

Sand Hill Wind Repowering Project

Appendix A-2. Assessment of Turbines 11 through 20

March 2019

Turbine 11

Turbine 11 has only one location (Site 11A) for the four layouts (Figure A-11).

Topographical Description

Site 11A is near the top of a small southeastward-sloping ridge. It is also on the edge of a steep, broad swale that extends from a stock pond downslope to the north in the adjacent ravine to the top of the ridge, creating a broad saddle on the north side of the ridge (Plate 15). The site is also set back about 200 feet eastward from a steep broad west-southwest-facing ridge.

Proximity to Other Potential Risk Factors

A stock pond is approximately 500-feet north of the site.

Relative Risk and Determination

Although Site 11A is located near the top of the ridge, the proximity to the saddle/swale on the north side of the ridge and the west-facing slope of the ridge results in moderate-risk to raptors whose flight patterns are influenced by these topographic features. Raptors, particularly golden eagles, may use the low, broad swale as a flight corridor, and the west-facing slope creates potential slope-accelerated winds where raptors, particularly red-tailed hawks, may kite and hover as they hunt above the slope. However, the Site 11A location may be sufficiently distant (200 feet at the slope break) from the west-facing slope.

Recommendation

Any local relocation would place the turbine either more in alignment with the swale/saddle or closer to the west-facing slope. So, the current location of Site 11A is the recommended site. This is generally consistent with Smallwood and Neher (2018).



Plate 15. Looking north from Site 11A.



1/05/2019

SOURCE: Google Earth 2018.

Figure A-11
Location of Alternative Sites for Turbine 11 at the Sand Hill Wind Project

Turbine 12

Turbine 12 has five alternative locations, 12A (Layout 1), 12B (layout 2), 12C (layout 3), 12D (layout 4), and 12E (an additional proposed alternative as per the February 4-5 site visit by sPower engineers) (Figure A-12).

Topographical Description

Overall, the topography in the vicinity of Turbine 12 is relatively low-relief rolling hills.

Site 12A is on relatively flat ground, sloping down slightly to the northeast and east, and slightly up to the southwest. There are no significant topographic features in the immediate vicinity that would influence raptor flight patterns.

Site 12B is on a small shoulder on a gentle southeast-facing slope. The slope gradually increases to the west toward the top of the low ridge. There is a dip at the top of the slope. Northward after reaching the top of the southeast-facing slope, the terrain drops down into a deep swale.

Site 12C is along an old generation turbine string near the top of a low ridge. The slope continues upward to the southeast until reaching the apex at a gravel road before dropping off into a ravine to the southeast. The old turbine pads create small benches cut into the north and northwest-facing slope.

Site 12D is 110 feet southwest of Site 12A. It's near the top of a gradual north-facing slope. The terrain continues to ascend toward the southwest and descend toward the north and east. There are no significant topographic features in the immediate vicinity that would influence raptor flight patterns (Plate 16).

Site 12E is 37 feet south of Site 12D with similar topographic conditions.

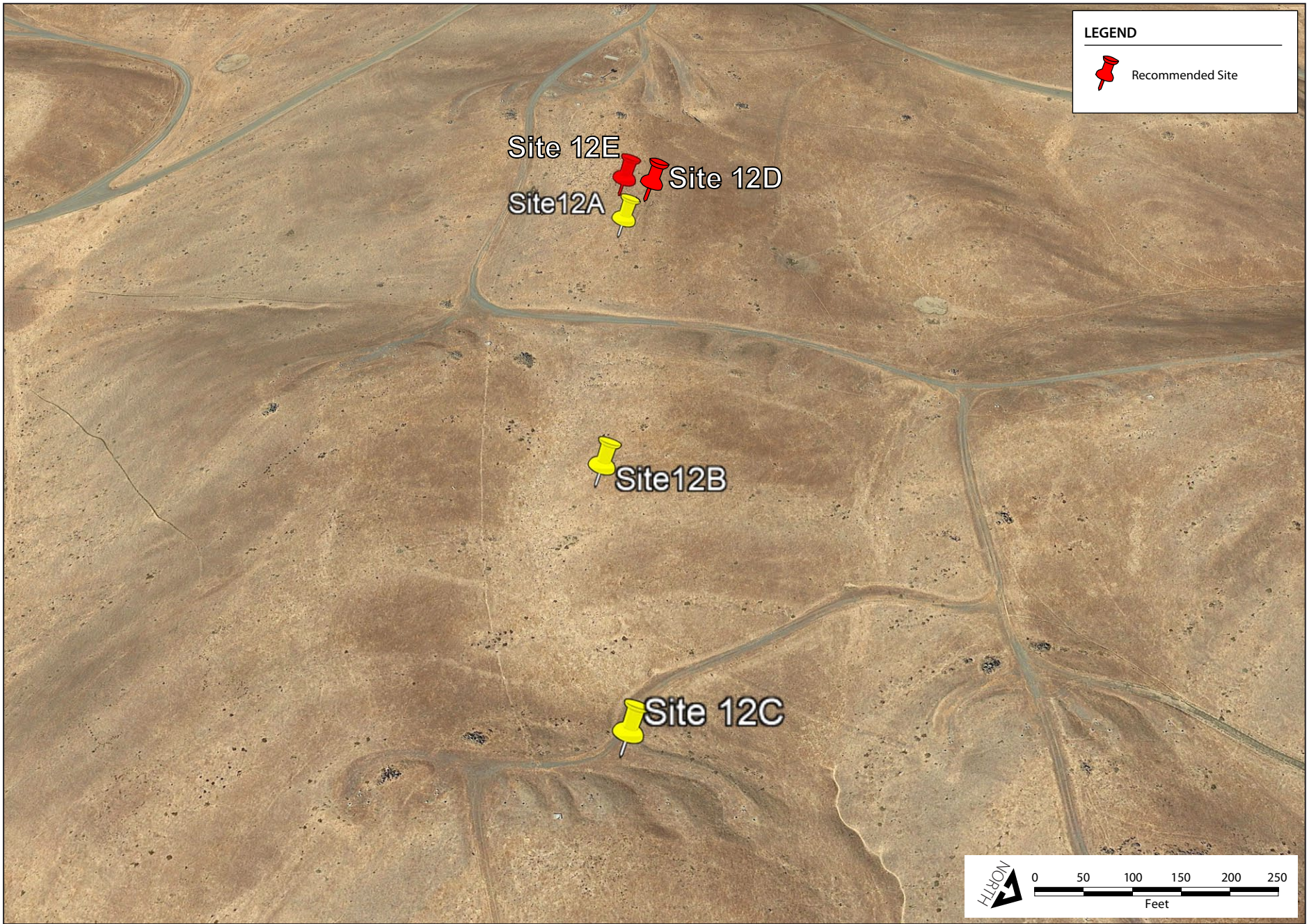
Proximity to Other Potential Risk Factors

A transmission line is 600-700 feet west of Sites 12A and 12D. There is a large rock pile within 130 feet of Site 12C.

Relative Risk and Determination

All four of the Turbine 12 sites are relatively low- to moderate-risk sites. Each is on a gentle slope and because of the generally low topographical relief in the area, there are few significant topographic features that influence raptors movements.

Site 12A is considered a relatively low-risk site due to the generally flat topography and lack of other risk factors. Site 12B is considered low-to-moderate risk due to slope conditions. Site



4/2/2019

SOURCE: Google Earth 2018.

