

Appendix G

Telecommunications Studies

Wind Power GeoPlanner™

AM and FM Radio Report

Pleasant Valley Wind Farm Repower Project



Prepared on Behalf of
Xcel Energy

January 19, 2022





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1. Introduction

Comsearch analyzed AM and FM radio broadcast stations whose service could potentially be affected by the proposed Pleasant Valley Wind Farm Repower Project in Dodge and Mower Counties, Minnesota.

2. Summary of Results

AM Radio Analysis

Comsearch found eight database records¹ for AM stations within approximately 30 kilometers of the project, as shown in Table 1 and Figure 1. The closest station to the project is KQAQ, which broadcasts out of Austin, Minnesota, located 11.68 km from the nearest turbine, to the west of the project. KQAQ is licensed to operate at two different power levels, a higher transmit power for daytime operations and a lower transmit power for nighttime operations.

ID	Call Sign	Status ²	Frequency (kHz)	Transmit ERP ³ (kW)	Operation Time	Latitude (NAD 83)	Longitude (NAD 83)	Distance to Nearest Turbine (km)
1	KQAQ	LIC	970	5.0	Daytime	43.707464	-92.946025	11.68
2	KQAQ	LIC	970	0.5	Nighttime	43.707464	-92.946025	11.68
3	KAUS	LIC	1480	1.0	Daytime	43.622186	-92.990750	18.33
4	KAUS	LIC	1480	1.0	Nighttime	43.622186	-92.990750	18.33
5	KROC	LIC	1340	1.0	Unlimited	44.029686	-92.492122	28.20
6	KFAN	LIC	1270	1.0	Nighttime	43.979686	-92.447675	28.42
7	KFAN	LIC	1270	5.0	Daytime	43.979686	-92.447675	28.42
8	KOLM	LIC	1520	0.8	Nighttime	43.987742	-92.427953	30.23

Table 1: AM Radio Stations within 30 km

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.

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

³ ERP = Transmit Effective Radiated Power.

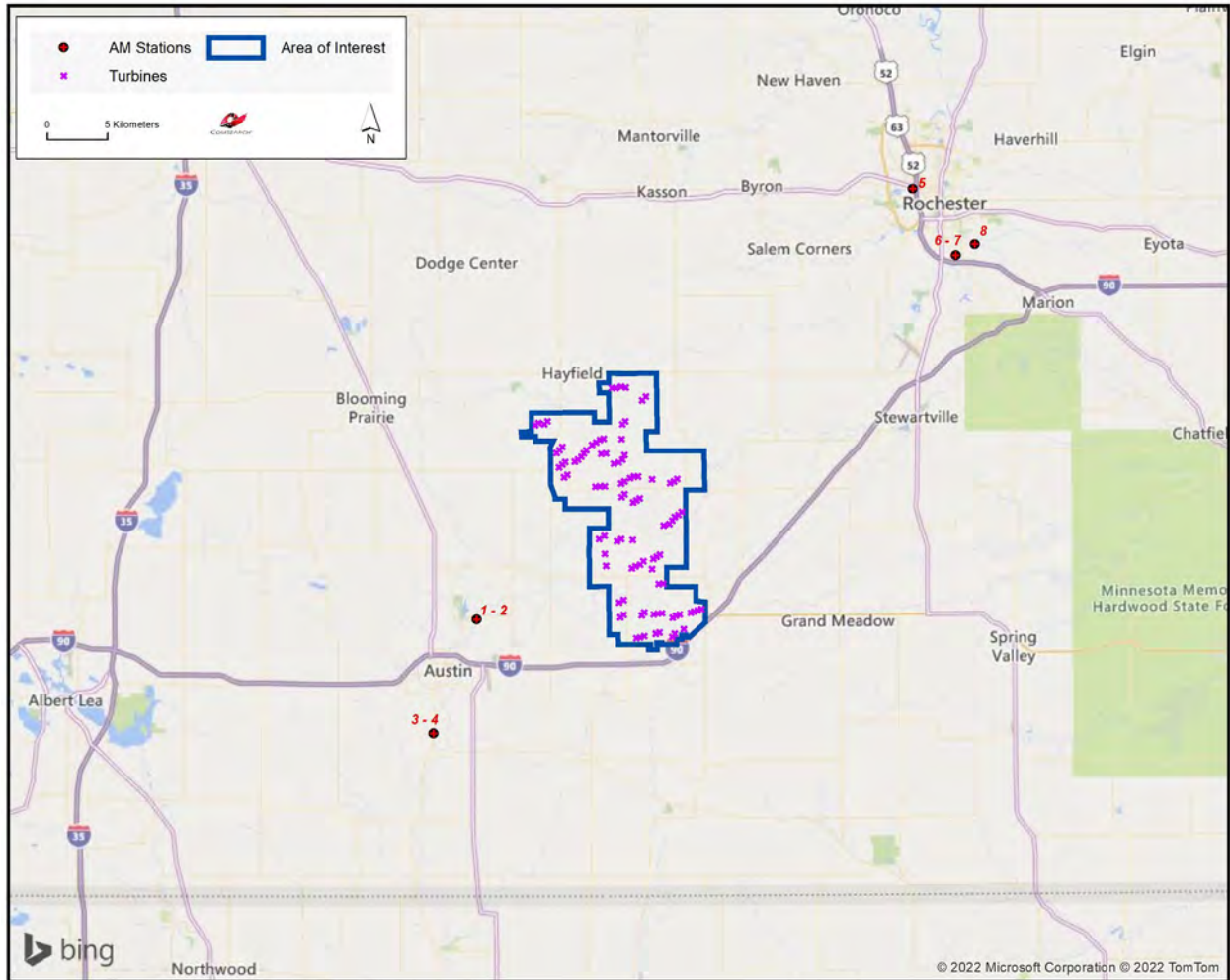


Figure 1: AM Radio Stations within 30 km

FM Radio Analysis

Comsearch determined that there were twenty-six database records for FM stations within a 30-kilometer radius of the Pleasant Valley Wind Farm Repower Project, as shown in Table 2 and Figure 2. Twenty-two of the stations are licensed and operating, nine of which are translator stations, three are auxiliary (backup) stations and one is a low power station that operate with limited range. The closest licensed station to the project is K255AN, which broadcasts out of Hayfield, Minnesota, to the north of the project area and located 3.53 km from the nearest turbine.

ID	Call Sign	Service ⁴	Status ⁵	Frequency (MHz)	Transmit ERP ⁶ (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to Nearest Turbine (km)
1	K255AN	FX	LIC	98.9		43.887056	-92.849139	3.53
2	-	FM	CP	88.1	25.0	43.887056	-92.849139	3.53
3	-	FM	APP	88.1	50.0	43.888056	-92.857833	3.71
4	KYBA	FM	LIC	105.3	50.0	43.673000	-92.698500	4.05
5	KFNL-FM	FM	LIC	104.3	10.0	43.643306	-92.647389	9.30
6	KCJL-LP	FL	LIC	95.1	0.1	43.992472	-92.860194	13.10
7	K277AD	FX	LIC	103.3	0.1	43.670222	-92.977111	15.10
8	K280EF	FX	LIC	103.9	0.009	43.670222	-92.977111	15.10
9	KMSK	FM	LIC	91.3	0.135	43.677444	-93.001278	16.79
10	-	FM	APP	88.1	42.0	43.642778	-92.526667	17.07
11	KVCS	FM	LIC	89.1	12.0	43.642750	-92.526556	17.08
12	KWWK	FM	LIC	96.5	43.0	44.033000	-92.602944	22.13
13	KROC-FM	FS	LIC	106.9	0.64	44.033028	-92.602972	22.14
14	K289BO	FX	LIC	105.7	0.115	44.024417	-92.544889	24.58
15	KFSI	FM	LIC	92.9	6.0	44.024111	-92.543500	24.64
16	KRCH	FS	LIC	101.7	0.4	44.003278	-92.485444	26.97
17	KMFX-FM	FS	LIC	102.5	0.17	44.003278	-92.485444	26.97
18	K236BT	FX	LIC	95.1	0.099	44.003306	-92.485278	26.99
19	K228FY	FX	LIC	93.5		44.003333	-92.485278	26.99
20	KRCH	FM	LIC	101.7	39.0	44.116333	-92.689611	27.31
21	KROC-FM	FM	LIC	106.9	100.0	43.570806	-92.427111	28.12
22	K293CV	FX	LIC	106.5	0.25	44.018917	-92.465917	29.23
23	KNSE	FM	LIC	90.1	6.0	43.640806	-93.147694	29.23
24	K245CX	FX	LIC	96.9	0.25	44.018972	-92.465750	29.24

⁴ FM = FM broadcast station; FX = FM translator station; FS = FM auxiliary (backup) station; FB = FM booster station, FL = FM low power station..

⁵ LIC = Licensed and operational station; APP = Application for construction permit; CP=Construction permit granted; CP MOD = Modification of construction permit.

⁶ ERP = Transmit Effective Radiated Power.

ID	Call Sign	Service ⁴	Status ⁵	Frequency (MHz)	Transmit ERP ⁶ (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to Nearest Turbine (km)
25	K285EL	FX	LIC	104.9	0.25	44.018972	-92.465750	29.24
26	KAUS-FM	FM	LIC	99.9	100.0	43.628278	-93.153528	30.07

Table 2: FM Radio Stations within 30 km

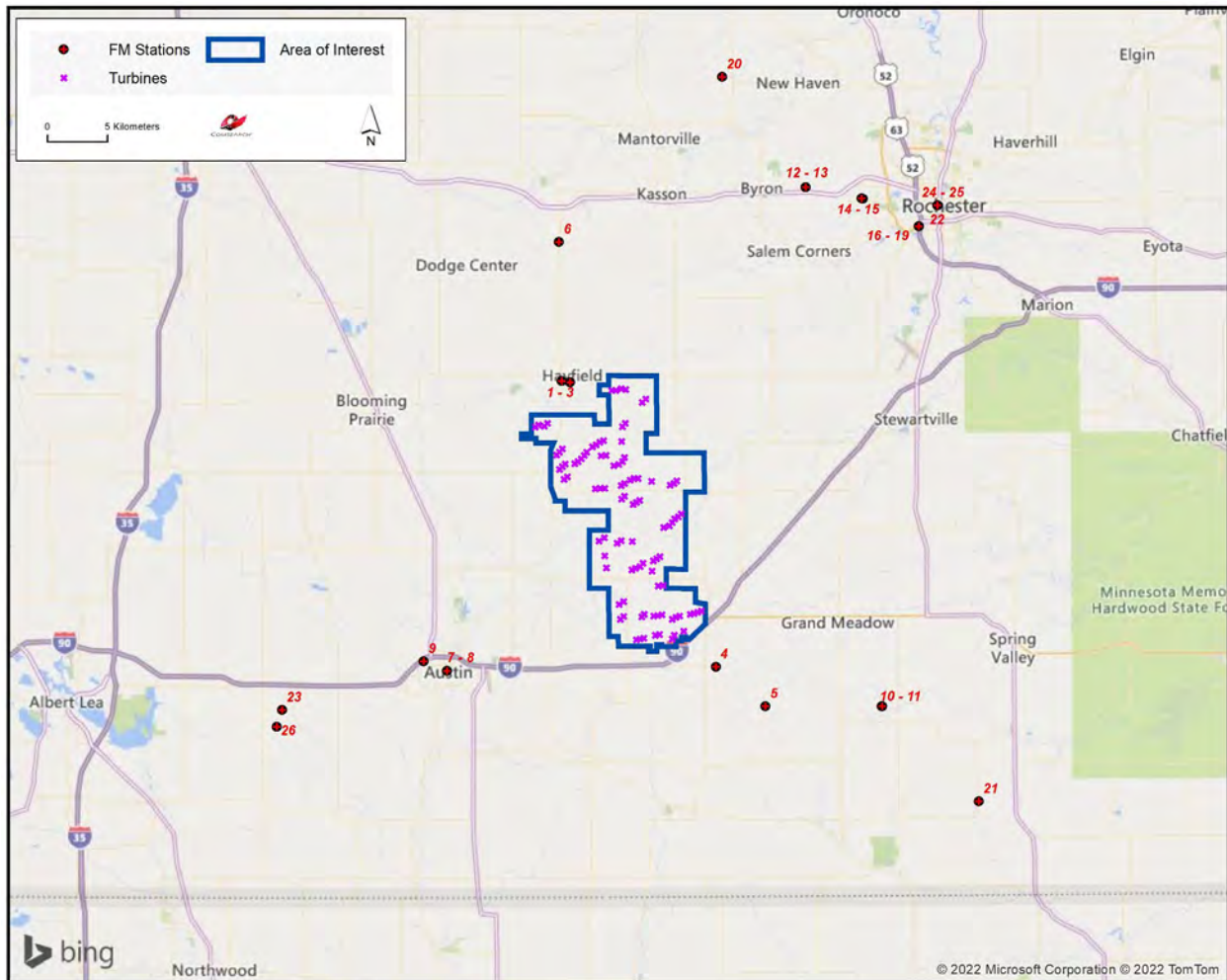


Figure 2: FM Radio Stations within 30 km

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. The closest AM station to the Pleasant Valley Wind Farm Repower Project, KQAQ, is more than 11.68 kilometers from the nearest turbine. As there were no stations found within 3 kilometers of the 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 sensitive to interference due to wind turbines, especially when large objects (e.g., wind turbines) are located in the far field region of the radiating antenna to avoid the risk of distorting its radiation pattern. Station K255AN is the nearest FM station to any given turbine at 3.53 km away. 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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Wind Power GeoPlanner™

Communication Tower Study

Pleasant Valley Wind Farm Repower Project



Prepared on Behalf of
Xcel Energy

January 21, 2022



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A CommScope Company



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1. Introduction

This Communication Tower Study was performed for the Pleasant Valley Wind Farm Repower Project in Dodge and Mower Counties, 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 data¹ 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 ten communication antennas were identified within the Pleasant Valley Wind Farm Repower Project area using the data sources described in our methodology above. The structure found was registered with the FCC, which contains seven of the ten 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 name².

