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Communication Surveys

Wind Power GeoPlanner™

AM and FM Radio Report

Ball Hill Wind



Prepared on Behalf of
Renewable Energy
Systems Americas Inc.

September 13, 2016





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1. Introduction

Comsearch analyzed AM and FM radio broadcast stations whose service could potentially be affected by the proposed Ball Hill Wind project in Chautauqua County, New York.

2. Summary of Results

AM Radio Analysis

Comsearch found two database records¹ for AM stations within approximately 30 kilometers of the project, as shown in Table 1 and Figure 1. These records represent station WDOE, which broadcasts out of Dunkirk, New York, to the west of the project. This station is licensed separately for daytime and nighttime operations, with a higher transmit power permitted during daytime hours.

| ID | Call Sign | Status ² | Frequency (kHz) | Transmit ERP ³ (kW) | Operation Time | Latitude (NAD 27) | Longitude (NAD 27) | Required Separation Distance ⁴ (km) | Distance to Nearest Turbine (km) |
|----|-----------|---------------------|-----------------|--------------------------------|----------------|-------------------|--------------------|------------------------------------------------|----------------------------------|
| 1 | WDOE | LIC | 1410 | 1.0 | Daytime | 42.463611 | -79.355833 | 0.21 | 16.35 |
| 2 | WDOE | LIC | 1410 | 0.031 | Nighttime | 42.463611 | -79.355833 | 0.21 | 16.35 |

Table 1: AM Radio Stations within 30 Kilometers

¹ Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data presented in this report is derived from the AM/FM station's FCC license and governed by Comsearch's data license notification and agreement located at http://www.comsearch.com/files/data_license.pdf.

² LIC = Licensed and operational station; APP = Application for construction permit; CP=Construction permit granted; CP MOD = Modification of construction permit.

³ ERP = Transmit Effective Radiated Power.

⁴ The required separation distance is based on the lesser of 10 wavelengths or 3 kilometers for directional antennas and 1 wavelength for non-directional antennas.

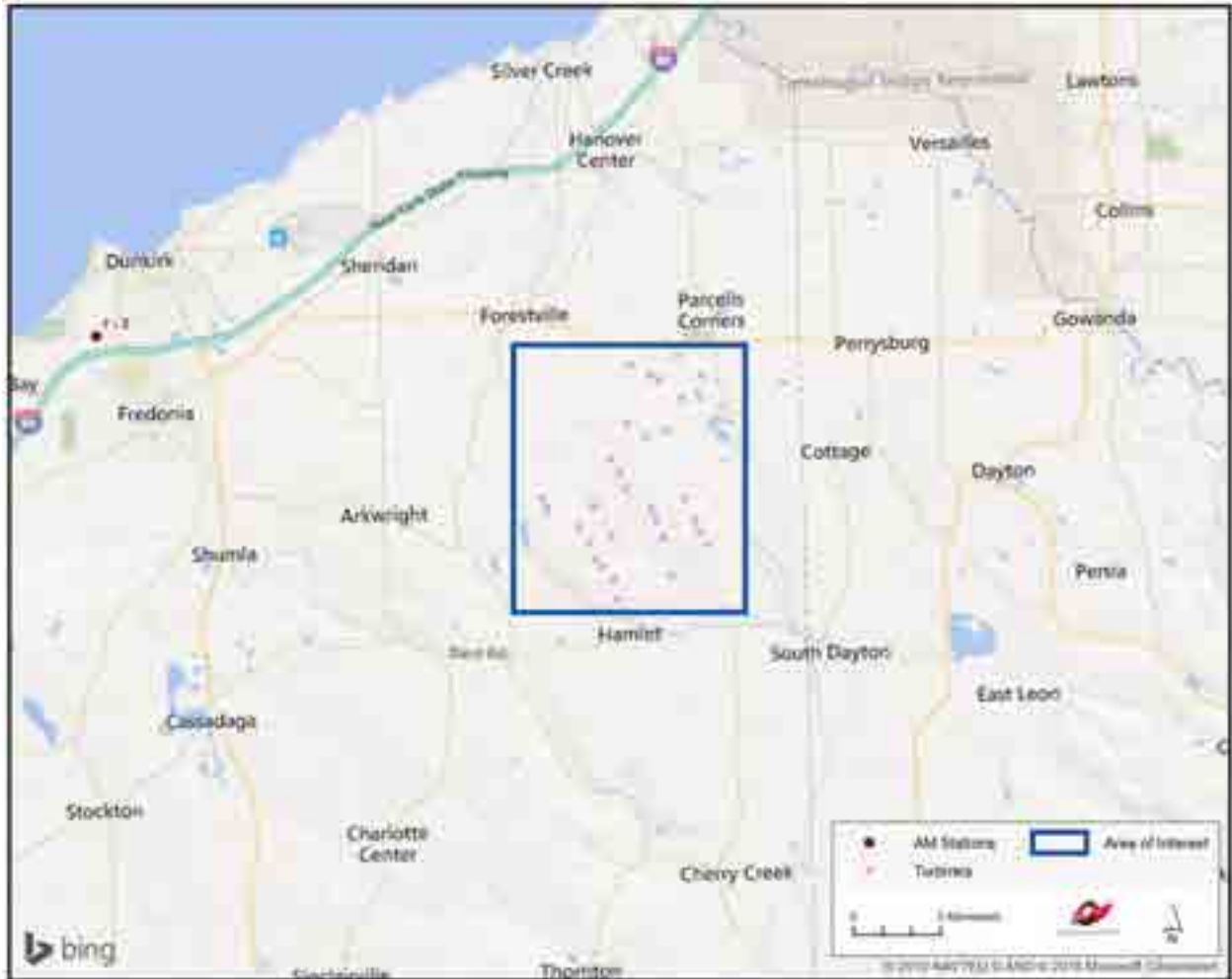


Figure 1: AM Radio Stations within 30 Kilometers



FM Radio Analysis

Comsearch determined that there were twelve records for FM stations within a 30-kilometer radius of the Ball Hill Wind project, as shown in Table 2 and Figure 2. Only ten of these stations are currently licensed and operating, four of which are translator stations that operate with limited range.

| ID | Call Sign | Status ⁵ | Service ⁶ | Frequency (MHz) | Transmit ERP ⁷ (kW) | Latitude (NAD 27) | Longitude (NAD 27) | Distance to Nearest Turbine (km) |
|----|-----------|---------------------|----------------------|-----------------|--------------------------------|-------------------|--------------------|----------------------------------|
| 1 | W263CN | CP MOD | FX | 100.5 | 0.18 | 42.432028 | -79.277750 | 9.14 |
| 2 | W203AW | LIC | FX | 88.5 | 0.019 | 42.451667 | -79.301667 | 11.72 |
| 3 | WCVF-FM | LIC | FM | 88.9 | 0.13 | 42.452222 | -79.337222 | 14.48 |
| 4 | W263CN | APP | FX | 100.5 | 0.15 | 42.489000 | -79.330278 | 15.77 |
| 5 | W235BP | LIC | FX | 94.9 | 0.2 | 42.367222 | -79.386667 | 18.44 |
| 6 | WBKX | LIC | FM | 96.5 | 1.4 | 42.367222 | -79.386667 | 18.44 |
| 7 | WCOM-FM | LIC | FM | 89.3 | 8.0 | 42.578056 | -78.963056 | 18.48 |
| 8 | WYRR | LIC | FM | 88.9 | 0.42 | 42.175833 | -79.317222 | 26.89 |
| 9 | WUBJ | LIC | FM | 88.1 | 2.7 | 42.179722 | -79.341389 | 27.68 |
| 10 | W220EL | LIC | FX | 91.9 | 0.009 | 42.131389 | -79.220278 | 28.29 |
| 11 | W254AQ | LIC | FX | 98.7 | 0.01 | 42.131389 | -79.220278 | 28.29 |
| 12 | WHUG | LIC | FM | 101.9 | 6.0 | 42.131389 | -79.220278 | 28.29 |

Table 2: FM Radio Stations within 30 Kilometers

⁵ LIC = Licensed and operational station; APP = Application for construction permit; CP=Construction permit granted; CP MOD = Modification of construction permit.

⁶ FM = FM broadcast station; FX = FM translator station; FL = FM low-power station; FB = FM booster station.

⁷ ERP = Transmit Effective Radiated Power.

