



**Engineering Statement  
Prepared for Dane County  
Re:  
Proposed WBKY Tower Site #2157  
Township of Rutland  
  
Application for CUP**

**January 25, 2011**

**Prepared by:**

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**Engineering Statement  
Prepared for Dane County**

**Re:  
Proposed WBKY Tower Site #2157  
3768 Old Stage Road  
Township of Rutland**

**I. BACKGROUND**

This engineering report has been prepared by Ralph E. Evans, of Evans Associates Communications Consultants in Thiensville, Wisconsin, regarding a proposed 488-foot guyed lattice antenna structure and equipment shelter to be located in the Township of Rutland in Dane County, Wisconsin. The tower will be located on property owned by Stoughton Farms, Incorporated on a 15.5 acre parcel of land in the southeast corner of the property. The tower will be adjacent to a gravel pit, tucked into a grove of trees nearly equidistant from Old Stage road, North Union Road, Union-Dane Road, and Shady Willow Road. It is approximately 1800' from the nearest side road, a private drive servicing the gravel pit.

Evans Associates has been retained to evaluate the tower proposal from the standpoint of radio engineering and coverage necessity. Pursuant to our employment, this statement has been prepared.

The siting information utilized in the instant analysis has been provided to Evans Associates by Magnum Communications and the Dane County Division of Zoning. This information has been checked and updated using Evans' databases and software programs. The combined information has been used in evaluating the structure at this proposed location with respect to Dane County's Zoning Ordinance.

Magnum Communications is the licensee of Class A FM station WBKY, previously assigned to Portage, Wisconsin, but which is currently in the process of reassignment and relocation to Stoughton, Wisconsin in Dane County. Dane County's Tower Ordinance entitled *PROCEDURE AND STANDARDS FOR THE PLACEMENT, CONSTRUCTION OR MODIFICATION OF COMMUNICATION TOWERS* has provided the template for the engineering evaluation. The analysis and the conclusions contained herein have been prepared by or under the direction of Ralph Evans, of Evans Associates. Information provided to Evans Associates by other parties is believed to be correct, and has been verified where feasible.

**II. ABSTRACT**

Obtaining local approval to construct the tower site is the final step in WBKY's quest to move and improve its underutilized facility (according to the applicant, the 60 db service contour population would increase from 62,943 persons to 233,071 persons<sup>1</sup>, and Stoughton would obtain its first FM

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<sup>1</sup> Evans' analysis shows similar, but not exactly the same populations of 48,512 and 213,585 persons respectively.

transmission service). This is a substantial facility improvement, and it is consistent with the FCC's mandate that licensees maximize their facilities to the greatest extent possible to serve underrepresented communities. However, the final construction application is a matter for local zoning and planning authorities to consider. According to the code, the applicant must address a public interest evaluation showing the balance between the environmental and visual impact of the tower compared to other positive and mitigating factors. As the below discussion affirms, Evans Associates is of the opinion that a grant of the Magnum application is in the public interest, and is respectful of environmental impact factors consistent with other installations of this type.

Broadcast radio facilities are mandated by the FCC to serve their cities of license. Depending upon the programming format used on the station, such service usually takes the form of entertainment, news and local public safety information delivered to the licensed community and the surrounding area. Weather information and school closings are examples of typical public safety broadcasts. Other aural services assigned to Madison or other communities would not usually exhibit a local Stoughton focus. The proposed construction of the broadcast facility appears to have met the public interest requirements of the FCC, the FAA, the Wisconsin Bureau of Aeronautics, and the Environmental Protection Agency<sup>2</sup>.

Accordingly, this document provides information that may be used to weigh land use and other environmental considerations, including the visual impact of a 488' tower. The proposed site has been analyzed carefully from the standpoints of regulatory history, service necessity and availability of alternative sites. The conclusions reached herein represent the most complete engineering evaluation Evans is able to perform. This document and the attached exhibits are true and accurate to the best knowledge and belief of Evans Associates.

### **III. SITE ANALYSIS**

The following paragraphs represent our analysis of Magnum's application for a guyed antenna supporting structure in the Township of Rutland near Brooklyn, Wisconsin.

