



**Engineering Statement**  
**Prepared for the City of Madison**  
**Re:**  
**Proposed U.S. Cellular Site #782483**  
**545 Zor Shrine Place**  
**Madison, WI 53719**

**Application for CUP**

**February 2, 2010**

**Prepared by:**

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**Figure 2 – Service Area Map with Proposed Site**

**Figure 3 – Site Search Ring**

**Figure 4 – Vertical Elevation Drawing**



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**I. BACKGROUND**

This engineering report has been prepared by B. Benjamin Evans, P.E. of Evans Associates, Communications Consultants in Thiensville, Wisconsin, regarding a proposed U.S. Cellular 70-foot light pole antenna structure and associated equipment shelter in the City of Madison, Dane County, Wisconsin. The structure will be located on the High Point Office Park property at 545 Zor Shrine Place in the City of Madison.

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

The siting information provided to Evans Associates by U.S. Cellular has been used in evaluating the appropriate information with respect to the City of Madison's Zoning Ordinance, Section 28.04(22). The analysis and the conclusions contained herein have been prepared by or under the direction of B. Benjamin Evans, P.E., of Evans Associates, or have been submitted by the applicant. Information provided to Evans Associates by other parties is believed to be correct, and has been verified where feasible.

**II. ABSTRACT**

Every so often, cellular base station networks need to be supplemented with an additional site when a base station is overwhelmed by increased call traffic, or when base stations cannot penetrate an area populated with large buildings with high enough signals to provide service in the buildings. As stated in U.S. Cellular's application for Conditional Use Permit, such is the case with the U.S. Cellular service along the Beltline Highway between Gammon and Mineral Point Roads. According to U.S. Cellular, due to the increased wireless call demand in this area, a new site is needed to offload call traffic from adjacent U.S. Cellular base station sites which are reaching their call capacity, and to provide in-building coverage primarily to the High Point business park area which presently is not served adequately by the existing base stations.



Accordingly, the specified site is a “microcell”, which means it is required for supplementary service in U.S. Cellular’s service area, i.e., increased call capacity and in-building coverage to an underserved area.

As cellular phone use increases, the incidence of emergency and safety of life communications also increases, making high-penetration levels and the ability to connect mandatory on the cellular frequencies. Federal regulations require that local communities treat all carriers identically with respect to permit requirements.

On the other hand, public safety<sup>1</sup>, land use and other environmental considerations must be addressed at the local level. Accordingly, 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 we are 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 the instant U.S. Cellular application for a base station antenna site in the High Point office park, referred to as the “Zor site”, which was conceived out of a need to offload high call traffic from adjacent cells as well as provide in-building coverage in this area.

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

The proposed site utilizes a three-antenna array, representing full omnidirectional coverage. The structure height proposed, 70 feet AGL, has been requested by U.S. Cellular. Low-profile, flush-mounted antennas will be installed on the proposed light pole at 65’-6”. According to the engineering information provided, this structure height will ensure suitability for one additional co-locator, for a total of two carriers. The co-locator’s antenna arrays would be placed at 55’-6”. Because of the topography of the area, a shorter structure than 70 feet would invite additional structure proliferation, which is not recommended. Relatively taller structures are required to serve areas behind hills, dense trees, and buildings, especially for co-locators. The property is zoned PCD (planned commercial development).

In U.S. Cellular’s opinion, this structure represents the minimum height and location that will achieve the required technical objectives. As the herein analysis confirms, Evans Associates agrees with this determination.

<sup>1</sup> Except *Radio Frequency (RF) Exposure* issues, which are regulated by the FCC.

## **#2 RF Exposure**

The proposed U.S. Cellular antennas at 65.5 feet above ground will meet FCC RF exposure requirements with respect to the general population as long as industry-standard equipment and practices are utilized. If or when a second carrier mounts its antennas at 55.5 feet above ground, the second carrier should demonstrate in a written analysis that its operation would not cause the site to exceed the RF exposure limits.

With the RF energy exposure standards utilized in previous 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**

There appears to be no clearly superior existing structure within a 1½-mile radius of the proposed site (See Paragraph #9 below).

In the opinion of this consultant, U.S. Cellular has made a good-faith effort to locate existing antenna supporting structures to service the required area. It is the intent of the City's Ordinance to populate the city with the minimum number of structures by requiring co-location, while still ensuring a robust E-911 infrastructure.