Figure A-12
Location of Alternative Sites for Turbine 12 at the Sand Hill Wind Project

12C is considered a low-to moderate risk due to location on a small slope bench. Sites 12D and 12E are considered low risk sites due to relatively flat terrain with no significant topographical features in the immediate area that would influence raptor flight patterns. Because of the generally low topographical profile, each would be highly visible from all directions. Access road and turbine pad construction would not substantially alter topography or raptor use or movement at any of these sites.

Recommendation

Sites 12D and 12E are similar and are probably the safest of the five locations. Either of these is the recommended site. This is consistent with Smallwood and Neher (2018). Risk could be further reduced by moving the site 280 feet to the southwest to the top of the hill. However, this places the turbine within 300 feet of the transmission line.



Plate 16. Looking southeast from Site 12D, the recommended location for Turbine 12.

Turbine 13

Turbine 13 has four alternative locations, 13A (Layout 1), 13B (layout 2), 13C (layout 3) and 13D (layout 4) (Figure A-13).

Topographical Description

All four alternative sites are along a narrow northeast-southwest-oriented ridge with steep (25%) drop-offs to the northwest and southeast (Figure A-13). The flatter portion of the ridge top ranges from about 30 to 45 feet-wide along the length of the ridge.

Site 13A is on relatively steep (20%) west-facing slope at the far west end of the narrow ridge (Plate 17). The site is 172 feet down the westward-ascending ridge from the ridge top.

Site 13B is on a particularly narrow portion of the ridge top between two shallow saddles along the ridgeline (Plate 18).

Site 13C is in a dip at the site of an old-generation turbine. Eastward, the ridge is ascending, so Site 13C is in a low spot on the ridge line at the base of a slope (Plate 19).

Site 13D is about 90 feet upslope to the east of Site 13A and about 90 feet from the top of the ridge just downslope from the site of an old-generation turbine (Plate 20).

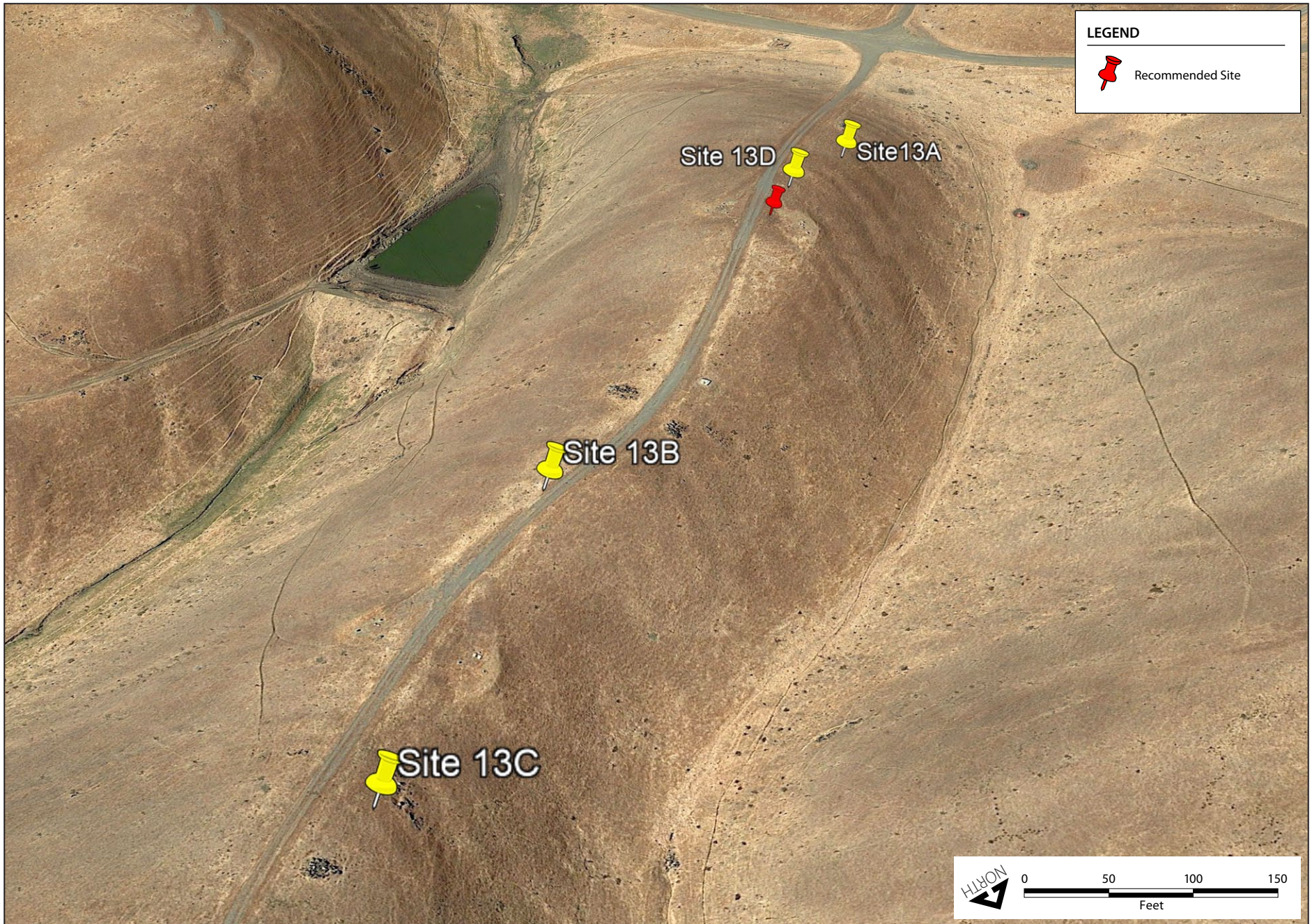
Proximity to Other Potential Risk Factors

There is a large rock pile within 80 feet of Site 13A and two rock piles within 120 feet of Site 13B. There is also a large stock pond downslope in the ravine approximately 250 feet southeast of Sites 13A and 13D.

Relative Risk and Determination

Because of its narrowness, construction at any of the Turbine 13 alternatives along the ridge will likely require the creation of a large bench, which may create a significant notch in the ridgeline, and potentially result in a high-risk topographical feature at the location of the turbine. Also, significant road construction will be required to access this ridge and construct the turbine, which will modify the topographic conditions along the ridge and potentially result in high risk topographical features not currently present.

The slopes on both sides of this ridge provide ideal contour hunting opportunities for golden eagles. The relative narrowness of the slope means that the turbine will be in close proximity to the edge of the ridge slope.



1/05/2019

SOURCE: Google Earth 2018.

Figure A-13
Location of Alternative Sites for Turbine 13 at the Sand Hill Wind Project

Recommendation

Alternatives for reducing risk potential are limited for Turbine 13 due mainly to the narrowness of the ridgetop. Site 13D is preferable to Site 13A because it moves the site further up on the slope. However, Site 13D should be moved an additional 50 feet to the top of the hill at the location of the old generation turbine site (37.769669/121.613260). This is the recommended location (Figure A-13). Another alternative location for Turbine 13 is approximately 400 feet northeast of site 13C to the top of the hill (37.771870/121.610223). This is also the site of an old generation turbine. This location relocates the turbine off of the narrowest portion of the ridgeline onto a slightly broader, flatter site. However, if this site were used, access should be from the existing road that crosses the ridge to the northeast to avoid the significant earth-moving that would be required if the ridge road from the southwest were used. These recommendations are generally consistent with Smallwood and Neher (2018).



Plate 17. Looking east upslope from Site 13A toward Site 13D. The site is 172 feet downslope from the top of the ridge.



Plate 18. Looking east along the narrow ridge at Site 13B. Note the narrow ridge and the shallow saddle just east of the site.



