Wind Power GeoPlanner™

Doppler Weather Radar Study

High Bridge Wind Farm

Prepared on Behalf of
Calpine Corporation

October 30, 2018

COMSEARCH®
A CommScope Company

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1. Introduction

The purpose of this document is to describe the research, calculations, and analysis performed to assess the impact of the proposed High Bridge Wind Farm project on the operation of Doppler Weather Radar Systems owned and operated by television stations and commercial interests within the vicinity of the project. The report also discusses the New York State Mesonet weather station network and addresses any potential for impact from the presence of the wind energy project. This study was performed for Calpine Corporation.

2. Project Area

The location of the High Bridge Wind Farm project in Chenango County, New York is shown in Figure 1. The proposed turbines will have a maximum hub height of 130 meters and a rotor diameter of up to 150 meters, giving the structures an overall maximum height of 205 meters above ground level. At the time of this study, there are thirty-five turbines proposed for the High Bridge Wind Farm project. Table 1 lists these turbines and their coordinates within the project area. A detailed view is provided in Figure 2.

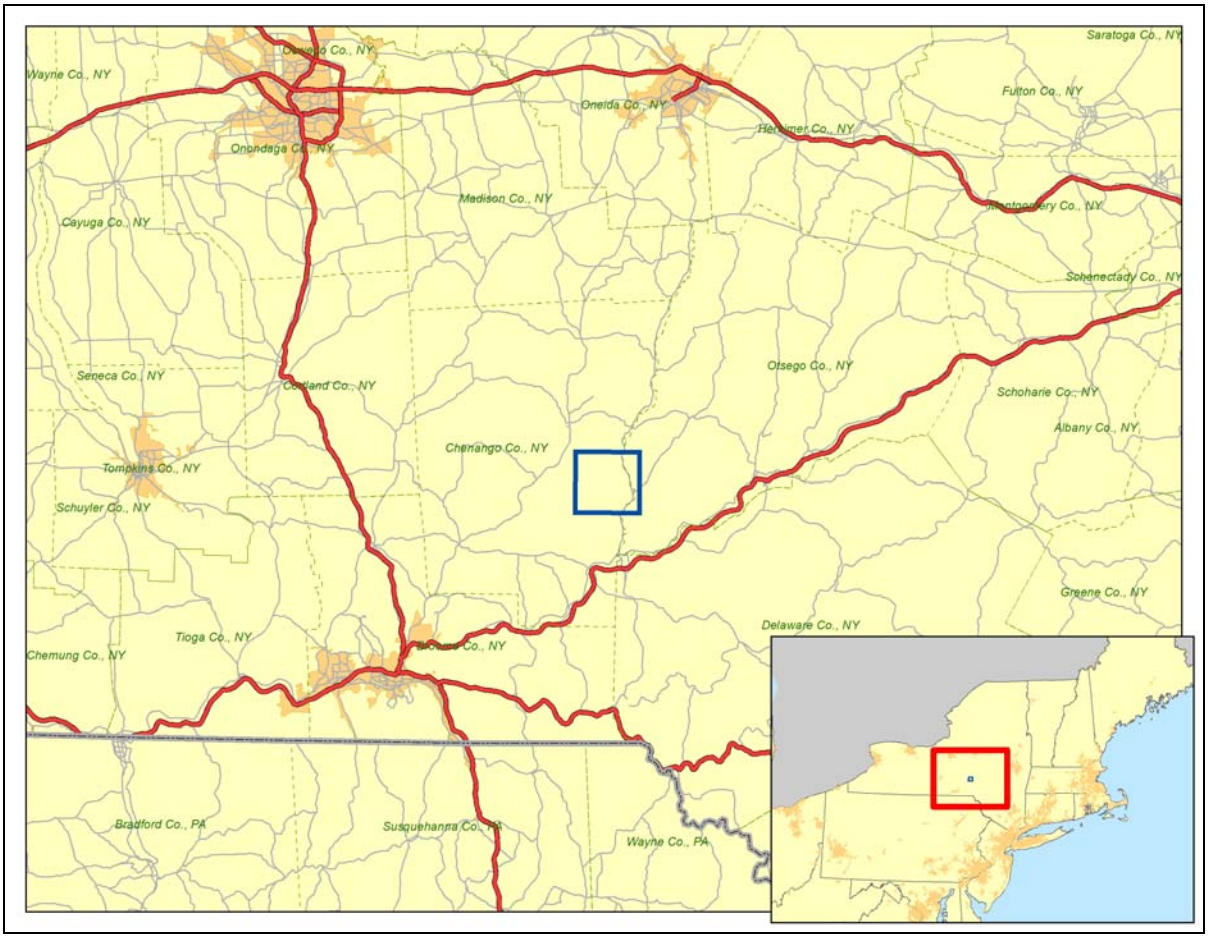

Figure 1: Location of High Bridge Wind Farm Project in the State of New York

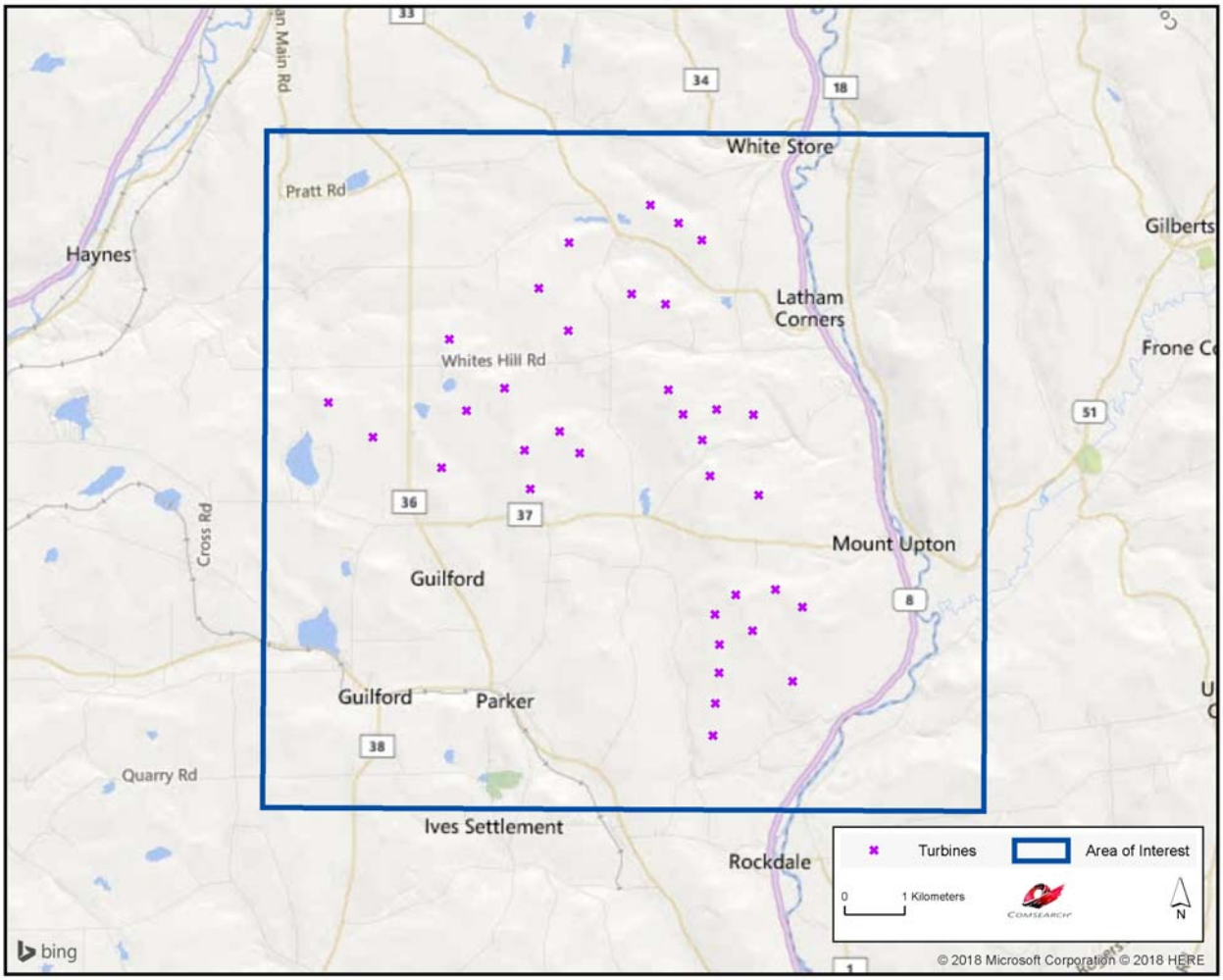

Figure 2: Location of Turbines within High Bridge Wind Farm Project

Turbine ID	Latitude (NAD83)	Longitude (NAD83)	Ground Elevation (m)	Maximum Blade Height Above Mean Sea Level (m)
1	42.447337	-75.497779	544.0	749.0
2	42.442219	-75.488776	561.9	766.9
3	42.437708	-75.474880	538.5	743.5
4	42.446283	-75.469891	553.9	758.9
5	42.456908	-75.473443	571.2	776.2
6	42.449673	-75.462292	584.5	789.5
7	42.471467	-75.449393	508.2	713.2
8	42.464612	-75.455481	537.3	742.3
9	42.477168	-75.433018	458.2	663.2
10	42.474518	-75.427354	458.1	663.1