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)	Distance the Nearest Turbine (km)
Tower001	1251890	Minnesota, state of	100.6	43.848111	-92.861722	1.27

Table 1: Summary of Tower Structures

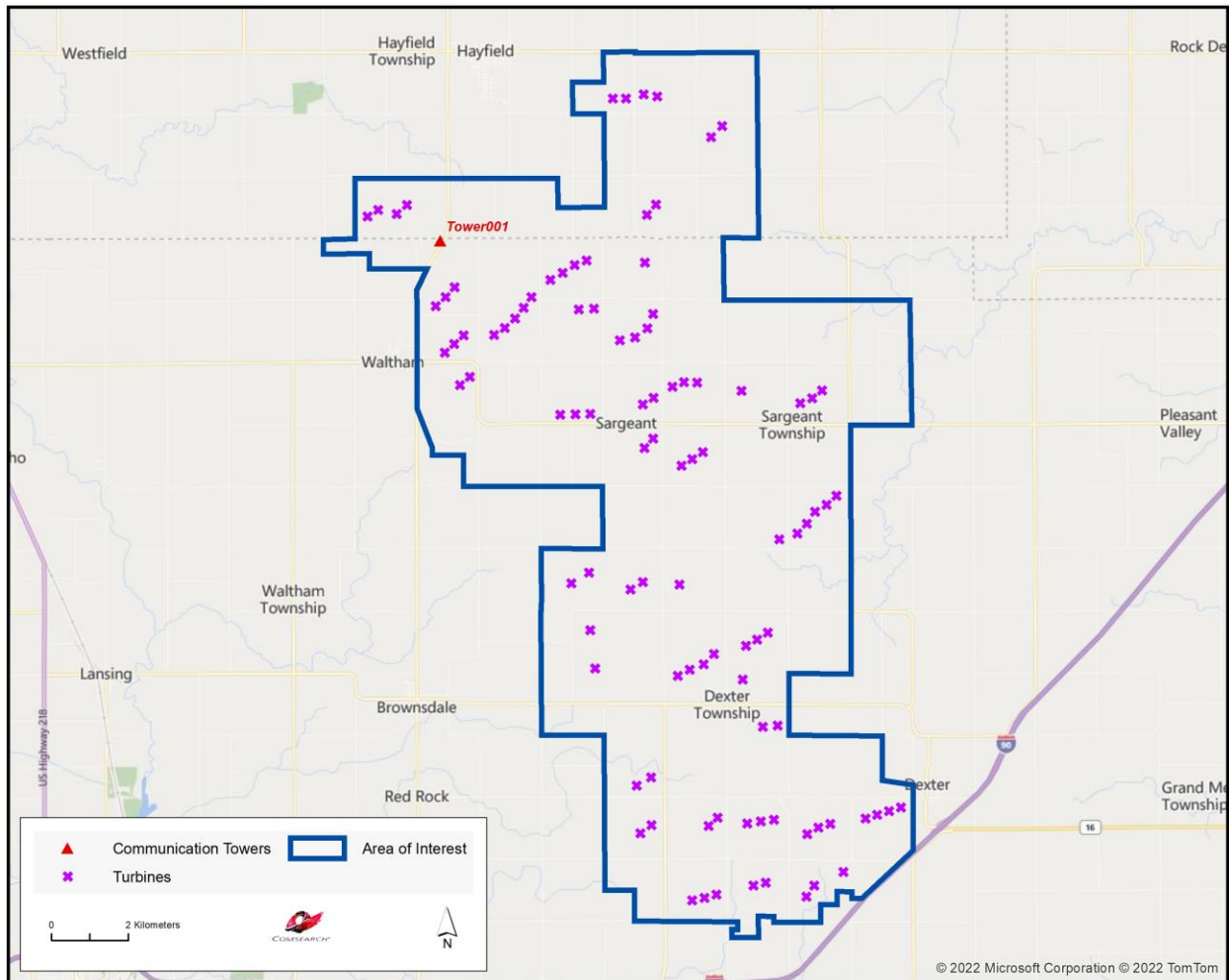


Figure 1: Towers within the Area of Interest

ID	Tower ID	Callsign	Service Type	Licensee	Antenna Height AGL (m)	Latitude (NAD83)	Longitude (NAD83)	Distance the Nearest Turbine (km)
1		WQRV582	Land Mobile	SHEELY FARMS	41.1	43.756417	-92.820528	0.56
2		KSV530	Land Mobile	LARSON PRODUCTS INC	30.0	43.804139	-92.802972	0.76
3		WNRK620	Land Mobile	GEBHARDT, MICHAEL:GEBHARDT, ROBERT:GEBHARDT, JAMES DBA GEBHA	18.0	43.815806	-92.868528	0.94
4	Tower001	K40JT	TV	DIGITAL NETWORKS-MIDWEST, LLC	47.0	43.848111	-92.861722	1.27
5	Tower001	WQHE600	Land Mobile	MINNESOTA, STATE OF	105.2	43.848111	-92.861722	1.27
6	Tower001	WQSK907	Land Mobile	MINNESOTA, STATE OF	104.5	43.848111	-92.861722	1.27
7	Tower001	WNTP952	Microwave	Minnesota, State of (DOT)	57.91	43.848111	-92.861722	1.27
8	Tower001	WQIK762	Microwave	Minnesota, State of (DOT)	42.7/33.5	43.848111	-92.861722	1.27
9	Tower001	WQRK859	Microwave	Steele County Sheriff's Office	42	43.848111	-92.861722	1.27
10	Tower001	WRFS599	Microwave	Minnesota Wifi	54.86	43.848111	-92.861722	1.27

Table 2: Summary of Communication Antennas

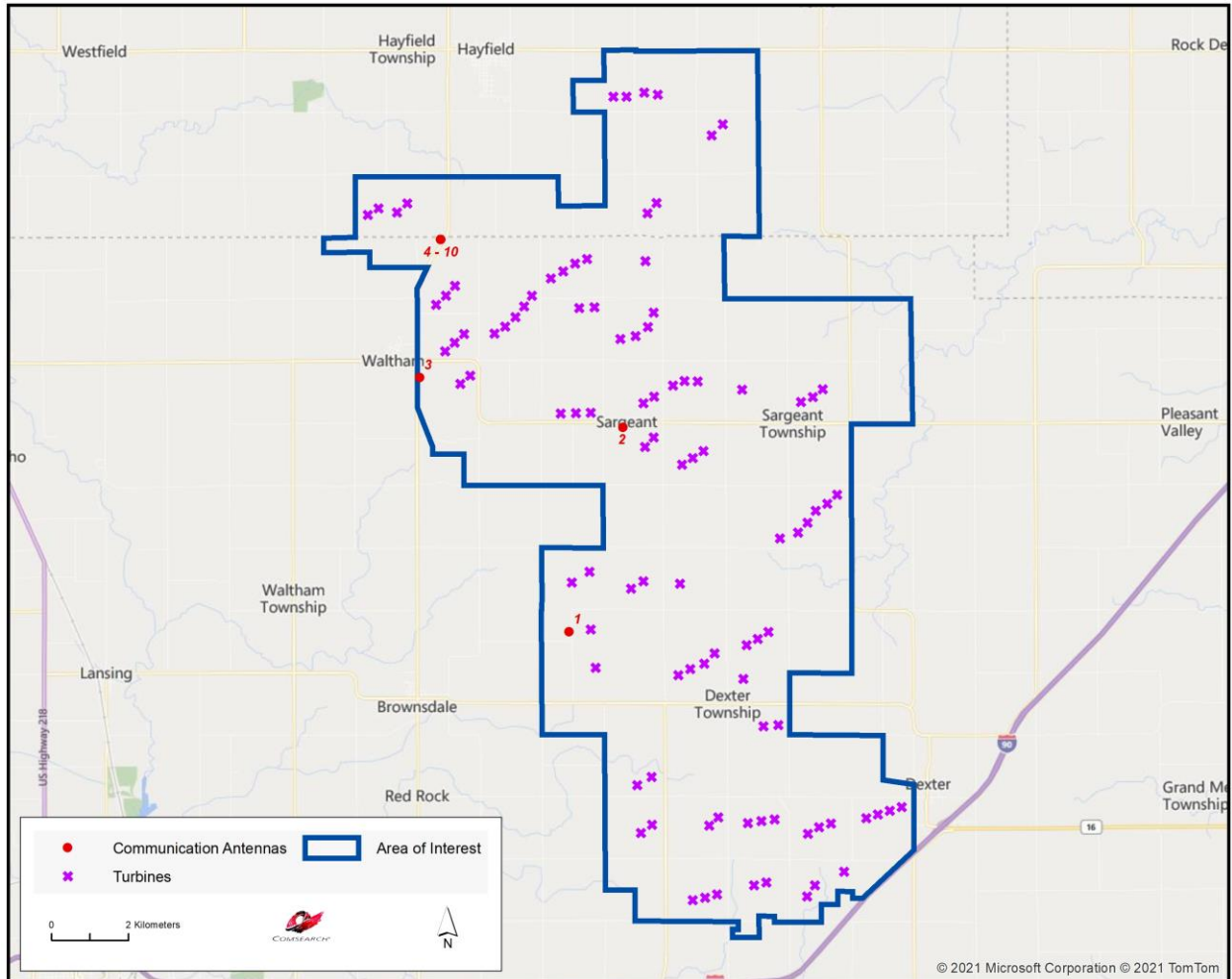


Figure 2: Communication Antennas within or near the Area of Interest

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 360°, 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 tower structure and ten communication antennas within the project area. They are used for microwave, TV, and land mobile services in the area.



5. Contact Us

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

Contact person: David Meyer
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Wind Power GeoPlanner™

Land Mobile & Emergency Services Report

Pleasant Valley Wind Farm Repower Project



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1. Introduction

An assessment of the emergency services in the Pleasant Valley Wind Farm Repower 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 Mower and Dodge Counties, Minnesota, appears below in Figure 1.

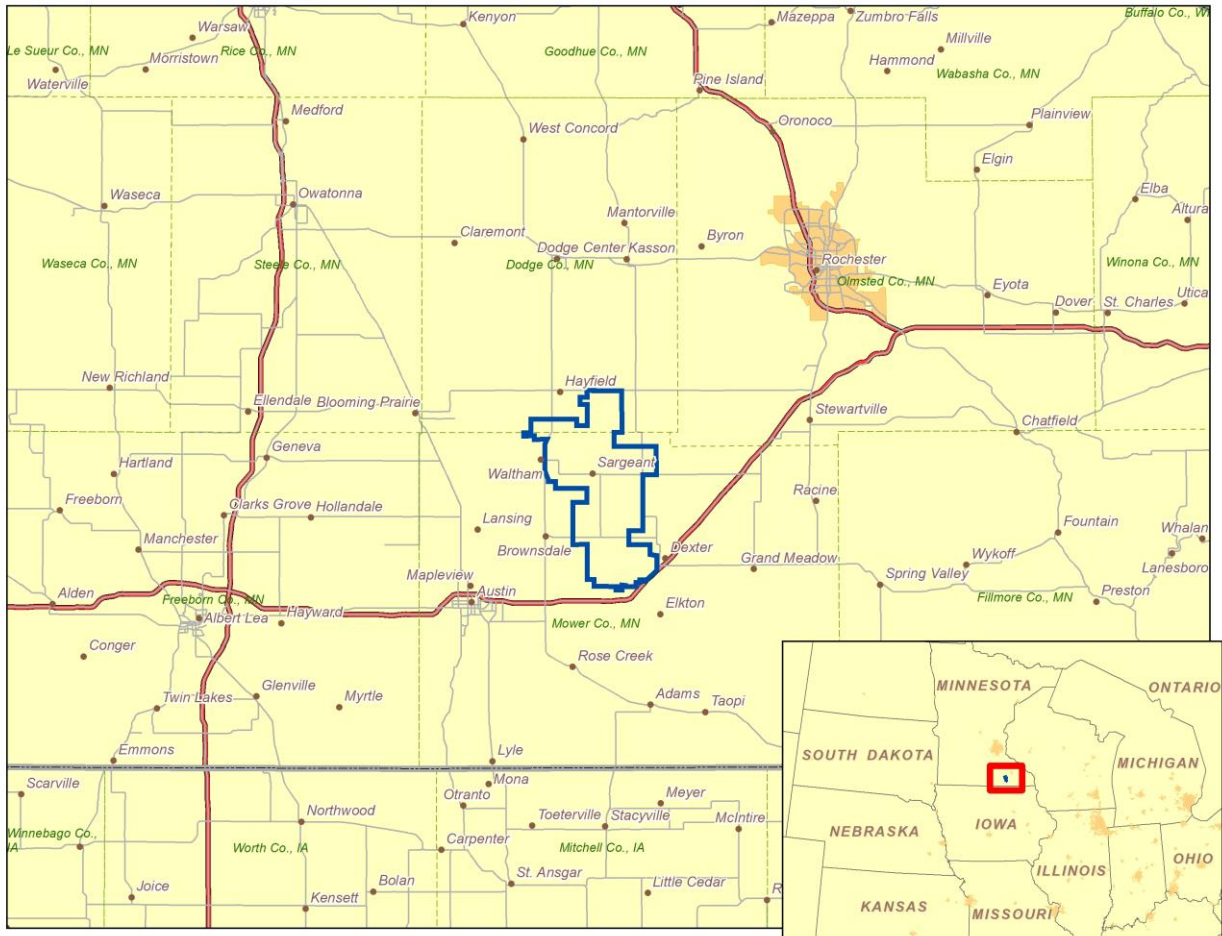


Figure 1: Area of Interest (AOI)

2. Summary of Results

Our land mobile and emergency services incumbent data¹ 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 the project area appears in Figure 2.

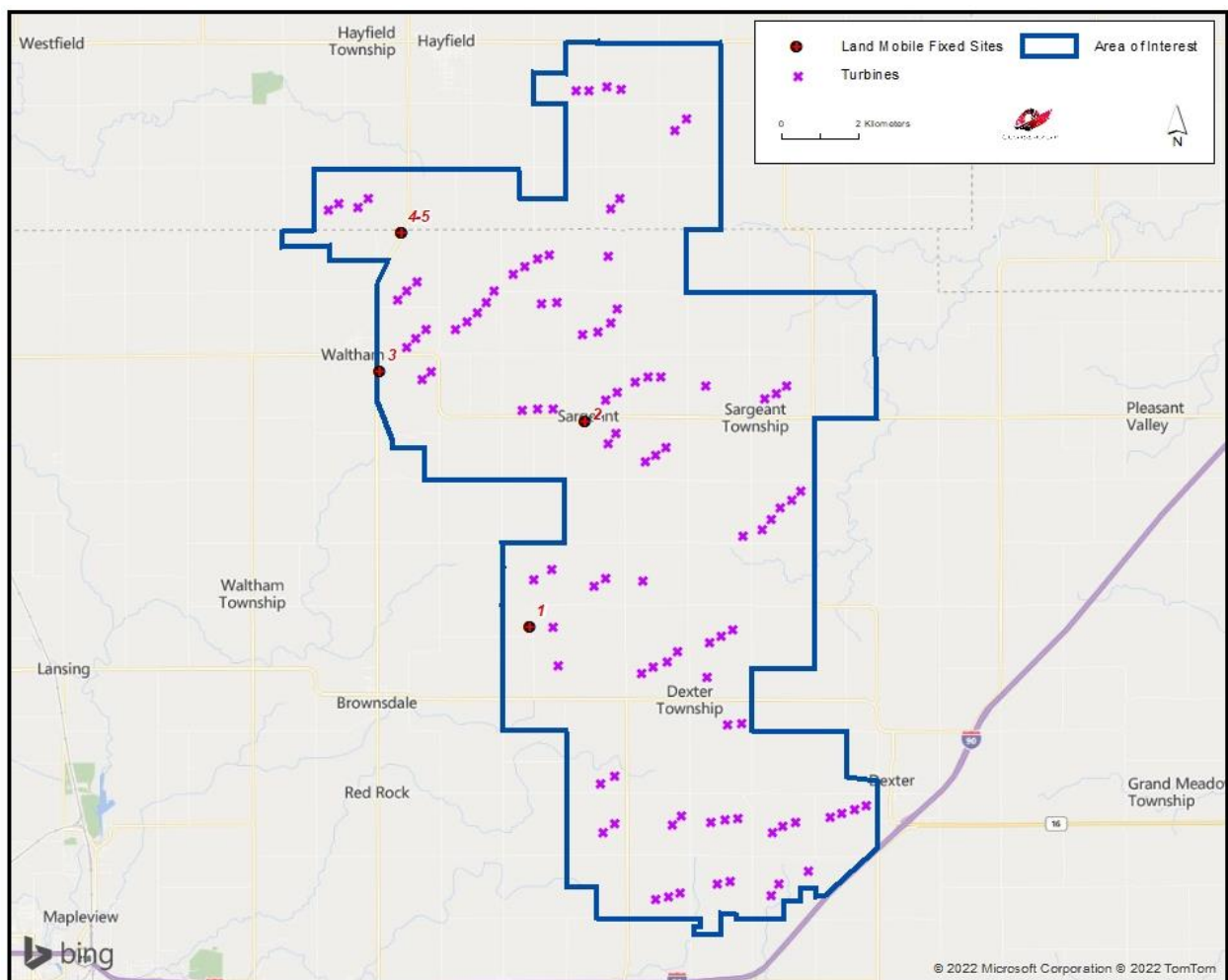


Figure 2: Land Mobile & Emergency Service Sites in Area of Interest

Figure 2 identifies five site-based licenses in the Pleasant Valley Wind Farm Repower 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 Nearest Turbine (km)
1	WQRV582	450-470	SHEELY FARMS	41.1	43.756417	-92.820528	0.56
2	KSV530	150-174	LARSON PRODUCTS INC	30	43.804139	-92.802972	0.76
3	WNRK620	450-470	GEBHARDT, MICHAEL:GEBHARDT, ROBERT:GEBHARDT, JAMES DBA GEBHA	18	43.815806	-92.868528	0.94
4	WQHE600	800/900	MINNESOTA, STATE OF	105.2	43.848111	-92.861722	1.27
5	WQSK907	800/900	MINNESOTA, STATE OF	104.5	43.848111	-92.861722	1.27

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

Mobile Licenses

In addition to the fixed-site licenses above, 561 mobile licenses defined by center point and radius were found to intersect the Pleasant Valley Wind Farm Repower Project area. Appendix A contains a tabular summary of these stations.

