



# IDK Communications

July 30, 2023

Mr. Phil Auger  
Strafford Planning Board  
12 Mountain View Drive  
Strafford, NH 03884

RE: Mariner Tower Application – 15 Strafford Road

Dear Mr. Auger:

IDK Communications (“IDK”) has been tasked with the following scope pertaining to the above referenced subject.

- 1.) Review the technical information and coverage analysis for existing and proposed sites provided by the applicant, dated November 29, 2022.
- 2.) Review the drawings provided by the applicant dated March 28, 2023, latest revision.
- 3.) Perform an independent coverage analysis.
- 4.) Provide a written summary report with outputs.

## Radio Frequency (RF) Coverage Analysis:

When analyzing a site for radio frequency propagation several factors contribute to the overall performance. Of great importance are factors such as height above average terrain, tree density, building density and construction, frequency and equipment performance specifications.

The following paragraphs identify characteristics of each item used in determining overall performance.

#### Equipment specifications:

It is important to first determine whether a candidate site is limited by the radio path from the handset in a vehicle or building to the radio base station at the tower or by the radio path from the base station at the tower to the handset in a vehicle. In most cases because of the limited output power of the handset the path from the vehicle or inside a building to the radio base station at the tower is your limiting factor. Once this is known input parameters for both the base station and the handset are used to calculate the overall receive parameter used in the propagation modeling.

#### Height above average terrain:

Another important factor in determining a site's viability is how high the antennas will be in relation to the surrounding terrain. In the cellular/PCS world being at a maximum height above the average terrain is not necessarily a good thing since the systems are designed to provide handoffs to adjacent sites. Cellular/PCS carriers will re-use frequencies at different sites so it is important not to create interference with themselves. This philosophy differs from that of older wireless paging systems for example where sites were picked for their greater heights above average terrain. Cellular/PCS sites are picked by how they relate to the area that requires coverage. These areas are where the general population lives and commutes. A site that provides for coverage within a geographical area does not need to be on the highest point for that area but rather an area that provides enough clearance above the average terrain.

#### Tree Density:

Going along with height above average terrain is tree density. This factor is important because where the height of the antennas just clears the overall tree canopy in the surrounding area there may be additional losses associated with foliage. This loss can vary depending on types of trees and the density of the area. These losses are taken into account when determining propagation. It is also important to note that tree losses at the PCS frequencies of 1900/2100 MHz are greater than the cellular frequencies of 700/800 MHz.

#### Building Density and Construction:

Another factor in the determination of propagation is the building density and construction. Buildings can exhibit different types of losses depending on the construction material. Appropriate RF parameters for building density can be used when modeling coverage for areas such as Strafford.

Input parameter values are chosen and then used in statistical calculations to determine if a viable signal is available for a particular area. In some cases coverage deficient areas are caused by shadows from particularly high terrain. Elimination of the deficient area may sometimes only be accomplished by increasing antenna height or by selecting an alternative site if the heights become too great.

## **Site Configuration Options**

### Antenna Support Structures

When designing an antenna site there are several options with respect to the structure that supports the antennas. Two of the most basic structures are lattice and monopole towers.

The lattice tower consists of three or four legs with interconnecting braces and is capable of heights in excess of 300 feet. The lattice towers can be either guyed with wires or self-supporting. With structural capacity being equal the self-supporting structures are wider than the guyed counterpart version.

The monopole structures are possible to heights of 190 feet. As their heights increase so does the complexity of the foundations used to support the structure. Antennas can be either mounted on the exterior of the pole with the transmission lines inside the pole or they can be mounted inside the pole with the transmission lines. Mounting the antennas inside the pole creates a more stealth design and they can also be disguised as flagpoles or trees. Mounting antennas within a pole however will cause the carriers to take up more vertical space and thus the amount of co-location will decrease. If antennas are mounted outside the pole they can be flush mounted to the exterior of the pole to reduce the visual impact. Doing this would also have the same result as mounting the antennas inside with respect to the co-location opportunities. The pictures below offer three types of antenna installations outside of a monopole.



