly broad part of the ridge, which separates two converging swales on the east side of the ridge. Slopes on the east are fairly steep (40%) and variable, including both east-facing slopes descending off of the ridge and slopes associated with the swales that extend laterally from the ridge and thus have north and south-facing slopes. The west side of the ridge has similar steep slopes and variable topography due to converging swales (Plates 61, 62, and 63). The ridge continues northward for about 400 feet with a slight descending slope before abruptly dropping toward the creek paralleling Patterson Pass Road. The surrounding topography is highly variable and relatively low elevation as the ridges descend toward the deep gorge paralleling Patterson Pass Road.

Proximity to Other Potential Risk Factors

The nearest potential nest trees are along the drainage paralleling Patterson Pass Road, approximately 0.22 miles north of the site. The nearest golden nest is along this drainage 0.37 miles north of the site. Moderate level of golden eagle activity was recorded near this site during raptor use surveys. Kernel density analysis places it in the intermediate use zone. There is also a transmission line corridor 0.29 miles south of the site with towers that provide perching and nesting opportunities for raptors, including golden eagles. There are no other perching sites, nesting habitat, or conditions that encourage ground squirrel activity in the immediate vicinity of the site and little to no ground squirrel activity was noted near the site. However, a new meteorological tower would be installed approximately 700 feet south of Turbine 20, creating a new potential perching structure for raptors.

Risk Determination and Recommendation

Risk is considered high at the proposed Turbine 20 site due to its location near the convergence of multiple deep swales and close proximity to an active golden eagle nest. The site itself is on flat ground on a fairly broad portion of the ridge top, but the presence of the ascending swales is expected to influence bird movement and potentially increase risk at and near the point of convergence on the ridge top. This is also a relatively low elevation area and birds may engage in ascending flight patterns to reach altitude in order to reach or cross the higher elevation hills to the south and north. During the site evaluation, a golden eagle was observed in a circling flight pattern, gradually increasing altitude from below the ridge line to above the ridge line and passing through the rotor plane of the proposed turbine. The close proximity of this turbine to the golden eagle nest along the creek paralleling Patterson Pass Road also increases risk to those nesting birds. Access to the site would require road improvements along the existing road, which would require substantial earth moving and expansion of the existing road bench along the slope leading to the ridge top.

There are no recommended alternative locations for this site that would reduce potential risk.

Response to Recommendation and Alternative Relocation

Mulqueeny Wind selected a new site for Turbine 20 approximately 805 feet southwest of the original location at 37.686347° -121.592045° (Figure A-20). The site is on an east-west-oriented ridge, lateral to the north-south-oriented ridge where the original Turbine 20 is sited.

Risk Determination and Recommendation for Alternative Relocation

The site is along an access road on the ridge top, which leads to a small turbine string on the far western edge of the ridge. The ridge top is fairly broad, with steep slopes (30 to 40%) and straddling deep swales on the north and south, and ascending slightly westward (10-15%) toward the end of the ridge, where it drops steeply toward Patterson Pass Road, and eastward where it converges with the north-south-oriented ridge. With similar distances to suitable nesting and perching habitat, the site is further away from the golden eagle nest (0.51 miles) and further from the converging swales, and is thus considered less risky than the original Turbine 20 site (Plate 64).

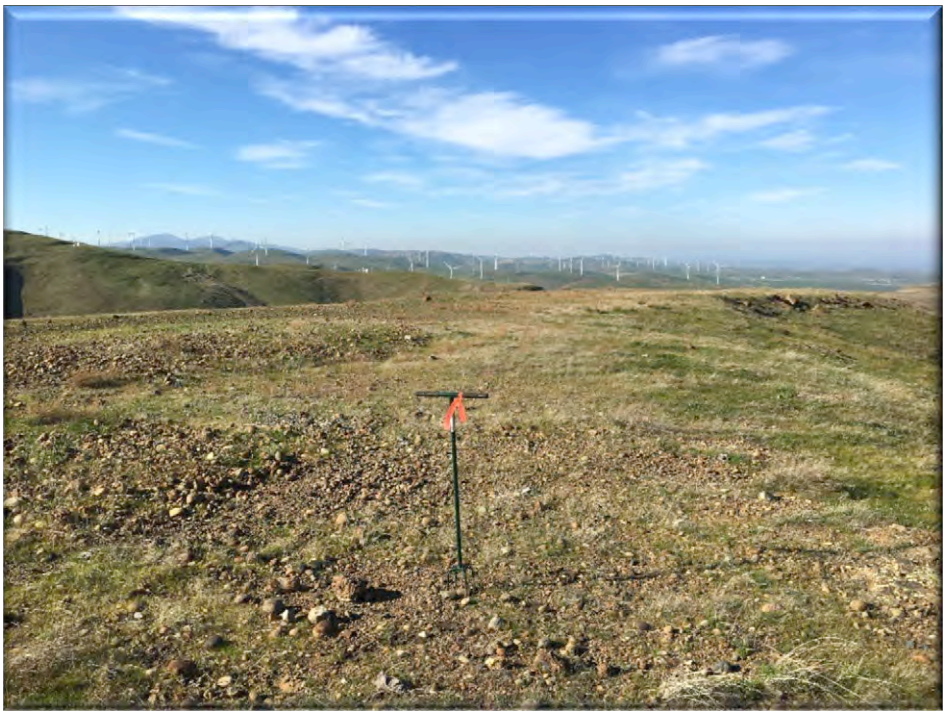


Plate 61. Looking north from the initially proposed Turbine 20 location. Note the flat ridge top.

Plate 62. Looking south from the initially proposed Turbine 20.

Plate 63. Looking northeast along east-facing slope of Turbine 20 ridge. The golden eagle nest is along the drainage near the center of the photo.

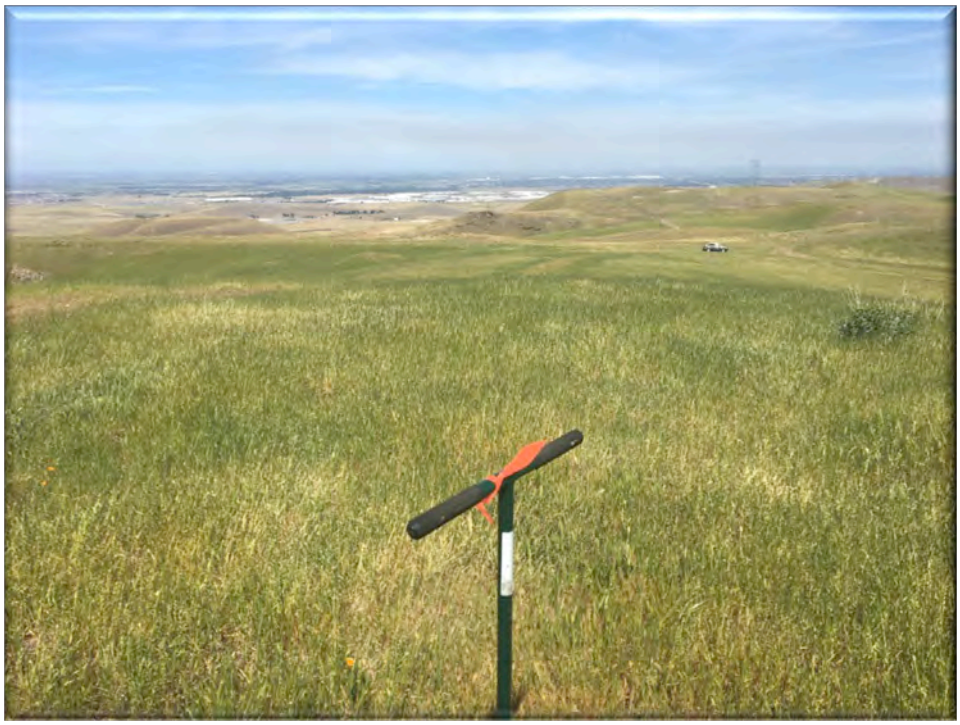
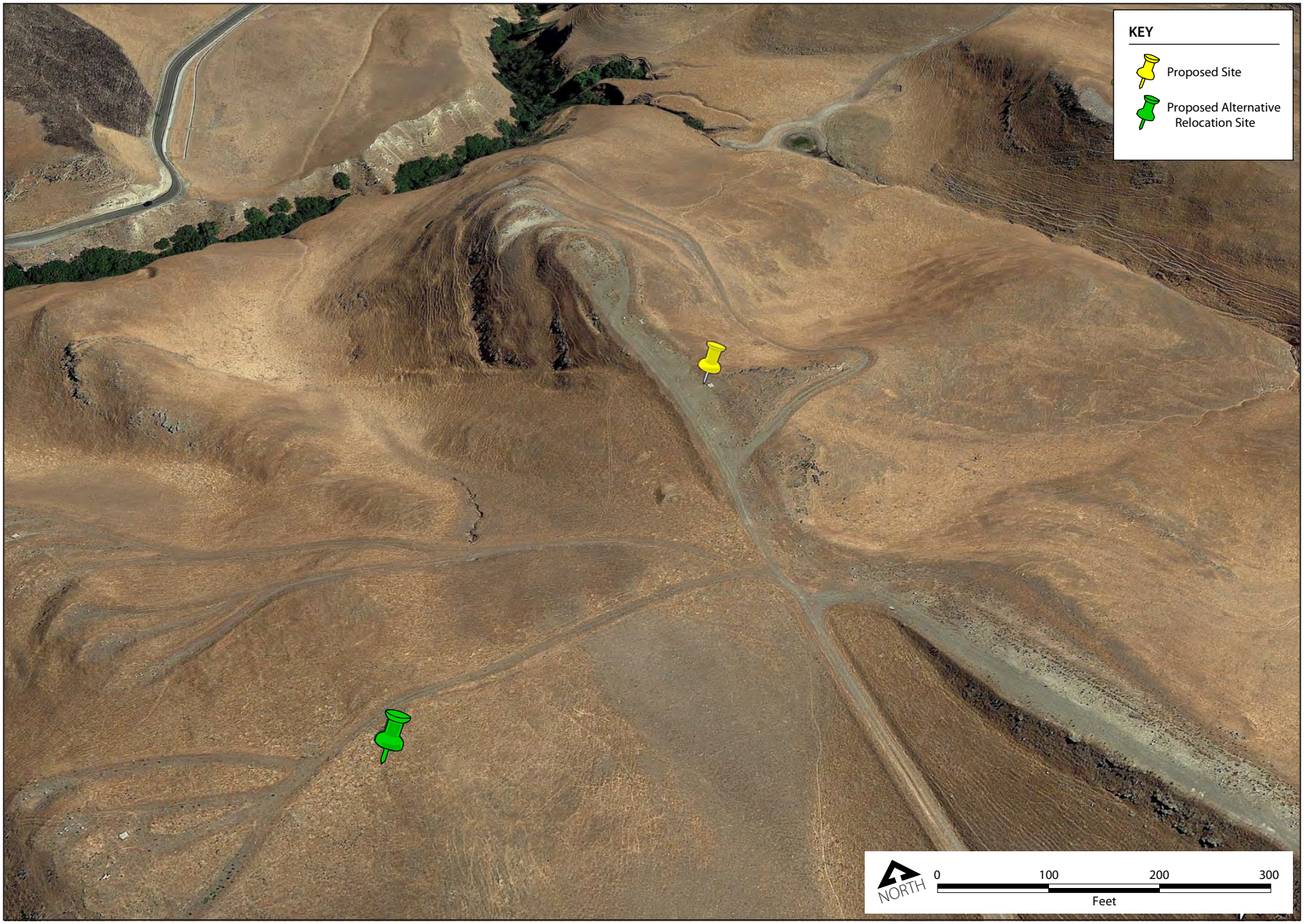


Plate 64. Looking east from alternative relocation site. The initially proposed site is on the small, low ridge in the middle right background of the photo where several deep swales converge.



05/03/2020

SOURCE: Google Earth 2020.

Figure A-20
Location of Proposed and Recommended Sites for Turbine 20 at the Mulqueeney Wind Project

Mulqueeney Ranch Wind Repowering Project

Appendix A-3. Assessment of Turbines 21 through 30

May 2020

Turbine 21

Topographical Description

The Turbine 21 site is located on the east-facing slope of a south-north oriented descending ridge (Figure A-21). Southward, the ridge ascends toward a higher elevation east-west-oriented ridge. The 30% east-facing slope descends toward a deep ravine. The flat portion of the hill top is about 130 feet wide. The surrounding topography generally drops in elevation to the north and east, and increases to the south and southwest (Plates 65, 66, and 67). Topographical conditions that may influence raptor movement include the slopes surrounding the ridge, which are ideal for contour hunting, and the higher elevation ridge to the south.

Proximity to Other Potential Risk Factors

The proposed turbine site is 0.21 miles west of a transmission line corridor, the towers of which provide perching and nesting habitat for raptors, including golden eagles. The nearest potential tree-nesting habitat is 0.8 miles southwest. There are no other perching sites, nesting habitat, or conditions that encourage ground squirrel activity in the immediate vicinity and no ground squirrel concentration areas were noted near the site. The nearest reported golden eagle nest is 1 mile southwest of the site. Low level of golden eagle activity was reported from the vicinity of this site during raptor surveys. Kernel density analysis places it in the lowest use zone.

Risk Determination and Recommendation

The Turbine 21 site is considered a high-risk site due to its location on a slope, along a descending ridge, and near a higher elevation ridge just south of the site. Birds flying across this ridge and flying along the north-south ridge or through the adjacent swale would encounter the rotor plane of the turbine within 700 to 800 feet of the crossing. An approximately 320-foot spur road would be constructed to access the site from the existing road, which would require expansion to accommodate material deliveries. Placement of the turbine at this location and construction of a spur road would create a bench in the slope, potentially influencing bird movement and further increasing potential risk.

There is no recommendation for movement of this site that would substantially reduce the risk. Risk could be reduced somewhat by moving the turbine off of the slope and on the top of the ridge; however, it would still be considered a high-risk site due to the close proximity to the higher elevation ridge and the location on a descending ridgeline.

Response to Recommendation and Alternative Relocation

Mulqueeney Wind selected the initially proposed site for Turbine 21.

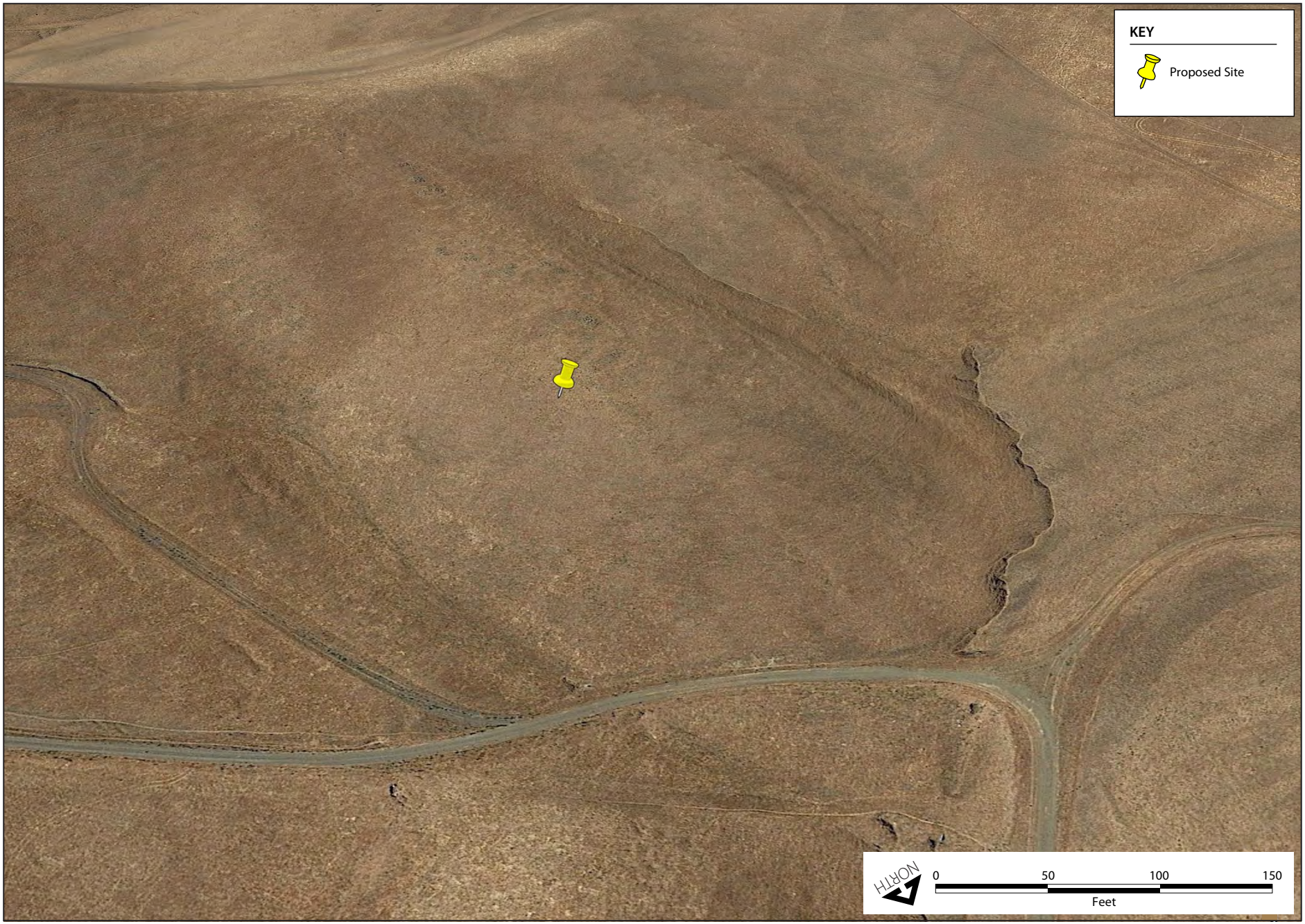
Risk Determination and Recommendation for Alternative Relocation

None.

Plate 65. Looking west, upslope, from Turbine 21 location.

Plate 66. Looking east from Turbine 21 location.

Plate 67. Looking south from Turbine 21 location. The lower elevation of the site poses a potential risk to birds flying across the higher elevation ridge to the south.



05/03/2020

SOURCE: Google Earth 2020.

Figure A-21
Location of Proposed and Recommended Sites for Turbine 21 at the Mulqueeney Wind Project

Turbine 22

Topographical Description

Turbine 22 is located on a west-facing slope along a small, low-elevation, northwest-southwest-oriented ridge with a former old-generation turbine string (Figure A-22). The site is just above the creek that parallels Patterson Pass Road. The small ridgetop is relatively flat with a steep (35%) northeast-facing slope descending into a ravine and a less steep (15-20%) west-facing slope gradually descending into a small basin. The site is in fairly close proximity to higher elevation ridges to the northeast, east, and south and lies near the convergence of three higher elevation ridges and associated swales/ravines (Plates 68 and 69).

Proximity to Other Potential Risk Factors

The proposed turbine site is 0.57 miles west of a transmission line corridor, the towers of which provide perching and nesting habitat for raptors, including golden eagles. The nearest potential tree-nesting habitat is along the creek that Parallels Patterson Pass Road, about 600 feet west of the site. The golden eagle nest along this creek is about 656 feet west of the site. Moderate-to-high level of golden eagle activity was reported from the vicinity of Turbine 22 during raptor surveys. Kernel density analysis places it in the second to highest use zone.

Risk Determination and Recommendation

The Turbine 22 site is considered a High-risk site due to its location on a slope and at the convergence of higher elevation ridges and lower elevation swales/ravines. Because of the complex topography in this area, lower elevation sites pose a significant risk to birds flying across the higher elevation ridgelines and those flying through the swales/ravines. Primary access to the site would be along an existing road; however, it would require substantial expansion to accommodate material deliveries to the site, and a short (approximately 60-foot) spur road would be required to access the turbine pad. Both the road and the turbine pad would create a bench in the south-facing slope, potentially increasing risk. The site is also considered high-risk due to the close proximity to an active golden eagle nest.