Area-Wide Licenses

The regional area-wide licenses were compiled from FCC data sources and identified for each county intersected by the wind energy project area. The Pleasant Valley Wind Farm Repower Project is located in Mower and Dodge Counties, Minnesota, part of Public Safety Region #22, which contains all the counties in Minnesota. The regional public safety operations are overseen by the entity listed below.

James Mohn

Chairperson, Public Safety Region #22

Illinois Department of Public Health

Office of Statewide Radio Communications, Minnesota Department of Transportation

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The chairperson for Region #22 serves as the representative for all public safety entities in the area and is 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, thirteen licenses were found for the State of Minnesota, one for the County of Dodge, and one for the County of Mower (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: MN	25-50
2	CART INC	Statewide: MN	150-174
3	City of Minneapolis, MN	Statewide: MN	2450-2500
4	CLAREMONT, CITY OF	Countywide: DODGE, MN	150-174
5	GREATER NORTHWEST EMERGENCY MEDICAL SERVICES	Statewide: MN	450-470
6	HENNEPIN, COUNTY OF	Statewide: MN	25-50, 150-174, 406-413, 450- 470, 800/900
7	Minnesota Canine Search Rescue and Tracking	Statewide: MN	150-174
8	MINNESOTA DEPARTMENT OF PUBLIC SAFETY	Statewide: MN	150-174
9	Minnesota, State of	Statewide: MN	0-10, 150-174, 450-470, 769- 775/799-805, 800/900, 2450- 2500, 4940-4990
10	MOWER, COUNTY OF	Countywide: MOWER, MN	150-174
11	NATIONAL SKI PATROL SYSTEM INC	Statewide: MN	150-174
12	Nevada Division of Forestry	Statewide: MN	150-174
13	NORTHSTAR SEARCH AND RESCUE	Statewide: MN	150-174
14	ROCHESTER CITY OF	Statewide: MN	150-174
15	SAINT LOUIS, COUNTY OF	Statewide: MN	150-174, 450-470, 800/900

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 Mower and Dodge Counties, Minnesota, in Table 3.

Mobile Phone Carrier	Service ²
AT&T	700 MHz, AWS, PCS, WCS
Blue Ridge Wireless II	AWS
Bug Tussel Wireless	AWS
DISH Network	700 MHz, AWS
T-Mobile	AWS, PCS
US Cellular	700 MHz
Verizon	700 MHz, AWS, Cellular, PCS

Table 3: Mobile Phone Carriers in Area of Interest with E911 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 Pleasant Valley Wind Farm Repower 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 with regard 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

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

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

For questions or information regarding the Land Mobile & Emergency Services Report, please contact:

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Web site:	www.comsearch.com

Appendix A

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
1	WNKW643	450-470	2 WAY RADIO OF MINNESOTA INC	64	44.141639	-93.511889
2	WNRO383	450-470	2 WAY RADIO OF MINNESOTA INC	64	44.141639	-93.511889
3	WNAK990	450-470	2-WAY RADIO OF MINNESOTA INC	64	43.791056	-93.440222
4	WPBU497	450-470	A & K FEED AND GRAIN CO INC	64	43.440250	-92.284889
5	WQNP927	450-470	ABSOLUTE ENERGY	32	43.496944	-92.954722
6	WQYJ371	450-470	ABSOLUTE ENERGY LLC	32	43.497806	-92.954361
7	WNFA507	150-174	ADAMS, CITY OF	32	43.568139	-92.718361
8	WQCG650	450-470	ADVANCED WIRELESS COMMUNICATIONS	80	44.441639	-93.018000
9	WQUX493	450-470	AG POWER ENTERPRISES	32	43.781028	-93.236361
10	WQUX493	450-470	AG POWER ENTERPRISES	32	44.043750	-92.996917
11	WQUX493	450-470	AG POWER ENTERPRISES	32	43.505083	-92.944722
12	WQXR597	450-470	AG POWER ENTERPRISES	32	44.103250	-92.841389
13	WNSV528	450-470	AGRIMSON, ARNE	121	43.854139	-91.908500
14	WQNS806	450-470	AHRENS FARMS	32	44.037778	-93.120278
15	WQRX968	450-470	AKKERMAN FARMS	32	43.716694	-92.870806
16	WQJB885	450-470	Akkerman Inc	8	43.742222	-92.887500
17	WNUZ853	450-470	ALBERTS, DON	48	44.091083	-92.757139
18	WNSX665	450-470	ALBERTS, DUANE O	32	44.166639	-92.708528
19	WQRM790	450-470	AL-CORN CLEAN FUEL	32	44.049250	-93.017167
20	WNVX591	450-470	Aldrich Communications Inc	56	44.001361	-93.417444
21	WNVX591	450-470	Aldrich Communications Inc	56	44.291083	-93.210500
22	WPGK514	450-470	ALDRICH COMMUNICATIONS INC	56	44.348028	-92.830194
23	WQUZ925	450-470	ALL AMERICAN CO OP	32	43.853028	-92.486000

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
24	WQQU249	450-470	ALLI ROLLOFF, INC.	32	44.011472	-92.699250
25	WPPA626	450-470	ALLIANCE PIPELINE L P	32	43.646639	-93.166861
26	WNXV768	450-470	Allnet Wireless LLC	120	44.930528	-93.145778
27	WPJU667	450-470	Allnet Wireless LLC	121	44.045806	-94.158278
28	WPJU667	450-470	Allnet Wireless LLC	121	43.983306	-92.208222
29	WPDU983	800/900	Alpha Wireless Communications	113	43.666944	-94.122222
30	WNMI988	800/900	ALPHA WIRELESS COMMUNICATIONS CO	113	44.181111	-94.029444
31	WNVS439	450-470	ALPHA WIRELESS COMMUNICATIONS CO.	121	44.148583	-93.979389
32	WQRA654	450-470	ALTER METAL RECYCLING	8	43.878250	-92.840389
33	WQFW336	450-470	AMERICAN TIME	20	44.032250	-92.866028
34	WQFW336	450-470	AMERICAN TIME	20	44.045028	-92.746889
35	WQFW336	450-470	AMERICAN TIME	20	44.042750	-92.741639
36	WQFW336	450-470	AMERICAN TIME	20	44.052167	-92.651111
37	WQFW336	450-470	AMERICAN TIME	20	43.852444	-92.493917
38	WQEI908	450-470	AMERICAN TIME & SIGNAL CO.	20	43.665389	-92.996139
39	WQEI908	450-470	AMERICAN TIME & SIGNAL CO.	20	43.648056	-92.994306
40	WQEI908	450-470	AMERICAN TIME & SIGNAL CO.	20	43.673583	-92.984333
41	WQEI908	450-470	AMERICAN TIME & SIGNAL CO.	20	43.688528	-92.980278
42	WQEI908	450-470	AMERICAN TIME & SIGNAL CO.	20	43.650889	-92.970778
43	WQEI908	450-470	AMERICAN TIME & SIGNAL CO.	20	43.662472	-92.952556
44	WQEI908	450-470	AMERICAN TIME & SIGNAL CO.	20	43.662389	-92.949194
45	WQEI908	450-470	AMERICAN TIME & SIGNAL CO.	20	43.666250	-92.945472
46	WQEI908	450-470	AMERICAN TIME & SIGNAL CO.	20	44.038389	-92.742667
47	WQEI908	450-470	AMERICAN TIME & SIGNAL CO.	20	43.855111	-92.490861
48	WQVN419	450-470	AMERICAN TIME & SIGNAL CO.	20	43.668111	-93.002167

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
49	WQVN419	450-470	AMERICAN TIME & SIGNAL CO.	20	43.889972	-92.837889
50	WQVN419	450-470	AMERICAN TIME & SIGNAL CO.	20	44.033444	-92.630083
51	WQVN419	450-470	AMERICAN TIME & SIGNAL CO.	20	43.708944	-92.562139
52	WQVN419	450-470	AMERICAN TIME & SIGNAL CO.	20	43.861556	-92.499778
53	WQVN419	450-470	AMERICAN TIME & SIGNAL CO.	20	43.848861	-92.479528
54	WRDL268	450-470	AMERICAN TIME & SIGNAL CO.	20	43.668028	-92.979306
55	WRDL268	450-470	AMERICAN TIME & SIGNAL CO.	20	43.568639	-92.716833
56	WPDS432	450-470	Ancom Communications, Inc	113	44.802750	-93.174389
57	WPQD717	450-470	Ancom Communications, Inc.	32	43.676389	-93.003611
58	WPTA322	450-470	Ancom Communications, Inc.	32	43.957750	-93.210472
59	WQAM765	800/900	Ancom Communications, Inc.	113	44.044722	-92.400278
60	WQKP408	450-470	Ancom Communications, Inc.	32	44.042194	-92.471000
61	WQTT427	450-470	Ancom Communications, Inc.	32	43.613139	-92.430556
62	WQUZ350	450-470	Ancom Communications, Inc.	32	43.720194	-92.704639
63	WNVT202	450-470	ANDERSON BUS CO INC	97	44.549417	-93.535778
64	WRBL370	450-470	Angell, Gary	32	43.677694	-92.724167
65	WQBK882	150-174	Arens Heating and Cooling	40	43.666639	-92.971306
66	WQGB846	450-470	AUSTIN INDEPENDENT SCHOOL DISTRICT #492	25	43.668333	-92.978333
67	WQGB846	450-470	AUSTIN INDEPENDENT SCHOOL DISTRICT #492	25	43.668611	-92.978333
68	WQGB846	450-470	AUSTIN INDEPENDENT SCHOOL DISTRICT #492	32	43.662556	-92.949583
69	WQAU830	150-174	AUSTIN MEDICAL CENTER	40	43.674417	-92.977972
70	WRJQ424	450-470	AUSTIN UTILITIES	24	43.692750	-92.952222
71	KJZ653	150-174	AUSTIN, CITY OF	40	43.697750	-92.963528
72	WQAW860	150-174	AUSTIN, CITY OF	15	43.666639	-92.966861
73	WQAW860	150-174	AUSTIN, CITY OF	40	43.666639	-92.966861

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
74	WQCR764	150-174	AUSTIN, CITY OF	32	43.670417	-92.969389
75	WQGX781	150-174	AUSTIN, CITY OF	40	43.666639	-92.972417
76	WQWR291	450-470	Autumn Ridge Church	80	44.005528	-92.518972
77	WNGG479	450-470	AVERA MC KENNAN HOSPITAL	322	43.530528	-96.713667
78	WPAU761	450-470	BAGLEY, JAMES	56	43.719417	-93.215472
79	KRR779	25-50	BARNETT BROS INC	80	44.352472	-93.606611
80	WPWJ805	450-470	Baudoin Oil Co Inc	30	43.706639	-92.589056
81	WPPV679	150-174	BBRH INC.	100	44.291083	-93.294111
82	WRCN231	450-470	BEHR, RONALD	159	43.026306	-93.330222
83	WQTY224	450-470	Belshan, Calvin	32	43.558111	-93.155750
84	WQSL531	450-470	BENEDIX, CRAIG;BENEDIX, CARYL DBA DOUBLE B FARMS	40	44.106639	-92.742139
85	WRMB778	450-470	Berge, Brandon	40	44.097972	-92.870389
86	WQTZ807	450-470	BESKAU, PAUL J	32	43.949472	-92.862472
87	WQNS799	450-470	BIRDS EYE FOODS, LLC	80	44.075778	-93.512056
88	WRCR679	450-470	Bishop, Adam	32	43.850611	-93.010361
89	WPGS831	150-174	BLOOMING PRAIRIE INDEPENDENT SCHOOL DISTRICT 756	40	43.867750	-93.063806
90	WPQA356	150-174	BLOOMING PRAIRIE, CITY OF	20	43.866917	-93.055750
91	KNET617	25-50	BMC AGGREGATES LLC	72	43.256333	-93.420750
92	WPQH731	450-470	BOE, WILLIAM D	32	43.561083	-92.630167
93	WQWG231	450-470	Boulders of Rochester LLC	32	44.004194	-92.554222
94	WQOM569	450-470	BOYSEN FARMS	32	43.821778	-92.877472
95	KNIN820	450-470	BREKKE, MICHAEL	48	43.767444	-93.454667
96	WQYD785	450-470	BROADWATER, BEN	48	43.558333	-92.231083
97	WPNP944	450-470	BROOKS EXCAVATING CO INC	32	44.075972	-92.689250

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
98	WQNS579	150-174	BROWNSDALE FIRE DEPARTMENT	40	43.741083	-92.870611
99	WQWR566	450-470	Budach, Gary	32	43.893861	-93.285417
100	WQYD339	150-174	BUNNE, DOMINICK	40	43.536611	-92.510139
101	WQEH780	150-174	BYRON, CITY OF	30	44.031444	-92.656833
102	WQSG203	800/900	CARBAJAL, RUDOLPH J	113	44.006722	-92.718611
103	WQRZ612	450-470	CARMAN, MARK	32	43.656139	-92.513972
104	WQYM200	450-470	Carpenter Farms	32	43.655972	-92.690639
105	WQQY536	450-470	Cedar Valley Services	20	43.688417	-92.982917
106	WPPN880	450-470	CENTRAL CO-OP	32	43.871806	-93.044639
107	WPPN880	450-470	CENTRAL CO-OP	32	43.890250	-92.849972
108	WQWM718	450-470	Century Farms	40	43.620444	-92.708194
109	WNAW956	450-470	CHARLSON EXCAVATING INC	80	43.132472	-93.216583
110	WNNS310	150-174	CITY AND LAKES CORP	80	44.301361	-93.289944
111	WNUJ643	150-174	CLAUSSEN, DAVID	48	43.530500	-93.343250
112	KDG651	450-470	Clement, Tracy	20	43.642778	-92.526667
113	KDG651	450-470	Clement, Tracy	32	43.642833	-92.526472
114	WNQG647	450-470	Cole Farms	121	43.269972	-93.041583
115	WPTW664	150-174	COLOFF MEDIA, LLC	70	43.148583	-93.147139
116	WQVJ836	450-470	Con-Tech Manufacturing Inc	32	43.992583	-92.860194
117	WPTP508	150-174	COUNTY MATERIALS CORPORATION	121	44.963056	-92.558056
118	WPNZ226	150-174	Croell Redi-Mix, Inc.	40	43.509694	-92.501833
119	WPNZ226	150-174	Croell Redi-Mix, Inc.	40	43.669972	-92.386556
120	WNSR429	450-470	CUSTOM COMMUNICATIONS INC	80	44.008306	-92.471000
121	WQHK257	450-470	CUSTOM COMMUNICATIONS, INC.	80	44.001139	-92.487972
122	KNFG989	150-174	D&H STARK FARMS LTD	56	43.370528	-92.456556