Plate 19. Looking west from Site 13C. Note the bench below the ridge.



Plate 20. Looking east from Site 13D. About 80 feet east would put the turbine on top of the ridge.

Turbine 14

Turbine 14 has three alternative locations, 14A (Layout 1 and Layout 4), 14B (layout 2), and 14C (layout 3) (Figure A-14).

Topographical Description

Site 14A is at the far southwest end of a northeast-southwest-oriented ridge intersected by several fairly deep lateral (northwest-southeast-oriented swales) (Plate 21). As a result, several smaller northwest-southeast-oriented ridges occur, with Site 14A located on the western-most of these near the top of a broad west- to southwest-facing slope. The site is along an old-generation turbine string. The west-southwest-facing slope is fairly steep (20%) and with its northwest-southeast extent (>1,200 feet-wide), creates a significant location for slope-accelerated winds. Topography is relatively flat to the north with an ascending slope to the south along the old-generation turbine string. From a northwest-southeast orientation, the site is on a shoulder of the south-facing ascending slope. Eastward the slope descends into a broad swale.



SOURCE: Google Earth 2018.

Figure A-14
Location of Alternative Sites for Turbine 14 at the Sand Hill Wind Project

Site 14B is located on a hill top along an old-generation turbine string (Plate 22). Its approximately 650 feet east-northeast of Site 14A along the next small northwest-southeast-oriented lateral ridge, across the broad swale east of Site 14A. The topography slopes steeply (25%) northward into a ravine, and descends (15%) to the west into the swale separating it from Site 14A, eastward (15%), and southward (10%).

Site 14C is approximately 450 feet northeast of Site 14B near the top of the northeast-southwest-oriented ridgeline (Plate 23). The ridge top is relatively narrow at this location. The site itself is fairly flat with a slight (5%) ascending slope southwestward – down the ridgeline – but with only about 40 feet of flat ridgetop before dropping steeply to the north (20%) into a deep ravine, and to the south (15%) into a deep swale.

Proximity to Other Potential Risk Factors

There is a stock pond approximately 600 feet of all three sites. There is a rock pile about 120 feet west of Site 14B. There are 3 large rock piles within 150 to 200 feet of Site 14C.

Relative Risk and Determination

Site 14A is a relatively high-risk location due its proximity to the west-southwest-facing slope, which has potential for slope-accelerated winds where raptors, particularly red-tailed hawks, will hunt by kiting or hovering in the wind and creating opportunities for birds to backup or turn back toward the turbine rotors while changing position.

Site 14B is a low- to moderate-risk site. It's on a fairly broad hilltop along on old-generation turbine string with good road access.

Site 14C is a moderate-risk site due to the narrowness of the ridge, which may require substantial earth-moving to create a pad, and possibility of creating a notch in the ridgeline from the installation of the turbine pad.

All three sites have existing road access, but in each case, roads will need substantial improvements. Improving the road at Site 14A would create a larger berm along the west-facing slope and potentially increase risk. Road construction to access Sites 14B and 14C would result in less alteration of the local topography and are less likely to increase risk.

Recommendation

A less-risk alternative for Site 14A is to relocate the turbine about 130 feet northward along the ridge (37.767506/121.611658). This moves it further from the shoulder on the south, although it does not reduce the risk caused by slope-accelerated winds. The recommended site for Turbine 14 is Site 14B. This location moves the turbine away from the high-risk wind conditions at Site 14A and is on a relatively flat and broad ridge/hilltop (Figure A-14). This is consistent with Smallwood and Neher (2018).



Plate 21. Looking northeast along the ridge from Site 14A.



Plate 22. Looking southward from Site 14B.



Plate 23. Looking northeast along ridge from Site 14C.

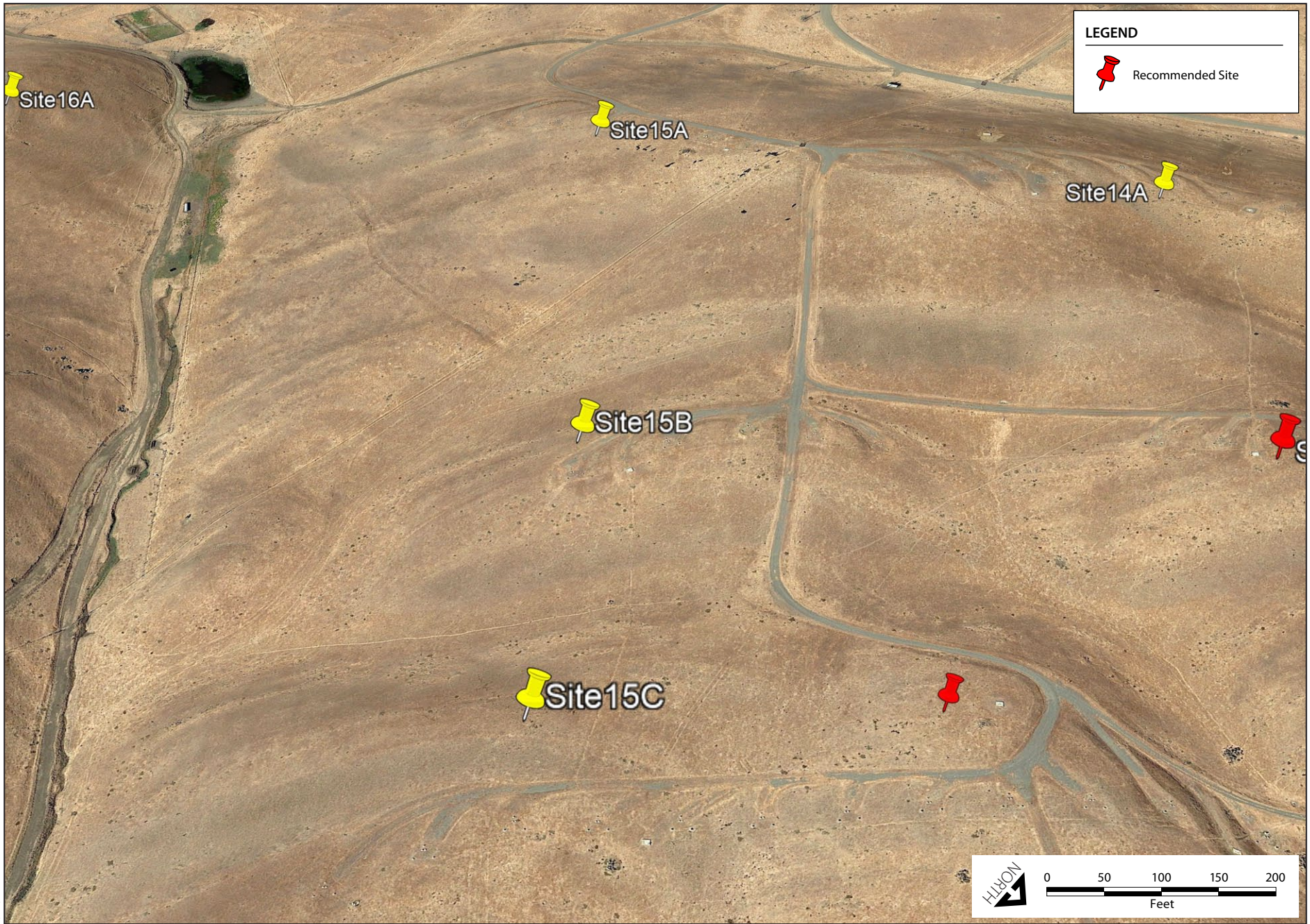
Turbine 15

Turbine 15 has three alternative locations, 15A (Layout 1 and Layout 4), 15B (layout 2), and 15C (layout 3) (Figure A-15).