Moving the turbine 108 feet north to the top of the ridge along the old generation turbine string at 37.693109° -121.586942° would slightly improve potential risk; however, this would not alleviate the issue of the surrounding higher elevation and convergence of ridges and swales/ravines in the immediate area or place it further from the golden eagle nest. The site would still be considered High-risk.

Response to Recommendation and Alternative Relocation

Mulqueeney Wind selected an alternative site for Turbine 22 approximately 1,090 feet northeast of the original site at 37.694853° -121.584280° (Figure A-22).

Risk Determination and Recommendation for Alternative Relocation

The site is along a higher elevation ridge to the northeast along an old-generation turbine string. The site is on a flat, broad ridgetop that descends northwestward, near the top of an ascending swale that creates a slight saddle on the ridge, and with 30% slopes to the east and west (Plates 70 and 71). The site remains

in close proximity to an active golden eagle nest (0.29 miles), and thus, although the physical location is less risky compared with the original site, it is still a Moderate-High-risk site.

Plate 68. Looking north from initially proposed Turbine 22 location. The vehicle in the top right corner indicates the top of the ridge.

Plate 69. Looking west from initially proposed Turbine 22 location.

Plate 70. Looking north from proposed alternative relocation site for Turbine 22.

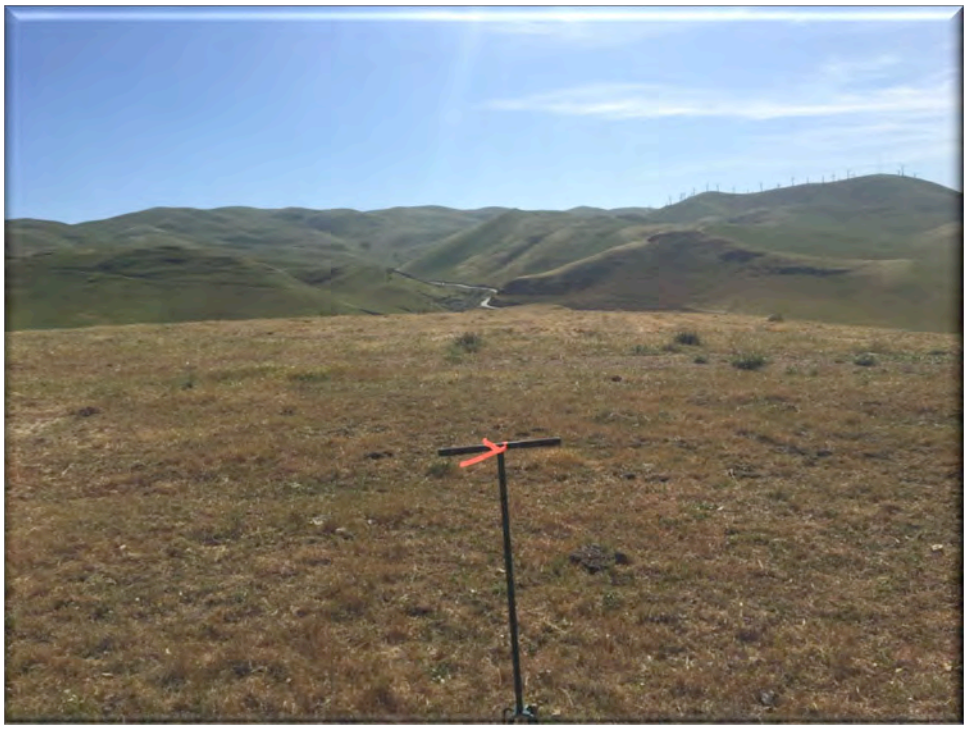
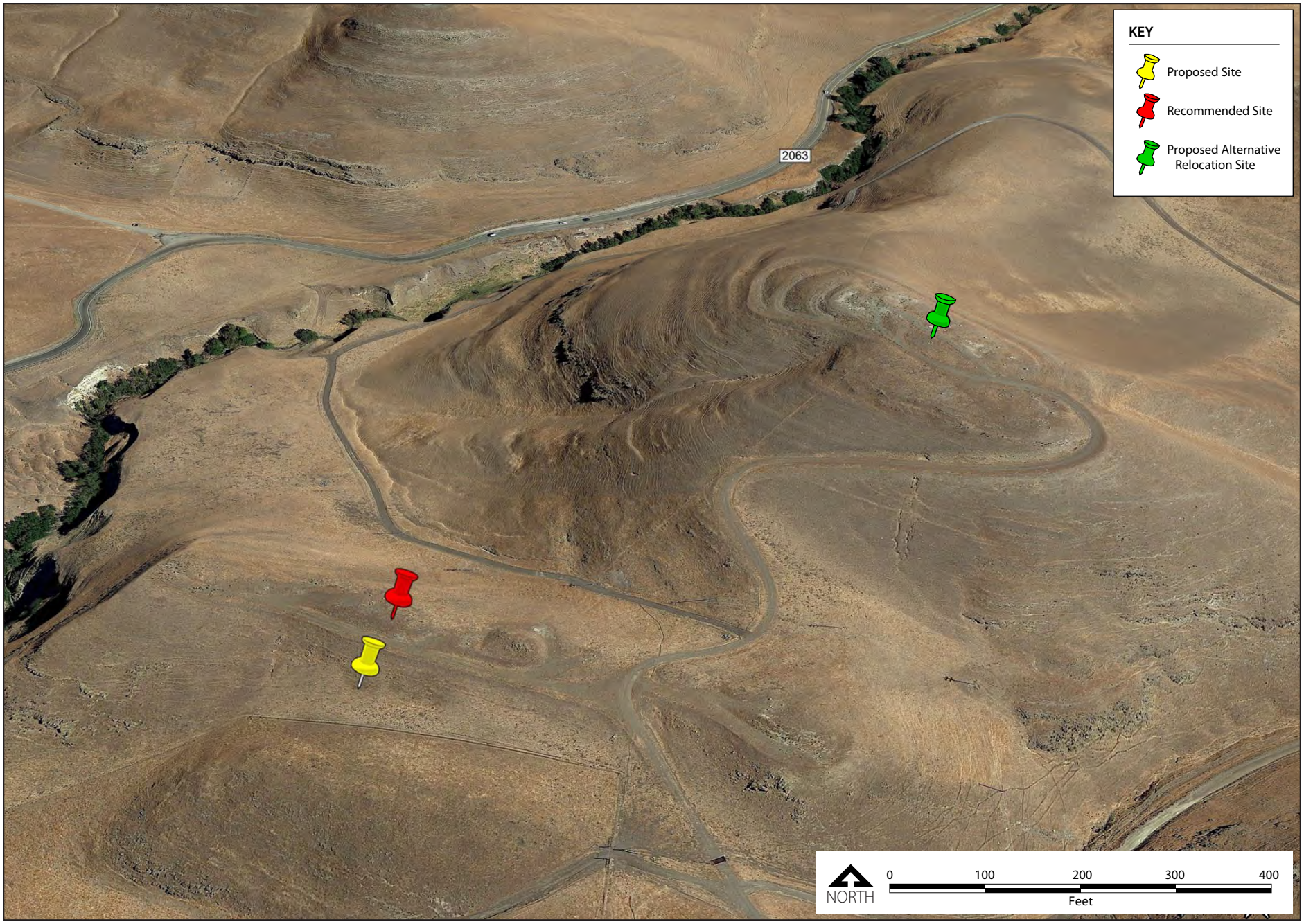


Plate 71. Looking west from proposed alternative relocation site for Turbine 22.



05/03/2020

SOURCE: Google Earth 2020.

Figure A-22
Location of Proposed and Recommended Sites for Turbine 22 at the Mulqueeney Wind Project

Turbine 23

Topographical Description

The Turbine 23 site is located at the south end of a north-south-oriented ridge along an old-generation turbine string (Figure A-23). The ridgeline is fairly flat but slightly descending northward. The approximately 100-foot-wide ridge top descends steeply (30 to 40% slopes) to the east, west, and south into deep ravines. A broad swale ascends toward the ridgetop from the east just north of the site creating a shallow saddle in the ridgeline. The surrounding topography is complex and variable, particularly to the west and south, with numerous intersecting ridges and swales/ravines. Eastward, elevation decreases and the topography less hilly toward the transition into the Central Valley (Plates 72, 73, and 74).

Proximity to Other Potential Risk Factors

The site is 0.31 miles northwest of a transmission line corridor with towers that provide perching and nesting opportunities for raptors, including golden eagles. The nearest potential tree-nesting habitat is less than 500 feet south in a small group of isolated trees, and 0.32 miles northwest along the creek paralleling Patterson Pass Road. There are no other perching or nesting opportunities in the immediate vicinity of the site. The Patterson Pass Road golden eagle nest is 0.65 miles southwest of the site. Low level of golden eagle activity was reported from the vicinity of Turbine 23 during raptor surveys. Kernel density analysis places it in the second lowest use zone.

Risk Determination and Recommendation

Risk is considered moderate at the proposed Turbine 23 site. Raptor use and movement in this area is expected to occur through the deep east-west gorge on the south below the turbine site and east-west ridge-to-ridge flights. However, use patterns are expected to be somewhat more widely dispersed in the vicinity of and east of the proposed site as topography is less vertical and more open. The shallow saddle in the ridge is not expected to increase risk due to the size of the turbine and altitude of the rotor plane. Existing roads will be expanded to access the site, but would not alter terrain sufficient to influence raptor movement.

There are no opportunities to move this turbine in the immediate vicinity that would result in a potential decrease in collision risk. The turbine is sited on the top of the ridge and although near a shallow saddle, is not within or near any risky topographical features along the ridgeline.

Response to Recommendation and Alternative Relocation

Due to the lack of suitable alternative locations, Mulqueeney Wind selected the initially proposed site for Turbine 23.

Risk Determination and Recommendation for Alternative Relocation

None.

Plate 72. Looking east from the initially proposed Turbine 23 location. Note the less hilly landscape eastward toward the Central Valley.

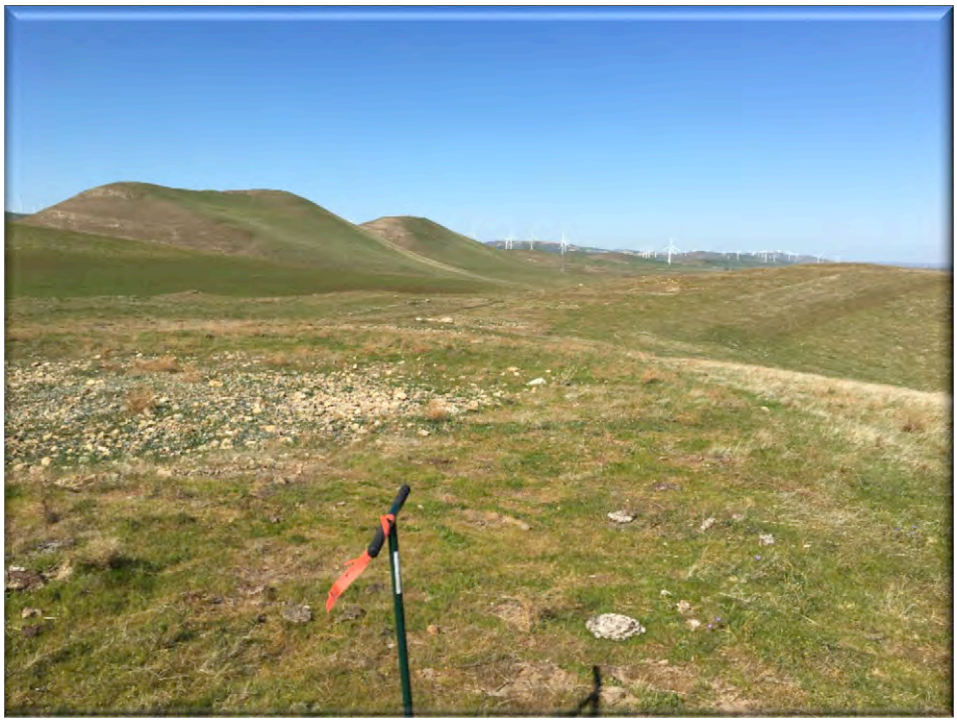


Plate 73. Looking north from the initially proposed Turbine 23 location. Note the generally flat ridgeline with the shallow saddle where the swale ascends toward the ridgetop on the right.

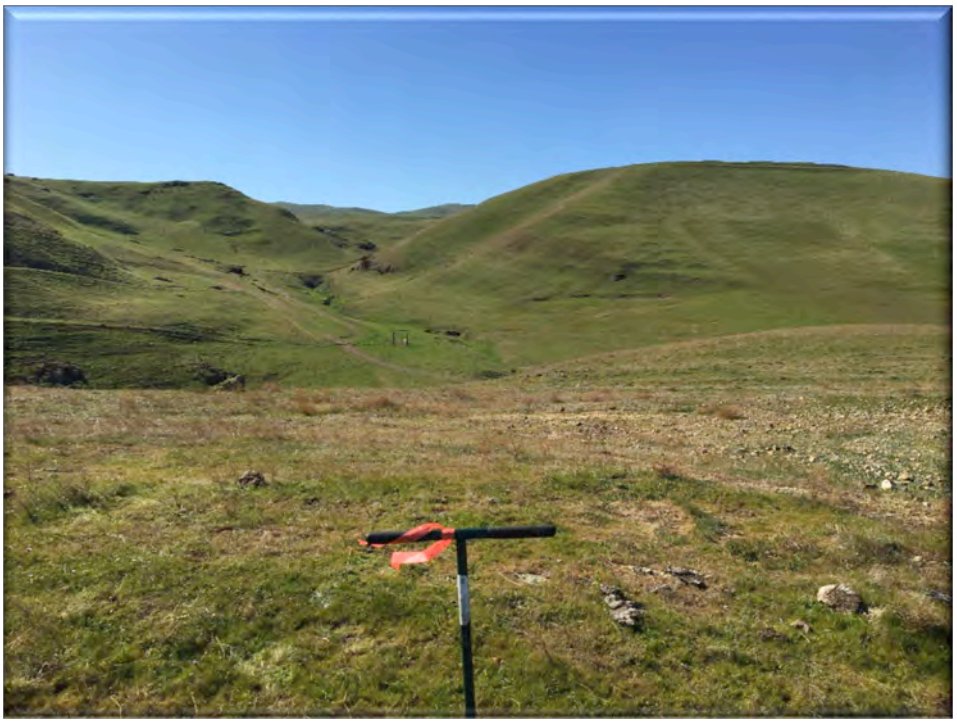
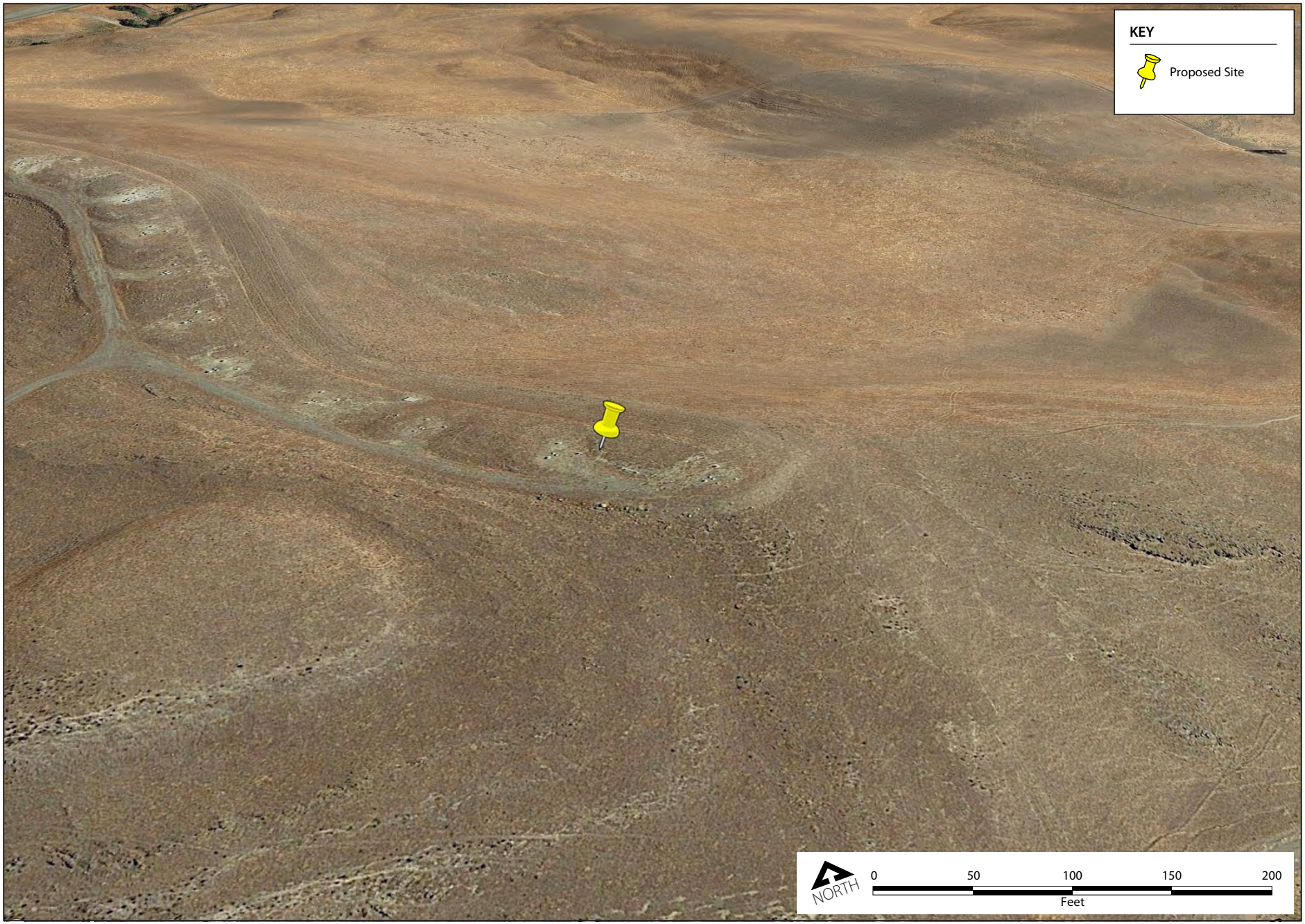


Plate 74. Looking west from the initially proposed Turbine 23 location. Note the steeper and more complex topography westward and the shallow saddle in the ridgeline just beyond the turbine marker.



05/04/2020

SOURCE: Google Earth 2020.

Figure A-23
Location of Proposed and Recommended Sites for Turbine 23 at the Mulqueeney Wind Project

Turbine 24

Topographical Description

The Turbine 24 site is on the east-facing slope of a south-north-oriented ridge (Figure A-24). The slope descends eastward with a 20-30% slope for 0.35 miles before reaching the bottom of a deep ravine. The turbine site is approximately 500 feet downslope of the ridgetop. The site is also between two east-west swales that ascend toward the ridgetop. Topographical conditions in vicinity of the proposed turbine site that may influence raptor movement are primarily associated the steep, broad south-facing slope, which is ideal for contour hunting (Plates 75 and 76).

Proximity to Other Potential Risk Factors

The site is 0.19 miles southeast of a transmission line corridor with towers that provide perching and nesting opportunities for raptors, including golden eagles. The nearest potential tree-nesting habitat is 1.2 miles northwest along the creek paralleling Patterson Pass Road. There are no other perching or nesting opportunities or conditions that encourage ground squirrel activity in the immediate vicinity of the site and no ground squirrel activity was noted near the site. The nearest golden eagle nest is the Patterson Pass Road nest, which is 1.23 miles northwest of the site. Low level of golden eagle activity was reported from the vicinity of Turbine 24 during raptor surveys. Kernel density analysis places it in the lowest use zone.

