

# Payne Mountain Wind Project

Swift Current Energy

*Mills and Lampasas Counties, Texas*

*Obstruction Evaluation & Airspace Analysis*

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October 9, 2018



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## Summary

Capitol Airspace conducted an obstruction evaluation and airspace analysis for the Payne Mountain wind project in Mills and Lampasas Counties, Texas. The purpose for this analysis was to identify obstacle clearance surfaces established by the Federal Aviation Administration (FAA) that could limit the placement of 499 and 660 foot above ground level (AGL) wind turbines. At the time of this analysis, 40 individual wind turbine locations had been identified (black points, [Figure 1](#)). This analysis assessed height constraints overlying each location as well as an approximately 27 square mile study area (red outline, [Figure 1](#)) to aid in identifying optimal wind turbine locations.

14 CFR Part 77.9 requires that all structures exceeding 200 feet AGL be submitted to the FAA so that an aeronautical study can be conducted. The FAA's objective in conducting aeronautical studies is to ensure that proposed structures do not have an effect on the safety of air navigation and the efficient utilization of navigable airspace by aircraft. The end result of an aeronautical study is the issuance of a determination of 'hazard' or 'no hazard' that can be used by the proponent to obtain necessary local construction permits. It should be noted that the FAA has no control over land use in the United States and cannot enforce the findings of its studies.

Height constraints overlying the Payne Mountain wind project are a constant 2,049 feet above mean sea level (AMSL) and are associated with minimum vectoring altitude sectors. Proposed wind turbines that exceed this surface would require an increase to minimum vectoring altitudes. If the FAA determines that this impact would affect a significant volume of operations (*as few as one per week*), it could result in determinations of hazard.

United States Geological Survey (USGS) elevation data indicates that this surface could limit 499 foot AGL wind turbines on higher terrain throughout the study area, including 37 of the proposed locations. Additionally, this surface could limit 660 foot AGL wind turbines throughout the majority of the study area, including all 40 of the proposed locations.

Low-altitude military training routes overlie the Payne Mountain wind project. Although impact on these routes cannot result in FAA determinations of hazard, it could result in military objections to proposed wind development.

This study did not consider electromagnetic interference on communications, navigation, or radar surveillance systems. However, the Payne Mountain wind project is located in an area designated as 'Yellow' by the FAA/DoD Long Range Radar Screening Tool. Impact on navigational aids and radar surveillance systems can result in the issuance of determinations of hazard regardless of the lack of impact on the other surfaces described in this report.

*Capitol Airspace applies FAA defined rules and regulations applicable to obstacle evaluation, instrument procedures assessment and visual flight rules (VFR) operations to the best of its ability and with the intent to provide the most accurate representation of limiting airspace surfaces as possible. Capitol Airspace maintains datasets obtained from the FAA which are updated on a 56 day cycle. The results of this analysis/map are based on the most recent data available as of the date of this report. Limiting airspace surfaces depicted in this report are subject to change due to FAA rule changes and regular procedure amendments. Therefore, it is of the utmost importance to obtain FAA determinations of no hazard prior to making substantial financial investments in this project.*



## Methodology

Capitol Airspace studied the proposed project based upon location information provided by Swift Current Energy. Using this information, Capitol Airspace generated graphical overlays to determine proximity to airports (*Figure 1*), published instrument procedures, enroute airways, FAA minimum vectoring altitude and minimum instrument flight rules (IFR) altitude charts, as well as military airspace and military training routes.

Capitol Airspace evaluated all 14 CFR Part 77 imaginary surfaces, published instrument approach and departure procedures, visual flight rules operations, FAA minimum vectoring altitudes, minimum IFR altitudes, and enroute operations. All formulas, headings, altitudes, bearings and coordinates used during this study were derived from the following documents and data sources:

- 14 CFR Part 77 Safe, Efficient Use, and Preservation of the Navigable Airspace
- FAA Order 7400.2L Procedures for Handling Airspace Matters
- FAA Order 8260.3D United States Standard for Terminal Instrument Procedures
- FAA Order 8260.58A United States Standard for Performance Based Navigational (PBN) Instrument Procedure Design
- Technical Operations Evaluation Desk Guide for Obstruction Evaluation/Airport Analysis Version 1.3.0
- United States Government Flight Information Publication, US Terminal Procedures
- National Airspace System Resource Aeronautical Data

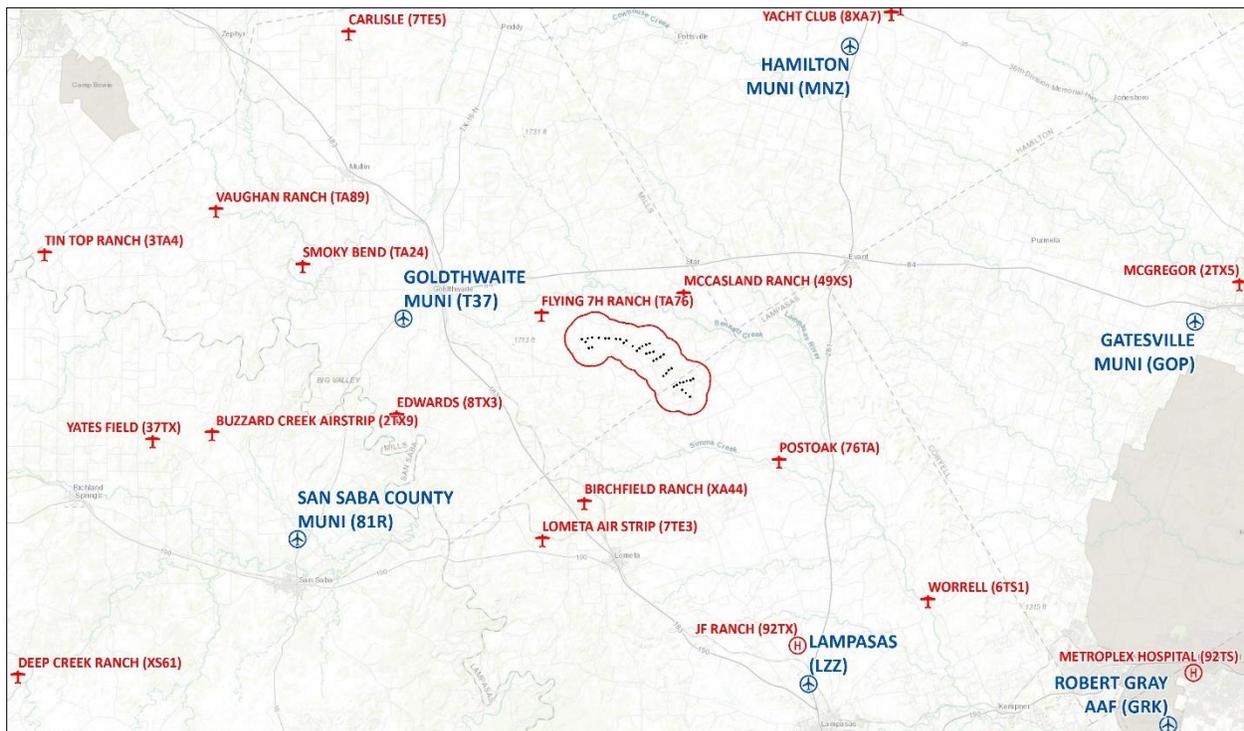


Figure 1: Public-use (blue) and private-use (red) airports in proximity to the Payne Mountain wind project

