Appendix D
Telecommunications Reports

Microwave Study

August 23, 2016

Wind Power GeoPlanner™

Microwave Study

Bitter Root Wind

Prepared on Behalf of
Flying Cow Wind, LLC

August 23, 2016

COMSEARCH®
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Table of Contents

1. Introduction - 1 -

2. Project Overview - 1 -

3. Fresnel Zone Analysis - 2 -

4. Conclusion - 5 -

5. Contact - 5 -

1. Introduction

Microwave bands that may be affected by the installation of wind turbine facilities operate over a wide frequency range (900 MHz – 23 GHz). Comsearch has developed and maintains comprehensive technical databases containing information on licensed microwave networks throughout the United States. These systems are the telecommunication backbone of the country, providing long-distance and local telephone service, backhaul for cellular and personal communication service, data interconnects for mainframe computers and the Internet, network controls for utilities and railroads, and various video services. This report focuses on the potential impact of wind turbines on licensed, proposed and applied non-federal government microwave systems.

2. Project Overview

Project Information

Name: Bitter Root Wind

County: Deuel (SD) and Yellow Medicine (MN)

State: South Dakota and Minnesota

Number of Turbines: TBD

Blade Diameter: 126 meters

Hub Height: 87 meters

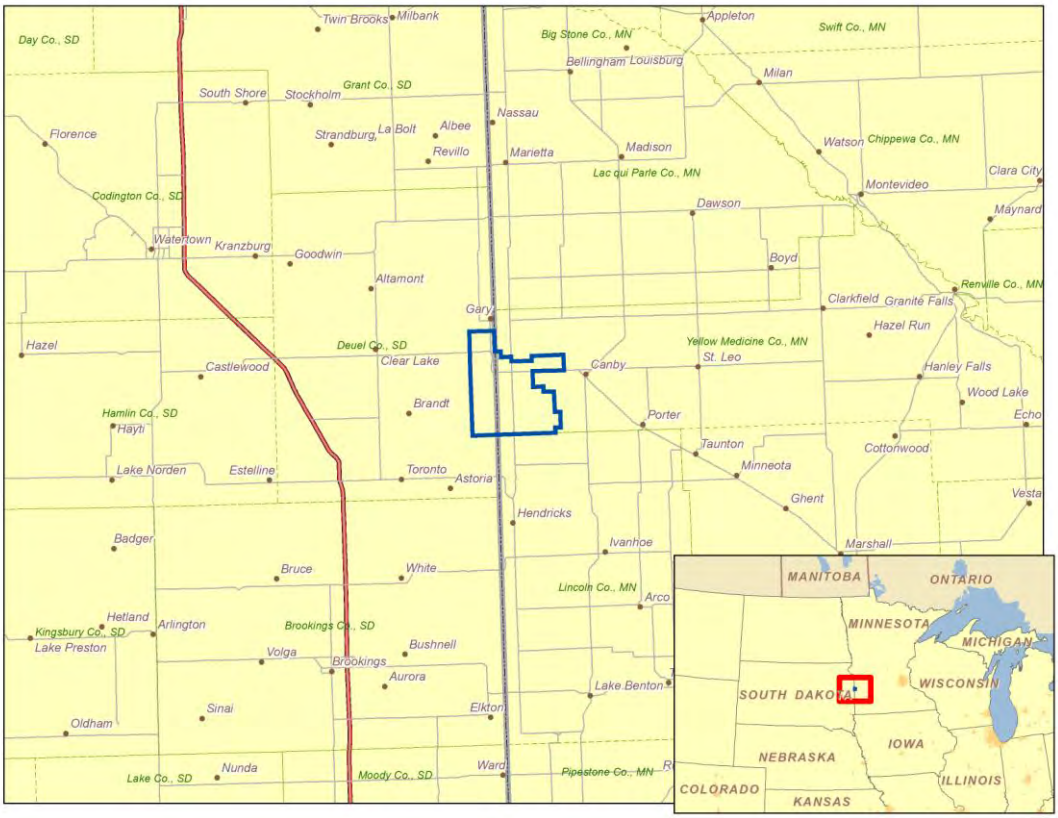


Figure 1: Area of Interest

3. Fresnel Zone Analysis

Methodology

Our obstruction analysis was performed using Comsearch's proprietary microwave database, which contains all non-government licensed, proposed and applied paths from 0.9 - 23 GHz[1]. First, we determined all microwave paths that intersect the area of interest[2] and listed them in Table 1. This path and the area of interest that encompasses the planned turbine locations are shown in Figure 2.

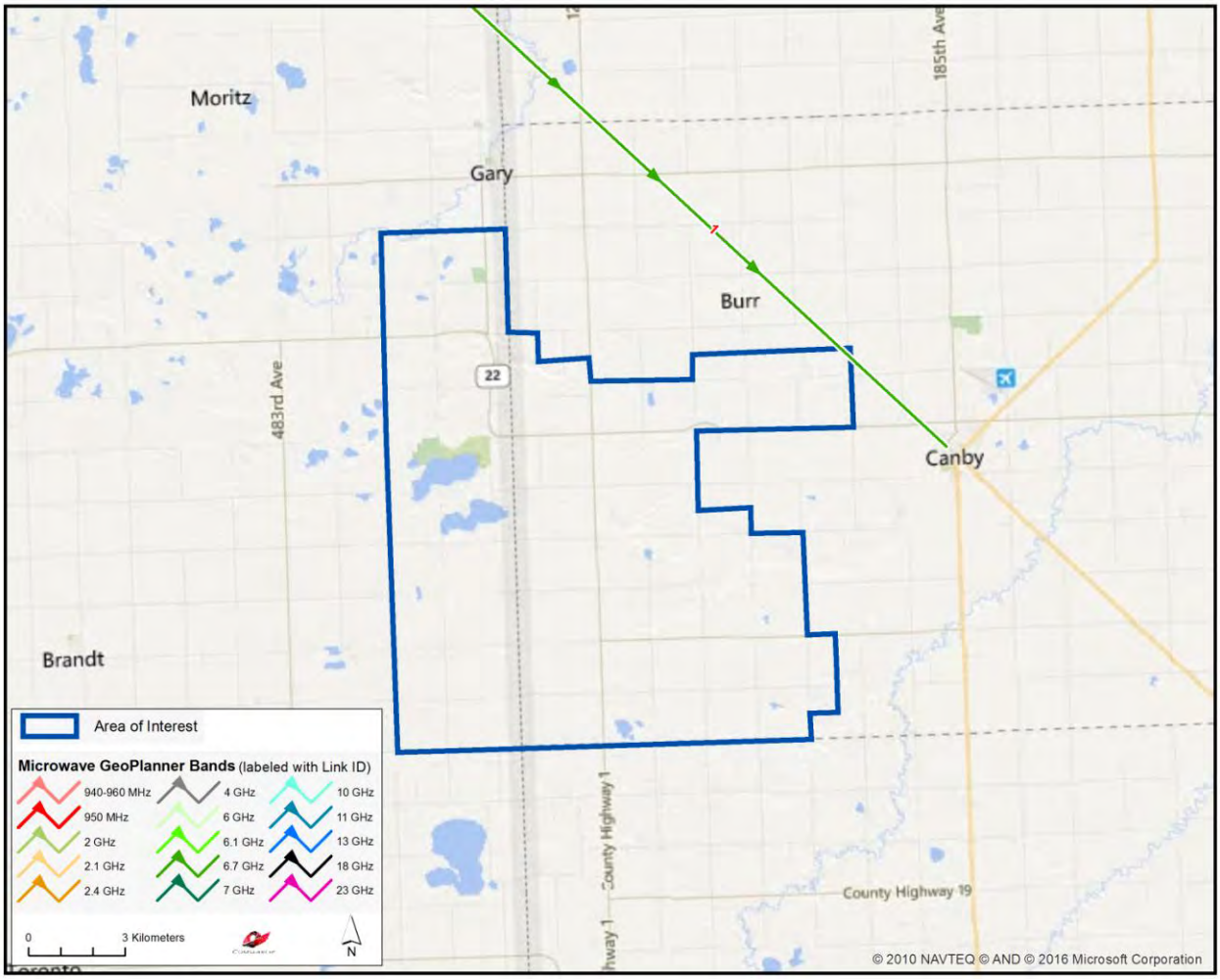


Figure 2: Microwave Paths that Intersect the Area of Interest

[1] Please note that this analysis does not include unlicensed microwave paths or federal government paths that are not registered with the FCC.

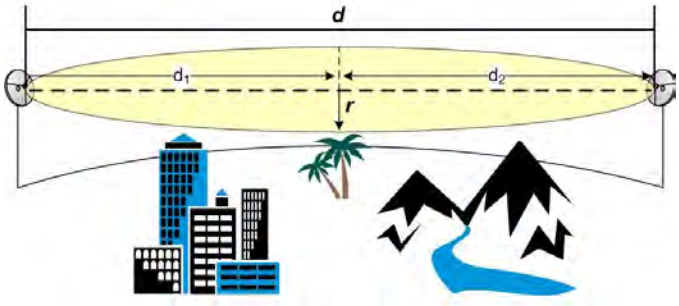
[2] We use FCC-licensed coordinates to determine which paths intersect the area of interest. It is possible that as-built coordinates may differ slightly from those on the FCC license.