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
123	WQSY894	450-470	Dahl, Thomas	56	43.712500	-93.248333
124	WPBF383	450-470	DAHLBY, DALE	56	43.477444	-93.221028
125	KOK429	450-470	DAIRYLAND POWER COOPERATIVE	116	43.556917	-92.682139
126	WRBV603	450-470	DAIRYLAND POWER COOPERATIVE	32	43.732778	-92.675556
127	WRBV603	450-470	DAIRYLAND POWER COOPERATIVE	32	43.680000	-92.355083
128	WPMF559	150-174	Dakota Minnesota & Eastern Railroad Corporation	30	43.668306	-92.960194
129	WPRI228	150-174	DAKOTA MINNESOTA & EASTERN RAILROAD CORPORATION	62	44.081639	-93.228000
130	WQNS915	800/900	DAKOTA, COUNTY OF	241	44.714833	-93.124778
131	WQRM434	450-470	DAMEL CORPORATION INC	32	43.701611	-92.982167
132	KNGL791	450-470	DAVIS, JIM	32	43.736361	-92.629333
133	KNIF242	450-470	DAVISON, BRUCE:DAVISON, JACK DBA DAVISON FARMS	64	43.184139	-93.046028
134	WRAR597	450-470	DECOOK EXCAVATING INC.	32	44.028028	-92.636278
135	WRCX660	450-470	DECOOK, BRYAN	32	43.904472	-92.620667
136	WQTV395	450-470	DEML FARMS	32	43.924556	-93.266833
137	WQLJ962	450-470	DIAMOND FARMS INC.	32	43.691750	-92.867361
138	WPZR702	150-174	DODGE, COUNTY OF	40	44.025556	-92.848056
139	KYX730	150-174	DONKERS, MARVIN & TIM D	64	44.324139	-93.029111
140	WNKB246	450-470	DONLEY, FARMS, INC	32	43.955806	-92.656861
141	KNIG840	450-470	DOUGAN, SUE	32	43.667306	-92.509000
142	WQRW563	450-470	DURST BROTHERS DAIRY	32	44.132750	-92.753361
143	WREM662	450-470	EAGLE BROOK CHURCH	32	44.022028	-92.458361
144	WNYY334	450-470	EBELING FAMILY FARM	48	44.024694	-93.186583
145	WRFS985	450-470	EDF Renewables Services, Inc.	32	43.772694	-92.680694
146	WNVB930	450-470	Eickhoff, Jeff N	40	43.681917	-92.254056

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
147	WNGX885	800/900	ELECTRONIC ENGINEERING COMPANY	113	43.120833	-93.193611
148	WNJA778	450-470	ELECTRONIC ENGINEERING COMPANY	64	43.467167	-93.465222
149	WNVV722	450-470	ELECTRONIC ENGINEERING COMPANY	48	43.279139	-92.821028
150	WNGC334	800/900	Electronic Specialties, Inc	112	43.102194	-93.597722
151	KNHH478	800/900	Electronic Specialties, Inc.	113	43.357444	-93.308250
152	WNVP259	800/900	Electronic Specialties, Inc.	113	42.862222	-93.610833
153	WNWK644	450-470	Electronic Specialties, Inc.	80	43.365250	-93.133806
154	WPEN706	450-470	Electronic Specialties, Inc.	97	43.423278	-93.533556
155	WPGZ256	450-470	Electronic Specialties, Inc.	80	43.118583	-93.239639
156	WRCB432	150-174	Ellingson Trenchless LLC	80	44.138417	-92.900417
157	WQPY461	72-76, 150-174, 450-470, 470-512	ENTERCOM LICENSE, LLC	130	44.976444	-93.276111
158	WQPY464	72-76, 150-174, 450-470, 470-512	ENTERCOM LICENSE, LLC	200	44.976472	-93.276139
159	WQJZ882	450-470	enXco	32	43.741889	-92.705361
160	WNSH547	150-174	ERLER, GRANT D	40	44.146639	-92.986583
161	WNVR429	450-470	FASBENDER, DON:FASBENDER, MARK DBA FASBENDER FARMS	40	43.529694	-92.687139
162	WQEL823	150-174	FERRIER, THOMAS	40	43.943583	-92.273778
163	WQQN305	450-470	FIELD CREST CARE CENTER	5	43.893056	-92.843056
164	WPEU410	450-470	FINSETH FAMILY FARMS	56	43.762472	-92.097944
165	KNHX289	150-174	FIRST STUDENT INC	40	44.024444	-92.545000
166	KNHX289	150-174	FIRST STUDENT INC	56	44.024444	-92.545000
167	WPSF861	150-174	FIRST STUDENT INC	40	44.024444	-92.545000
168	WQUS500	450-470	Flying S Farm	40	43.851028	-92.866611
169	WQTY287	450-470	FOWLER CORPORATION	32	43.714611	-92.378139

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170	WNBY880	450-470	FRANKS, G RONALD	80	43.226333	-93.382972
171	KNBG837	450-470	FREEBORN MOWER COOPERATIVE SERVICES	56	43.640806	-93.147694
172	WNFS292	150-174	FRITCHER, DAVID	64	43.409972	-92.377111
173	WQWY717	150-174	G & J PRAIRIE FARM INC	32	43.487361	-93.054972
174	WNRK620	450-470	GEBHARDT, MICHAEL:GEBHARDT, ROBERT:GEBHARDT, JAMES DBA GEBHA	48	43.815806	-92.868528
175	WRAX937	450-470	Gerlach, Larry	32	43.630056	-92.928694
176	KNAE325	450-470	GLENNS SHELL SERVICE	72	44.284139	-93.250222
177	WPEX927	450-470	GLS AGRONOMY A MINNESOTA PARTNERSHIP	48	43.969139	-92.227389
178	KNBA595	25-50	GM CONTRACTING INC	161	44.114694	-94.211639
179	KNAR750	450-470	GOLDBECK TOWING SERVICE	129	43.865528	-91.321528
180	KAE754	150-174	GOODHUE COUNTY COOPERATIVE ELECTRIC ASSOC	64	44.286639	-92.654361
181	WQXV630	450-470	GOODHUE COUNTY COOPERATIVE ELECTRIC ASSOCIATION	65	44.393056	-92.714444
182	WQVN549	450-470	Goslee, Larry	32	43.558056	-93.048056
183	WQSF996	800/900	GOUAUX, SUE M	113	44.006722	-92.718611
184	WNII614	450-470	GRAIN MILLERS INC	48	43.385056	-92.922417
185	WQGX590	150-174	GRAND MEADOW, CITY OF	24	43.702750	-92.574889
186	WPSF967	450-470	Great River Energy	32	43.802500	-92.683889
187	WNJL652	150-174	GREENWOOD FARMS INC	48	44.157472	-92.339056
188	WNJZ902	150-174	GRISIM, CURT	48	43.848861	-92.487944
189	WPPD445	150-174	GUNDERSEN LUTHERAN MEDICAL CENTER	600	43.794417	-91.249583
190	WNNO413	450-470	HAARSTAD, ODEAN:HAARSTAD, ANDREW:HAARSTAD, KENNETH:HAARSTAD,	48	43.781083	-92.706861
191	WQNR476	450-470	HAARSTADS HOME IMPROVEMENTS LLC	80	43.676167	-92.869222
192	WQOC975	450-470	HAFNER FARMS	32	43.620556	-92.348611

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
193	WQWN580	450-470	Hahn, Brian	40	43.848972	-92.749750
194	WPEG465	150-174	HALVORSON, CURTIS	56	43.477194	-92.944083
195	WRFE865	450-470	HAM, JAMIE	80	43.242222	-92.865556
196	WRJT635	150-174	Hanegraaf Farms	40	43.623750	-92.896500
197	WPHM349	450-470	HARMONY AGRI SERVICES, INC.	80	43.554583	-92.002194
198	WPSF577	800/900	HARTLE, WM P	32	43.991389	-93.175556
199	WQFC633	450-470	HAWK AND SONS CONSTRUCTION	25	44.038278	-92.561694
200	WQOM602	450-470	HAYFIELD PUBLIC SCHOOLS	32	43.881333	-92.841167
201	WRFN928	450-470	Hayfield Window and Door Company	8	43.880556	-92.845944
202	WQSI406	450-470	Hayfield, City of	16	43.890583	-92.847722
203	WNGC397	800/900	HDH Leasing Inc.	113	44.524167	-92.576389
204	WPHB812	150-174	Helena Agri-Enterprises, LLC	48	43.282750	-92.791861
205	WQYF728	450-470	HEMANN, KURT	32	43.466667	-92.777500
206	WQTT782	450-470	Hemingway, Eric	97	44.412500	-92.594417
207	WQPI707	150-174	HENDERSON, DAVE	30	43.653028	-92.389056
208	WPMJ422	450-470	HERBST, BRIAN R	20	44.029139	-92.698528
209	WPMJ422	450-470	HERBST, BRIAN R	32	44.029139	-92.698528
210	WPML679	450-470	HEYDT, CURTIS W	32	43.891639	-92.849972
211	WQVM230	450-470	H-FARMS, INC.	32	43.685639	-92.688472
212	WQQH265	150-174	HI YIELD PRODUCTS INC	40	43.760444	-93.177889
213	WQWZ877	150-174	HIGH PRAIRIE 2 WIND FARM, LLC DBA	32	43.496250	-92.579306
214	WQYT901	450-470	Hilltop Communications, Inc	30	43.894417	-92.852139
215	WSS343	450-470	Hilltop Communications, Inc	80	44.006083	-92.423778
216	WNRW374	450-470	Hilltop Communications, Inc.	80	44.325250	-92.652972
217	WNYY719	450-470	Hilltop Communications, Inc.	80	44.006083	-92.423778



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218	WPGY568	450-470	Hilltop Communications, Inc.	80	44.412472	-92.272667
219	WPGZ803	450-470	Hilltop Communications, Inc.	80	44.325250	-92.652972
220	WPGZ805	450-470	Hilltop Communications, Inc.	80	44.461083	-93.183000
221	WPHA250	450-470	Hilltop Communications, Inc.	80	44.398583	-92.817417
222	WPHA251	450-470	Hilltop Communications, Inc.	80	44.398583	-92.817417
223	WPHD723	450-470	Hilltop Communications, Inc.	80	44.081639	-93.191333
224	WPIC271	450-470	Hilltop Communications, Inc.	121	44.303306	-93.240500
225	WPIE272	450-470	Hilltop Communications, Inc.	121	44.006083	-92.423778
226	WPIF622	450-470	Hilltop Communications, Inc.	121	44.236639	-92.558806
227	WPIF624	450-470	Hilltop Communications, Inc.	121	44.081639	-93.191333
228	WPIF625	450-470	Hilltop Communications, Inc.	121	44.303306	-93.240500
229	WPIF626	450-470	Hilltop Communications, Inc.	121	44.303306	-93.240500
230	WPNQ368	450-470	Hilltop Communications, Inc.	32	44.006083	-92.423778
231	WPQC511	450-470	Hilltop Communications, Inc.	32	44.006083	-92.423778
232	WPQC512	450-470	Hilltop Communications, Inc.	32	44.006083	-92.423778
233	WPWP658	450-470	Hilltop Communications, Inc.	32	44.006111	-92.423611
234	WQVQ405	450-470	HILTON, BILL	32	43.685056	-92.687611
235	WRCQ820	450-470	HINDT FAMILY FARMS	32	43.674250	-92.395750
236	WQQ590	150-174	HINKLE, GREG	40	43.839139	-92.386833
237	WPWE820	800/900	Hoefs, Paul	113	44.181111	-94.029444
238	KNJX373	150-174	HOUSE CHEVROLET COMPANY	48	43.850806	-92.488500
239	WRCQ237	150-174	Howe Farms	32	43.746750	-92.690139
240	WQVE884	450-470	HSRE-WSL ON MAYOWOOD II TRS, LLC	32	43.998361	-92.475722
241	WQXR614	450-470	HUNT, JASON	80	43.993611	-92.448167
242	WPDF296	450-470	IBM Research and Development Inc.	56	44.066639	-92.504611

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
243	WSN377	150-174	IBM Research and Development Inc.	32	44.059139	-92.504333
244	WYJ839	450-470	IHLENFELD, JOHN:IHLENFELD, MARK DBA IHLENFELD BROTHERS	40	44.097194	-93.200222
245	KWJ508	25-50	INDEPENDENCE READY MIXED CONCRETE	121	44.285278	-91.361111
246	WPXN535	450-470	INDEPENDENT SCHOOL DISTRICT #535	32	44.003278	-92.448194
247	WPGE368	450-470	INDEPENDENT SCHOOL DISTRICT 196	121	44.809972	-93.178278
248	WQRH271	450-470	INDEPENDENT SCHOOL DISTRICT 495	32	43.709056	-92.561778
249	WRCL625	150-174	INDEPENDENT SCHOOL DISTRICT 497	32	43.508806	-92.943194
250	WREC791	150-174	INDEPENDENT SCHOOL DISTRICT 531	32	44.031444	-92.656833
251	WREC791	150-174	INDEPENDENT SCHOOL DISTRICT 531	32	44.043722	-92.650917
252	WREC791	150-174	INDEPENDENT SCHOOL DISTRICT 531	32	44.035722	-92.646639
253	WPRI344	450-470	INDEPENDENT SCHOOL DISTRICT 535	32	44.034694	-92.485722
254	WPUF832	450-470	International Paper	32	43.681333	-92.964667
255	WQTF900	450-470	INTERSTATE MILLS	16	43.889944	-92.849972
256	WQDV323	150-174	Interstate Power & and Light Company	290	43.557167	-93.661056
257	WQDV323	150-174	Interstate Power & and Light Company	290	42.686944	-91.826389
258	WQCT231	800/900	INTERSTATE POWER & LIGHT COMPANY	113	43.372028	-92.100194
259	WPBI316	800/900	Interstate Power and Light Company	113	43.850278	-92.175278
260	WPBI317	800/900	Interstate Power and Light Company	113	42.849056	-92.415889
261	WPBI317	800/900	Interstate Power and Light Company	113	43.315778	-91.788972
262	WPBI318	800/900	Interstate Power and Light Company	113	43.098028	-93.289889
263	WPBI318	800/900	Interstate Power and Light Company	113	43.240667	-92.973639
264	WPBI318	800/900	Interstate Power and Light Company	113	43.556917	-92.682139
265	WPBI318	800/900	Interstate Power and Light Company	113	43.188056	-92.358333
266	WPBI319	800/900	Interstate Power and Light Company	113	43.557167	-93.661056

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
267	WPBI319	800/900	Interstate Power and Light Company	113	43.745306	-93.452639
268	WPBI319	800/900	Interstate Power and Light Company	113	43.094167	-93.294167
269	WPXS635	800/900	Interstate Power and Light Company	113	42.980278	-93.608611
270	WPYY361	800/900	Interstate Power and Light Company	113	43.090222	-91.854833
271	WQAR953	800/900	Interstate Power and Light Company	113	43.316500	-91.455000
272	WQAR953	800/900	Interstate Power and Light Company	113	43.315722	-91.438139
273	WQBR912	800/900	Interstate Power and Light Company	113	43.120833	-93.193611
274	WQCS284	800/900	Interstate Power and Light Company	113	42.955833	-91.816111
275	WQTI695	800/900	Iota Spectrum Holdings, LLC	113	44.006722	-92.718611
276	WQTI696	800/900	Iota Spectrum Holdings, LLC	113	44.006722	-92.718611
277	WQTN282	800/900	Iota Spectrum Holdings, LLC	50	44.006722	-92.718611
278	WQSF998	800/900	Iota Spectrum Partners, LP	113	44.006722	-92.718611
279	WQSF999	800/900	Iota Spectrum Partners, LP	113	44.006722	-92.718611
280	WQSG202	800/900	Iota Spectrum Partners, LP	113	44.006722	-92.718611
281	WQMM943	450-470	ITC MIDWEST	80	43.959056	-93.466639
282	WQMM943	450-470	ITC MIDWEST	80	43.801111	-92.189889
283	WQZF388	450-470	J & K CONSTRUCTION	80	43.283611	-92.790556
284	WQTU931	450-470	J & S Repair Precision Inc	32	43.714611	-92.378083
285	WPPB574	450-470	JAX DAIRY FARMS INC	32	43.512833	-92.829083
286	WQWN579	450-470	Jensen Farms	40	43.746500	-93.346667
287	WQYD441	450-470	Jensen, Michael D	80	43.703111	-93.568222
288	WPQG347	450-470	JOHNSON, GALEN	32	43.989417	-92.879639
289	WQKM777	450-470	JONES, TERRY	32	43.710833	-92.596944
290	WPMM754	450-470	JORGENSON, JIM	32	44.044972	-92.681306
291	WPMY730	450-470	JORGENSON, RODNEY	25	44.044972	-92.696028