Turbine ID	Latitude (NAD83)	Longitude (NAD83)	Ground Elevation (m)	Maximum Blade Height Above Mean Sea Level (m)
11	42.471939	-75.422602	457.3	662.3
12	42.463847	-75.436721	518.9	723.9
13	42.462350	-75.429901	509.0	714.0
14	42.458306	-75.449461	528.1	733.1
15	42.449538	-75.429272	536.8	741.8
16	42.445883	-75.426259	535.8	740.8
17	42.446652	-75.419450	489.1	694.1
18	42.445895	-75.412083	450.4	655.4
19	42.442039	-75.422325	525.1	730.1
20	42.436674	-75.420758	562.9	767.9
21	42.433885	-75.410894	536.2	741.2
22	42.434614	-75.456949	549.7	754.7
23	42.440379	-75.458198	561.3	766.3
24	42.440032	-75.447007	522.2	727.2
25	42.443234	-75.451061	531.7	736.7
26	42.419041	-75.415454	556.1	761.1
27	42.419808	-75.407445	507.8	712.8
28	42.417239	-75.402024	525.2	730.2
29	42.413639	-75.412041	537.9	742.9
30	42.416086	-75.419601	512.0	717.0
31	42.411570	-75.418696	488.6	693.6
32	42.407374	-75.418711	478.5	683.5
33	42.406104	-75.403874	453.1	658.1
34	42.402772	-75.419410	446.0	651.0
35	42.397955	-75.419879	428.8	633.8

Table 1: Wind Turbine Coordinates

3. Technical Data

Based on a preliminary analysis of the terrain within the vicinity of the project and taking into account the precise location and elevation of turbines listed in Section 2, a reasonable search radius for radar systems was established at 250 kilometers from the center of the project area. Tables 2 and 3 contain the technical parameters of the commercial Doppler radar systems located within 250 kilometers of the project, including ownership and geographical data[1]. A

[1] 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.

depiction of the location of the Doppler radar systems with respect to the project boundaries appears in Figure 3.

ID	Call Sign	Frequency (MHz)	Ground Elevation (m)	Antenna Height (m)	Output Power (Watts)	Distance to Nearest Turbine (km)
1	WPPY879	5575	483.0	33.0	250000.0	70.10
2	WPRT837	5460	135.7	45.7	200.0	131.19
3	KKI208	5350-5460	2120.0	12.0	200.0	140.10
4	WPZR862	5550-5600	292.6	39.0	250000.0	151.16
5	WQCT907	5500-5600	159.1	38.0	1000000.0	202.37
6	WQHM264	5500-5600	182.3	36.9	1000000.0	211.71
7	WQHM264	5500-5600	182.3	36.9	1000000.0	211.71
8	WNQJ338	5350-5460	162.0	44.0	175.0	218.14
9	WPYR578	5350-5460	195.0	53.0	200.0	225.69
10	WNAN640	3500-3550	32.9	37.5	324339.617	229.30
11	WPQG659	5450-5550	52.1	30.0	350000.0	229.35
12	WPJU561	5350	213.0	39.0	200.0	230.76
13	WPYN253	5350-5650	96.0	45.8	724.4	245.47

Table 2: Technical Data for Commercial Interest and Television Station Doppler Radar Systems within 250 Kilometers of the High Bridge Wind Farm Project

ID	Call Sign	Owner- Operator	Location	Latitude (NAD83)	Longitude (NAD83)
1	WPPY879	Nexstar Broadcasting, Inc.	Pompey, NY	42.944500	-76.024639
2	WPRT837	WRGB Licensee, LLC	Niskayuna, NY	42.813194	-73.891250
3	KKI208	Local TV Pennsylvania License, LLC	Hanover Twp., PA	41.182861	-75.872417
4	WPZR862	WNYT-TV, LLC	Brunswick, NY	42.785917	-73.628194
5	WQCT907	CBS Broadcasting Inc.	Alpine, NJ	40.961306	-73.922889
6	WQHM264	FOX Television Stations, LLC	Martinsville, NJ	40.604889	-74.559250
7	WQHM264	FOX Television Stations, LLC	Martinsville, NJ	40.604889	-74.559250
8	WNQJ338	WHEC-TV, LLC	Brockport, NY	43.212556	-77.954722

ID	Call Sign	Owner- Operator	Location	Latitude (NAD83)	Longitude (NAD83)
9	WPYR578	Nexstar Broadcasting, Inc.	Agawam, MA	42.083694	-72.703972
10	WNAN640	NBC Telemundo License LLC	North Brunswick, NJ	40.470778	-74.435639
11	WPQG659	Meredith Corporation - WFSB	Eastgranby, CT	41.940028	-72.699806
12	WPJU561	Nexstar Broadcasting, Inc.	Hamden, CT	41.427583	-72.950111
13	WPYN253	ABC, Inc.	Warminster, PA	40.202583	-75.080444

Table 3: Location and Ownership of Commercial Interest and Television Station Doppler Radar Systems within 250 Kilometers of the High Bridge Wind Farm Project

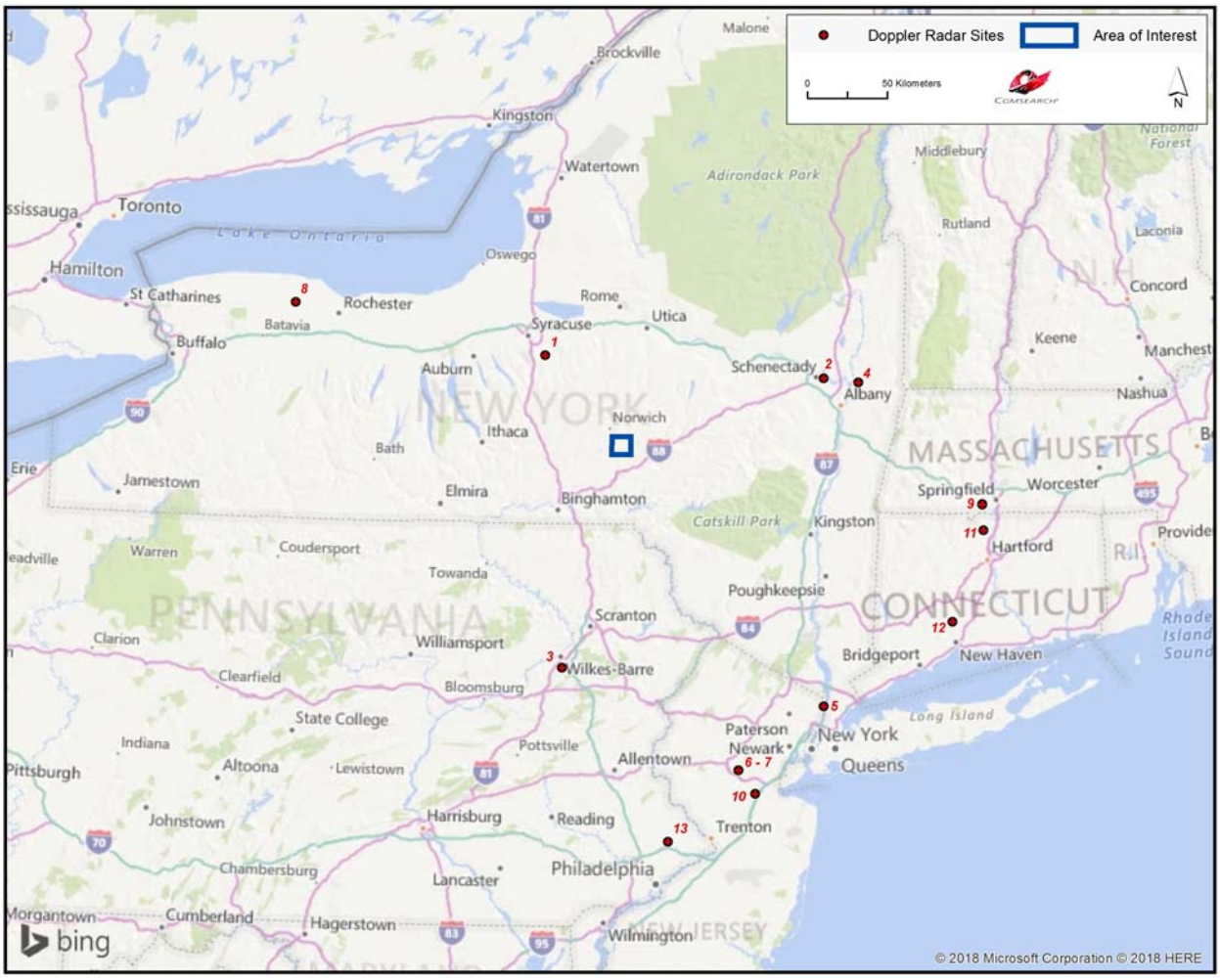

Figure 3: Location of Doppler Radar Systems within 250 Kilometers of the High Bridge Wind Farm Project

4. Impact Assessment

The technical approach to determine the potential impact of the turbines on the Doppler radar systems in the area is to calculate whether the wind turbines are in line-of-sight (LOS) of the radar systems. The wind turbines of the High Bridge Wind Farm project have the potential to block radar coverage and produce false targets if the turbines are in line-of-sight of the radar systems' transmitted signals.