#### **#1 Validation of RF Information**

The proposed site utilizes an FM antenna that will be mounted near the top of the tower, representing full omnidirectional coverage. The antenna height proposed has been requested by Magnum in order to "fill in" behind hills and avoid multipath distortion, which, in this engineer's experience, is a challenge for "high definition" (IBOC) digital FM radio channels<sup>3</sup>. The Longley-Rice study of Figure 2 shows the area (red) that would receive broadcast-quality digital radio within the "Grade A" (city grade) contour. Even at the proposed height of 488', some degradation of signal is shown at the edges of the city grade contour by the yellow areas at the periphery.

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<sup>2</sup> Administered by the FCC with regard to environmental impact and radio intensity levels.

<sup>3</sup> Magnum may not initially utilize IBOC technology, but competitive pressure will mandate its use in two or three years.

According to the applicant, the tower will be built with sufficient strength to ensure suitability for additional co-locators. It should be noted that the County's ordinance requires four additional co-locators, a figure that is not specifically mentioned by Magnum with reference to particular antenna weight and wind loading. This observation is further discussed in the "*Recommendations*" section of this document. Because of the topology of the area, the proposed tower would provide a unique opportunity for other wireless networks to supply high-reliability services, such as land mobile radio and broadband Internet. Relatively taller structures are required to serve areas behind hills, in buildings and through dense trees.

To evaluate the effect of shorter towers than that proposed, Evans ran propagation analyses at 315' and 400' in addition to the proposed height of 488 feet. In Magnum's opinion, the maximum height represents the minimum that will achieve the required technical objectives. The attached propagation maps show the effect of decreasing tower height, and paragraph III-5 shows the relative population associated with each. While the 315'<sup>4</sup>, 400' and 488' maps show definite differences in coverage, it certainly may be argued that the difference in performance between a tower of an intermediate height, say 450', would be minor compared to that at 488'. However, the differential visual impact would be minor as well, thereby achieving a dubious benefit.

Figure 1, attached, shows the area within which the tower may be located according to the FCC's allocation and city coverage rules. There are no known FCC registered towers within this area, the closest being only 200' high and outside of the siting window. It should be noted that cell towers under 200 feet do not require FCC registration.

## **#2 RF Considerations**

The proposed site will meet FCC RF exposure requirements with respect to the general population, and will not interfere with public safety radio networks as long as industry-standard equipment is used and good engineering practices are followed during construction. FCC rules require that a tower climbing power-down procedure be put in place during antenna maintenance. It is suggested that the applicant's OET 65 (RF exposure) procedure be supplied for the record.

Accordingly, with the RF energy standards utilized in the evaluations by this consultant, and as per previous concurring opinions from the Medical College of Wisconsin, it is concluded that there is no credible concern related to RF health risks with respect to the described site as long as the industry standard construction practices are followed.

## **#3 Alternative Ways of Addressing a Particular Service Area Void**

In the search area defined by Magnum, there appears to be no clearly superior alternative location for this tower. Moving the site south would be disadvantageous because it would reduce the population served. Moving northeast may be problematical because of increased residential density.

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<sup>4</sup> Lower towers than 315' would reduce the coverage of the station below the FCC's full Class A designation.

Evans has rechecked the Magnum search area map, and the result is shown in Figure 1. The proposed site is located at the northwestern boundary of the area (see Section #9 of this report). It is the intent of the County's Ordinance to populate the county with the minimum number of structures by requiring co-location. Since there are several Internet, cell and PCS providers in the Dane County area, additional providers could be expected to co-locate at this proposed site, especially as wireless Internet services become more prevalent. The tower will be placed near a gravel pit, and partially shielded by trees. In this engineer's opinion, it probably would be difficult to replicate this confluence of factors within the remainder of the siting area.

It should also be noted that this location could be an excellent site for other public safety and Internet initiatives known to be proceeding in Dane County. While such use cannot be guaranteed, it is suggested that the Sheriff's Communications Committee and the State Patrol be made aware of the existence of the tower if it is constructed.

#### **#4 Conformance to Industry Standards**

The proposed site has received clearance from the FAA and from the Wisconsin Department of Transportation, Bureau of Aeronautics.