ID	Status	Callsign 1	Callsign 2	Band	Path Length (km)	Licensee
1	Licensed	WHI614	WHI616	Upper 6 GHz	21.85	Otter Tail Power Company

Table 1: Summary of Microwave Paths that Intersect the Area of Interest
(See enclosed mw_geopl.xlsx for more information and
GP_dict_matrix_description.xls for detailed field descriptions)

Next, we calculated a Fresnel Zone for this path based on the following formula:

$$r \cong 17.3\sqrt{\frac{n}{F_{GHz}}\left(\frac{d_1 d_2}{d_1 + d_2}\right)}$$



Where,

r	=	Fresnel Zone radius at a specific point in the microwave path, meters
n	=	Fresnel Zone number, 1
F_{GHz}	=	Frequency of microwave system, GHz
d_1	=	Distance from antenna 1 to a specific point in the microwave path, kilometers
d_2	=	Distance from antenna 2 to a specific point in the microwave path, kilometers

The calculated Fresnel Zone shows the narrow area of signal swath and is calculated for the microwave path in the project area. In general, this is the area where the planned wind turbines should be avoided, if possible. A depiction of the individual Fresnel Zones is shown in Figure 3, and is also included in the shapefiles[3,4].

[3] The ESRI® shapefiles enclosed are in NAD 83 UTM Zone 14 projected coordinate system.

[4] Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data provided in this report is governed by Comsearch's data license notification and agreement located at http://www.comsearch.com/files/data_license.pdf.

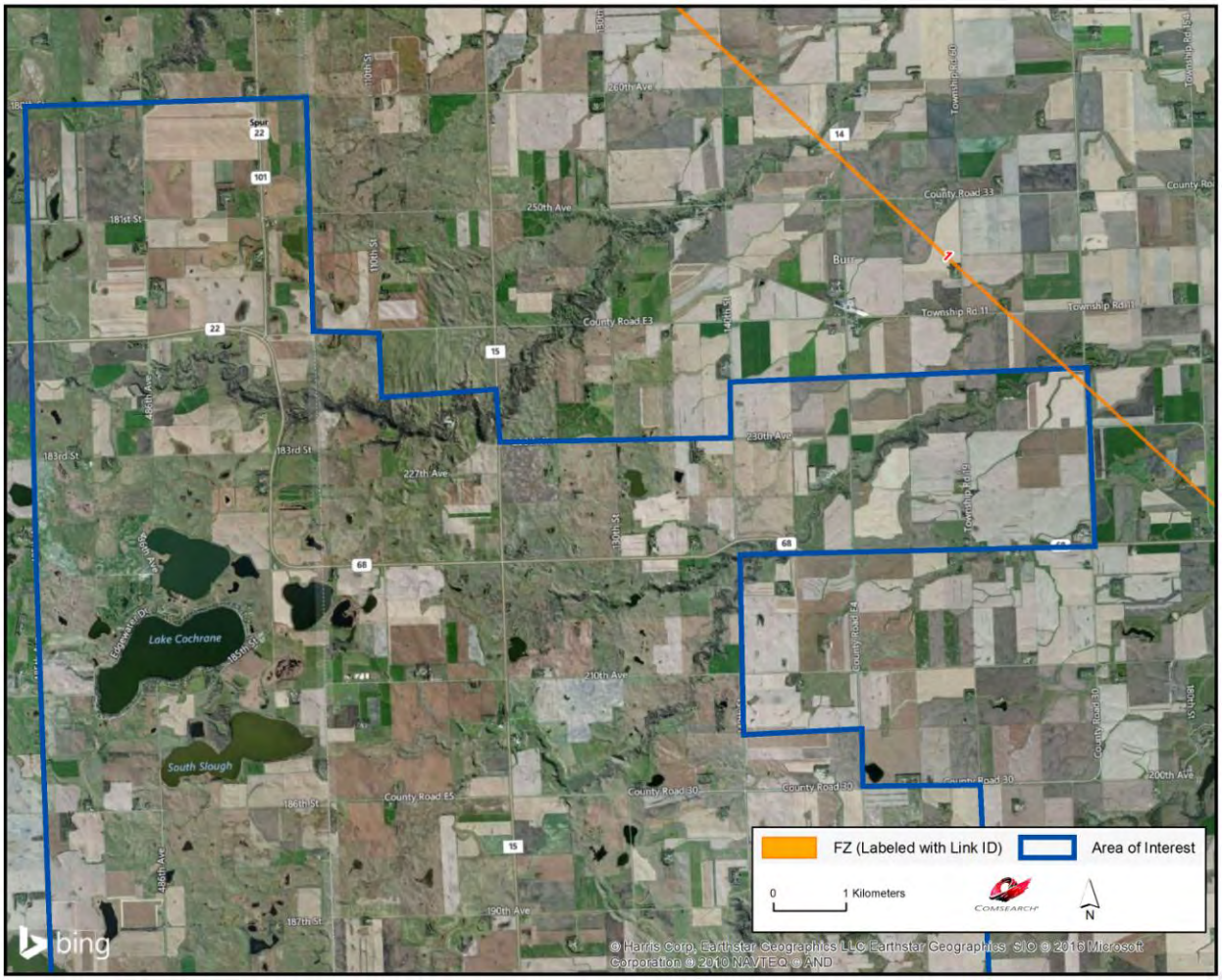


Figure 3: Fresnel Zones in the Area of Interest

Discussion of Potential Obstructions

Total Microwave Paths	Paths with Affected Fresnel Zones	Total Turbines	Turbines intersecting Fresnel Zones
1	N/A	N/A	N/A

For this project, turbine locations were not provided; thus we could not determine if any potential obstructions exist between the planned wind turbines and the incumbent microwave path. If the latitude and longitude values for turbine locations are provided, Comsearch can identify where a potential conflict might exist.

4. Conclusion

Our study identified one microwave path intersecting the Bitter Root Wind project area. The Fresnel Zones for this microwave path were calculated and mapped. We recommend that all turbines be sited in locations that will not obstruct the Fresnel Zones.

5. Contact

For questions or information regarding the Microwave Study, please contact:

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AM and FM Report

August 26, 2016

Wind Power GeoPlanner™

AM and FM Radio Report

Bitter Root Wind Farm

Prepared on Behalf of
Flying Cow Wind, LLC

August 26, 2016

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Table of Contents

1. Introduction - 1 -

2. Summary of Results - 1 -

3. Impact Assessment - 3 -

4. Recommendations - 3 -

5. Contact - 3 -

1. Introduction

Comsearch analyzed AM and FM radio broadcast stations whose service could potentially be affected by the proposed Bitter Root Wind Farm in Deuel County, South Dakota and Yellow Medicine County, Minnesota.

2. Summary of Results

AM Radio Analysis
Comsearch did not find any database records[1] for AM stations within 30 kilometers of the project.

ID	Call Sign	Status	Frequency (kHz)	Transmit ERP (kW)	Latitude (NAD 27)	Longitude (NAD 27)	Required Separation Distance (km)	Distance to project AOI (km)
No AM Stations Found within 30 km of Project Area of Interest								

Table 1: AM Radio Stations within 30 Kilometers

[1] Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data presented in this report is derived from the AM/FM station's FCC license and governed by Comsearch's data license notification and agreement located at http://www.comsearch.com/files/data_license.pdf.

FM Radio Analysis

Comsearch determined that there was one FM station within a 30-kilometer radius of the Bitter Root Wind Farm project area, as shown in Table 2 and Figure 2. This station is currently licensed and operating.

ID	Call Sign	Status[2]	Service[3]	Frequency (MHz)	Transmit ERP[4] (kW)	Latitude (NAD 27)	Longitude (NAD 27)	Distance to Project AOI (km)
1	KDBX	Licensed	FM	107.1	9.8	44.61222222	-96.67805556	14.29