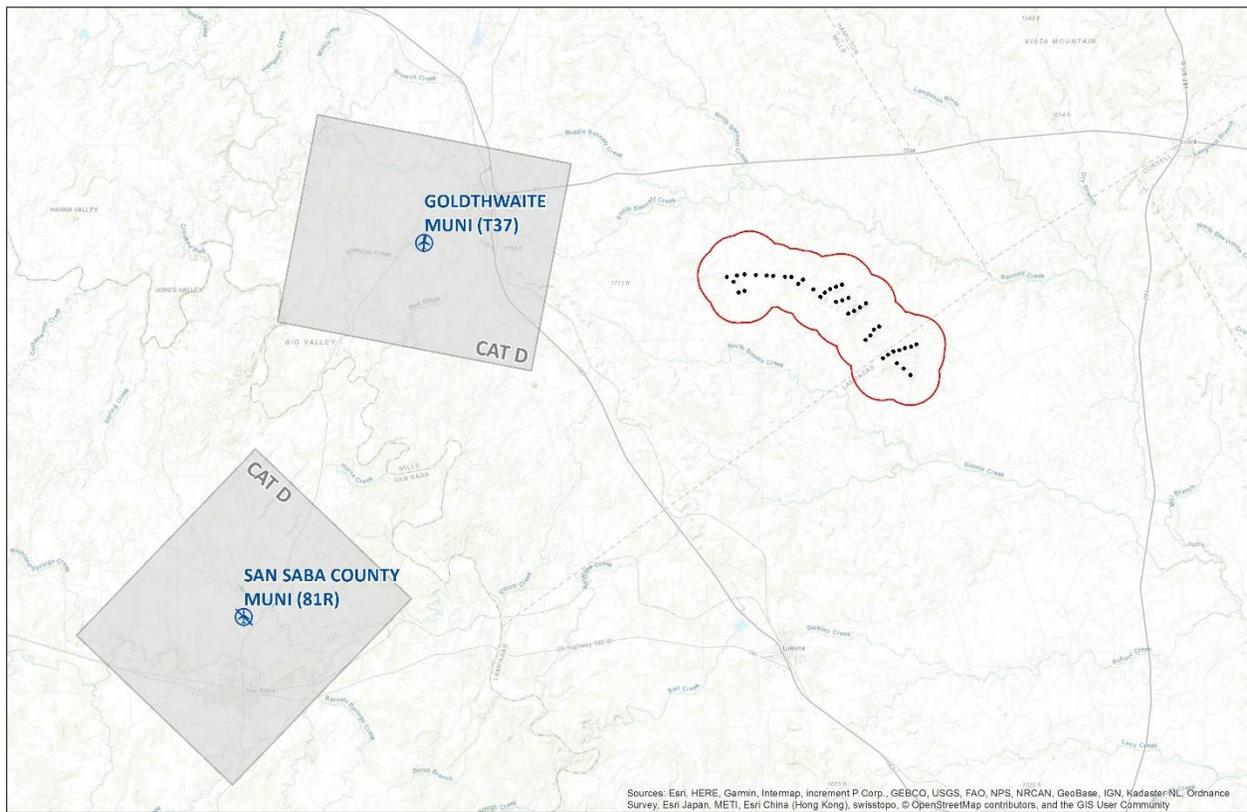




### Visual Flight Rules (VFR) Traffic Pattern Airspace

VFR traffic pattern airspace is used by pilots operating during visual meteorological conditions. The airspace dimensions are based upon the category of aircraft which, in turn, is based upon the approach speed of the aircraft. 14 CFR Part 77.17(a)(2) and 77.19 (as applied to a *visual* runway) imaginary surfaces establish the obstacle clearance surface heights within VFR traffic pattern airspace.

VFR traffic pattern airspace does not overlie the Payne Mountain wind project and should not limit 499 or 660 foot AGL wind turbines within the defined study area (**Figure 3**).



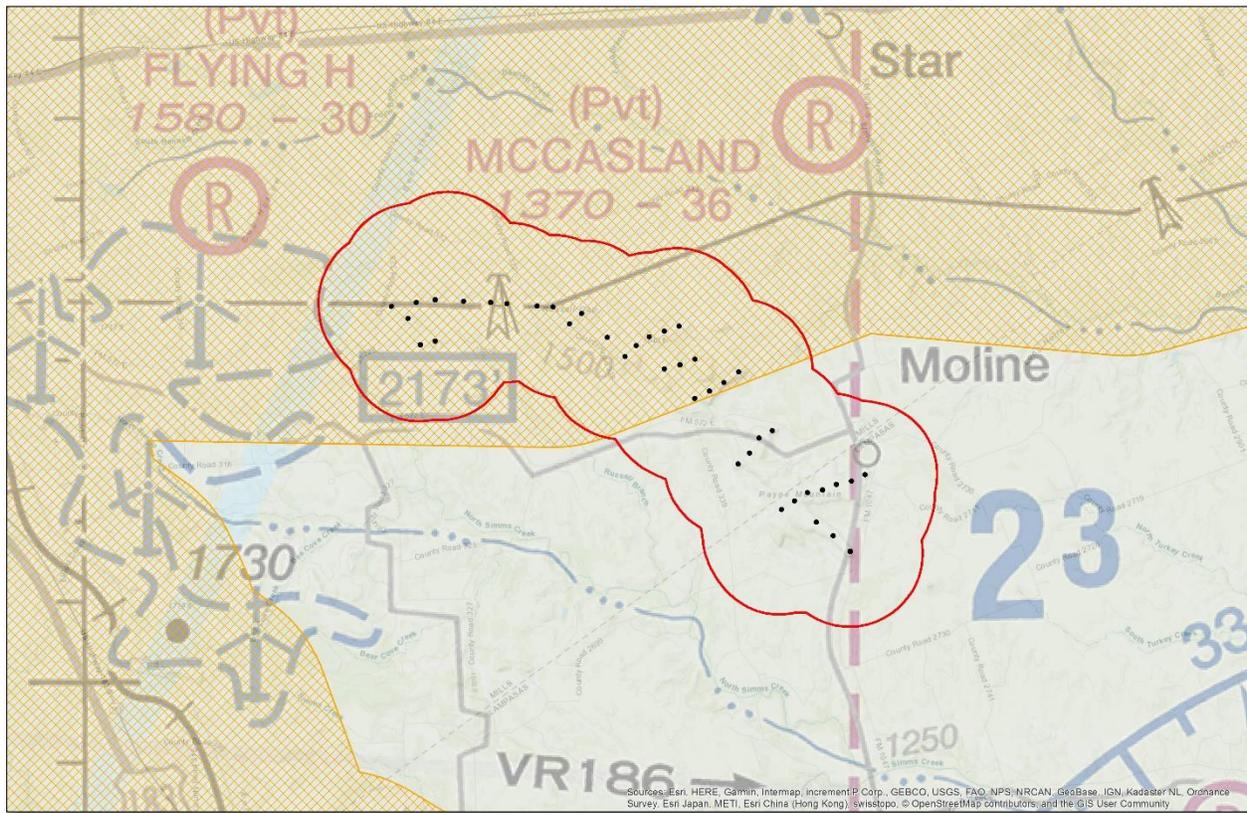
**Figure 3: VFR traffic pattern airspace in proximity to the Payne Mountain wind project**