Topographical Description

Site 15A is near the top of a hill on relatively flat terrain (Plate 24). There is a 5% ascending slope to the top of the hill, approximately 140 feet northward. The terrain slopes steeply (20%) downward to the west at the south end of the broad west-facing slope. As a result, this site may also be subject to slope-accelerated winds from the west and southwest, but perhaps not to the extent of Site 14A. There is also a fairly steep (15%) descending slope toward the south into a deep ravine and a gentle descending slope to the east into a swale. At the top of the hill, the terrain is relatively flat and broad to the north-northwest for about 450 feet.

Site 15B is located along a small, fairly low-profile northwest-southeast-oriented transverse ridge at the southeast end of an old-generation turbine string (Figure A-15). There is an ascending slope to the north toward the top of the hill/ridge and slightly downward to the south. The slopes descend more steeply into swales to the east (15%) and west (20%). The site is on a small slope bench created during the installation of the old-generation turbines (Plate 25).



1/05/2019

SOURCE: Google Earth 2018.

Figure A-15
Location of Alternative Sites for Turbine 15 at the Sand Hill Wind Project

Site 15C is on relatively flat terrain extending nearly 300 feet to the northwest before an ascending slope to the top of the hill and for about 150 feet to the northeast before dropping into a swale (Plate 26). The site slopes down to the south into a deep ravine, and to the west into a swale that separates Site 5C from Site 5B.

Proximity to Other Potential Risk Factors

There is an overhead powerline approximately 300 feet west of Site 15A (which would be removed by the project) and a transmission line approximately 1,000 feet. There is also a rock pile about 130 feet north of Site 15A, and a rock pile within 200 feet of Site 15C.

Relative Risk and Determination

Site 15A is considered a high-risk due to the proximity of the west-facing slope. Sites 15B and 15C are considered to have to moderate risk. There are no extreme topographical features associated with the immediate vicinity of either site; however, both are on a broad mid-slope bench below the ridgetop to the north and above a deep ravine to the south. This may create some risk for birds using this south-facing slope for movement or contour hunting. Also, installing a turbine at the Site 15B or 15C locations would create a larger bench along the south-facing slope, potentially increasing risk.

Recommendation

Although still subject to slope-accelerated winds, risk at Site 15A may be reduced by moving the turbine upslope about 140 feet northwest to the top of the ridge (37.764653/121.612303). This moves the site off of the slope and further from the deep ravine on the south. This is consistent with Smallwood and Neher (2018).

Risk at Site 15B would be reduced by moving the turbine upslope 200 feet to the northwest (37.767039/121.608761) to the top of the ridge. This would relocate the turbine off of the south-facing slope to the top of the ridge and closer to the existing road, minimizing road construction and changes to the slope contour from both turbine and new roads.

Risk at Site 15C would be minimized by moving the turbine upslope about 450 feet to the northwest to the top of the hill (37.768344/121.607787). This site is at the top of the hill, has the greatest amount of flat ground, and is closer to the existing road (Plate 27). This is the recommended site for Turbine 15 (Figure A-15).



Plate 24. Looking east along ridge from Site 15A. Note proximity to deep ravine to south (right).



Plate 25. Looking north-northwest upslope from Site 15B.



Plate 26. Looking east from Site 15C.



Plate 27. Recommended relocation site for Turbine 15. North and slightly upslope from Site 15C, and further from the deep ravine to the south.

Turbine 16

Turbine 16 has three alternative locations, 16A (Layout 1 and Layout 4), 16B (layout 2), and 16C (layout 3) (Figure A-16).

Topographical Description

Site 16A is on a bench of a northwest-facing slope below the top of a hill at the end of an old-generation turbine string. The hill top is the western end of a northeast-southwest-oriented ridge with deep transverse swales that create a rolling topography (Figure A-16). The top of the slope is approximately 100 feet east-southeast of the site. The steep slope (30%) descends immediately to the north into a deep ravine (Plate 28). The terrain also slopes downward toward the west and upward toward the top of the hill.

Site 16B is approximately 800 feet northeast of Site 16A along the northeast-southwest-oriented ridge. The site is within a swale along the northwest-facing slope, which ascends to the south and east (Plate 29). Site 16C is on the east-facing slope of a large north-south-oriented swale with ascending slopes to the east and west (Plate 30).

Proximity to Other Potential Risk Factors

There is a stock pond approximately 300 feet downslope to the west of Site 16A. Site 16B is within 120 to 250 feet of numerous rock piles. Site 16C is within 120 feet of overhead power lines (that would be removed) and within 60 feet of a fence line.

Relative Risk and Determination

Sites 16A, 16B, and 16C are all considered high risk sites. Site 16A is considered high-risk due to its location on a bench of a steep slope. Site 16B is considered high-risk due to its location within a swale that creates a dip in the northwest-facing slope. Site 16C is considered high risk due to its location within a deep swale. These are topographic features that influence raptor movement and behavior and can contribute to collision risk.

Recommendation

Potential risk can be slightly reduced at Site 16A by moving the turbine upslope to the top of the hill about 90 feet east-southeast (37.762922/121.608068). The site would still be on the edge of a deep ravine, a potentially risky site. Potential risk can be reduced somewhat at Site 16B by moving the turbine upslope to the top of the ridge about 120 feet east-southeast (37.764529/121.605827). This is the recommended location for Turbine 16 (Figure A-16). At this location, the turbine is on a relatively flat ridge top (Plate 31), although still in close proximity to a deep ravine. Opportunities to reduce risk at Site 16C are limited and would require moving the turbine at least 500 to 600 feet east-southeast to the next ridgeline.