Risk Determination and Recommendation

The Turbine 24 site is considered high risk due to its location on a steep slope, far below the ridgetop. Raptors using the slope to contour hunt or flying through or across the broad slope and low-elevation basin could encounter the rotor plane of the turbine. An approximately 445-foot-long spur road would be constructed from the existing access road, which would be expanded, to the turbine pad. Construction of this spur road and the turbine pad would create a large bench in the slope, creating additional potential risk. Placing a turbine on a slope would also reduce the distance between the ground and the rotor plane, creating additional risk to birds that contour hunt along the slope or that cross the ridge to the west. Because the slope is so broad and the turbine located so far down the slope, there are no opportunities for local movement to reduce risk. Risk can be reduced by relocating the turbine 570 feet southwest to the top of the ridge at 37.677488° -121.576626°. At this location, the turbine would be off of the slope and on top of the ridge. The recommended location is considered a Moderate-risk site.

Response to Recommendation and Alternative Relocation

To move further from a transmission line, Mulqueeney Wind selected an alternative site 925 feet northeast of the original site at 37.680816° -121.573633° (Figure A-24).

Risk Determination and Recommendation for Alternative Relocation

This site is 922 feet downslope to the northeast from the original site and at the convergence of two swales (Plate 77). It's on a low elevation knoll that descends toward to the east to a broad bench before dropping steeply into a deep ravine. To the west and southwest is a steep ascent toward the initial turbine location (Plate 78). This site is also considered High risk due to the location at the base of a steep hill

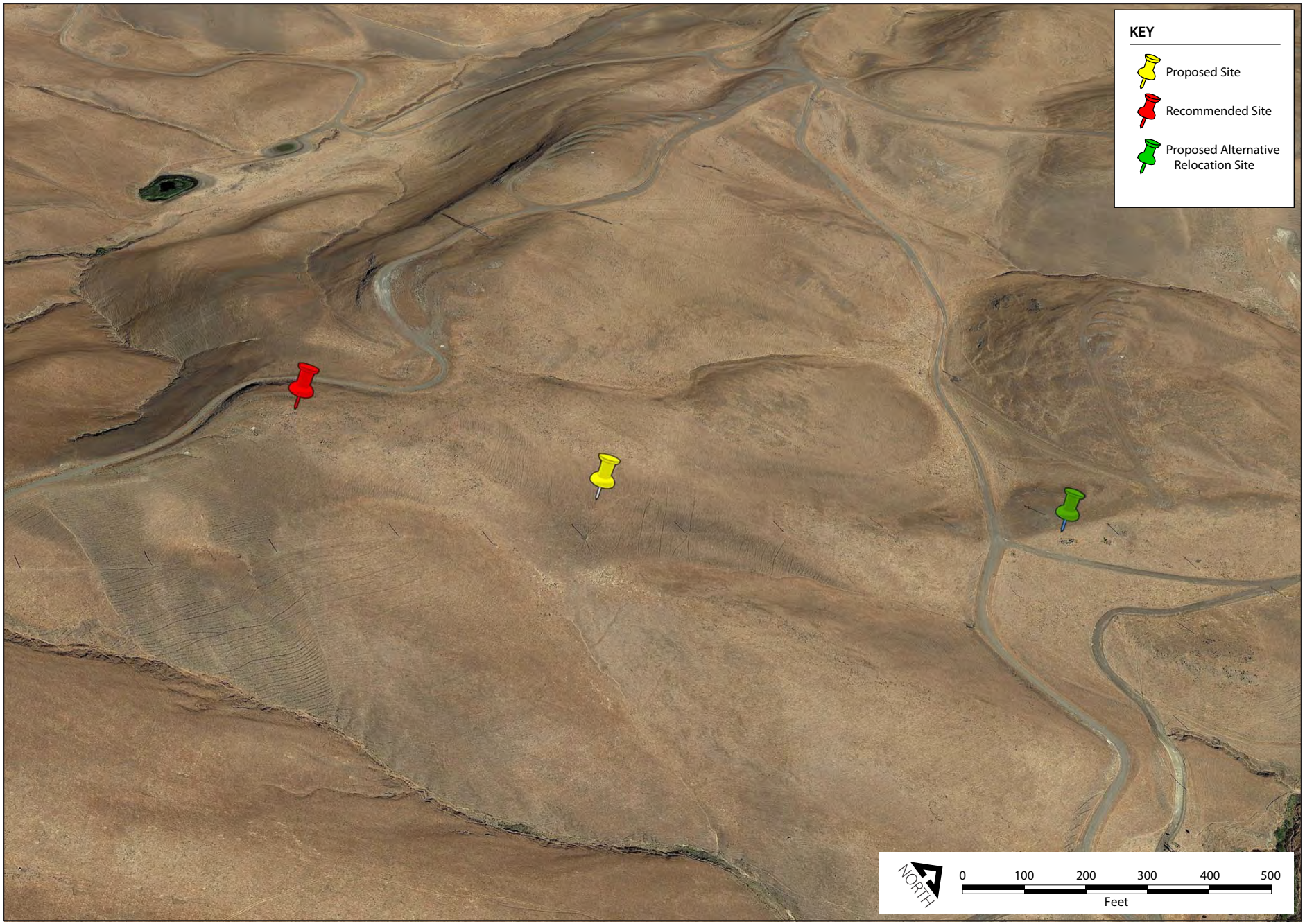
slope and at the convergence of two deep swales. There are no opportunities for local movement that would decrease this risk.

Plate 75. Looking west, upslope, from the initially proposed Turbine 24 site. The recommended relocation site is at the top of this ridge.

Plate 76. Looking north from initially proposed Turbine 24 site.

Plate 77. Looking northeast from the initially proposed Turbine 24 site. The proposed alternate relocation site is on the low hill downslope on the left side of the photo

Plate 78. Looking southwest from the proposed alternative relocation site near the base of a high ridge and near the confluence of two ascending swales. The initially proposed location is on the northeast-facing slope in the background and the recommended location is on the ridgetop.



05/04/2020

SOURCE: Google Earth 2020.

Figure A-24
Location of Proposed and Recommended Sites for Turbine 24 at the Mulqueeney Wind Project

Turbine 25

Topographical Description

The Turbine 25 site is located at the far north end of relatively short southeast-northwest-oriented ridge (Figure A-25). The site is on the ridgetop above a steep southwest-facing slope. The ridgetop ascends slightly toward the southeast for about 300 feet before descending toward the southern end of the ridge. The ridgetop is 80- to 90-feet wide with steep 40% slopes – to the east, west, and north, descending into deep gorges (Plates 79 and 80). The access road along the west side of the ridgetop creates a berm just below the apex of the ridge, creating the potential for slope-accelerated winds.

Proximity to Other Potential Risk Factors

The site is 913 feet northwest of a transmission line corridor with towers that provide perching and nesting opportunities for raptors, including golden eagles. The nearest potential tree-nesting habitat is 0.33 miles north of the site in a small group of isolated trees. The site is also 0.51 miles east of the creek paralleling Patterson Pass Road. There are no other perching or nesting opportunities or conditions that encourage ground squirrel activity in the immediate vicinity of the site and no ground squirrel activity was noted near the site. The nearest golden eagle nest is the Patterson Pass Road nest, which is 0.53 miles northwest of the site. Moderate level of golden eagle activity was reported from the vicinity of Turbine 25 during raptor surveys.

Risk Determination and Recommendation

The proposed Turbine 25 site is considered a Moderate-High-risk site. The turbine would be located at the edge of a steep slope surrounding the site on the west, east, and north. Because of the narrow ridgetop, the rotors would extend far over these slopes. There is also potential for slope-accelerated winds at this site, which could place foraging birds within the rotor plane. Existing roads would be used to access the site, and although they would be expanded to accommodate material deliveries to the site, they would not further influence raptor movement through the site.

Risk could be slightly reduced by relocating the turbine 175 feet southeast along the slope at 37.690993° -121.579242°. This moves the turbine to the highest point on the ridge and away from steep slope on the far end of the ridge. Although still subject to slope-accelerated winds, this location would be considered a Moderate risk site.

Response to Recommendation and Alternative Relocation

Mulqueeney Wind determined that the recommended site, and the originally proposed site, were considered too close the transmission line corridor to the east. They selected an alternative site 762 feet west of the originally proposed site at 37.691306° -121.582308° (Figure A-25).

Risk Determination and Recommendation for Alternative Relocation

The site is on the top of a short, narrow northwest-southeast-oriented ridge leading to a steep-sloped promontory at the northwest end (Plate 81). Steep (50-60%) slopes occur the on north, east, and west. The ridgetop is mostly flat, but rotors would extend over slopes in all directions (Plate 82). The site is

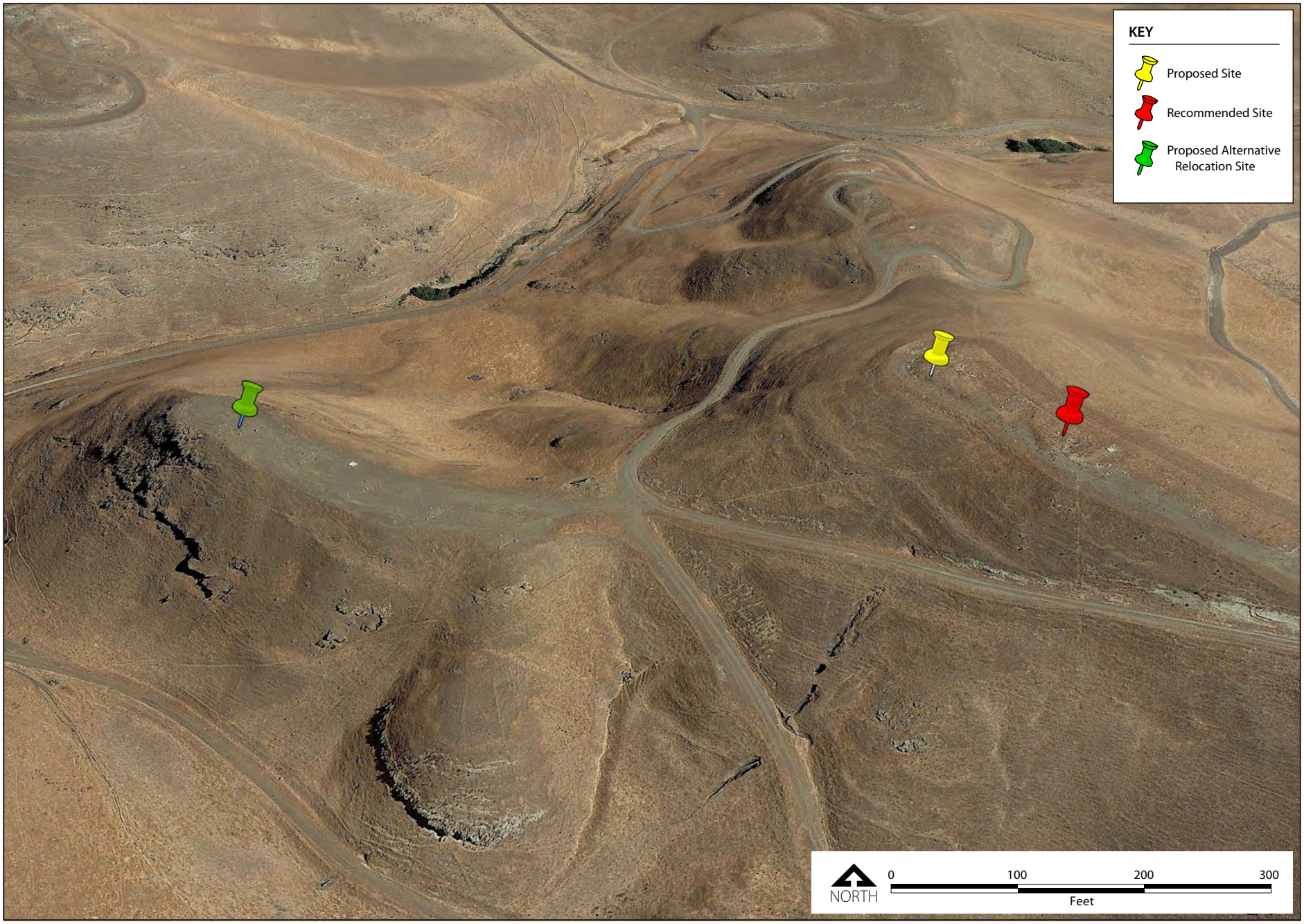
also closer to the Patterson Pass Road golden eagle nest (0.4 miles). This site is considered a Moderate-High-risk location with no alternatives for local movement that would reduce risk.

Plate 79. Looking southeast, upslope along the ridge from the initially proposed Turbine 25 location. The recommended site is near the vehicle in the background.

Plate 80. Looking west from the initially proposed Turbine 25 location.

Plate 81. Looking east toward the proposed alternative relocation site along the rocky-faced ridge in the center background. The furthest ridge in the background is the location of the initially proposed turbine 25.

Plate 82. Looking southeast along the ridgetop of the proposed alternative relocation site. The marker can be faintly seen near the center of the photo



05/04/2020

SOURCE: Google Earth 2020.

Figure A-25
Location of Proposed and Recommended Sites for Turbine 25 at the Mulqueeney Wind Project

Turbine 26

Topographical Description

The Turbine 26 site is located on an east-facing slope of a north-south-oriented ridge that forms a low elevation west-east-oriented descending lateral ridge (Figure A-26). The lateral ridge continues its eastward gradual descent (20% slope) for over 900 feet before reaching a narrow drainage at the bottom of the ravine. Deep parallel swales are present on both sides of the lateral ridge. An old-generation turbine string extends along the north-south ridge. The proposed site is approximately 200 feet downslope of this ridge, which has a steep (30% to 40 %) southwest-facing slope, dropping into a deep ravine (Plates 83 to 86).

Proximity to Other Potential Risk Factors

The site is 861 feet north of a transmission line corridor with towers that provide perching and nesting opportunities for raptors, including golden eagles. The nearest potential tree-nesting habitat is 0.62 miles northwest of the site along creek paralleling Patterson Pass Road. There are no other perching or nesting opportunities or conditions that encourage ground squirrel activity in the immediate vicinity of the site and no ground squirrel activity was noted near the site. The nearest golden eagle nests are 0.72 miles north (Patterson Pass Road nest) and 1.7 miles south of the site. Low level of golden eagle activity was reported from the vicinity of Turbine 26 during raptor surveys. Kernel density analysis places it in the second lowest use zone.

Risk Determination and Recommendation

The proposed Turbine 26 site is considered a high-risk site. The turbine would be located deep on an east-facing slope along a low elevation descending lateral ridge. Raptors contour hunting this slope would be at particular collision risk, and birds that cross the north-south-oriented ridge to the west could fly within the altitude of the rotor plane. Also, placing a turbine on a slope creates a bench, and along with construction of a new 200-foot spur road to access the site would create interruptions in the slope contour that could affect flight behavior. Placing the turbine on the slope would also reduce the distance from the ground to the rotor plane, further increasing risk to contour-hunting raptors.

Risk could be reduced by relocating the turbine upslope to the top of the north-south-oriented ridge along the old-generation turbine string at 37.681677° -121.587503°. This relocates the turbine off of the slope and off of the descending low-elevation east-west ridge. This location is considered a Moderate-risk site.

Response to Recommendation and Alternative Relocation

Mulqueeney Wind selected an alternative to the recommended site to provide greater distance from the transmission line corridor to the north. The site is 62 feet south of the recommended site along the north-south-oriented ridge at 37.681502° -121.587488° (Figure A-26).

Risk Determination and Recommendation for Alternative Relocation

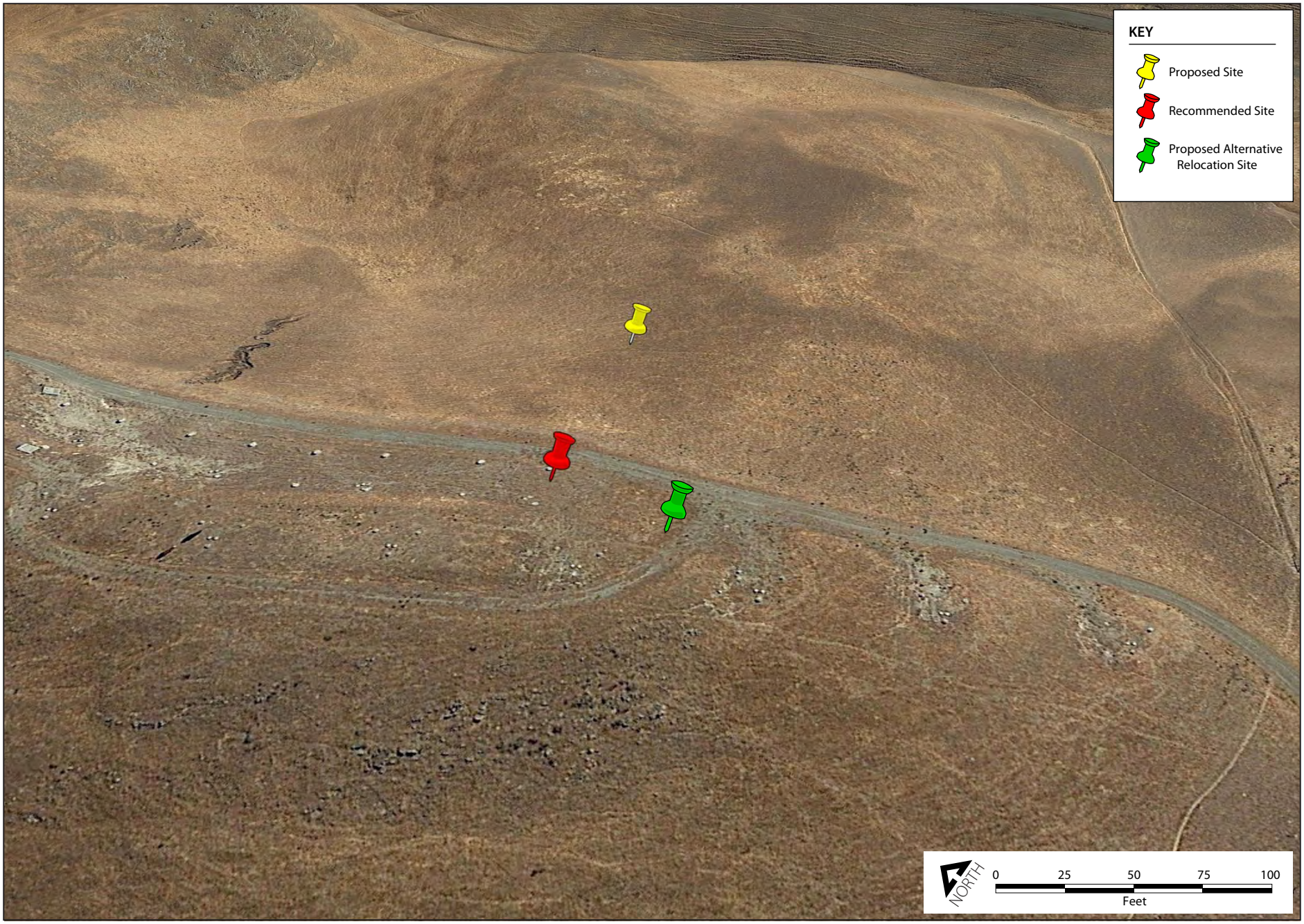
This portion of the ridgeline begins to descend; however, not to the extent that risk would be substantially increased compared with the recommended site.

Plate 83. Looking east from initially proposed Turbine 26 location. Note the low elevation descending ridge, which extends off of the larger north-south-oriented ridge behind this view.

Plate 84. Looking north from the initially proposed Turbine 26 site. This is the east-facing slope of the north-south-oriented ridge, the ridgetop of which can be seen at the top of the photo.