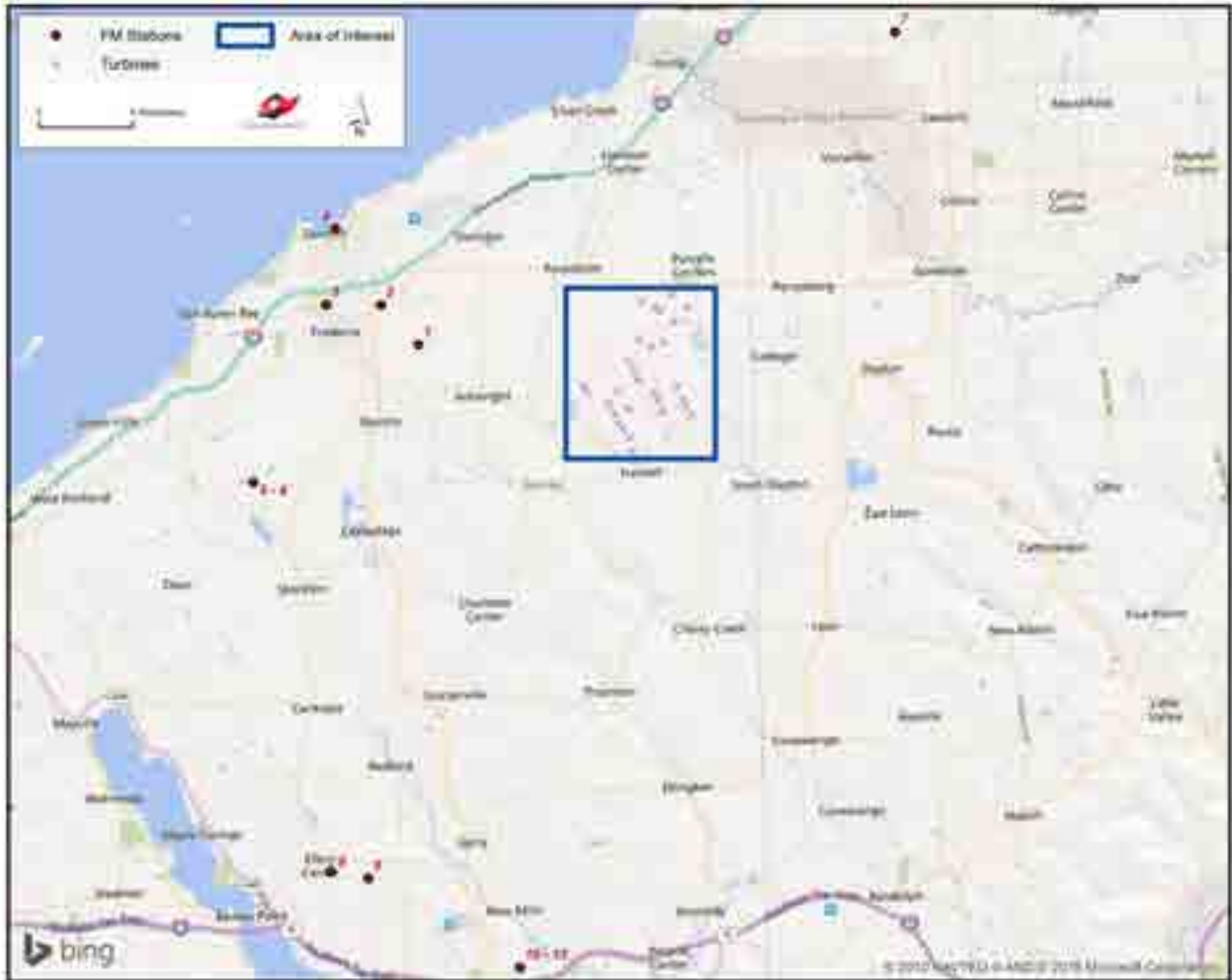


Figure 2: FM Radio Stations within 30 Kilometers



3. Impact Assessment

The exclusion distance for AM broadcast stations varies as a function of the antenna type and broadcast frequency. For directional antennas, the exclusion distance is calculated by taking the lesser of 10 wavelengths or 3 kilometers. For non-directional antennas, the exclusion distance is simply equal to 1 wavelength. Potential problems with AM broadcast coverage are only anticipated when AM broadcast stations are located within their respective exclusion distance limit from wind turbine towers. The closest AM station to the Ball Hill Wind project, WDOE, is more than 16.3 kilometers from the nearest turbine. As there were no stations found within 3 kilometers of the project, which is the maximum possible exclusion distance based on a directional AM antenna broadcasting at 1000 KHz or less, the project should not impact the coverage of local AM stations.

The coverage of FM stations is generally not susceptible to interference caused by wind turbines, especially when large objects, such as wind turbines, are sited in the *far field* region of the radiating FM antenna in order to avoid the risk of distorting the antenna's radiation pattern. The closest operational station to the Ball Hill Wind project, W203AW, is located more than 11.7 kilometers from the nearest turbine. At this distance, there should be adequate separation to avoid radiation pattern distortion.

4. Recommendations

Since no impact on the licensed and operational AM or FM broadcast stations was identified in our analysis, no recommendations or mitigation techniques are required for this project.

5. Contact

For questions or information regarding the AM and FM Radio Report, please contact:

| | |
|-----------------|---------------------------------------------|
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| Web site: | www.comsearch.com |

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Off-Air TV Analysis

Ball Hill Wind



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1. Introduction

Off-air television stations broadcast signals from terrestrially-based facilities directly to television receivers. Comsearch identified those off-air stations whose service could potentially be affected by the proposed Ball Hill Wind project in Chautauqua County, New York. Comsearch then examined the coverage of the stations and the communities in the area that could potentially have degraded television reception due to the location of the proposed wind turbines.

2. Summary of Results

The proposed wind energy project area and local communities are depicted in Figure 1, below.



Figure 1: Wind Farm Project Area and Local Communities

To begin the analysis, Comsearch compiled all off-air television stations¹ within 150 kilometers of the center of the project area of interest (AOI). Appendix A contains a tabular summary of these stations. A plot depicting their locations appears in Figure 2, below.

