

**Dane County, Wisconsin**  
**Telecommunications Site Review**  
**New Support Structure**

**CityScape**

C O N S U L T A N T S , I N C .

7050 W. Palmetto Park Road #15-652

Boca Raton, FL 33433-3483

Tel: 877.438.2851 Fax: 877.220.4593

March 18, 2019

Supervisor Jerry Bollig  
Chair, Dane County Zoning & Land Regulation Committee  
210 Martin Luther King Jr., Blvd  
Madison, WI 53703

**RE: Review of Dane County Conditional Use Permit Application #2456 by Bug Tussel  
Wireless / Town of Montrose**

Dear Supervisor Bollig & Members of the Committee,

At your request, on behalf of Dane County, Wisconsin (“County”), CityScape Consultants, Inc. (“CityScape”) in its capacity as telecommunications consultant for the County, has considered the merits of the above referenced application submitted by Bug Tussel Wireless (“Applicant”), to construct a new 255’ tall wireless telecommunications support structure and associated ground compound near the intersection of Montrose and Fritz Roads, in section 30 of the Town of Montrose, Wisconsin, *see Figure 1*. Because the proposed structure is greater than 199 feet in height it will require FAA lighting and marking.

This application is proposed to provide fixed wireless service to areas of southwestern Dane County near the town of Montrose, Wisconsin. The Applicant has also stated the tower will accommodate AT&T wireless phone service as well as FirstNet, a public safety service that the federal government has contracted with AT&T to provide. However, no substantial evidence or data was submitted with the application that would enable this consultant to verify that these additional services will be provided, or that the proposed tower is necessary in order to provide them. Therefore, this review is limited to consideration of the fixed wireless service for which the applicant has provided information. The proposal has been evaluated from the following perspectives:

- Whether the proposed facility, as specified, is justified due to technological reasons and is essential for the Applicant to provide its telecommunications service; and,
  - Whether the proposed facility will follow the requirements of the Federal Law, Wisconsin State Law, the Dane County Ordinance and all other pertinent rules and regulations.
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### **Dane County Ordinance Requirements**

§10.194(1): CUP required

§10.194(2) CUP requirements:

- a. No existing towers exist within search area: SBA tower 1.2 miles southwest
- b. Any existing towers are of sufficient height and height deficiency cannot be remedied at reasonable cost: Applicant claims SBA tower too short
- c. Any existing towers are of insufficient structural strength which cannot be remedied at reasonable cost: unknown (SBA tower)
- d. Installation of Applicant's equipment would result in electromagnetic interference with/by equipment on existing tower and such interference cannot be eliminated at reasonable cost: provided
- e. Collocation fees unreasonable relative to industry norms: Applicant claims they are
- f. Applicant demonstrates that there are other factors that render existing tower(s) unsuitable and establishes that the public interest is best served by proposed new tower: None

§10.194(3): Term *reasonable* defined as 125% cost of new tower – unknown

§10.194(4): Third party review – CityScape

§10.194(5): If less than 150 feet is proposed, tower must be capable of future increase to 150 feet and 2 collocations – proposed tower is 250 feet, 3 future collocators shown in design

§10.194(6): CUP required for substantial modification: Not Applicable

§10.194(7): CUP condition requirements can be checked at later date – Not Applicable

§10.194(8): CUP not required for collocations that are non-substantial – Not Applicable

§10.194(9): Equipment building limits: N/A (no building proposed)

§10.194(10): Equipment Type on Tower – provided

§10.194(11): Future buildout plans may be required – Future sites shown in first map in Applicant's engineering exhibit

Additional CUP requirements for communication towers

- A. Legal Description: provided
  - B. Tax Parcel number(s): provided
  - C. Completed Zoning Application Form: provided
  - D. Completed Communication Tower Information Form (CTIF): provided
  - E. Written Statement: Statement from RF engineer
  - F. Site Plan, Design Elevations, Site Photos and Photo Simulations: provided
  - G. CUP filing fee: *defer to County*
  - H. RF Engineering Analysis: 3<sup>rd</sup> party Consultant
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### **Fixed Wireless Informational Tutorial**

There are two variations or wireless facilities that are supported by various laws. Most are familiar with what is generally called Cellular Services. In fact, Cellular is a broad term used by most to describe mobile services, much like Kleenex is the common term for tissues. Cellular services were the 1<sup>st</sup> phase (or 1G) of personal wireless services and consisted of wireless telephones that operated between 850MHz and 990Mhz. The original providers of this service were the local telephone exchanges and a single independent company called Cellular One.