Plate 85. Looking south from the initially proposed Turbine 26 site. The slope gradually descends southward into a broad basin.

Plate 86. Looking east from the recommended location on the ridgetop toward the initially proposed site. The marker can be faintly seen in the center right of the photo.



05/04/2020

SOURCE: Google Earth 2020.

Figure A-26
Location of Proposed and Recommended Sites for Turbine 26 at the Mulqueeney Wind Project

Turbine 27

Topographical Description

The Turbine 27 site is located on a slightly descending south-north ridge along on old-generation turbine string (Figure A-27). The proposed turbine is sited on the west side of an approximately 120-foot-wide ridgetop overlooking a steep (40%) slope descending into a deep ravine. On the east, the slope is slightly less steep (35%) descending into a deep swale. On the ridgetop, the proposed turbine is sited at the base of a southward ascending portion of the ridge, similar to a notch in the ridgeline. The ridgeline descends more gradually as it extends northward (Plates 87, 88, and 89). The access road along the west side of the ridgetop creates a berm just below the apex of the ridge, creating the potential for slope-accelerated winds.

Proximity to Other Potential Risk Factors

The site is 861 feet north of a transmission line corridor with towers that provide perching and nesting opportunities for raptors, including golden eagles. The nearest potential tree-nesting habitat is 0.62 miles northwest of the site along creek paralleling Patterson Pass Road. There are no other perching or nesting opportunities or conditions that encourage ground squirrel activity in the immediate vicinity of the site and no ground squirrel activity was noted near the site. The nearest golden eagle nests are 1.5 miles northwest (Patterson Pass Road nest) and 1.7 miles southwest of the site. Low level of golden eagle activity was reported from the vicinity of Turbine 27 during raptor surveys. Kernel density analysis places it in the lowest use zone.

Risk Determination and Recommendation

The Turbine 27 site is considered a Moderate-High-risk site due to its location at the base of slope along a descending ridge. The southwest-facing slope may also be subject to slope-accelerated winds, creating additional risk for birds that hover-hunt in the wind above the ridge. The site will be accessed via the existing road along the ridge, and while it will require substantial improvements, because the road is along the ridge top, road construction is not expected to alter the topography or influence raptor movement through the site.

Potential risk can be reduced by moving the turbine 571 feet to the south on the ridgeline at 37.681704° -121.564134°. This moves the turbine out of the notch in the ridge and to the highest portion of the ridge. Although it does not reduce the potential for risk associated with slope-accelerated winds, this location is considered Moderate risk.

Response to Recommendation and Alternative Relocation

To create sufficient separation distance from neighboring turbines, Mulqueeney Wind selected an alternative site along the ridgetop between the originally proposed site and the recommended site at 37.682258° -121.564904° (Figure A-27).

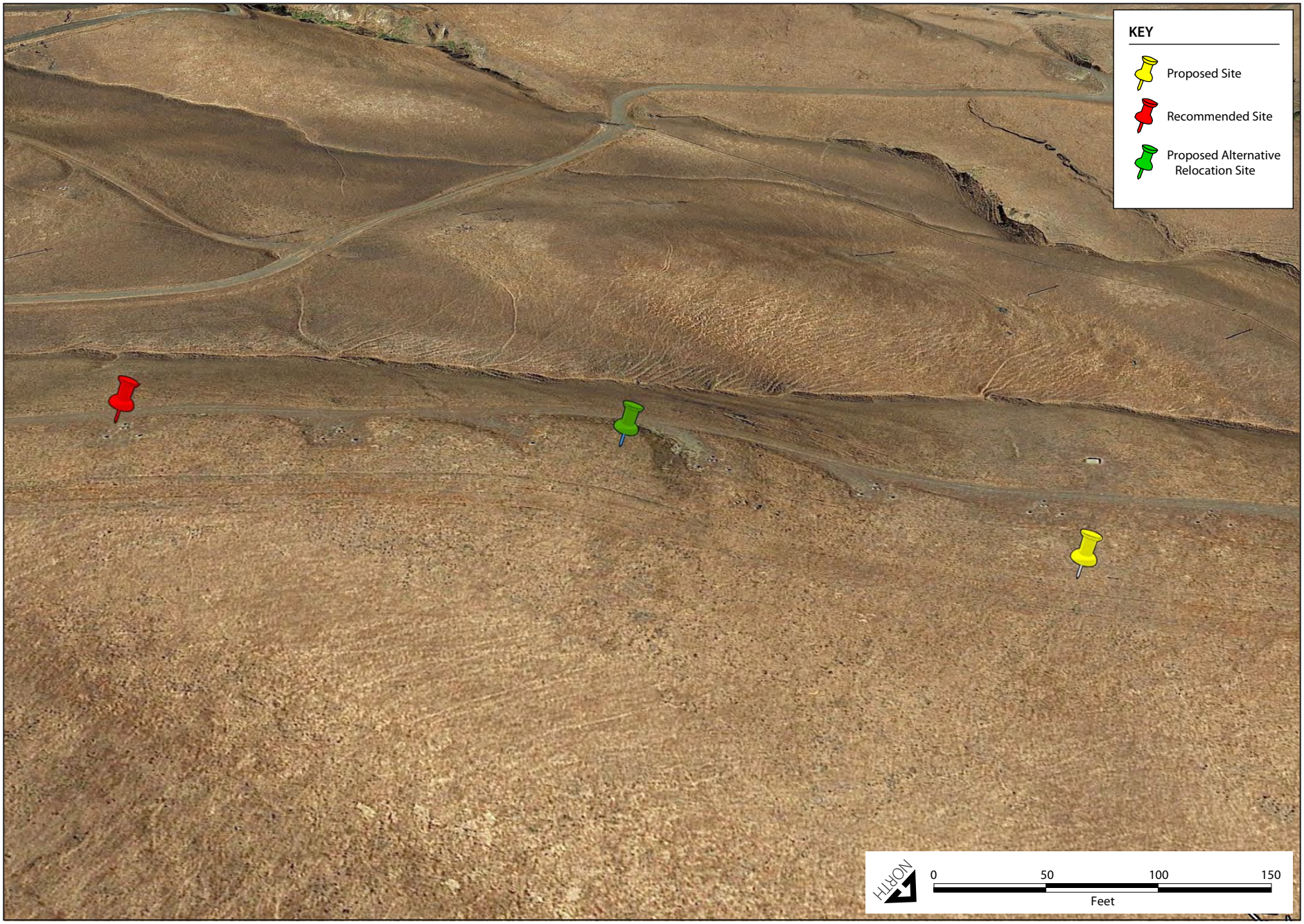
Risk Determination and Recommendation for Alternative Relocation

Although still on the gradually descending ridgeline, it is in a slightly better location than the originally proposed site, and is considered a Moderate-risk location.

Plate 87. Looking north from initially proposed Turbine 27 site.

Plate 88. Looking east from initially proposed Turbine 27 site.

Plate 89. Looking south from the initially proposed Turbine 27 site along the ascending ridgeline, upslope toward the recommended site at the top of the slope.



05/04/2020

SOURCE: Google Earth 2020.

Figure A-27
Location of Proposed and Recommended Sites for Turbine 27 at the Mulqueeney Wind Project

Turbine 28

Topographical Description

The Turbine 28 site is located near the south end of a southeast-northwest-oriented ridge at the south end of an old-generation turbine string where it intersects with a steep south-facing slope (Figure A-28). The proposed site is also at the top of a broad ascending northwest-southwest-oriented swale, which forms the west-facing slope of the ridge. A more gradual east-facing slope descends for over 1,000 feet into a deep gorge (Plates 90 and 91).

Topographical conditions that may influence raptor movement include the slopes surrounding the ridge, particularly the east-facing slope, which is ideal for contour hunting, and the large swale that ascends to the top of the ridge at the location of the proposed turbine.

Proximity to Other Potential Risk Factors

The site is 183 feet southeast of a meteorological tower that would be removed, and 0.71 miles south of a transmission line corridor with towers that provide perching and nesting opportunities for raptors, including golden eagles. The nearest potential tree-nesting habitat is 0.17 miles south of the site in a small group of trees along a small creek. Other than the met tower that will be removed, there are no other perching or nesting opportunities or conditions that encourage ground squirrel activity in the immediate vicinity of the site and no ground squirrel activity was noted near the site. The nearest golden eagle nests are 1.83 miles northwest (Patterson Pass Road nest) and 2.7 miles southwest of the site. Low levels of golden eagle activity were reported from the vicinity of Turbine 28 during raptor surveys. Kernel density analysis places it in the lowest use zone.

Risk Determination and Recommendation

Potential collision risk at the Turbine 28 site is considered Moderate. The primary risk factor is the location of the proposed turbine at the top of an ascending swale. Birds crossing this ridge along the swale would encounter the turbine. The site is otherwise flat and broad and can accommodate the turbine pad without substantially altering the topography. Access would be along the existing road, and although it would require expansion to accommodate material deliveries, because it is on the top of the ridge, it is not expected to influence raptor movement through the site.

Potential collision risk may be reduced somewhat by moving the turbine northward 333 feet along the ridge further away from the ascending swale (Figure A-28).

Response to Recommendation and Alternative Relocation

Mulqueeney Wind selected an alternative location 810 feet west of the originally proposed turbine site at 37.680653° -121.561869° (Figure A-28) that provides a better wind resource compared with the originally proposed and recommended turbine sites.

Risk Determination and Recommendation for Alternative Relocation

The site is along the south-facing ridge slope and on the west side of the ascending swale. The site is slightly downslope on a southwest-facing slope of a small hill and on the edge of a shallow northwest-southeast-oriented swale (Plate 92). The site is higher in elevation than the initially proposed site or the recommended site; however, risk is considered Moderate-High at this location due to its location downslope and its proximity to a swale. To reduce risk at this location, relocate the turbine 71 feet northeast to 37.680824° -121.561747° (Plate 93). This moves the turbine off of the slope to the top of the ridge along the old-generation turbine string.

Plate 90. Looking north from the initially proposed Turbine 28 location. Meteorological tower is in the background.

Plate 91. Looking east from initially proposed Turbine 28 location.

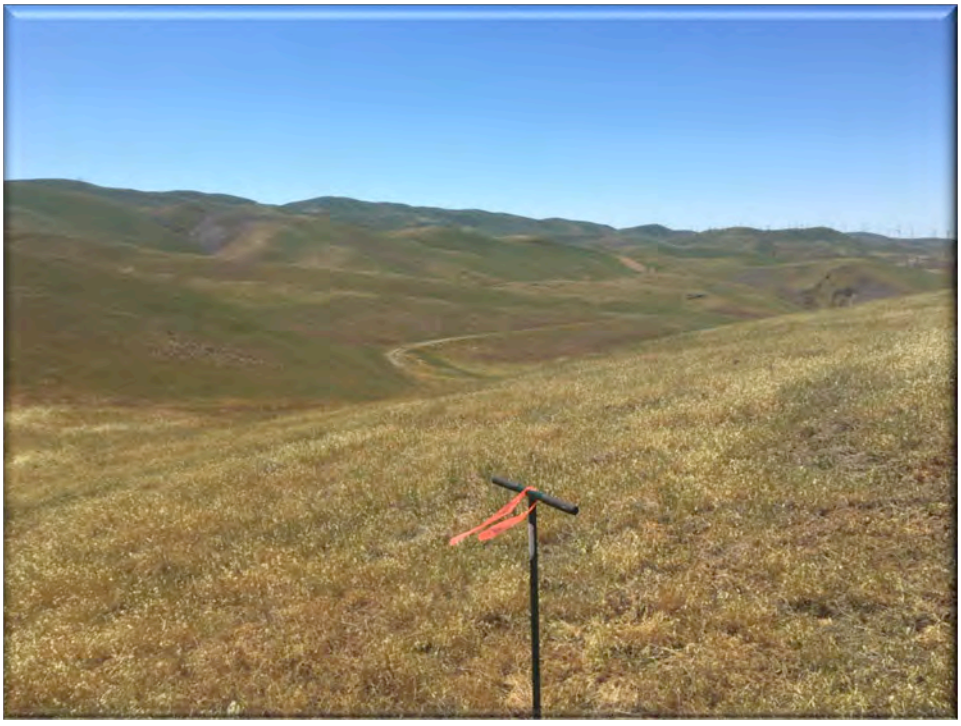
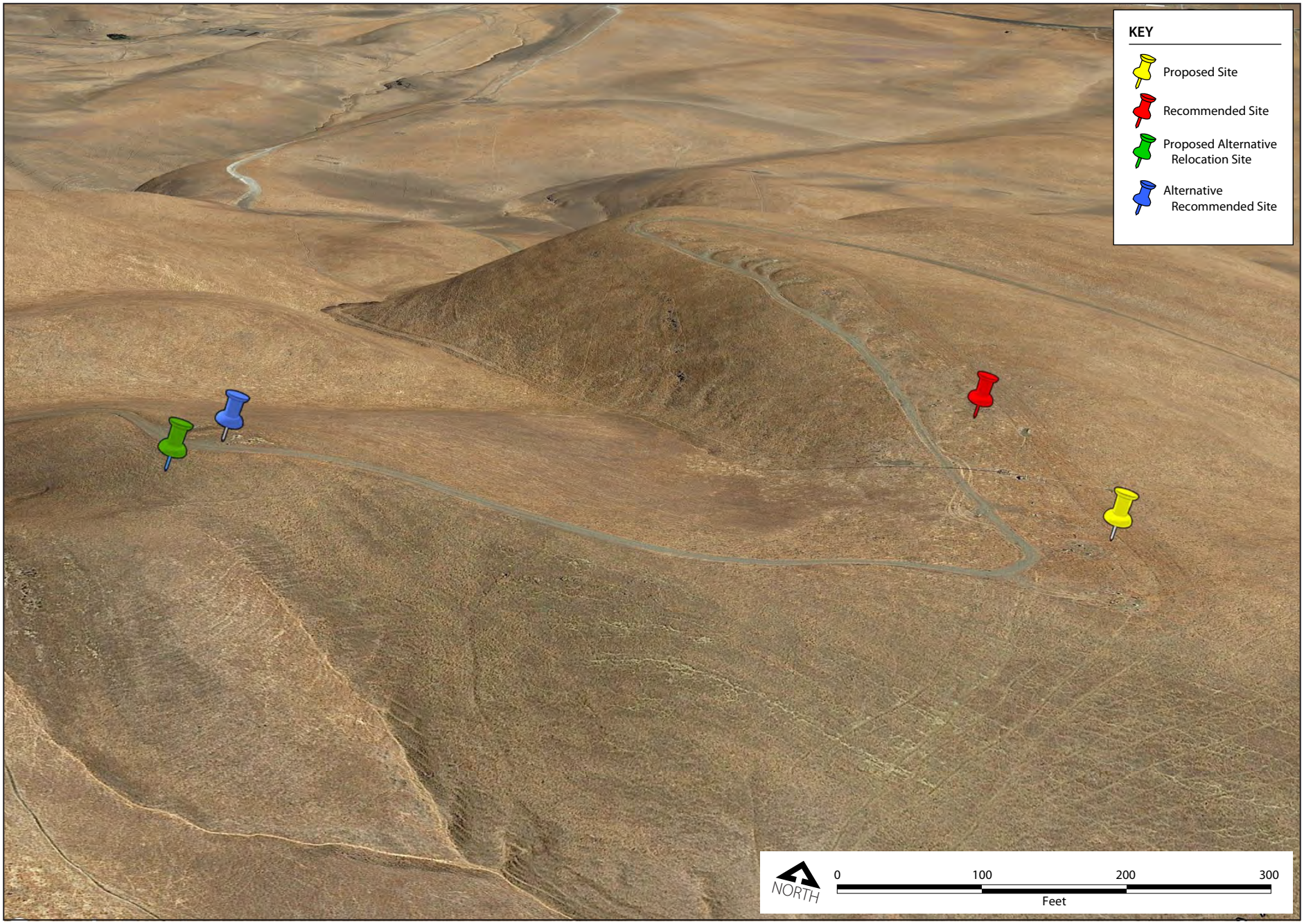


Plate 92. Looking northwest from the proposed alternative relocation site. Note the location on the edge of an ascending swale.

Plate 93. Looking north from the proposed alternative relocation site toward the recommended relocation site at the top of the ridge along the old generation turbine string.



05/04/2020

SOURCE: Google Earth 2020.

Figure A-28
Location of Proposed and Recommended Sites for Turbine 28 at the Mulqueeney Wind Project

Turbine 29

Topographical Description

The Turbine 29 site is located on a relatively low elevation hilltop extending off of a short northwest-southeast-oriented ridge with an old-generation turbine string (Figure A-29). The site is 186 feet northeast and slightly downslope of the old-generation turbine string on a flat, short, east-west oriented lateral ridge that slopes slightly to the north and south into shallow swales (Plates 94, 95, and 96).

Proximity to Other Potential Risk Factors

The site is 0.2 miles east of a transmission line corridor with towers that provide perching and nesting opportunities for raptors, including golden eagles. The nearest potential tree-nesting habitat is 1 mile west of the site along the creek paralleling Patterson Pass Road. There are no other perching or nesting opportunities or conditions that encourage ground squirrel activity in the immediate vicinity of the site and no ground squirrel activity was note near the site. The nearest golden eagle nest is the Patterson Pass Road nest, which is 1.1 miles northwest of the site. Low level of golden eagle activity was reported from the vicinity of Turbine 29 during raptor surveys. Kernel density analysis places it in the lowest use zone.

Risk Determination and Recommendation

Turbine 29 is considered a moderate risk location. The site is mostly flat and fairly broad. The elevation along the old-generation turbine string is slightly higher, but relocation there would place the turbine on the edge of a southwest-facing slope. The proposed site will require the construction of an approximately 1,600-foot spur road extending from an existing access road below the ridge. The road will create a bench along the south and east-facing slope of the ridge, which may influence raptor movement. However, because the turbine is on the top of the slope, this is not expected to result in additional risk. There is no opportunity to relocate the turbine that would substantially reduce risk, and therefore no recommendation for relocation.

Response to Recommendation and Alternative Relocation

Mulqueeney Wind selected the initially proposed site for Turbine 29.

Risk Determination and Recommendation for Alternative Relocation

None.

Plate 94. Looking north from Turbine 29 location.

