

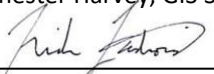



Palmers Creek Wind Project Microwave Beam Study

Granite Falls, MN

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Report Update

EAPC bears no responsibility to update this report for any changes occurring subsequent to the final issuance of this report.

Revision History

Revision No.	Revision Purpose	Date	Revised By
0	Original	10/15/2016	C. Harvey
1	Revised WTG Layout	2/21/2018	C. Harvey

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1. INTRODUCTION

EAPC mapped the locations of microwave beam paths proximate to the Palmers Creek Wind Project site north of Granite Falls, Minnesota. Microwave beams are used by commercial and public service entities to transmit communications over long distances. Beam paths are the straight-line vectors along which microwave signals pass from one microwave dish (typically mounted on a tower) to another dish. Any interruption to a microwave beam could cause disturbances to the microwave service carrier. As a standard practice, EAPC Wind recommends avoiding any potential disturbances to microwave beams when planning a wind farm layout. Defining an exclusion zone consisting of the maximum beam width and a buffer of at least the wind turbine blade length insures that no communications interference results from installed turbines. Developers are also encouraged to consider how the location of cranes and turbine components during turbine installation may affect microwave beam transmission.

This study does not identify unlicensed microwave paths or federal government paths that are not registered with the FCC (such as DOD and Homeland Security).

2. METHODOLOGY

Microwave transmissions are regulated by the FCC, and records of the locations of all operating transmitters and receivers are publically available. EAPC mapped the straight-line vectors between associated transmitters and receivers using an azimuthal map projection centered on the southwest end of the study area, where a number of microwave antennas are located. Beams with frequencies between 800 and 60,000 Mhz were mapped.

EAPC then calculated the maximum beam width which cannot be obstructed while maintaining normal operation of microwave communications. This is defined as the maximum radius of the 1st Fresnel zone, which is a parabolic zone with endpoints at the transmitter and receiver, and whose widest point is at the midpoint of the beam. The maximum radius of the 1st Fresnel zone is calculated based on the frequency of microwave transmission and the overall length of the beam, according to the formula:

$$r = 8.657 \sqrt{\frac{D}{f}}$$

where r = radius in meters, D = beam length in kilometers, and f = transmission frequency in gigahertz. Beam paths were offset by this radius along their entire length. This arrives at a slight overestimate of unobstructable space as it does not account for the taper of the 1st Fresnel zone radius at either end of the beam.

In addition to providing a 1st Fresnel zone offset, EAPC provides an additional 58 m offset for each beam representing the blade sweep of the GE wind turbine model with a 116 m rotor diameter that is proposed for this project. A wind turbine of this size would need to be sited outside this offset area in order to avoid interference with the 1st Fresnel zone. Smaller-sized turbines could potentially be located closer, but EAPC highly recommends siting turbines with an additional several blade-lengths of margin to avoid interference associated with construction operations and account for error in microwave beam location. EAPC mapped microwave beam location based on coordinates provided by the FCC public record, and did not ground-truth or correct the location of transmitters or receivers based on aerial photography. As-built locations of transmitters and receivers may differ slightly from licensed positions, and should be verified before final wind turbine layout and construction.