Table 2: FM Radio Stations within 30 Kilometers of Project Area

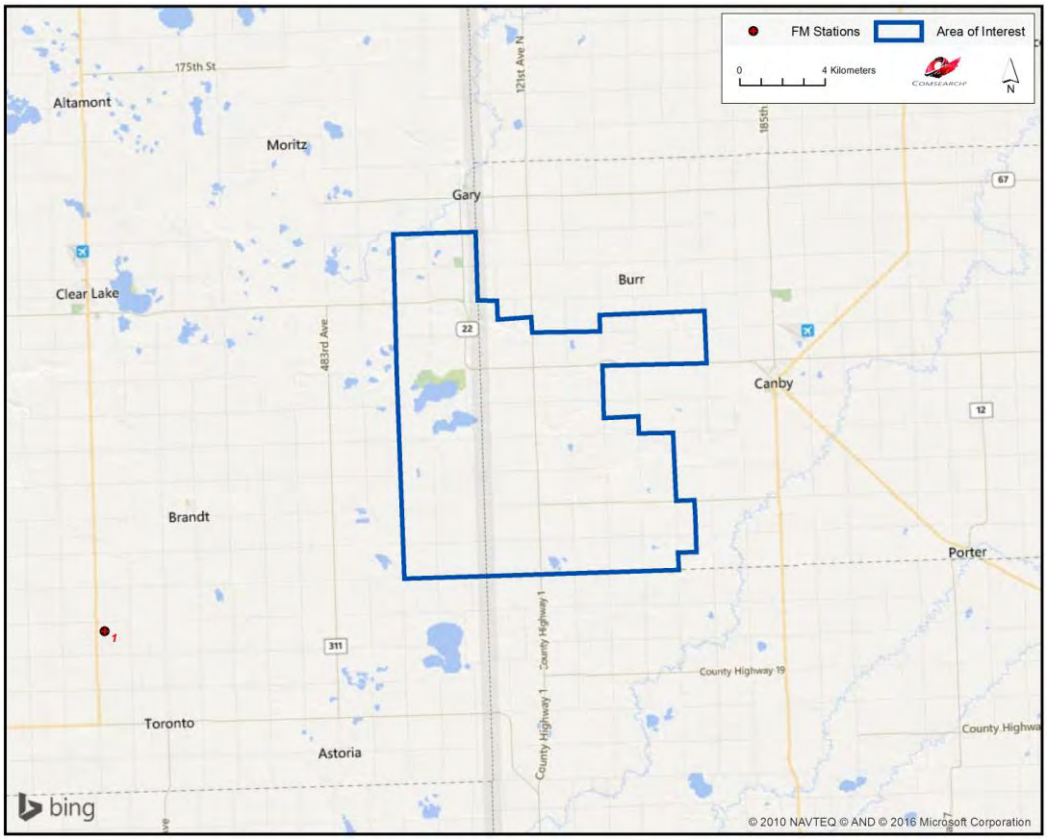

Figure 2: FM Radio Stations within 30 Kilometers of Project Area

[2] LIC = Licensed and operational station; APP = Application for construction permit; CP=Construction permit granted; CP MOD = Modification of construction permit.

[3] FM = FM broadcast station; FX = FM translator station; FL = Low-power FM station; FS = FM auxiliary (backup) station; FB = FM booster station.

[4] ERP = Transmit Effective Radiated Power.

3. Impact Assessment

The exclusion distance for AM broadcast stations varies as a function of the antenna type and broadcast frequency. For directional antennas, the exclusion distance is calculated by taking the lesser of 10 wavelengths or 3 kilometers. For non-directional antennas, the exclusion distance is simply equal to 1 wavelength. Potential problems with AM broadcast coverage are only anticipated when AM broadcast stations are located within their respective exclusion distance limit from wind turbine towers. As there were no stations found within 30 kilometers of the Bitter Root Wind Farm wind project, which is the maximum possible exclusion distance based on a directional AM antenna broadcasting at 1000 KHz or less, the project should not impact the coverage of local AM stations.

The coverage of FM stations is generally not susceptible to interference caused by wind turbines, especially when large objects, such as wind turbines, are sited in the *far field* region of the radiating FM antenna in order to avoid the risk of distorting the antenna's radiation pattern. The FM station identified near the Bitter Root Wind Farm, KDBX, is more than 14 kilometers from the project area. At this distance, there should be adequate separation to avoid radiation pattern distortion.

4. Recommendations

Since no impact on the licensed and operational AM or FM broadcast stations was identified in our analysis, no recommendations or mitigation techniques are required for this project.

5. Contact

For questions or information regarding the AM and FM Radio Report, please contact:

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TV Report

August 26, 2016

Wind Power GeoPlanner™

Off-Air TV Analysis

Bitter Root Wind Farm

Prepared on Behalf of
Flying Cow Wind, LLC

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Table of Contents

1. Introduction - 1 -
2. Summary of Results - 1 -
3. Impact Assessment - 4 -
4. Recommendations - 5 -
5. Contact - 5 -
6. Appendix A - 6 -

1. Introduction

Off-air television stations broadcast signals from terrestrially-based facilities directly to television receivers. Comsearch identified those off-air stations whose service could potentially be affected by the proposed Bitter Root Wind Farm in Deuel County, South Dakota and Yellow Medicine County, Minnesota. Comsearch then examined the coverage of the stations and the communities in the area that could potentially have degraded television reception due to the location of the proposed wind turbines.

2. Summary of Results

The proposed wind energy project area and local communities are depicted in Figure 1, below.

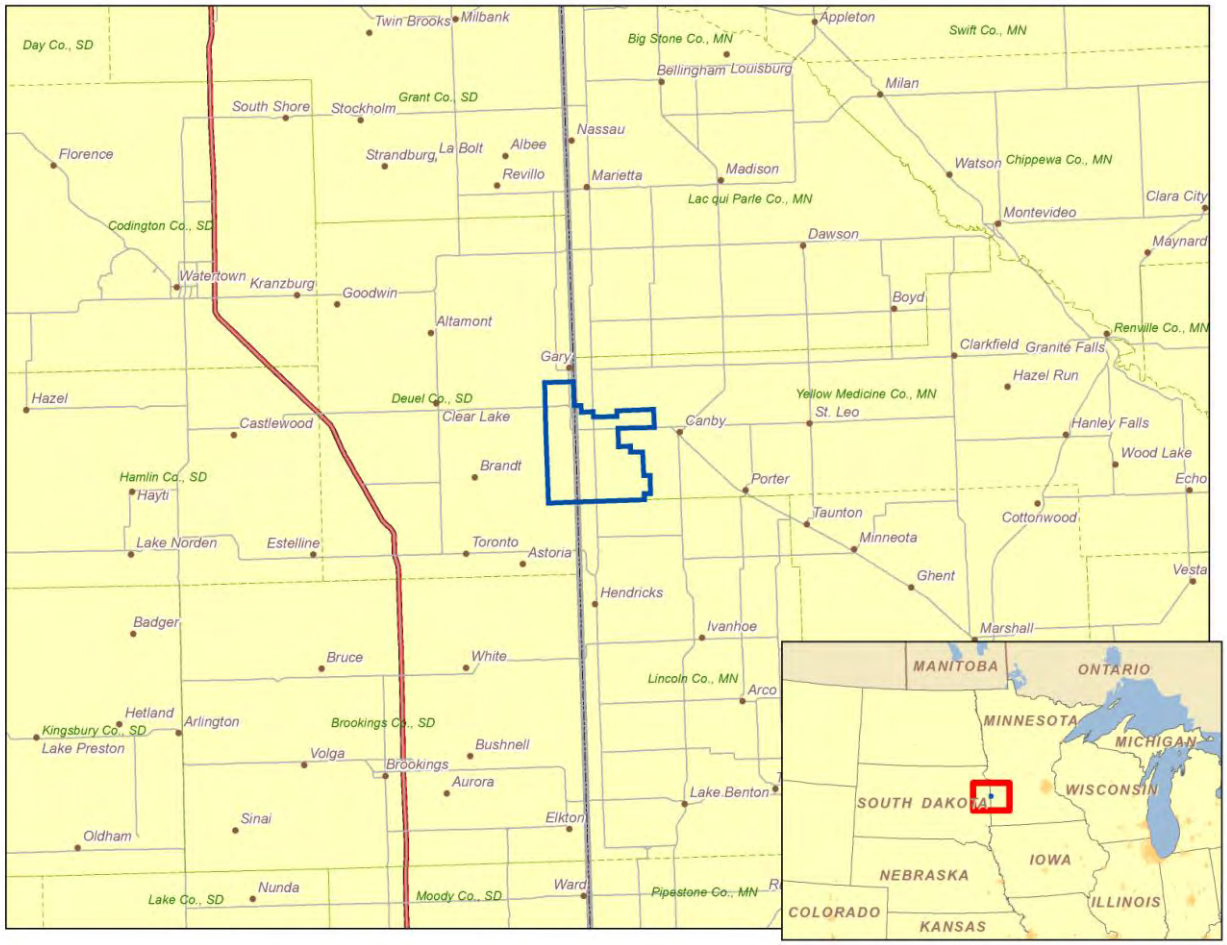

Figure 1: Wind Farm Project Area and Local Communities

To begin the analysis, Comsearch compiled all off-air television stations[1] within 150 kilometers of the project area of interest (AOI). Appendix A contains a tabular summary of these stations. A plot depicting their locations appears in Figure 2, below.