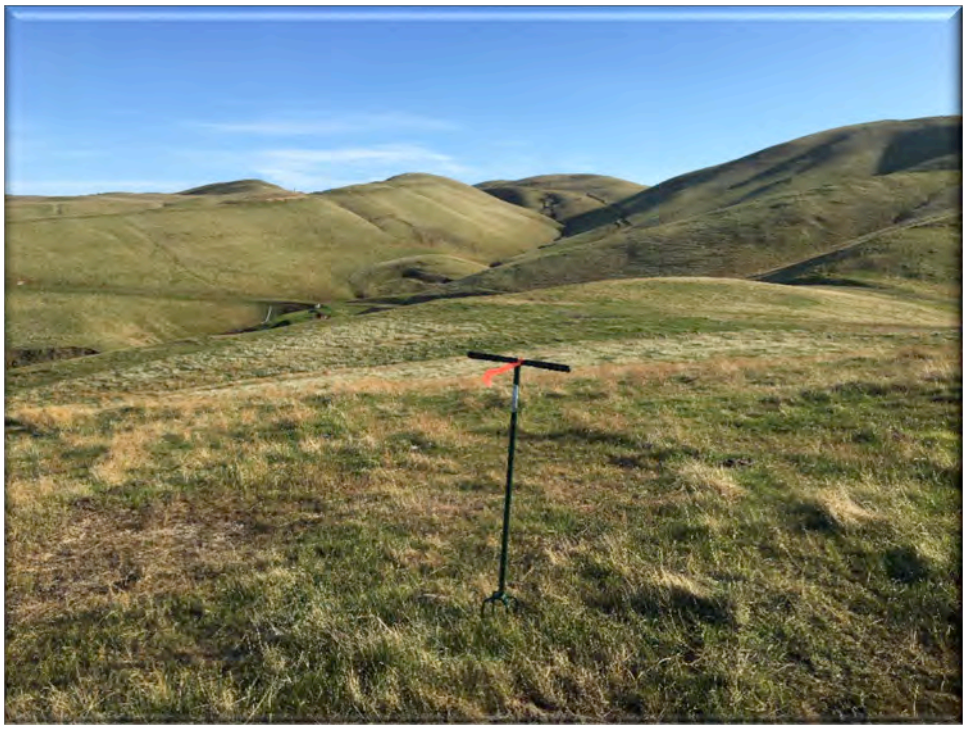
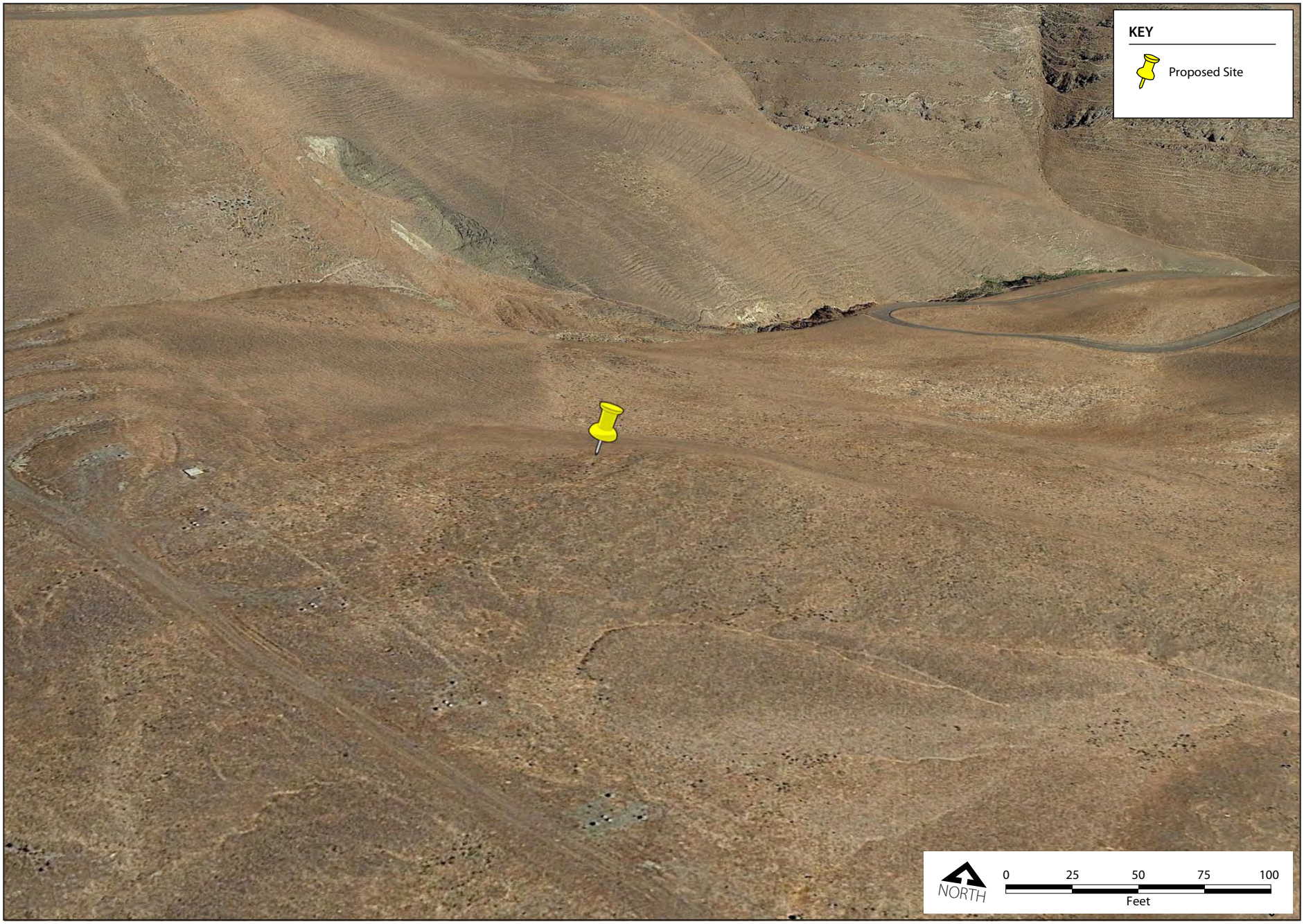


Plate 95. Looking south from Turbine 29 location.

Plate 96. Looking east from Turbine 29 location.



05/04/2020

SOURCE: Google Earth 2020.

Figure A-29
Location of Proposed and Recommended Sites for Turbine 29 at the Mulqueeney Wind Project

Turbine 30

Topographical Description

The Turbine 30 site is located downslope of a short, northwest-southeast oriented ridge (Figure A-30). The site is 197 feet down the steep (45%) northeast-facing slope (Plates 97 and 98). The slope continues to descend to the east and northeast toward deep ravines. From the ridgetop, the southwest-facing slope is less steep (20%) and descends into a deep swale. Primary topographic feature that could influence raptor use and behavior is the northeast-facing slope, which is ideal for contour hunting.

Proximity to Other Potential Risk Factors

The site is 403 feet northeast of a meteorological tower that may be used by perching raptors that will be removed, and 0.28 miles south of a transmission line corridor with towers that provide perching and nesting opportunities for raptors, including golden eagles. The nearest potential tree-nesting habitat is 1.04 miles south of the site in oak savannah and 1.04 miles north of the site in riparian habitat along the creek that parallels Patterson Pass Road. There are no other perching or nesting opportunities or conditions that encourage ground squirrel activity in the immediate vicinity of the site and no ground squirrel activity was note near the site. The nearest golden eagle nests are 1.2 miles north (Patterson Pass Road nest) and 1.5 miles south of the site. Low level of golden eagle activity was reported from the vicinity of Turbine 30 during raptor surveys. Kernel density analysis places it in the lowest use zone.

Risk Determination and Recommendation

Turbine 30 is considered a High-risk location due to the placement on a steep slope. Raptors using the ravines for movement or the slopes for contour hunting would be at particular risk of collision. Placement of the turbine on the slope, along with a new spur road that would extend northwestward from the existing access road along the ridge top for approximately 370 feet down slope, would create a bench along this slope, which can also influence local raptor movement patterns. Also, placing the turbine on the slope would reduce the distance between the ground and the rotor plane, further increasing potential collision risk to birds using the slope.

Risk can be reduced by moving the turbine 204 feet upslope to the west along the old-generation turbine string (Plate 99) to 37.674801° -121.584927° (Figure A-30). This would place the turbine on the top of the ridge, above the slope. This location is considered a Moderate-risk site.

Response to Recommendation and Alternative Relocation

Mulqueeney Wind selected the recommended location for Turbine 30.

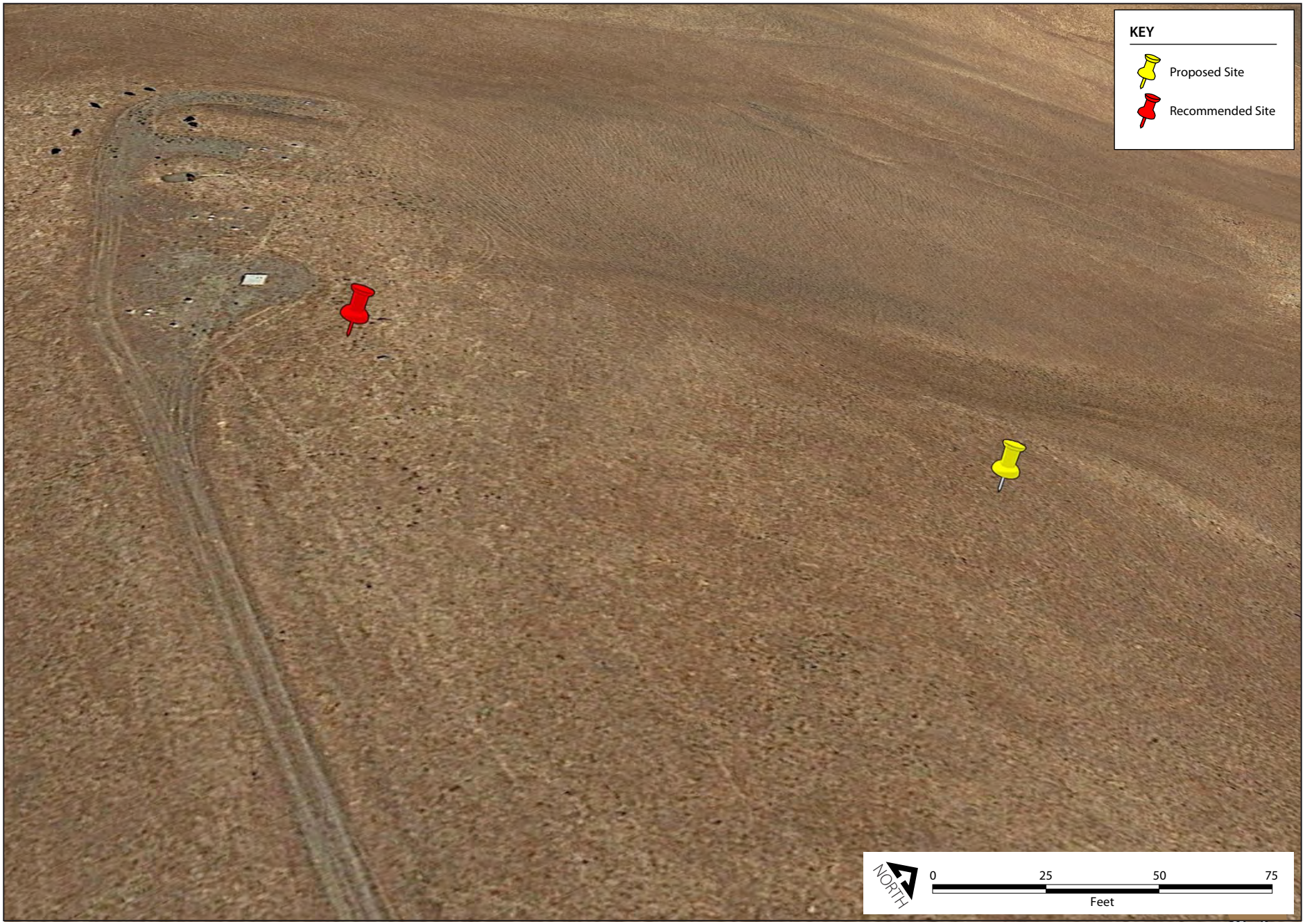
Risk Determination and Recommendation for Alternative Relocation

None.

Plate 97. Looking northeast from the initially proposed Turbine 30 location.

Plate 98. Looking northwest from the initially proposed Turbine 30 location.

Plate 99. Looking south from recommended site.



05/04/2020

SOURCE: Google Earth 2020.

Figure A-30
Location of Proposed and Recommended Sites for Turbine 30 at the Mulqueeney Wind Project

Mulqueeney Ranch Wind Repowering Project

Appendix A-4. Assessment of Turbines 31 through 36

May 2020

Turbine 31

Topographical Description

The Turbine 31 site is located near the bottom of a northwest-southeast-oriented swale (Figure A-31). North and south-facing 25% slopes ascend to ridges with old-generation turbine strings. The swale extends southeast for about 700 feet where it converges with four other swales. To the northwest, the swale gradually ascends for 730 feet, creating a saddle where two ridges converge, before dropping steeply into a ravine (Plates 100, 101, and 102). Significant raptor movement is likely to occur through this swale and along the slopes of the swale.

Proximity to Other Potential Risk Factors

The site is 681 feet southeast of a meteorological tower that may be used by perching raptors, that would be removed, and 0.22 miles west of a transmission line corridor with towers that provide perching and nesting opportunities for raptors, including golden eagles. The nearest potential tree-nesting habitat is oak savannah 0.95 miles southwest of the site. Riparian nesting habitat along the creek paralleling Patterson Pass Road is 1.17 miles northwest of the site. There are no other perching or nesting opportunities or conditions that encourage ground squirrel activity (e.g., rock piles, fence lines, drainages) in the immediate vicinity of the site. However, the site is 0.4 miles south of only one of three areas where a concentration of ground squirrel burrows was observed. The nearest golden eagle nests are 1.34 miles north (Patterson Pass Road nest), and 1.5 miles southwest of the site. Low level of golden eagle activity was reported from the vicinity of Turbine 31 during raptor surveys. Kernel density analysis places it in the second lowest use zone.

Risk Determination and Recommendation

The Turbine 31 site is considered a high-risk location due to its position at the bottom of a swale and at the base of steep slopes. Birds flying through this corridor would be at significant risk of collision and birds that are flying across the ridgelines would encounter the rotor plain at a lower altitude. New road construction would be required to access this site and that could influence raptor movement through the site.

Risk can be reduced by moving the turbine 801 feet southwest to the top of the ridge along the old-generation turbine string at 37.671805° -121.585696°. This will relocate the turbine out of the swale onto a broad ridgetop. This location is considered a Moderate risk location.

Response to Recommendation and Alternative Relocation

Mulqueeney Wind selected the recommended site for Turbine 31.

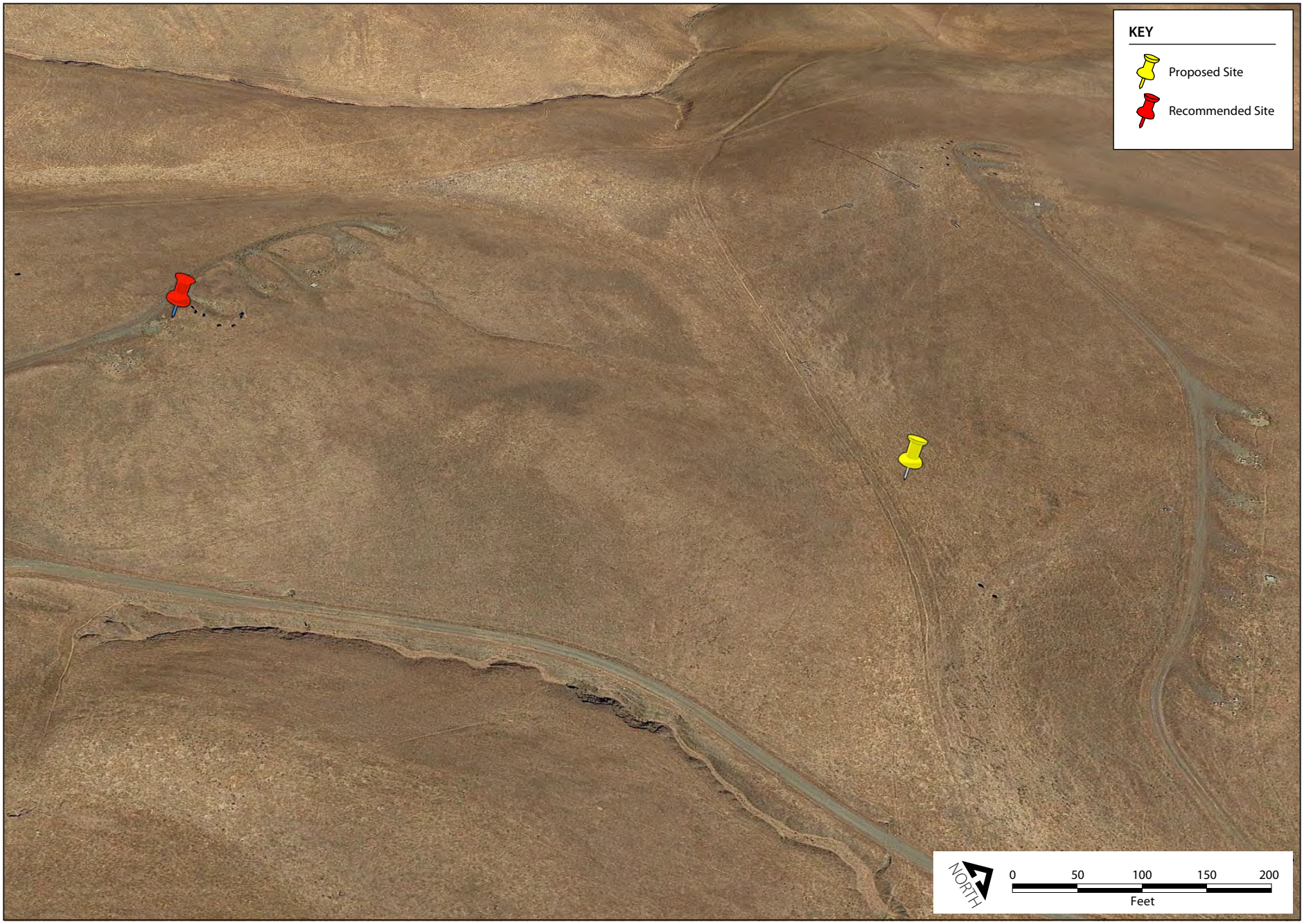
Risk Determination and Recommendation for Alternative Relocation

None.

Plate 100. Looking southwest, upslope from the initially proposed Turbine 31 location toward the recommended location along the ridgetop.

Plate 101. Looking northwest from the initially proposed Turbine 31 location along the swale. The swale ascends for 730 feet where it forms a saddle between two converging ridges, before descending steeply into a ravine.

Plate 102. Looking southeast from the initially proposed Turbine 31 location.



05/04/2020

SOURCE: Google Earth 2020.

Figure A-31
Location of Proposed and Recommended Sites for Turbine 31 at the Mulqueeney Wind Project

Turbine 32

Topographical Description

The Turbine 32 site is located on a descending southeast-northwest-oriented ridge at the slope of a large, deep saddle in the descending ridgeline (Figure A-32). The site is on a small bench at the end of an old-generation turbine string (Plate 103). The ascending (20% to 30%) ridge slope to the south is initially steep (30% to 40%) before continuing for approximately 1,200 feet until reaching the apex of the ridgeline. The descending slope to the north is somewhat less steep (30%) as it drops into the ridge saddle (Plates 104 and 105). Topographical features that could influence raptor flight patterns include the ridge saddle and the descending ridge slope following a slope break.

Proximity to Other Potential Risk Factors

The site is 0.19 miles east of a transmission line corridor with towers that provide perching and nesting opportunities for raptors. The nearest potential tree-nesting habitat is oak savannah 1.14 miles southwest of the site. There are no other perching or nesting opportunities or conditions that encourage ground squirrel activity in the immediate vicinity of the site and no ground squirrel activity was noted near the site. The nearest golden eagle nests are 1.43 miles north (Patterson Pass Road nest), and 1.7 miles southwest of the site. Low-to-moderate level of golden eagle activity was reported from the vicinity of Turbine 32 during raptor surveys.

Risk Determination and Recommendation

Turbine 32 is considered a high-risk site due to its location on the edge of a broad ridge saddle and on a descending ridgeline following a slope break caused by construction of the old-generation turbine string. Because the rotors would extend across the saddle, birds using this feature as a crossing point would be at significant risk. The turbine pad would also create a bench on the slope at the edge of the saddle, further increasing risk. Road access would be along existing roads, although they would require substantial expansion to accommodate material delivery.

Risk could be reduced slightly by moving the turbine upslope to the south on the ridgeline to 37.673823° -121.575557° (Figure A-32). This moves the turbine out of the saddle and on less steep portion of the descending ridgeline. This site would still be considered Moderate-high risk due to its location on the descending ridge and proximity to an ascending swale from the southwest.

Response to Recommendation and Alternative Relocation

Mulqueeney Wind selected the recommended site for Turbine 32.

Risk Determination and Recommendation for Alternative Relocation

None.