As the demand grew, the Federal Communications Commission opened new frequencies between 1,700MHz to 1,990Mhz which were technically designated as Personal Communications Service (PCS) frequencies. Over the years there have been additional frequencies added from 2,100MHz to 2,490MHz which included not only the same types of services as all Cellular-type operations but did include a new service called Advanced Wireless Services (AWS) or wireless broadband. Also, within this general spectrum is a service called Fixed Wireless or Fixed Broadband. This service differs from the cellular-type mobile telephone services with which most are familiar.

The evolution of cellular telephone-type services has grown from 1G, low band analogue wireless services to 2G adding PCS spectrum and conversion to digital, then 3G which increased speed and began some applications such as texting and sending photos, the 4G and its many variations now to include advanced LTE (Long Term Evolution). In the next few years will be 5G, which will be primarily High-Speed broadband and will carry on top of its signal standard Cellular-type operations. Generally, 5G will use shorter support structures located every 50 meters (164 feet) to 500 meters (1640 feet) depending on the population.

Fixed wireless service is a means to provide internet or wireless data to a fixed location such as a home or business. Instead of the end user being a mobile device (like a smart phone or tablet), fixed wireless service utilizes a small outdoor/rooftop antenna which communicates with antennas mounted on towers, buildings or other elevated structures in the area. The height and location of the elevated antenna platform is critical to provide sufficient wireless network coverage. Generally, the higher the antenna is mounted on the support structure, the farther the wireless signal penetrates a geographic area.

In the wireless system evolution, a provider would initially provide service with facilities spaced further apart with relatively tall antenna elevations to maximize the "footprint" at minimal cost. As the subscriber density increases, network capacity for these facilities increases, resulting in slow download/upload speeds for end users. To remedy this situation, the antennas are mounted at lower heights to reduce the coverage area, thus reducing subscriber count per facility. When coverage areas are reduced, a new facility is needed to fill in the previously served area. The need for more infrastructure is higher in densely populated areas, as compared to rural areas.

The search ring is a vital part of the submittal for any new wireless facility. The Ring identifies the optimum location for the facility and will control the operating parameters needed to meet the facility objectives. Of primary interest to a community are the location and the height of a structure, all which is dictated by the ring.

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A reasonable search ring location is a key element in assuring that a site is justified. Generally, new wireless communication facilities are equally spaced with respect to existing sites. However, terrain, network capacity and other issues may necessitate a facility that it is *not* equally spaced with respect to existing sites. Typically, the wireless provider is asked to provide coverage prediction maps to indicate that a site is properly located.

In addition to the minimum height and power needed for effective signal coverage, as more wireless devices are deployed, user capacity issues become the limiting factor. Technology is improving which allows towers to handle more devices, but it is not keeping up with the speed that such devices are connecting.

### Site Justification and Coverage

For a new wireless communications facility to be justified, its need, location and height must be addressed. The applicant proposes to construct a new two hundred fifty-five (255) foot *guyed* tower, *see Appendix, Exhibit A*. The proposed site coordinates are not listed on the drawings but are shown in the engineering study and on the CTIF (County form). However, these coordinates differ slightly and neither appear to match the location on the site plan. Therefore, for purposes of this report, CityScape will assume the following coordinates, based on review of the site plan: 42.88134 N, 89.58786 W.

The purpose of this tower is to provide fixed wireless service for Bug Tussel Wireless. As noted in the tutorial above, Fixed Wireless is a service where a tower or network of towers provides wireless service to homes that have an external (rooftop) antenna that communicates with the tower. The Applicant has also noted the tower will accommodate AT&T/FirstNet, a public safety service that the federal government has contracted with AT&T to provide. Initially, this was just a statement of potential collocation, but a recent letter dated January 9, 2019 claims AT&T/FirstNet will collocate on the tower. Since no substantial evidence was provided with the application in support of these additional services, this review is limited to the proposed fixed wireless service.

It is CityScape's understanding from conversations with county staff that Bug Tussel has been considering a tower at the proposed site since at least early 2016 when a preliminary application was submitted to the county. The Applicant originally provided two engineering statements / studies with its present application. The first study was a 3-page report by Dean Hansen, a Radio Frequency (RF) Engineer with Bug Tussel Wireless, dated March 8, 2016 while

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the other was a report and sworn affidavit by another RF Engineer, Scott Reiter, dated June 25, 2018. Mr. Hansen's 2016 study mentioned two alternate towers: the SBA tower and the WSUM tower. The SBA tower is 1.2 miles away while the WSUM tower is 2.25 miles away. The WSUM tower was eliminated based on inadequate coverage predictions while the SBA tower was eliminated due to factors involved in ease of equipment changes and cost of structural application fees for changes. The claimed SBA tower issues are the same for any operator currently or wishing to collocate on a tower owned by SBA or other entity. Finally, Mr. Hansen's report did not state the SBA tower would not work from an RF perspective but focused on the administrative issues to discount the site.