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

At the requested structure height of only 70 feet, notification to the Federal Aviation Administration is most likely not required. The nearest airport to the Zor site is Morey Field in Middleton, about four miles north.

Assuming no serious malfunction of U.S. Cellular's transmitters, 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 structure bonding and grounding.

## **#5 Proposed Height Verification**

As per the above discussion, the structure 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 70 feet above ground level, considering that U.S. Cellular intends to accommodate an additional carrier.



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

None received by Evans.

**#7 Validation of Adequate Support Structure**

U.S. Cellular has provided technical drawings of the proposed structure. A set of detailed design drawings should be reviewed and stamped by a structural engineer licensed by the State of Wisconsin to verify that the latest EIA/TIA standards are being observed and that the structure will support the antennas of an additional wireless co-locator.

**#8 Visual Impact**

A visual assessment is not included in the scope of the consultant's work with respect to this project. Site photos, including simulation views from different locations, have been included with the application. They appear to show that the light pole would be fairly inconspicuous, owing to the 70-foot height, screening by mature trees, and the commercial character of the area. U.S. Cellular states that stealth, flush-mounted antennas will be employed which will be painted brown to match the color of the light pole, thus minimizing visual impact.

The FAA will not require the structure to be lighted since there are no airports nearby.

There are no documented communications towers less than one-quarter mile from the Zor site.

**#9 Alternative Sites**

The attached Figure 3 shows the site "search ring" within which a new base station structure should be located in order to address the service problems described in Section II of this report. The proposed Zor Shrine site is well within this search ring. According to the applicant, and as confirmed by database searches performed by this office, there were no other structures within ¼ mile of the proposed site.

A search performed by this office of the FCC structure registration database revealed several existing communications structures within 1½ miles. The structures are identified below, along with the reasons they cannot or should not be used:

- Madison Community Tower – This structure, located at Mineral Point and Pleasant View Roads, is the transmitting site of several TV and FM stations. This site is too close to U.S. Cellular's West Side Businessman's site to be of practical use.

- Pole at Struck Street – This site is farther east of the Zor site than the Gammon & Watts U.S. Cellular site, and is thus not suitable for serving the problem area.
- WNWC(FM) Tower – This tower is just under 1.5 miles south of the Zor site and is too far to serve the problem area.
- WMTV(TV) Tower – This tower is farther east of the Zor site than the Gammon & Watts U.S. Cellular site, and is thus not suitable for serving the problem area.
- Tower at 201 S. Gammon Road – This tower is too close to U.S. Cellular’s West Towne site to be of practical use.
- Existing U.S. Cellular sites – There are three existing U.S. Cellular base station sites within 1½ miles of the proposed Zor site. Installing a new microsite at any of these three locations would not solve the problem of lack of in-building coverage in the High Point business park area, since the only way to resolve that problem is to establish a new base station site in the vicinity of the problem area.

U.S. Cellular states that there are no buildings or other structures in the area that are greater than about 35 feet in height that might accommodate cellular antennas. This is not enough height above the horizon to resolve the service issues in the problem area.

The history of the search for a suitable solution to a coverage gap in the network reveals a difficult decision process. It is the opinion of Evans Associates that U.S. Cellular has done a thorough job of searching for alternative sites, and, in our opinion, has met the requirements of the City of Madison’s Ordinance in this regard.

#### **#10 Co-location Capabilities**

According to U.S. Cellular, the proposed structure has been designed to be 70 feet in height and accommodate a future additional carrier. The Madison Telecommunications Tower Ordinance requires a minimum capability of three antenna arrays, unless it is “economically and technologically unfeasible” or for reasons of aesthetics. U.S. Cellular states that designing the light pole to accommodate a third antenna array would necessarily add height and girth to the structure, thereby making it more conspicuous. Evans agrees. A third antenna array at 45.5 feet on the 70-foot pole (10 feet below the possible future co-locator’s antennas) may not be desirable or possible for another co-locator due to the diminished “look angle” at the lower height, which degrades coverage. Also, a third antenna array on the 70-foot structure might not be possible from the standpoint of complying with the RF exposure standards.



**#11 Network Propagation Analysis**

A propagation study conducted by U.S. Cellular, and verified by this engineer, shows that there is an unmistakable in-building coverage void at Highpoint Road near the Beltline Highway, as seen in “yellow” in attached Figure 1. This coverage gap results in no connection, reduced quality or dropped calls in this area. A “green” level of service is necessary for reliable wireless service in large office buildings.