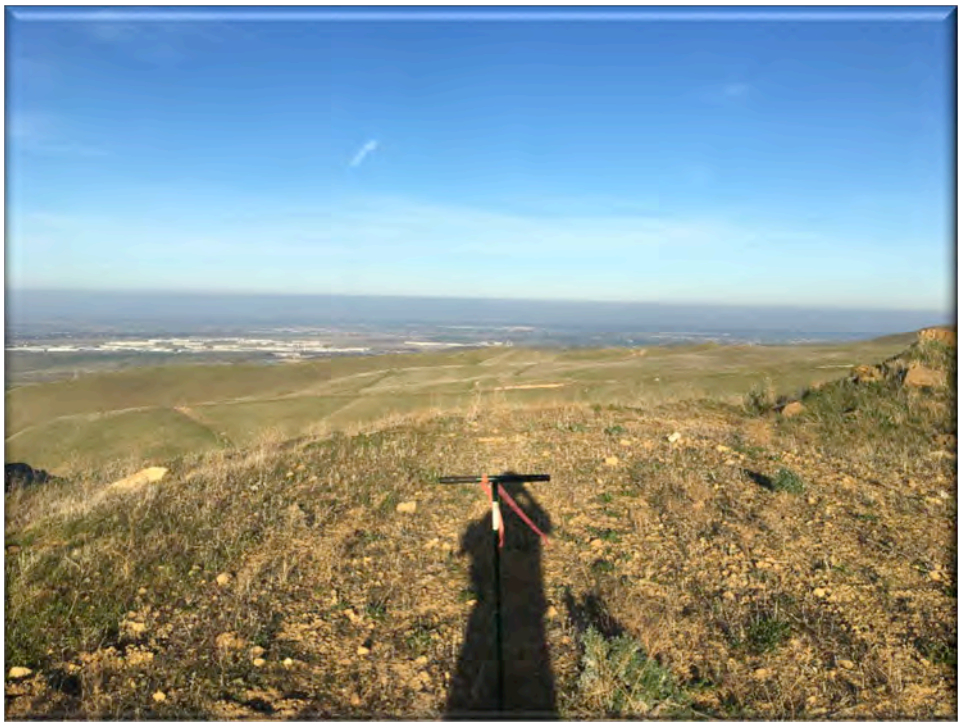
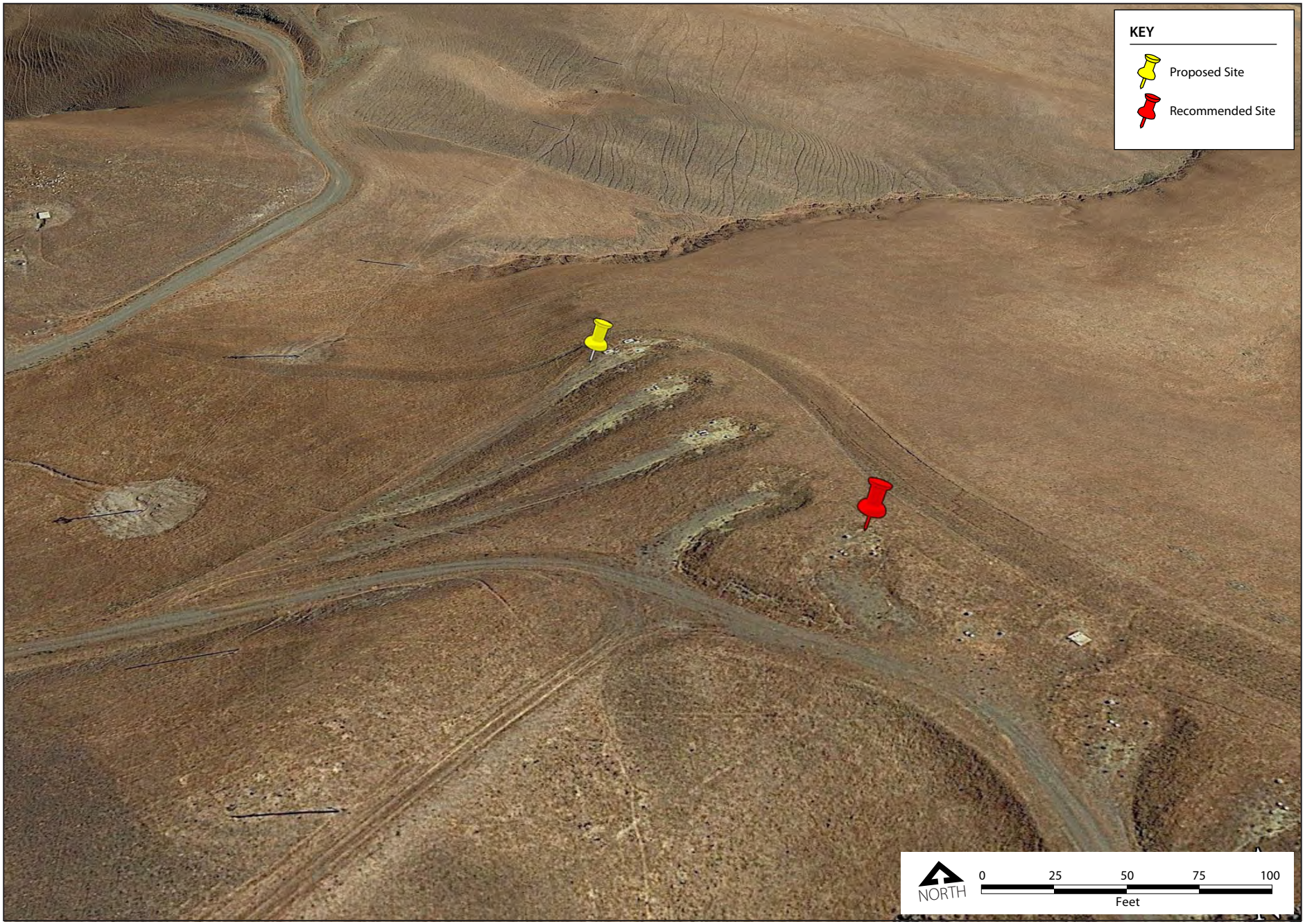


Plate 103. Looking east from the initially proposed Turbine 32 location. Note the small bench created for the old-generation turbine.

Plate 104. Looking north from the initially proposed Turbine 32 location. The slope saddle is to the left of the photo. The rotors would extend across this saddle.

Plate 105. Looking south from the initially proposed Turbine 32 location, upslope along the ascending ridge. The recommended relocation site is at the top of the photo above the ridge slope.



05/04/2020

SOURCE: Google Earth 2020.

Figure A-32
Location of Proposed and Recommended Sites for Turbine 32 at the Mulqueeney Wind Project

Turbine 33

Topographical Description

The Turbine 33 site is located midpoint along the same ridgeline as Turbine 32 (Figure A-33). The site is on a northward-descending portion of the ridge along an old-generation turbine string, with a narrow ridge top and steep 40% slopes on the east and west descending to deep gorges (Plates 106, 107, and 108). The ridge has multiple benches and notches caused by the installation of the old-generation turbines. The site is on one of these benches created by the pad of an old-generation turbine site – on the northward-descending portion of the ridgeline. The existing access road along the old-generation turbine string is on the west side of the ridge, which has created a berm just below the apex of ridgeline, which can create slope-accelerated winds.

Topographical features that could influence raptor flight patterns include the descending ridge slope, the benches and notches along the ridge, the steep slopes descending off of the ridge, which are ideal for contour hunting, and the potential for slope-accelerated winds on the southwest-facing slope.

Proximity to Other Potential Risk Factors

The site is 0.29 miles east of a transmission line corridor with towers that provide perching and nesting opportunities for raptors, including golden eagles. The nearest potential tree-nesting habitat is oak savannah 1 mile southwest of the site. There are no other perching or nesting opportunities or conditions that encourage ground squirrel activity in the immediate vicinity of the site, and no ground squirrel activity was noted near the site. The nearest golden eagle nest is 1.5 miles southwest of the site. The Patterson Pass Road nest is 1.61 miles north of the site. Low-to-moderate level of golden eagle activity was reported from the vicinity of Turbine 33 during raptor surveys.

Risk Determination and Recommendation

Potential collision risk at Turbine 33 is considered Moderately-High due to its location on a descending slope of a narrow ridge. Although the benches and notches along the ridge may influence raptor movement and flight patterns, this is unlikely to have a substantial effect on potential collision mortality due to the size of the turbine and the distance between the ridge and the rotor plain. Also, the new turbine pad would extend across a large portion of the ridgetop, effectively evening the ridgeline in the vicinity of the turbine. The site may also be subject to slope-accelerated winds from the southwest, the prevailing wind direction, increasing potential risk to birds using these winds to hover-hunt above the ridgeline. Because of the narrowness of the ridgetop, this cannot be mitigated by moving the turbine back from southwest slope. Access to the site would be along the existing access road along the ridgeline. Although this road would be expanded to accommodate material deliveries, because it is on the top of the ridge, it is not expected to further influence raptor movement through the site.

Risk can be reduced slightly by moving the turbine 218 feet southwest to 37.671715° -121.573939° (Figure A-33). This moves the turbine off of the descending ridge to the high point on the ridge. Because the turbine remains on narrow ridge subject to slope-accelerated winds, although an improvement from the initially proposed site, this location is still considered Moderate-High risk.

Response to Recommendation and Alternative Relocation

Mulqueeney Wind selected the recommended site for Turbine 33.

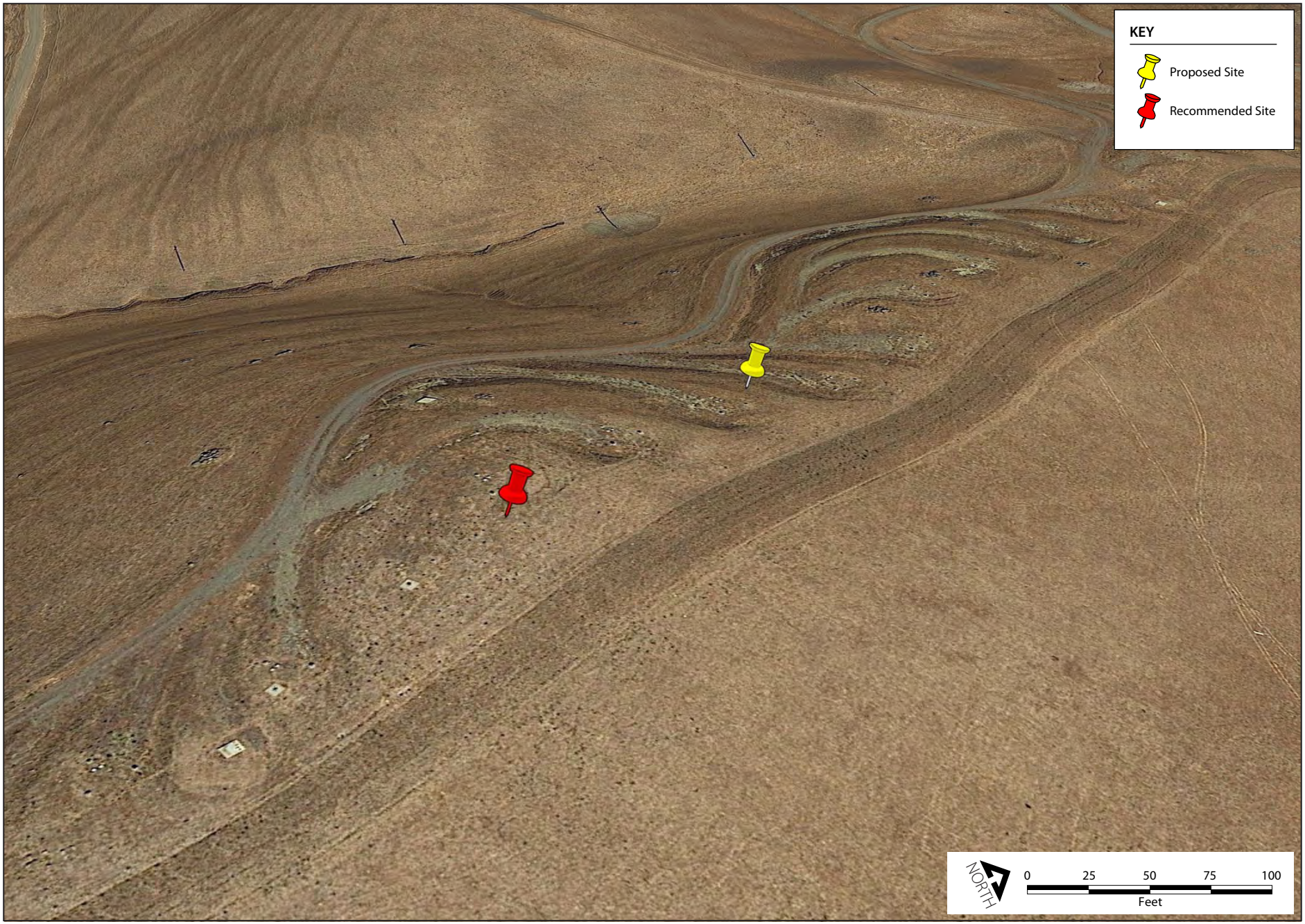
Risk Determination and Recommendation for Alternative Relocation

None.

Plate 106. Looking north from the initially proposed Turbine 33 location. The ridge is descending northward with multiple notches resulting from the turbine pads of the old-generation turbine string.

Plate 107. Looking south from the initially proposed Turbine 33 location. Note the location of the turbine site in a notch along the southward ascending ridge.

Plate 108. Looking west from the initially proposed Turbine 33 location.



05/04/2020

SOURCE: Google Earth 2020.

Figure A-33
Location of Proposed and Recommended Sites for Turbine 33 at the Mulqueeney Wind Project

Turbine 34

Topographical Description

The Turbine 34 site is located near the southern end of the same north-south-oriented ridge as Turbines 32 and 33 (Figure A-34). The site is on the southward-descending portion of the ridgeline along an old-generation turbine string. The flat ridgetop is fairly broad (about 140 feet), with steep slopes (40%) to the east, west, and south and descending into deep ravines. The ravines along the east and west sides of the ridge converge at the south end of the ridge. The ridge has numerous benches and notches resulting from the installation of the old-generation turbines. The site is on one of these benches (Plates 109, 110, and 111). The existing access road along the old-generation turbine string is on the west side of the ridge, which has created a berm just below the apex of ridgeline, which can create slope-accelerated winds.

Topographical features that could influence raptor flight patterns include the descending ridge slope, the benches and notches along the ridge, the steep slopes descending off of the ridge, which are ideal for contour hunting, the potential for slope-accelerated winds on the southwest-facing slope, and the convergence of the two ravines on the south end of the ridge.

Proximity to Other Potential Risk Factors

The site is 0.38 miles east of a transmission line corridor with towers that provide perching and nesting opportunities for raptors, including golden eagles. The nearest potential tree-nesting habitat is oak savannah 0.89 miles southwest of the site. There are no other perching or nesting opportunities or conditions that encourage ground squirrel activity in the immediate vicinity of the site, and no ground squirrel activity was noted near the site. The nearest golden eagle nest is 1.5 miles southwest of the site. Moderate level of golden eagle activity was reported from the vicinity of Turbine 34 during raptor surveys. Kernel density analysis places it in the intermediate use zone.

Risk Determination and Recommendation

The Turbine 34 site is considered a Moderate-High-risk site, primarily due to its location on a descending ridge line with multiple slope breaks. Although the benches and notches along the ridge may influence raptor movement and flight patterns, this is unlikely to have a substantial effect on potential collision mortality due to the size of the turbine and the distance between the ridge and the rotor plain. However, the new turbine pad in this location will create a large bench in the slope. The site may also be subject to slope-accelerated winds from the southwest, the prevailing wind direction, increasing potential risk to birds using these winds to hover-hunt above the ridgeline. Access to the site would be along the existing access road along the ridgeline. Although this road would be expanded to accommodate material deliveries, because it is on the top of the ridge, it is not expected to further influence raptor movement through the site.

There are no recommendations for movement of this site that would reduce potential collision mortality. Mortality could be reduced somewhat by moving the turbine northward to the high point along the ridge and off of the southward descending slope, but this is the recommended relocation for Turbine 33.

Response to Recommendation and Alternative Relocation

Mulqueeney Wind selected the initially proposed location for Turbine 34.

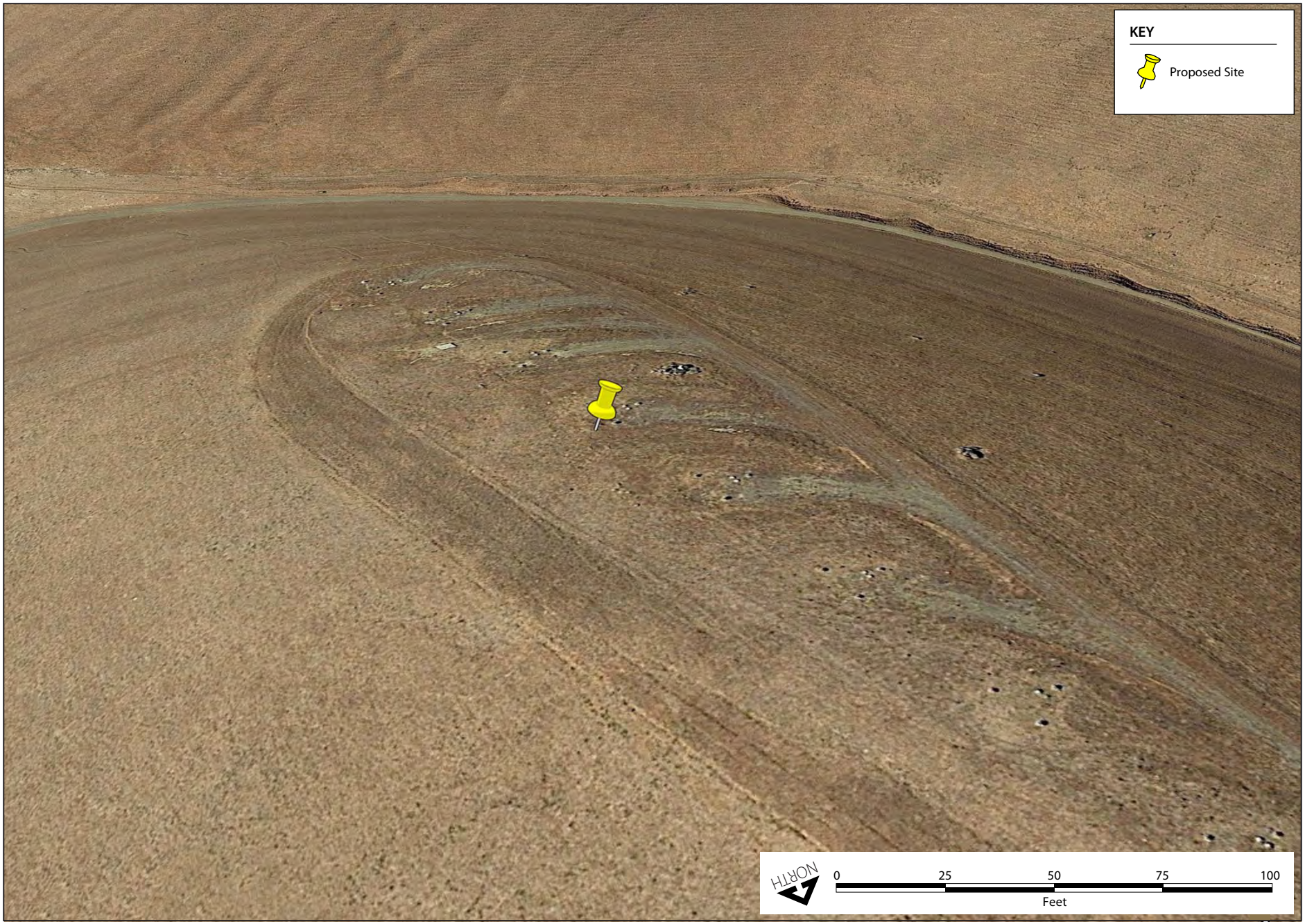
Risk Determination and Recommendation for Alternative Relocation

None.