### Visual Flight Rules (VFR) Routes

During periods of marginal Visual Meteorological Conditions (VMC) – low cloud ceilings and one statute mile visibility – pilots often operate below the floor of controlled airspace. Operating under these weather conditions requires pilots to remain within one statute mile of recognizable land marks such as roads, rivers, and railroad tracks. The FAA protects for known and regularly used VFR routes by limiting structure heights within two statute miles of these routes to no greater than 14 CFR Part 77.17(a)(1) – a height of 499 feet AGL at the site of the object.

The Payne Mountain wind project is located in proximity to a transmission line that may be used as a VFR route (**Figure 4**). However, operational data describing the usage of this potential route is not available. If the FAA determines that this potential VFR route is flown regularly, it could limit wind development in excess of 499 feet AGL and within two statute miles of this landmark (hatched orange, **Figure 4**).



**Figure 4: Potential VFR Routes in proximity to the Payne Mountain wind project**

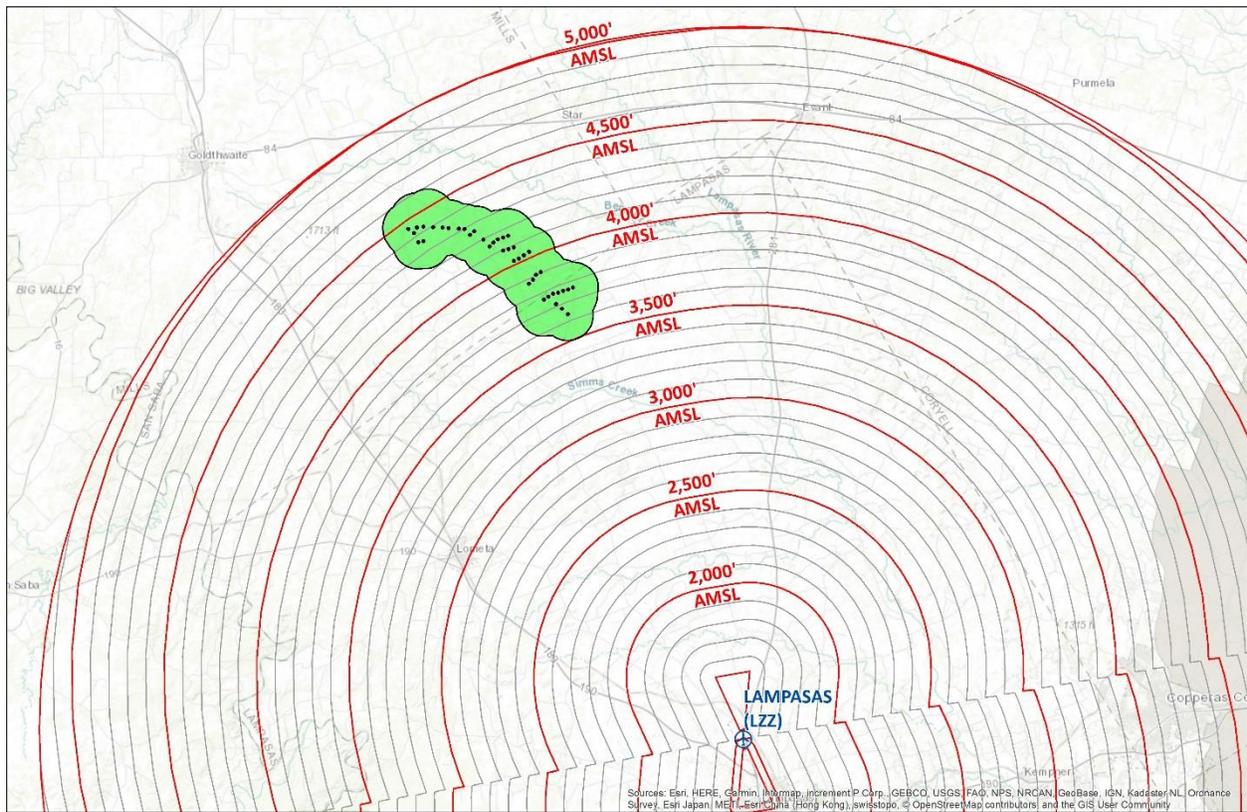


### Instrument Departures

In order to ensure that aircraft departing during marginal weather conditions do not fly into terrain or obstacles, the FAA publishes instrument departure procedures that provide obstacle clearance to pilots as they transition between the terminal and enroute environments. These procedures contain specific routing and minimum climb gradients to ensure clearance from terrain and obstacles.

Proposed structures that exceed instrument departure procedure obstacle clearance surfaces would require an increase to instrument departure procedure minimum climb gradients. If the FAA determines that this impact would constitute a substantial adverse effect, it could be used as the basis for determinations of hazard.

Instrument departure procedure obstacle clearance surfaces (e.g., [Figure 5](#)) are in excess of other lower surfaces and should not limit 499 or 660 foot AGL wind turbines within the defined study area.



**Figure 5: Lampasas Airport (LZZ) obstacle departure procedure assessment**



### Instrument Approaches

Pilots operating during periods of reduced visibility and low cloud ceilings rely on terrestrial and satellite based navigational aids (NAVAIDS) in order to navigate from one point to another and to locate runways. The FAA publishes instrument approach procedures that provide course guidance to on-board avionics that aid the pilot in locating the runway. Capitol Airspace assessed a total of four published instrument approach procedures at two public-use airports in proximity to the Payne Mountain wind project:

#### Hamilton Municipal (MNZ)

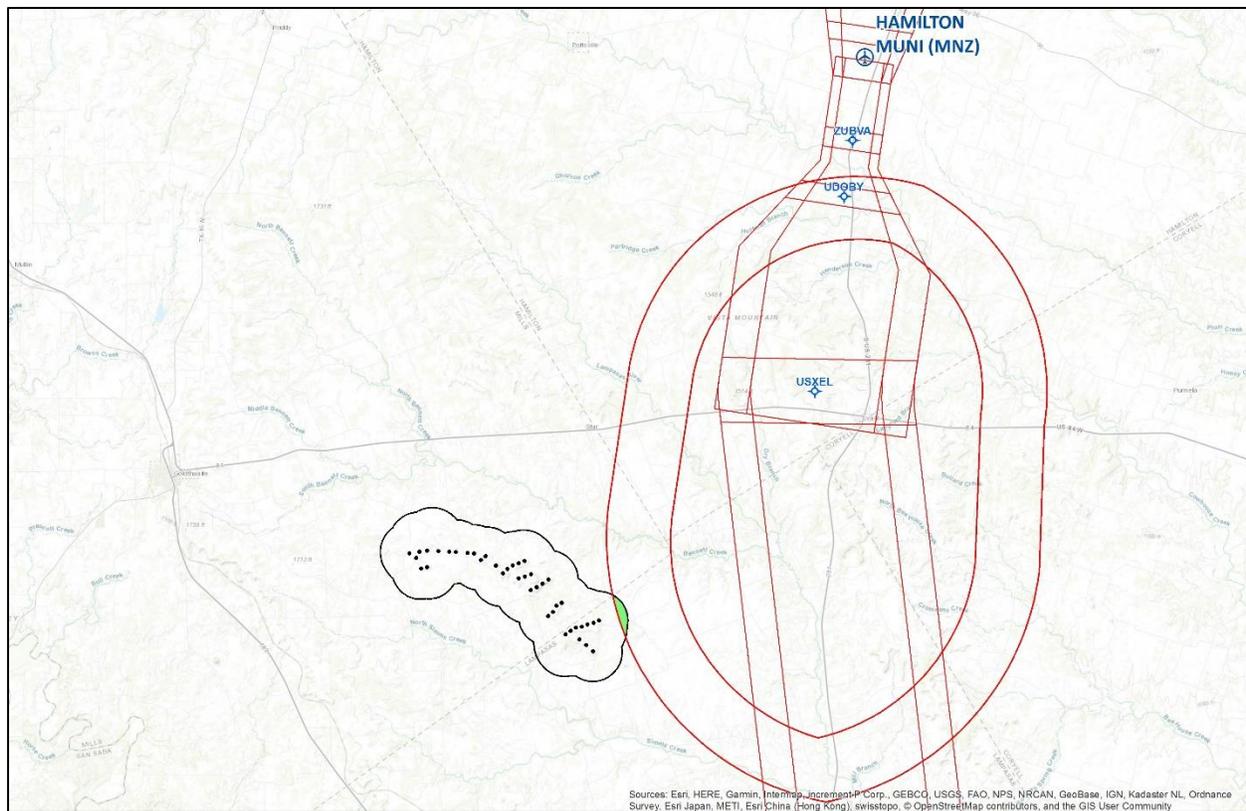
- RNAV (GPS) Approach to Runway 18
- RNAV (GPS) Approach to Runway 36

#### Lampasas (LZZ)

- RNAV (GPS) Approach to Runway 34
- VOR-A Circling Approach

Proposed structures that exceed instrument approach procedure obstacle clearance surfaces would require an increase to instrument approach procedure minimum altitudes. Increases to these altitudes, especially critical *decision altitudes (DA)* and *minimum descent altitudes (MDA)*, can directly impact the efficiency of an instrument approach procedure. If the FAA determines that this impact would affect a significant volume of operations it could be used as the basis for determinations of hazard.

Instrument approach procedure obstacle clearance surfaces (e.g., [Figure 6](#)) are in excess of other lower surfaces and should not limit 499 or 660 foot AGL wind turbines within the defined study area.



**Figure 6: Hamilton Municipal Airport (MNZ) RNAV (GPS) Approach to Runway 36**



## Enroute Airways

Enroute airways provide pilots a means of navigation when flying from airport to airport and are defined by radials between VHF omni-directional ranges (VORs). The FAA publishes minimum altitudes for airways to ensure clearance from obstacles and terrain. The FAA requires that each airway have a minimum of 1,000 feet of obstacle clearance in non-mountainous areas and normally 2,000 feet in mountainous areas.

Proposed structures that exceed enroute airway obstacle clearance surfaces would require an increase to minimum obstruction clearance altitudes (MOCA) and/or minimum enroute altitudes (MEA). If the FAA determines that this impact would affect a significant volume of operations (as few as one per week) it could result in a determination of hazard.

### V161-568

*Llano (LLO) VORTAC to BUILT*

The MOCA is 3,200 feet AMSL. The associated obstacle clearance surface (purple, [Figure 7](#)) is 2,200 feet AMSL and is in excess of other lower surfaces. At 660 feet AGL, 19 of the proposed wind turbines would require an increase to V161-568 MOCA. However, all of these wind turbines are located further than 22 nautical miles from the NAVAIDs defining V161-568. As a result, this impact should not be used as the basis for determinations of hazard.<sup>1</sup>

The MEA is 6,000 feet AMSL. The associated obstacle clearance surface (purple, [Figure 7](#)) is 5,000 feet AMSL and is in excess of other lower surfaces. Additionally, USGS elevation data indicates that this surface should not limit 499 or 660 foot AGL wind turbines within the defined study area.

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<sup>1</sup> In accordance with FAA Order 7400.2L Paragraph 6-3-9(d)(2), proposed structures beyond 22 nautical miles from an airway's supporting NAVAIDs that impact only the MOCA are not considered to have a substantial adverse effect. Therefore, height constraints associated with the V161-568 MOCA were only considered within 22 nautical miles from its supporting NAVAIDs.



Figure 7: Low altitude enroute chart L-19 with V161-568 obstacle evaluation areas (purple)



## Minimum Vectoring/IFR Altitudes

The FAA publishes minimum vectoring altitude (MVA) and minimum instrument flight rules (IFR) altitude charts that define sectors with the lowest altitudes at which air traffic controllers can issue radar vectors to aircraft based on obstacle clearance. The FAA requires that sectors have a minimum of 1,000 feet of obstacle clearance in non-mountainous areas and normally 2,000 feet in mountainous areas.

Proposed structures that exceed minimum vectoring/IFR altitude sector obstacle clearance surfaces would require an increase to the altitudes usable by air traffic control for vectoring aircraft. If the FAA determines that this impact would affect a significant volume of operations, it could result in determinations of hazard.

### Waco (ACT) Terminal Radar Approach Control (TRACON)

#### *Sector I (Multiple Charts)*

The MVA is 3,000 feet AMSL. The associated obstacle clearance surface (hatched purple, [Figure 8](#)) is 2,049 feet AMSL and is the lowest height constraint overlying the entire study area. USGS elevation data indicates that this surface could limit 499 foot AGL wind turbines on higher terrain throughout the study area (red area, [Figure 8](#)), including 37 of the proposed locations. Additionally, this surface could limit 660 foot AGL wind turbines throughout the majority of the study area (red and orange areas, [Figure 8](#)), including all of the proposed locations.

### Fort Hood (GRK) Army Radar Approach Control (ARAC)<sup>2</sup>

#### *Sector F*

The MVA is 3,200 feet AMSL. The associated obstacle clearance surface (hatched purple, [Figure 9](#)) is 2,249 feet AMSL and is in excess of other lower surfaces. However, USGS elevation data indicates that this surface could still limit 660 foot AGL wind turbines on higher terrain in the eastern half of the study area (orange areas, [Figure 9](#)), including 19 of the proposed locations.