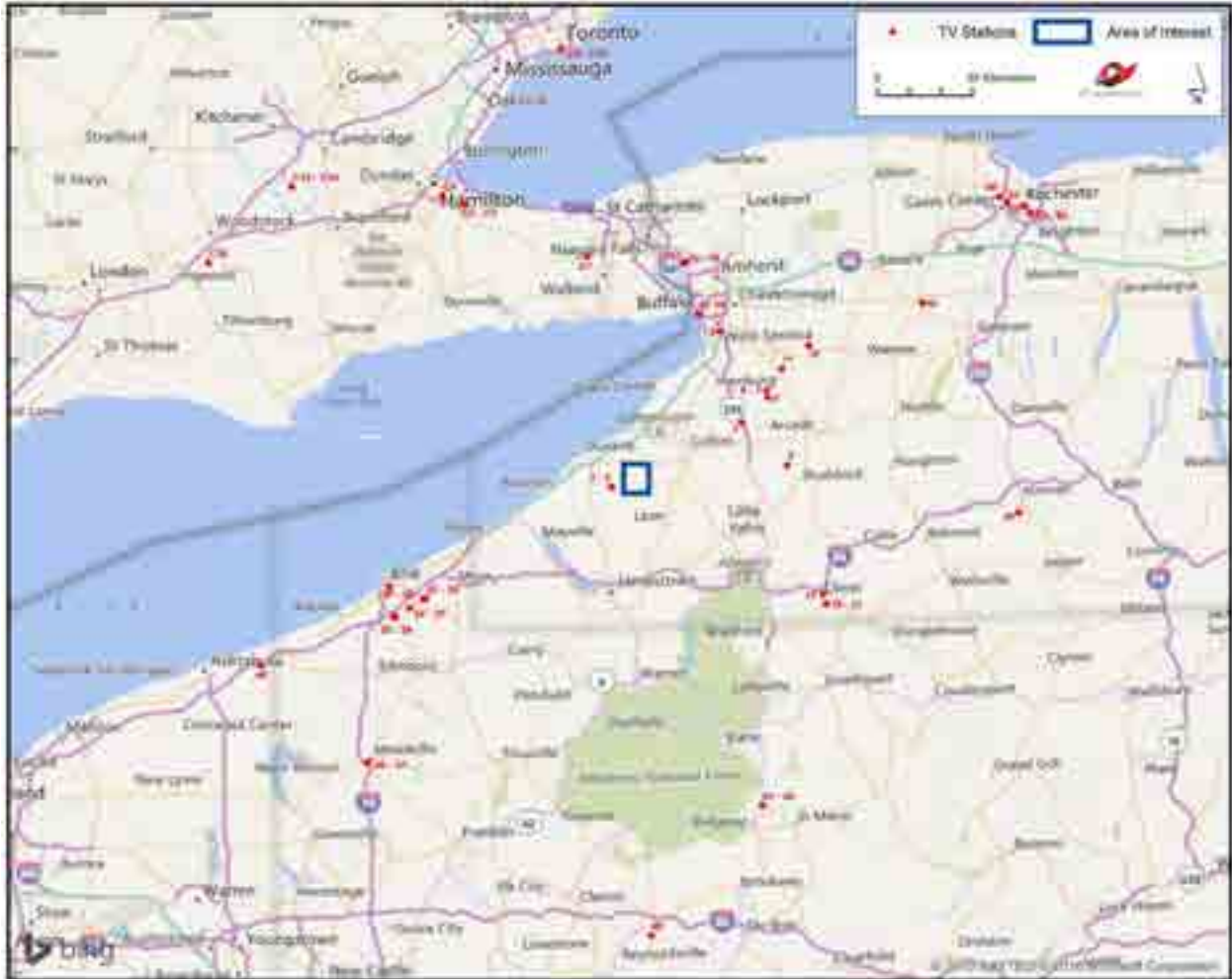


Figure 2: Plot of Off-Air TV Stations within 150 Kilometers of Project Area

TV stations at a distance of 75 kilometers or less are the most likely to provide off-air coverage to the project area and neighboring communities. These stations are listed in Tables 1 and 2, below, and a plot depicting their locations is provided in Figure 3. There are a total of twenty-four database records for stations within approximately 75 kilometers of the limits of the project AOI. Of these stations, only sixteen are currently licensed and operating, seven of which are low-power stations or translators. Translator stations are low-power stations that receive

¹ Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data presented in this report is derived from the TV station's FCC license and governed by Comsearch's data license notification and agreement located at http://www.comsearch.com/files/data_license.pdf.

signals from distant broadcasters and retransmit the signal to a local audience. These stations serve local audiences and have limited range, which is a function of their transmit power and the height of their transmit antenna. The nine remaining records represent stations WNYB, WBBZ-TV, WKBW-TV, WIVB-TV, WGRZ, WNYO-TV, WUTV, WNLO, AND WNED-TV, which broadcast at full power.

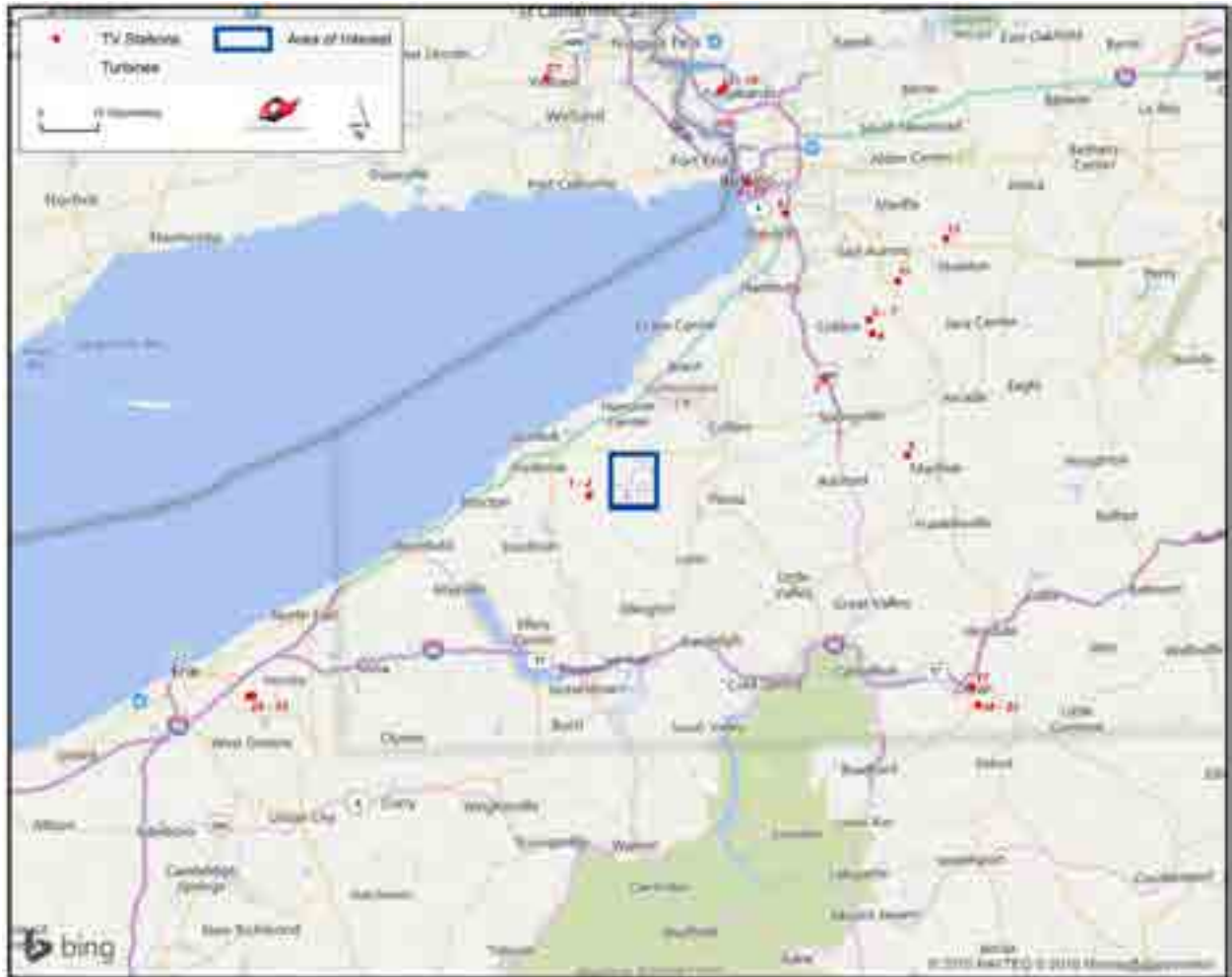


Figure 3: Plot of Off-Air TV Stations within 75 Kilometers of Project Area



| ID | Call Sign | Status | Service ² | Channel | Transmit ERP ³ (kW) | Latitude (NAD 27) | Longitude (NAD 27) | Distance to Nearest Turbine (km) |
|----|-----------|--------|----------------------|---------|--------------------------------|-------------------|--------------------|----------------------------------|
| 1 | WNYB | LIC | DT | 26 | 243.0 | 42.393333 | -79.228889 | 5.18 |
| 2 | WNYB | APP | DT | 26 | 450.0 | 42.393333 | -79.228889 | 5.18 |
| 3 | WBBZ-TV | LIC | DT | 7 | 26.9 | 42.567778 | -78.723333 | 33.94 |
| 4 | WKBW-TV | LIC | DT | 38 | 358.0 | 42.637444 | -78.619972 | 44.93 |
| 5 | WVTT-CD | LIC | DC | 34 | 15.0 | 42.443611 | -78.553056 | 45.24 |
| 6 | WIVB-TV | LIC | DT | 39 | 790.0 | 42.659167 | -78.625833 | 45.69 |
| 7 | WIVB-TV | CP | DX | 39 | 112.0 | 42.659167 | -78.625833 | 45.69 |
| 8 | WDTB-LP | LIC | TX | 39 | 16.9 | 42.830556 | -78.798333 | 49.16 |
| 9 | WBXZ-LP | LIC | LD | 17 | 15.0 | 42.880000 | -78.876667 | 51.15 |
| 10 | WDTB-LP | CP | LD | 29 | 15.0 | 42.880000 | -78.876667 | 51.15 |
| 11 | WGRZ | LIC | DT | 33 | 480.0 | 42.718611 | -78.563056 | 53.58 |
| 12 | WNYO-TV | LIC | DT | 49 | 198.0 | 42.782778 | -78.457778 | 64.72 |
| 13 | WUTV | LIC | DT | 14 | 1000.0 | 43.025556 | -78.928611 | 65.29 |
| 14 | WBNF-CD | LIC | DC | 15 | 15.0 | 43.025556 | -78.928611 | 65.29 |
| 15 | WNLO | LIC | DT | 32 | 1000.0 | 43.030000 | -78.920833 | 65.92 |
| 16 | WNED-TV | LIC | DT | 43 | 156.0 | 43.030000 | -78.920833 | 65.92 |
| 17 | W20AB | LIC | TX | 20 | 12.5 | 42.080556 | -78.430556 | 65.49 |
| 18 | WVTT-CD | CP | DC | 25 | 3.0 | 42.051111 | -78.420278 | 68.01 |
| 19 | W30BW | LIC | TX | 30 | 5.9 | 42.051111 | -78.419722 | 68.04 |
| 20 | W30BW | CP | LD | 30 | 1.0 | 42.051111 | -78.419722 | 68.04 |
| 21 | W20AB | CP | TX | 20 | 0.1 | 42.051028 | -78.419694 | 68.05 |
| 22 | W45EC-D | CP | LD | 45 | 15.0 | 42.090278 | -79.943611 | 73.01 |
| 23 | NEW | APP | LD | 30 | 2.5 | 42.089361 | -79.953278 | 73.76 |

