



**ENGINEERING REPORT  
CONCERNING THE EFFECTS UPON  
FCC LICENSED RF FACILITIES  
DUE TO CONSTRUCTION OF THE  
(Name of Project) WIND PROJECT  
Near  
(City, State)  
for  
(Name of Company)**

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**(Name of Project) Wind Project**

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**I. INTRODUCTION**

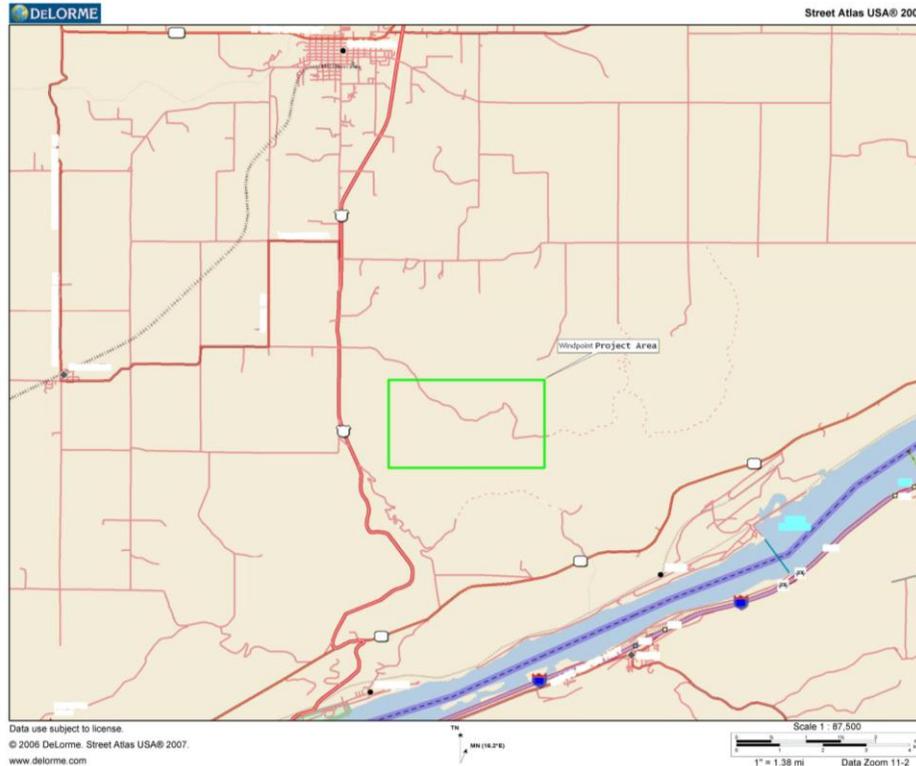
This engineering report describes the results of a study and analysis to determine the locations of federally licensed (FCC) point-to-point microwave and fixed station radio frequency facilities that may be adversely impacted as a result of the construction of the (Name of Project) wind turbine project in (County) County, (State). This document describes impact zones and any necessary mitigation procedures, along with recommendations concerning individual wind turbine siting. All illustrations, calculations and conclusions contained in this document are subject to on-site verification.

Frequently, wind turbines located on land parcels near RF facilities can cause more than one mode of RF impact, and may require an iterative procedure to minimize adverse effects. This procedure is necessary in order to ensure that disruption of RF facilities either does not occur or, in the alternative, that mitigation procedures will be effective. The purpose of this study is to facilitate the siting of turbines to avoid such unacceptable impact.

**(A discussion of project size and the scope of services is placed here.)**

Using industry standard procedures and FCC databases, a search was conducted to determine the presence of any existing microwave paths crossing the subject property, or land mobile or broadcast RF facilities within or adjacent to the identified area. A specific turbine layout has been submitted for analysis. Accordingly, this report will address any issues regarding possible impact to RF communications facilities due to the presence of the proposed turbines.

All methods of mitigation are described, including beam benders and equipment upgrades.