The other report by Mr. Reiter contained a sworn affidavit and included a search ring that was centered on the proposed site with a radius of 1.5 miles. This search ring encompasses the SBA tower, but not the WSUM tower. Thus, CityScape agrees with elimination of the WSUM tower, but not the SBA tower. Mr. Reiter's affidavit of 6/25/18 mentions (in item #5 that) an attachment which compares coverage from an existing structure located one mile from the proposed site. However, no such analysis was included in the documents. CityScape and the County asked for this analysis multiple times, but it was never provided. This is assumed to be the SBA tower but cannot be confirmed. The coverage maps that were included do show the improvement that the proposal will make to the existing coverage. However, the omission of the coverage comparison with the SBA tower is noted.

A search ring, by definition, is an area that the service provider designates where it can locate a facility which will meet its coverage goals. Thus, any site within this ring should be viable, if the ring is properly designed. There are other factors such as topographic traits that may require a different height tower within the ring. When the Applicant was further asked for the coverage comparison, it was revealed that Mr. Hansen's report was not part of the sworn affidavit. CityScape questions why it was included in the submittal at all.

Many additional submittals have been filed since the original October 2018 filing which contained the June 25, 2018 affidavit. Each additional submittal modified the supporting engineering which justifies the proposed site. A December 12, 2018 filing included a newer affidavit dated 12/11/18 which removed the statement about an analysis of an existing tower within one mile and adds the statement that "there are no existing towers or structures within 1-mile radius of the center of the attached search ring." This statement appears to be based on the inclusion of

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a new search ring. The “new” search ring provided in the December 12, 2018 filing is reduced in radius from 1.5 miles to 1.0 mile and is shifted about ¼ mile northwest of the proposed tower, *see Appendix, Exhibit B*.

However, the December 12, 2018 materials include plots of both rings. Since this new ring is smaller and centered further from the SBA tower, the SBA tower is no longer within the ring. An email from the Applicant noted that the search ring has changed over the last couple of years and that an older RF analysis was included with the incorrect ring. This is also puzzling since it was included in the June 2018 affidavit, relatively recently.

When the County asked for an explanation for the change in the ring’s size and location, a third affidavit was provided, dated January 7, 2019 modifying two items. Item number 5 of the affidavit was edited to state that a tower was found outside the search ring, identified as the SBA tower and that it was beyond the desired 1.5-mile distance from Montrose. Number 6 was also modified to include confirmation that AT&T will install FirstNet equipment on the tower. Copies of the 3 sworn statements can be found in Exhibit C of the Appendix.

#### RF Analysis (Coverage Mapping)

Additional items were submitted by the Applicant on January 24, 2019. These included many old items with previously discounted data such as the older affidavit and search ring. The Applicant did, however, include a comparison in coverage between the proposed site and the SBA site.

The concern that the Applicant states for the SBA site is both location and tower height. The SBA site is outside the new search ring, but inside the initial search ring. The applicant states that the proposed tower height of 250 feet (+5’ lighting rod) is higher than the reported 160-foot collocation spot available on the SBA tower. Coverage for the proposed fixed wireless service is directly related to height of the antennas on the tower, relative to the terrain surrounding each site. One cannot merely consider the height on the tower; the ground elevation is just as significant of a factor. When a tower is located on higher ground, this extends the coverage of the service. The SBA tower is located in an area with a ground elevation that is 150 feet higher than the ground elevation of the proposed site. Thus, the *effective* antenna height of the collocation spot available

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on the existing SBA tower is actually higher than the mounting height on the proposed tower and will result in a larger service area than that from the proposed site.

The coverage plots provided by the Applicant also compare the service from both locations. The coverage radius map shows circles, or coverage radii for both sites, *see Appendix, Exhibit C*. The smaller circle has a 2-mile radius and represents the coverage from the SBA site while the larger circle is 3 miles and represents the proposed site. These circles are most likely calculated using only the tower height without consideration of terrain or effective antenna height. Thus, this map is an inaccurate illustration of coverage.

Four coverage maps which do utilize terrain were provided. Each compares the two sites, one pair a large scale and one pair small scale showing a small geographic area of the Town of Montrose approximately 1.1 miles east of the proposed tower site. One important point to note from these maps is that the Applicant's service (fixed wireless) utilizes outdoor antennas mounted at roof levels. Signal levels needed for this type of service can be as low as -100 dBm. The signal levels that these coverage maps highlight (red colors) are signal levels that exceed -60 dBm, which is a much stronger signal level than the required -100 dBm. -60 dBm is a very strong signal level, even stronger than what is typically needed for indoor service.