To verify the presence or absence of LOS conditions between the High Bridge Wind Farm wind energy project and the Doppler radar systems identified in Section 3, LOS coverage plots were generated for each of the radar systems. These plots identify the geographical regions that have LOS to a given radar by taking into account the height of the radar antenna, the maximum height of the wind turbine blades, the curvature of the earth, and potential refractivity in the atmosphere. The plots may be referenced in the Appendix section of this report.

According to the LOS coverage plots, the effective terrain elevations would block LOS between the antennas of all seven radars and the wind project area. Therefore, LOS conditions would not exist between the radars and the wind turbines.

5. New York State Mesonet

The New York State Mesonet is a statewide network of weather stations developed and run by the University at Albany, which currently comprises a total of 126 stations. Mesoscale networks serve to collect data on mesoscale meteorological phenomena, such as dry lines, squall lines, and sea breezes, which is used to supplement data gathered by traditional automated surface observing systems (ASOS) and helps to support decision-making in agriculture, emergency management, energy, ground transportation, and aviation. To ensure the highest quality of data, each station in the New York State Mesonet must be located at least 300 feet from any tall obstacles, such as wind turbines. Table A-1, provided in the Appendix section of this report, lists the New York State Mesonet stations and their respective distances to the turbines in the High Bridge Wind Farm project. Table A-1 shows that the closest station to the project, "Sherburne", is more than 18.5 kilometers from the nearest proposed turbine location and well outside range of impact. Finally, it should be noted that the data from each station is transmitted via the Internet to a central ingest system located at the University of Albany and is therefore not subject to telecommunications interference from the High Bridge Wind Farm project as defined in the scope of this report.

6. Conclusions

Based on the analysis described in this report, none of the thirteen Doppler radar systems in the vicinity of the High Bridge Wind Farm wind energy project could be impacted by the project's planned wind turbines. The New York State Mesonet system is also not subject to impact due to the large separation distance between the component weather stations and the project turbines.

7. Contact

For questions or information regarding the Doppler Radar Study, please contact:

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Company:	Comsearch
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Telephone:	703-726-5656
Fax:	703-726-5595
Email:	dmeyer@comsearch.com
Web site:	www.comsearch.com

Appendix

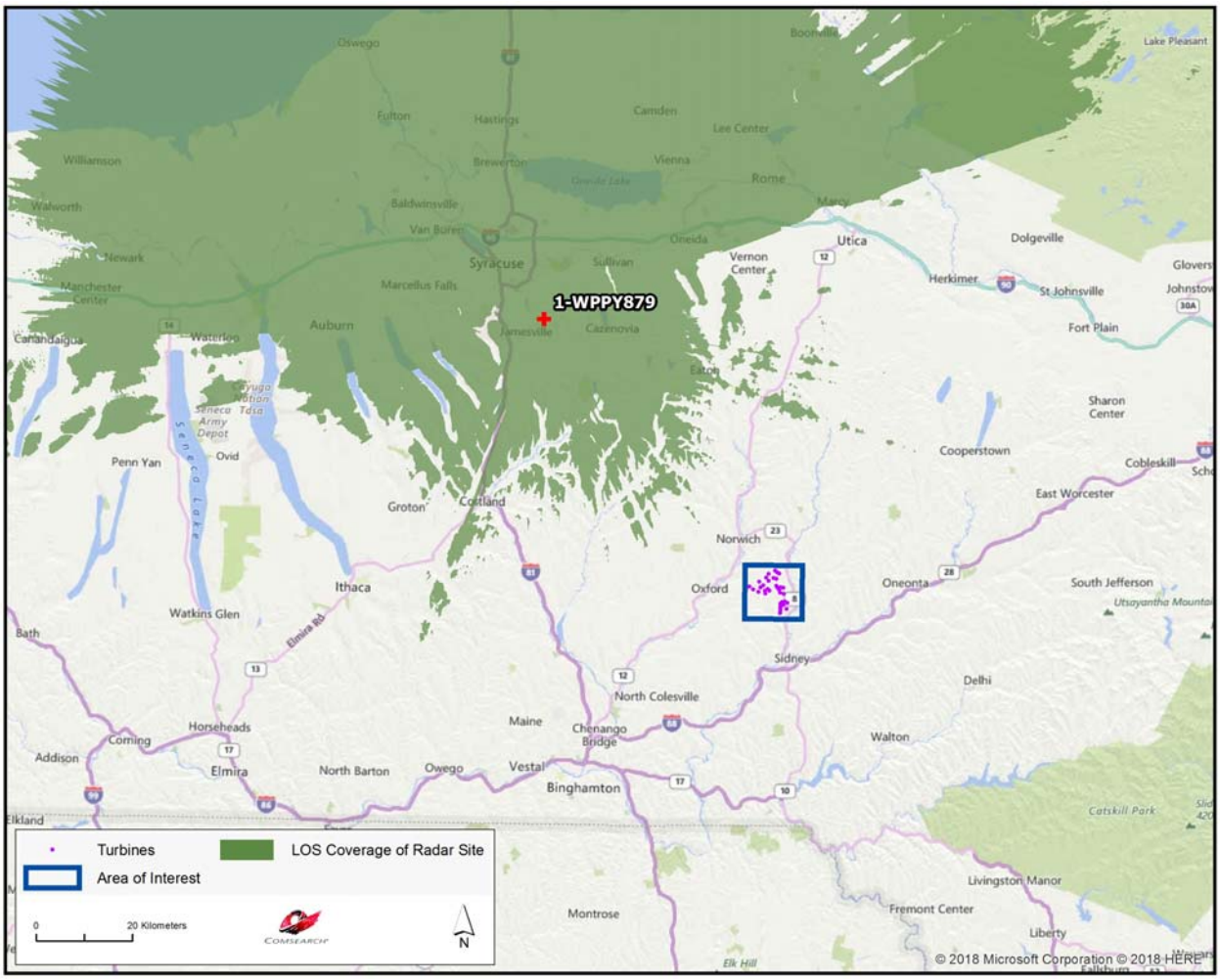

Figure A-1: Line-of-Sight Coverage of WPPY879 with Respect to High Bridge Wind Farm Project

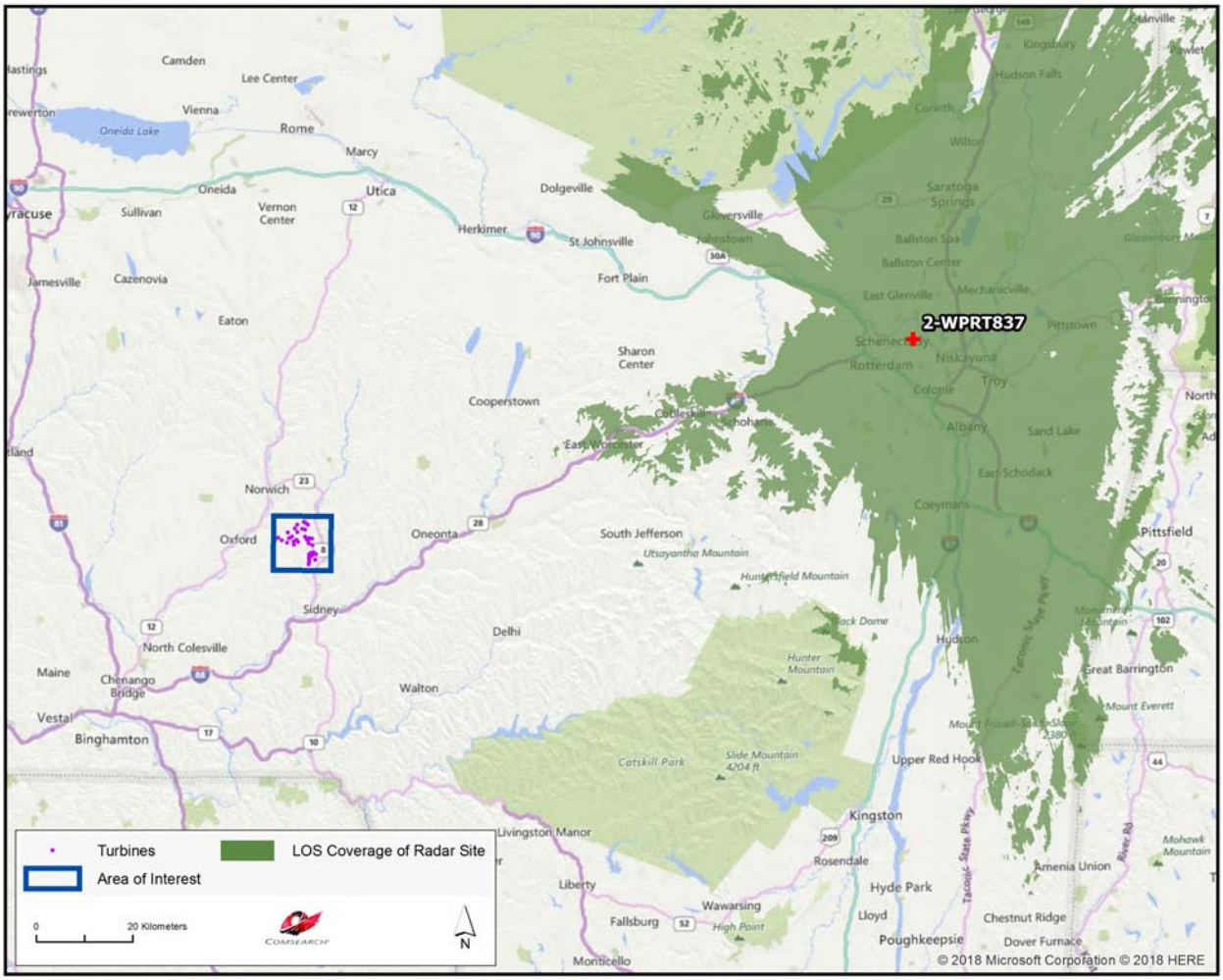

Figure A-2: Line-of-Sight Coverage of WPRT837 with Respect to High Bridge Wind Farm Project