Table 1: Off-Air TV Stations within 75 Kilometers of Project Area (United States)

² Definitions of service and status codes:

DT – Digital television broadcast station

DS – Digital special temporary authority (STA)

LD – Low power digital television broadcast station

DC – Class A digital television broadcast station

TX – Translator station

LIC – Licensed and operational station

CP – Construction permit granted

APP – Application for construction permit, not yet operational

STA – Special transmit authorization, usually granted by FCC for temporary operation

³ ERP = Transmit Effective Radiated Power



| ID | Call Sign | Status | Class ⁴ | Channel | Transmit ERP (kW) | Latitude (NAD 83) | Longitude (NAD 83) | Distance to Nearest Turbine (km) |
|----|-----------|--------|--------------------|---------|-------------------|-------------------|--------------------|----------------------------------|
| C1 | CKVP-DT | OP | R | 42 | 5.0 | 43.051667 | -79.300833 | 68.07 |

Table 2: Off-Air TV Stations within 75 Kilometers of Project Area (Canada)

3. Impact Assessment

The full-power digital stations WNYB, WBBZ-TV, WKBW-TV, WIVB-TV, WGRZ, WNYO-TV, WUTV, WNLO, AND WNED-TV may have their reception disrupted in and around the Ball Hill Wind project. The areas primarily affected would include TV service locations within 10 kilometers of the wind energy project that have clear line-of-sight (LOS) to a proposed wind turbine but not to the respective station. After the wind turbines are installed, communities and homes in these locations may have degraded reception of these three stations. This is due to multipath interference caused by signal scattering as TV signals are reflected by the rotating wind turbine blades and mast.

In addition, the contour of Class A station WVTT-CD overlaps with the project area. Potential disruption of this station would occur under similar LOS conditions as above.

4. Recommendations

While TV signals are reflected by wind turbines, which can cause multipath interference to the TV receiver, modern digital TV receivers have undergone significant improvements to mitigate the effects of signal scattering. When used in combination with a directional antenna, it becomes even less likely that signal scattering from wind farms will cause interference to digital TV reception.

Nevertheless, signal scattering could still impact certain areas currently served by the TV stations mentioned above, especially those that would have line-of-sight to at least one wind turbine but not to a respective station antenna. In the unlikely event that interference is observed in any of the TV service areas, it is recommended that a high-gain directional antenna be used, preferably outdoors, and oriented towards the signal origin in order to mitigate the interference.

Both cable service and direct broadcast satellite service will be unaffected by the presence of the wind turbine facility and may be offered to those residents who can show that their off-air TV reception has been disrupted by the presence of the wind turbines after they are installed.

⁴ Definitions of class and status codes:
 R – Regular VHF Television Broadcast Station
 OP – Licensed and operational station



5. Contact

For questions or information regarding the Off-Air TV Analysis, please contact:

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Web site: www.comsearch.com



Appendix A

| ID | Call Sign | Status | Service ⁵ | Channel | Transmit ERP ⁶ (kW) | Latitude (NAD 27) | Longitude (NAD 27) | Distance to Nearest Turbine (km) |
|----|-----------|--------|----------------------|---------|--------------------------------|-------------------|--------------------|----------------------------------|
| 1 | WNYB | LIC | DT | 26 | 243.0 | 42.393333 | -79.228889 | 5.18 |
| 2 | WNYB | APP | DT | 26 | 450.0 | 42.393333 | -79.228889 | 5.18 |
| 3 | WBBZ-TV | LIC | DT | 7 | 26.9 | 42.567778 | -78.723333 | 33.94 |
| 4 | WKBW-TV | LIC | DT | 38 | 358.0 | 42.637444 | -78.619972 | 44.93 |
| 5 | WVTT-CD | LIC | DC | 34 | 15.0 | 42.443611 | -78.553056 | 45.24 |
| 6 | WIVB-TV | LIC | DT | 39 | 790.0 | 42.659167 | -78.625833 | 45.69 |
| 7 | WIVB-TV | CP | DX | 39 | 112.0 | 42.659167 | -78.625833 | 45.69 |
| 8 | WDTB-LP | LIC | TX | 39 | 16.9 | 42.830556 | -78.798333 | 49.16 |
| 9 | WBXZ-LP | LIC | LD | 17 | 15.0 | 42.880000 | -78.876667 | 51.15 |
| 10 | WDTB-LP | CP | LD | 29 | 15.0 | 42.880000 | -78.876667 | 51.15 |
| 11 | WGRZ | LIC | DT | 33 | 480.0 | 42.718611 | -78.563056 | 53.58 |
| 12 | WNYO-TV | LIC | DT | 49 | 198.0 | 42.782778 | -78.457778 | 64.72 |
| 13 | WUTV | LIC | DT | 14 | 1000.0 | 43.025556 | -78.928611 | 65.29 |
| 14 | WBNF-CD | LIC | DC | 15 | 15.0 | 43.025556 | -78.928611 | 65.29 |
| 15 | WNLO | LIC | DT | 32 | 1000.0 | 43.030000 | -78.920833 | 65.92 |
| 16 | WNED-TV | LIC | DT | 43 | 156.0 | 43.030000 | -78.920833 | 65.92 |
| 17 | W20AB | LIC | TX | 20 | 12.5 | 42.080556 | -78.430556 | 65.49 |
| 18 | WVTT-CD | CP | DC | 25 | 3.0 | 42.051111 | -78.420278 | 68.01 |
| 19 | W30BW | LIC | TX | 30 | 5.9 | 42.051111 | -78.419722 | 68.04 |
| 20 | W30BW | CP | LD | 30 | 1.0 | 42.051111 | -78.419722 | 68.04 |
| 21 | W20AB | CP | TX | 20 | 0.1 | 42.051028 | -78.419694 | 68.05 |
| 22 | W45EC-D | CP | LD | 45 | 15.0 | 42.090278 | -79.943611 | 73.01 |
| 23 | NEW | APP | LD | 30 | 2.5 | 42.089361 | -79.953278 | 73.76 |
| 24 | WSEE-TV | LIC | DT | 16 | 75.0 | 42.064444 | -80.005278 | 78.87 |
| 25 | WICU-TV | APP | DT | 12 | 7.8 | 42.063833 | -80.005778 | 78.93 |
| 26 | WSEE-TV | APP | DT | 16 | 363.0 | 42.063833 | -80.005778 | 78.93 |
| 27 | WICU-TV | LIC | DT | 12 | 5.4 | 42.063889 | -80.005833 | 78.94 |
| 28 | NEW | CP | LD | 19 | 3.7 | 42.125194 | -80.082139 | 81.62 |

⁵ Definitions of service and status codes :

- TV – Analog television broadcast station
- DT – Digital television broadcast station
- DS – Digital special temporary authority (STA)
- LP – Low power analog television broadcast station
- LD – Low power digital television broadcast station
- CA – Class A analog television broadcast station
- DC – Class A digital television broadcast station
- TX – Translator station
- LIC – Licensed and operational station
- CP – Construction permit granted
- CP MOD – Modification of construction permit
- APP – Application for construction permit, not yet operational
- STA – Special transmit authorization, usually granted by FCC for temporary operation