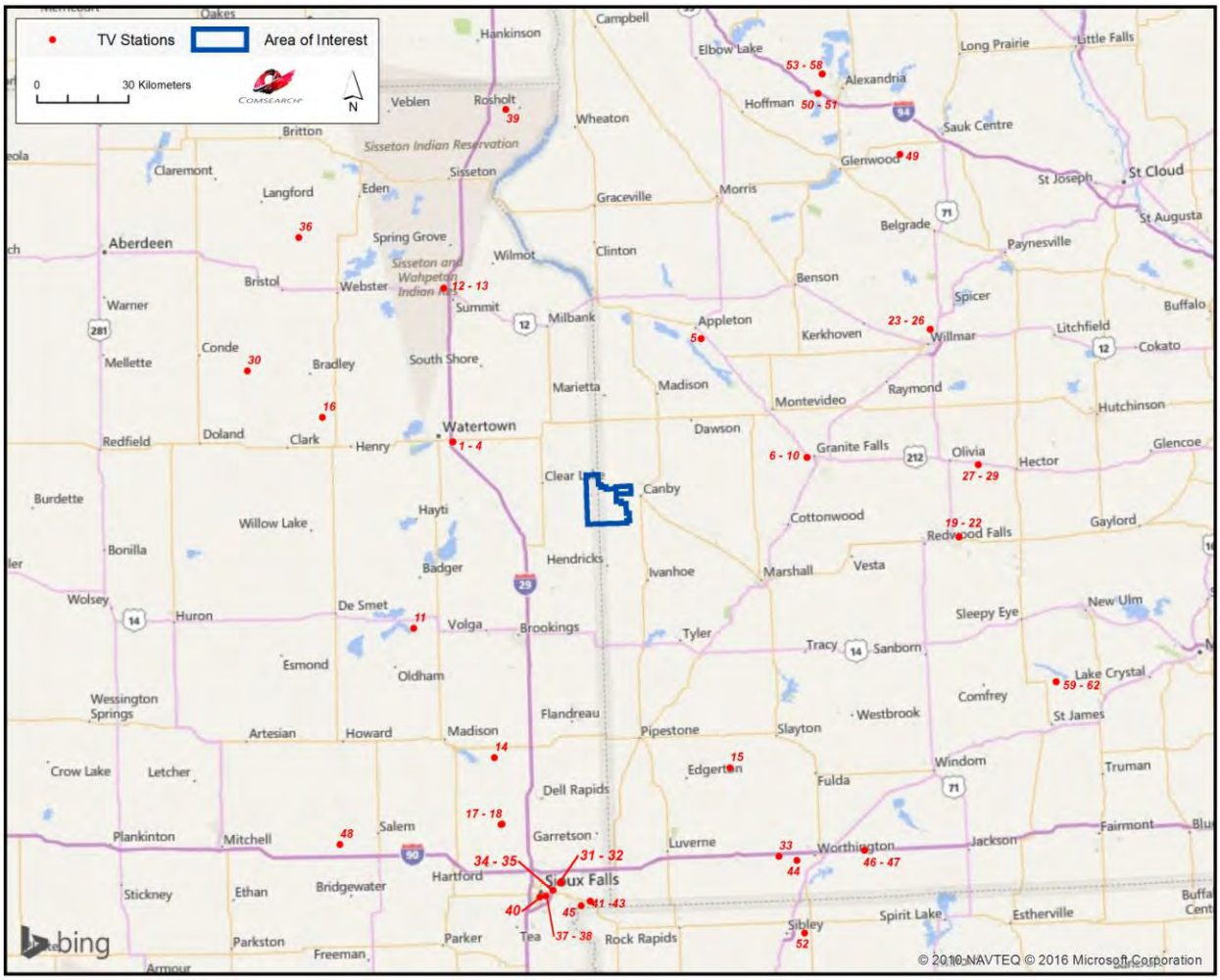

Figure 2: Plot of Off-Air TV Stations within 150 Kilometers of Project Area

TV stations at a distance of 75 kilometers or less are the most likely to provide off-air coverage to the project area and neighboring communities. These stations are listed in Table 1, below, and a plot depicting their locations is provided in Figure 3. There are a total of eleven database records for stations within approximately 75 kilometers of the limits of the project AOI. Of these stations, only seven are currently licensed and operating, five of which are low-power stations or translators. Translator stations are low-power stations that receive signals from distant

[1] Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data presented in this report is derived from the TV station's FCC license and governed by Comsearch's data license notification and agreement located at http://www.comsearch.com/files/data_license.pdf.

broadcasters and retransmit the signal to a local audience. These stations serve local audiences and have limited range, which is a function of their transmit power and the height of their transmit antenna.

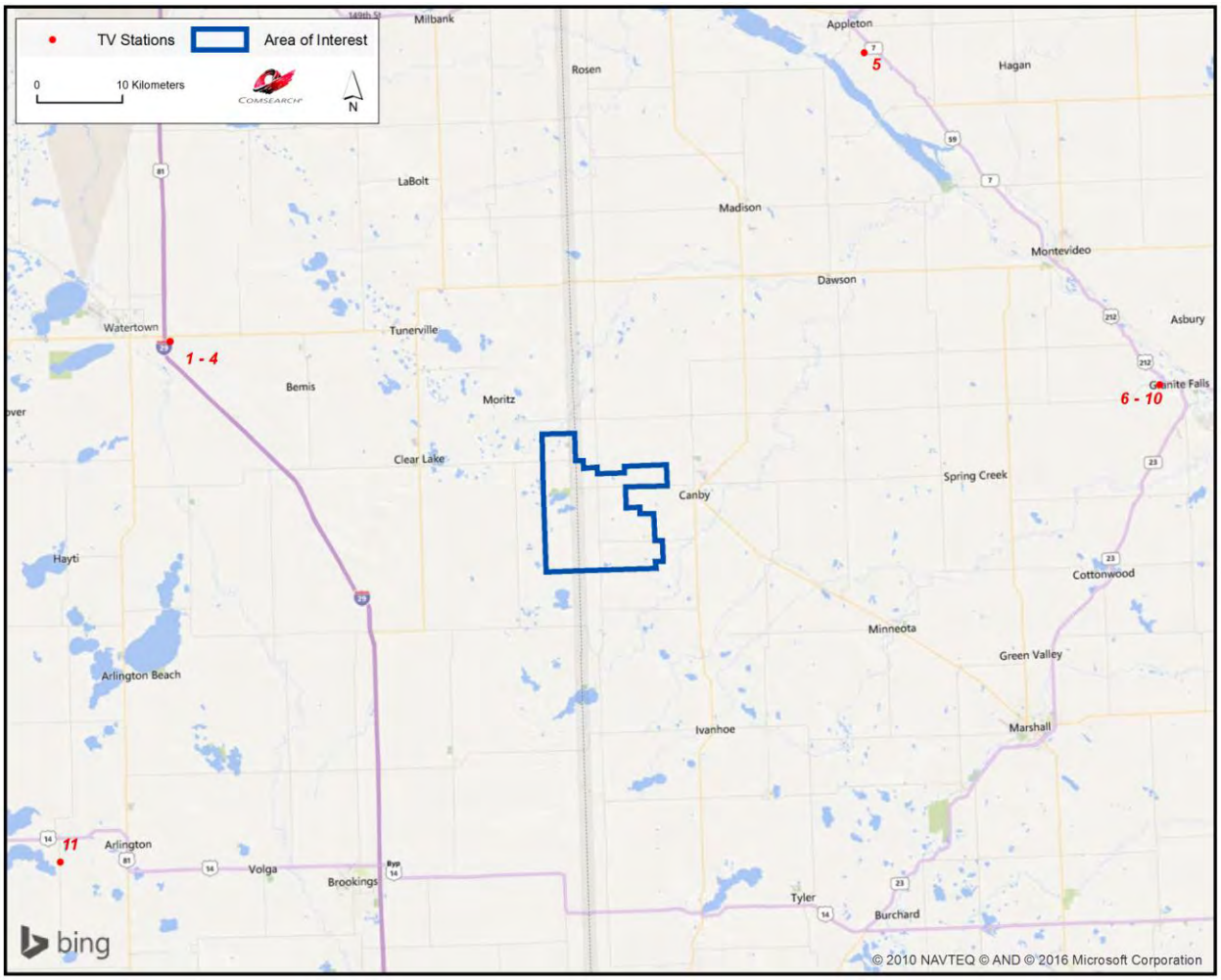

Figure 3: Plot of Off-Air TV Stations within 75 Kilometers of Project Area

ID	Call Sign	Status	Service[2]	Channel	Transmit ERP[3] (kW)	Latitude (NAD 27)	Longitude (NAD 27)	Distance to Project AOI (km)
1	K19KH-D	Construction Permit Granted	LD	19	2.0	44.88491667	-97.04791667	44.97
2	K20KZ-D	Construction Permit Granted	LD	20	2.0	44.88491667	-97.04791667	44.97
3	K22KF-D	Construction Permit Granted	LD	22	15.0	44.88500000	-97.04805556	44.98
4	K23LI-D	Construction Permit Granted	LD	23	15.0	44.88500000	-97.04805556	44.98
5	KWCM-TV	Licensed	DT	10	50.0	45.16750000	-96.00055556	53.70
6	K14OL-D	Licensed	LD	14	1.8	44.80472222	-95.58027778	58.80
7	K16CP-D	Licensed	LD	16	1.8	44.80472222	-95.58027778	58.80
8	K21LF-D	Licensed	LD	21	1.8	44.80472222	-95.58027778	58.80
9	K22DO-D	Licensed	LD	22	1.7	44.80472222	-95.58027778	58.80
10	K24CS-D	Licensed	LD	24	1.8	44.80472222	-95.58027778	58.80
11	KESD-TV	Licensed	DT	8	15.0	44.33777778	-97.22833333	66.46

Table 1: Off-Air TV Stations within 75 Kilometers of Project Area

3. Impact Assessment

Based on a contour analysis of the licensed stations within 75 kilometers of the Bitter Root Wind Farm project, it was determined that the two full-power digital stations, identified below in Table 2, may have their reception disrupted in and around the project area. The areas primarily affected would include TV service locations within 10 kilometers of the wind energy project that have clear line-of-sight (LOS) to a proposed wind turbine but not to the respective station. After the wind turbines are installed, communities and homes in these locations may have degraded reception of these stations. This is due to multipath interference caused by signal scattering as TV signals are reflected by the rotating wind turbine blades and mast.