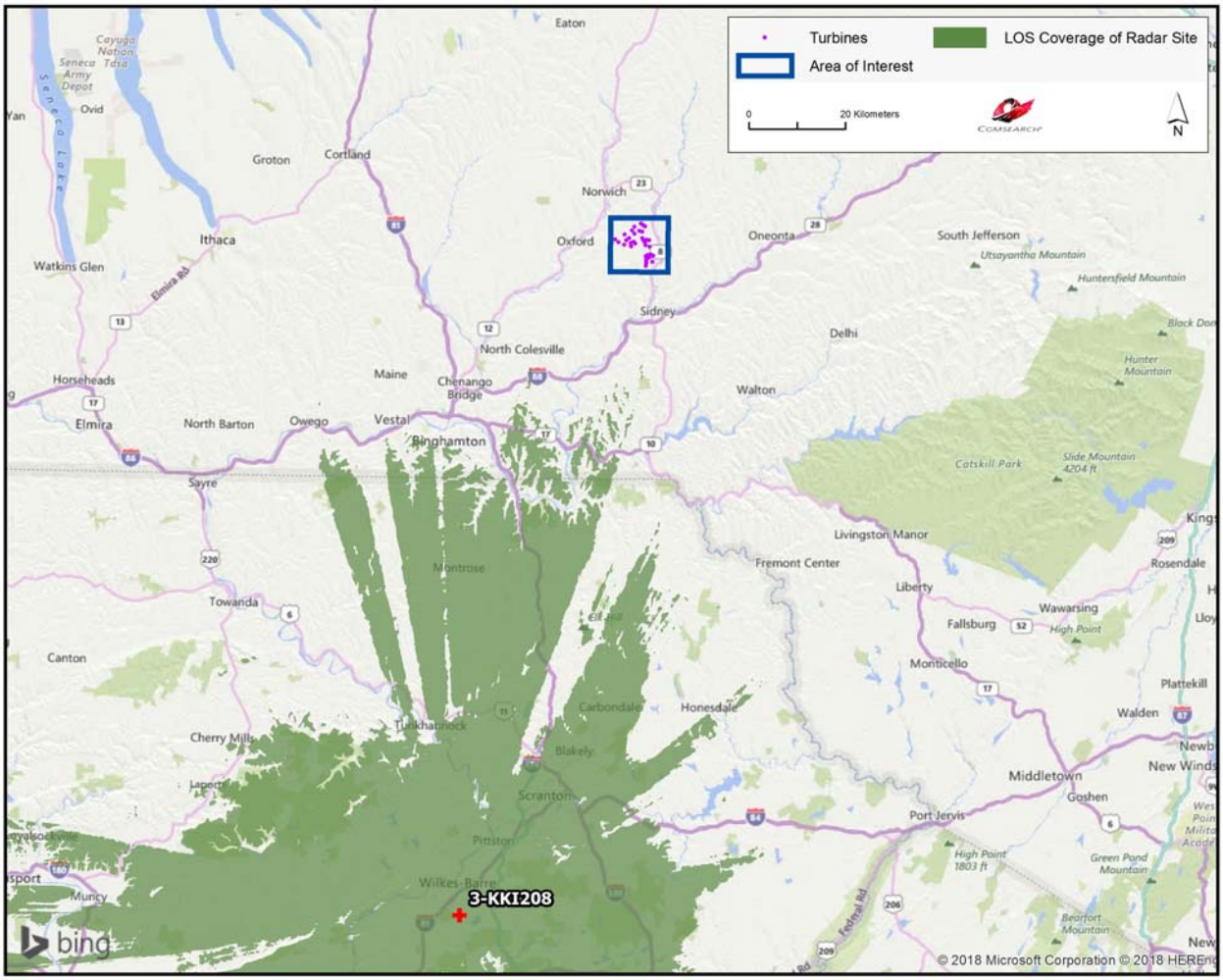

Figure A-3: Line-of-Sight Coverage of KKI208 with Respect to High Bridge Wind Farm Project

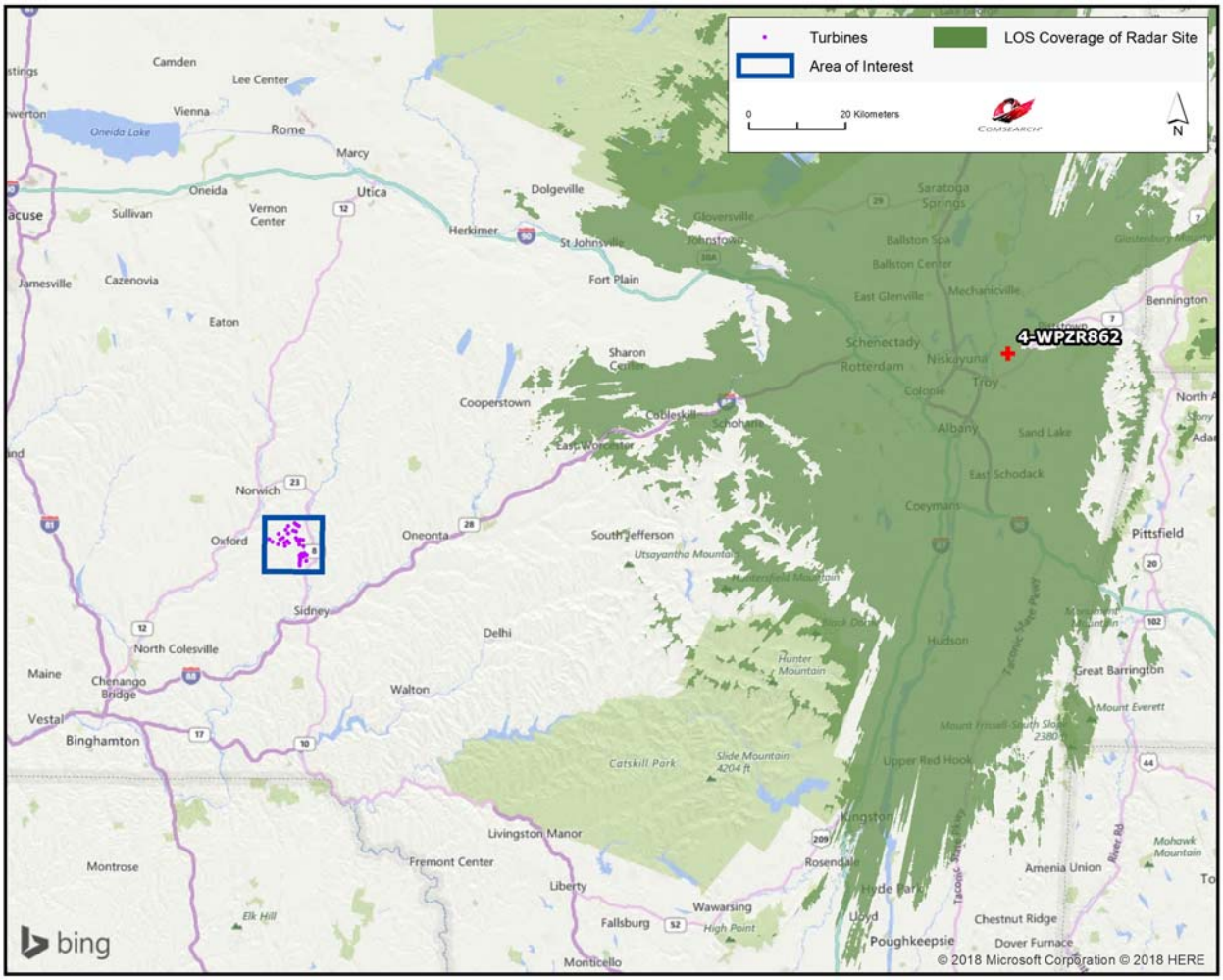

Figure A-4: Line-of-Sight Coverage of WPZR862 with Respect to High Bridge Wind Farm Project