⁶ ERP = Transmit Effective Radiated Power



| ID | Call Sign | Status | Service ⁵ | Channel | Transmit ERP ⁶ (kW) | Latitude (NAD 27) | Longitude (NAD 27) | Distance to Nearest Turbine (km) |
|----|-----------|--------|----------------------|---------|--------------------------------|-------------------|--------------------|----------------------------------|
| 29 | WXTM-LD | CP MOD | LD | 47 | 6.0 | 42.125194 | -80.082139 | 81.62 |
| 30 | WLEP-LD | LIC | LD | 43 | 12.0 | 42.039167 | -80.060833 | 84.25 |
| 31 | W48CH | LIC | TX | 48 | 10.2 | 42.038889 | -80.062500 | 84.39 |
| 32 | WQLN | LIC | DT | 50 | 300.0 | 42.042778 | -80.065556 | 84.40 |
| 33 | W32DH-D | LIC | LD | 32 | 2.07 | 42.037778 | -80.062222 | 84.43 |
| 34 | NEW | APP | LD | 34 | 2.0 | 42.037778 | -80.062222 | 84.43 |
| 35 | W36EK-D | CP | LD | 36 | 10.0 | 42.037778 | -80.062222 | 84.43 |
| 36 | WXTM-LD | CP MOD | LD | 47 | 1.6 | 42.037778 | -80.062222 | 84.43 |
| 37 | WFXP | LIC | DT | 22 | 850.0 | 42.040278 | -80.069167 | 84.79 |
| 38 | WJET-TV | LIC | DT | 24 | 523.0 | 42.040278 | -80.069167 | 84.79 |
| 39 | NEW | APP | LD | 35 | 15.0 | 42.040278 | -80.069167 | 84.79 |
| 40 | WPXJ-TV | LIC | DT | 23 | 455.0 | 42.895000 | -78.015556 | 102.06 |
| 41 | W17DU-D | CP | LD | 17 | 1.0 | 41.482222 | -78.683889 | 106.55 |
| 42 | W19EI-D | CP | LD | 19 | 1.0 | 41.482222 | -78.683889 | 106.55 |
| 43 | W21DO-D | CP | LD | 21 | 1.0 | 41.482222 | -78.683889 | 106.55 |
| 44 | W28EO-D | CP | LD | 28 | 1.0 | 41.482222 | -78.683889 | 106.55 |
| 45 | W16BE-D | LIC | LD | 16 | 0.277 | 42.292222 | -77.674167 | 118.16 |
| 46 | W52BO | CP | LD | 28 | 15.0 | 41.627778 | -80.170833 | 119.41 |
| 47 | W52BO | LIC | TX | 52 | 5.7 | 41.627778 | -80.170833 | 119.41 |
| 48 | W48CH | CP | LD | 48 | 4.0 | 41.905556 | -80.571111 | 128.62 |
| 49 | W45BT-D | LIC | LD | 45 | 6.32 | 41.119722 | -79.114444 | 139.88 |
| 50 | WGCE-CD | LIC | DC | 25 | 4.0 | 43.187222 | -77.702500 | 140.96 |
| 51 | WBGT-CD | LIC | DC | 46 | 15.0 | 43.170222 | -77.673167 | 141.85 |
| 52 | WGCE-CD | APP | DC | 25 | 15.0 | 43.156389 | -77.608611 | 145.41 |
| 53 | WUHF | LIC | DT | 28 | 320.0 | 43.134722 | -77.585278 | 145.76 |
| 54 | WAWW-LP | LIC | TX | 20 | 25.8 | 43.135278 | -77.585278 | 145.79 |
| 55 | WHSB-LP | LIC | TX | 36 | 16.0 | 43.135278 | -77.585278 | 145.79 |
| 56 | WNIB-LD | LIC | LD | 42 | 8.0 | 43.135278 | -77.585278 | 145.79 |
| 57 | WHAM-TV | LIC | DT | 13 | 18.0 | 43.135278 | -77.584167 | 145.87 |
| 58 | WXXI-TV | LIC | DT | 16 | 236.6 | 43.135278 | -77.584167 | 145.87 |
| 59 | WHEC-TV | LIC | DT | 10 | 18.1 | 43.135556 | -77.583889 | 145.91 |
| 60 | WROC-TV | LIC | DT | 45 | 1000.0 | 43.135556 | -77.583889 | 145.91 |

Table A: Off-Air TV Stations within 150 Kilometers of Project Area (United States)



| ID | Call Sign | Status | Class ⁷ | Channel | Transmit ERP (kW) | Latitude (NAD 83) | Longitude (NAD 83) | Distance to Nearest Turbine (km) |
|----|-------------|--------|--------------------|---------|-------------------|-------------------|--------------------|----------------------------------|
| 1 | CKVP-DT | OP | R | 42 | 5.0 | 43.051667 | -79.300833 | 68.13 |
| 2 | CITS-DT | OP | R | 36 | 473.0 | 43.207500 | -79.774167 | 99.08 |
| 3 | CHCH-DT | OP | R | 15 | 132.0 | 43.207500 | -79.774167 | 99.08 |
| 4 | CHCJ-DT | OP | R | 35 | 390.0 | 43.231667 | -79.859167 | 105.13 |
| 5 | CIII-DT-41 | OP | R | 41 | 100.0 | 43.642500 | -79.387222 | 133.95 |
| 6 | CBLT-DT(1) | AU | R | 20 | 106.9 | 43.642500 | -79.387222 | 133.95 |
| 7 | CJMT-DT | OP | R | 40 | 19.5 | 43.642500 | -79.387222 | 133.95 |
| 8 | CFTO-DT | OP | R | 9 | 10.8 | 43.642500 | -79.387222 | 133.95 |
| 9 | CITY-DT | OP | R | 44 | 21.0 | 43.642500 | -79.387222 | 133.95 |
| 10 | CFMT-DT | OP | R | 47 | 22.2 | 43.642500 | -79.387222 | 133.95 |
| 11 | CBLFT-DT(1) | AU | R | 25 | 106.2 | 43.642500 | -79.387222 | 133.95 |
| 12 | CICA-DT | OP | R | 19 | 106.5 | 43.642500 | -79.387222 | 133.95 |
| 13 | CIII-DT | OP | R | 17 | 165.0 | 43.260833 | -80.443889 | 139.95 |
| 14 | CICO-DT-28 | OP | R | 28 | 20.2 | 43.261389 | -80.444722 | 140.05 |
| 15 | CITY-DT-2 | OP | R | 31 | 20.0 | 43.046111 | -80.767778 | 148.67 |

Table A-2: Off-Air TV Stations within 150 Kilometers of Project Area (Canada)

⁷ Definitions of class and status codes:
 R – Regular VHF Television Broadcast Station
 C – Class C Television Broadcast Station
 OP – Licensed and operational station
 AU – Authorized, not yet fully operational

Wind Power GeoPlanner™

Land Mobile & Emergency Services Report

Ball Hill Wind



Prepared on Behalf of
Renewable Energy
Systems Americas Inc.

September 13, 2016





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1. Introduction

An assessment of the emergency services in the Ball Hill Wind project area was performed by Comsearch to identify potential impact from the planned turbines. We evaluated the registered frequencies for the following types of first responder entities: police, fire, emergency medical services, emergency management, hospitals, public works, transportation and other state, county, and municipal agencies. We also identified all industrial and business land mobile radio (LMR) systems and commercial E911 operators within the proposed wind energy facility boundaries. This information is useful in the planning stages of the wind energy facility because the data can be used in support of facility communications needs and to evaluate any potential impact on the emergency services provided in that region. An overview of the project area, which is located in Chautauqua County, New York, appears in Figure 1.



Figure 1: Area of Interest (AOI)

2. Summary of Results

Our land mobile and emergency services incumbent data¹ was derived from the FCC's Universal Licensing System (ULS) and the FCC's Public Safety & Homeland Security bureau. We identified both site-based licenses as well as regional area-wide licenses designated for public safety use.

Site-Based Licenses

The site-based licenses were imported into GIS software and geographically mapped relative to the wind energy project area of interest as defined by the customer. Each site on the map was given an ID number and associated with site information in a data table. A depiction of the fixed-site licenses in and around the project area appears in Figure 2.