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
292	WPLQ539	450-470	KAAL-TV, LLC	32	43.675806	-92.951861
293	WQGL277	150-174	KASSON MANTORVILLE INDEPENDENT SCHOOL DISTRICT	25	44.069611	-92.756028
294	WQGL277	150-174	KASSON MANTORVILLE INDEPENDENT SCHOOL DISTRICT	25	44.044167	-92.746889
295	WQGL277	150-174	KASSON MANTORVILLE INDEPENDENT SCHOOL DISTRICT	25	44.044889	-92.746528
296	KKW205	150-174	KASSON, CITY OF	40	44.024694	-92.748250
297	KLO481	150-174	KASSON, CITY OF	40	44.031639	-92.753528
298	WRHZ896	450-470	KELTRON CORPORATION	80	44.461556	-93.155806
299	WNJZ554	450-470	KEOKUK CO AMBULANCE	322	41.333333	-92.204639
300	KUM313	450-470	KIELMEYER CONSTRUCTION INC	64	44.291083	-93.211333
301	KUM313	450-470	KIELMEYER CONSTRUCTION INC	64	44.348028	-92.830194
302	WPMB807	450-470	KLOCKE BROTHERS FARMS INC	32	43.862472	-92.931306
303	WRO409	450-470	KNAPP, CARL	80	43.196083	-92.595750
304	WQCP503	150-174	Knott, Darwin	40	44.208028	-92.959917
305	KNEP328	150-174	KOENIGS, JEROME A	40	43.457472	-92.638806
306	WRCH993	450-470	Krahn X, LLC	32	43.730139	-92.350889
307	WNNM962	450-470	KRAUSHAAR, STEVEN	64	43.583306	-93.151583
308	WQVP932	150-174	Krell, Justin	80	43.864417	-93.061944
309	WNPO812	450-470	KRUEGELS INC	32	43.682750	-92.383778
310	WQUT609	150-174	KRUGER, ROGER	40	43.918472	-92.875306
311	KC7907	150-174	KSTP-TV, LLC	161	44.947194	-93.086611
312	KPF364	25-50	KSTP-TV, LLC	241	44.968583	-93.207722
313	WNZY645	150-174	KUBAT, DONALD F	40	44.052472	-93.024917
314	WQPE549	450-470	KUEHN, LARRY	80	44.510278	-93.009444
315	WRCX876	150-174	KUPER, DALLAS	40	43.359972	-92.811389

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
316	KNFU686	150-174	LA VALLE, TOWN OF	232	43.584417	-90.134583
317	WNNY447	150-174	LADWIG, MARVIN	40	43.494417	-92.384333
318	WQXB359	450-470	Lagerstedt, David L	32	43.563889	-92.733333
319	KAH922	450-470	LAKESIDE FOODS INC	97	44.155250	-92.175167
320	KSV530	150-174	LARSON PRODUCTS INC	19	43.834694	-92.767694
321	WPBB549	450-470	Latham Hi-Tech Hybrids, Inc.	121	42.796917	-93.496583
322	WQPM433	450-470	Lau, Mike	40	43.528611	-93.187944
323	WNRV825	450-470	LECY, DELBERT	32	43.791639	-92.671000
324	WREN859	450-470	LEGACY OF BROWNSDALE, LLC	5	43.743222	-92.867750
325	WNPC334	150-174	LEWIS, MICHAEL	48	43.432472	-92.400722
326	WQSW614	450-470	Lickteig & Bastyr Farms, LLC.	32	43.641389	-93.018056
327	WQSF987	800/900	LNS SPECTRUM, LLC	113	44.006722	-92.718611
328	WPWI617	450-470	Loose, Daniel	250	44.335000	-95.288611
329	WRT797	450-470	LOREN & HANSON FARM	32	43.734139	-92.504583
330	WQFT390	450-470	Loucks, Aaron	32	43.906389	-92.995833
331	WQPA482	150-174	LUECK, STEVE	72	44.070278	-91.939722
332	WNYK609	450-470	LUTHERAN HOSPITAL LA CROSSE	121	43.794417	-91.249583
333	WPAW465	150-174	LYLE, CITY OF	32	43.505806	-92.943806
334	WQUD932	450-470	M & L FARMS	32	43.821806	-92.883778
335	WQPM436	450-470	M J MERTEN P T S P	32	43.629972	-93.016306
336	WQBV417	150-174	MAAS, PAUL	48	44.197750	-93.267167
337	WNQN316	450-470	MARIGOLD FOODS INC	32	44.029972	-92.462667
338	WNQN316	450-470	MARIGOLD FOODS INC	32	44.022361	-92.452194
339	WNXU938	450-470	MARQUARDT, LEN	48	43.958306	-93.358000
340	WNJQ766	450-470	MARTIN, RODGER	64	43.196639	-92.732417

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
341	WPAW992	450-470	MASCHING, RICHARD	40	43.923583	-92.833528
342	WPMY448	450-470	MASTER COMMUNICATIONS	32	44.042194	-92.471000
343	WNBA817	150-174	MAY, GABRIEL	48	43.457194	-92.713250
344	KDR729	150-174	MAYO FOUNDATION	56.3	44.042194	-92.471000
345	KDR729	150-174	MAYO FOUNDATION	56.3	44.029417	-92.461833
346	WPJZ485	150-174	MAYO FOUNDATION	24	43.674139	-92.977694
347	WPLY304	800/900	MAYO FOUNDATION	40	44.021639	-92.467111
348	WPMA361	800/900	MAYO FOUNDATION	113	44.021639	-92.467111
349	WPMA366	800/900	MAYO FOUNDATION	113	44.021639	-92.467111
350	WPNZ361	450-470	MAYO FOUNDATION	32	44.021639	-92.464889
351	WPZR841	216-220	Mayo Foundation	80	44.021667	-92.466944
352	WNMS697	150-174	MC COLLEY, WAYNE	40	43.938583	-92.852694
353	WPJH549	450-470	MC NEILUS STEEL INC	16	44.023028	-92.853250
354	WQNK329	450-470	MCNEILUS TRUCK & MANUFACTURING INC	32	44.033083	-92.848111
355	WPBD259	450-470	MEYERHOFER, LE VERNE	40	43.679139	-92.596000
356	KNBG738	450-470	MICHEL, DALE	48	44.167194	-92.413222
357	WQJI438	450-470	MIDAMERICAN ENERGY COMPANY	80	43.054417	-92.673806
358	WQZA414	450-470	MIENERGY COOPERATIVE	80	43.772222	-91.985000
359	WQTH200	150-174, 450-470	Minnesota Freezer Warehouse Company	40	43.685000	-92.955278
360	WQDI812	800/900	MINNESOTA, STATE OF	40	43.934694	-92.617361
361	WQDI812	800/900	MINNESOTA, STATE OF	40	44.134167	-92.587500
362	WQDI812	800/900	MINNESOTA, STATE OF	40	44.020694	-92.467056
363	WQDI812	800/900	MINNESOTA, STATE OF	40	44.063611	-92.353333
364	WQDI812	800/900	MINNESOTA, STATE OF	40	43.854917	-92.336278
365	WQDJ729	800/900	MINNESOTA, STATE OF	113	44.529167	-93.408056

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
366	WQDJ729	800/900	MINNESOTA, STATE OF	113	44.093611	-93.253889
367	WQDJ729	800/900	MINNESOTA, STATE OF	113	44.291111	-93.211389
368	WQDJ729	800/900	MINNESOTA, STATE OF	113	44.048111	-92.962389
369	WQDJ729	800/900	MINNESOTA, STATE OF	113	44.416556	-92.874306
370	WQDJ729	800/900	MINNESOTA, STATE OF	113	44.342806	-92.642389
371	WQDJ729	800/900	MINNESOTA, STATE OF	113	44.524167	-92.576389
372	WQHE600	800/900	MINNESOTA, STATE OF	40	43.848111	-92.861722
373	WQHE600	800/900	MINNESOTA, STATE OF	40	43.658361	-92.688694
374	WQHE600	800/900	MINNESOTA, STATE OF	40	43.659306	-92.299667
375	WQHF415	800/900	MINNESOTA, STATE OF	113	43.810889	-91.644750
376	WQHF415	800/900	MINNESOTA, STATE OF	113	43.668750	-91.404194
377	WQHF415	800/900	MINNESOTA, STATE OF	113	43.550583	-91.361472
378	WQHK535	800/900	MINNESOTA, STATE OF	113	43.652028	-93.547556
379	WQHK535	800/900	MINNESOTA, STATE OF	113	43.817500	-93.292778
380	WQHK535	800/900	MINNESOTA, STATE OF	113	43.662000	-93.114389
381	WQNG466	150-174	MINNESOTA, STATE OF	40	44.013500	-93.306139
382	WQNG466	150-174	MINNESOTA, STATE OF	40	43.662000	-93.114389
383	WQNG466	150-174	MINNESOTA, STATE OF	40	44.052278	-92.901028
384	WQNG466	150-174	MINNESOTA, STATE OF	40	43.658361	-92.688694
385	WQNG467	150-174	MINNESOTA, STATE OF	40	44.063611	-92.353333
386	WQPB796	800/900	MINNESOTA, STATE OF	40	44.063611	-92.353333
387	WQPT587	800/900	MINNESOTA, STATE OF	40	43.545611	-92.470000
388	WQSK907	800/900	MINNESOTA, STATE OF	40	44.013500	-93.306139
389	WQSK907	800/900	MINNESOTA, STATE OF	40	44.109500	-93.199361
390	WQSK907	800/900	MINNESOTA, STATE OF	40	43.875083	-93.049583

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
391	WQSK907	800/900	MINNESOTA, STATE OF	40	44.052278	-92.901028
392	WQSK907	800/900	MINNESOTA, STATE OF	40	43.848111	-92.861722
393	WPYE254	150-174	MITCHELL, COUNTY OF	40	43.427750	-92.782750
394	WPQJ977	450-470	MOBILE RADIO ENGINEERING INC	121	44.559972	-93.321056
395	WNQZ567	150-174	MOWER, COUNTY OF	48	43.658361	-92.688694
396	WPMJ464	450-470	MOWER, COUNTY OF	32	43.658361	-92.688694
397	WPMX953	800/900	MOWER, COUNTY OF	40	43.658361	-92.688694
398	WPNR583	150-174	MOWER, COUNTY OF	32	43.670389	-92.969389
399	WQGM683	450-470	MOWER, COUNTY OF	32	43.658361	-92.688694
400	WQHH552	800/900	MOWER, COUNTY OF	40	43.501083	-92.992694
401	WQHH552	800/900	MOWER, COUNTY OF	40	43.658361	-92.688694
402	WQVL496	800/900	MOWER, COUNTY OF	40	43.668528	-92.992583
403	WNLJ839	450-470	MR SAM COMMUNICATIONS	56	43.547472	-92.714639
404	WNNU894	450-470	MR SAM COMMUNICATIONS	64	43.645222	-93.468000
405	WPPN854	450-470	MR SAM COMMUNICATIONS	30	43.438028	-92.783806
406	WQVN590	150-174	NEIA Pump Service Inc	96	43.221111	-91.835028
407	WNLJ890	450-470	NELSON, BRIAN L	48	44.106083	-93.156861
408	WQTM684	150-174	Nelson, Joel	40	43.501528	-92.901472
409	WNLG922	450-470	NESS, STERLING	48	43.965528	-92.699917
410	WPZH549	800/900	New Hampton Red Power, Inc.	113	43.008889	-92.316667
411	WNNT988	450-470	NEW RICHLAND SCHOOLS #2168	48	43.892500	-93.492778
412	WQLV443	450-470	NextEra Energy Resources O&M Services, LLC	32	43.616722	-92.598833
413	WPPH987	450-470	NORTHERN COUNTRY COOP	30	43.672750	-93.087694
414	WPPH987	450-470	NORTHERN COUNTRY COOP	30	43.880806	-92.714361
415	WQSJ709	450-470	NORTHERN COUNTRY CO-OP	32	43.439167	-92.780833



ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
416	WQJR520	450-470	Northern Iowa Windpower II, LLC	80	43.364528	-93.269389
417	KSI896	150-174	NORTHWAY COMMUNICATIONS INC.	322	44.888028	-89.652056
418	WNNB993	450-470	NUTRIEN AG SOLUTIONS INC	121	42.972194	-93.796056
419	KNAI909	150-174	OCONNOR GRAIN INC	32	43.819972	-93.096028
420	WQYD346	450-470	OEHLKE FARMS	32	43.756139	-92.553778
421	WPXQ433	800/900	Olmsted County Sheriff's Office	32	43.967472	-92.478222
422	WPXQ433	800/900	Olmsted County Sheriff's Office	40	44.063611	-92.353333
423	WRCA446	450-470	OLMSTED COUNTY WASTE	32	44.022361	-92.419556
424	WNKI511	150-174	OLMSTED, COUNTY OF	40	44.041083	-92.340722
425	WNKW871	450-470	OPFER, JOHN E	32	44.020806	-92.645472
426	WQRG718	150-174	OWATONNA BUS COMPANY, INC.	40	44.092500	-93.247778
427	WNQO287	150-174	Owatonna Concrete Products, LLC	40	43.722028	-93.359639
428	WNQO287	150-174	Owatonna Concrete Products, LLC	80	44.074972	-93.206056
429	WNQO287	150-174	Owatonna Concrete Products, LLC	80	44.272194	-92.989083
430	WNYS410	150-174	OWATONNA GROUNDMASTERS INC	40	44.124972	-93.205500
431	WQUR381	450-470	Pacelli Catholic Schools	24	43.669222	-92.980417
432	WSE810	150-174	Palmer Bus Co.	40	43.686833	-92.980694
433	WQRR650	150-174	PATTERSON, CHRISTOPHER L	32	43.490278	-92.877778
434	KNBW268	450-470	PEOPLES ENERGY COOPERATIVE	56	44.042194	-92.340722
435	WQXB751	450-470	Powers, Chris	121	44.021278	-92.495806
436	WRMK340	450-470	Prairie Ag Pumping, Inc.	32	43.582556	-92.629222
437	WQOR559	450-470	PREMEIR SECURITY	32	44.021083	-92.461556
438	WNYV328	150-174	PUBLIC UTILITIES COMMISSION	40	43.687194	-92.389611
439	WNRX468	150-174	PURFEERST GRAIN INC	48	44.267472	-93.102444
440	KZP477	150-174	PURFEERST, JAMES M	72	44.239139	-93.149111

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
441	WPYB749	800/900	RACOM Corporation	113	43.098056	-93.289722
442	WQKD865	800/900	RACOM Corporation	113	43.279722	-91.787778
443	WQKD880	800/900	RACOM Corporation	113	43.121389	-93.194444
444	WQKD884	800/900	RACOM Corporation	113	43.038056	-92.390556
445	WQKD897	800/900	RACOM Corporation	113	44.689167	-93.072778
446	WQKD916	800/900	RACOM Corporation	113	42.694167	-92.782778
447	WQKD926	800/900	RACOM Corporation	113	43.970278	-92.418333
448	WNIC728	450-470	RADIO COMMUNICATIONS CO INC	121	42.751361	-92.796028
449	KB88332	450-470	RADOR FARMS INC	32	44.049417	-92.852417
450	WNWA349	150-174	RAUSCH BROTHERS TRUCKING INC	121	43.034139	-92.451028
451	WQSG200	800/900	RAZI, LLC	113	44.006722	-92.718611
452	WRJL608	450-470	REICHERTS, GARY	50	43.373889	-92.672778
453	WNIU517	450-470	RESSLER, JOHN	48	43.627472	-92.626000
454	KAJ271	150-174	RICE, COUNTY OF	64	44.299417	-93.249111
455	WPEG804	450-470	RIVERLAND COMMUNITY COLLEGE	32	43.676083	-93.002694
456	WQDB755	150-174	Rochester Bus Service, Inc.	40	44.036611	-92.489167
457	WPZJ713	150-174, 450-470	ROCHESTER CITY OF	32	44.021667	-92.469722
458	WQHN487	450-470	ROCHESTER COMMUNITY & TECHNICAL COLLEGE	32	44.013028	-92.400722
459	WQTJ462	150-174	ROCHESTER COMMUNITY AND TECHNICAL COLLEGE	32	44.020667	-92.437250
460	WQTJ463	450-470	ROCHESTER COMMUNITY AND TECHNICAL COLLEGE	32	44.020806	-92.441833
461	WNHT247	450-470	ROCHESTER GOLF & COUNTRY CLUB	64	44.053306	-92.405167
462	WPKV380	450-470	ROCHESTER PUBLIC SCHOOLS	32	44.046361	-92.449333
463	WPKV380	450-470	ROCHESTER PUBLIC SCHOOLS	120	44.046361	-92.449333
464	KAA306	150-174, 450-470	Rochester Public Utilities	32	43.967472	-92.478222
465	WPAZ809	150-174	ROCHESTER PUBLIC UTILITIES	32	44.058306	-92.458500