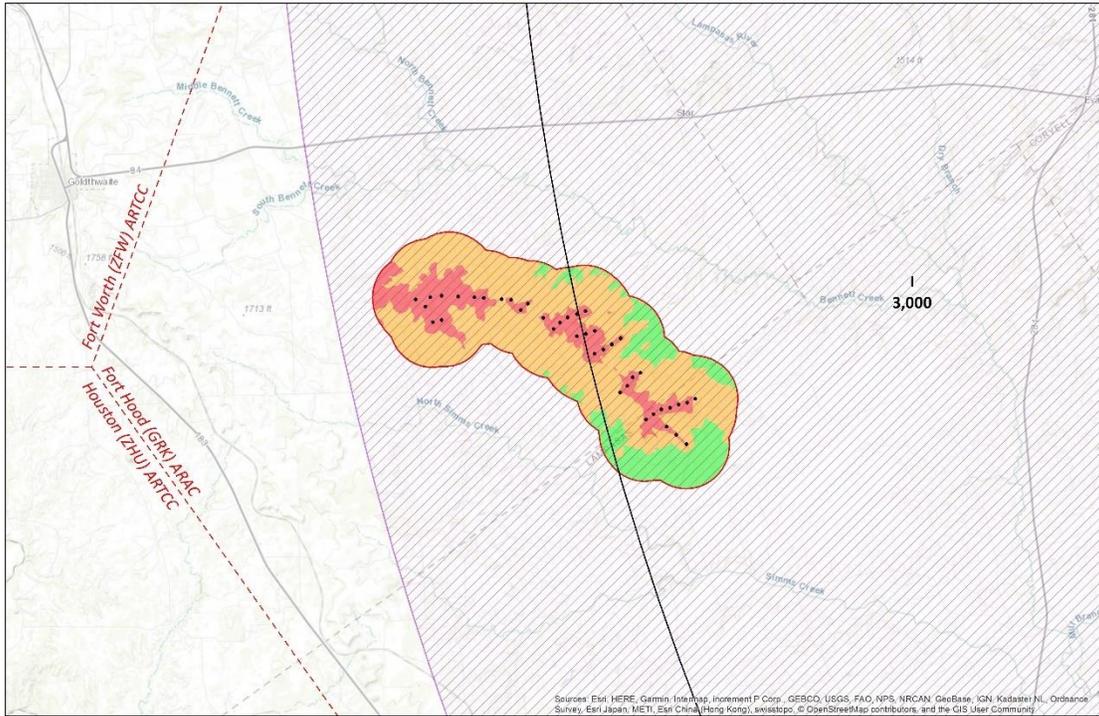
### Fort Worth (ZFW) Air Route Traffic Control Center (ARTCC)

#### *Sector FJEN03*

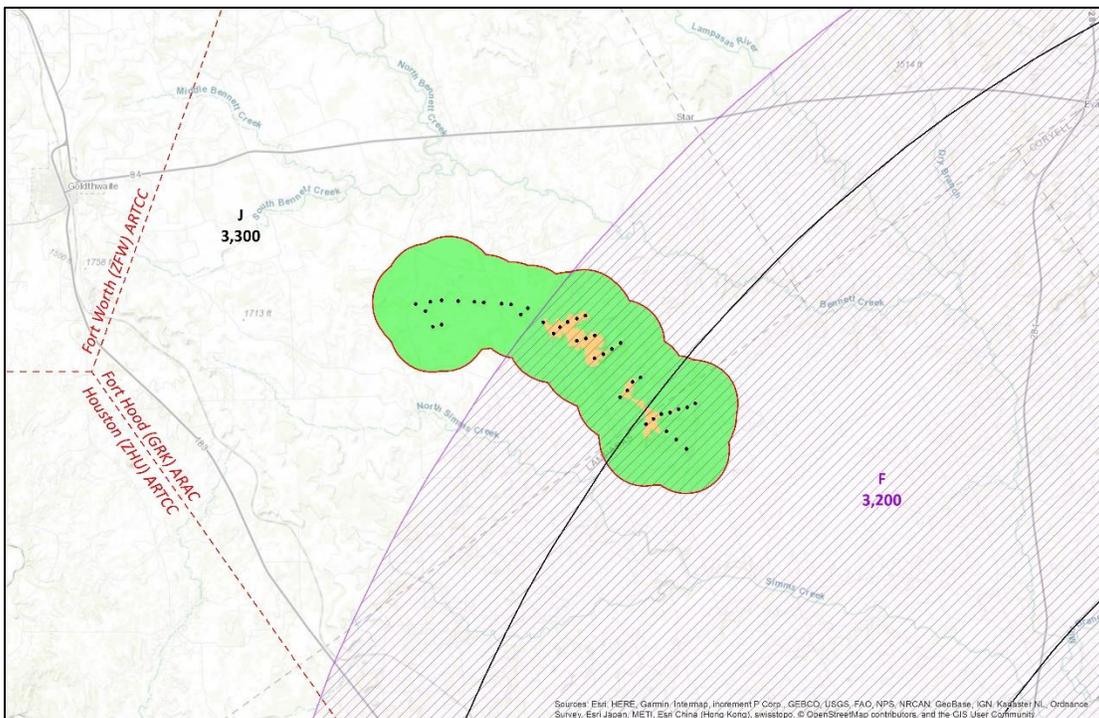
The minimum IFR altitude is 3,200 feet AMSL. The associated obstacle clearance surface is 2,249 feet AMSL and is in excess of other lower surfaces. However, USGS elevation data indicates that this surface could still limit 660 foot AGL wind turbines on higher terrain throughout the study area, including 30 of the proposed locations.

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<sup>2</sup> The Fort Hood (GRK) ARAC minimum vectoring altitude chart does not contain any geographic information. Capitol Airspace georeferenced the chart using aerial imagery and known airspace boundaries. Due to inaccuracies associated with georeferencing, it is possible that Fort Hood (GRK) ARAC minimum vectoring altitude sector boundaries differ slightly from those described in this report.



**Figure 8: Waco (ACT) TRACON "ACT\_ACT\_MVA\_2017" MVA sectors (black) with Sector I obstacle evaluation area (hatched purple)**