Assuming no serious malfunction of either transmitters or land mobile radio receivers, interference to public safety or other RF services is not expected. In any case, all transmitters and receivers located at common sites should observe good engineering practice with respect to tower bonding and grounding.

#### **#5 Proposed Height Verification**

As per the above discussion, the tower height is dictated by the antenna height necessary for reliable coverage, which is influenced by topography and "look angle." This proposal appears to be reasonable at 488 feet above ground level, considering that Magnum intends to accommodate additional carriers, and desires to service the maximum possible number of listeners. The affectivity of the tower height can be seen in the following population table vs. tower height:

<b>Facility</b>	<b>Contour</b>	<b>Population</b>	<b>Housing Units</b>
<b>WBKY Existing</b>	60 db	48,512	22,956
<b>WBKY Proposed 489'</b>	60 db	213,585	86,517
<b>WBKY 400' Tower</b>	60 db	202,303	81,739
<b>WBKY 315' Tower</b>	60 db	195,731	79,575

These figures were determined by Evans Associates. The 60 db service contour represents the minimum signal that will yield good stereo audio and relatively artifact-free digital signals.

## **#6 Response to Nearby Residents' Questions**

An objection to the new tower has been received from adjacent landowner Jessica Hutson Polakowski. Ms. Polakowski states that she learned of the proposed tower after closing on their land on September 7, 2010<sup>5</sup>. Several alleged deficiencies are listed in the written objection, as follows:

### **1. Insufficient “fall down” radius.**

*Evans is a radio frequency engineer, not a tower engineer, although we can offer our opinion concerning structural integrity based upon 45 years of designing tower-based facilities. Edge Consulting Engineers and the tower manufacturer (Electronic Research Inc.) are tasked to design the tower to service its desired application. In Evans' experience, properly installed towers almost never fail absent a preventable outside influence, because they are designed to very high Electronic Industry Association standards that specify up to 90 mile per hour winds with 1 inch of radial ice<sup>6</sup> (Hurricane force and thousands of pounds of ice load). In addition to the EIA standards, towers may be designed to respect any fall-down radius, including a 200% safety factor or higher. Of course, the towers must be properly manufactured, installed and maintained. Generally, in the rare event they may fail, perhaps due to improper installation or maintenance, they hardly ever fall down “flat”. Rather, they usually fold up upon themselves inside the outer guy radius. The primary exception to this is the case of sabotage when the guy wires are cut<sup>7</sup>. This is less likely to occur with the subject tower because there are six anchor points, each holding three or four guy wires.*

*Nevertheless, it is possible, although unlikely, that a properly designed and installed tower would “lay down flat” if all seven guy wires at two anchor points were cut simultaneously. To avoid this possibility, the applicant may wish to consider installing fencing and razor wire at the tower base and all six-guy points. For extra security, a solid-rod tower could be specified that would resist the shear forces introduced by the loss of one or more guy wires. This would have the additional advantage of increasing tower strength for additional co-locators. In addition, it is suggested that a professional engineer inspect the finished tower for manufacturer or installed defects.*

*It is possible that ice falling from the tower could pose a hazard in certain cases. This ice will usually fall within the outer guy radius, except in cases where it can “ride” down the guy wires. To address this issue, “ice breakers” should be installed on the guy wires.*

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<sup>5</sup> The FCC application for modification of construction permit was filed with the FCC in August 2010. The existence of the WBKY proposal should have been discoverable through due diligence.

<sup>6</sup> These two conditions almost never occur together.

<sup>7</sup> This mode of failure has also occurred if insufficient concrete is used at anchors.



