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Review of Blue Sky Towers DRI Application for Cell Tower at Mashpee Fire Station 2

The Cape Cod Commission engaged Isotrope to review the DRI application by Blue Sky Towers II, LLC to build a wireless facility and 150-foot monopole cell tower at the Mashpee Fire Station site at 101 Red Brook Road. Personal Wireless Service providers T-Mobile and Verizon participate in support of the application by providing the required information about wireless coverage needs.

Isotrope focused on the site plans, visual impact analysis, wireless coverage analysis, radio frequency energy safety analysis and noise analysis. The wireless coverage analysis is addressed under the aegis of the Wireless Technical Bulletin 97-001, as revised.

Recommendations

Several suggestions are made in this report:

- Verizon could provide proof of need for the height by providing coverage analysis 25 feet lower and 50 feet lower. (It is explained that height also benefits co-location, so the requested information informs the findings, it does not dictate a lower height.)
- T-Mobile could refocus its coverage analysis on in-building only and overlay coverage from both 700 MHz and 2100 MHz licenses. (caveats to this format are discussed in the narrative)
- T-Mobile could provide proof of need for the height by providing coverage analysis 25 and 50 feet lower.
- It is not clear why the applicant asserts the facility is in the Mashpee Wireless facilities Overlay District. Additional evidence is recommended, as this affects the required findings of the Commission.
- The visual impact analysis contains some discrepancies that could be corrected. (see discussion for details)

Technical Bulletin

The Wireless Technical Bulletin has performance criteria for a proposed wireless communications facility. It also contains submission guidelines for applications. To the extent we identify additional material would be helpful, it is recommended herein. This report does not endeavor to perform a checklist review of the materials submitted.

Location

The applicant was unable to identify existing structures within the general service area of the proposed tower that could be used in lieu of a new tower. If the Commission or the public have any suggestions, we and the applicant can review them.

Dimensional Requirements

General Height

The Technical Bulletin imposes an average-height-of-buildings-within-300-feet criterion for establishing the permissible tower height. For wireless communication facilities, this criterion is generally not viable. Also, because there are so few buildings near the proposed facility, the average height criterion is not relevant to the conditions. An average building height criterion can be helpful in densely developed areas, such as downtowns.

The Technical Bulletin says the tower design must be camouflaged if it exceeds the height limits of the zoning district. The proposed tower arguably does not exceed the zoning height limit in Mashpee. This is because the customary district height limit is preempted in the Mashpee zoning bylaw for wireless towers. The Mashpee zoning district height limit is preempted by footnote 4 of the Mashpee Zoning Bylaw Land Space Requirements Table (§174-31). The Mashpee zoning bylaw has tower height regulations that are like the requirements in the Technical Bulletin. (General height, Ground-mounted Height, etc.) Within the Mashpee Wireless Facility Overlay District, tower heights may be to 100 feet with a waiver to up to 200 feet allowed under appropriate circumstances.

Camouflage under the Technical Bulletin relates to the materials and design of the antenna structure, not to the screening by vegetation. If the camouflage requirement applies, additional discussion is necessary to address the camouflage requirement. However, because the Mashpee height limit is not exceeded, perhaps the Technical Bulletin camouflage requirement does not apply, or is eligible for waiver because of the wooded location and visual impact analysis. It is left to the Commission to make an interpretation.

Ground-Mounted Tower Height

The Technical Bulletin applies a combination height limit for Ground-Mounted Facilities. It invokes the average-building-height criterion and allows a tree-height criterion if there are no buildings within 300 feet. No 300-foot radius was seen on the submitted plans, however it is safe to observe that within 300 feet there is only the fire station building, which is on the same parcel. The tree-height criterion has the same conflict with good engineering practice, in typical cases, as the average-building-height criterion; both are in opposition to the needs of wireless facilities in most cases to be near or above the peak building or tree height in a given location.

Ground-mounted facilities with no buildings within 300 feet must be surrounded by dense tree growth. Regardless of whether this criterion strictly applies in this case, the facility is surrounded by dense tree growth to the nearest property lines more than 200 feet away.

Overlay District Height

The tower can exceed the foregoing height criteria if it is within a Wireless Facility Overlay District. The applicant says the facility is in an overlay district. The 2016 zoning bylaw does not explicitly list the map/parcel as being within the overlay district.