The Applicant states the proposed site will serve 2000 people while the SBA site will serve 450 people. It is unclear as to how these numbers were calculated, but CityScape assumes these are population numbers within the 2- and 3-mile coverage circles depicted on the coverage plots. As noted above, CityScape believes that the provided coverage circles are based only on the tower height and not the *effective* antenna height, which includes ground elevation and would result in coverage that is not a perfect circle. Therefore, the validity of these service population numbers is questionable.

In addition, it is not known what service level the yellow color represents since that color is not shown in the legend. It also appears that the first two maps are different scales which makes one coverage area appear larger than the other. Concerning the last two maps, areas in blue (-90 dBm) are more than adequate for fixed broadband and neither color is shown here. While the yellow color is undefined, it is believed that in both cases the signal levels are well above the -90 dBm level.

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### Missing/Incomplete Information

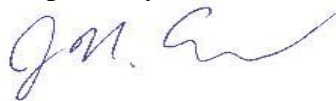
It is noted that the coordinates on the CTIF and engineering studies do not appear to match the location on the site plan. Also, the “Preliminary information on options for collocation” section of the CTIF is answered incorrectly since it states no towers exist within 1.5 miles. It also states that a search area radius of 1.5 miles was used to determine the tower location. This adds further confusion to the proper radius of the search ring(s).

### Conclusion

It is CityScape’s opinion that the Applicant has only demonstrated the need to install its antennas on a structure in the vicinity to improve its fixed wireless service. The submittals have conflicting information as to the validity of the search ring. The reduction in size and shift of the search ring is not substantiated. The coverage maps compare indoor signal levels between the proposed and SBA sites which is not relevant for fixed wireless service. Last, the indication that AT&T/FirstNet will also utilize this tower does not eliminate the possibility that AT&T/FirstNet could utilize another tower in the area, such as the SBA tower. Furthermore, without any formal information from AT&T/FirstNet such as need or coverage maps, any assumption that this site is needed for AT&T/FirstNet is unsubstantiated. For these reasons, CityScape does not find justification for a new, 255-foot lighted tower, as proposed by Bug Tussel Wireless.

I certify that to the best of my knowledge all the information included herein is accurate at the time of this report. CityScape only consults for public entities and has unbiased opinions. All recommendations are based on technical merits without prejudice per prevailing laws and codes.