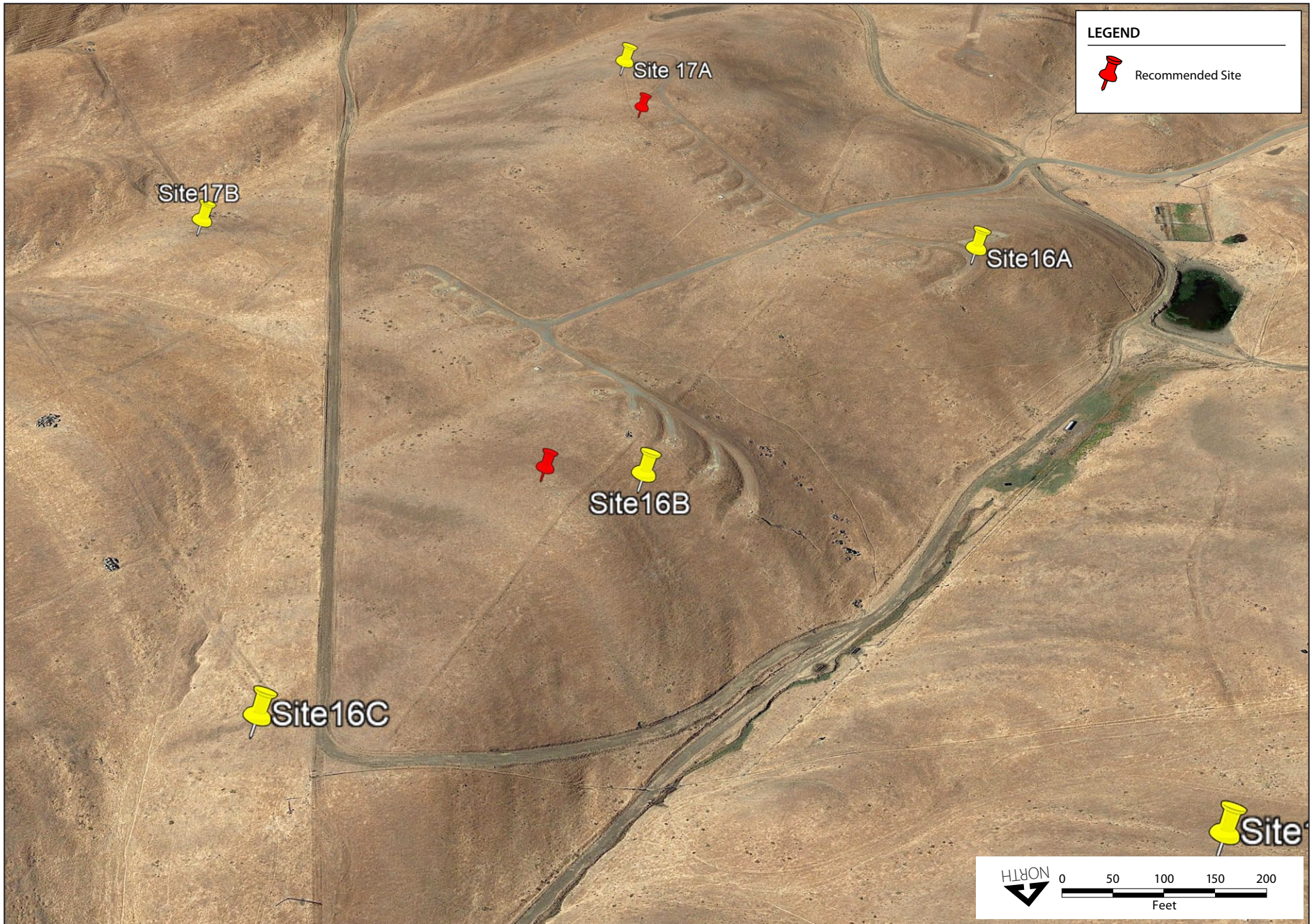


Figure A-16
Location of Alternative Sites for Turbine 16 at the Sand Hill Wind Project



Plate 28. Looking northeast along ridge from Site 16A. The site is downslope above a deep ravine.



Plate 29. Looking upslope to the southeast from Site 16B.



Plate 30. Looking south along the east-facing slope of the large swale at Site 16C.



Plate 31. Looking eastward from recommended location southeast of Site 16B.

Turbine 17

Turbine 17 has three alternative locations, 17A (Layout 1 and Layout 4), 17B (layout 2), and 17C (layout 3) (Figure A-17).

Topographical Description

Sites 17A, B, and C are along a northeast-southwest-oriented ridge with several deep, lateral swales across the ridge creating a rolling east-west topography (Figure A-17). Site 17A is at the upper edge of a south-facing slope along the south end of an old-generation turbine string (Plate 32). The south-facing descending slope is fairly steep (15%), leading down to a deep swale on the south and continues upward north of Site 17A, although less steep, for about 230 feet before the top of the ridge. The ridge top is relatively flat to the north and south, but drops down steeply to the west and more gently to the east. There are no extreme topographical features at this immediate location; however, the west-facing slope could generate slope-accelerated winds from the west and southwest, creating a potential hazard. The site is near the top of a hill that descends down in all directions. The hill top is fairly broad.

Site 17B is midway on a southeast-facing slope (7%) at the top of an east-west swale that turns northward just below the site (Plate 33). The ground slopes up to the north where there is a small swale, then an upslope to the west. Site 17C is midway up a southeast-facing slope (10%) about 250 feet from the top of the hill. The site is above a deep east-west-oriented swale (Plate 34). There are no extreme topographical features in the immediate vicinity.

Proximity to Other Potential Risk Factors

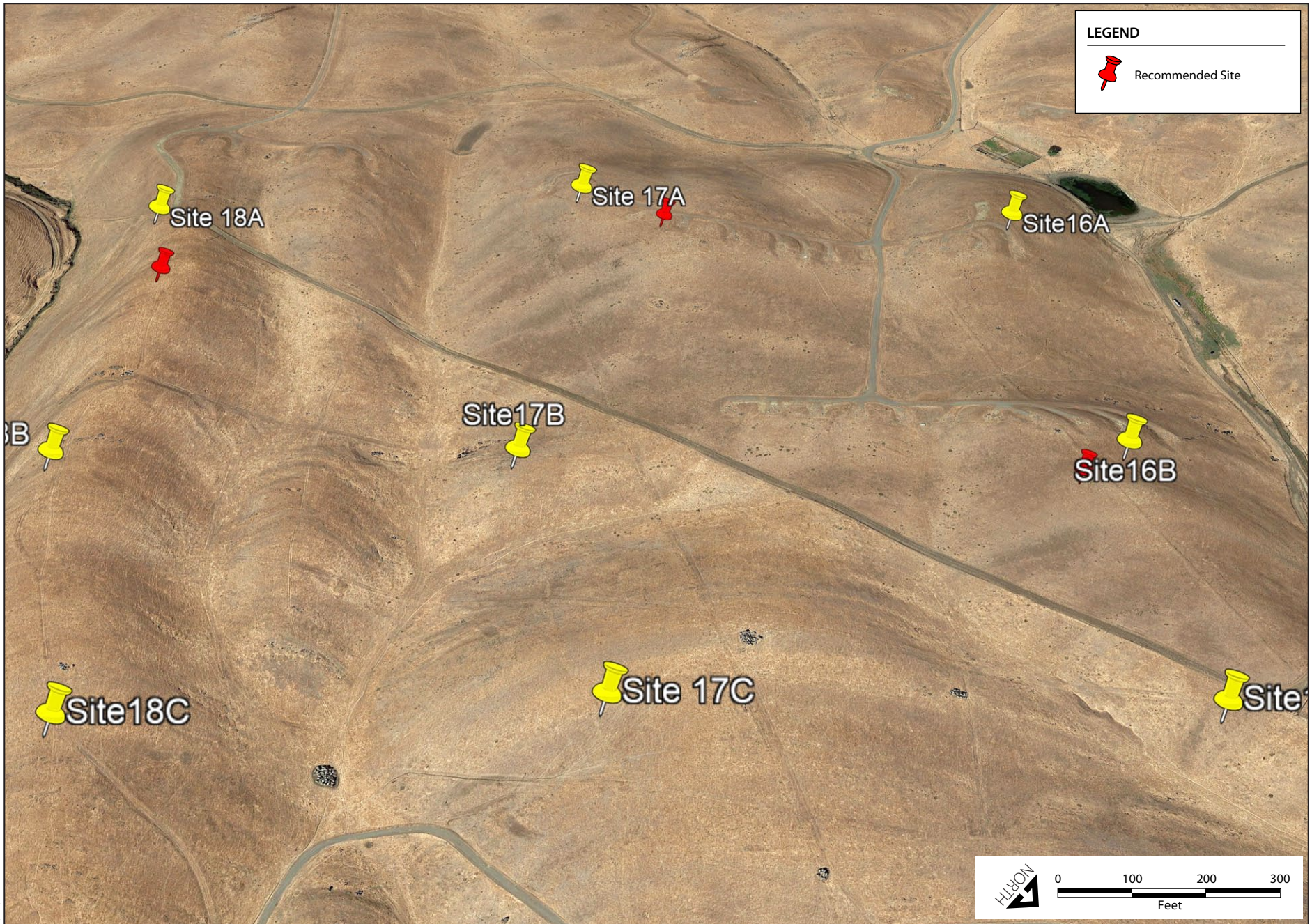
There is a rock pile within 100 feet and a fence line within 200 feet of Site 17B.