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
466	WPCB507	450-470	ROCHESTER PUBLIC UTILITIES	32	44.058306	-92.458500
467	WQMQ990	450-470	ROCHESTER PUBLIC UTILITIES	32	44.025000	-92.528472
468	WRHV510	450-470	ROCHESTER SCHOOL DISTRICT #535	32	44.054528	-92.520778
469	KAB816	150-174	ROCHESTER, CITY OF	48	44.022472	-92.362944
470	KAB885	150-174	ROCHESTER, CITY OF	32	44.019417	-92.478222
471	WNIV229	450-470	ROE, RUSSELL:ROE, MILO:ROE, RICK:ROE, BRIAN DBA ROE FARMS	40	43.515250	-92.579611
472	WRCI945	450-470	ROONEY TRUCKING, INC.	152	42.643139	-92.912417
473	KNFZ492	150-174	ROSE CREEK, CITY OF	24	43.601361	-92.832694
474	WNLK592	450-470	ROSENBERG RICHARD ROSENBERG JEFF DBA ROSENBERG F	64	43.372194	-93.011306
475	WRCD294	450-470	ROTTINGHAUS GRAIN INC.	64	43.123194	-92.795417
476	WNGS438	450-470	Rowan, John	56	44.284139	-93.250222
477	WQTY473	450-470	RUEHLOW, BLAKE	50	43.298611	-92.760278
478	WQSC810	150-174	RUNDE, RONNIE	40	43.486944	-92.611111
479	WQYI475	450-470	RUSSELL AND JORDAN NELSON	32	43.444444	-92.870556
480	WNAK403	450-470	SAINT ANSGAR COMMUNITY SCHOOLS	80	43.382472	-92.919639
481	WQAU815	450-470	SAMARITAN BETHANY INC	32	44.031611	-92.462944
482	WYY356	450-470	SAMPSON, GERALD	72	43.508028	-92.877139
483	WNGG480	450-470	SANFORD USD MEDICAL CENTER	322	43.524972	-96.739222
484	WPCQ731	450-470	SCHAEFER, MARK	48	43.501639	-92.658806
485	WRDT637	450-470	Schams Heifer Express	121	44.278333	-91.843889
486	WNHT444	450-470	SCHERGER, LARRY R	32	44.030250	-92.898806
487	WQTS820	450-470	Schlicter Farms	32	43.593972	-92.780444
488	KXH817	150-174, 450-470	SCHMELING, ROBERT	32	43.864972	-93.000194
489	WQRI683	25-50	SCHMITTY & SONS BUS COMPANY	113	44.620361	-93.296056

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
490	WPJU243	450-470	SCHULTZ FARMS INC	32	43.833028	-92.370722
491	WPBZ649	450-470	SCHWIZER, MERLYN D	64	43.134417	-92.892139
492	WQVA247	450-470	SCOTCH PRAIRIE FARMS LLC	80.4	44.338056	-92.211389
493	WSH917	450-470	Scott, Allan	64	43.720528	-92.703528
494	KAE879	450-470	SENECA FOODS CORPORATION	32	44.007194	-92.459056
495	WQRV582	450-470	SHEELY FARMS	32	43.756417	-92.820528
496	WRDS659	450-470	SHOWALTER, DANIEL	80	43.485000	-92.870278
497	WQJI420	450-470	SIGNATURE FLIGHT SUPPORT	32	43.916861	-92.493528
498	WQUD957	450-470	Simplified Technology Solutions, LLC	32	43.667167	-92.972889
499	WQRV886	450-470	SISKOW FARMS	42	43.575611	-92.510139
500	WPCS262	150-174	SLAICHERT, HARLAN W	56	43.377194	-92.937694
501	KNHQ355	450-470	SOBOLIK, JAMES R	80	43.356917	-92.162667
502	WQQB224	450-470	SOMINN MACHINERY SALES	40	44.023083	-92.851944
503	KNAO871	150-174	SONBERG FARMS LLC	80	43.313028	-92.870472
504	WRDI677	450-470	Southland School District 500	32	43.568139	-92.718222
505	WQRX433	450-470	SPINDLER, MARVIN	32	44.011611	-93.118111
506	WQRZ991	150-174	Spring Valley Street Department	40	43.692194	-92.374333
507	KNIC679	150-174	SPRING VALLEY, CITY OF	72	43.686917	-92.390167
508	WQPC975	450-470	SPRUNG, LEVI	32	43.407778	-92.661111
509	WQNT540	150-174	ST ANSGAR MILLS INC	40	43.378056	-92.917500
510	WRP910	150-174	STACYVILLE COOPERATIVE CO	70	43.436361	-92.781306
511	WQUB919	450-470	STANTON FARMS	32	43.891750	-92.873028
512	WQQT329	450-470	START FARMS INC	32	43.573278	-92.445500
513	WQNV388	450-470	STAUB, CHRIS	32	44.131667	-92.963333
514	WQPE652	800/900	STEELE, COUNTY OF	40	44.109500	-93.199361

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
515	WQPN205	800/900	STEELE, COUNTY OF	40	44.109500	-93.199361
516	WQED612	450-470	STEINKAMP, ALAN	24	43.566000	-92.719194
517	WQZF632	450-470	STENCEL, TODD	80	43.961611	-93.628333
518	WQR701	25-50	STUSSY CONSTRUCTION INC	48	44.068306	-92.755194
519	WQET917	150-174	STUSSY CONSTRUCTION INC.	40	44.077972	-92.755639
520	KD53854	450-470	SUBLINE CORP RIVERFRONT DBA SUBWAY	113	44.149417	-93.979389
521	WQXP568	150-174	Sunopta	40	43.961639	-93.276611
522	WNBB792	150-174	TERPSTRA, ALLAN	64	44.080250	-93.282722
523	WPAP494	450-470	TORRENS, LOREN A	113	43.949972	-92.700194
524	WREJ687	800/900	TPS, INC.	113	44.759306	-93.258222
525	WNAK216	150-174	TRADE MART FURNITURE	32	44.029139	-92.494611
526	WNUS633	450-470	TRITON SCHOOLS	48	44.030250	-92.855750
527	KNBE918	450-470	TROM, LOWELL I	40	43.932472	-92.996583
528	WQCD461	450-470	Twin City Concrete Products	121	44.882361	-93.152944
529	WNMH253	800/900	Twin City Concrete Products, Inc.	113	44.581639	-91.916278
530	WQYC577	450-470	Twin Creek Farms	80	44.071083	-92.897500
531	WPQE372	450-470	TWOHEY, EDWARD	32	43.886361	-92.597667
532	WQDD260	150-174	TWO-WAY COMMUNICATIONS INC	160	44.600000	-91.216667
533	KNJZ613	150-174	Union Pacific Railroad Company	40	44.120194	-93.086667
534	WPTI620	800/900	Upper Iowa Communications	113	43.381639	-92.107417
535	WQSF992	800/900	VERTICAL VENTURES V, LLC	113	44.044722	-92.400278
536	WQSG211	800/900	VERTICAL VENTURES V, LLC	113	44.044722	-92.400278
537	WQWT339	450-470	Vestas American Wind Technology	32	43.436556	-92.783583
538	WQWT339	450-470	Vestas American Wind Technology	40	43.720361	-92.704972
539	WQOS636	450-470	VIKING AUTOMATIC SPRINKLER COMPANY	80	44.043306	-92.528361

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
540	WQWD656	450-470	VOGT, PETER A	32	43.868944	-93.126750
541	WQSY895	150-174	Waage, Brian	32	43.869444	-93.204722
542	WNNJ480	150-174	WAGNER, RODERICK A	40	44.066917	-93.069083
543	WQSB986	450-470	WALERAK BROTHERS FARM	32	43.861583	-92.757000
544	WNYS829	150-174	Wanous, Gary	40	44.037194	-93.145194
545	WPAX372	450-470	WASECA SAND & GRAVEL INC	64	44.001361	-93.417444
546	WQNV333	150-174	WAYNES, JEFFREY	40	43.826528	-93.266139
547	WPPT600	450-470	WELLIK, KEVIN	32	43.838028	-92.474056
548	WQYR274	450-470	WEST UNION TRENCHING LLC	160	42.963556	-91.799028
549	WQSF994	800/900	WIGGINS, WESLEY	113	44.006722	-92.718611
550	WQVP550	150-174	Wigham, Duane	32	43.629222	-92.710722
551	WQSG201	800/900	WILLSON SPECTRUM, LLC	113	44.006722	-92.718611
552	KD50657	150-174	WISCONSIN POWER AND LIGHT COMPANY	241	43.776389	-90.443333
553	WQSA439	150-174	WISPERING PINES FARMS LLC	40	43.925833	-93.004111
554	WQSY954	150-174	XCEL ENERGY SERVICES INC.	80	44.299139	-93.249111
555	WQTD982	450-470	XCEL ENERGY SERVICES INC.	80	44.299139	-93.249111
556	WQXN436	150-174	XCEL ENERGY SERVICES INC.	80	44.299139	-93.249111
557	WQUW918	800/900	Xcel Energy Services, Inc	113	44.623889	-92.636944
558	WPMD814	450-470	YMCA OF AUSTIN	20	43.672750	-92.977139
559	WPIU349	450-470	ZIEGLER INC	143	44.849972	-93.300222
560	WQYU647	450-470	Ziegler Inc	32	43.929528	-92.469722
561	WNKP939	450-470	ZUMBROTA MAZEPPA PUBLIC SCHOOLS DISTRICT 2805	56	44.348028	-92.830194

Table A: Mobile Licenses Intersecting Project Area

Wind Power GeoPlanner™

Off-Air TV Analysis

Pleasant Valley Wind Farm Repower Project



Prepared on Behalf of
Xcel Energy

January 20, 2022



COMSEARCH
A CommScope Company



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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 Pleasant Valley Wind Farm Repower Project wind project in Dodge and Mower Counties, 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.

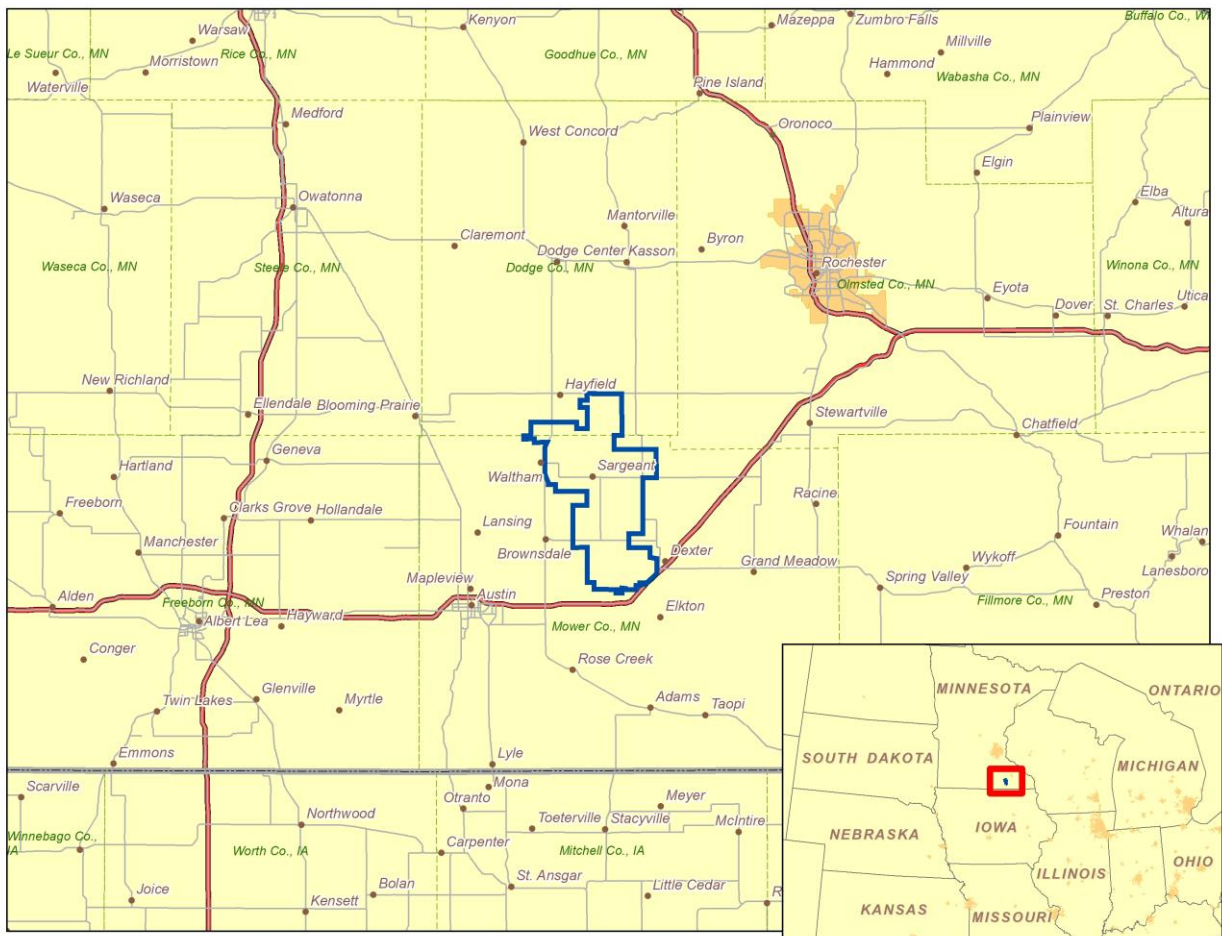


Figure 1: Wind Farm Project Area and Local Communities

To begin the analysis, Comsearch compiled all off-air television stations¹ within 150 kilometers of the proposed turbines. TV stations at a distance of 150 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, on the next page, and a plot depicting their locations is provided in Figure 2. There are a total of 136 database records for stations within approximately 150 kilometers of the proposed turbines. Of these stations, only 83 stations are currently licensed and operating, 56 of which are low-power stations or translators. Translator stations are low-power stations that receive signals from distant 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.