Plate 109. Looking south from Turbine 34 location.

Plate 110. Looking east from Turbine 34 location.

Plate 111. Looking north from the Turbine 34 location, upslope along the ascending ridge.



05/04/2020

SOURCE: Google Earth 2020.

Figure A-34
Location of Proposed and Recommended Sites for Turbine 34 at the Mulqueeney Wind Project

Turbine 35

Topographical Description

The Turbine 35 site is located within a deep saddle along a northeast-southwest-oriented ridge (Figure A-35). The ridgeline ascends at 20% to the east and west. From the saddle, the north and south slopes ascend at 20 to 30% into deep swales (Plate 112).

The saddle is the primary feature at this location that could influence raptor movement. Birds flying through the swales to the north and south will often cross the ridge at this saddle.

Proximity to Other Potential Risk Factors

The site is 0.18 miles west of a transmission line corridor with towers that provide perching and nesting opportunities for raptors, including golden eagles. The nearest potential tree-nesting habitat is oak savannah 0.63 miles south of the site. There are no other perching or nesting opportunities or conditions that encourage ground squirrel activity in the immediate vicinity of the site, and no ground squirrel activity was noted near the site. The nearest golden eagle nest is 0.8 miles southwest of the site. Low level of golden eagle activity was reported from the vicinity of Turbine 35 during raptor surveys. Kernel density analysis places it in the lowest use zone.

Risk Determination and Recommendation

The Turbine 35 turbine is considered a high-risk site due to its location within a deep ridge saddle. Risk could be reduced by moving the turbine 233 feet to the east at 37.667987° -121.583324°. This moves the turbine out of the saddle to the ridgetop (Figure A-35). This location is considered a Moderate-risk site.

Response to Recommendation and Alternative Relocation

To provide sufficient distance from the nearby transmission line, Mulqueeney Wind selected an alternative location 787 feet southwest of the original site at 37.666529° -121.586167° (Figure A-35).

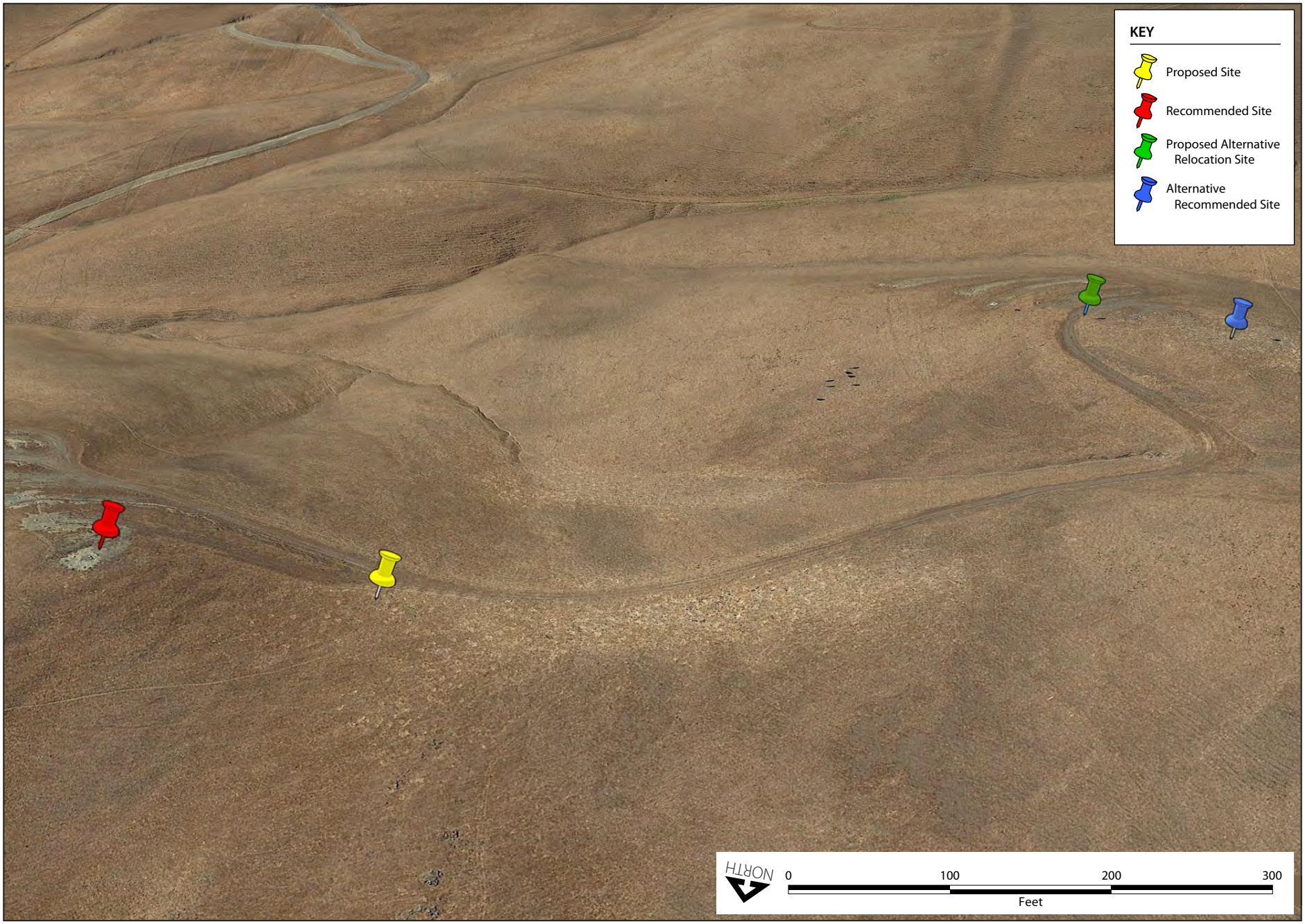
Risk Determination and Recommendation for Alternative Relocation

The site is along an old-generation turbine string on a short, descending northwest-southeast-oriented ridge. The proposed alternative turbine site is on the edge of an east-facing slope in a notch below the top of the ridge. There is a meteorological tower at the top of the ridge, which would be removed. Slopes on the east, north, and south descend into deep swales. A deep saddle crosses the ridge to the west. A higher elevation ridge is just west of the site (Plates 113 and 114), but probably sufficiently distant to not create additional risk to birds crossing the ridge. This location is considered less risky than the initially proposed site; however, is still considered Moderate-high risk. Risk can be reduced further by moving the site 146 feet northwest to 37.666690° -121.586635°. This places the turbine on the highest point on the ridge at the met tower location.

Plate 112. Looking east from the initially proposed Turbine 35 location, upslope from the saddle toward the recommended location on the hill top.

Plate 113. Looking west from the proposed alternative relocation site. The met tower in the background is the high point on this small ridge. Note the higher elevation ridge in the background.

Plate 114. Looking south from the proposed alternative relocation site.



05/04/2020

SOURCE: Google Earth 2020.

Figure A-35
Location of Proposed and Recommended Sites for Turbine 35 at the Mulqueeney Wind Project

Turbine 36

Topographical Description

The Turbine 36 site is located within a broad saddle along a northwest-southeast-oriented ridge, downslope to the east from the ridgetop (Figure A-36). Steep slopes (40%) on the southwest and northeast sides of the ridge descend into deep gorges. From the saddle, the ridgeline slopes to the southeast at 30% and to the northwest at about 20% (Plates 115, 116, and 117). The existing access road along the old-generation turbine string is on the west side of the ridge, which has created a berm just below the apex of ridgeline, which can create slope-accelerated winds.

Topographic features that could influence raptor movement include the slopes along ridge and the broad saddle, a likely crossing point. The site is also subject to slope-accelerated winds from the southwest, the prevailing wind direction, potentially effecting birds using these winds to hover-hunt above the ridgeline.

Proximity to Other Potential Risk Factors

The site is 0.27 miles east of a transmission line corridor with towers that provide perching and nesting opportunities for raptors, including golden eagles. The nearest potential tree-nesting habitat is oak savannah 0.61 miles southwest of the site. There are no other perching or nesting opportunities or conditions that encourage ground squirrel activity in the immediate vicinity of the site, and no ground squirrel activity was noted near the site. However, a new meteorological tower would be installed approximately 545 feet northwest of Turbine 36, creating a new potential perching structure for raptors. The nearest golden eagle nest is 1.4 miles southwest of the site. Low-to-moderate level of golden eagle activity was reported from the vicinity of Turbine 36 during raptor surveys. Kernel density analysis places it in the second lowest use zone.

Risk Determination and Recommendation

The Turbine 36 site is considered high risk due to its location on a steep slope and within a broad ridge saddle. Placement of the turbine at this location would result in a large bench on the slope just below the top of the saddle. A new spur road would also be required to access the ridgetop road, which would provide primary access to the site. Potential risk can be reduced by relocating the turbine 439 feet southeast at 37.665531° -121.574653°. This moves the turbine off of the slope to the ridge top and out of the ridge saddle (Figure A-36). This location remains subject to slope-accelerated winds and is in close proximity to steep slopes. It is considered a Moderate-High risk site.

Response to Recommendation and Alternative Relocation

To provide sufficient distance from property boundary, Mulqueeney Wind selected an alternative site 387 feet northwest of the original site at 37.666755° -121.576997° (Figure A-36).

Risk Determination and Recommendation for Alternative Relocation

This site is along the same ridge as the original site. Although this moves the turbine off of the southeast-facing slope, it remains within the broad saddle of the ridge with rotors that would extend across the saddle, and thus remains a High-risk location (Plates 118 and 119). To reduce risk to Moderate-High,

move the turbine 588 feet northwest along the ridgeline to the highest point and out of the broad saddle at 37.668147° -121.578077°.

Plate 115. Looking northeast from the initially proposed Turbine 36 location.

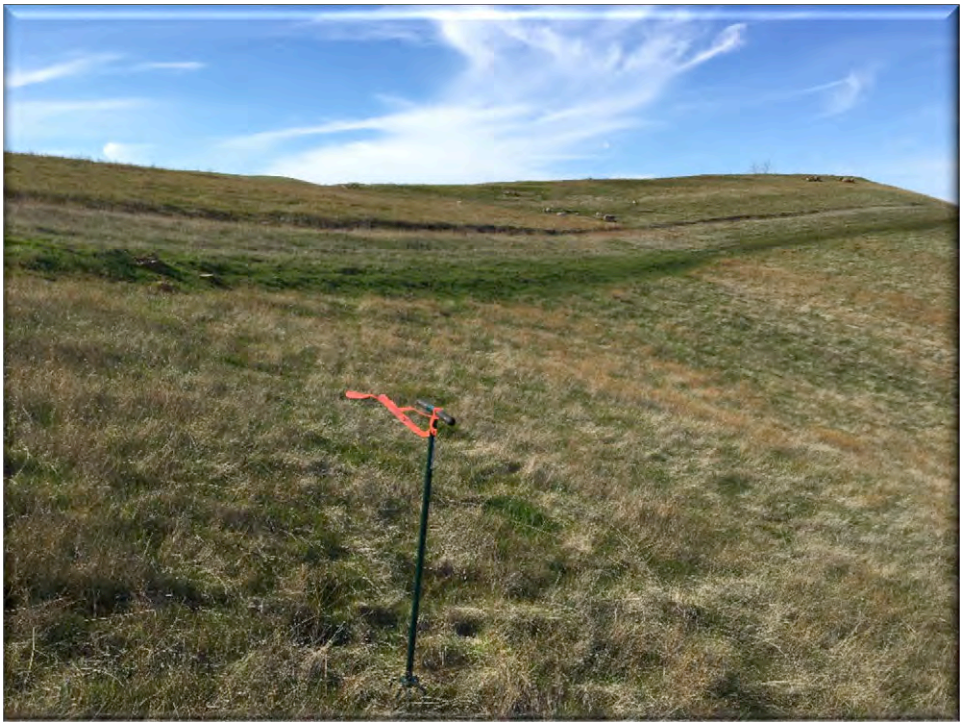
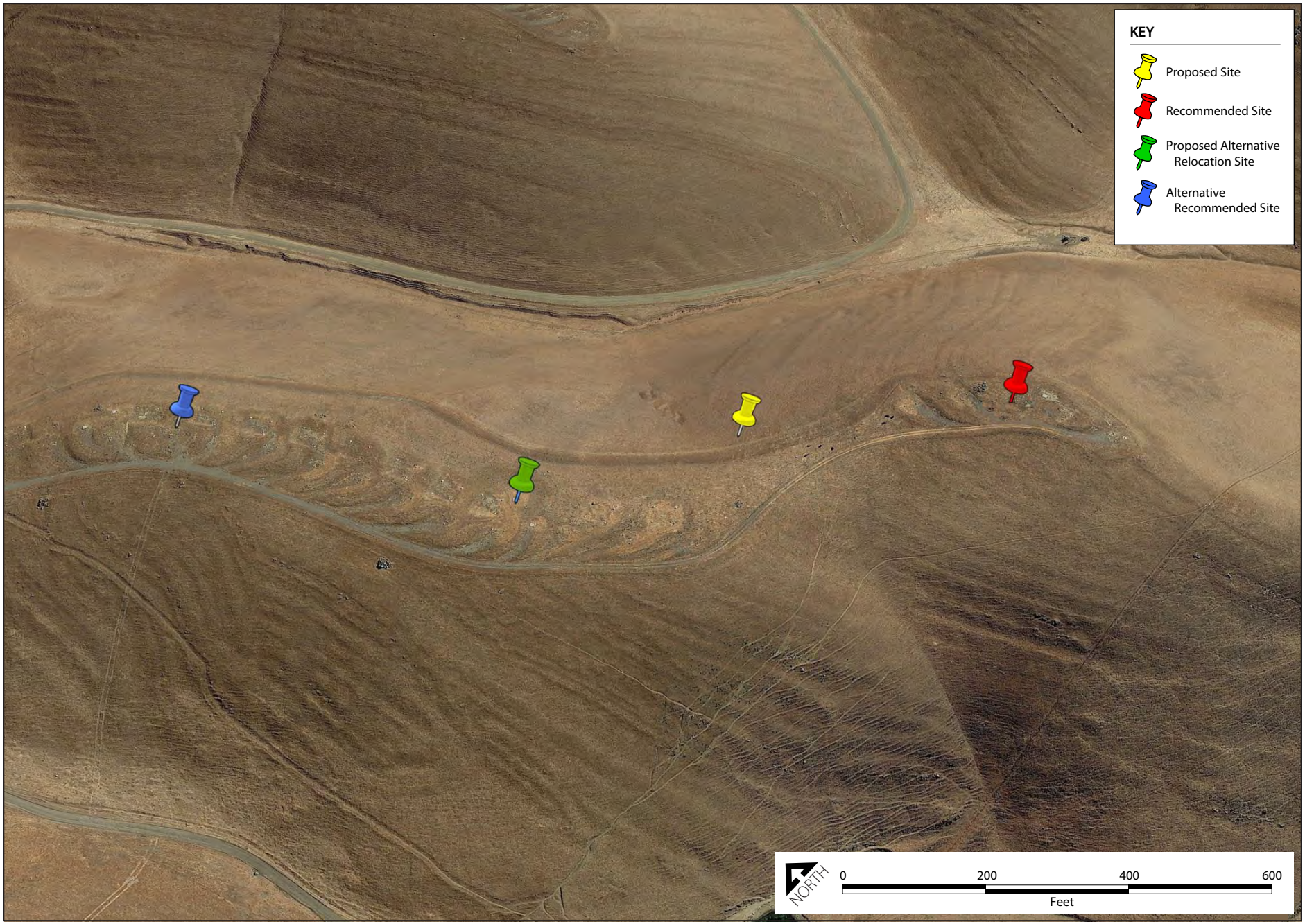


Plate 116. Looking northwest from the initially proposed Turbine 36 location. The location is downslope from the ridge top and within a broad saddle.

Plate 117. Looking southeast from the initially proposed Turbine 36 location toward the recommended site at top of hill along the old generation turbine string.

Plate 118. Looking southeast from proposed alternative relocation site. Note that the site remains within the broad saddle along this narrow ridge. Rotors would extend across the saddle. The initially proposed site is further southeast and on the slope to the left. The recommended site is at the far end of the ridge in the background beyond the saddle.

Plate 119. Looking northwest upslope along the ridge from the proposed alternative relocation site. The recommended alternative for the proposed relocation site is at the top of this ridgeline.



05/04/2020

SOURCE: Google Earth 2020.

Figure A-36
Location of Proposed and Recommended Sites for Turbine 36 at the Mulqueeney Wind Project

Turbine 37

Turbine 37 is one of three proposed turbine locations that was not initially evaluated. Mulqueeney Wind removed three of the originally sited turbines, 8, 9, and 13, due to wake, proximity to transmission lines, or low wind issues. These turbines were replaced with three new turbine locations, enumerated here as Turbines 37, 38, and 39 to maintain numerical continuity. They are proposed, however, to replace the three originally sited turbines that were removed.

Topographical Description

Turbine 37 is located on a narrow ridge where two ascending swales converge (Figure A-37). The site is on the western-most portion of a larger east-west-oriented ridge along an old-generation turbine string. The ridgetop is flat at this location, but is on a lower bench of the ridge and immediately adjacent to a steep ascent on the east toward a higher portion of the ridgeline (Plate 120). The slopes are very steep (60 to 70%) on the north and south within the ascending swales and on the west and northwest faces of the ridge terminus. Topographic features that may influence raptor movement at this location include the convergence of swales at the ridgetop and the location at the base of a steep slope along the ridgeline, all of which create a likely crossing point for raptors.