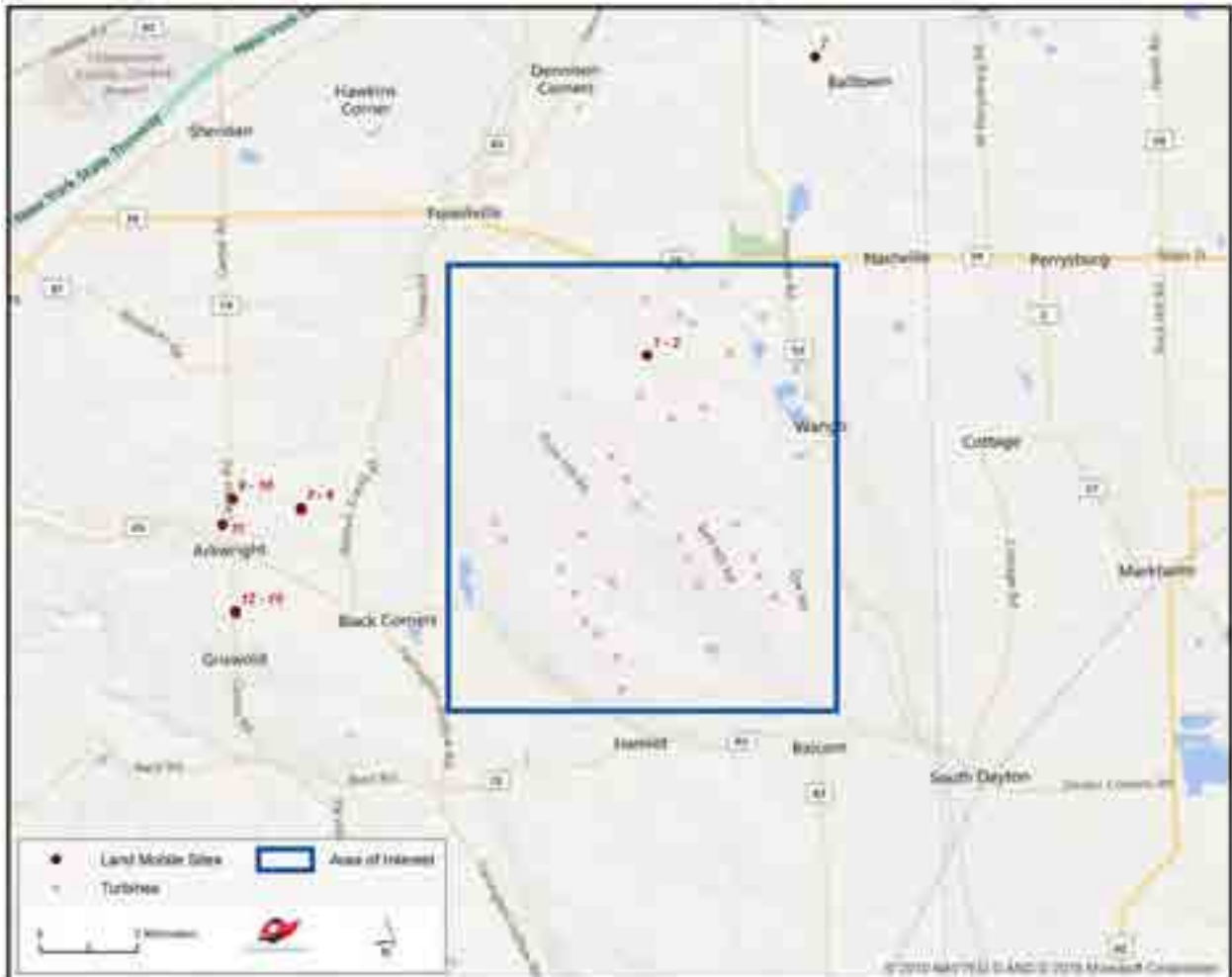


Figure 2: Land Mobile & Emergency Service Sites in Area of Interest



Figure 2 identifies fifteen site-based licenses in and around the Ball Hill Wind project area of interest. Specific information about these sites is provided in Table 1.

| ID | Call Sign | Frequency Band (MHz) | Licensee | Antenna Height AGL (m) | Latitude (NAD83) | Longitude (NAD83) | Distance to Nearest Turbine (km) |
|----|-----------|----------------------|--------------------------------------|------------------------|------------------|-------------------|----------------------------------|
| 1 | KNRS991 | 800/900 | NPCR, Inc. | 61.0 | 42.440611 | -79.131694 | 0.84 |
| 2 | KNRT703 | 800/900 | NPCR, Inc. | 61.0 | 42.440611 | -79.131694 | 0.84 |
| 3 | WNXQ602 | 150-174 | WCA Services Corporation | 52.0 | 42.413667 | -79.218944 | 4.02 |
| 4 | WNXQ602 | 450-470 | WCA Services Corporation | 9.0 | 42.413667 | -79.218944 | 4.02 |
| 5 | WPGH563 | 450-470 | S. St. George Enterprises, Inc. | 55.0 | 42.413667 | -79.218944 | 4.02 |
| 6 | WQOA377 | 450-470 | Eagle Radio | 52.0 | 42.413667 | -79.218944 | 4.02 |
| 7 | WNXC831 | 450-470 | National Fuel Gas Supply Corporation | 34.0 | 42.495333 | -79.088083 | 5.03 |
| 8 | WNBK721 | 450-470 | Harvey, Robert D | 55.0 | 42.415611 | -79.235889 | 5.43 |
| 9 | WNMI645 | 450-470 | Erie 2 Chautauqua Cattaraugus BOCES | 55.0 | 42.415611 | -79.235889 | 5.43 |
| 10 | WPCP419 | 450-470 | Carrier Coach, Inc. | 55.0 | 42.415611 | -79.235889 | 5.43 |
| 11 | KQD357 | 150-174 | Norfolk Southern Railway Company | 13.0 | 42.411167 | -79.238667 | 5.63 |
| 12 | WPVX592 | 150-174 | Chautauqua, County of | 45.7 | 42.395056 | -79.235889 | 5.68 |
| 13 | WQVE292 | 150-174 | Chautauqua, County of | 50.3 | 42.395056 | -79.235889 | 5.68 |
| 14 | KEB392 | 150-174 | Chautauqua, County of | 58.0 | 42.394778 | -79.235889 | 5.69 |
| 15 | KEB909 | 25-50 | Chautauqua, County of | 46.0 | 42.394778 | -79.235889 | 5.69 |

Table 1: Land Mobile & Emergency Service Sites in Area of Interest

¹ Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data presented in this report is derived from the land mobile station's FCC license and governed by Comsearch's data license notification and agreement located at http://www.comsearch.com/files/data_license.pdf



Area-Wide Licenses

The regional area-wide licenses were compiled from FCC data sources and identified for each county in the wind energy project area. The Ball Hill Wind project is located in Chautauqua County, New York, part of Public Safety Region #55, which contains all of the counties in Western New York. The regional public safety operations are overseen by the entity listed below.

Mr. Steven C. Sharpe
Chairperson
 Director of Emergency Communications
 Genesee County
 165 Park Road
 Batavia, NY 14020
 phone: 585-345-3000 ext. 3400
 fax: 585-343-9129
 email: ssharpe@co.genesee.ny.us

The chairperson for Region #55 serves as the representative for all public safety entities in the area and is responsible for coordinating current and future public safety use in the wireless spectrum. In the bands licensed by the FCC for area-wide first responders, which include 220 MHz, 700 MHz, 800 MHz and 4.9 GHz, as well as the traditional Part 90 public safety pool of frequencies, twenty-six licenses were found for the State of New York, and eleven for the County of Chautauqua (see Table 2). These area-wide licenses are designated for mobile use only.

| ID | Licensee | Area of Operation | Frequency Band (MHz) |
|----|---------------------------------------------------|------------------------|--------------------------------------------------------|
| 1 | American National Red Cross | Statewide: New York | 25-50, 450-470 |
| 2 | Bergen Volunteer Fire Department | Statewide: New York | 150-174 |
| 3 | Busti, Town of | Countywide: Chautauqua | 150-174 |
| 4 | Busti Volunteer Fire Department, Inc. | Countywide: Chautauqua | 25-50, 450-470 |
| 5 | Cassadaga Valley Central School System | Countywide: Chautauqua | 25-50 |
| 6 | Central Islip Hauppauge Volunteer Ambulance, Inc. | Statewide: New York | 150-174 |
| 7 | Chautauqua, County of | Countywide: Chautauqua | 25-50, 150-174, 450-470, 800/900, 2450-2500, 4940-4990 |
| 8 | Chautauqua County Airport - Jamestown | Countywide: Chautauqua | 150-174 |
| 9 | Chautauqua County Department of Public Facilities | Countywide: Chautauqua | 25-50 |
| 10 | Clymer, Town of | Countywide: Chautauqua | 150-174 |