**Figure 1 - Turbine Project Area**

The following tabulation and analysis consists of four sections:

1. Microwave point-to-point path analysis
2. Land mobile, public safety, DoD, NTIA, NEXRAD and Cellular
3. Broadcast television and radio analysis
4. (Earth station aperture blockage analysis also available by request)

Each of the RF analyses is described separately in the paragraphs that follow.



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**II. ANALYSIS OF MICROWAVE LINKS**

An extensive analysis was undertaken to determine the likely effect of the new wind turbine farm upon the existing microwave paths, consisting of a Fresnel x/y axis study and a z-axis (height) evaluation. The microwave paths have been overlaid on Google Earth™ maps, and the images of the microwave paths and the proposed turbines also available as KMZ and GIS shape files.

Evans performs due diligence to ensure that all existing microwave facilities are represented.

Frequently, if interference is shown, Evans performs an engineering analysis to determine how the additional facilities can be accommodated or, if wind turbine structures are already built, determine a method to re-direct the offending beam path.

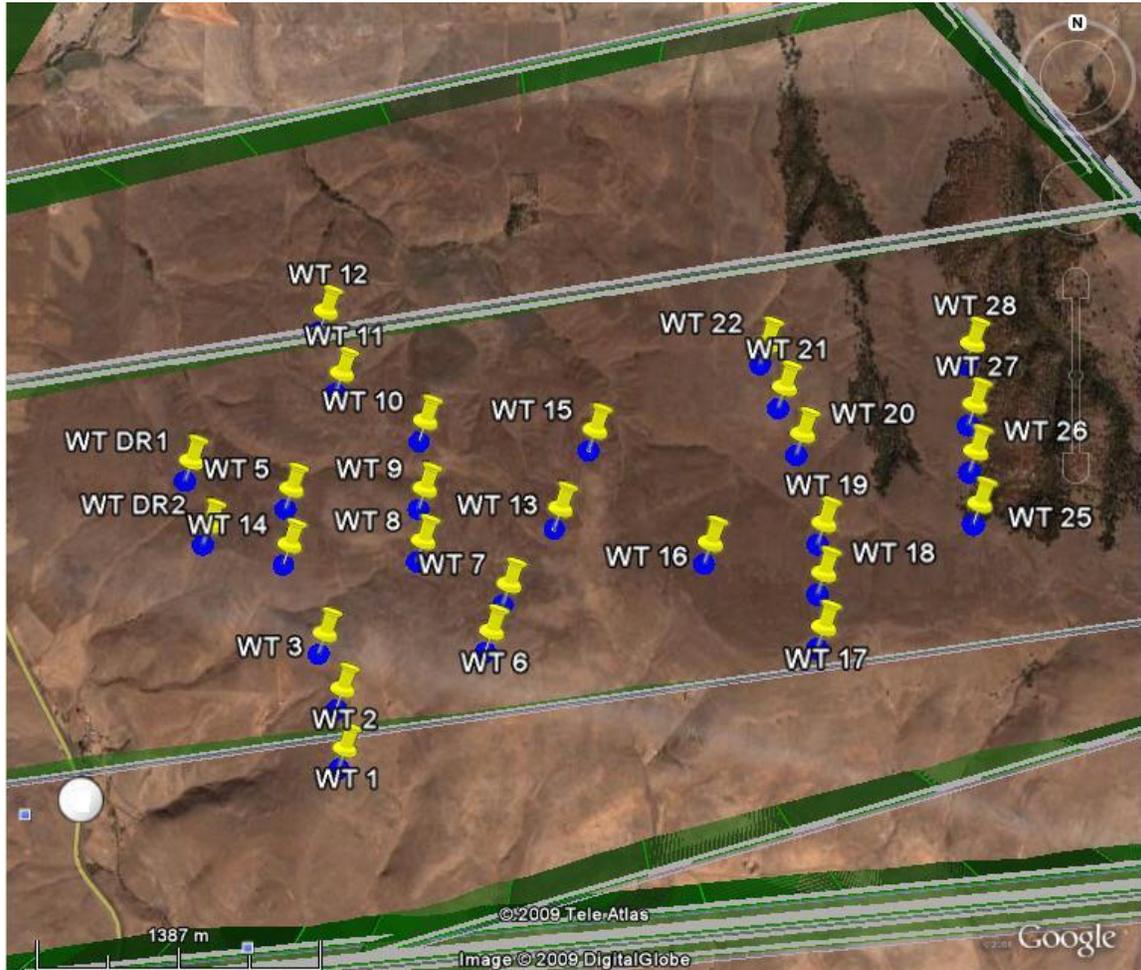
In general, the Fresnel Zone Interference Area is defined by the cylindrical area whose axis is the direct line between the microwave link endpoints and whose radius is calculated according to interference criteria. Evans Engineering Solutions tabulates the microwave paths as follows:

ID	Call Sign	Status	Name Site 1	Name Site 2	Freq. (MHz)	Licensee	WCFZ (m)
xx	WXX123	A			2137.2		20.4
xx	WXX123	E			2187.2		20.2
xx	WXX123	A			6775		27.0
xx	WXX123	A			2093		48.6
xx	WXX123	A			6785		27.0
xx	WXX123	A			6625		27.3
xx	WXX123	A			5960		33.9
xx	WXX123	A			6226.9		26.2

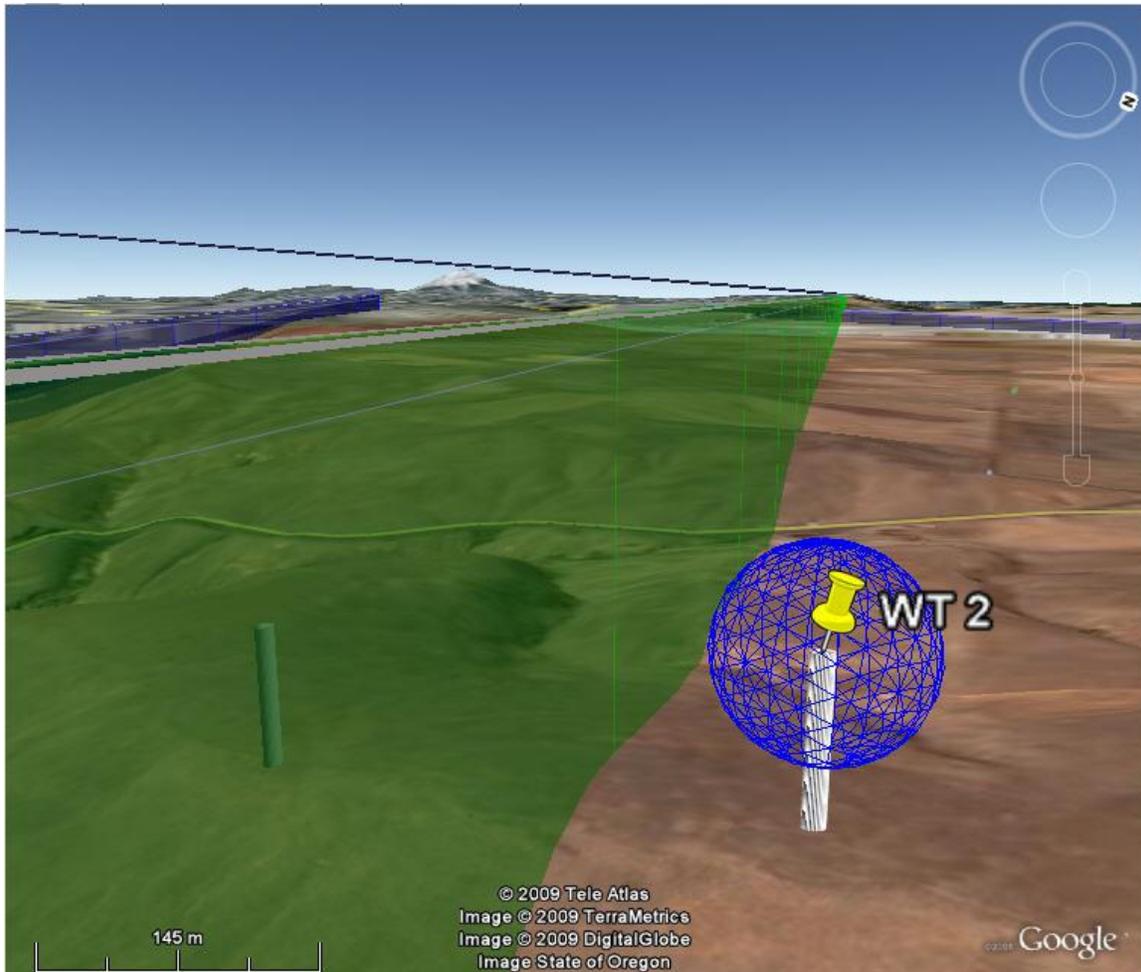
“A” = Active Path, “E” = Expired Path

**Table 1 – Microwave Links Near Turbines**

The microwave links highlighted in yellow are close to planned turbines. Google Earth™ GIS images showing the microwave paths and planned turbines are on the pages that follow.