The general clause allows parcels that are not subject to certain limitations. The applicant has not substantiated whether the proposed site is free of those limitations.

§174-5 C.(2) [The Wireless Facility Overlay District shall include]...

> *lands in the Town which are not located within the boundaries of the Mashpee National Wildlife Refuge, within one thousand (1,000') of a Historic District or of structures or places listed in the Massachusetts State Register of Historic Places, within the Otis A.N.G.B. Accident Prevention Zone within the R-3 or R-5 zoning districts or within three hundred (300') feet of the right of way of any designated scenic roadway.*[1]

The parcel is within the R3 District (see footnote). Moreover, there is no evidence of a 1000'radius being studied for historic properties. Specific proof that the relevant roads are not designated scenic might be requested, as well.

If the facility is not within the overlay district, it appears a variance will be required to satisfy the Mashpee zoning bylaw. If so, there might be locations within the overlay district that would not require a variance.

Visual Impact Analysis

The application includes a visual impact analysis (Exhibit 6) prepared by Virtual Site Simulations, LLC ("VSS") based on a balloon test it conducted from the site. While the general structure of the

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[1] Note that the reference to zoning districts R3 and R5 is not preceded by a comma. Literally, this phrase lacking the comma might be intended to mean "within the Otis A.N.G.B. Accident Prevention Zone within the R3 or R5 zoning district." The accident prevention district is in another part of town and overlaps only some R3 and R5 territory. It seems unnecessary to invoke R3 and R5 if the accident prevention district is the objective (assumes no comma); it also seems unnecessary to invoke the accident prevention district separately from the R3 and R5 if all R3 and R5 areas are the objective (missing comma). The latter interpretation (missing comma, making the overlay exclusion apply to all R3 and R5) would exclude substantial areas in Mashpee, making it very difficult to site a tower without a use variance.

photosimulation and visual impact report is consistent with current practice, we note what appear to be some discrepancies in scale.

The simulation of location #3 and the simulation of location #4 are markedly different in apparent size, despite the fact they are comparable distances from the proposed tower site (0.14 versus 0.17 miles – a 21% increase in distance). One would expect a proportional decrease in apparent size from photo #3 to photo #4. However, the photo #4 tower and antennas seem to be less than half of the size of those in photo #3.

The balloons in the original photos for #3 and #4 are also mismatched. This suggests the original photos are taken with different degrees of lens zoom. Best practice favors using 50 to 85 mm equivalent focal lengths.[2]

It appears photo #4 was taken with a wider field of view, suggesting a wide-angle lens. This creates an unrealistically distant impression of the tower. The equivalent focal lengths of all images should be reported on each photo's legend. Images should be about 50 mm equivalent focal length, except for vista shots, where the viewer might visually attend to the tower, when up to 85 mm focal lengths would be appropriate.

The method of inserting the tower image is not disclosed. Best practice is based on a 3D CAD model of a tower, in which the image of the tower is corrected for perspective and distance. The closer the photo is to the tower, the more perspective (viewing up underneath the antenna platforms) the tower image should have. Both the focal length (and corresponding field of view) and the 3D model of the tower can be employed in a mathematically rigorous way to produce an accurate photosimulation.

The photosimulation service should provide a description of methodology that explains how the photos were taken, how the relative size of the tower was established, and how the perspective of the tower based on observer distance was established.

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[2] It is customary to refer to focal lengths with respect to traditional 35 mm film formats. Digital cameras have different sensor sizes and correspondingly different focal-length-to-field-of-view ratios. This report uses 35 mm format *equivalent focal lengths* to normalize discussion of the images.

Photosimulation #3 at 0.14 mi. **Photosimulation #4 at 0.17 mi.**
Same scale from both images.
Note how the #4 tower seems much more distant despite the minor change in camera distance.

Noise Analysis

A professional noise analysis was performed and documented (Exhibit 18) by Modeling Specialties. The noise analysis employed best practices to arrive at its conclusions.

Radio Frequency Energy Safety Analysis

The radio frequency energy safety analysis prepared by Dr. Haes (Exhibit 19) appropriately assesses the combined impact of multiple facilities that could operate at the site. Isotrope agrees with the Haes report's conclusions that the radio frequency emissions will be compliant with federal and state guidelines by a substantial margin. The general population will not be exposed to unsafe levels of emissions from the proposed facility.