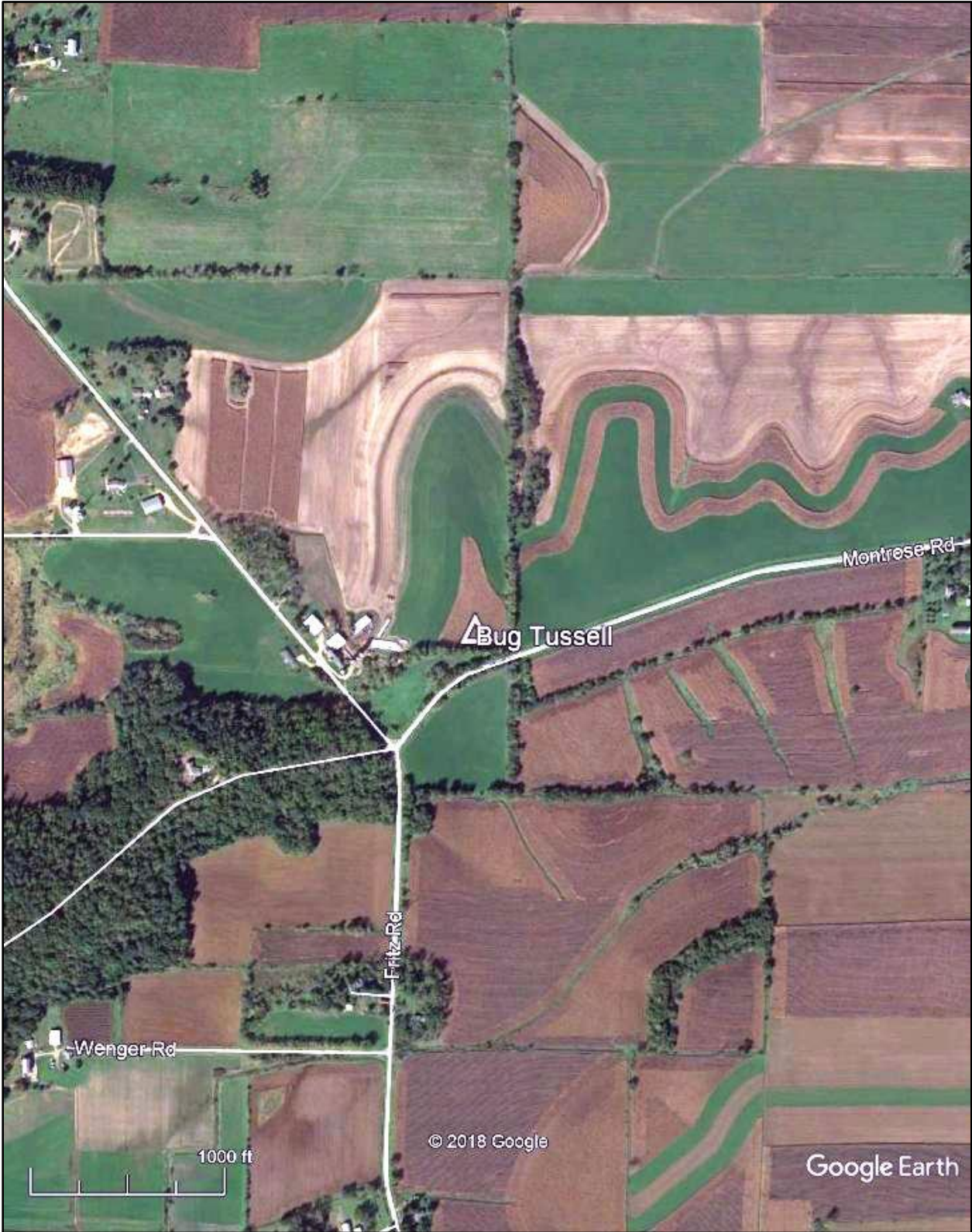
Respectfully submitted,



Jonathan N. Edwards, P.E.  
CityScape Consultants, Inc.

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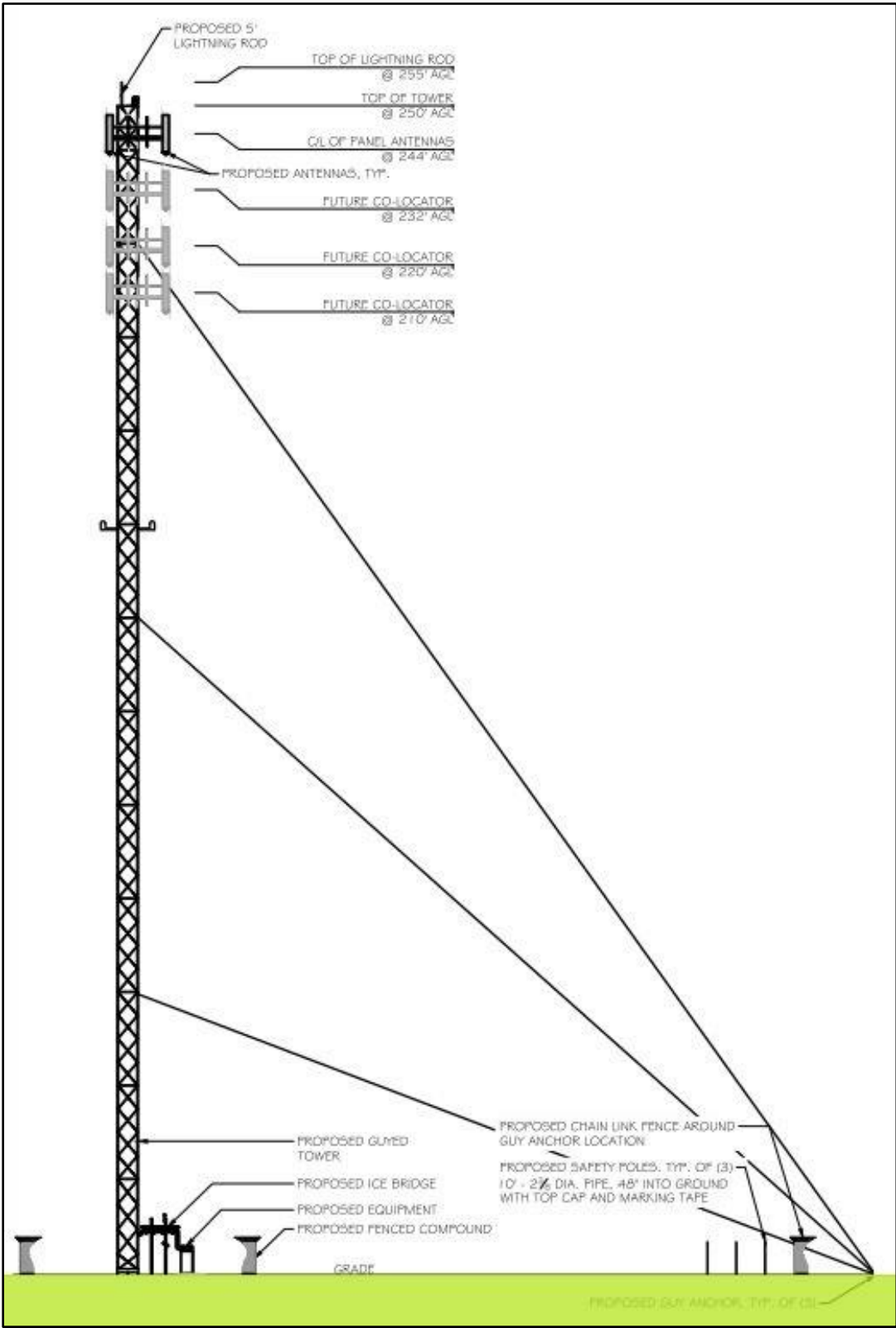