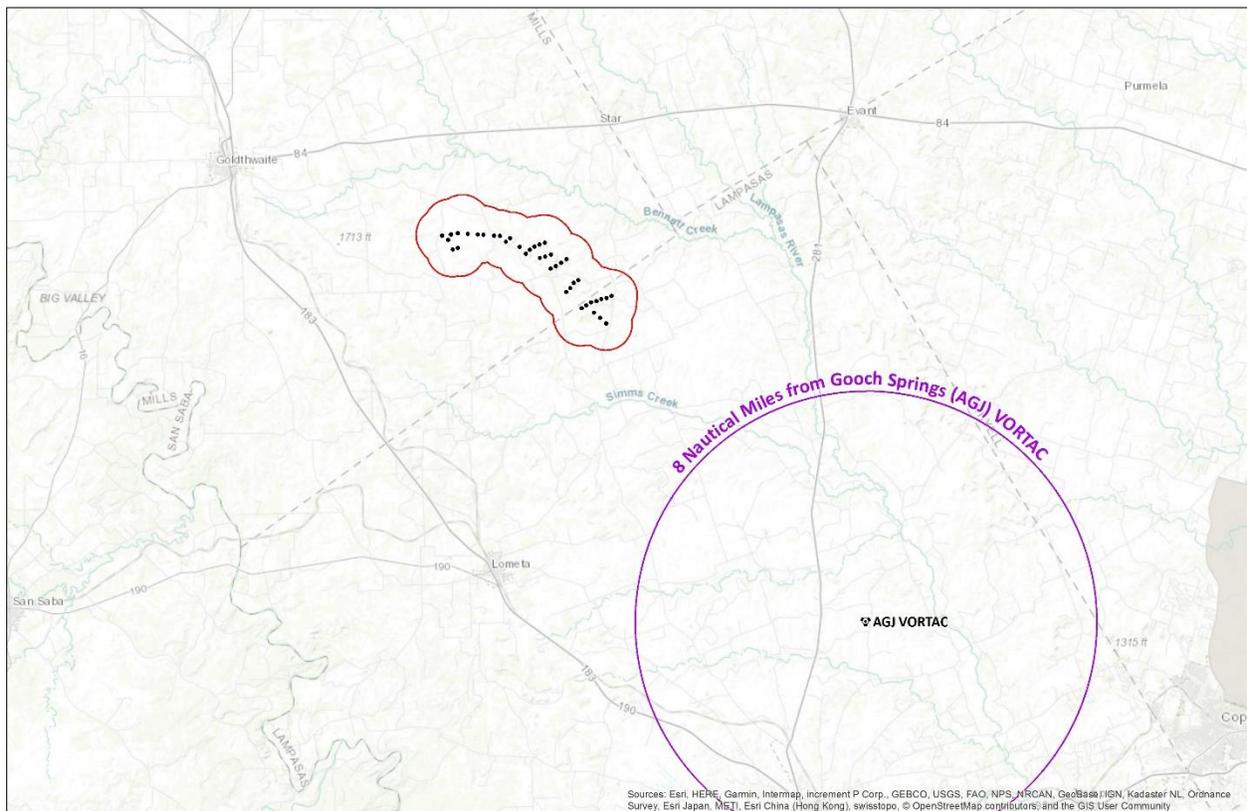
**Figure 9: Fort Hood (GRK) ARAC MVA sectors (black) with Sector F obstacle evaluation area (hatched purple)**



### Terminal and Enroute Nav aids

The FAA has established screening surfaces in order to identify proposed structures that may have a physical and/or electromagnetic effect on navigation facilities. The surface dimensions vary based on the proposed structure type as well as the navigational facility type. Proposed structures that exceed these surfaces may interfere with navigational facility surfaces and will require further review by FAA Technical Operations. If further review determines that proposed structures would have a significant physical and/or electromagnetic effect on navigational facilities it could result in determinations of hazard.

Navaid screening surfaces (e.g. **Figure 10**) do not overlie the Payne Mountain wind project. As a result, it is unlikely that proposed structures would have a physical or electromagnetic effect on navigation facilities.



**Figure 10: Gooch Springs (AGJ) VORTAC screening surface**



### Military Airspace and Training Routes

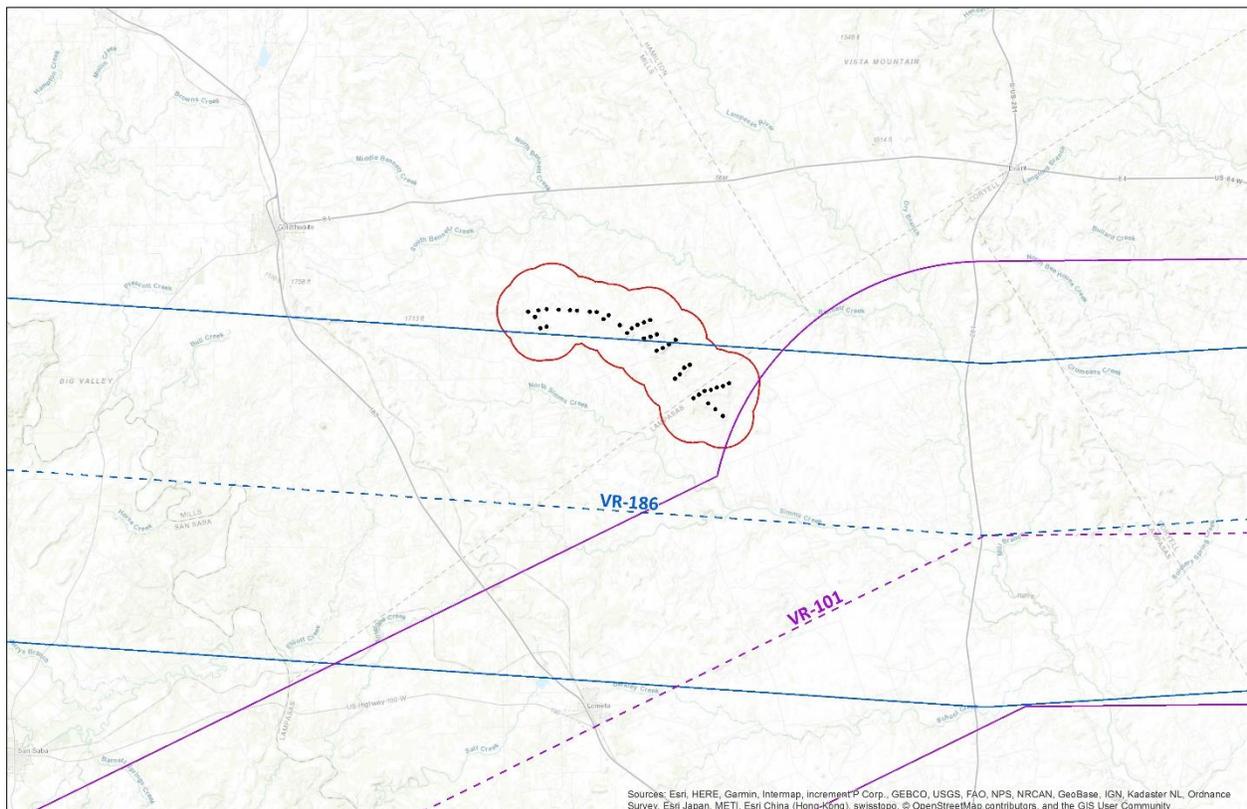
Since the FAA does not protect for military airspace or training routes, impact on their operations cannot result in a determination of hazard. However, the FAA will notify the military of proposed wind turbines located within these segments of airspace. If the planned development area is located on federal land, impact on military airspace or training routes may result in the denial of permits by the Bureau of Land Management.

Visual flight rules routes (VR) overlying the Payne Mountain wind project (**Figure 11**):

#### Naval Air Station (NAS) Joint Reserve Base (JRB) Fort Worth (NFW)

Route/Airspace	Minimum Altitude
VR-101	1,000 feet AGL
VR-186	500 feet AGL

Due to the low altitudes associated with these VR routes, it is possible that wind development could have an impact on their operations. If NAS JRB Fort Worth use these routes regularly, it may result in military objections to proposed wind development.