Co-Location

The applicant is in the business of providing tower space to wireless carriers and has an incentive to provide space to as many co-locators as possible. Two carriers are participating in the process, demonstrating commitments to occupy the tower.

Site Plans

The site plans (Exhibit 5) Prepared by Pro Terra Design Group show a facility with the typical configuration for multiple wireless carriers. The Verizon and T-Mobile equipment are laid out in the plan, accompanied by sufficient space reserved on the ground and the tower for two additional carriers. The Verizon installation employs the traditional 3-sector antenna arrays mounted on a triangular tower platform.

T-Mobile has begun employing four-sector arrays on square platforms. The additional sector enables T-Mobile to provide more capacity to the surrounding area by breaking it into four instead of three service sectors. The detail plan shows the square platform. The overall plan views of the site are simplified by showing the triangular form of the Verizon platform without the square T-

Mobile platform below it. Provided the reader is aware of this variation in platform design, there is no need to correct the drawings.

T-Mobile does not plan to use a generator. Verizon does. One propane tank is proposed, with space reserved for a second propane tank in the event another carrier proposed a generator for its facility. (The noise study included a hypothetical second generator and other carriers' equipment in a combined noise analysis.)

Fall Zone

A fall zone equal to the height of the tower plus appurtenances is required. The proposed tower has well more than the required ~150-foot setback from property lines.

A legal interest in the fall zone is required of the applicant, "to meet the requirements of this section." It could be inferred that meeting the requirements means ensuring that in the future the fall zone will continue to protect "any property line, road, habitable dwelling, business or institutional use, or public recreational area..." The lease area is 100x100 feet, which is not enough to cover the fall zone. The applicant suggests "The Owner, the Town of Mashpee, understands the nature of the fall zone requirements under the Town and the Cape Cod Commission's regulations." The Commission could determine whether Town ownership is sufficient to meet this requirement, or if additional protections are in order.

Coverage or Capacity Problem

The Technical Bulletin seeks a demonstration of a coverage or capacity problem requiring a solution. No capacity statistics have been provided for the record, and the applicant's two tenants have provided coverage analysis to support their claims. Note that the determination of a "coverage or capacity problem" is not necessarily the same as a determination of a "coverage gap" under federal law.

As the Commission is aware, if a proposed wireless facility is not approved and the non-approval results in an effective prohibition of the provision of personal wireless service, the applicant has recourse under federal law (advice of counsel is always recommended in dealing with the federal obligations for the placement of wireless facilities). In this report, the focus is on the applicant's tenants' description of a "coverage problem" and not on whether there is a significant gap in wireless service.

Prospective tenants Verizon and T-Mobile provided coverage analyses of their networks in the area of the proposed tower. Verizon notes three roads with 2500-5000 vehicles per day are in the affected area, plus streets, residences and businesses within the area of, and including, Red Brook Road, Great Oak Road, Great Neck Road South, Monomoscoy Road and Rock Landing Road.

Verizon

Verizon provides coverage maps that rely on its customary signal level thresholds for service to areas developed like the Mashpee area is (-95 dBm RSRP). Existing coverage is below this threshold in the targeted area. Verizon uses the coverage from its 700 MHz licenses, because this is the most optimistic. In other words, 700 MHz goes the farthest through terrain and vegetation, so it is a good indicator of the maximum service area available from existing facilities.

The proposed site is on the southern edge of coverage from the existing Mashpee site about 1.5 miles to the north. Ordinarily, wireless carriers prefer to place new facilities in the middle of the area of poorest service. This would be about ¾ mile south of the proposed site, near the intersection of Hush Road and Great Oak Road.

To compensate for the proposed location being offset to the north, the Verizon facility design is not intended to fully cover a 360-degree service area. Instead, the blue wedges on the coverage map show that the proposed facility would focus antennas to the east, south and west, ignoring the northerly direction. A location more to the south would better serve the densely developed New Seabury area, providing better coverage and more capacity to where the demand for services is likely the highest.