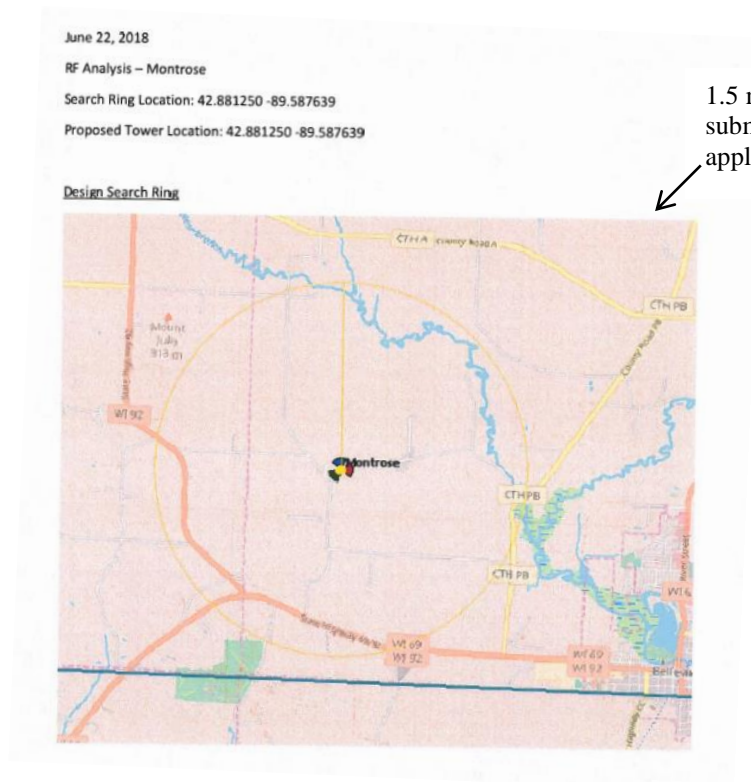
**Figure 1 – Aerial Site View**

## Appendix

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**Exhibit A - Proposed Support Structure**