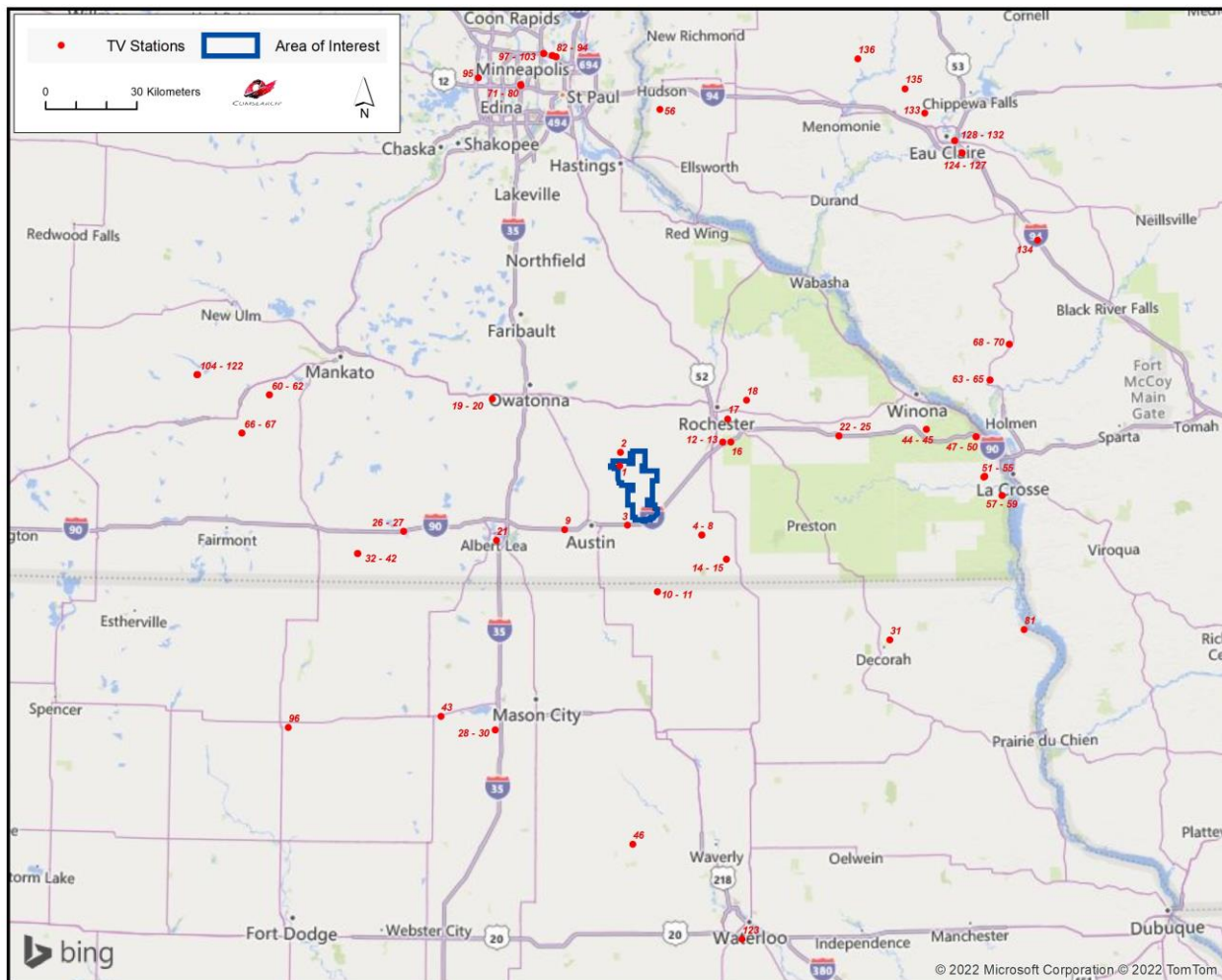


Figure 2: Plot of Off-Air TV Stations within 150 Kilometers of Proposed Turbines

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.

ID	Call Sign	Status	Service ²	Channel	Transmit ERP ³ (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to the Closest Turbine (km)
1	K40JT	CP	LPD	40	15.0	43.848111	-92.861722	1.27
2	W22FD-D	CP	LPD	22	15.0	43.888056	-92.857833	3.71
3	K27OW-D	LIC	LPT	27	5.62	43.672556	-92.830306	4.61
4	KSMQ-TV	APP/STA	DTV	20	319.2	43.642778	-92.526667	17.07
5	KSMQ-TV	LIC	DTV	20	319.2	43.642778	-92.526667	17.07
6	KXLT-TV	LIC	DTV	26	108.0	43.642778	-92.526667	17.07
7	K35PC-D	CP	LPD	35	8.7	43.642778	-92.526667	17.07
8	KAAL	LIC	DTV	36	620.0	43.642778	-92.526667	17.07
9	K30QY-D	CP	LPD	30	15.0	43.659528	-93.086750	23.95
10	KYIN	LIC	DTV	18	533.0	43.475556	-92.708333	24.47
11	KIMT	LIC	DTV	24	472.0	43.475556	-92.708333	24.47
12	K29OE-D	CP	LPD	29	2.0	43.917250	-92.439083	26.71
13	K30RA-D	CP	LPD	30	2.0	43.917250	-92.439083	26.71
14	KTTC	LIC	DTV	10	43.1	43.570833	-92.427222	28.11
15	KTTC	CP	DTV	10	80.0	43.570833	-92.427222	28.11
16	K41MP-D	CP	LPD	41	1.0	43.917444	-92.404333	29.26
17	K31LN-D	CP	LPD	31	4.0	43.986139	-92.417667	30.91
18	K25NK-D	LIC	LPD	25	15.0	44.041139	-92.340417	39.15
19	K21NU-D	CP	LPD	21	5.0	44.045528	-93.384083	45.33
20	K48KJ-D	LIC	LPD	48	4.92	44.045528	-93.384083	45.33
21	K40JT	LIC	LPX	40	10.7	43.627778	-93.363889	45.89
22	K19IT-D	CP	LPD	19	1.0	43.932167	-91.962333	63.76
23	K27KL-D	CP	LPD	27	1.0	43.932167	-91.962333	63.76

² Definitions of service and status codes:

ACA - Analog Class A
DCA - Digital Class A
DRT - Digital Replacement Translator
DT - ETL testing
DTS - Distributed Transmission System
DTV - Full Service Television
DTX - Digital TV Auxiliary
LPA - Low Power Analog TV
LPD - Low Power Digital TV
LPT - Digital TV Translator
LPX - Analog TV Translator
TS - Legacy Service for Analog TV Auxiliary
TV - Analog TV legacy

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
AMD - Amendment

³ ERP = Transmit Effective Radiated Power

ID	Call Sign	Status	Service ²	Channel	Transmit ERP ³ (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to the Closest Turbine (km)
24	K29JH-D	CP	LPD	29	1.0	43.932167	-91.962333	63.76
25	K31KX-D	CP	LPD	31	1.0	43.932167	-91.962333	63.76
26	K23PT-D	CP	LPD	23	5.0	43.652361	-93.742417	72.53
27	K34QZ-D	CP	LPD	34	5.0	43.652361	-93.742417	72.53
28	K22LJ-D	CP	LPD	22	5.0	43.066639	-93.365250	84.19
29	K27MI-D	CP	LPD	27	3.0	43.066639	-93.365250	84.19
30	K35PA-D	CP	LPD	35	15.0	43.066639	-93.365250	84.19
31	K25PE-D	LIC	LPT	25	15.0	43.326667	-91.765833	87.91
32	K14KD-D	LIC	LPD	14	3.0	43.585833	-93.929722	89.23
33	K16MA-D	LIC	LPT	16	3.0	43.585833	-93.929722	89.23
34	K17MX-D	LIC	LPD	17	3.0	43.585833	-93.929722	89.23
35	K19LJ-D	LIC	LPT	19	3.0	43.585833	-93.929722	89.23
36	K21KF-D	LIC	LPD	21	3.0	43.585833	-93.929722	89.23
37	K23FY-D	LIC	LPT	23	3.0	43.585833	-93.929722	89.23
38	K27FI-D	LIC	LPT	27	3.0	43.585833	-93.929722	89.23
39	K29IF-D	LIC	LPD	29	3.1	43.585833	-93.929722	89.23
40	K31EF-D	LIC	LPT	31	3.0	43.585833	-93.929722	89.23
41	K34NV-D	LIC	LPT	34	3.0	43.585833	-93.929722	89.23
42	K35IU-D	LIC	LPT	35	3.0	43.585833	-93.929722	89.23
43	KAAL	LIC	DRT	33	8.3	43.105917	-93.585361	92.21
44	K24JA-D	CP	LPD	24	0.05	43.947806	-91.604028	92.37
45	K25LC-D	CP	LPD	25	0.05	43.947806	-91.604028	92.37
46	K17MH-D	LIC	LPD	17	11.7	42.729167	-92.811389	107.13
47	W32DW-D	CP	LPD	32	1.0	43.923306	-91.400389	108.10
48	W34EB-D	CP	LPD	34	1.0	43.923306	-91.400389	108.10
49	W45DM-D	CP	LPD	45	1.0	43.923306	-91.400389	108.10
50	W46EP-D	CP	LPD	46	1.0	43.923306	-91.400389	108.10
51	WEAU	LIC	DRT	30	15.0	43.804444	-91.372167	108.43
52	WLAX	LIC	DTV	33	1000.0	43.804444	-91.372167	108.43
53	WHLA-TV	LIC	DTV	15	400.0	43.805083	-91.368083	108.77
54	WXOW	LIC	DTV	28	251.0	43.806389	-91.367500	108.83
55	W34FC-D	LIC	LPT	34	15.0	43.806389	-91.367500	108.83
56	W19EN-D	LIC	LPT	19	6.0	44.902778	-92.691111	113.67
57	KQEG-CD	STA	DCA	23	2.25	43.747861	-91.298500	114.02
58	WZEO-LD	CP	LPD	26	15.0	43.747861	-91.298500	114.02
59	KQEG-CA	LIC	DCA	23	15.0	43.748056	-91.297500	114.10
60	K25QC-D	CP	LPD	25	7.5	44.051500	-94.299972	115.61
61	K43JE-D	AMD	LPD	25	7.5	44.051500	-94.299972	115.61
62	K43JE-D	LIC	LPD	43	10.82	44.051500	-94.299972	115.61
63	WKBT-DT	CP	DTV	8	38.7	44.091111	-91.338056	116.55
64	WKBT-DT	LIC	DTV	8	25.7	44.091111	-91.338056	116.55
65	W19DP-D	CP	LPD	19	15.0	44.091111	-91.338056	116.55

ID	Call Sign	Status	Service ²	Channel	Transmit ERP ³ (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to the Closest Turbine (km)
66	KMNF-LD	LIC	LPT	7	3.0	43.936750	-94.410833	122.87
67	KEYC-TV	LIC	DTV	12	52.7	43.936944	-94.410833	122.87
68	W28DT-D	CP	LPD	28	1.0	44.194694	-91.255611	126.23
69	W21DC-D	CP	LPD	21	1.0	44.194667	-91.255417	126.24
70	W22DT-D	CP	LPD	22	0.5	44.194667	-91.255417	126.24
71	WUMN-LD	LIC	LPD	21	15.0	44.973583	-93.270500	126.84
72	K14RB-D	LIC	LPD	14	15.0	44.976111	-93.272500	127.15
73	KWJM-LD	LIC	LPD	15	15.0	44.976111	-93.272500	127.15
74	KMBD-LD	LIC	LPD	20	3.0	44.976111	-93.272500	127.15
75	KJNK-LD	LIC	LPD	25	15.0	44.976111	-93.272500	127.15
76	KJNK-LD	STA	LPT	25	1.0	44.976111	-93.272500	127.15
77	KJNK-LD	LIC	LPT	25	15.0	44.976111	-93.272500	127.15
78	KJNK-LD	STA	LPT	25	1.0	44.976111	-93.272500	127.15
79	K33LN-D	LIC	DCA	33	15.0	44.976111	-93.272500	127.15
80	KMQV-LD	LIC	LPD	36	15.0	44.976111	-93.272500	127.15
81	K31NJ-D	LIC	LPT	31	15.0	43.349722	-91.221111	127.25
82	KMSP-TV	CP	DTV	9	36.2	45.058333	-93.124444	133.18
83	KMSP-TV	LIC	DTV	9	30.0	45.058333	-93.124444	133.18
84	KTCI-TV	LIC	DTV	23	325.0	45.058333	-93.124444	133.18
85	WFTC	LIC	DTV	29	1000.0	45.058333	-93.124444	133.18
86	KTCA-TV	LIC	DTV	34	662.0	45.058333	-93.124444	133.18
87	WUCW	LIC	DTV	22	1000.0	45.062222	-93.139444	133.83
88	KSTP-TV	LIC	DTV	35	755.0	45.062222	-93.139444	133.83
89	KSTP-TV	CP	DTV	35	1000.0	45.062222	-93.139444	133.83
90	KSTC-TV	LIC	DTV	30	1000.0	45.062500	-93.139444	133.86
91	KSTC-TV	STA	DTV	30	716.0	45.062500	-93.139444	133.86
92	KSTC-TV	CP	DTV	30	1000.0	45.062500	-93.139444	133.86
93	KARE	LIC	DTV	31	1000.0	45.062500	-93.139444	133.86
94	WCCO-TV	LIC	DTV	32	1000.0	45.062500	-93.139444	133.86
95	KKTW-LD	LIC	LPD	19	8.75	44.995583	-93.449056	133.94
96	KDIT-LD	LIC	LPD	17	0.5	43.068056	-94.202500	134.23
97	KTCJ-LD	CP	LPD	13	3.0	45.068639	-93.176417	135.14
98	KHVM-LD	CP	LPD	18	15.0	45.068639	-93.176417	135.14
99	WDMI-LD	CP	LPD	26	15.0	45.068639	-93.176417	135.14
100	WDMI-LD	STA	LPD	26	1.0	45.068639	-93.176417	135.14
101	WDMI-LD	LIC	LPD	31	15.0	45.068639	-93.176417	135.14
102	KHVM-LD	LIC	LPD	48	15.0	45.068639	-93.176417	135.14
103	KTCJ-LD	LIC	LPD	50	15.0	45.068639	-93.176417	135.14
104	K14KE-D	LIC	LPD	14	2.0	44.106944	-94.595833	140.04
105	K26CS-D	LIC	LPT	26	1.7	44.106944	-94.595833	140.04
106	K28OH-D	LIC	LPD	28	0.5	44.106944	-94.595833	140.04
107	K30FN-D	LIC	LPD	30	2.0	44.106944	-94.595833	140.04

ID	Call Sign	Status	Service ²	Channel	Transmit ERP ³ (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to the Closest Turbine (km)
108	K32GX-D	LIC	LPD	32	1.2	44.106944	-94.595833	140.04
109	K34JX-D	LIC	LPD	34	2.0	44.106944	-94.595833	140.04
110	K16CG-D	LIC	LPD	16	1.8	44.107778	-94.598889	140.30
111	K17MW-D	LIC	LPD	17	0.5	44.107778	-94.598889	140.30
112	K18NE-D	LIC	LPT	18	0.6	44.107778	-94.598889	140.30
113	K19LI-D	LIC	LPD	19	0.5	44.107778	-94.598889	140.30
114	K20LP-D	LIC	LPD	20	1.3	44.107778	-94.598889	140.30
115	K21DG-D	LIC	LPD	21	1.2	44.107778	-94.598889	140.30
116	K22MQ-D	LIC	LPD	22	0.5	44.107778	-94.598889	140.30
117	K23MF-D	LIC	LPD	23	1.8	44.107778	-94.598889	140.30
118	K24JV-D	LIC	LPD	24	1.8	44.107778	-94.598889	140.30
119	K24JV-D	CP	LPD	24	0.35	44.107778	-94.598889	140.30
120	K29IE-D	LIC	LPT	29	3.0	44.107778	-94.598889	140.30
121	K31KV-D	LIC	LPD	31	1.8	44.107778	-94.598889	140.30
122	K35KI-D	LIC	LPD	35	1.8	44.107778	-94.598889	140.30
123	K44FK	LIC	LPX	44	9.1	42.445833	-92.375000	141.87
124	W19DJ-D	CP	LPD	19	1.0	44.762806	-91.435444	145.15
125	W29DQ-D	CP	LPD	29	1.0	44.762806	-91.435444	145.15
126	W30EN-D	CP	LPD	30	1.0	44.762806	-91.435444	145.15
127	W31DN-D	CP	LPD	31	1.0	44.762806	-91.435444	145.15
128	W14ER-D	CP	LPD	14	0.5	44.800000	-91.465833	146.23
129	WBDL-LD	LIC	LPT	18	15.0	44.800000	-91.465833	146.23
130	WEAU	APP	DRT	24	15.0	44.800000	-91.465833	146.23
131	WQOW	LIC	DTV	25	253.0	44.800000	-91.465833	146.23
132	W33DH-D	LIC	LPD	33	15.0	44.800000	-91.465833	146.23
133	W23FC-D	LIC	LPD	23	15.0	44.882917	-91.587083	146.39
134	W46EQ-D	CP	LPD	46	1.0	44.501222	-91.128806	148.53
135	WEUX	LIC	DTV	21	600.0	44.956667	-91.667778	148.84
136	WHWC-TV	LIC	DTV	27	400.0	45.046917	-91.863222	148.88