**2. Visibility from Lands owned by the DNR and the U.S. Fish and Wildlife Service (et. al.)**

*Evans' opinion as an expert concerning matters of visual impact is little better than anyone else's opinion. However, the Town and/or the County are only required to "consider" the visual impact of the tower in its deliberations. In this case, reasonable people may differ.*

*It may be proper to ask the applicant to provide photo simulations of the tower taken at the sites mentioned in the objection.*

*It should be noted that the statements made in the objection concerning the tower lighting are incorrect. According to Evans' information, the tower will be painted international orange and white, and red lights (incandescent or LED) will be used during the night.*

*The photo simulations indicate that surrounding mature trees will partially obscure the view of the tower from close-in vantage points.*

**3. Information provided to Evans Associates**

*Evans Associates has received all information necessary to support the instant analysis. The five questions submitted to the applicant have been satisfactorily addressed.*

*Evans concurs that there is no other known structure within the siting area that could reasonably be extended to the required height.*

**#7 Validation of Adequate Support Structure**

Magnum has provided a conceptual drawing of the proposed tower (see Figure 5). A set of detailed design drawings has been reviewed and stamped by a structural engineer licensed by the State of Wisconsin to verify that the latest EIA/TIA standards are being observed. A specific statement concerning the extent of possible co-location should be provided (see "Recommendations").

**#8 Alternative Sites**

According to the applicant, there are no existing structures that would supply essentially the same functionality as the proposed tower off of old Stage Road. Indeed, this engineer found no record of any existing or planned communications towers within 4.7 kilometers of the proposed search area in the FCC or FAA databases, other than Magnum's own applications for the Brooklyn site (#1263803), and a previous abandoned application for a location in Oregon, Wisconsin (#1276118). Within the allocation siting area shown in Figure 1, there does not appear to be a clearly superior location offering the same or better tree screening and road setbacks.

The history of the search for a suitable solution to the broadcast coverage deficiency reveals few options for alternative sites. It is the opinion of Evans Associates that Magnum has done a thorough



job of searching for alternative sites, and, in our opinion, has met the pertinent requirements of the Dane County ordinance.

#### **#9 Co-location Capabilities**

According to Magnum, the proposed tower has been designed to accommodate additional future additional carriers. The Dane County standard is a total of five cellular carriers. Due to the unique facility being requested, it may be appropriate that additional collocation measures be requested. This is a good way of encouraging consolidation, thereby reducing tower proliferation.

#### **#10 Propagation Analysis**

The attached figures 2, 3 and 4 show the level of reception to be expected at 488, 315, and 400 feet above ground level. The color scheme used for the attached propagation maps is as follows:

- Red – acceptable analog and digital coverage
- Orange – marginal digital coverage
- Yellow – Some digital artifacts present and some stereo noise in analog signal
- Green – The minimum reception level for most listeners using line-cord or mobile antennas

The best service among these three exhibits is rendered at 488 feet.

### **IV. RECOMMENDATIONS**

It is this engineer's opinion that Magnum has sufficiently demonstrated a need for building a tower at the proposed site, to be used by Class A broadcasting station WBKY. There are no alternative existing tower sites that can reasonably be determined as superior locations. Assuming that a qualified contractor does the installation, no undue impact is expected to public safety or convenience, as defined by the County's tower ordinance. Once built, however, the tower should be configured to support as many co-locators as reasonably possible in order to prevent additional tower proliferation.

This consultant recommends the approval of the proposed construction at the requested height above ground of 488 feet, subject to the conditions tabulated below. Cutting the tower below the 488 level would seem to offer little or no commensurate visual impact benefit. With the adoption of the recommendations contained herein, it is the opinion of this consultant that the proposed tower will accommodate the communication needs of residents and businesses while protecting the public health, safety and general welfare, with respect to those items for which Evans Associates is expert.

Evans recommends that several additional exhibits be provided by Magnum, addressing the items mentioned in Section III of this document. These documents and certifications should be submitted to the County Zoning Committee, where they can be reviewed and approved when all items are properly addressed. These items therefore would be Conditions of Use, along with any other conditions the committee may recommend:

1. A copy of the FCC required radiation calculations should be provided according to Office of Engineering and Technology (OET) Bulletin 65 and its revisions.
2. A statement of compliance concerning the inspection of the erected tower by a registered professional tower engineer should be provided.
3. A statement from Magnum AND a professional tower engineer should be provided detailing the number and type of co-locators that could be supported by the tower. The statement should also verify that the following minimum set of co-locators could be supported:
  - a. Four 4-bay 150 MHz. antennas centered at 400 feet with 7/8" transmission line.
  - b. Four Cellular/PCS antenna arrays (six antennas mounted on the tower without platforms) at 200 to 250 feet with six 7/8" transmission lines. If meeting this condition requires a tower with a greater visual impact, consideration should be given to mitigation measures such as using a solid rod tower for reduced face size.
  - c. An equipment shelter should be used that can be expanded to house the equipment for these antennas.
4. A statement should be provided that the proponent and the tower erector will be responsible to install "ice breakers" and "preform clips" on the guy wires for extra safety<sup>8</sup>.
5. 10' fences with razor wire should be installed to secure the guy anchors and tower base.
6. All tower components, appurtenances and transmission lines should be securely bonded and grounded to prevent RF interference caused by stray signals.