3. RESULTS

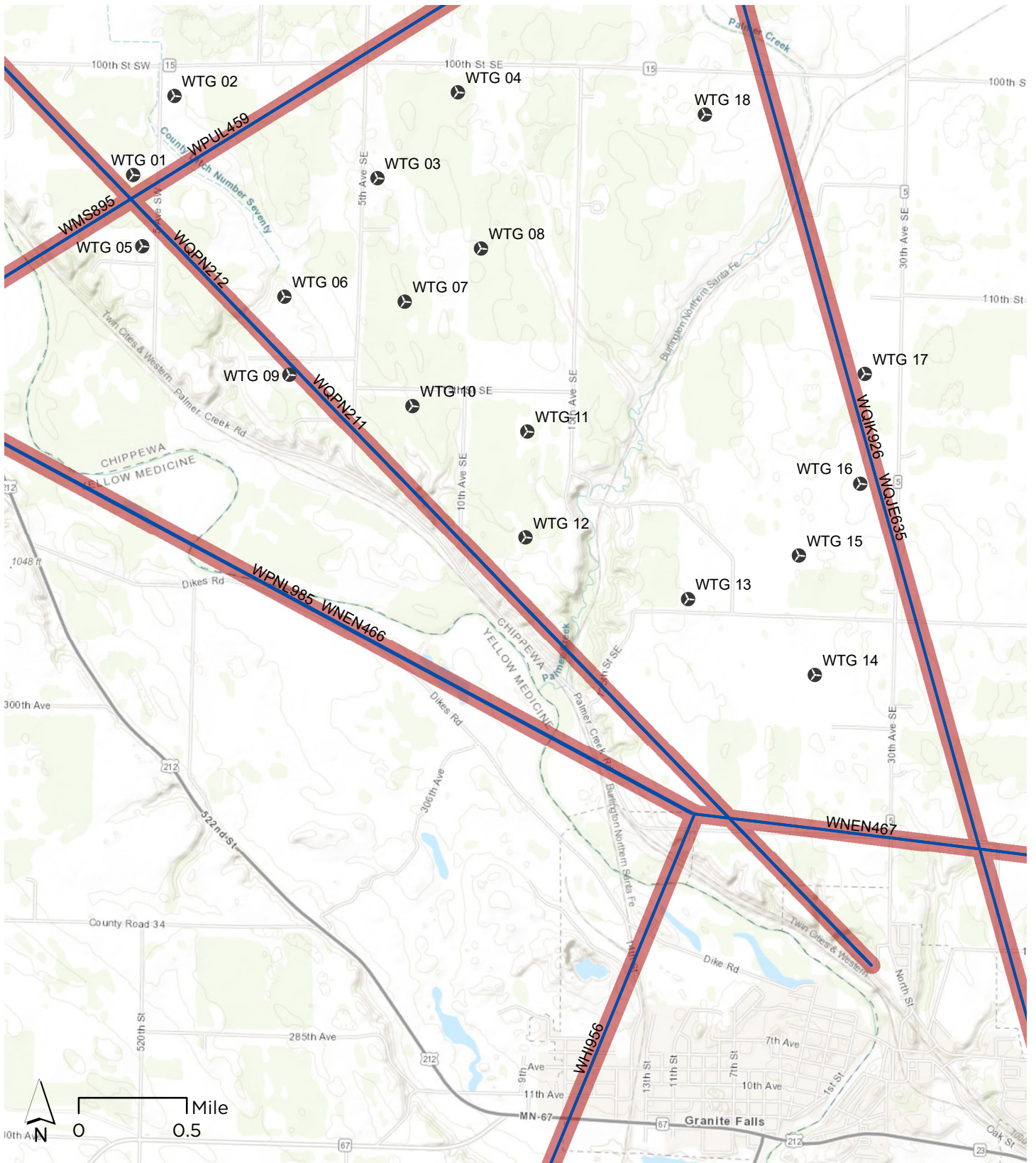
All but one of the WTG sites provided by the client fall outside the recommended buffers from microwave beams crossing the project area. WTG 9 is located slightly within (~5') the recommended buffer from WQPN211. Information about each of the 20 microwave beam paths passing within one mile of the project area is summarized in Table 1. Redundant call sign and path number combinations are reflective of multiple listings in the FCC database and may be due to multiple transmission frequency assignments or other characteristics.

A map of the microwave beam paths is included in Appendix A.

Table 1: Microwave beams passing within one mile of the project area and their controlling entities.

Call Sign	Path Number	Controlling Entity	Entity City	Entity Telephone
WHI956	2	East River Electric Power Cooperative	Madison, SD	(605) 256-4536
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WMS895	7	New Cingular Wireless PCS, LLC	Richardson, TX	(972) 234-7003
WMS895	4	New Cingular Wireless PCS, LLC	Richardson, TX	(972) 234-7003
WNEN466	2	East River Electric Power Cooperative	Madison, SD	(605) 256-4536
WNEN466	1	East River Electric Power Cooperative	Madison, SD	(605) 256-4536
WNEN466	3	East River Electric Power Cooperative	Madison, SD	(605) 256-4536
WNEN467	1	East River Electric Power Cooperative	Madison, SD	(605) 256-4536
WPNL985	1	East River Electric Power Cooperative	Madison, SD	(605) 256-4536
WPNL985	1	East River Electric Power Cooperative	Madison, SD	(605) 256-4536
WPUL459	3	New Cingular Wireless PCS, LLC	Richardson, TX	(972) 234-7003
WPUL459	1	New Cingular Wireless PCS, LLC	Richardson, TX	(972) 234-7003
WQIK926	4	Minnesota, State of	Saint Pail, MN	(651) 234-7973
WQJE635	3	Minnesota, State of	Saint Pail, MN	(651) 234-7973
WQPN211	1	Verizon Wireless (VAW) LLC	Alpharetta, GA	(770) 797-1070
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WQPN211	1	Verizon Wireless (VAW) LLC	Alpharetta, GA	(770) 797-1070
WQPN212	2	Verizon Wireless (VAW) LLC	Alpharetta, GA	(770) 797-1070
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WQPN212	2	Verizon Wireless (VAW) LLC	Alpharetta, GA	(770) 797-1070
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Appendix A: Map of microwave beams intersecting the project area



Palmers Creek Wind Project - Granite Falls, MN

Microwave Beam Study

- Proposed WTG Site
- Microwave Beam Path
- Recommended Buffer from Beam Path