Figure 2 shows a coverage areas map with the proposed site activated. The proposed U.S. Cellular site is well situated and will provide good service in the High Point area, which is currently lacking in coverage.

The color scheme used for the propagation maps is as follows:

- Green – excellent in-vehicle and in-building coverage
- Yellow – excellent outdoor coverage

Figures 1 and 2 do not show information regarding call volume at the proposed Zor Shrine site and existing U.S. Cellular sites.

**IV. RECOMMENDATIONS**

This consultant recommends the approval of the proposed site at the requested light pole height above ground of 70 feet.. It is the opinion of this consultant that the proposed facility will accommodate the communication needs of cellular subscribers in the area while protecting the public health, safety and general welfare, with respect to those items for which Evans Associates is expert.

It is this engineer’s opinion that U.S. Cellular has sufficiently demonstrated a need for building a structure at the proposed site. According to U.S. Cellular, there have been many complaints from U.S. Cellular subscribers regarding lack of service in buildings in the High Point area. The facility proposed will alleviate this problem. There are no alternative sites that can reasonably be determined as usable.

Assuming that a qualified contractor does the installation, no RF interference is expected that would be the subject of local jurisdiction.





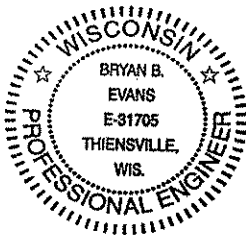
The following recommendations are made with respect to the U.S. Cellular structure site:

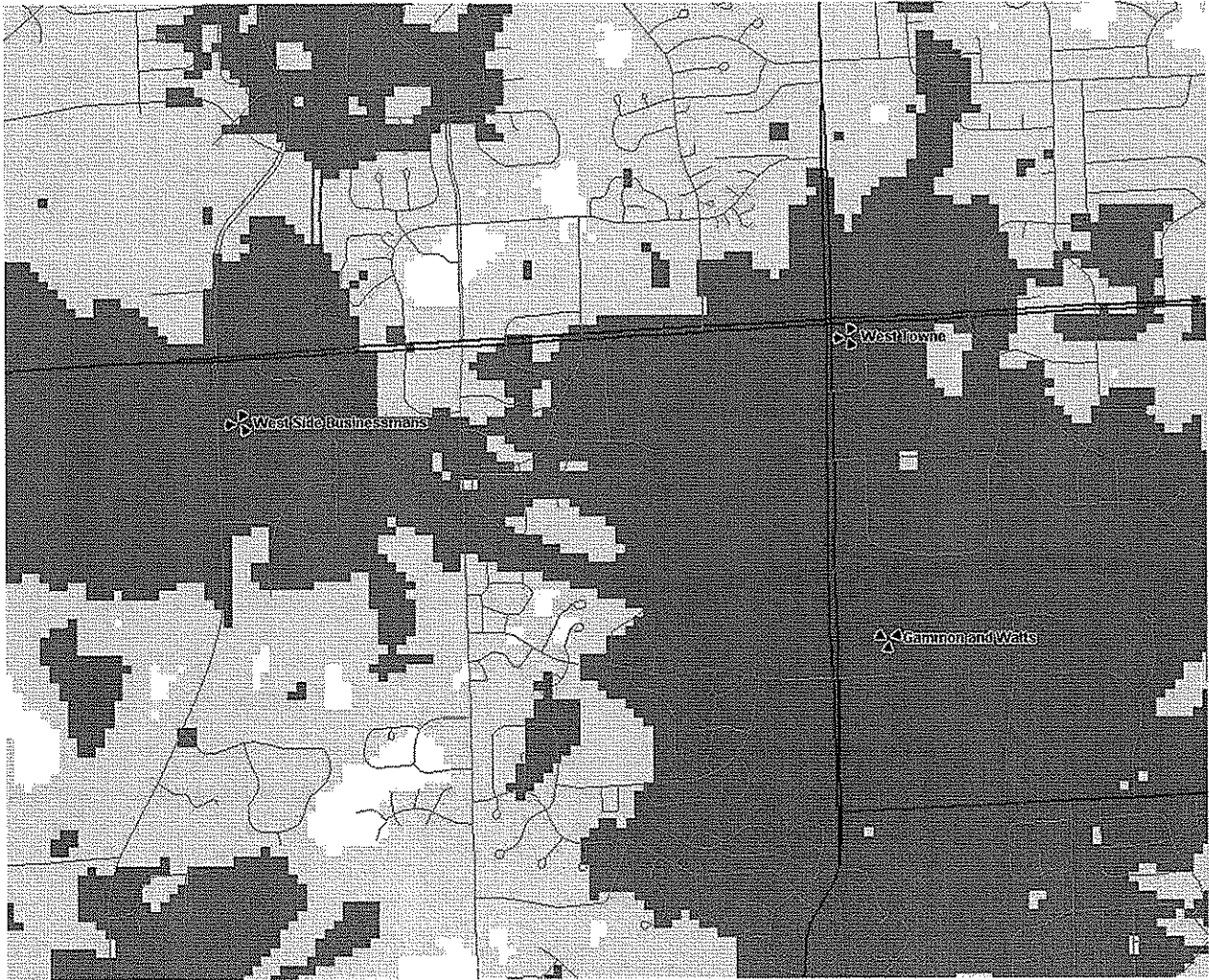
1. All structure components, appurtenances and transmission lines should be securely bonded and grounded to prevent RF interference caused by stray signals.
2. A set of detailed design drawings should be reviewed and stamped by a structural engineer licensed by the State of Wisconsin to verify that the latest EIA/TIA standards are being observed and that the structure will support the antennas of an additional possible future wireless co-locator.