Respectfully submitted,

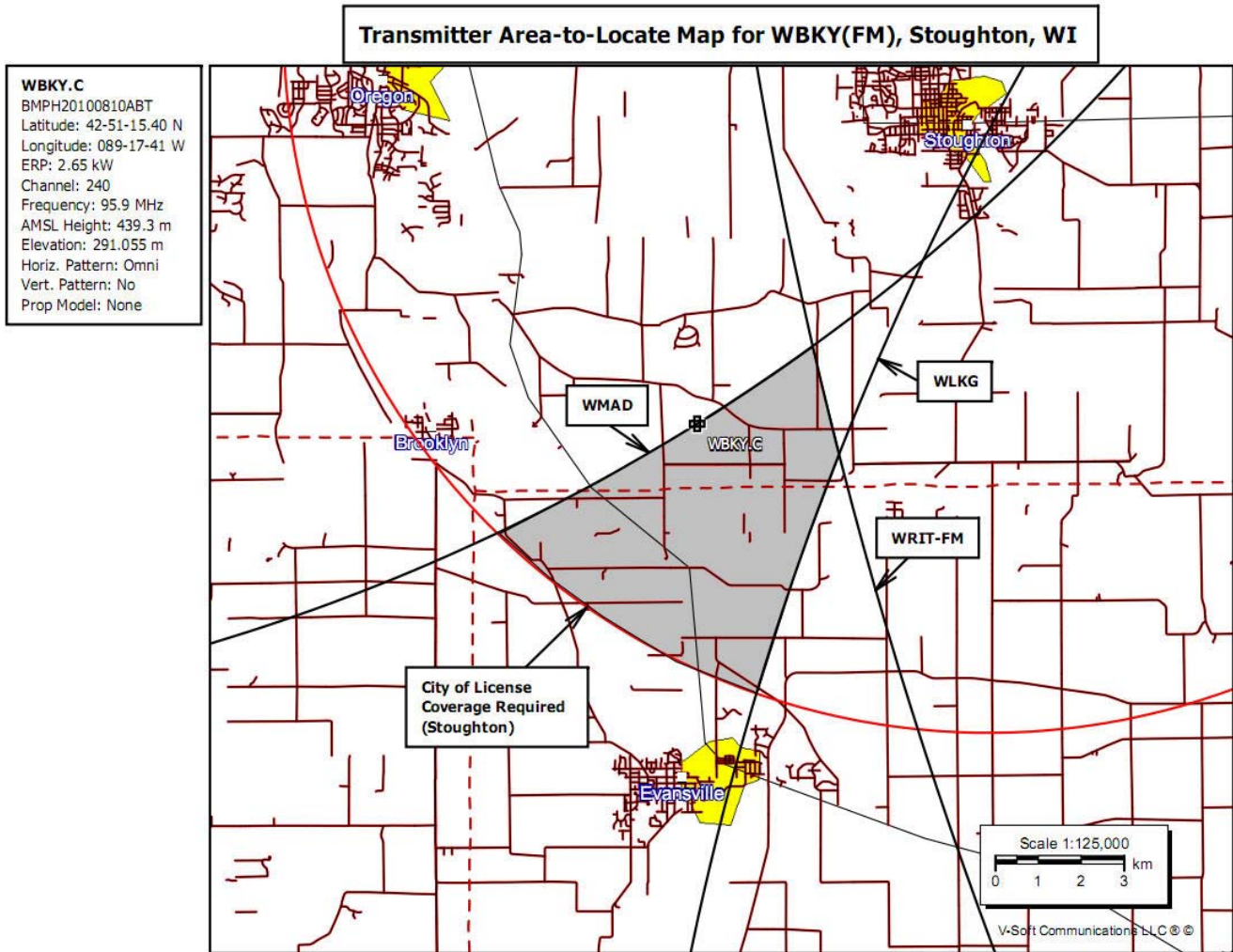
A handwritten signature in blue ink, appearing to read "Ralph E. Evans".