**Figure 11: NAS JRB Fort Worth military training routes overlying the Payne Mountain wind project**



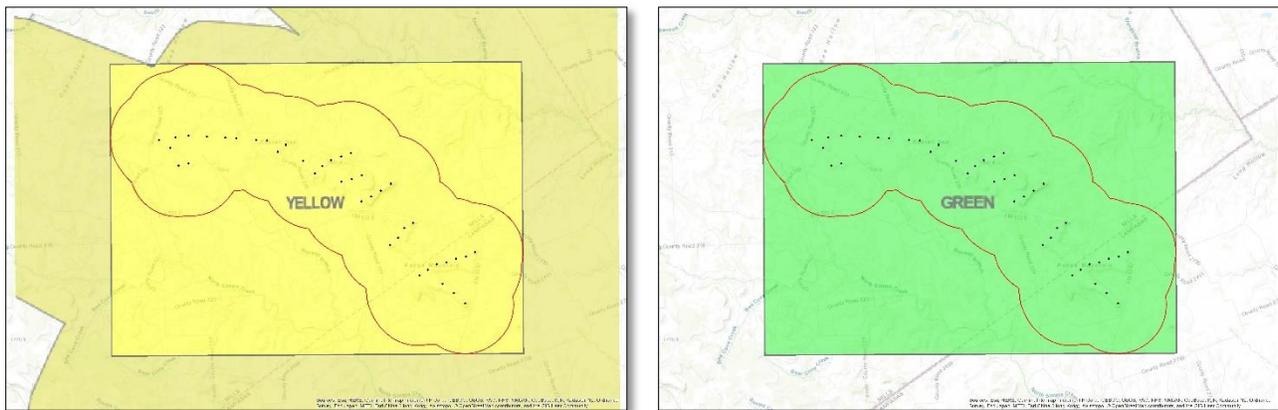
### Long Range and NEXRAD Radar

While Capitol Airspace did not assess for electromagnetic interference on communications, navigational or surveillance systems, the FAA/DOD preliminary screening tool was utilized to determine likely electromagnetic interference on long range and NEXRAD radars.<sup>3</sup> According to the Long Range Radar tool, the Payne Mountain wind project is located in an area designated as ‘Yellow’ (left, [Figure 12](#)). The FAA defines this area as follows:

**Yellow:** Impact likely to Air Defense and Homeland Security radars. Aeronautical study required.

Further, according to the NEXRAD tool, the Payne Mountain wind project is located in an area designated as ‘Green: No Impact Zone’ (right, [Figure 12](#)). The FAA defines this area as follows:

**Green: No Impact Zone.** Impacts not likely. NOAA will not perform a detailed analysis, but would still like to know about the project.



*Figure 12: Long range (left) and NEXRAD (right) radar screening tool results*

<sup>3</sup> The preliminary screening tool does not consider turbine height nor does it consider the cumulative impact of existing turbines in proximity to the area studied.



## Conclusion

At 499 and 660 feet AGL, the proposed wind turbines will not exceed 14 CFR Part, 77.17(a)(2) or 77.19/21/23 imaginary surfaces (**Figure 2**). However, at 660 feet AGL, the proposed wind turbines will exceed 14 CFR Part 77.17(a)(1) – a height of 499 feet AGL at the site of the object – and will be identified as obstructions regardless of location. However, heights in excess of these surfaces are feasible provided proposed wind turbines do not exceed FAA obstacle clearance surfaces.

Obstacle clearance surfaces overlying the Payne Mountain wind project are a constant 2,049 feet AMSL (**Figure 13**) and are associated with Waco (ACT) TRACON minimum vectoring altitude Sector I (**Figure 8**). Proposed wind turbines that exceed this surface would require an increase to minimum vectoring altitudes. If the FAA determines that this impact would affect a significant volume of operations (*as few as one per week*), it could result in determinations of hazard.

USGS elevation data indicates that this surface could limit 499 foot AGL wind turbines on higher terrain throughout the study area (red areas, **Figure 14**), including 37 of the proposed locations. Additionally, this surface could limit 660 foot AGL wind turbines throughout the majority of the study area (red and orange areas, **Figure 14**), including all 40 of the proposed locations.

Two low-altitude military training routes overlie the Payne Mountain wind project (**Figure 11**). Although impact on these routes cannot result in determinations of hazard, it could result in military objections to proposed wind development.

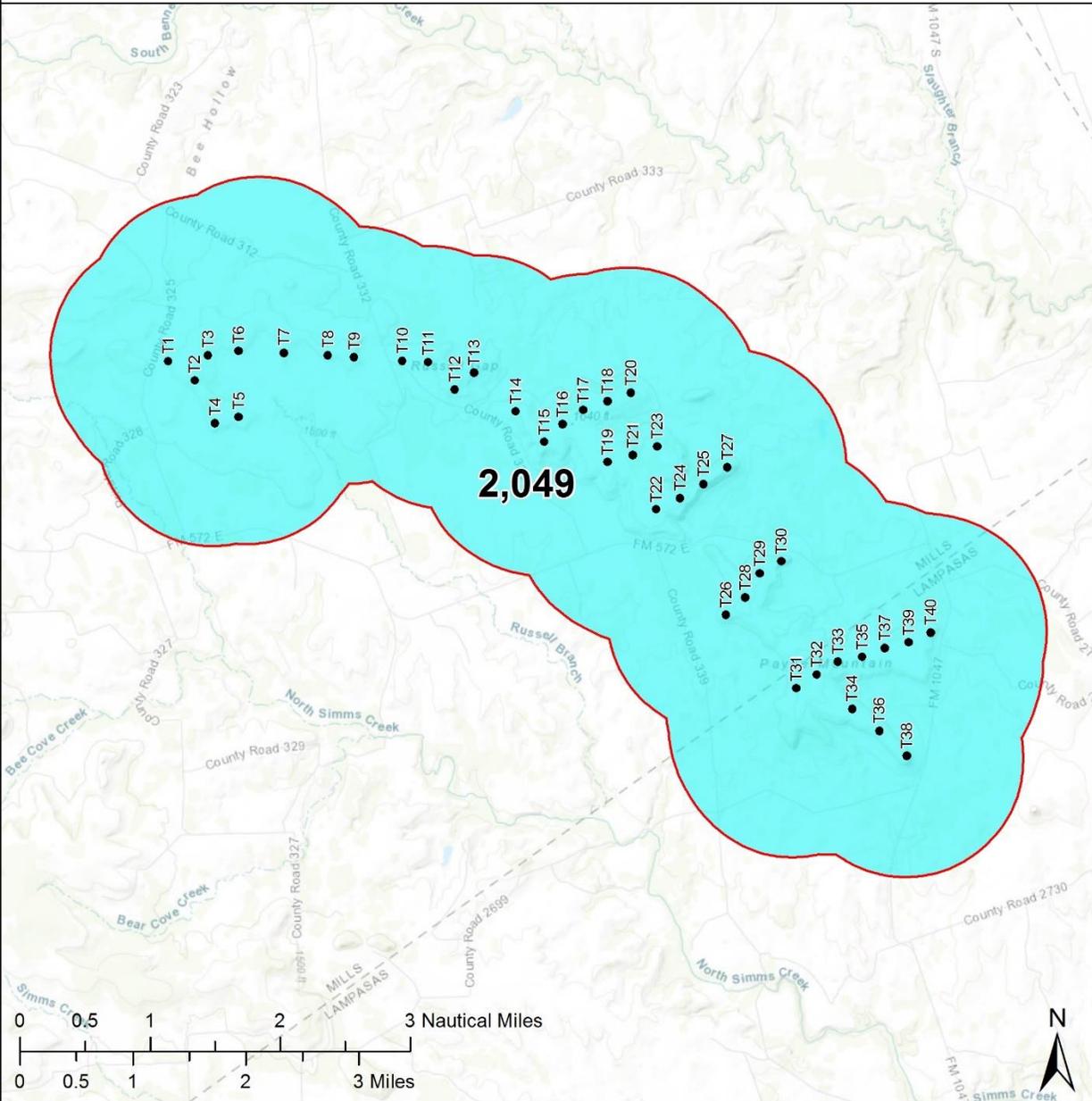
Lastly, the Payne Mountain wind project is located in an area designated as ‘Yellow’ by the FAA/DoD Long Range Radar Screening Tool (left, **Figure 12**). Impact on radar surveillance systems can result in determinations of hazard regardless of the lack of impact on the airspace surfaces described in this report.