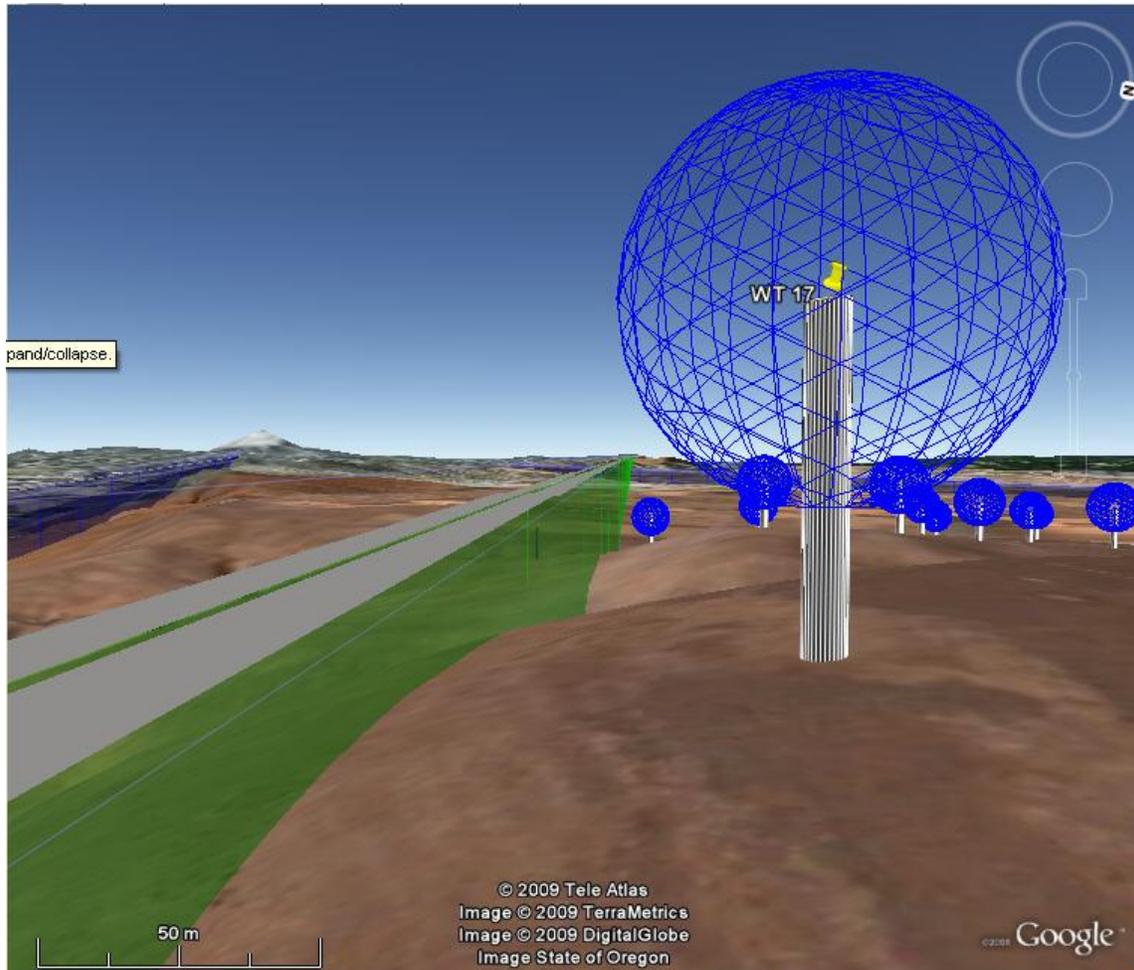


**Figure 2 – Active Microwave Paths Near Turbines**



**Figure 3 – Turbine 2 Near Microwave Path #XX**

The shaft of Turbine 2 is at a horizontal distance of about 105 meters from the centerline of Microwave Path #XX, and the rotor is well below the Fresnel zone. Thus, based on the antenna coordinates and heights supplied by the operator of this microwave link, Turbine 2 should not affect the link.



**Figure 4 – Turbine 17 Near Microwave Path #XX**

The shaft of Turbine 17 is at a horizontal distance of about 101 meters from the centerline of Microwave Path #XX. Thus, based on the antenna coordinates supplied by the microwave operator, Turbine 17 should not affect the microwave link.



**III. ANALYSIS OF FIXED RADIO FACILITIES**

**3.1 Land Mobile Facilities**

There are nine land mobile stations identified from the FCC’s database that fall within the search area. The list of land mobile sites is as follows:

Call Sign	Status	Latitude (NAD-83)	Longitude (NAD-83)	Antenna Height (m AGL)	Distance Required (m)
WXYZ123	A	xx-xx-xx	xxx-xx-xx	5	xxx
WXYZ123	E	xx-xx-xx	xxx-xx-xx	3	xxx
WXYZ123	A	xx-xx-xx	xxx-xx-xx	21	xxx
WXYZ123	E	xx-xx-xx	xxx-xx-xx	21	xxx
WXYZ123	T	xx-xx-xx	xxx-xx-xx	21	xxx
WXYZ123	A	xx-xx-xx	xxx-xx-xx	16	xxx
WXYZ123	A	xx-xx-xx	xxx-xx-xx	16	xxx
WXYZ123	A	xx-xx-xx	xxx-xx-xx	12	xxx
WXYZ123	A	xx-xx-xx	xxx-xx-xx	20	xxx

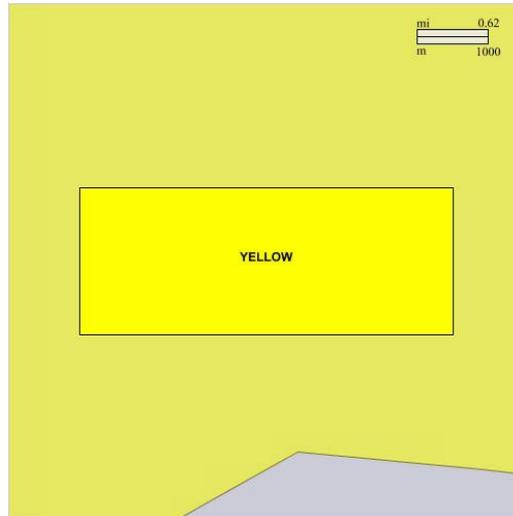
“A” = Active, “E” = Expired, “T” = Terminated

**Table 2 – Land Mobile Stations**

Should undocumented or newly licensed land mobile services be located farther away from any turbine more than the required distance, significant disruption is not expected.

**3.2 FAA and DoD Concerns**

The Department of Defense and the Department of Homeland Security *Long Range Radar Joint Program Office* “JPO” has adopted a “pre-screening tool” to evaluate the impact of wind turbines on air defense long-range radar.