Respectfully submitted,

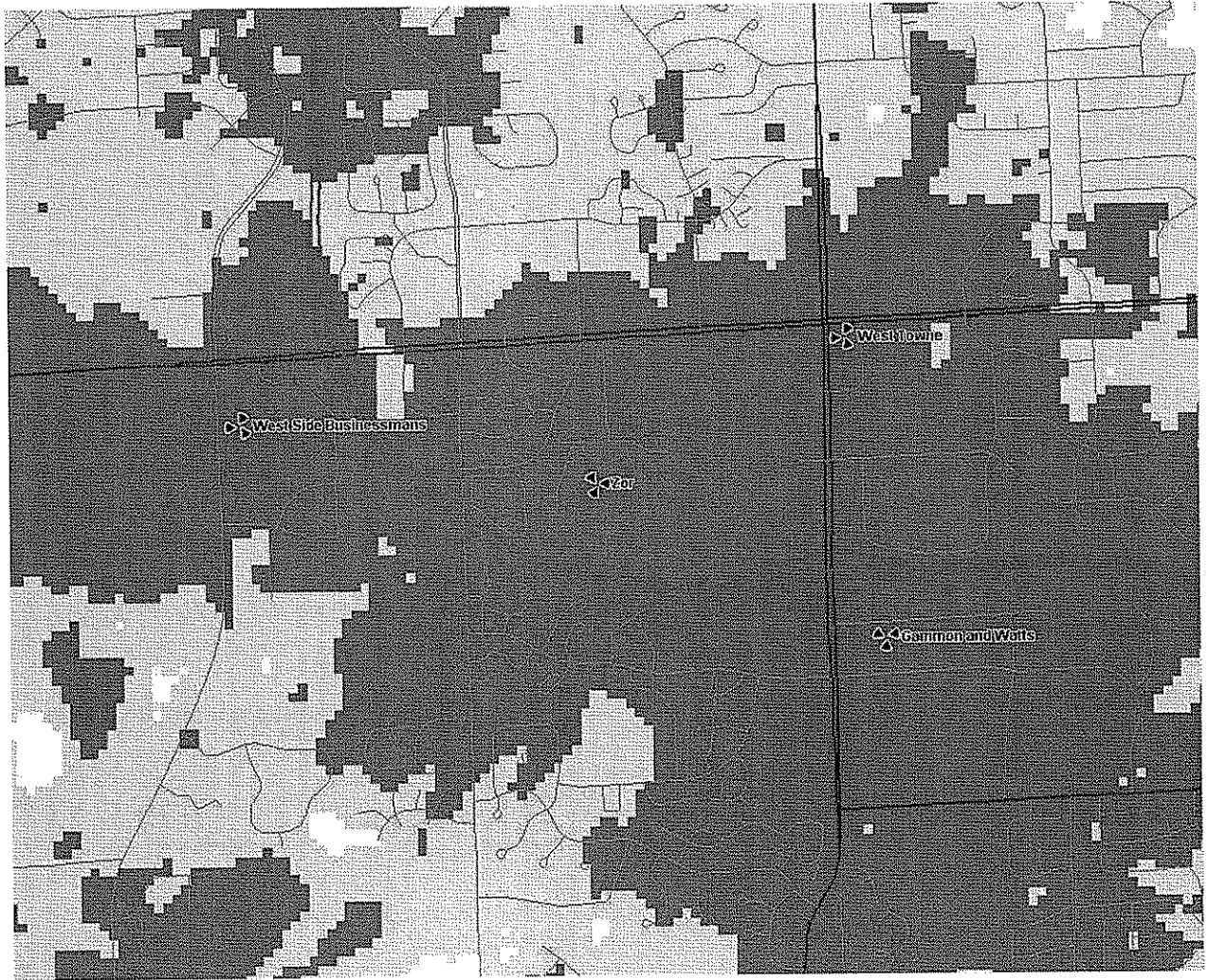
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February 2, 2010