ID	Call Sign	Status	Service	Channel	Transmit ERP[3] (kW)	Latitude (NAD 27)	Longitude (NAD 27)	Distance to Project AOI (km)
5	KWCM-TV	Licensed	DT	10	50.0	45.16750000	-96.00055556	53.70
11	KESD-TV	Licensed	DT	8	15.0	44.33777778	-97.22833333	66.46

Table 2: Licensed Off-Air TV Stations Subject to Degradation

[2] Definitions of service codes:
DT – Digital television broadcast station
DC – Class A digital television broadcast station
LD – Low power digital television broadcast station
TX – Translator station
DX – Digital auxiliary (backup) facility

[3] ERP = Transmit Effective Radiated Power

4. Recommendations

While TV signals are reflected by wind turbines, which can cause multipath interference to the TV receiver, modern digital TV receivers have undergone significant improvements to mitigate the effects of signal scattering. When used in combination with a directional antenna, it becomes even less likely that signal scattering from wind farms will cause interference to digital TV reception.

Nevertheless, signal scattering could still impact certain areas currently served by the TV stations mentioned above, especially those that would have line-of-sight to at least one wind turbine but not to a respective station antenna. In the unlikely event that interference is observed in any of the TV service areas, it is recommended that a high-gain directional antenna be used, preferably outdoors, and oriented towards the signal origin in order to mitigate the interference.

Both cable service and direct broadcast satellite service will be unaffected by the presence of the wind turbine facility and may be offered to those residents who can show that their off-air TV reception has been disrupted by the presence of the wind turbines after they are installed.

5. Contact

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Web site:	www.comsearch.com

6. Appendix A

ID	Call Sign	Status	Service[4]	Channel	Transmit ERP[5] (kW)	Latitude (NAD 27)	Longitude (NAD 27)	Distance to Project AOI (km)
1	K19KH-D	CP	LD	19	2.0	44.88491667	-97.04791667	44.97
2	K20KZ-D	CP	LD	20	2.0	44.88491667	-97.04791667	44.97
3	K22KF-D	CP	LD	22	15.0	44.88500000	-97.04805556	44.98
4	K23LI-D	CP	LD	23	15.0	44.88500000	-97.04805556	44.98
5	KWCM-TV	LIC	DT	10	50.0	45.16750000	-96.00055556	53.70
6	K14OL-D	LIC	LD	14	1.8	44.80472222	-95.58027778	58.80
7	K16CP-D	LIC	LD	16	1.8	44.80472222	-95.58027778	58.80
8	K21LF-D	LIC	LD	21	1.8	44.80472222	-95.58027778	58.80
9	K22DO-D	LIC	LD	22	1.7	44.80472222	-95.58027778	58.80
10	K24CS-D	LIC	LD	24	1.8	44.80472222	-95.58027778	58.80
11	KESD-TV	LIC	DT	8	15.0	44.33777778	-97.22833333	66.46
12	K14OP-D	CP	LD	14	1.0	45.34002778	-97.07102778	77.11
13	K25MD-D	CP	LD	25	1.0	45.34002778	-97.07102778	77.11
14	K21LK-D	CP	LD	21	2.0	43.94941667	-96.90947222	82.46
15	KSMN	LIC	DT	15	200.0	43.89777778	-95.94722222	87.22
16	KDLO-TV	LIC	DT	3	14.4	44.96555556	-97.58944444	88.60
17	K18IW-D	LIC	LD	18	3.0	43.75231667	-96.88506111	102.35
18	K18IW-D	CP	LD	18	3.0	43.75138889	-96.88944444	102.55
19	K17BV-D	LIC	LD	17	0.4	44.54972222	-94.96666667	108.48
20	K19CV-D	LIC	LD	19	0.4	44.54972222	-94.96666667	108.48
21	K22KU-D	LIC	LD	22	0.4	44.54972222	-94.96666667	108.48
22	K25II-D	LIC	LD	25	0.4	44.54972222	-94.96666667	108.48
23	K14LF-D	LIC	LD	14	0.5	45.16611111	-95.04361111	111.15
24	K15IS-D	CP	LD	15	0.4	45.16611111	-95.04361111	111.15
25	K17FA-D	LIC	LD	17	0.5	45.16611111	-95.04361111	111.15
26	K19IH-D	LIC	LD	19	0.6	45.16611111	-95.04361111	111.15
27	K18IR-D	LIC	LD	18	0.8	44.75916667	-94.87305556	114.44

[4] Definitions of service and status codes :
TV – Analog television broadcast station
DT – Digital television broadcast station
DS – Digital special temporary authority (STA)
LP – Low power analog television broadcast station
LD – Low power digital television broadcast station
CA – Class A analog television broadcast station
DC – Class A digital television broadcast station
DX – Digital auxiliary (backup) facility
TX – Translator station
LIC – Licensed and operational station
CP – Construction permit granted
CP MOD – Modification of construction permit
APP – Application for construction permit, not yet operational
STA – Special transmit authorization, usually granted by FCC for temporary operation

[5] ERP = Transmit Effective Radiated Power

ID	Call Sign	Status	Service[4]	Channel	Transmit ERP[5] (kW)	Latitude (NAD 27)	Longitude (NAD 27)	Distance to Project AOI (km)
28	K20JY-D	LIC	LD	20	0.8	44.75916667	-94.87305556	114.44
29	K23FP-D	LIC	LD	23	0.8	44.75916667	-94.87305556	114.44
30	KABY-TV	LIC	DT	9	19.4	45.10638889	-97.89916667	116.34
31	NEW	APP	LD	23	3.0	43.57472222	-96.65055556	117.96
32	KCSD-TV	LIC	DT	24	80.9	43.57444444	-96.65527778	118.03
33	K17MA-D	CP	LD	17	1.0	43.63186111	-95.76155556	120.21
34	K22KD-D	CP	LD	22	3.0	43.55388889	-96.68472222	120.57
35	K56GF	CP	LD	23	15.0	43.55388889	-96.68472222	120.57
36	KDSD-TV	LIC	DT	17	37.8	45.49833333	-97.67444444	122.34
37	K04RR-D	CP	LD	4	3.0	43.53805556	-96.71388889	122.62
38	K06QJ-D	CP	LD	6	3.0	43.53805556	-96.71388889	122.62
39	K22KI-D	CP	LD	22	2.0	45.86213889	-96.79022222	122.80
40	KCPO-LP	LIC	TX	26	7.6	43.53416667	-96.73916667	123.34
41	K20MB-D	CP MOD	LD	20	13.2	43.51861111	-96.53466667	123.61
42	KELO-TV	LIC	DT	11	30.0	43.51861111	-96.53472222	123.61
43	KSFY-TV	LIC	DT	13	22.7	43.51861111	-96.53472222	123.61
44	K22HJ-D	LIC	LD	22	1.8	43.61722222	-95.68888889	124.04
45	KTTW	LIC	DT	7	7.5	43.50527778	-96.57194444	125.19
46	K20LV-D	CP	LD	20	1.0	43.63958333	-95.41372222	132.68
47	K24KZ-D	CP	LD	24	1.0	43.63958333	-95.41372222	132.68
48	Q14A-D	CP	LD	14	1.0	43.70305556	-97.54769444	132.83
49	KCCO-TV	LIC	DT	7	29.0	45.68611111	-95.13416667	140.39
50	K23MH-D	CP	LD	23	1.0	45.87608333	-95.46808333	142.80
51	K24JU-D	CP	LD	24	15.0	45.87611111	-95.46805556	142.81
52	K26JI-D	LIC	LD	26	14.0	43.40277778	-95.67083333	146.58
53	K14LZ-D	LIC	LD	14	1.1	45.93305556	-95.44722222	149.16
54	K16CO-D	LIC	LD	16	1.1	45.93305556	-95.44722222	149.16
55	K18DG	LIC	TX	18	1.6	45.93305556	-95.44722222	149.16
56	K21GN-D	LIC	LD	21	1.1	45.93305556	-95.44722222	149.16
57	K26CL-D	LIC	LD	26	1.1	45.93305556	-95.44722222	149.16
58	K18DG	CP	LD	18	1.6	45.93308333	-95.44716667	149.17
59	K16CG-D	LIC	LD	16	1.8	44.10777778	-94.59861111	149.89
60	K20LP-D	LIC	LD	20	1.3	44.10777778	-94.59861111	149.89
61	K23MF-D	LIC	LD	23	1.3	44.10777778	-94.59861111	149.89
62	K24JV-D	LIC	LD	24	1.8	44.10777778	-94.59861111	149.89

Table A: Off-Air TV Stations within 150 Kilometers of Project Area

Communication Tower

August 29, 2016

Wind Power GeoPlanner™

Communication Tower Study

Bitter Root Wind Farm

Prepared on Behalf of
Flying Cow Wind, LLC

August 29, 2016

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Table of Contents

1. Introduction - 1 -

2. Summary of Results - 1 -

3. Discussion of Separation Distances - 4 -

4. Conclusions - 4 -

5. Contact Us - 5 -

1. Introduction

This Communication Tower Study was performed for the Bitter Root Wind Farm project in Deuel County, South Dakota, and Yellow Medicine County, Minnesota to identify the tower structures as well as FCC-licensed communication antennas that exist in the project area. This information is useful in the planning stages of the wind energy facilities to identify turbine setbacks and to prevent disruption to the services provided by the tenants on the towers. This data can be used in support of the wind energy facilities communications needs in addition to avoiding any potential impact to the current communications services provided in the region.

2. Summary of Results

The communication towers and antennas in the study area were derived from a variety of sources including the FCC's Antenna Structure Registration (ASR) database, Universal Licensing System (ULS), national and regional tower owner databases, and the local planning and zoning boards. The data[1] was imported into GIS software and the structures mapped in the wind energy area of interest. Each tower location is identified with a unique ID number associated with detailed structure and contact information provided in a spreadsheet attachment.