Relative Risk and Determination

Site 17A is considered a moderate risk site due to its location on a slope above a deep swale and near a southwest-facing slope with potential for slope-accelerated winds. Site 17B is a moderate- to high-risk site due to its location on a slope and at the top end of a long swale. Site 17C is considered a moderate-risk site. Although it's on a slope, the slope is broad and only moderately steep with no other relevant topographic features in the immediate vicinity. Construction of the turbine pad and access road at each of these sites would create slope benches and berms and would further increase risk.

Recommendation

Risk can be reduced at Site 17A by moving the turbine approximately 230 feet north to the top of the ridge/hill (37.761537/121.606710) (Plate 35) (Figure A-17). This is the recommended location and is generally consistent with Smallwood and Neher (2018). There are no suitable



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SOURCE: Google Earth 2018.

Figure A-17
Location of Alternative Sites for Turbine 17 at the Sand Hill Wind Project

opportunities to reduce risk for Site 17B without substantial relocation distance. Risk can be reduced at Site 17C by moving the turbine upslope about 250 feet west-northwest (37.763914/121.603422). This will put the turbine at the top of the hill and off of the slope.



Plate 32. Looking east from Site 17A. The top of the hill is upslope to the left of the photo.



Plate 33. Looking east from Site 17B.



Plate 34. Looking east from Site 17C.



Plate 35. Looking north from recommended relocation site for Site 17A

Turbine 18

Turbine 18 has three alternative locations, 18A (Layout 1 and Layout 4), 18B (layout 2), and 18C (layout 3) (Figure A-18).

Topographical Description

The four alternative sites for Turbine 18 are along the same narrow northeast-southwest ridge (Figure A-18). The ridge has a gradual northeastward descending slope.

Site 18A is the westernmost of the three and near the west end of the ridge. The turbine is sited down the steep south-facing slope, which continues into a deep canyon (Plate 36). The ridgeline drops westward to a lower bench. A road crosses the ridge about 40 feet west of Site 18A creating a small shoulder in the west slope. To the north, the ridge slopes down more gradually.

Site 18B is near the top of the narrow ridge (although slightly downslope to the south) about 1,000 feet northeast of Site 18A. A relatively flat site, the ridge descends gradually to the northeast. The site is within a slight dip in the ridgeline with a somewhat steeper ascending slope southwestward. The narrow ridge slopes steeply to the south and more gradually to the north (Plate 37).

Site 18C is near the northeastern end of the ridge (Figure A-18). Topographical considerations at this site are similar to Site 18B. The site itself is relatively flat (3% slope) and fairly level for about 100 feet eastward toward the east-facing descending slope (Plate 38). But like Site 18B, the ridgeline ascends gradually to the southwest. The ridge top is slightly broader here than at Site 18B, but also steeply slopes to the south, east, and more gradually to the north.

Proximity to Other Potential Risk Factors

There is an overhead power line about 40 feet from Site 18A (which would be removed) and a fence line within about 30 feet of the site. There is a rock pile within about 100 feet of Site 18B.

Relative Risk and Determination

Site 18A is considered a high-risk site due to its location along the south-facing slope of the ridge and just above (east of) a lower bench of the ridge.

Site 18B is considered a moderate-high risk site due to its location along a narrow ridge with steep slopes. Although the top of the ridge is less risky than the slopes, the close proximity to the steep slopes – particularly given the size of the turbines – poses some risk. Also, because the narrowness of the ridge, construction of a turbine pad in this location may create a notch in the ridgeline, further increasing risk at this location. Road construction will also require significant

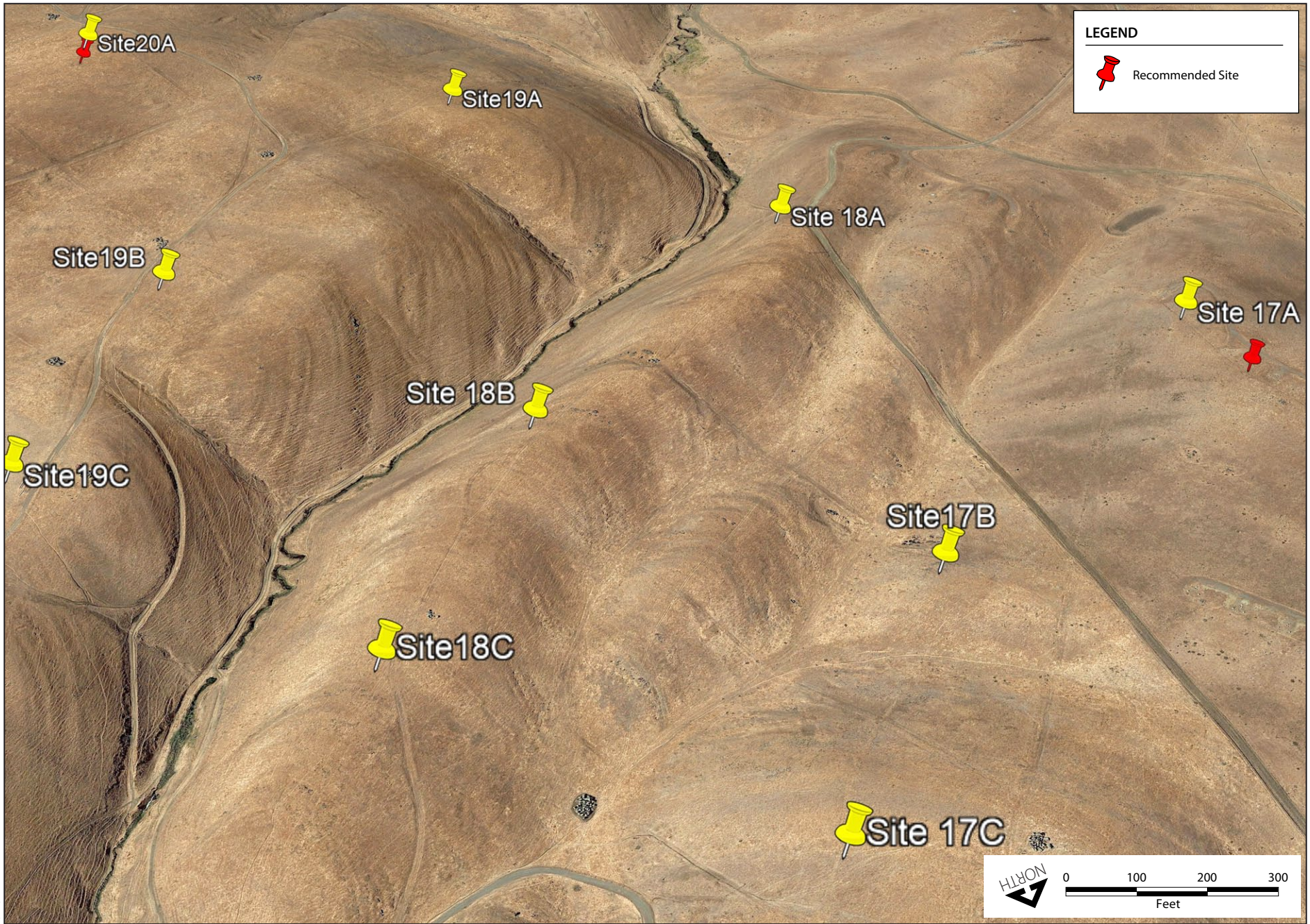


Figure A-18
Location of Alternative Sites for Turbine 18 at the Sand Hill Wind Project

modification of a portion of the slope, and given the narrowness of the ridgeline, may also result in increased risk at this location.