Ralph E. Evans  
Evans Associates  
January 25, 2011

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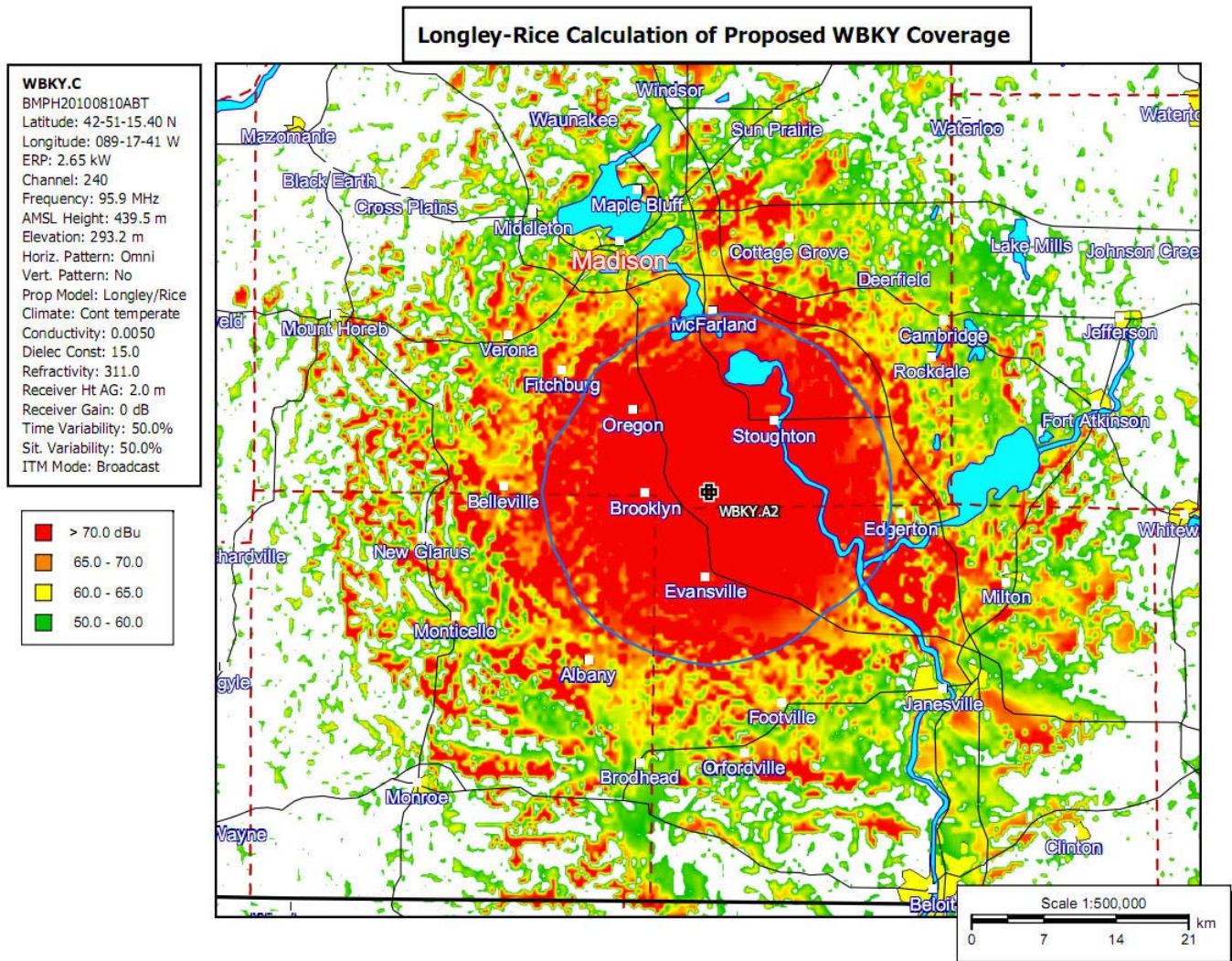
<sup>8</sup> The reason for the preform clips is to keep the loops at the ends of the guy wires from "unraveling", thereby weakening the attachment points.