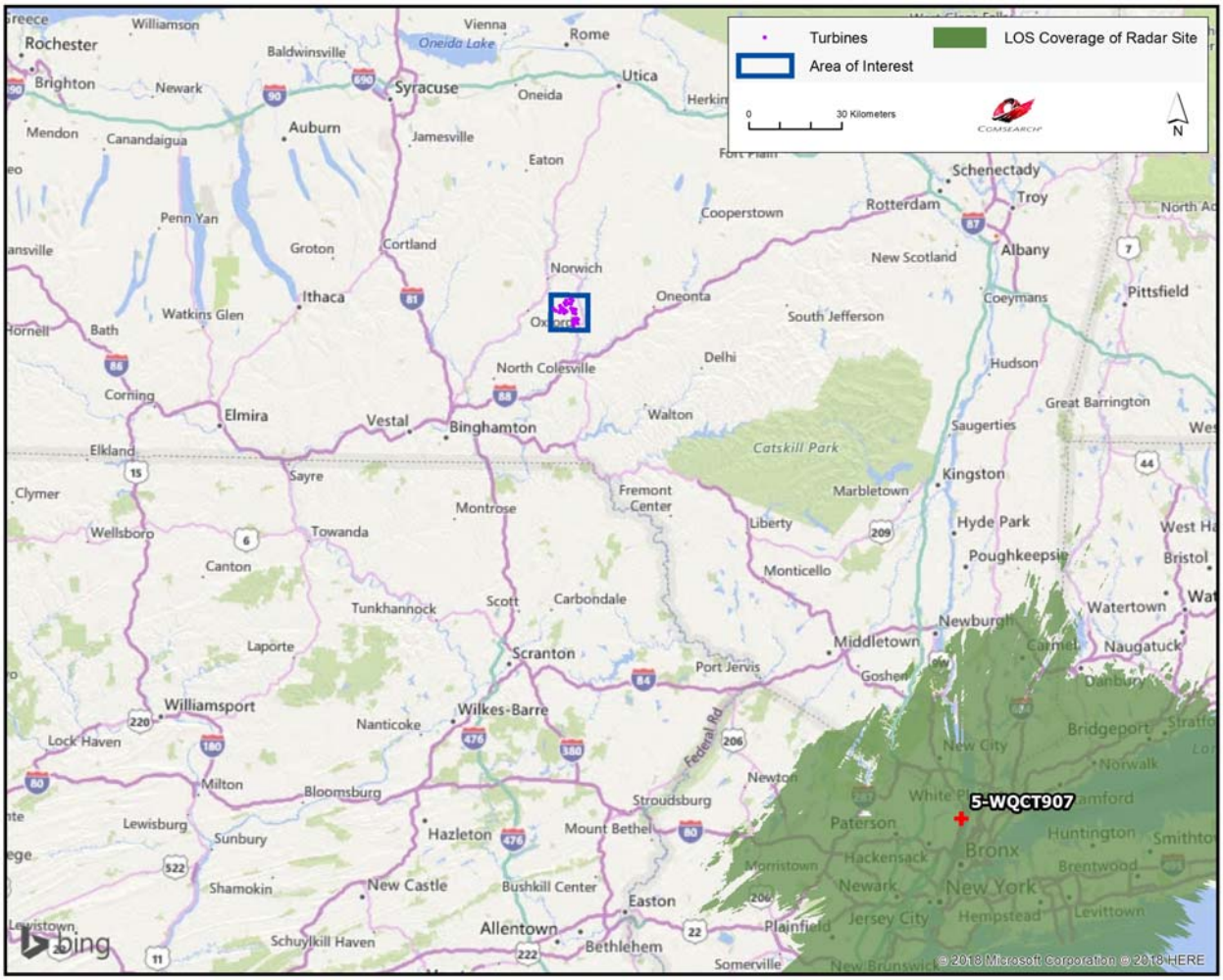

Figure A-5: Line-of-Sight Coverage of WQCT907 with Respect to High Bridge Wind Farm Project

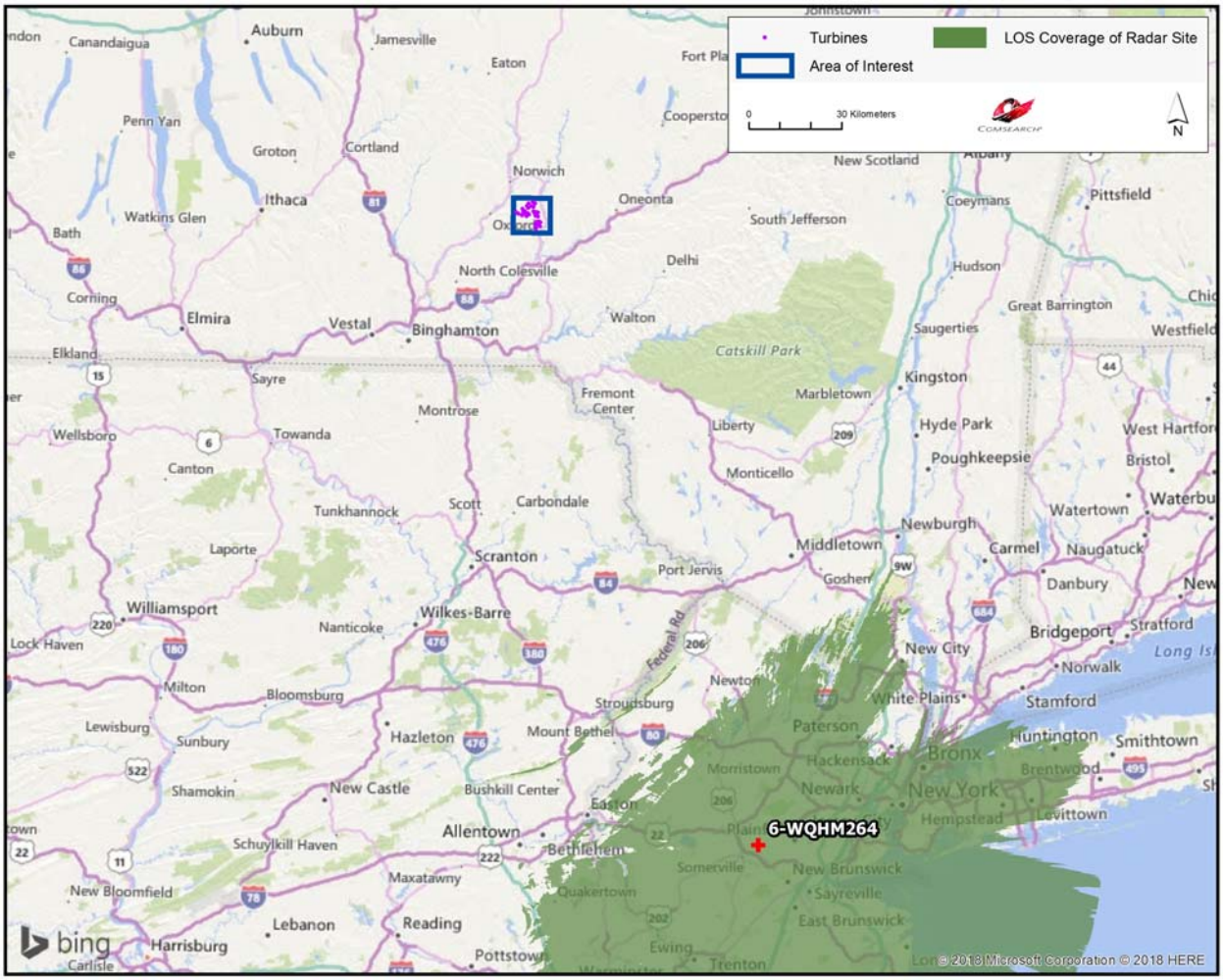

Figure A-6: Line-of-Sight Coverage of WQHM264 with Respect to High Bridge Wind Farm Project