Non-Flush Mount



Flush Mount Install



Monopine Stealth

## Equipment Powering

Typically a cell/PCS carrier constructs a site with an electrical feed and a backup option in the event of an AC failure. The electrical feed to a site is either supported overhead by utility poles or is trenched underground through conduits.

The backup power option can consist of various options such as a propane/diesel generator or batteries. Typically for maintenance purposes the generators are run a few times a month for a short duration. The exact time and day when a generator runs can be negotiated with an applicant.

## **Coverage Analysis:**

IDK was tasked to validate the radio frequency performance of the proposed site. The applicant submitted an RF study by C2 Systems. The RF study used frequency bands currently licensed to cell carriers in the area. Mariner Tower does not have a cell carrier as a co-applicant and thus the RF study does not specifically use existing site data from a cell carrier but rather examines coverage from existing sites in the towns surrounding Strafford. IDK ran an analysis using information supplied in the RF report to determine if the amount of coverage afforded by existing sites and the proposed location are reasonable. The output of our analyses is a map or plot that depicts the radio frequency propagation prediction for each site. IDK has presented an analysis using the 700 MHz frequency band as that will supply more of the primary coverage than the 1900/2100 MHz band and is used by the major cell carriers in the Strafford area. We used the same colors for the three signal levels as was presented in the RF Study by C2 Systems, with green being excellent coverage, orange being fair to very good and grey being fair to less than reliable.

The sites used by IDK in the analysis are as follows:

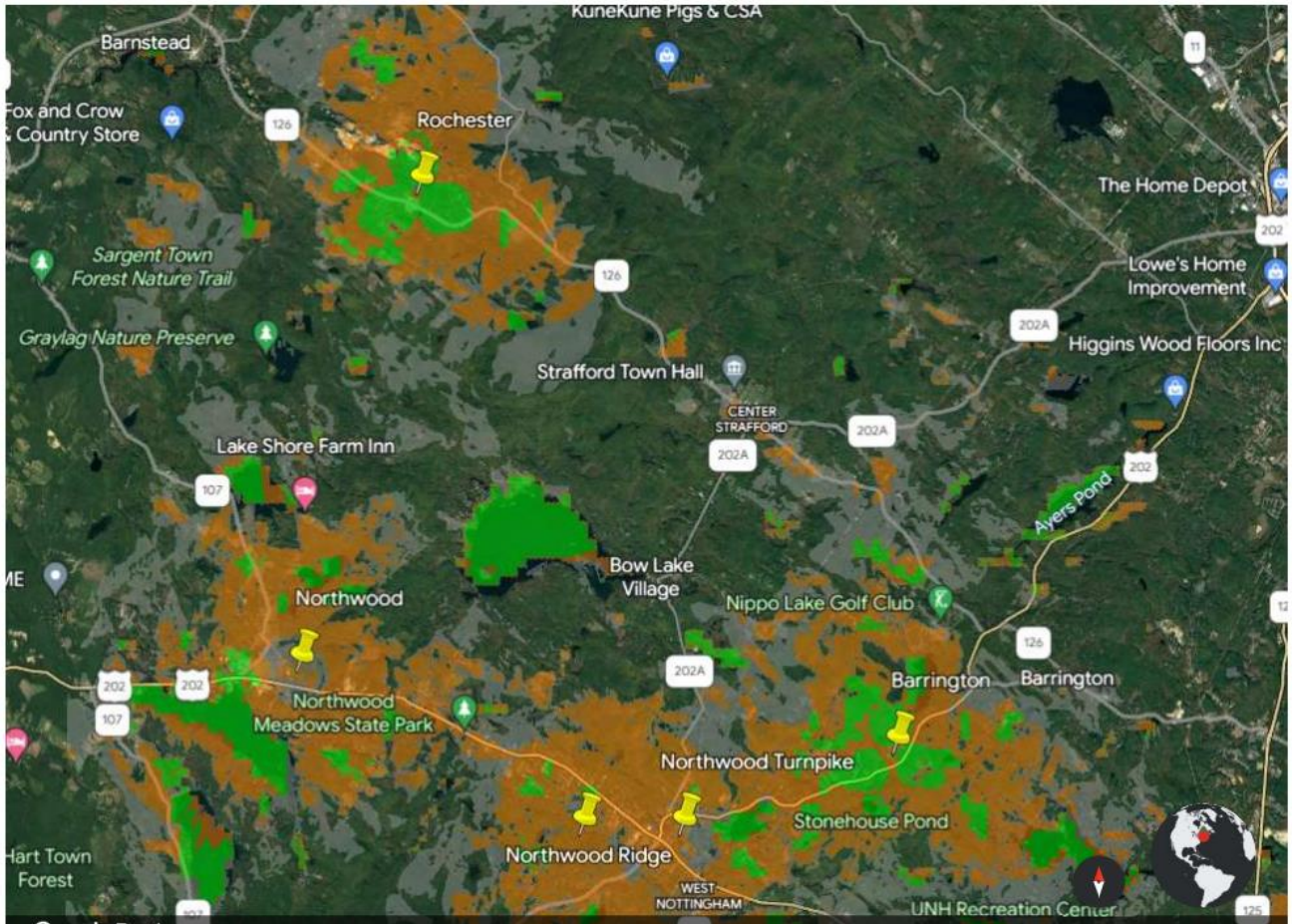
- 1.) Existing sites in the adjoining municipalities
- 2.) Proposed site at 15 Strafford Road