**Figure 1 – Site Location Area**



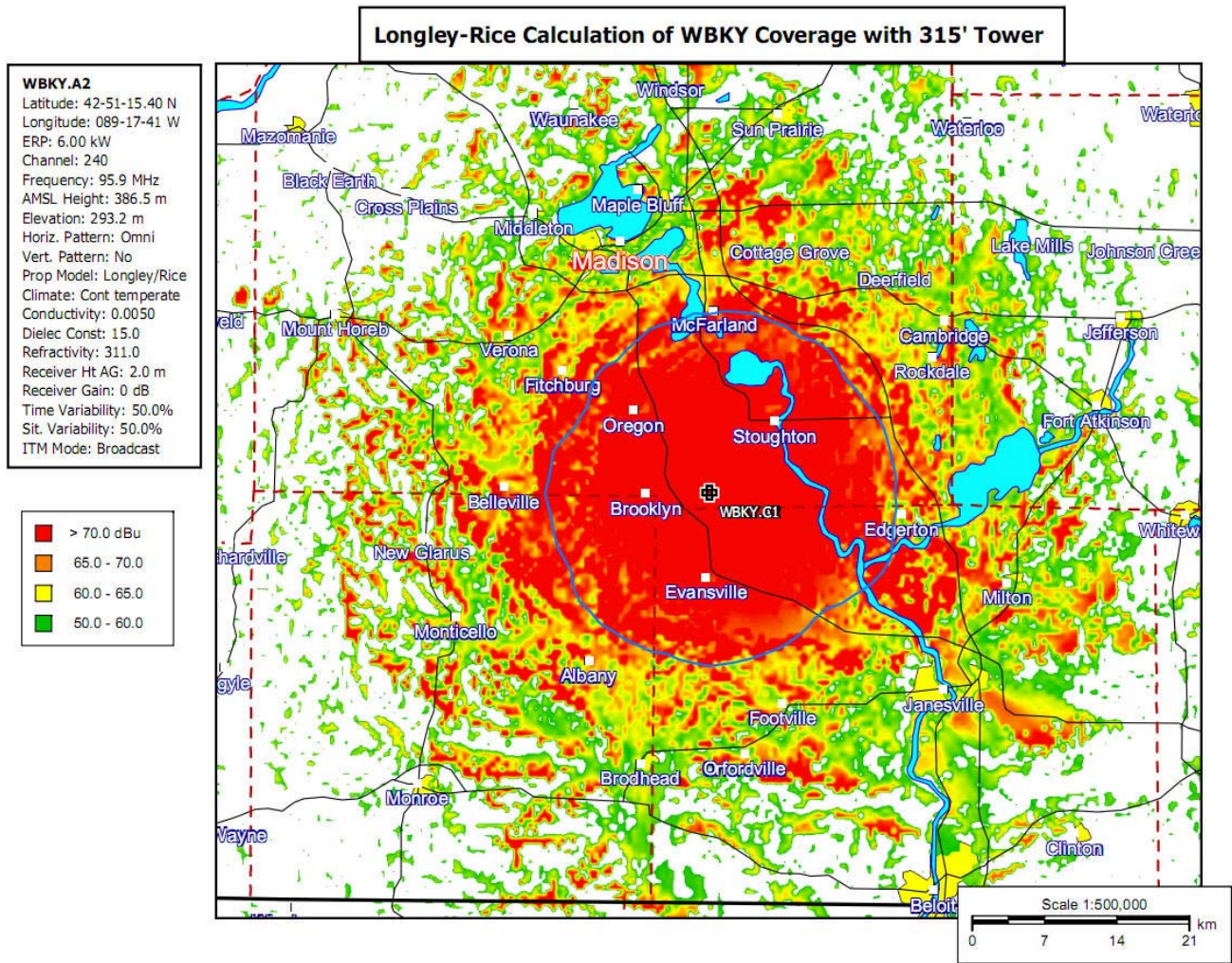


**Figure 2 – Propagation Map Using Proposed Facilities**