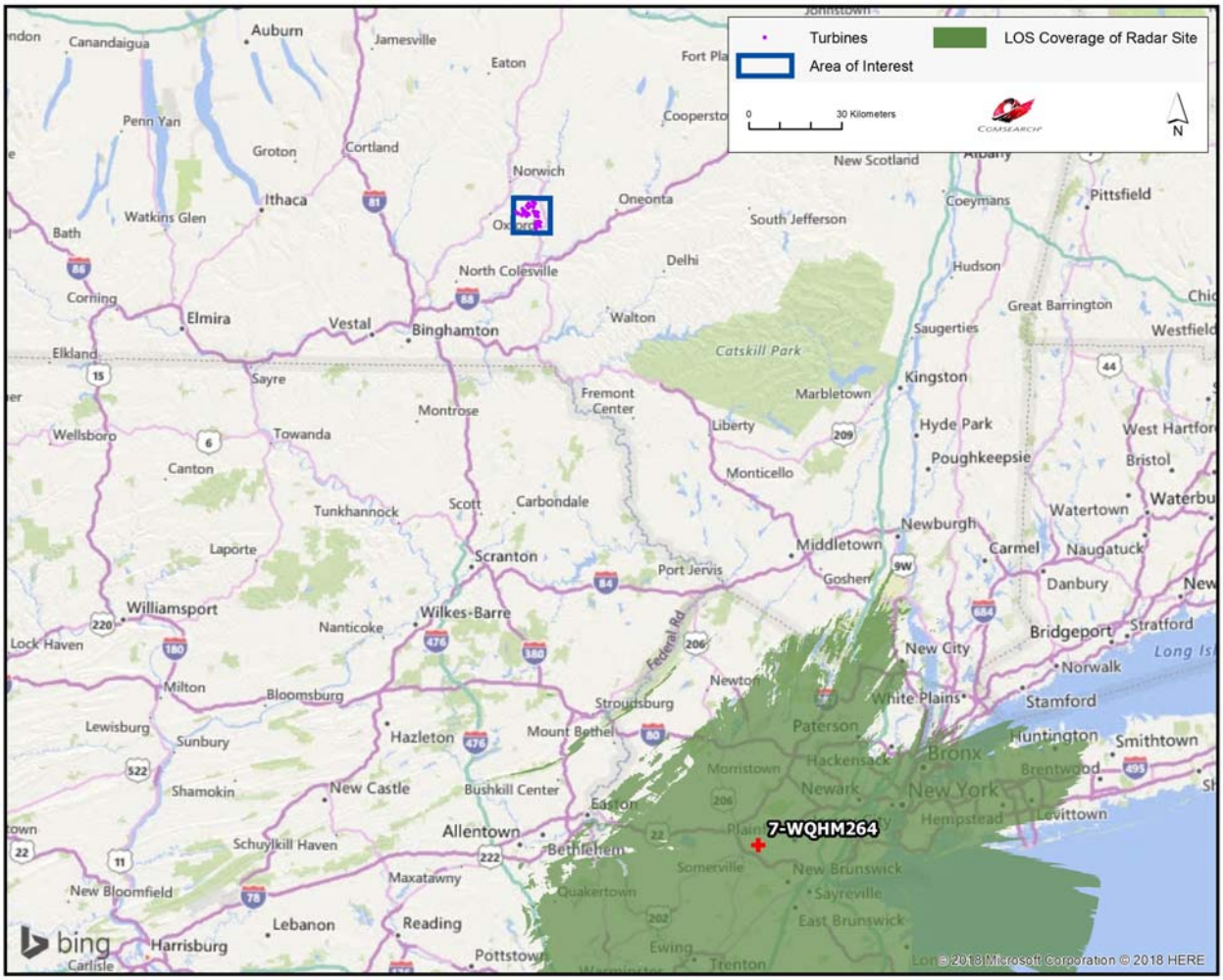

Figure A-7: Line-of-Sight Coverage of WQHM264 with Respect to High Bridge Wind Farm Project

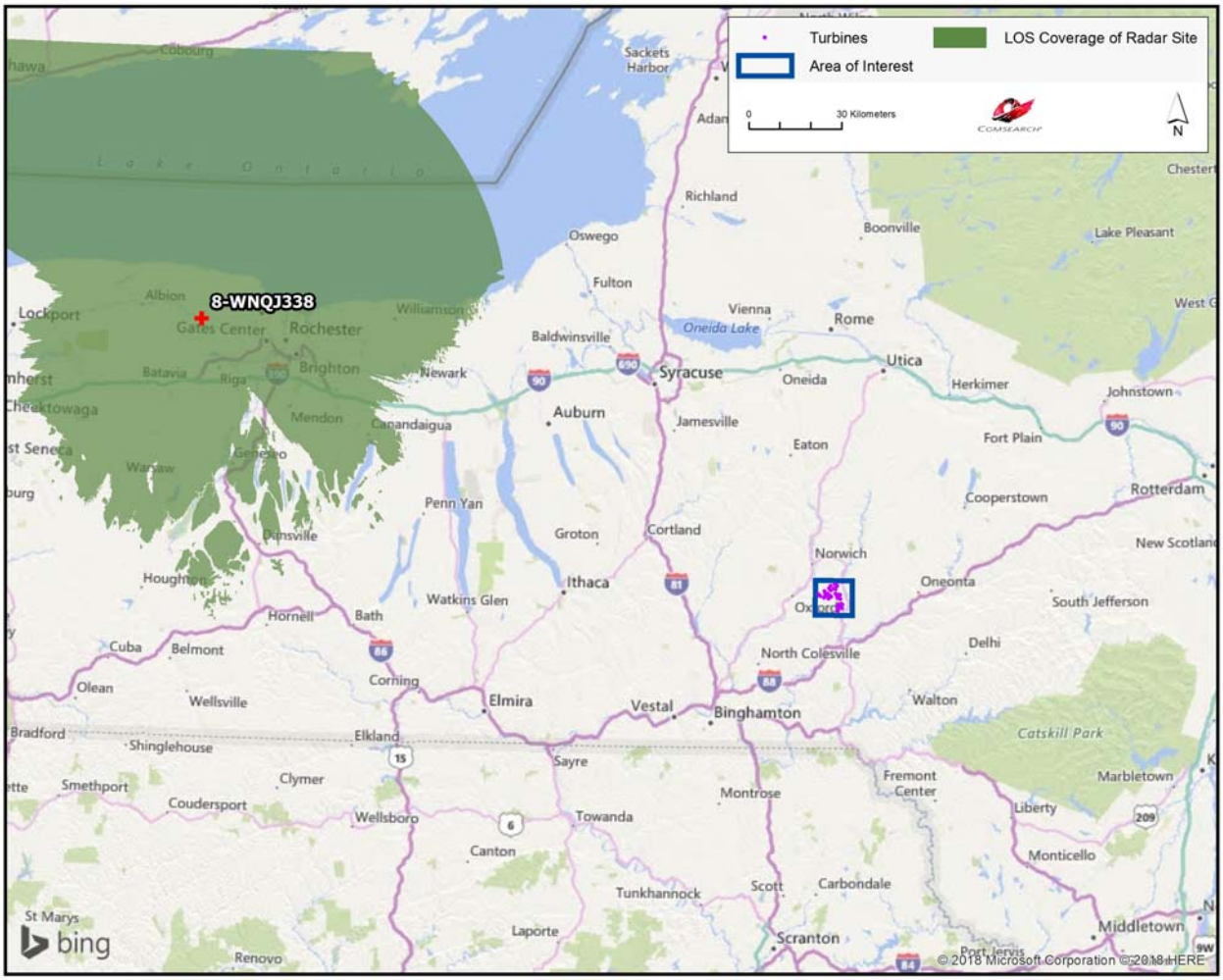

Figure A-8: Line-of-Sight Coverage of WNQJ338 with Respect to High Bridge Wind Farm Project

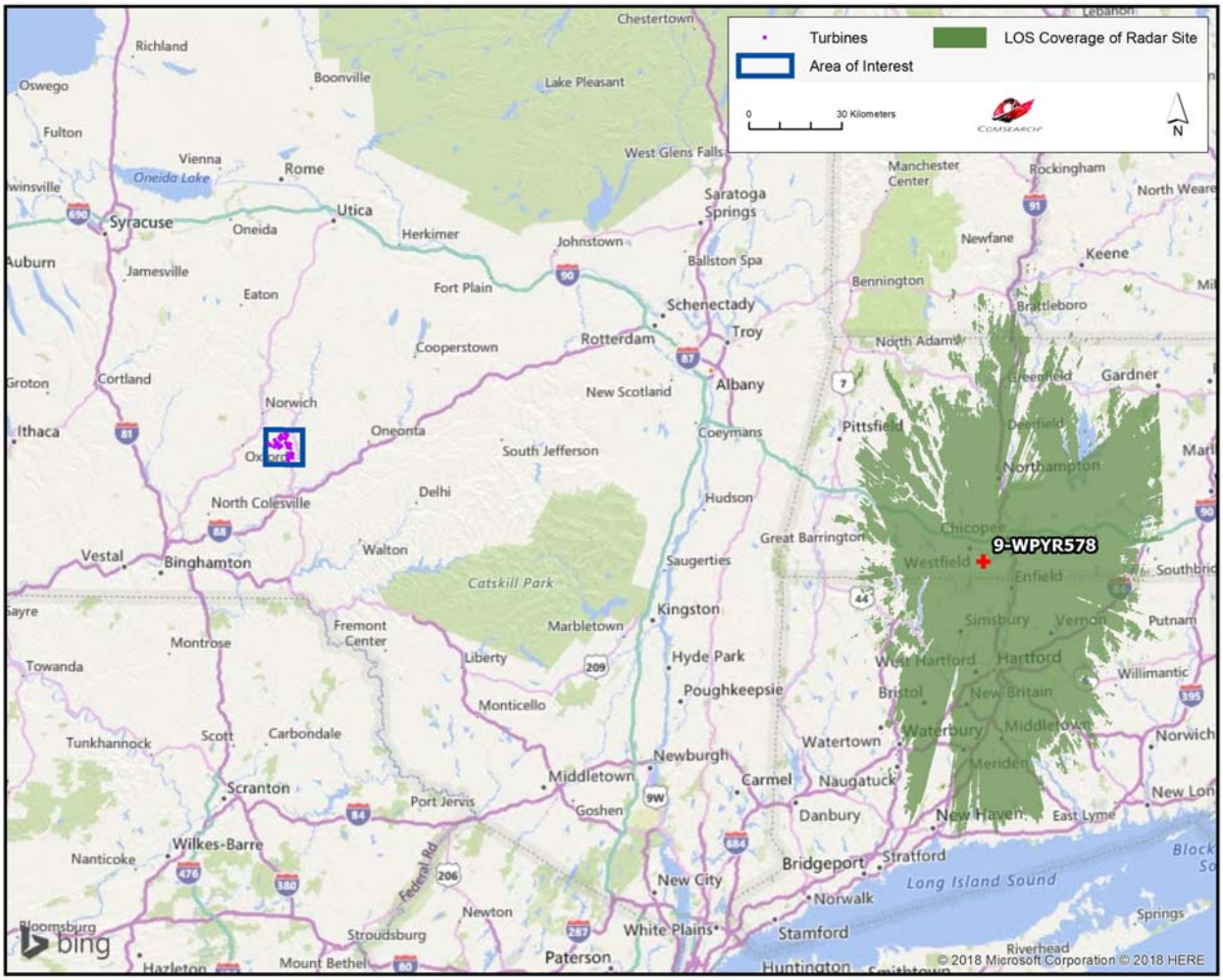

Figure A-9: Line-of-Sight Coverage of WPYR578 with Respect to High Bridge Wind Farm Project