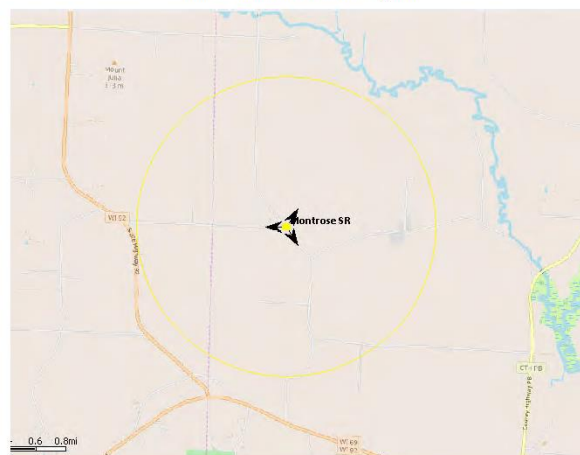


1.5 mile Search Ring submitted with initial application 10/12/18

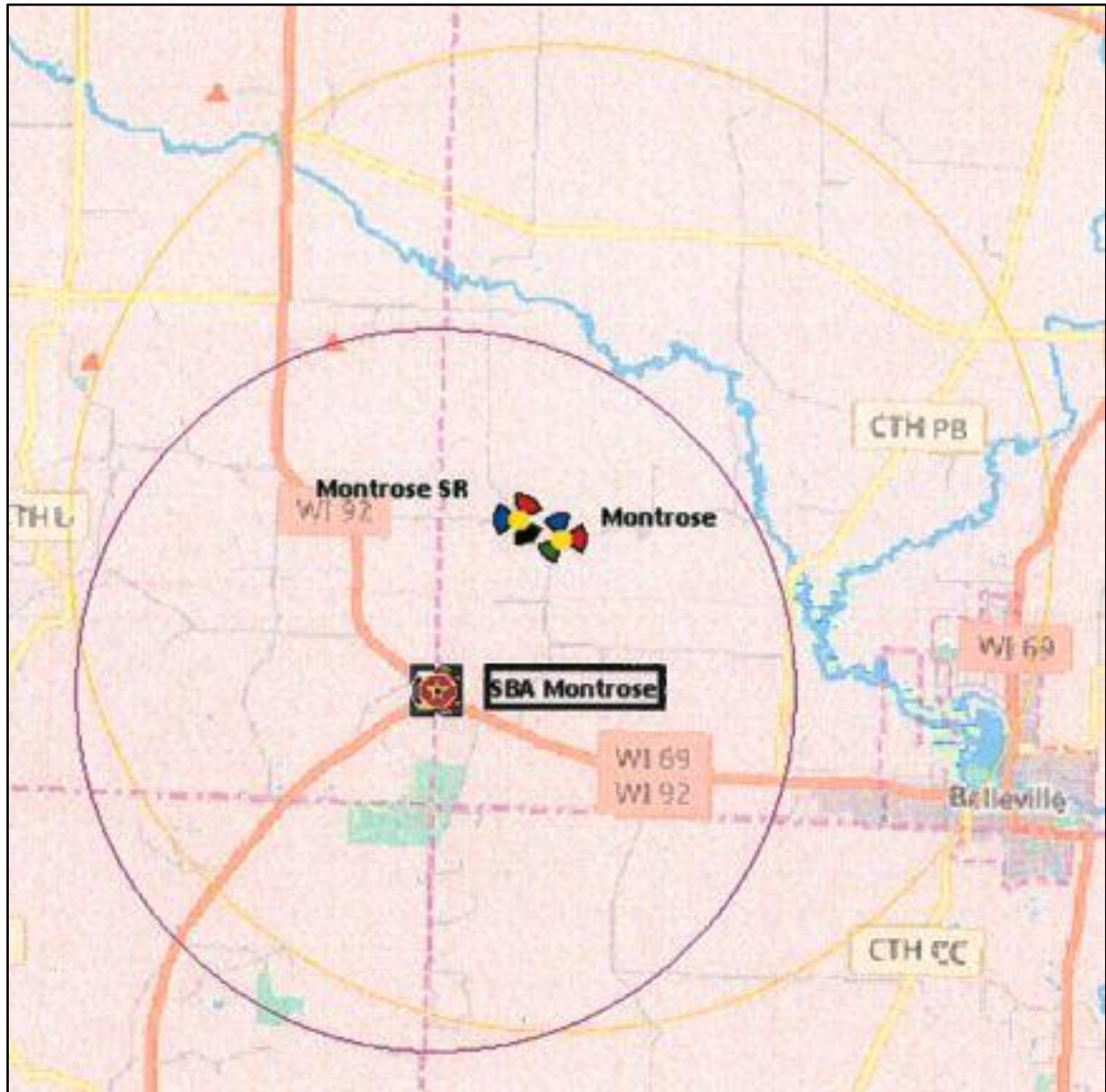
### Search Ring Release

Structure ID: Dane-5074  
 Site Name: Montrose  
 County: Dane  
 Latitude: 42.882717  
 Longitude: -89.592704  
 Proposed Height: 250 Feet  
 Search Ring Radius: 1.0 mile  
 Elevation: 900  
 Town of Montrose and surrounding area

Revised 1 mile Search Ring submitted 12/11/18



### Exhibit B – Conflicting Search Rings



**Exhibit C – Coverage Radius\***

\*CityScape staff believes that the provided coverage circles are based only on the tower height and not the effective antenna height, which includes ground elevation and would result in coverage that is not a perfect circle. CityScape therefore questions the validity of the predicted difference in coverage.

### Exhibit D – Sworn Statements

Sworn statement provided with initial application submittal 10/12/18

#### AFFIDAVIT OF SCOTT REITER

STATE OF WISCONSIN    )  
  ) ss.  
COUNTY OF BROWN    )

I, the undersigned, being duly sworn, state as follows:

1. I am an adult resident of the State of Wisconsin and a radio-frequency engineer employed by Bug Tussel Wireless, LLC and Cloud 1, LLC.
2. I make this affidavit in support of Cloud 1, LLC's application to the Town of Montrose and Dane County to construct a new communications tower located at: Tax parcel identification number 040-0508-301-9001-1 (Owned by: Dennis and Lisa Nolden, 484 Fritz Road, Belleville, WI 53508).
3. Bug Tussel Wireless, LLC is a duly licensed mobile service provider and shall be the anchor tenant on the Cloud 1, LLC tower proposed for the Busser property.
4. One of my job responsibilities is to design and direct the placement of the Bug Tussel Wireless antenna facilities throughout its entire mobile service network.
5. Attached hereto and incorporated herein is a true and correct copy of an analysis performed by me which compares the coverage that Bug Tussel Wireless would have if it were to collocate on the existing structure located within one mile of the proposed tower site.
6. Bug Tussel Wireless, LLC has performed a thorough search of this area and found that the proposed location best suits our needs for Line of Site to cover the most customers.