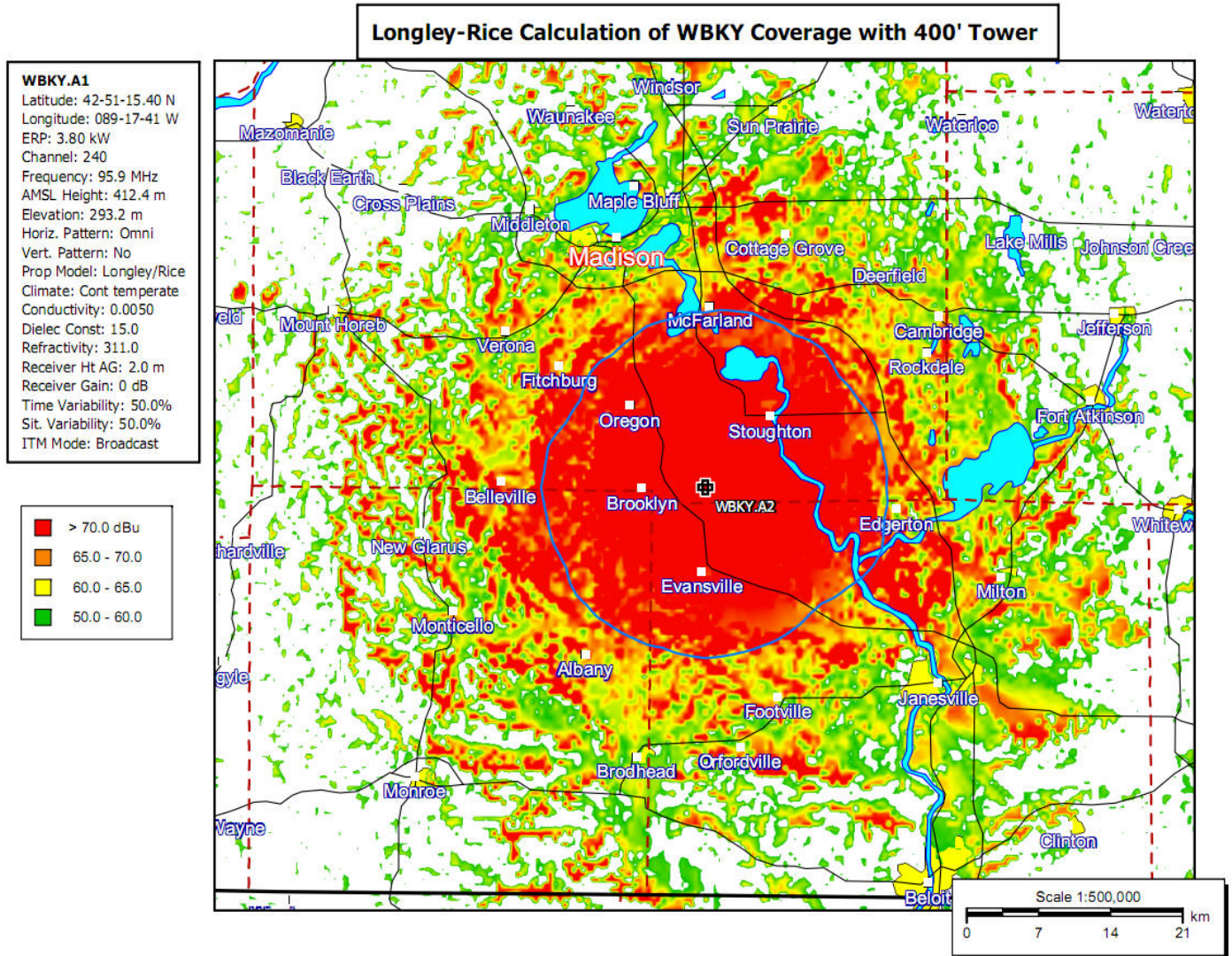


**Figure 3 - Propagation Map at 315'**





**Figure 4 - Propagation Map at 400'**



**Figure 5 – Vertical Elevation Drawing**