Proximity to Other Potential Risk Factors

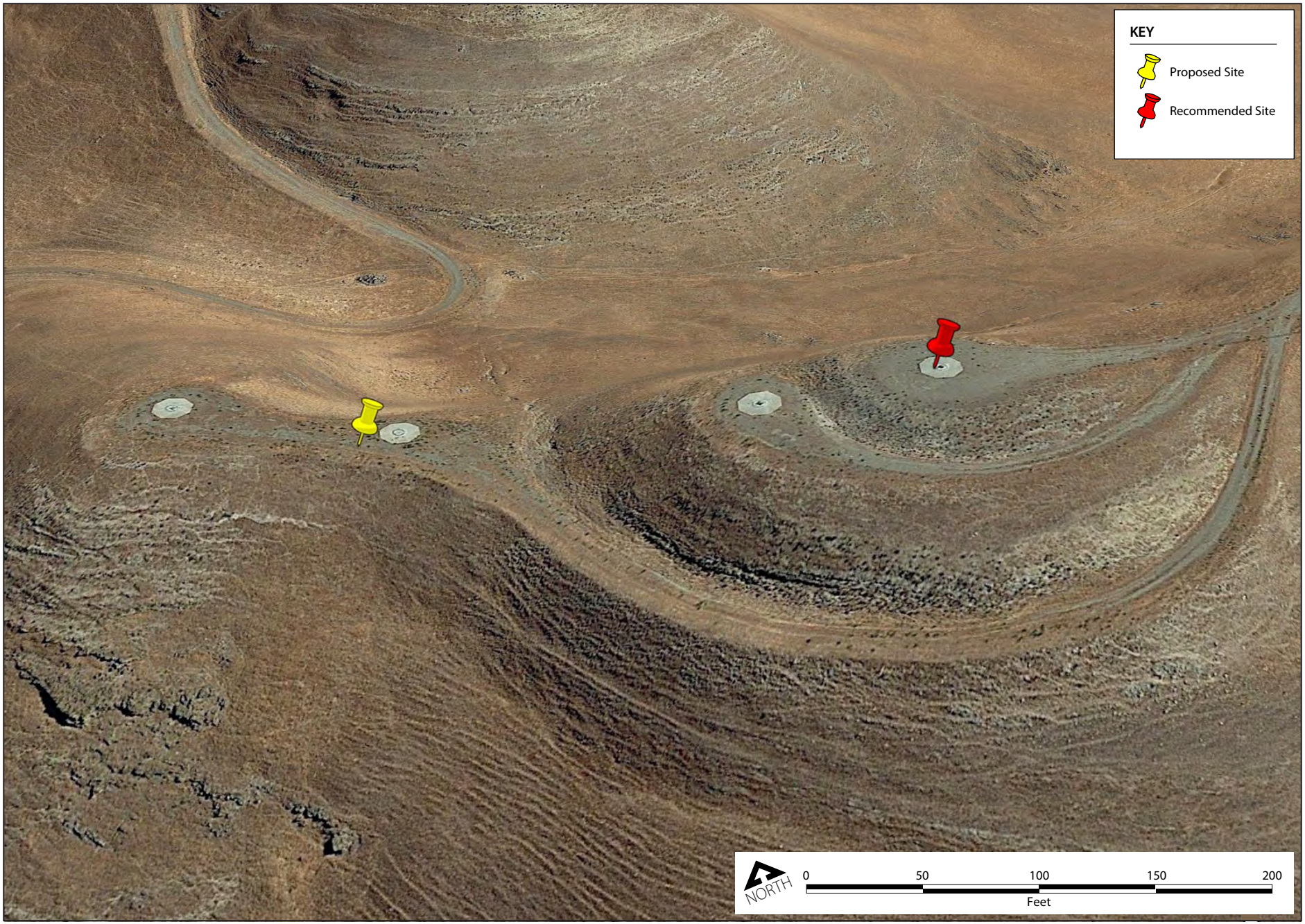
The site is 0.35 miles south of a transmission line corridor with towers that provide perching and nesting opportunities for raptors, including golden eagles. The site is also 592 feet west of a meteorological tower, which also provides perching opportunities for raptors but would be removed. The nearest potential tree-nesting habitat are the riparian trees along the creek that parallels Patterson Pass Road, 0.44 miles east of the site. There are no other perching or nesting opportunities or conditions that encourage ground squirrel activity (e.g., rock piles, spoils sites, fence rows, drainages) in the immediate vicinity of the site and no ground squirrel activity was noted near the site. The nearest golden eagle nest is the Patterson Pass Road nest, 0.59 miles south of the site. Moderate-to-high levels of golden eagle activity was reported in the vicinity of this site during raptor surveys. Kernel density analysis places it in the second highest use zone.

Risk Determination and Recommendation

The Turbine 37 site is considered high risk due to its location at the convergence of two ascending swales and at the base of a steep ascending slope along the ridge line. These factors combine to make this a likely crossing point for raptors. The site is also close to a met tower used by perching golden eagles, although it would be removed. On two occasions, an adult golden eagle from the Patterson Pass nest was observed perching on this met tower before flying back toward the nest site. This eagle was also observed contour-hunting and circling above the ridgeline in the vicinity of Turbine 37.

Risk can be reduced by relocating the turbine 313 feet southeast along the ridge. This moves the turbine to a high point on the ridge away from the ascending swales. This site is considered a Moderate-High risk site.

Plate 120. Looking southeast along the ridge toward the Turbine 37 site. The marker is faintly seen in front of the vehicle. Note the steep ascending swales that converge and the ascending slope eastward along the ridge. The recommended location is on the ridgetop in the background. The met tower is faintly seen in the center left of the photo.



05/04/2020

SOURCE: Google Earth 2020.

Figure A-37
Location of Proposed and Recommended Sites for Turbine 37 at the Mulqueeney Wind Project

Turbine 38

Turbine 38 is one of three proposed turbine locations that was not initially evaluated. Mulqueeney Wind removed three of the originally sited turbines, 8, 9, and 13, due to wake, proximity to transmission lines, or low wind issues. These turbines were replaced with three new turbine locations, enumerated here as Turbines 37, 38, and 39 to maintain numerical continuity. They are proposed, however, to replace the three originally sited turbines that were removed.

Topographical Description

Turbine 38 is located near the northwest terminus of a northwest-southeast-oriented ridge (Figure A-38). Although near a very steep (70%) west-facing slope that descends into a deep gorge, the site is in a fairly broad and flat area at the end of an old-generation turbine string. The site slopes eastward at 20 to 30% into a broad swale (Plates 121 and 122).

Proximity to Other Potential Risk Factors

The site is 0.51 miles west of a transmission line corridor with towers that provide perching and nesting opportunities for raptors, including golden eagles. The nearest potential tree-nesting habitat are the riparian trees along the creek that parallels Patterson Pass Road, 0.19 miles northwest of the site. There are no other perching or nesting opportunities or conditions that encourage ground squirrel activity (e.g., rock piles, fence lines, spoils sites) in the immediate vicinity of the site. The nearest golden eagle nest is the Patterson Pass Road nest, 0.26 miles northwest of the site. Moderate-to-high level of golden eagle activity was documented in the vicinity of this site during raptor surveys.

Risk Determination and Recommendation

The Turbine 38 site is considered High risk. There are no high-risk topographic features in the immediate area; however, its close proximity to an active golden eagle nest increases the potential for collision mortality. Topographically, the turbine is otherwise situated in the safest location in the immediate area. There is no potential for local movement that would reduce risk.

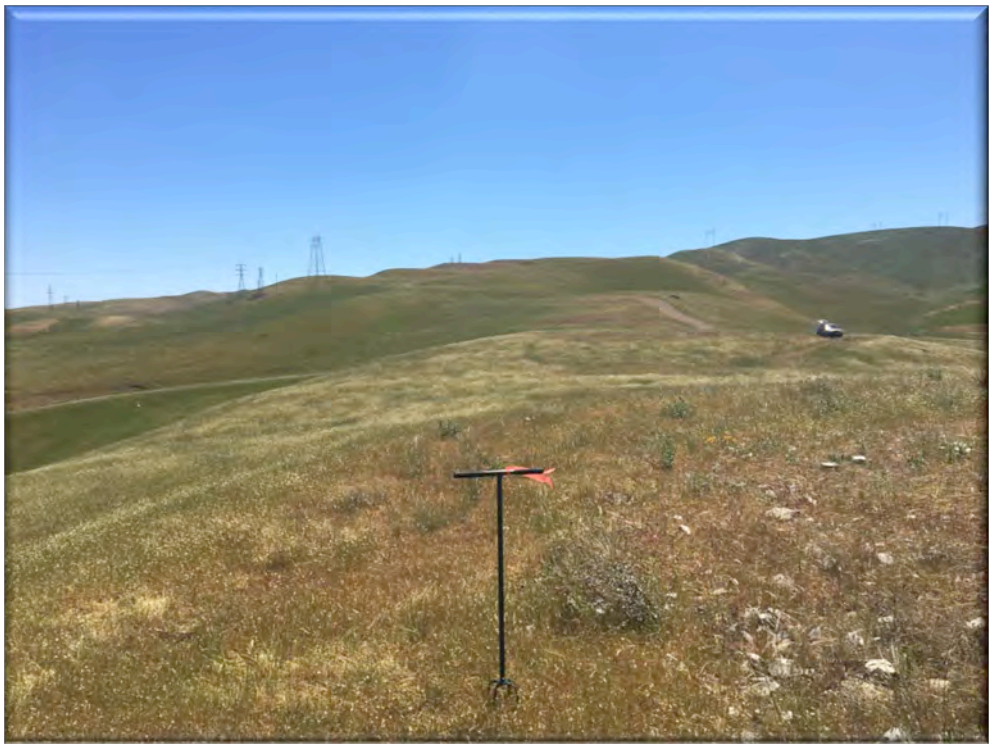
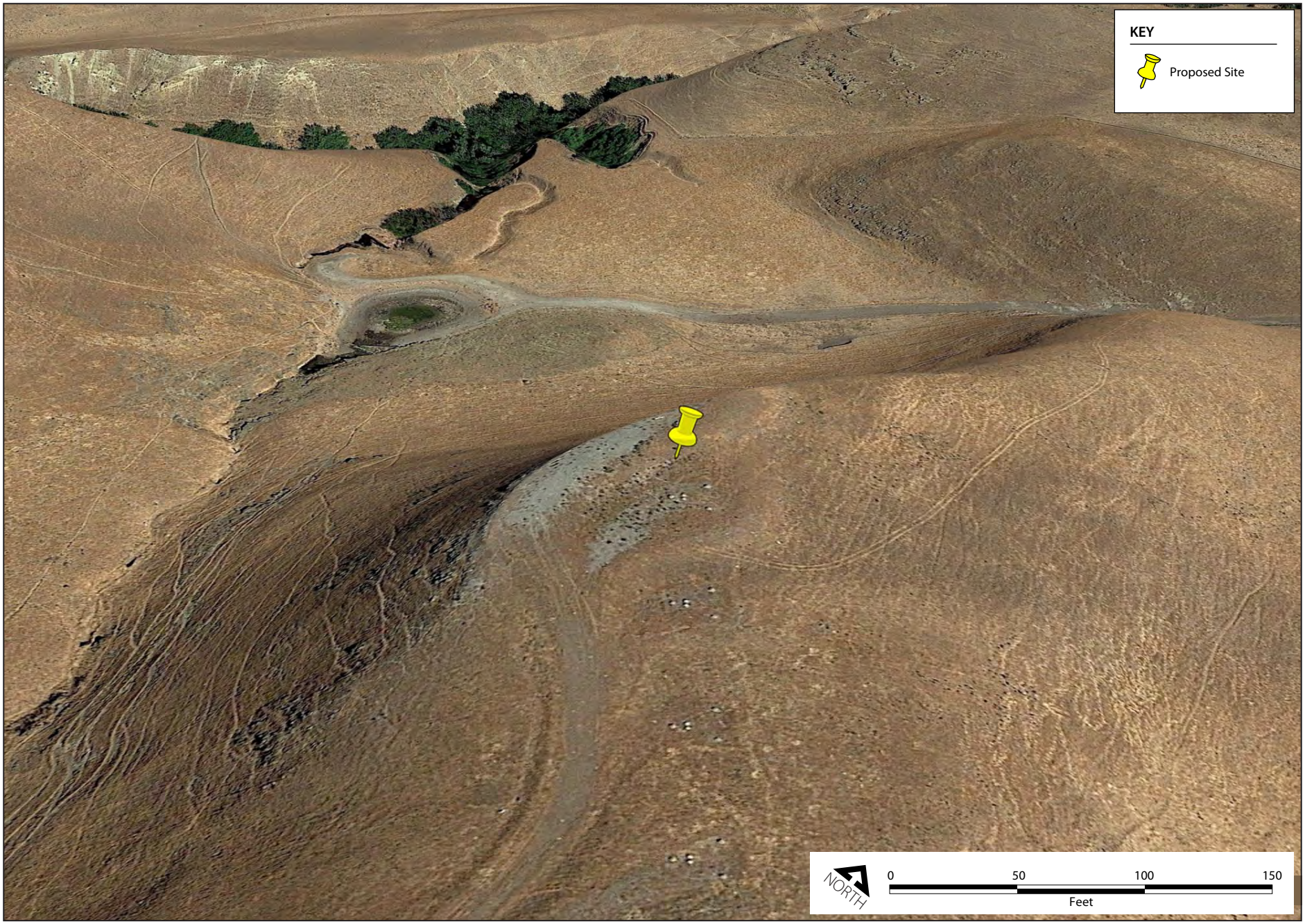


Plate 121. Looking south from Turbine 38 location.

Plate 122. Looking east from Turbine 38 location.



05/04/2020

SOURCE: Google Earth 2020.

Figure A-38
Location of Proposed and Recommended Sites for Turbine 38 at the Mulqueeney Wind Project

Turbine 39

Turbine 39 is one of three proposed turbine locations that was not initially evaluated. Mulqueeney Wind removed three of the originally sited turbines, 8, 9, and 13, due to wake, proximity to transmission lines, or low wind issues. These turbines were replaced with three new turbine locations, enumerated here as Turbines 37, 38, and 39 to maintain numerical continuity. They are proposed, however, to replace the three originally sited turbines that were removed.

Topographical Description

Turbine 39 is located on the lower slope of a high, broad north-facing ridge. The ascending slope is about 25% at the site, then more steeply ascends to the ridgetop. To the north, the slope descends at 25% toward the road at the base of the hill. The site is surrounded by higher elevation hills and ridges (Plate 123).

Proximity to Other Potential Risk Factors

The site is 0.30 miles west of a transmission line corridor with towers that provide perching and nesting opportunities for raptors, including golden eagles. The nearest potential tree-nesting habitat are the riparian trees along the creek that parallels Patterson Pass Road, 0.95 miles northwest of the site. There are no other perching or nesting opportunities in the immediate vicinity. The site is about 500 feet from a seasonal drainage and two stock ponds. These features often are more conducive to ground squirrel occurrence, probably due to more favorable soil conditions. Several ground squirrel burrows were observed around these features, one of which was used by nesting burrowing owls. The nearest golden eagle nest is the Patterson Pass Road nest, 1.04 miles north of the site. Moderate level of golden eagle activity was reported in the vicinity of this site during raptor surveys.

Risk Determination and Recommendation

The Turbine 39 site is considered high risk due to its location on a slope near the base of a tall ridge and surrounded by higher elevation hills and ridges. Placement of the turbine and construction of a road to access the site would also create a bench in the slope, further increasing risk. Contour-hunting raptors and birds flying ridge to ridge would encounter this turbine. Because of its location so far down the slope, there are no opportunities for local relocation that would reduce risk.

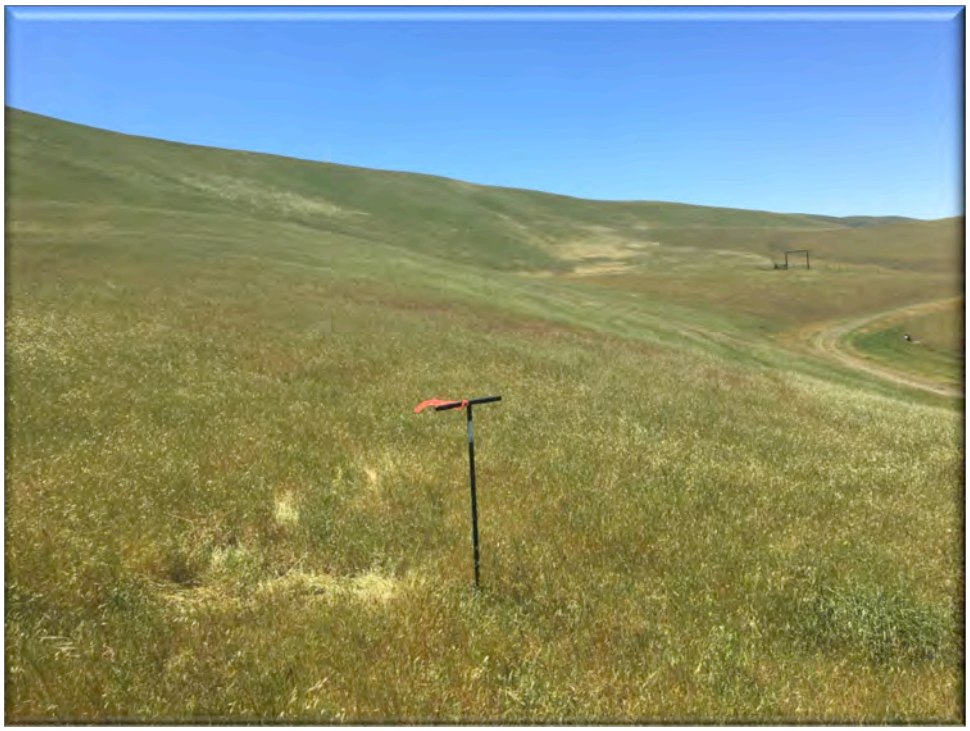
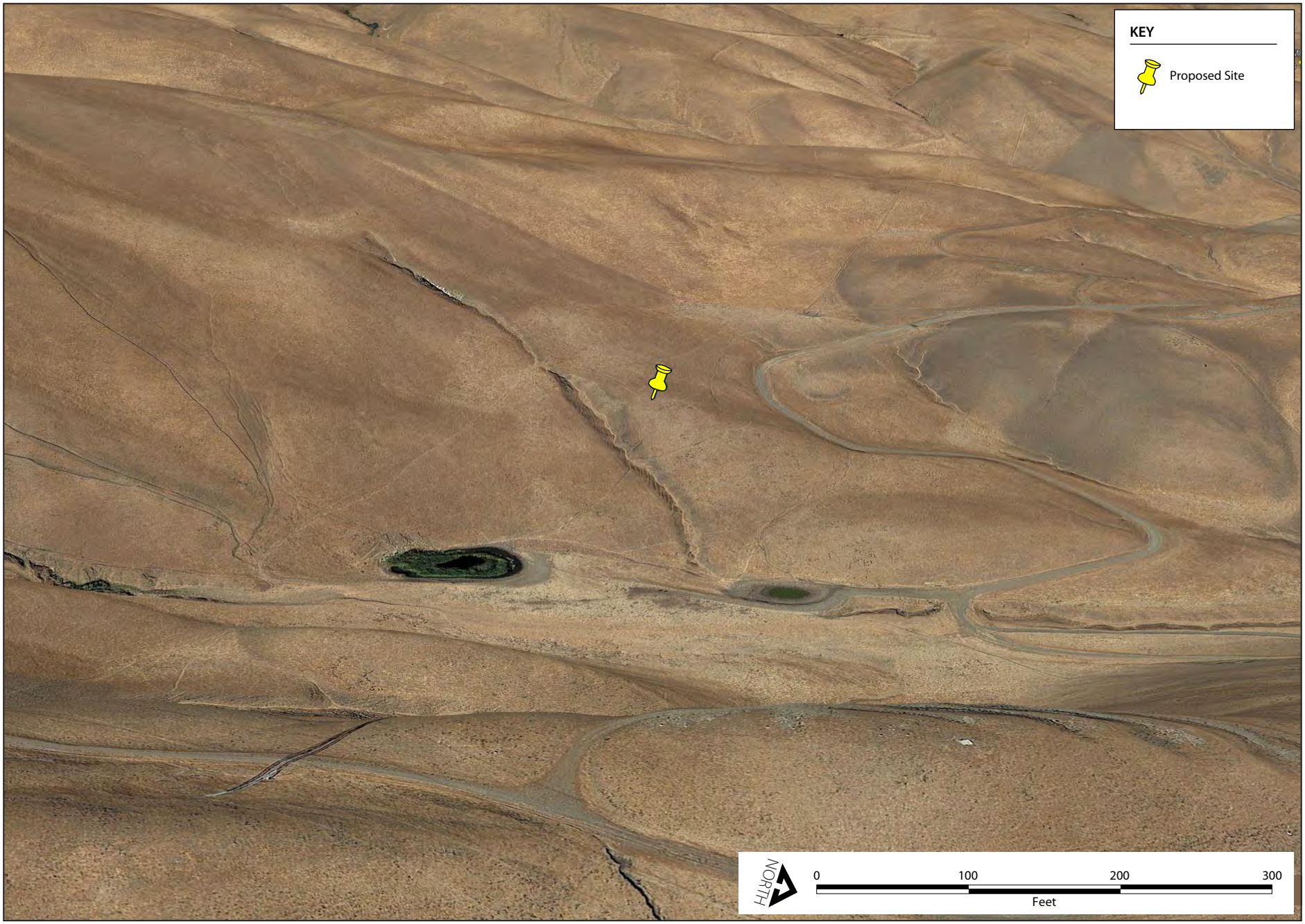


Plate 123. Looking west from Turbine 39 location.



05/04/2020

SOURCE: Google Earth 2020.

Figure A-39
Location of Proposed and Recommended Sites for Turbine 39 at the Mulqueeney Wind Project