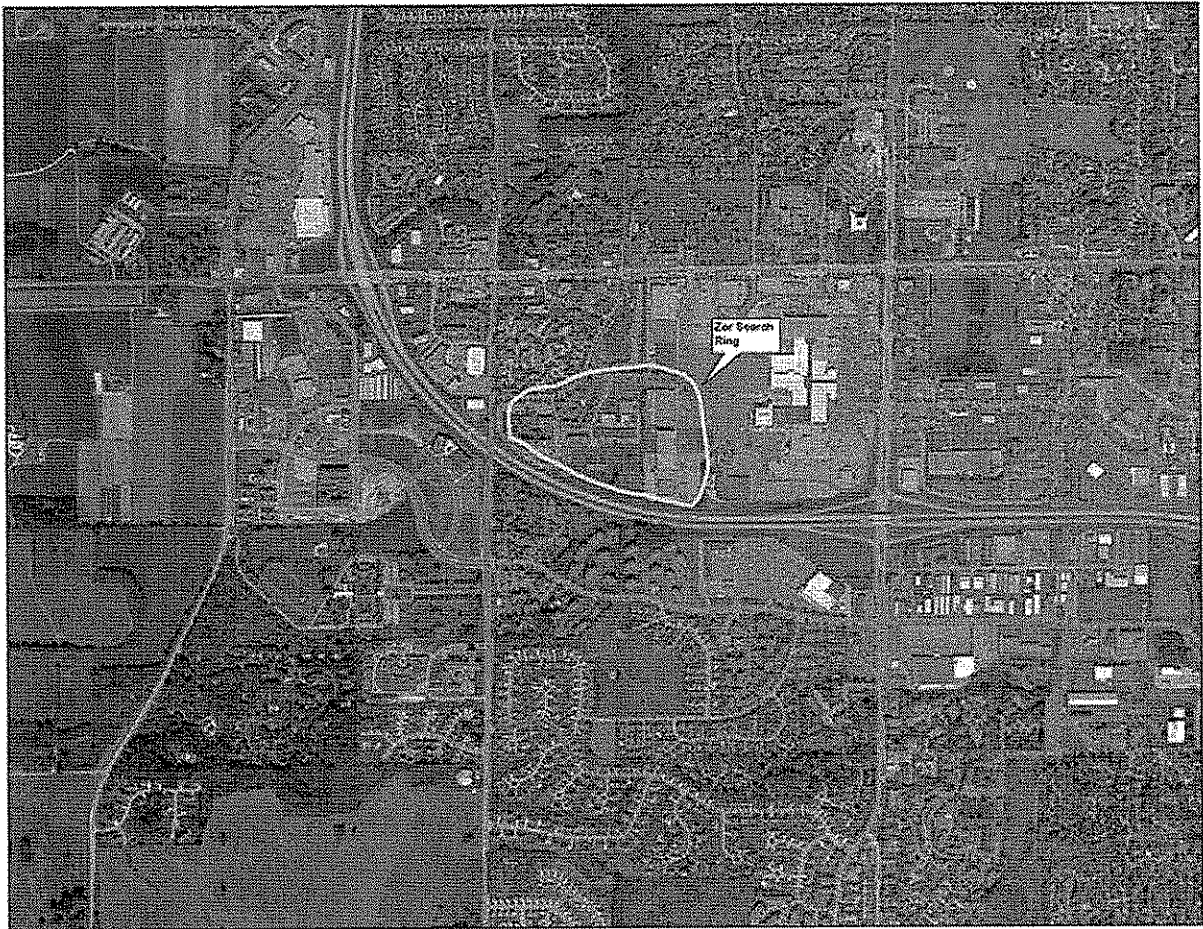




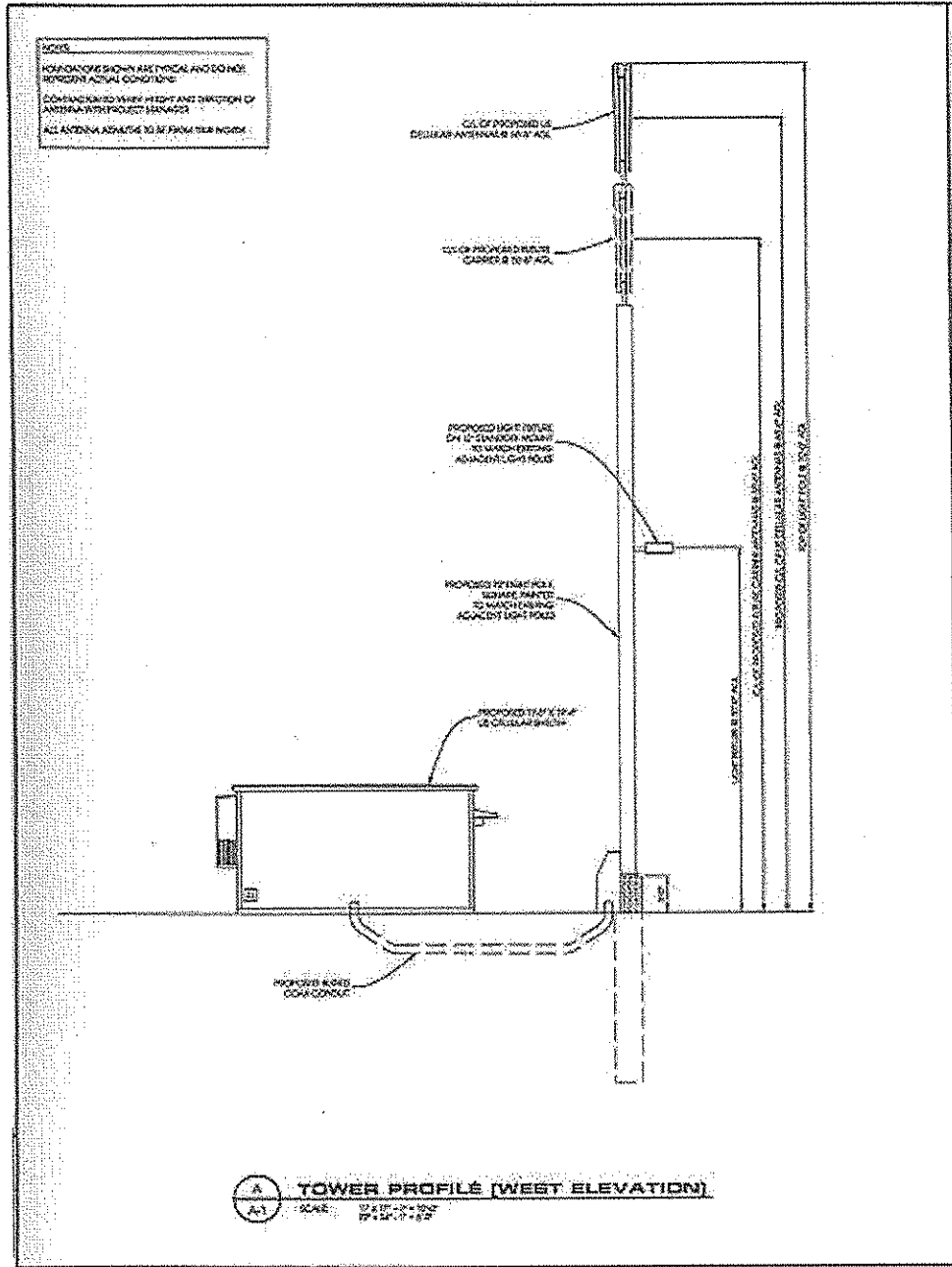
**Figure 1 - Propagation Map Without Proposed Site**



**Figure 2 – Propagation Map with Proposed Site**



**Figure 3 – Site Search Ring**



**Figure 4 – Vertical Elevation Drawing**