There remains a pocket in Popponesset that would not realize substantial improvement in service from the proposed facility. Future expansion might need to rely on utility-pole and rooftop-mounted small cells to provide fill-in coverage and capacity during peak season.

Verizon has provided no data on whether the proposed height is necessary. Clearly, the proposed tower is intended to co-locate potentially all four of the current wireless carriers, and establishing the minimum height for Verizon is not a way to literally establish the tower height, unless the proposed height needs to be mitigated at the expense of potential co-location.

It could be helpful to see projected Verizon coverage from a 125-foot tower (121 ft center) and a 100-foot tower (96 ft center), overlaid on existing coverage. This helps show how 700 MHz coverage would diminish not only for Verizon, put for other potential co-locators, as the height is reduced. This will help inform a decision whether 150 feet is reasonable and necessary from the standpoint of coverage, co-location and visual impact.

The Verizon drive test map is reasonably consistent with the computer predictions, which validates the computer predictions. The drive testing was done with no foliage, so it is expected to show better coverage than the computer predictions, which it does.

T-Mobile

T-Mobile makes a slightly different presentation. T-Mobile ignores its 700-MHz frequency band and provides coverage analysis for its weakest service – 2100 MHz. This understates the total coverage because T-Mobile has a 700 MHz license and is building out a 600 MHz license. These lower frequencies penetrate terrain and foliage much better than 2100 MHz. For now, T-Mobile focuses on 2100 MHz because it has substantially more capacity than the 700 MHz license. Under T-Mobile's circumstances, we recommend that both the 2100 MHz service and the 700 MHz service be shown together. The 700 MHz coverage shows how far the T-Mobile facility can reach with a specific grade of service, while the 2100 MHz coverage shows where high demand for capacity (densely developed or occupied areas) is best.

T-Mobile also shows two tiers of coverage – in-building (green at -97 dBm, similar to Verizon's maps) and in-vehicle (yellow at -114 dBm, not shown by Verizon). T-Mobile demonstrates that in vehicles and outdoors, its existing coverage (at 2100 MHz) in the area near the proposed tower is readily available. In-vehicle coverage dissipates in the areas of New Seabury and Popponesset.

T-Mobile's drive test map is much more pessimistic than the coverage predictions. Since the drive testing was performed by a different party than that were the computer predictions, there may be some differences in method that are not reconciled. We rely on the computer-predicted maps.

Like Verizon, T-Mobile's dominant coverage needs are substantially south of the proposed site. T-Mobile's best coverage at 2100 MHz falls on the least densely populated area to be served by the proposed tower, including the wildlife refuge.

T-Mobile also provides no evidence of the need for the height proposed. The same trade-offs between coverage and tower co-location apply to T-Mobile as they do to Verizon (discussed above).

T-Mobile could provide coverage maps using the -97 dBm threshold for 2100 MHz (and its equivalent at 700 MHz) to illustrate the two stages of in-building coverage available today, and with the proposed facility. Then it could add coverage analysis from a 125-foot tower (110 ft antenna center height) and a 100-foot tower (85-foot antenna center height). These will inform findings about height versus coverage, co-location potential and visual impact.

Coverage Need in General

In general, the two sets of coverage analysis suggest that the New Seabury and Popponesset areas will obtain improved service from the proposed tower, in addition to the roads and lighter development near the proposed tower. However, the sheer density of these areas suggests that in the long run, additional facilities will be needed central to New Seabury and Popponesset to handle the volume of demand (capacity) and the need for better signal strength (coverage and

capacity) in these developed areas. Local regulations should anticipate this future need by encouraging low-impact facilities such as small cells on utility poles and rooftops in these densely developed areas.

Telecommunications Act of 1996

If there is sufficient reason under DRI regulations to not approve the proposed tower, the Commission is obliged to avoid making a decision that effectively prohibits the provision of personal wireless services in the subject area. Assuming there is what the courts would consider to be a significant gap in service, there would have to be alternatives for the applicant's tenants to the proposed tower. An assessment of potential alternative locations would determine whether non-approval would cause an effective prohibition. It is encouraging that the Mashpee zoning bylaw contemplates wireless facilities on any parcel that complies with the several specific limitations. Whether any such parcels are nearby, or potentially farther south has not been explored. If the Commission is inclined to not approve the application, further work on alternatives is recommended first.

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