One tower structure and seven communication antennas were identified within the Bitter Root project area using the data sources described in our methodology above. The structure found is not registered with the FCC and contains one of the seven communication antennas. The remaining antennas may be located on a variety of structure types such as guyed towers, monopoles, silos, rooftops or portable structures. The specific type of structure would normally need to be determined by an on-site visit.

Detailed information about the tower structures and communication antennas is provided in Table 1 and Table 2 including location coordinates, structure height above ground level, and owner-operator name[2].

A discussion of turbine setback distances is provided in section three.

[1] Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data provided in this report is governed by Comsearch's data license notification and agreement located at http://www.comsearch.com/files/data_license.pdf.

[2] Please note that this report analyzes all known operators on the towers from data sources available to Comsearch. Unidentified operators may exist on the towers due to unlicensed or federal government systems, mobile phone operators with proprietary locations, erroneous data on the FCC license, and other factors beyond our control.

Tower ID	ASR Number	Owner	Structure Height AGL (m)	Latitude (NAD83)	Longitude (NAD83)
Tower001		AT&T	59.1	44.7627	-96.4575

Table 1: Summary of Tower Structures

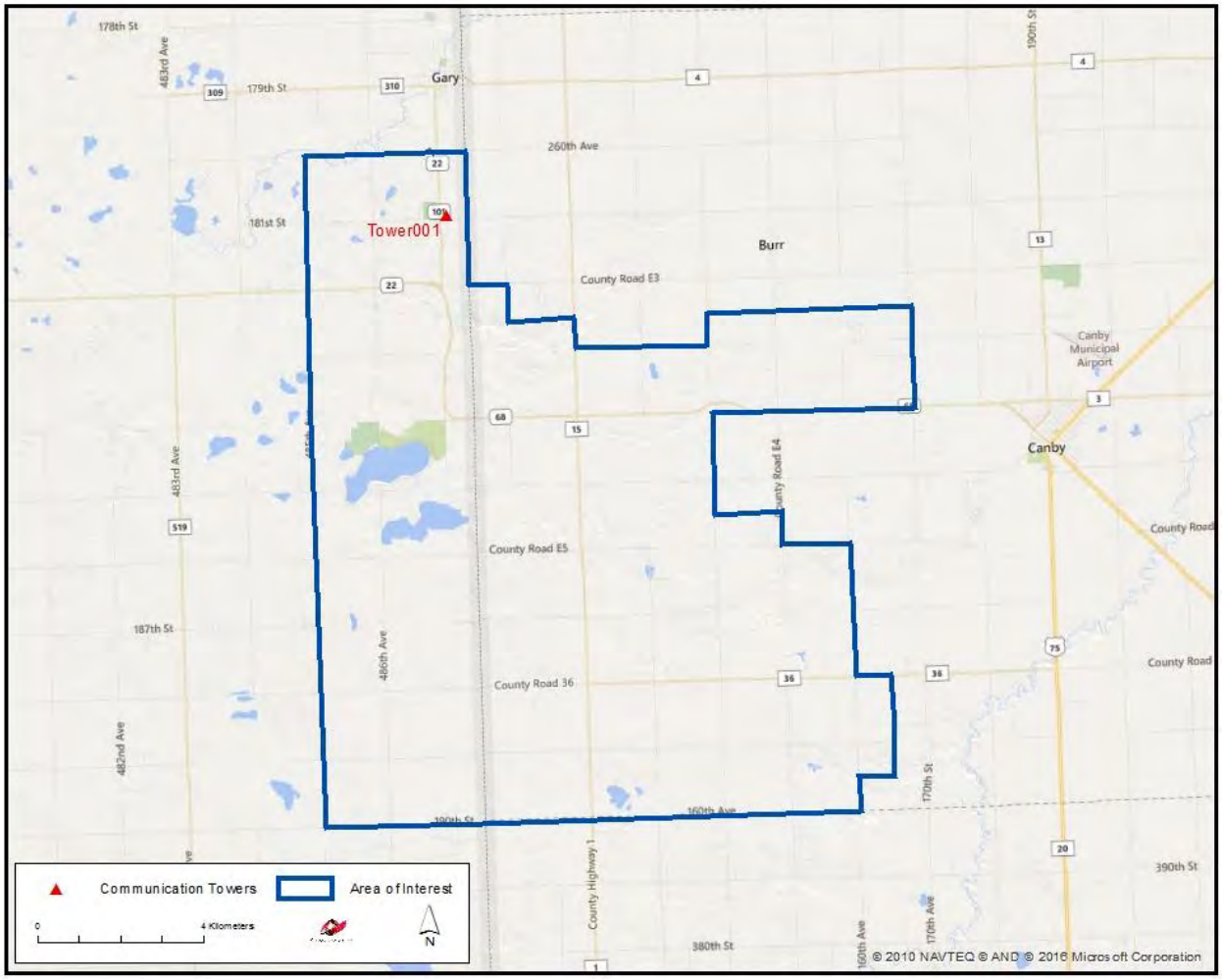

Figure 1: Towers within the Area of Interest

ID	Tower ID	Callsign	Service Type	Licensee	Antenna Height AGL (m)	Latitude (NAD83)	Longitude (NAD83)
1	Tower001	KNKN384	Cellular	AT&T Mobility Spectrum LLC	57.9	44.76269444	-96.45758333
2		WQBR995	Land Mobile	Thompson, Doyle	27	44.74997222	-96.48033333
3		WQSB888	Land Mobile	Knutson, Michael	5.4	44.72588889	-96.34005556
4		WNYR673	Land Mobile	Lincoln Pipestone Rural Water System	15	44.70497222	-96.45033333
5		WPIA671	Land Mobile	Kockelman Construction Inc	55	44.70386111	-96.42088889
6		WQDL983	Land Mobile	Alpha Wireless Communications	61	44.67441667	-96.42336111
7		WQDM582	Land Mobile	Farmers Co Op Association	61	44.67441667	-96.42336111

Table 2: Summary of Communication Antennas

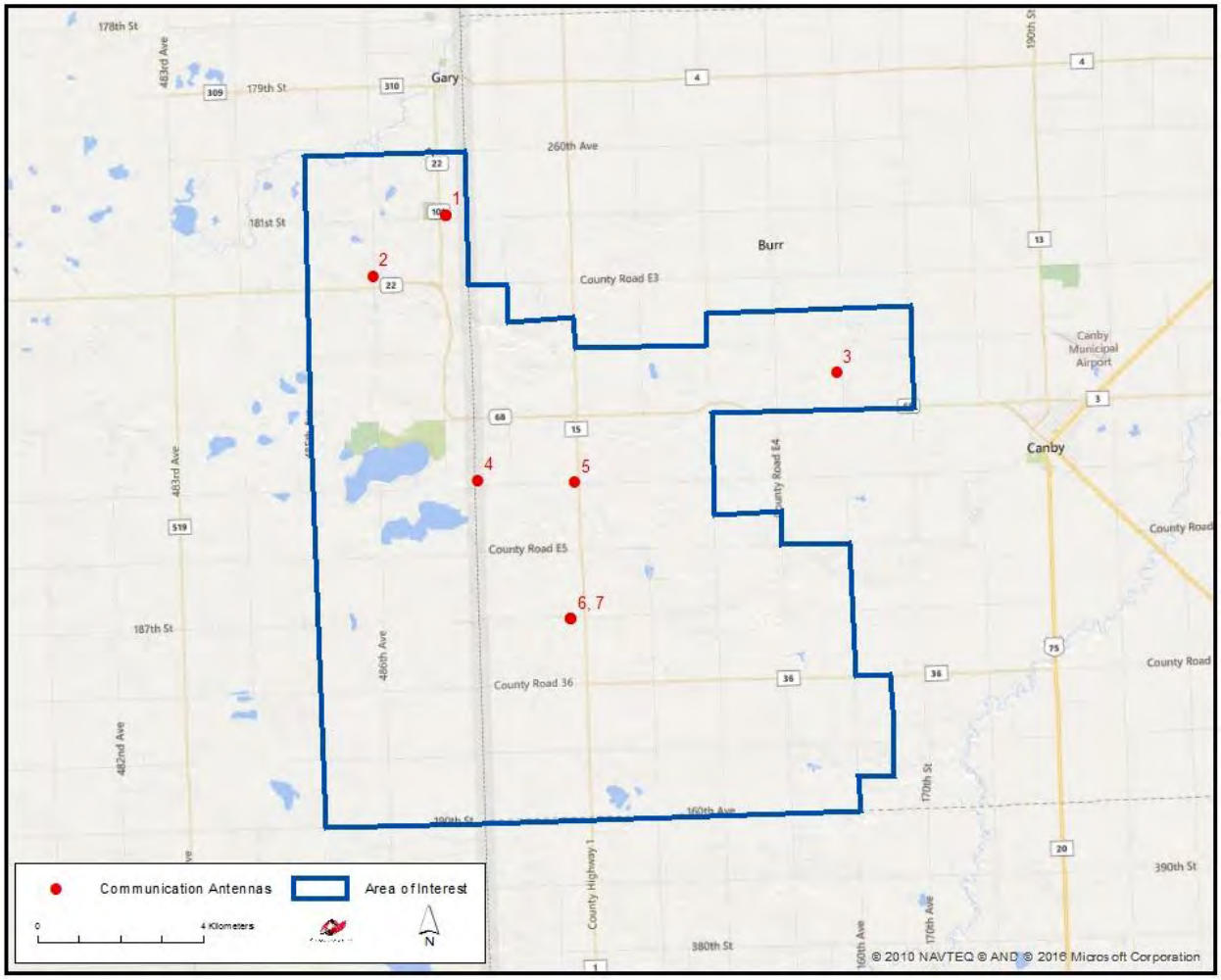

Figure 2: Communication Antennas within the Area of Interest

3. Discussion of Separation Distances

In planning the wind energy turbine locations, a conservative approach would dictate not locating any turbines in close proximity to existing tower structures to avoid any possible impact to the communications services provided by the structures. Reasonable distance between communication towers and wind turbine towers is a function of two things: (1) the physical turning radius of the wind turbine blades and (2) the characteristics of the communication systems on the communication tower.