## Results:

Propagation analysis was performed using the existing and proposed sites. Maps are included on the following pages that depict the results with the coverage areas depicted in the three colors identified above. The following paragraphs identify each scenario with the associated results:

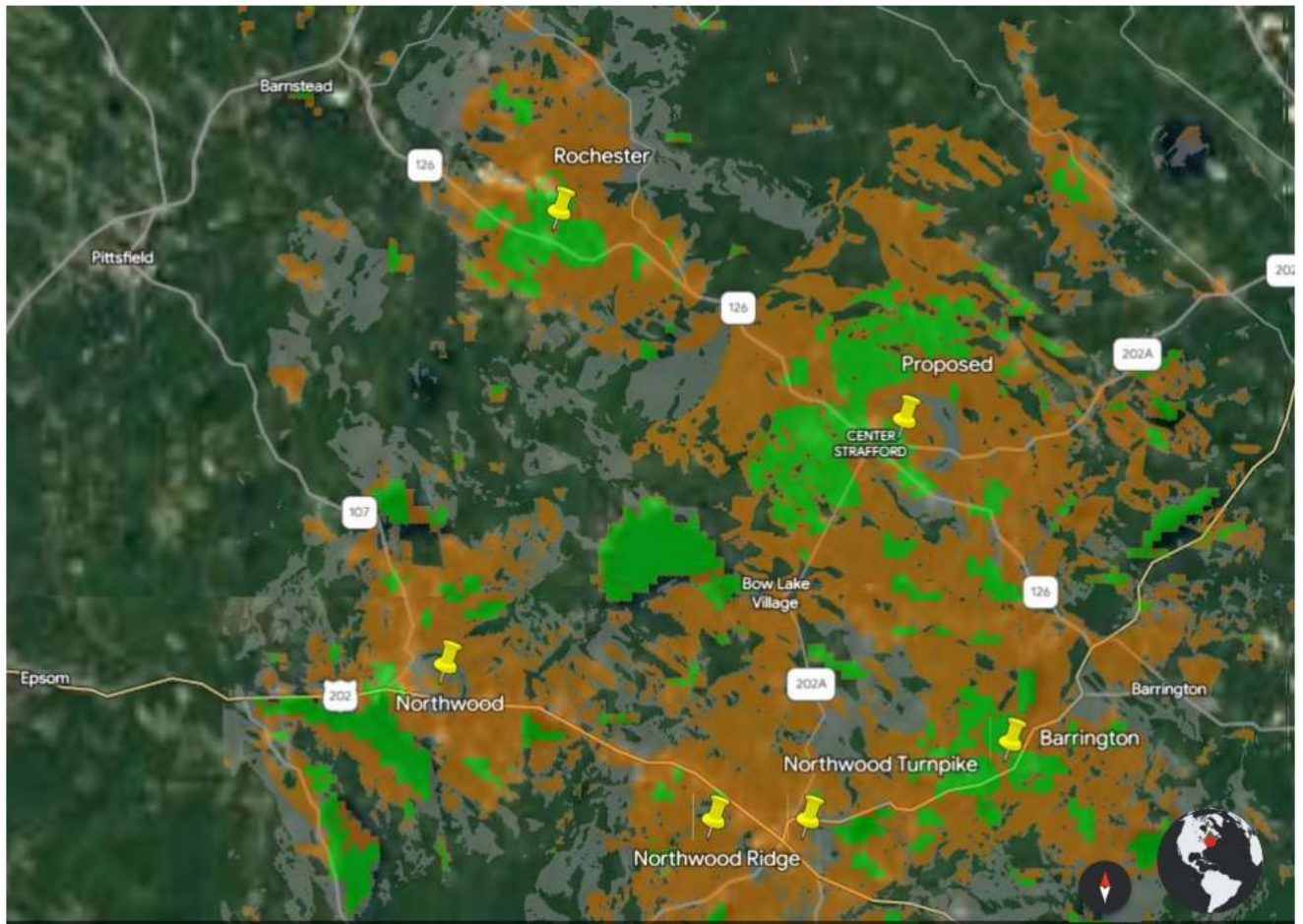
**FIGURE 1 – Existing 700 MHz Coverage**

IDK ran 700 MHz coverage for the existing sites identified in the C2 Systems RF report. The results show that there is minimal coverage in the eastern portion of Strafford, especially along Routes 202A and 126.



**FIGURE 2 – Existing 700 MHz Coverage with Addition of Proposed Site**

IDK ran a 700 MHz coverage analysis to determine the impact to coverage by adding the proposed site at 15 Strafford Road using a tower height of 160 feet and antenna height of 155 feet. The site offers coverage to the east area of Strafford and along Routes 202A and 126.



## **Coverage Summary & Recommendations**

The following summarizes the findings of the coverage scenarios:

- Today the predicted coverage in the east area of Strafford is poor, including along Routes 202A and 126.
- The proposed site at 15 Strafford Road provides predicted coverage for those poor areas.
- The predicted coverage shown in the RF Report seems reasonable and similar to our coverage analysis.

Understanding the East Overlay allows for a tower height up to 160 feet and the coverage analysis for the proposed site used a tower height of 160 feet and antenna height of 155 feet it might be beneficial to see what the afforded coverage is at lower heights. If multiple carriers utilize this proposed tower, then lower antenna heights would be used and thus more of a worst case scenario would be analyzed and also would confirm the requested tower height.

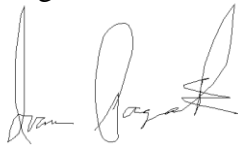
Additionally, since there is not a cell carrier as a co-applicant, before any building permit would be issued the applicant should be required to submit specific coverage analysis for the cell carrier proposed to use the structure. Coverage analysis should include the carrier's existing sites and the proposed site. This information would be valuable in evaluating future applications.

An RF Energy Emission report should also be required before any building permit is issued. The report should include not only the proposed carrier but any existing carrier on the tower if applicable.

## **Application Review**

IDK has no other additional comments regarding the referenced application or drawings.

Regards,



Ivan Pagacik