Site 18C is also considered a moderate-high risk site due the issues described above for Site 18B. It's also a bench on a descending ridge slope and may be used as a cross-over point for raptors. However, because the ridgetop is somewhat broader at this site and because road access would require less modification of the ridge topography (an existing road is approximately 500 feet from the site with a spur road directly to the site), it is considered slightly less risky than Site 18B.

Recommendation

Risk can be reduced slightly at Site 18A by moving the turbine upslope approximately 290 feet to the northeast (37.759722/121.604003). This would move the site to the top of the ridge and off of the slope. However, because of the narrowness of the ridgetop, placement of the turbine pad in this location may create a notch in the ridgeline, which would also create risk; however, it would be a somewhat safer location than the current site.

Risk can be reduced slightly at Site 18B by moving the turbine about 100 feet northeast along the ridge top. However, because the site is on a gradually descending ridge line, constructing a turbine pad in this location may result in additional risk by creating a shelf along the narrow, descending ridge.

There are limited opportunities for reducing risk at Site 18C. Although the site for the turbine pad is somewhat larger and flatter than Sites 18A and 18B, its position near the end of a descending ridge where deep ravines converge create risky conditions, and any local relocation would likely increase risk.

Even with local movements, these sites are likely to remain moderate to high risk sites due to the narrow ridge and the close proximity to a deep ravine. Road construction along this narrow ridge or upslope to access the ridge top would increase potential risk at all sites by creating berms along the slope or ridgeline.

There is some conflict with these recommendations with Smallwood and Neher (2018). They suggest that Site 18A is the safest location; however, they do not recommend moving the site upslope. They also include no recommendations for Sites 18B or 18C. At its currently downslope location above a deep canyon, Site 18A is considered high-risk due to potential interaction with raptors using the slope contours for hunting or movement. However, relocating the turbine to the ridgetop, while still at least a moderately risky location, is an improvement from its current location.



Plate 36. Looking east from Site 18A.



Plate 37. Looking east along the gradually descending ridge from Site 18B.



Plate 38. Looking east from Site 18C.

Turbine 19

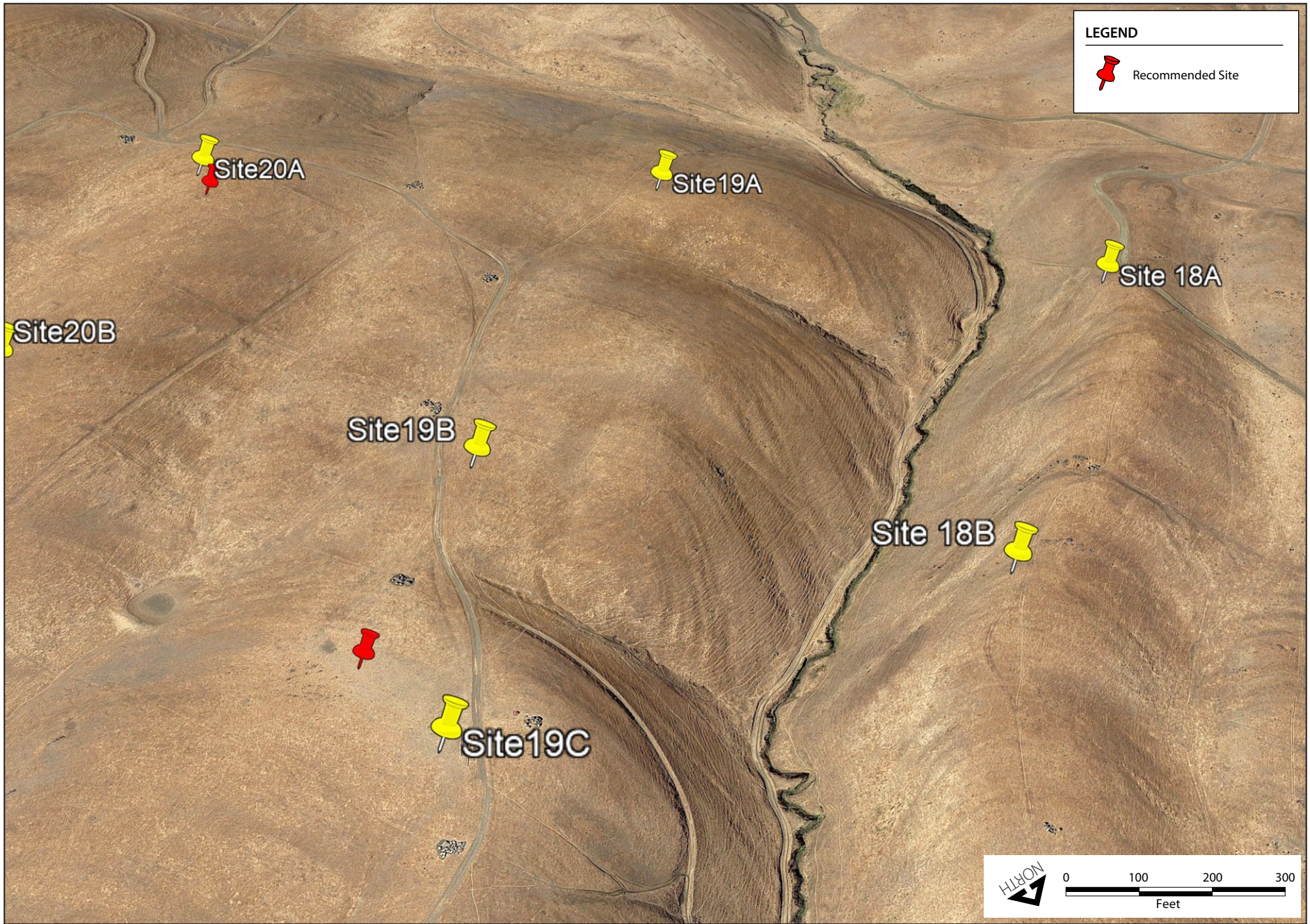
Turbine 19 has three alternative locations, 19A (Layout 1 and Layout 4), 19B (layout 2), and 19C (layout 3) (Figure A-19).

Topographical Description

Site 19A is in a relatively flat location, but near the top of steep west-facing slope that is subject to slope-accelerated winds. To the east is a broad swale that descends northward into a deep ravine. To the south, there is a shallow dip in the west-facing ridge, then the terrain slopes slightly upward before descending into another swale (Plate 39).

Site 19B is at a relatively flat location but is at the base of an east-facing slope and near the top of a deep swale to the north that descends into a deep ravine (Plate 40).

Site 19C is also in a relatively flat location but near the base of a 15% ascending slope to the southwest. The site is also near the top of a swale that extends eastward (Plate 41).



1/05/2019

SOURCE: Google Earth 2018.

Figure A-19
Location of Alternative Sites for Turbine 19 at the Sand Hill Wind Project

Proximity to Other Potential Risk Factors

There is an overhead powerline near Site 19A (that would be removed). There are two debris piles within 100 feet of the Site 19B and a debris pile within 100 feet of Site 19C.

Relative Risk and Determination

Site 19A is considered a moderate to high risk site due to its proximity to the west-facing slope and the potential for slope-accelerated winds. Site 19B is considered a moderate risk site due to its location at the top of a long, extended swale that may function as a flight corridor for raptors. Site 19C is considered a low- to moderate risk site due to relatively flat topography but in close proximity to the top of a swale and the base of an upward slope.