The AGL Clearance Map (**Figure 14**) is based on USGS National Elevation Dataset (NED) 1/3 Arc Second data which has a vertical accuracy of generally +/- 7 meters. Therefore, the AGL Clearance Map should only be used for general planning purposes and not exact structure siting. In order to avoid determinations of hazard, proposed structure heights should adhere to the height constraints depicted in the Composite Map (**Figure 13**).

If you have any questions regarding the findings of this study, please contact **Ron Morgan** or **Nick Lee** at (703) 256-2485.



Proposed structures that exceed 14 CFR Part 77.17(a)(1) - a height of 499 feet AGL at the site of the object - will be identified as obstructions regardless of location.



**Obstacle Clearance Surface**  
**Height - AMSL Feet**  
 2,049

- Wind Turbine Location (Labeled with ID)

All heights above mean sea level (AMSL)

**Payne Mountain Wind Project**  
 Composite Height Constraint Map

**Plot Date:**  
9 October 2018

**Coordinate System:**  
NAD 1983 UTM Zone 14N

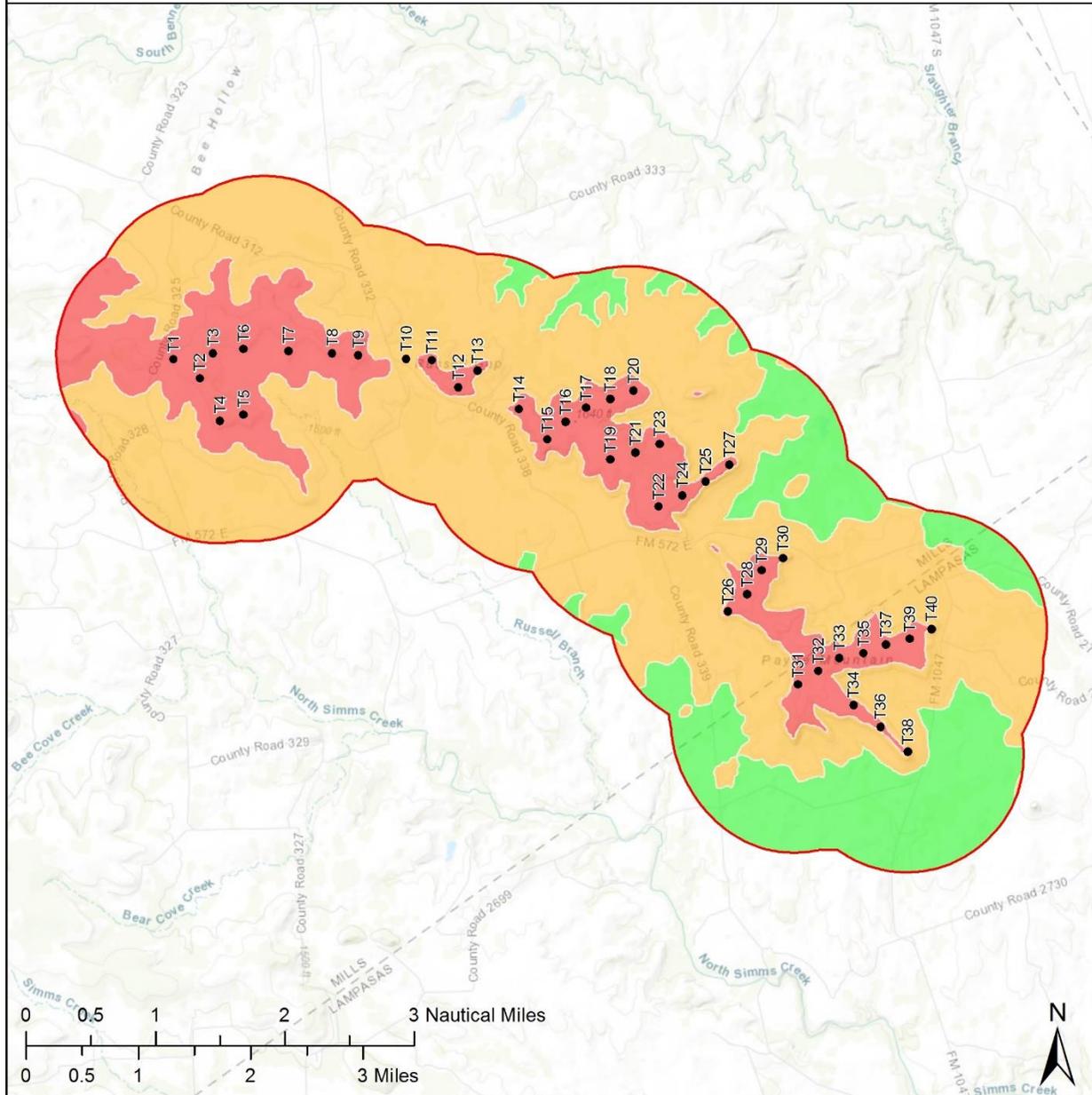
Nick Lee

**Figure 13**

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The USGS 1/3 Arc Second Digital Elevation Model (DEM) data used to create this map has a vertical accuracy of +/- 7 meters. This map should only be used for general planning purposes and not exact structure siting.



**Clearance**

**Height - AGL Feet**

- < 499
- ≥ 499 < 660
- ≥ 660

- Wind Turbine Location (Labeled with ID)

**Payne Mountain Wind Project**  
Above Ground Level (AGL) Clearance Map

**Plot Date:**  
9 October 2018

**Figure 14**

**Coordinate System:**  
NAD 1983 UTM Zone 14N

Nick Lee



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