Since wind turbine blades can rotate 360º, the first consideration of separation distance to other structures is clearance of the blades. If the blade radius is 50 meters, then a separation distance greater than 50 meters is necessary. From a practical standpoint, a setback distance greater than the maximum height of the turbine is necessary to insure a “fall” safety zone in the unlikely event of a turbine tower failure. Setback requirements for “fall” safety are typically specified by the local zoning ordinances.

The required separation distance based on the characteristics of the communication systems will vary depending on the type of communication antennas that are installed on the tower. For example, AM broadcast antennas should be separated by distances that allow for normal coverage which can extend up to 3 kilometers. For land mobile and mobile phone systems, setback distances are based on FCC interference emission limits from electrical devices in the land mobile and mobile phone frequency bands.

Finally, the tower structures identified could be a potential benefit in support of communications network needs for the wind energy facility. An example would be the implementation of a Supervisory Control and Data Acquisition (SCADA) system that monitors and provides communications access to the wind energy facility.

4. Conclusions

Our study identified one structure and seven communication antennas within the project area. They are used for cellular and land mobile services in the area. Detailed impact assessments should be performed for each service type.

5. Contact Us

For questions or information regarding the Communication Tower Study, please contact:

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Land Mobile and Emergency Services

August 29, 2016

Wind Power GeoPlanner™

Land Mobile & Emergency Services Report

Bitter Root Wind Farm

Prepared on Behalf of
Flying Cow Wind, LLC

August 29, 2016

COMSEARCH®
A CommScope Company

Table of Contents

1. Introduction - 1 -

2. Summary of Results - 2 -

3. Impact Assessment - 7 -

4. Recommendations - 7 -

5. Contact - 8 -

1. Introduction

An assessment of the emergency services in the Bitter Root Wind Farm project area was performed by Comsearch to identify potential impact from the planned turbines. We evaluated the registered frequencies for the following types of first responder entities: police, fire, emergency medical services, emergency management, hospitals, public works, transportation and other state, county, and municipal agencies. We also identified all industrial and business land mobile radio (LMR) systems and commercial E911 operators within the proposed wind energy facility boundaries. This information is useful in the planning stages of the wind energy facility because the data can be used in support of facility communications needs and to evaluate any potential impact on the emergency services provided in that region. An overview of the project area, which is located in Deuel County, South Dakota and Yellow Medicine County, Minnesota, appears in Figure 1.

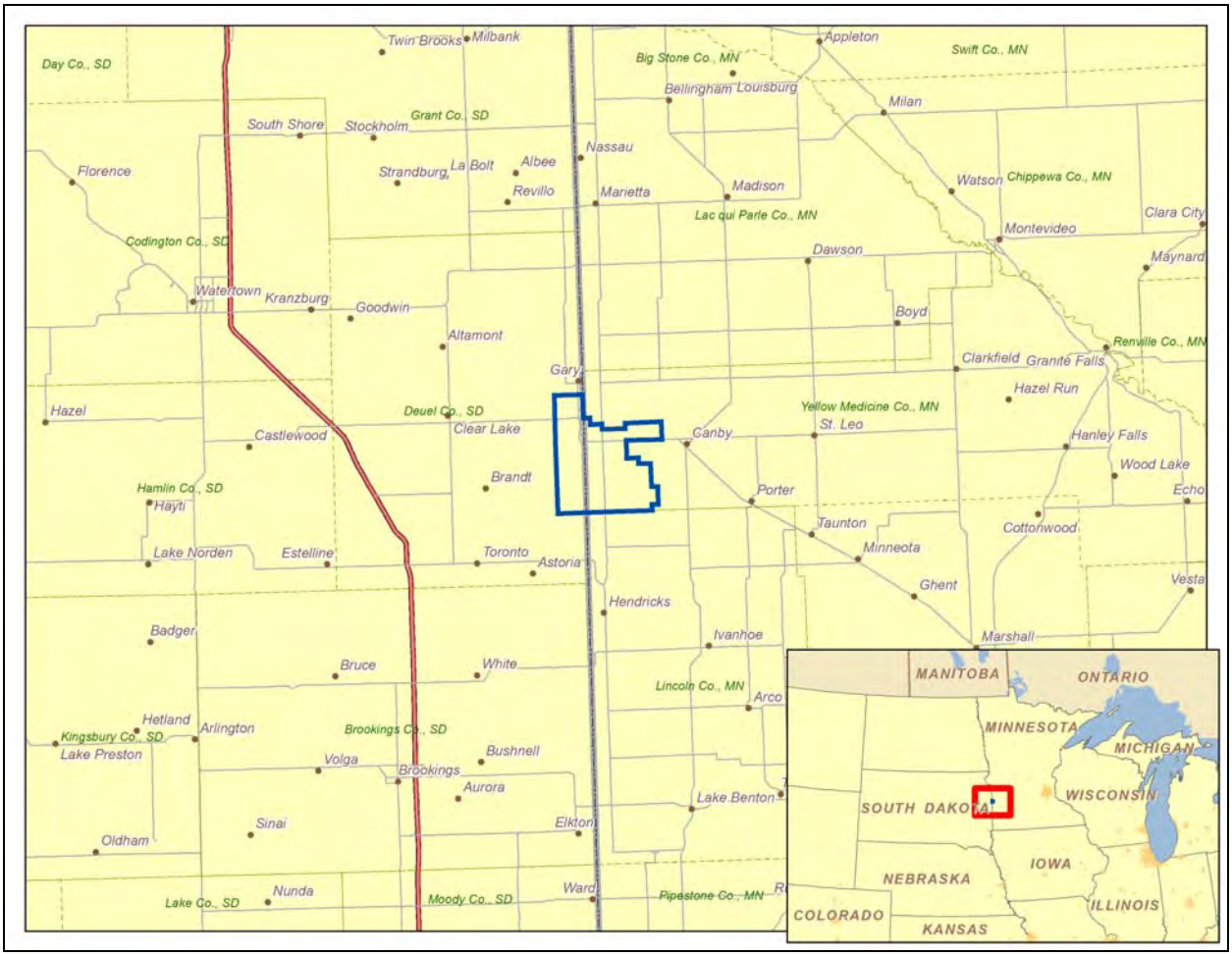

Figure 1: Area of Interest (AOI)

2. Summary of Results

Our land mobile and emergency services incumbent data[1] was derived from the FCC's Universal Licensing System (ULS) and the FCC's Public Safety & Homeland Security bureau. We identified both site-based licenses as well as regional area-wide licenses designated for public safety use.

Site-Based Licenses

The site-based licenses were imported into GIS software and geographically mapped relative to the wind energy project area of interest as defined by the customer. Each site on the map was given an ID number and associated with site information in a data table. A depiction of the fixed-site licenses in and around the project area appears in Figure 2.