**Figure 4 – Long-Range Radar Determination**

The public airport closest to the project area is (Name of Airport), which is 5.9 miles north-northwest of the center of the turbine area. While the proposed turbines in all likelihood will not adversely impact operations associated with this airport, the 7460-1 evaluation process is the final determination of the impact, if any, to airspace navigation.

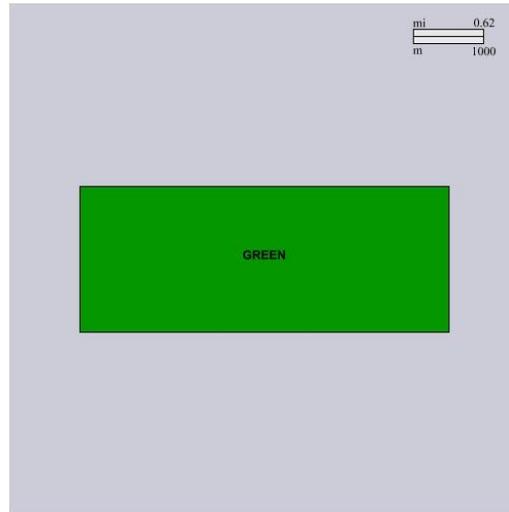
### **3.3 NEXRAD and Other Government RF Facilities**

The NTIA has set in place a review process, wherein the Interdepartmental Radio Advisory Committee (IRAC), consisting of representatives from various government agencies, reviews new proposals for wind turbine projects for impact on government frequencies.

A pre-screening tool has been developed to evaluate the potential impact of obstructions to the NEXRAD Weather Surveillance Doppler Radar Stations. The turbine site area was applied to this tool, and it returned the following result:



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**Figure 5 – NEXRAD Weather Radar Determination**

- *Green* - Minimal to no impact to WSR-88D weather radar operations. Aeronautical study required. NTIA notification advised.

### **3.4 Other Communications Sites**

A search of the FCC registered antenna structures database showed that, other than the land mobile sites, there are no existing registered communications towers located within 3 kilometers of any proposed new wind turbine. However, it is recommended that possible cellular, earth station and PCS antennas be searched for during the physical site visits.



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**3.5 Cell Phone Reception**

(A Cell Phone Analysis is placed in this section.)

**IV. ANALYSIS OF BROADCAST FACILITIES**

**4.1 HDTV Broadcast Facilities**

The rotating blades of a wind turbine have the potential to disrupt over-the-air broadcast TV reception within a few miles of the turbine, especially when the direct path from the viewer’s residence is obstructed by terrain. This is known as “multipath interference.” Occasionally, multipath interference from one or more turbines can cause video failure in HDTV receivers, especially if the receiver location is in a valley or other place of low elevation.

Analog TV transmission is scheduled to end on June 12, 2009 (unless the date is extended by Congress or the FCC), after which TV stations are mandated to transmit only in HDTV (“Digital” or “High Definition”).

(Name of County) County is in the (Name of DMA) Designated Market Area (DMA) according to Nielsen Media Research; however, none of the (DMA City) HDTV stations’ predicted service contours reach the (Name of Project) wind turbine area. The following full service digital TV facilities have been identified as placing a predicted FCC primary service signal over at least a part of the turbine area:

Call Sign	Network Affiliate	Channel	City of License	Power (KW)	Ant. Height (m HAAT)	Distance (km)	Azimuth (°T)
KXYZ-TV	ABC	14	City, ST	160	293	90.3	13.5
KXYZ-TV	NBC	16	City, ST	150	266	90.4	13.6
KXYZ-TV	CBS	33	City, ST	100	292	90.3	13.5

**Table 3 – Digital TV Stations to Serve Project Area**

The population of the area within about X miles of the turbines is about 85 persons (approximately 35 households). Mitigation measures are expected to be available for all expected anomalies, with satellite services providing the worst-case solution.