| ID | Licensee | Area of Operation | Frequency Band (MHz) |
|----|--------------------------------------------------------------------------|------------------------|------------------------------------------------------------|
| 11 | Dewittville Fire District | Countywide: Chautauqua | 25-50 |
| 12 | Erie, County of | Statewide: New York | 25-50, 150-174, 421-430, 450-470 |
| 13 | Frewsburg Fire District | Countywide: Chautauqua | 25-50, 450-470 |
| 14 | Massasauga Search and Rescue, Inc. | Statewide: New York | 150-174 |
| 15 | Mayville, Village of | Countywide: Chautauqua | 450-470 |
| 16 | National Ski Patrol System, Inc. | Statewide: New York | 150-174 |
| 17 | New York, City of | Statewide: New York | 450-470, 800/900, 4940-4990 |
| 18 | New York City Police Department | Statewide: New York | 150-174 |
| 19 | New York, State of | Statewide: New York | 0-10, 25-50, 150-174, 220-222, 450-470, 800/900, 4940-4990 |
| 20 | New York State Department of Corrections and Community Supervision | Statewide: New York | 150-174, 450-470, 4940-4990 |
| 21 | New York State Department of Environmental Conservation | Statewide: New York | 25-50, 150-174 |
| 22 | New York State Department of Health Bureau of Emergency Medical Services | Statewide: New York | 25-50, 150-174, 450-470 |
| 23 | New York State Department of Transportation | Statewide: New York | 0-10, 4940-4990 |
| 24 | New York State Division of State Police | Statewide: New York | 150-174, 450-470, 800/900, 2450-2500 |
| 25 | New York State Office of Emergency Management | Statewide: New York | 25-50, 150-174 |
| 26 | New York State Office of Parks, Recreation, and Historic Preservation | Statewide: New York | 450-470 |
| 27 | New York State OPRHP - Albany | Statewide: New York | 150-174 |
| 28 | New York State OPRHP - Long Island Region | Statewide: New York | 150-174 |
| 29 | New York State OPRHP - Niagara Region | Statewide: New York | 150-174 |
| 30 | Niagara Frontier Search and Rescue | Statewide: New York | 150-174 |
| 31 | Northeast Mobile Search and Rescue, Inc. | Statewide: New York | 150-174 |
| 32 | Northeastern Forest Fire Protection Compact | Statewide: New York | 25-50, 150-174 |
| 33 | Ossining, Village of | Statewide: New York | 25-50, 450-470 |
| 34 | Sherman Central School District | Countywide: Chautauqua | 150-174 |
| 35 | Triborough Bridge and Tunnel Authority | Statewide: New York | 4940-4990 |



| ID | Licensee | Area of Operation | Frequency Band (MHz) |
|----|------------------------------------|---------------------|----------------------|
| 36 | Western New York Search Dogs, Inc. | Statewide: New York | 150-174 |
| 37 | Woodbury, Town of | Statewide: New York | 4940-4990 |

Table 2: Regional Licenses

E911 Operators

Wireless operators are granted area-wide licenses from the FCC to deploy their cellular networks, which often include handsets with E911 capabilities. Since mobile phone market boundaries differ from service to service, we disaggregated the carriers' licensed areas down to the county level. We have identified the type of service for each carrier in Chautauqua County, New York in Table 3.

| Mobile Phone Carrier | Service ² |
|----------------------|----------------------------------|
| AT&T | AWS, Cellular, PCS, WCS, 700 MHz |
| Blue Wireless | PCS |
| Cavalier Wireless | 700 MHz |
| DISH Network | AWS, 700 MHz |
| Northstar Wireless | AWS |
| SNR Wireless | AWS |
| Sprint | PCS |
| T-Mobile | AWS, PCS |
| Verizon | AWS, Cellular, PCS, 700 MHz |

Table 3: Mobile Phone Carriers in Area of Interest with E911 Service

² AWS: Advanced Wireless Service at 1.7/2.1 GHz
 CELL: Cellular Service at 800 MHz
 PCS: Personal Communication Service at 1.9 GHz
 WCS: Wireless Communications Service at 2.3 GHz
 700 MHz: Lower 700 MHz Service



3. Impact Assessment

The first responder, industrial/business land mobile sites, area-wide public safety, and commercial E-911 communications as described in this report are typically unaffected by the presence of wind turbines, and we do not anticipate any significant harmful effect to these services in the Ball Hill Wind project area. Although each of these services operates in different frequency ranges and provides different types of service including voice, video and data applications, there is commonality among these different networks in regards to the impact of wind turbines on their service. Each of these networks is designed to operate reliably in a non-line-of-sight (NLOS) environment. Many land mobile systems are designed with multiple base transmitter stations covering a large geographic area with overlap between adjacent transmitter sites in order to provide handoff between cells. Therefore, any signal blockage caused by the wind turbines does not materially degrade the reception because the end user is likely receiving signals from multiple transmitter locations. Additionally, the frequencies of operation for these services have characteristics that allow the signal to propagate through wind turbines. As a result very little, if any, change in their coverage should occur when the wind turbines are installed.

When planning the wind energy turbine locations in the area of interest, a conservative approach would dictate not locating any turbines within 77.5 meters of land mobile fixed-base stations to avoid any possible impact to the communications services provided by these stations. This distance is based on FCC interference emissions from electrical devices in the land mobile frequency bands. As long as the turbines are located more than 77.5 meters from the land mobile stations, they will meet the setback distance criteria for FCC interference emissions in the land mobile bands.

4. Recommendations

In the event that a public safety entity believes its coverage has been compromised by the presence of the wind energy facility, it has many options to improve its signal coverage to the area through optimization of a nearby base station or even adding a repeater site. Utility towers, meteorological towers or even the turbine towers within the wind project area can serve as the platform for a base station or repeater site.



5. Contact

For questions or information regarding the Land Mobile & Emergency Services Report, please contact:

Contact person: Denise Finney
Title: Account Manager
Company: Comsearch
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Fax: 703-726-5595
Email: dfinney@comsearch.com
Web site: www.comsearch.com

Wind Power GeoPlanner™

Microwave Study

Ball Hill Wind



Prepared on Behalf of
Renewable Energy
Systems Americas Inc.

September 16, 2016





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1. Introduction

Microwave bands that may be affected by the installation of wind turbine facilities operate over a wide frequency range (900 MHz – 23 GHz). Comsearch has developed and maintains comprehensive technical databases containing information on licensed microwave networks throughout the United States. These systems are the telecommunication backbone of the country, providing long-distance and local telephone service, backhaul for cellular and personal communication service, data interconnects for mainframe computers and the Internet, network controls for utilities and railroads, and various video services. This report focuses on the potential impact of wind turbines on licensed, proposed and applied non-federal government microwave systems

2. Project Overview

Project Information

Name: Ball Hill Wind

County: Chautauqua

State: New York

Number of Turbines: 29

Blade Diameter: 126 meters

Hub Height: 87 meters



Figure 1: Area of Interest

3. Fresnel Zone Analysis

Methodology

Our obstruction analysis was performed using Comsearch’s proprietary microwave database, which contains all non-government licensed, proposed and applied paths from 0.9 - 23 GHz¹. First, we determined all microwave paths that intersect the area of interest² and listed them in Table 1. This path and the area of interest that encompasses the planned turbine locations are shown in Figure 2.