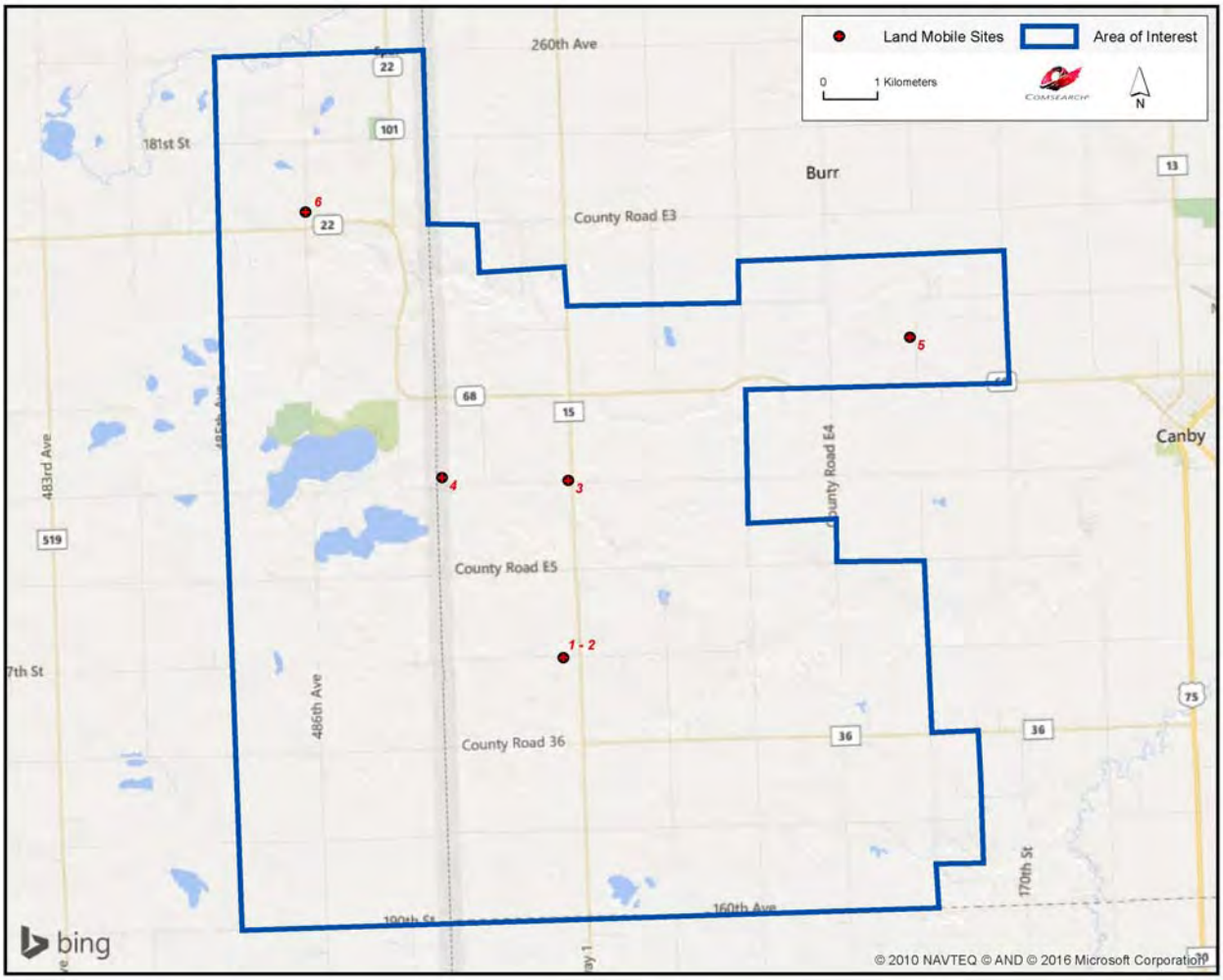

Figure 2: Land Mobile & Emergency Service Sites in Area of Interest

Figure 2 identifies six site-based licenses in the Bitter Root Wind Farm project area of interest. Specific information about these sites is provided in Table 1.

ID	Call Sign	Frequency Band (MHz)	Licensee	Antenna Height AGL (m)	Latitude (NAD83)	Longitude (NAD83)	Distance to Center of AOI (km)
1	WQDL983	450-470	Alpha Wireless Communications	61.0	44.674417	-96.423361	1.86
2	WQDM582	450-470	Farmers Co Op Association	61.0	44.674417	-96.423361	1.86
3	WPIA671	450-470	Kockelman Construction	55.0	44.703861	-96.420889	1.46
4	WNYR673	150-174	Lincoln Pipestone Rural Water System	15.0	44.704972	-96.450333	2.52
5	WQSB888	450-470	Knutson, Michael	5.4	44.725889	-96.340056	7.78
6	WQBR995	150-174	Thompson, Doyla	27.0	44.749972	-96.480333	7.87

Table 1: Land Mobile & Emergency Service Sites in Area of Interest

[1] Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data presented in this report is derived from the land mobile station's FCC license and governed by Comsearch's data license notification and agreement located at http://www.comsearch.com/files/data_license.pdf

Area-Wide Licenses

The regional area-wide licenses were compiled from FCC data sources and identified for each county in the wind energy project area. The Bitter Root Wind Farm is located in Yellow Medicine County, Minnesota, part of Public Safety Region #22, which contains all of the counties in the State of Minnesota, and Deuel County, South Dakota, part of Public Safety Region #38, which contains all of the counties in the State of South Dakota. The regional public safety operations are overseen by the respective entities listed below.

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The chairpersons for Regions 22 and 38 serve as representatives for all public safety entities in their respective regions and are responsible for coordinating current and future public safety use in the wireless spectrum. In the bands licensed by the FCC for area-wide first responders, which include 220 MHz, 700 MHz, 800 MHz and 4.9 GHz, as well as the traditional Part 90 public safety pool of frequencies, eleven licenses were found for the State of Minnesota, one for the County of Yellow Medicine, eight for the State of South Dakota, and one for the County of Deuel (see Table 2). These area-wide licenses are designated for mobile use only.

ID	Licensee	Area of Operation	Frequency Band (MHz)
1	American National Red Cross	Statewide: Minnesota	25-50, 450-470
2	American National Red Cross	Statewide: South Dakota	25-50, 450-470
3	Cart Ambulance, Inc.	Statewide: Minnesota	150-174

ID	Licensee	Area of Operation	Frequency Band (MHz)
4	Deuel, County of	Countywide: Deuel	25-50, 150-174
5	Greater Northwest Emergency Medical Services	Statewide: Minnesota	450-470
6	Hennepin, County of	Statewide: Minnesota	25-50, 150-174, 406-420, 450-470, 800/900
7	Hyde County 911	Statewide: South Dakota	150-174, 450-470
8	Lawrence, County of	Statewide: South Dakota	25-50
9	Minnesota, State of	Statewide: Minnesota	0-10, 150-174, 450-470, 769-775/799-805, 800/900, 2450-2500, 4940-4990
10	Minnesota Department of Public Safety	Statewide: Minnesota	150-174
11	National Ski Patrol System, Inc.	Statewide: Minnesota	150-174
12	National Ski Patrol System, Inc.	Statewide: South Dakota	150-174
13	Nevada Division of Forestry	Statewide: Minnesota	150-174
14	Northstar Search and Rescue	Statewide: Minnesota	150-174
15	Pennington, County of	Statewide: South Dakota	150-174, 450-470
16	Rochester, City of	Statewide: Minnesota	150-174, 450-470
17	Saint Louis, County of	Statewide: Minnesota	150-174, 450-470, 800/900
18	South Dakota, State of	Statewide: South Dakota	450-470, 2450-2500
19	South Dakota BIT / State Radio Communications	Statewide: South Dakota	0-10, 25-50, 150-174, 450-470
20	Watertown, City of	Statewide: South Dakota	150-174
21	Yellow Medicine, County of	Countywide: Yellow Medicine	150-174, 4940-4990

Table 2: Regional Licenses

E911 Operators

Wireless operators are granted area-wide licenses from the FCC to deploy their cellular networks, which often include handsets with E911 capabilities. Since mobile phone market boundaries differ from service to service, we disaggregated the carriers' licensed areas down to the county level. We have identified the type of service for each carrier in Deuel County, South Dakota and Yellow Medicine County, Minnesota in Table 3.

Mobile Phone Carrier	Service[2]	
	Deuel County, South Dakota	Yellow Medicine County, Minnesota
AT&T	AWS, Cellular, PCS, WCS, 700 MHz	AWS, Cellular, WCS, 700 MHz
Bug Tussel Wireless	AWS	-
Cleartalk (NTCH)	-	PCS
DISH Network	AWS, 700 MHz	AWS, 700 MHz
Northstar Wireless	AWS	AWS
SNR Wireless	AWS	AWS
Sprint	PCS	PCS
T-Mobile	AWS, PCS, 700 MHz	AWS, PCS, 700 MHz
TrioTel Communications	AWS, 700 MHz	-
Verizon	AWS, Cellular, PCS, 700 MHz	AWS, Cellular, PCS, 700 MHz

Table 3: Mobile Phone Carriers in Area of Interest with E911 Service

[2] AWS: Advanced Wireless Service at 1.7/2.1 GHz
CELL: Cellular Service at 800 MHz
PCS: Personal Communication Service at 1.9 GHz
WCS: Wireless Communications Service at 2.3 GHz
700 MHz: Lower 700 MHz Service

3. Impact Assessment

The first responder, industrial/business land mobile sites, area-wide public safety, and commercial E-911 communications as described in this report are typically unaffected by the presence of wind turbines, and we do not anticipate any significant harmful effect to these services in the Bitter Root Wind Farm project area. Although each of these services operates in different frequency ranges and provides different types of service including voice, video and data applications, there is commonality among these different networks in regards to the impact of wind turbines on their service. Each of these networks is designed to operate reliably in a non-line-of-sight (NLOS) environment. Many land mobile systems are designed with multiple base transmitter stations covering a large geographic area with overlap between adjacent transmitter sites in order to provide handoff between cells. Therefore, any signal blockage caused by the wind turbines does not materially degrade the reception because the end user is likely receiving signals from multiple transmitter locations. Additionally, the frequencies of operation for these services have characteristics that allow the signal to propagate through wind turbines. As a result very little, if any, change in their coverage should occur when the wind turbines are installed.

When planning the wind energy turbine locations in the area of interest, a conservative approach would dictate not locating any turbines within 77.5 meters of land mobile fixed-base stations to avoid any possible impact to the communications services provided by these stations. This distance is based on FCC interference emissions from electrical devices in the land mobile frequency bands. As long as the turbines are located more than 77.5 meters from the land mobile stations, they will meet the setback distance criteria for FCC interference emissions in the land mobile bands.

4. Recommendations

In the event that a public safety entity believes its coverage has been compromised by the presence of the wind energy facility, it has many options to improve its signal coverage to the area through optimization of a nearby base station or even adding a repeater site. Utility towers, meteorological towers or even the turbine towers within the wind project area can serve as the platform for a base station or repeater site.

5. Contact

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