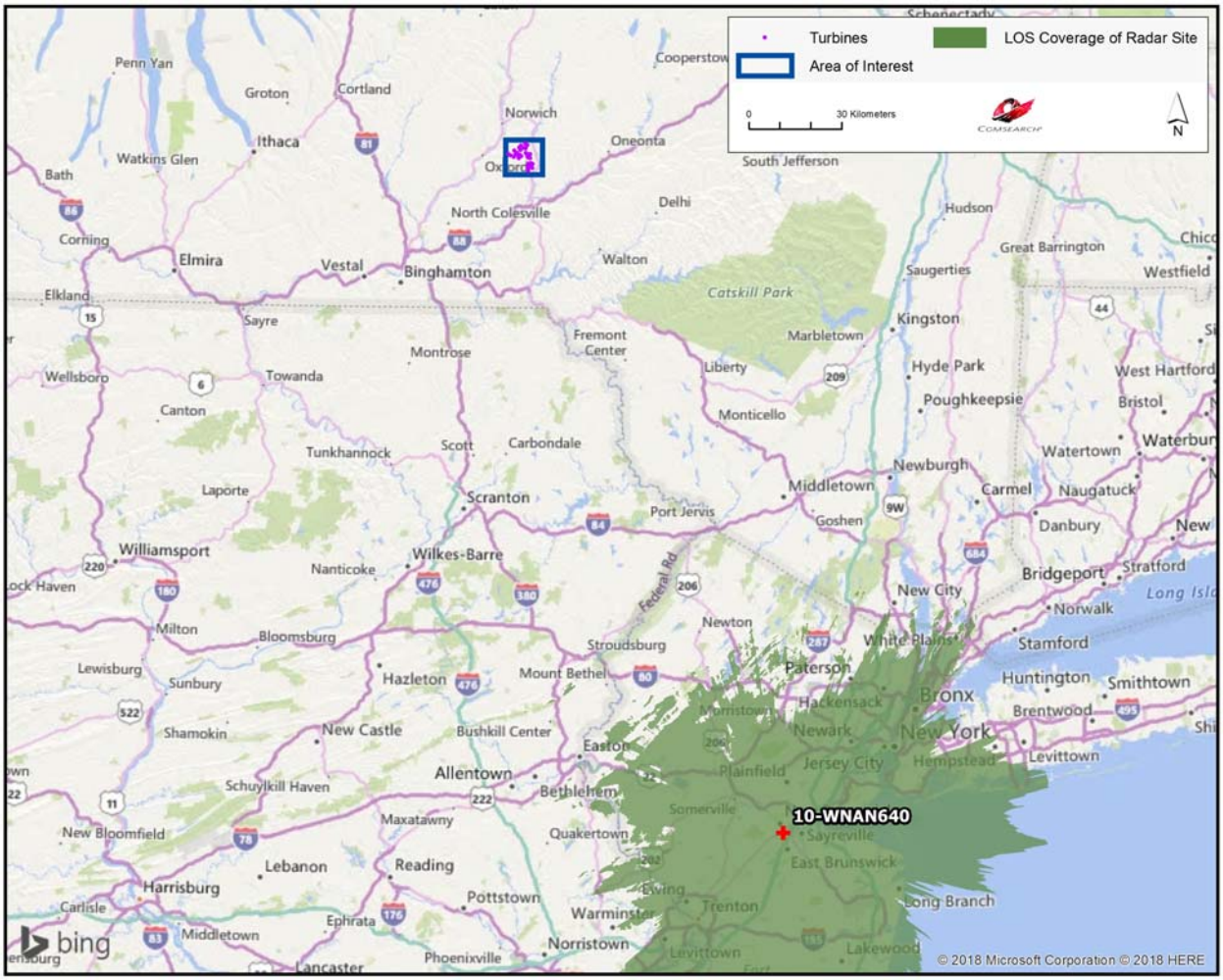

Figure A-10: Line-of-Sight Coverage of WNAN640 with Respect to High Bridge Wind Farm Project

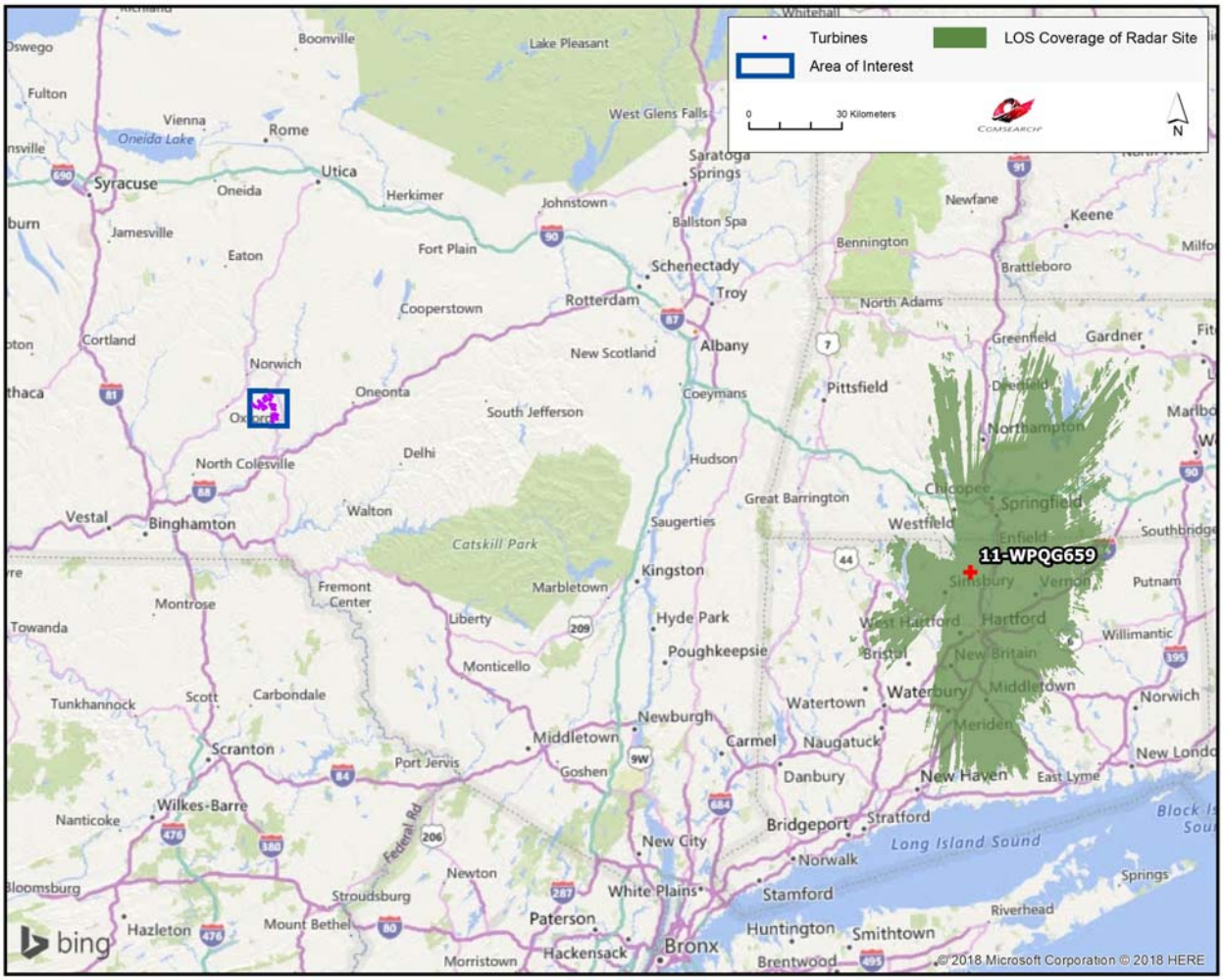

Figure A-11: Line-of-Sight Coverage of WPGQ659 with Respect to High Bridge Wind Farm Project