[Signature]  
(Signature)

4/25/18  
(Date)

Scott Reiter

Subscribed and sworn to before me  
this 25<sup>th</sup> day of June, 2018.

[Signature], Notary Public  
Brown County, Wisconsin  
My Commission Expires 12-9-2019



Revised sworn statement provided  
in subsequent submittal 12/12/18

**AFFIDAVIT OF SCOTT REITER**

STATE OF WISCONSIN )  
                                  ) ss.  
COUNTY OF BROWN )

I, the undersigned, being duly sworn, state as follows:

1. I am an adult resident of the State of Wisconsin and a radio-frequency engineer employed by Bug Tussel Wireless, LLC and Cloud 1, LLC.
2. I make this affidavit in support of Cloud 1, LLC's application to the Town of Montrose and Dane County to construct a new communications tower located at: Tax parcel identification number 040-0508-301-9001-1 (Owned by: Dennis and Lisa Nolden, 484 Fritz Road, Belleville, WI 53508).
3. Bug Tussel Wireless, LLC is a duly licensed mobile service provider and shall be the anchor tenant on the Cloud 1, LLC tower proposed for the Nolden property.
4. One of my job responsibilities is to design and direct the placement of the Bug Tussel Wireless antenna facilities throughout its entire mobile service network.
5. Attached hereto and incorporated herein is a true and correct copy of an analysis performed by me. There are no existing towers or structures within 1-mile radius of the center of the attached search ring. Collocation on existing structures is not a viable option. As a result, Bug Tussel is proposing to build a new communication tower at this location to address the needs of the mobile service network for this area.
6. Bug Tussel Wireless, LLC has performed a thorough search of this area and found that the proposed location best suits our needs for Line of Site to cover the most customers.

  
\_\_\_\_\_  
(Signature)

12/12/18  
\_\_\_\_\_  
(Date)

Scott Reiter  
\_\_\_\_\_

Subscribed and sworn to before me  
this 11<sup>th</sup> day of December, 2018.

  
\_\_\_\_\_, Notary Public  
Brown County, Wisconsin  
My Commission Expires 12-9-2019



Second revised sworn statement  
provided in subsequent submittal 1/9/19

**AFFIDAVIT OF SCOTT REITER**

STATE OF WISCONSIN    )  
  ) ss.  
COUNTY OF BROWN    )


I, the undersigned, being duly sworn, state as follows:

1. I am an adult resident of the State of Wisconsin and a radio-frequency engineer employed by Bug Tussel Wireless, LLC and Cloud 1, LLC.
2. I make this affidavit in support of Cloud 1, LLC's application to the Town of Montrose and Dane County to construct a new communications tower located at: Tax parcel identification number 040-0508-301-9001-1 (Owned by: Dennis and Lisa Nolden, 484 Fritz Road, Belleville, WI 53508).
3. Bug Tussel Wireless, LLC is a duly licensed mobile service provider and shall be the anchor tenant on the Cloud 1, LLC tower proposed for the Nolden property.
4. One of my job responsibilities is to design and direct the placement of the Bug Tussel Wireless antenna facilities throughout its entire mobile service network.
5. I have performed a review of our search area and found no structures within a mile radius. We have found a structure outside our search area. That structure is an existing tower owned by SBA. This existing tower is 1.2 miles from our search area center. This existing tower has an available centerline of 160'. This tower is 1.7 miles from our coverage objective which is the town of Montrose. This distance is too far to provide serviceable inbuilding coverage. We try to stay within 1.5 miles of the town so we can provide inbuilding coverage. This ensures that voice and internet services are working reliable. The proposed tower can reach 2000 pops compared to the SBA tower reaching only 450 pops.
6. The proposed site will have AT&T mobile voice, internet, and First Net emergency services. It will also include Bug Tussel Wireless fixed internet services.

  
\_\_\_\_\_  
(Signature)

1/7/19  
\_\_\_\_\_  
(Date)

Scott Reiter  
\_\_\_\_\_

Subscribed and sworn to before me  
this 7<sup>th</sup> day of January, 2019.  
, Notary Public  
Brown County, Wisconsin  
My Commission Expires 12-9-2019