There is some possibility of TV reception disruption for residences that have to point their outdoor antennas through the turbine area, or that utilize “rabbit ear” antennas, or that utilize



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older HDTV receivers. The usual effect is intermittent “pixilation” or freezing of the digital TV picture. This estimate is based upon Evans’ experience with similar turbine farms.

In the opinion of this consultant, the number of instances of turbine disruption to over-the-air TV should be low. Mitigation would consist of the installation of a rooftop high-gain antenna in the nominal case, and providing a cable or satellite hookup in the worst case. In the experience of this consultant, it is most likely that about four HDTV receivers may be affected. Mitigation costs would be approximately \$XXX in each instance.

**4.2 TV Translators**

**(This analysis is done only in situations where there are less than five full-power over-the-air TV signals serving the area.)**

The following licensed analog TV translators place a predicted primary service signal over at least part of the wind project area:

Call Sign	City of License	Channel	Coordinates (NAD-27)	ERP (KW)	Ant. Height (m AGL)
K00XY	City, ST	6	xx-xx-xx; xxx-xx-xx	0.25	13
K00XY	City, ST	51	xx-xx-xx; xxx-xx-xx	12	12
K00XY	City, ST	67	xx-xx-xx; xxx-xx-xx	1.45	0

**Table 4 – TV Translators Serving Project Area**

In addition to the licensed translators, FCC construction permits are pending for the following digital TV translator or low power stations which are predicted to serve the wind project area:

Call Sign	City of License	Channel	Coordinates (NAD-27)	ERP (KW)	Ant. Height (m AGL)
K00XY	City, ST	22	xx-xx-xx; xxx-xx-xx	0.361	17.5
K00XY	City, ST	51	xx-xx-xx; xxx-xx-xx	2.23	12

**Table 5 – Digital TV Translator & Low Power Stations to Serve Project Area**

Since the areas within and adjacent to the project boundaries are sparsely populated, and there are no significant concentrations of populations nearby in which the received direct TV signals would be passing through the project area, there is not expected to be a significant number of cases of signal disruption with respect to the (Name of Project) wind turbines. The population of



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the area within about X miles of the turbines is about 85 persons (approximately 35 households). If there are any instances of receiver interference to the above operating TV translator and low power stations attributable to the turbines, (Name of Company) will cooperate fully to resolve those complaints.

**4.3 FM FACILITIES**

The following full-service FM stations each place a predicted primary signal over most or all of one or both of the turbine properties:

Call Sign	Format	Freq. (MHz)	City of License	Power (KW)	Ant. Height (m HAAT)	Dist. (km)	Azimuth (°T)
KXYZ-FM	Classic Rock	92.7	City, ST	3.4	271	39.5	254.8
KXYZ-FM	News/Talk	97.7	City, ST	5.1	271	39.5	254.8
KXYZ-FM	Country	102.3	City, ST	2.1	571	11.8	234.4
KXYZ-FM	Adult Contemp.	93.5	City, ST	35	277	67.8	146.1
KXYZ-FM	Adult Contemp.	104.5	City, ST	100	609	25.8	262.5

**Table 6 – FM Stations Serving Project Area**

Because of the (technical considerations), significant disruptions to the above facilities are not expected. Although the received signal may vary with the blade rotation at some receive locations in the immediate area, good quality FM receive radios will most likely factor out such time-varying signals. In those relatively few cases where significant impact is caused, home FM radios could be connected to the rooftop TV receive antennas to pull in a stronger direct signal.

**4.4 AM Facilities**

A search of the FCC’s database revealed no AM facilities within the required notification distance of X kilometers beyond the project area boundaries.

**V. CONCLUSIONS**

- 1. (Description of Turbines Impacts and Mitigation – Summary)**
- 2. (Description of Land Mobile Impacts and Mitigation – Summary)**
- 3. (Description of FM Broadcast Impacts and Mitigation – Summary)**
- 4. (Description of TV Broadcast Impacts and Mitigation – Summary)**