Table 1: Off-Air TV Stations within 150 Kilometers of Proposed Turbines

3. Impact Assessment

Based on a contour analysis of the licensed stations within 150 kilometers of the Pleasant Valley Wind Farm Repower Project, it was determined that seven of the full-power digital stations, identified below in Table 2, along with three low-power digital stations, may have their reception disrupted in and around the project. The areas primarily affected would include TV service locations within 10 kilometers of the turbines 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 (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to the Closest Turbine (km)
3	K27OW-D	LIC	LPT	27	5.62	43.672556	-92.830306	4.61
5	KSMQ-TV	LIC	DTV	20	319.2	43.642778	-92.526667	17.07
6	KXLT-TV	LIC	DTV	26	108.0	43.642778	-92.526667	17.07
8	KAAL	LIC	DTV	36	620.0	43.642778	-92.526667	17.07
10	KYIN	LIC	DTV	18	533.0	43.475556	-92.708333	24.47
11	KIMT	LIC	DTV	24	472.0	43.475556	-92.708333	24.47
14	KTTC	LIC	DTV	10	43.1	43.570833	-92.427222	28.11
18	K25NK-D	LIC	LPD	25	15.0	44.041139	-92.340417	39.15
20	K48KJ-D	LIC	LPD	48	4.92	44.045528	-93.384083	45.33
64	WKBT-DT	LIC	DTV	8	25.7	44.091111	-91.338056	116.55

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

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 station mentioned above, especially those that would have line-of-sight to at least one wind turbine but not to the 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

For questions or information regarding the Off-Air TV Analysis, please contact:

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Pleasant Valley Wind Project

Xcel Energy

Dodge and Mower Counties, Minnesota

Microwave Path Analysis

June 19, 2020



Capitol Airspace Group

capitolairspace.com

(703) 256 - 2485



Summary

Capitol Airspace conducted a microwave path analysis for the Pleasant Valley wind project in Dodge and Mower Counties, Minnesota. The purpose for this analysis was to identify licensed and applied coordinated non-federal microwave paths that could limit increasing the rotor diameter of 95-meter hub height wind turbines from 100 to a maximum of 120 meters. At the time of this analysis, 100 wind turbine locations (black points, **Figure 1**) had been identified for repowering. This analysis assessed each location (including its rotor-swept volume) to determine if it could obstruct Fresnel zones associated with microwave paths in proximity to the Pleasant Valley wind project.

Point-to-point microwave transmission is a critical component of the national communications infrastructure. Microwave paths enable broadband data transmission that supports telephone, cellular, and personal communication service (PCS) networks, wireless internet providers, audio and video transmission from television studios to transmitter sites, as well as many other industry and utility applications. In order to ensure signal reliability, these paths are sited to avoid any line-of-sight obstructions. Proposed structures that create a line-of-sight obstruction can degrade signal reliability and could require revisions to the microwave system.

Five microwave links (blue and pink, **Figure 1**) overlie the Pleasant Valley wind project. However, none of the proposed locations would be located within the associated Fresnel zones. As a result, increasing the rotor diameter of existing wind turbines to a maximum of 120 meters should not impact any applied or licensed non-federal microwave links.

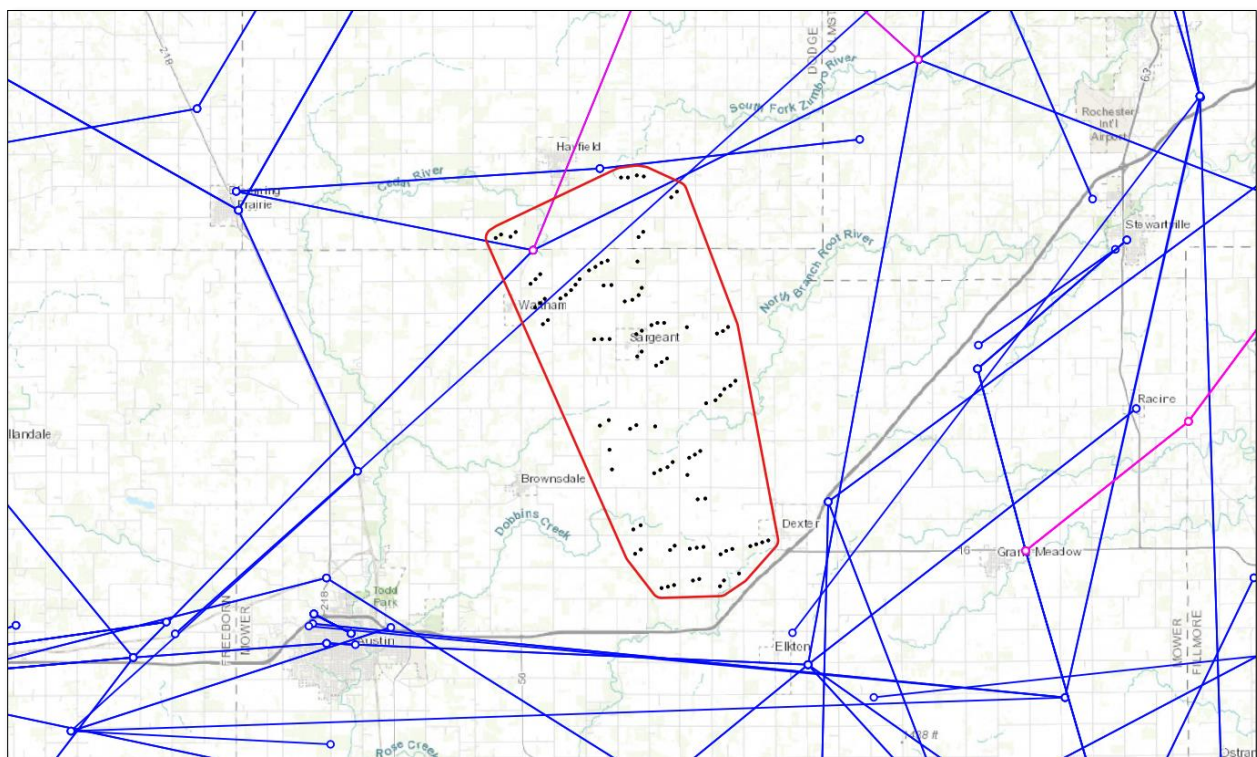


Figure 1: Licensed (blue) and applied (pink) microwave paths in proximity to the Pleasant Valley wind project

Capitol Airspace maintains a database obtained from the FCC which is updated on a daily basis. The results of this analysis are based on FCC data available as of the date of this report.



Methodology

Capitol Airspace studied the proposed project based upon location information provided by Xcel Energy. Using this information, Capitol Airspace used a Geographic Information System (GIS) to determine proximity to both licensed and applied coordinated non-federal microwave paths contained in the Federal Communication Commission (FCC) Universal Licensing System (ULS) database.

This analysis considers impact on microwave paths resulting from the physical blockage of the first Fresnel zone (*Figure 2*). The first Fresnel zone is a three-dimensional volume whose radius at a given point is calculated using the path frequency and distance from the transmitting and receiving antennas. The Fresnel zone radius is largest at the path midpoint (where $d_1 = d_2$). Lower frequencies result in larger Fresnel zone radii for a given path and are typically associated with longer paths. Higher frequencies result in smaller Fresnel zone radii for a given path and are typically associated with shorter paths.

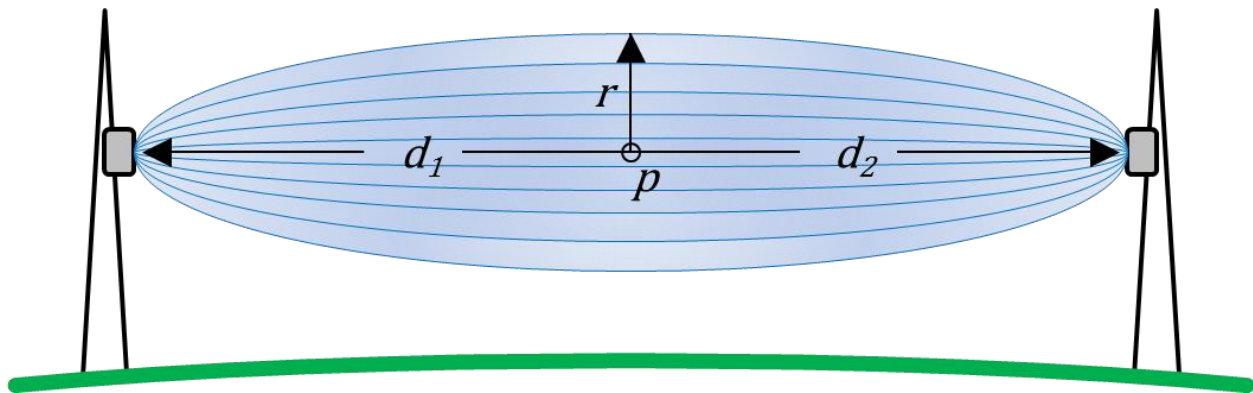


Figure 2: Fresnel zone example

In many cases, ULS database microwave transmitter and receiver antenna locations are inaccurate (e.g. *Figure 3*). Available satellite and aerial imagery were used to improve the coordinates for locations associated with microwave paths in proximity to the defined study area.



Figure 3: Example of using aerial imagery to correct erroneous ULS database antenna location



Findings

Nine paths associated with five microwave links overlie the Pleasant Valley wind project ([Table 1](#) & [Figure 4](#)).

Licensee	Call Sign	Path	Status	Transmitter	Receiver	Frequency (MHz) ¹
KAAL-TV, LLC	KPH213	2	Licensed	BYRON RELAY	MYRTLE TOWER	2086
Minnesota WiFi	WQXF431	7	Applied	KASSON	HAYFIELD ARM	10995
	WRF5599	1	Licensed	HAYFIELD ARM	KASSON	11485
Minnesota, State of	WNTP952	3	Licensed	Hayfield	Rock Dell	6093
	WQIH488	1	Licensed	Rock Dell	Hayfield	6345
	WQIK762	3	Licensed	Hayfield	Oakland Woods	6005
	WQIK790	7	Licensed	OAKLAND WOOD	Hayfield	6257
STEELE, COUNTY OF	WQRK858	1	Licensed	BLOOMING PRAIRIE	HAYFIELD	6286
	WQRK859	1	Licensed	HAYFIELD	BLOOMING PRAIRIE	6034

Table 1: Microwave paths with Fresnel zones overlying the Pleasant Valley wind project

Conclusion

The results of this analysis indicate that nine paths associated with five microwave links overlie the Pleasant Valley wind project. However, none of the proposed wind turbines (including their rotor-swept volume) are located within the associated Fresnel zones (green, [Figure 4](#)). As a result, increasing the rotor diameter of existing wind turbines from 100 to 120 meters should not create a line-of-sight obstruction for any licensed or applied non-federal microwave links.

If you have any questions regarding the findings of this study, please contact [James Scott](#) or [Candace Childress](#) at (703) 256-2485.

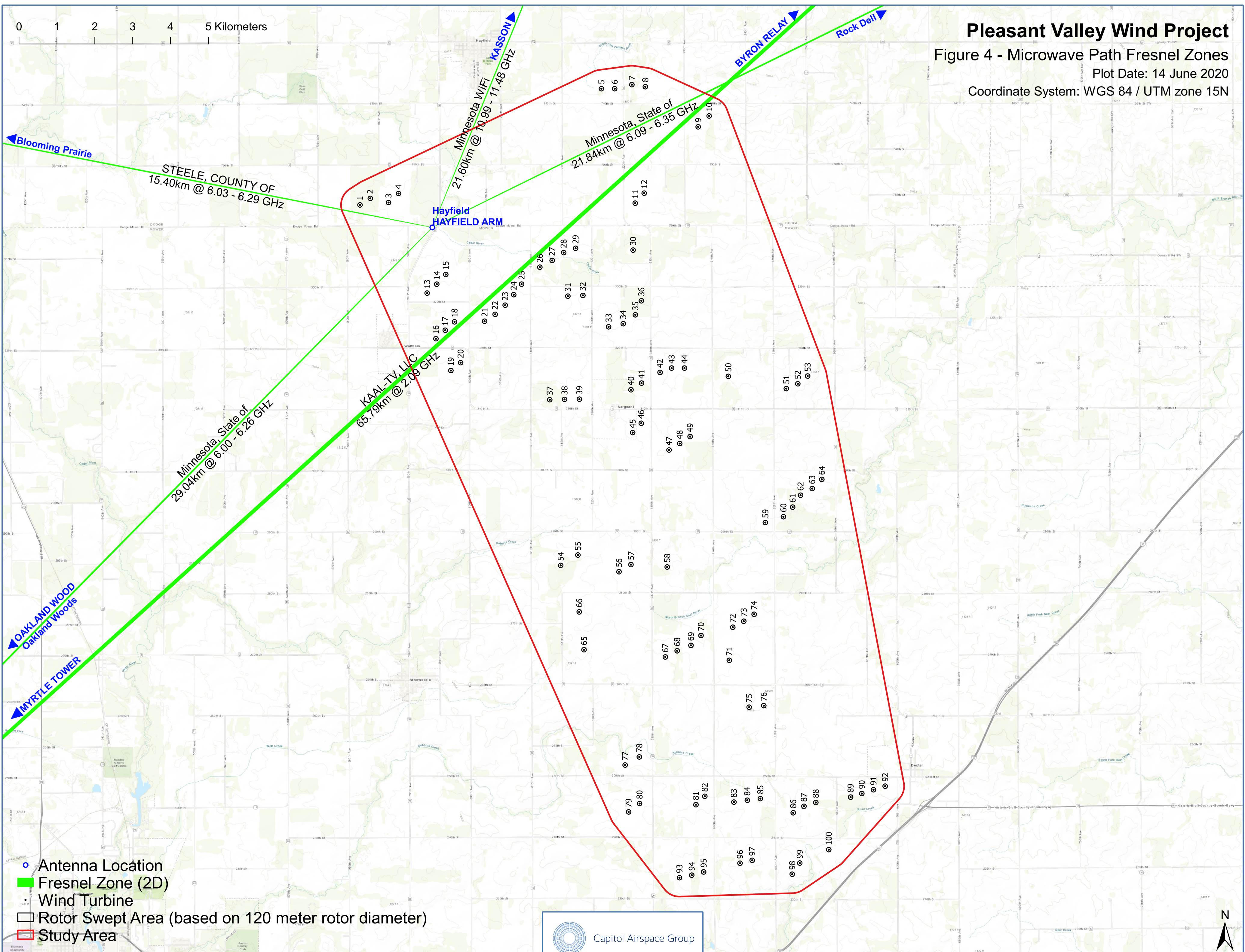
¹ Microwave paths may be licensed to operate using more than one frequency. For the purposes of calculating Fresnel zone radii, the lowest frequency was used to create the largest Fresnel zone.

Pleasant Valley Wind Project

Figure 4 - Microwave Path Fresnel Zones

Plot Date: 14 June 2020

Coordinate System: WGS 84 / UTM zone 15N



0 1 2 3 4 5 Kilometers

Blooming Prairie

STEELE, COUNTY OF
15.40km @ 6.03 - 6.29 GHz

Minnesota, State of
29.04km @ 6.00 - 6.26 GHz

KAAI-TV, LLC
65.79km @ 2.09 GHz

Minnesota, State of
21.60km @ 10.99 - 11.48 GHz

Minnesota, State of
21.84km @ 6.09 - 6.35 GHz

KASSON

BYRON RELAY

Rock Dell

OAKLAND WOOD
Oakland Woods

MYRTLE TOWER

- Antenna Location
- Fresnel Zone (2D)
- Wind Turbine
- Rotor Swept Area (based on 120 meter rotor diameter)
- Study Area