Recommendation

There are limited opportunities to reduce risk at Sites 19A and B. Risk may be reduced at Site 19C by moving the turbine south for approximately 200 feet toward the top of the hill and away from the top of the east-west swale (37.759488/121.598865) (Plate 42) (Figure A-19). This is generally consistent with Smallwood and Neher (2018); however, they did not recommend relocating the turbine.



Plate 39. Looking south from Site 19A (next to vehicle). The site is on the edge of a broad west-facing slope (right).



Plate 40. Looking east from Site 19B. The site is near a ridge saddle at the top of a swale.



Plate 41. Looking east-northeast from Site 19C. Note the shallow swale to the east.



Plate 42. Looking east from recommended relocation site for Site 19C.

Turbine 20

Turbine 20 has three alternative locations, 20A (Layout 1 and Layout 4), 20B (layout 2), and 20C (layout 3) (Figure A-20).

Topographical Description

The three alternative locations for Turbine 20 are all along a relatively low-profile, broad northeast-southwest ridge (Figure A-20).

Site 20A is near the southwestern end of the northeast-southwest ridge. The site itself is fairly flat but is on a very gradual west- and south-facing slope just below the top of the ridge/hill to the northeast and just upslope and northeast of a saddle at the top of the west-facing ridge below. There are broad swales to the north and south. To the west, the slope gradually descends to the road on the west and then rapidly beyond the road to the bottom of the west-facing ridge slope (Plate 43).

Site 20B is along the south-facing slope of the ridge about 670 feet northeast of Site 20A (Figure A-20). The slope ascends for about 470 feet to the ridge top and descends into a deep swale (Plate 44).

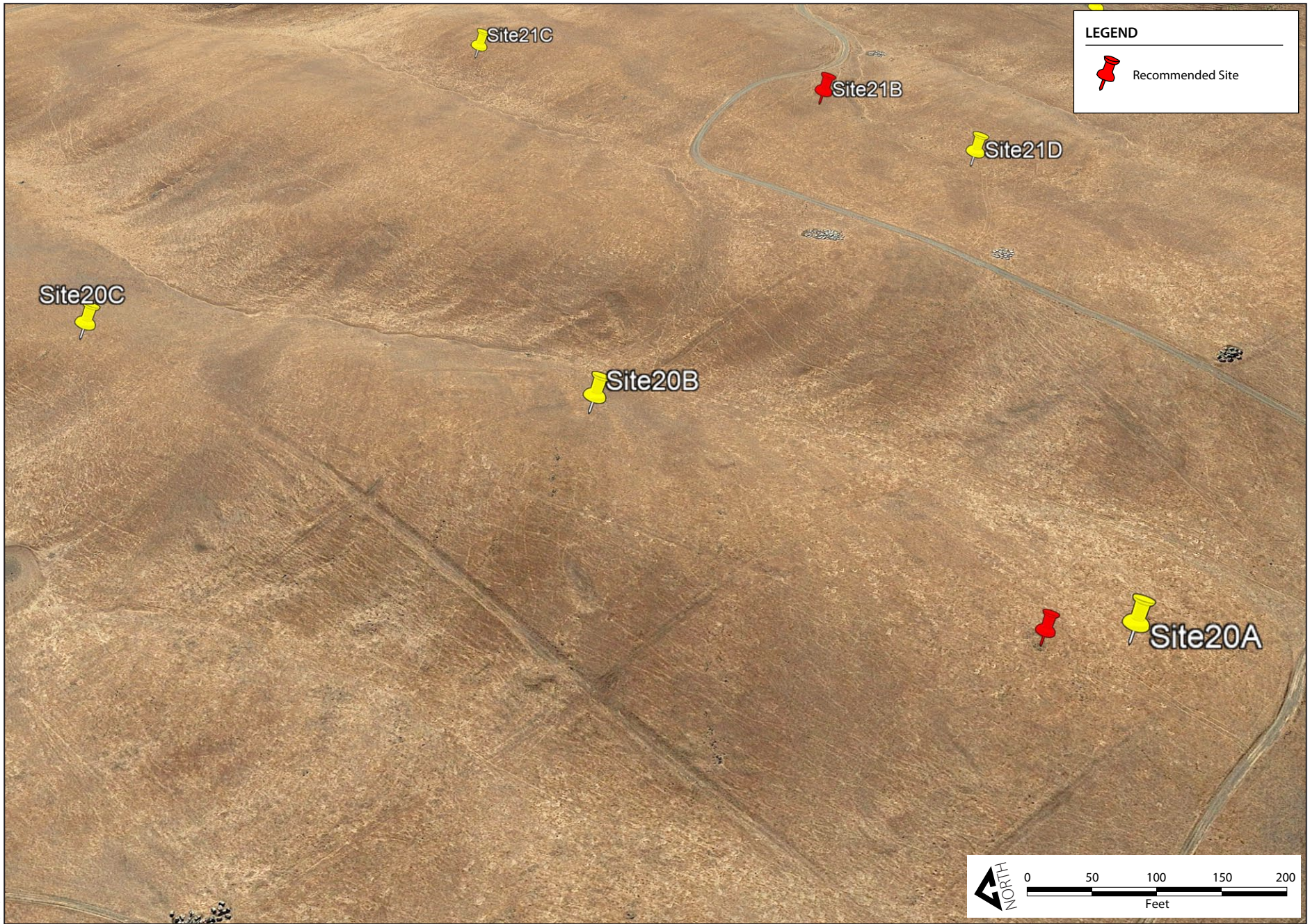


Figure A-20
Location of Alternative Sites for Turbine 20 at the Sand Hill Wind Project

Site 20C is on the top of the northeastern end of the ridge (Figure A-20). The site itself is relatively flat, but the ridge slope gradually descends eastward (Plate 45). The north and south slopes descend into deep swales, which converge about 900 feet east of the site.

Proximity to Other Potential Risk Factors

There is a debris pile within 220 feet of Site 20A and a stock pond downslope approximately 370 feet northwest of Site 20C.

Relative Risk and Determination

Site 20A is a relatively low- to moderate-risk site. The site is on a very gradual slope, which ascends northward to the top of the ridge/hill. The site is also near a shallow saddle along the west-facing slope. This slope may also be subject to slope-accelerated winds; however, site 20A may be sufficiently distant from the edge of the slope to be considered a hazard to raptors using these winds to hunt. Beyond the shallow saddle to the south, the terrain ascends to a higher hill on the south. But otherwise, the surrounding terrain is relatively low-profile. Road and turbine pad construction at this location would not alter the terrain sufficient to substantially affect raptor use or movement through the area.

Site 20B is a moderate-risk site due to its location on the slope above a deep swale and on a gradually descending ridge slope. Also, road construction into the site would require substantial earth moving and possible changes to the slope configuration.

Site 20C is considered a moderate-risk site due to its location on the descending ridge slope and the extent of earth-moving required for road access to the site. Construction of the turbine pad at this location would also create a bench in the gradually descending slope and increase potential risk.

Recommendation

Risk can be reduced at Site 20A by moving the turbine 80 feet to the north-northeast (37.755965/121.600147). This moves the turbine to the highest point on the ridge where there is a broad, flat area within 200 feet of an existing road. It also moves the turbine further from the west-facing slope. This is the recommended location for Turbine 20 and is generally consistent with Smallwood and Neher (2018) (Figure A-20).

Risk can be reduced at Site 20B by moving the turbine upslope to the north approximately 170 feet northwest to the ridge top (37.756896/121.598853). However, this would still keep the turbine on the descending ridge slope.

There are limited opportunities to reduce risk at Site 20C.



Plate 43. Looking south from Site 20A.



Plate 44. Looking upslope to the west from Site 20B.



Plate 45. Looking downslope eastward toward Site 20C.