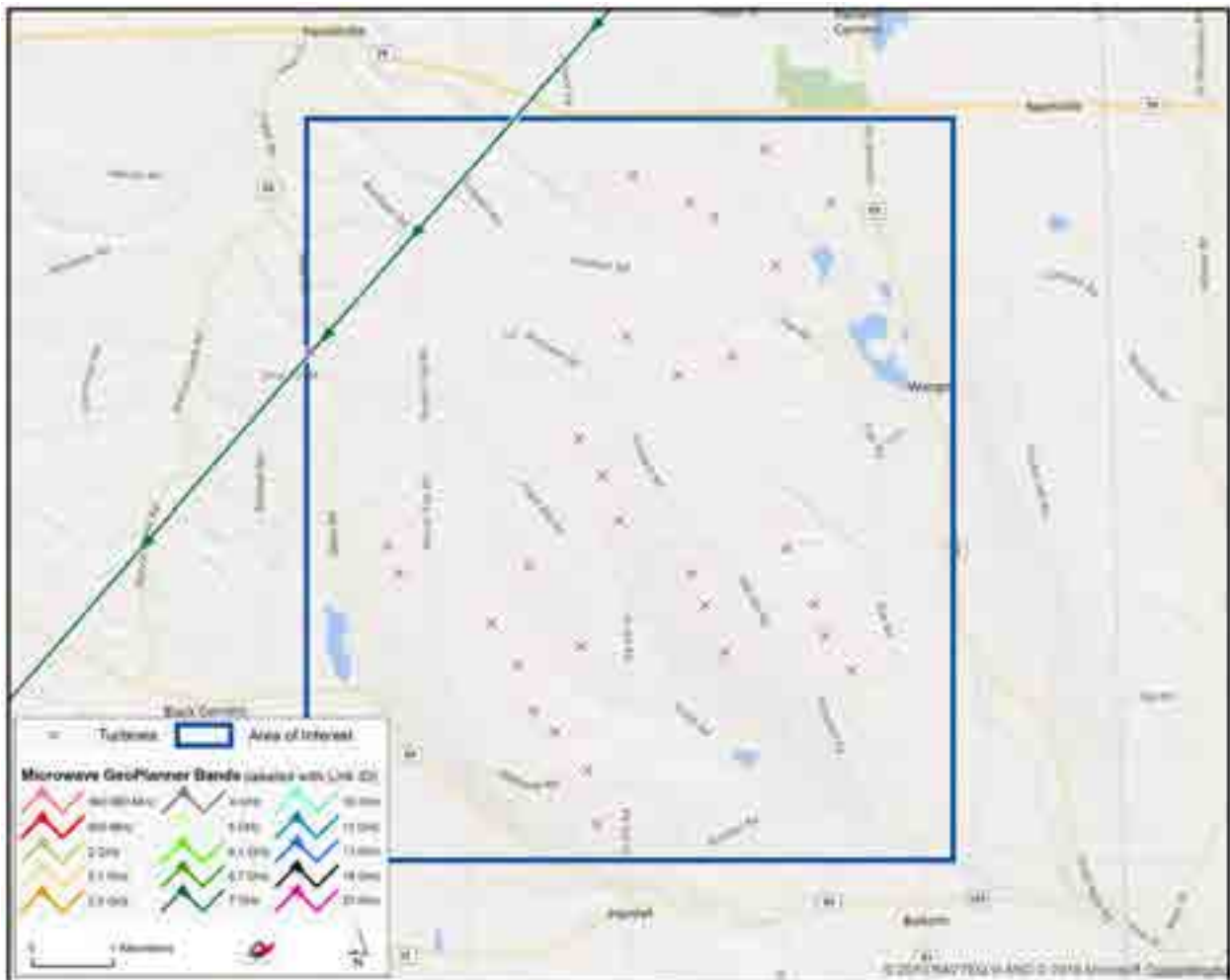


Figure 2: Microwave Paths that Intersect the Area of Interest

¹ Please note that this analysis does not include unlicensed microwave paths or federal government paths that are not registered with the FCC.

² We use FCC-licensed coordinates to determine which paths intersect the area of interest. It is possible that as-built coordinates may differ slightly from those on the FCC license.

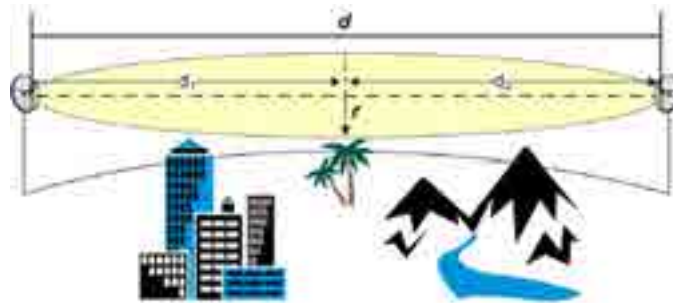
| ID | Status | Callsign 1 | Callsign 2 | Band | Path Length (km) | Licensee |
|----|----------|------------|------------|-------|------------------|----------------------------------|
| 1 | Licensed | WPNF351 | RXONLY | 7 GHz | 55.63 | FAITH BROADCASTING NETWORK, INC. |

Table 1: Summary of Microwave Paths that Intersect the Area of Interest

(See enclosed mw_geopl.xlsx for more information and GP_dict_matrix_description.xls for detailed field descriptions)

Next, we calculated a Fresnel Zone for this path based on the following formula:

$$r \cong 17.3 \sqrt{\frac{n}{F_{\text{GHz}}} \left(\frac{d_1 d_2}{d_1 + d_2} \right)}$$



Where,

- r = Fresnel Zone radius at a specific point in the microwave path, meters
- n = Fresnel Zone number, 1
- F_{GHz} = Frequency of microwave system, GHz
- d₁ = Distance from antenna 1 to a specific point in the microwave path, kilometers
- d₂ = Distance from antenna 2 to a specific point in the microwave path, kilometers

In general, this is the area where the planned wind turbines should be avoided, if possible. A depiction of the Fresnel Zones for the microwave path listed can be found in Figure 3, and is also included in the enclosed shapefiles^{3,4}.

³ The ESRI® shapefiles enclosed are in NAD 83 UTM Zone 17 projected coordinate system.

⁴ Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data provided in this report is governed by Comsearch's data license notification and agreement located at http://www.comsearch.com/files/data_license.pdf.

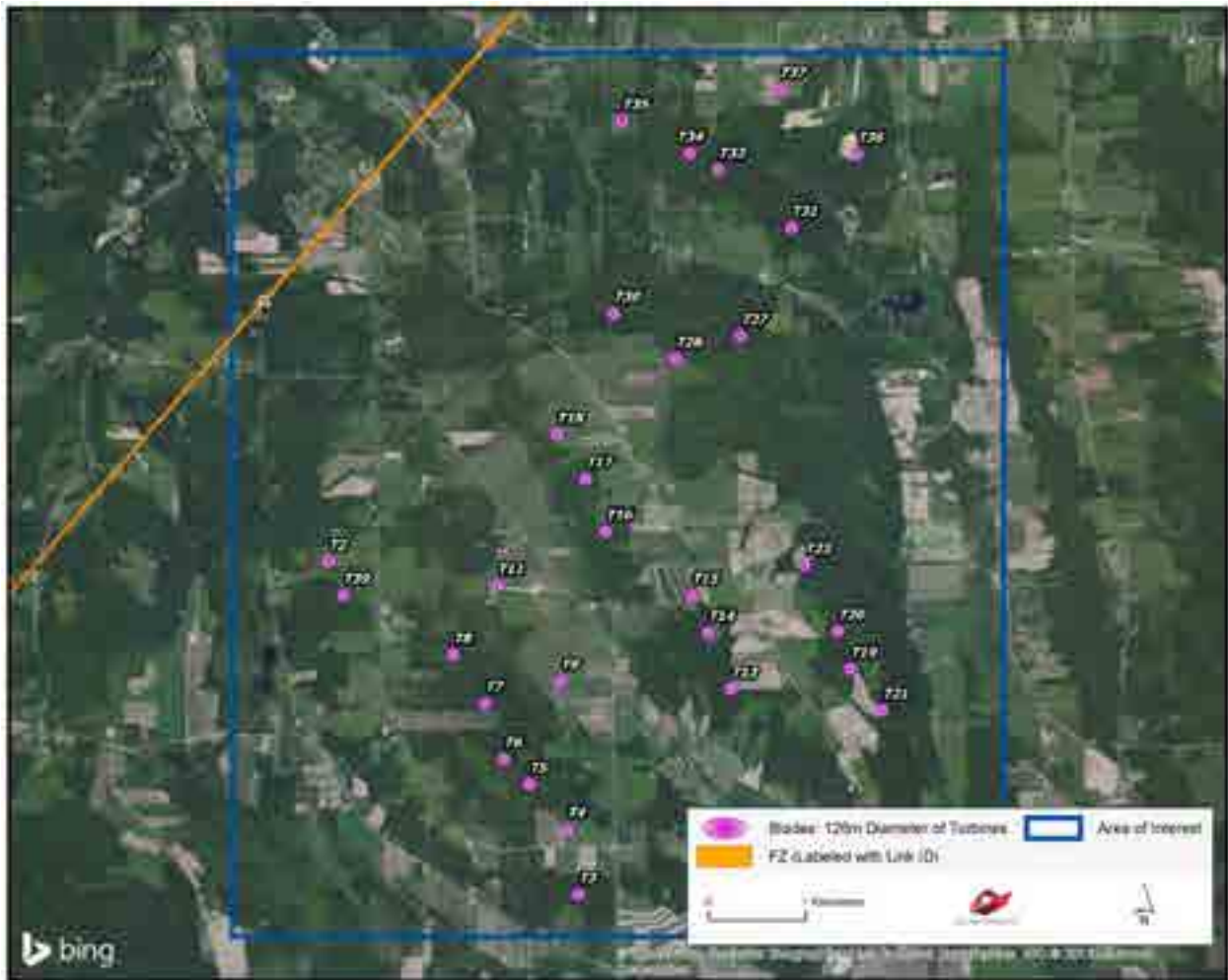


Figure 3: Microwave Paths with Fresnel Zones



4. Conclusion

| Total Microwave Paths | Paths with Affected Fresnel Zones | Total Turbines | Turbines intersecting the Fresnel Zones |
|-----------------------|-----------------------------------|----------------|-----------------------------------------|
| 1 | 0 | 29 | 0 |

Table 2: Fresnel Zone Analysis Result

Our study identified one microwave path intersecting the Ball Hill Wind area of interest. The Fresnel Zones for this microwave path were calculated and mapped in order to assess the potential impact from the turbines. A total of 29 turbines were considered in the analysis, each with a blade diameter of 126 meters and turbine hub height of 87 meters. Of those turbines, none were found to have potential obstruction with the microwave systems in the area.

5. Contact

For questions or information regarding the Microwave Study, please contact:

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