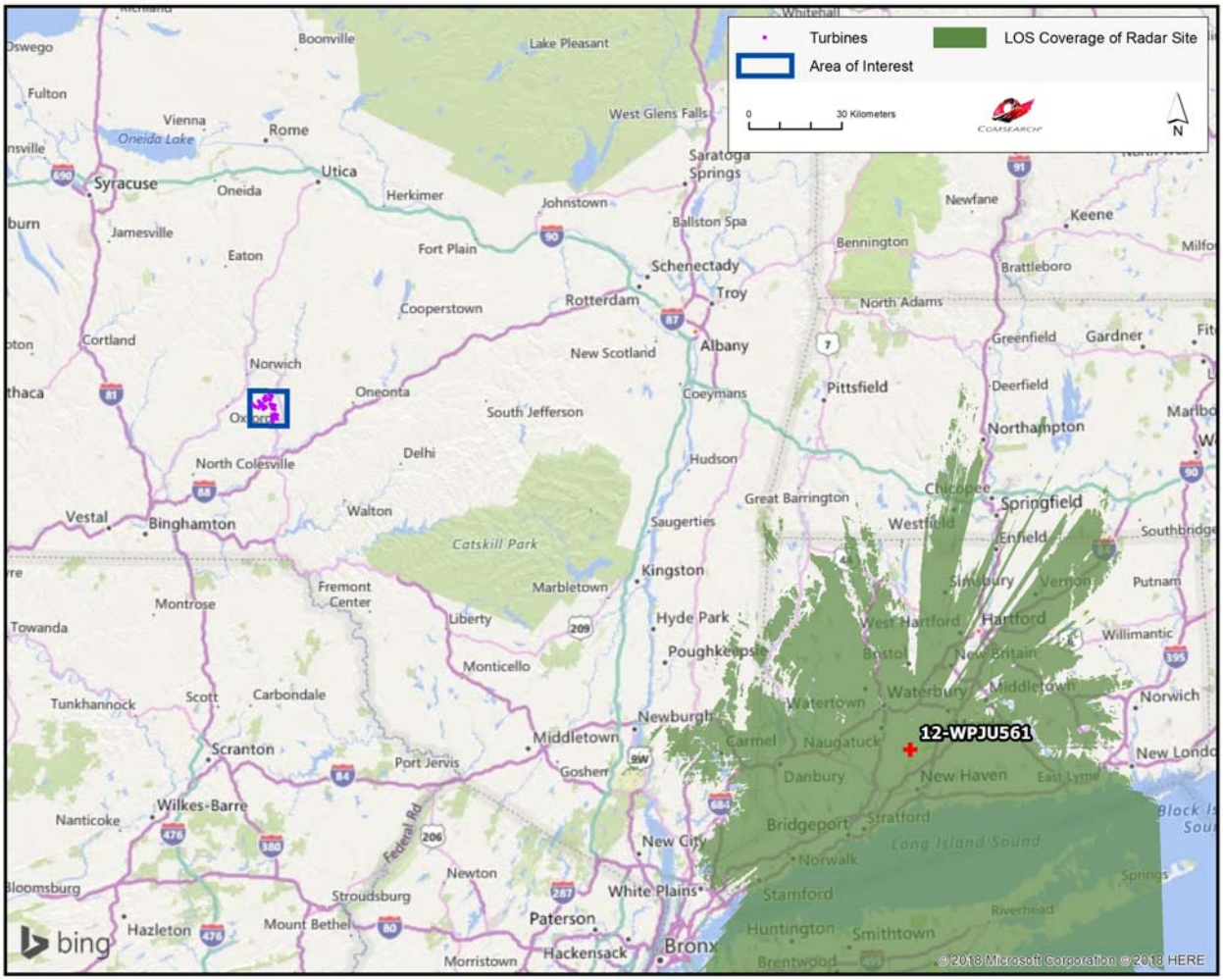

Figure A-12: Line-of-Sight Coverage of WPJU561 with Respect to High Bridge Wind Farm Project

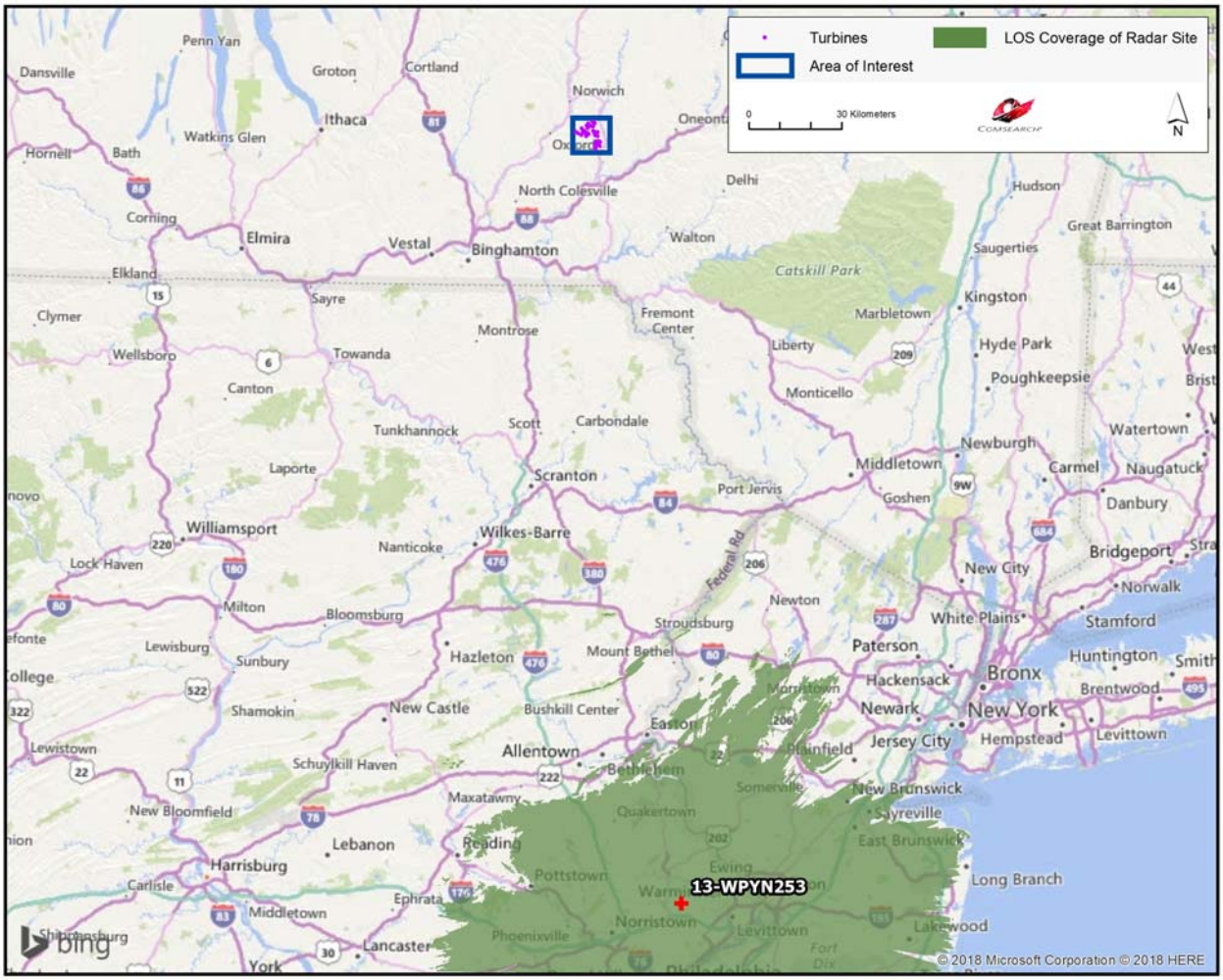

Figure A-13: Line-of-Sight Coverage of WPYN253 with Respect to High Bridge Wind Farm Project

Station ID	Station Name	Date Commissioned	County	Latitude (NAD83)	Longitude (NAD83)	Distance to Nearest Turbine (km)
SHER	Sherburne	2/23/2016	Chenango	42.640250	-75.483445	18.58
LAUR	Laurens	1/15/2016	Otsego	42.525260	-75.136900	24.22
WALT	Walton	4/18/2016	Delaware	42.239500	-75.178790	26.21
BELD	Belden	11/30/2015	Broome	42.223220	-75.668520	28.23
DEPO	Deposit	8/23/2016	Delaware	42.068551	-75.392193	36.66
BROO	Brookfield	8/5/2016	Madison	42.795910	-75.299290	37.07
CINC	Cincinnatus	4/21/2016	Cortland	42.522424	-75.975622	40.16
MORR	Morrisville	6/27/2016	Madison	42.883917	-75.642447	48.33
ANDE	Andes	8/4/2016	Delaware	42.182270	-74.801390	55.56
BING	Binghamton	10/4/2016	Broome	42.058430	-75.951040	57.14
HARP	Harpersfield	8/4/2016	Delaware	42.472800	-74.698490	58.21
BERK	Berkshire	11/19/2015	Tioga	42.320300	-76.203190	59.78
SPRI	Springfield	8/15/2016	Otsego	42.843150	-74.889610	60.09
TULL	Tully	3/30/2016	Onondaga	42.794630	-76.115550	63.70
WEST	Westmoreland	11/18/2015	Oneida	43.106470	-75.461460	69.95
HERK	Herkimer	8/10/2016	Herkimer	43.036620	-75.009570	71.16
NBRA	North Branch	7/21/2016	Sullivan	41.827920	-74.996890	72.34
GROT	Groton	12/21/2016	Tompkins	42.548550	-76.375340	73.01
ROXB	Roxbury	8/24/2016	Delaware	42.329640	-74.467460	77.59
OWEG	Owego	7/20/2016	Tioga	42.025710	-76.255430	78.13
FAYE	Fayetteville	7/14/2016	Onondaga	43.054226	-75.990041	78.42
COBL	Cobleskill	1/25/2016	Schoharie	42.676267	-74.507967	78.45
SPRA	Sprakers	11/6/2015	Montgomery	42.869763	-74.509978	86.89
CLAR	Claryville	10/20/2016	Ulster	41.979200	-74.517100	87.26
OPPE	Oppenheim	7/29/2016	Fulton	43.062600	-74.665437	90.26
SCIP	Scipio Center	9/22/2016	Cayuga	42.756216	-76.534035	91.70
COLD	Cold Brook	11/11/2015	Herkimer	43.261268	-74.978778	94.68
CAMD	Camden	6/29/2016	Oneida	43.339850	-75.742990	99.12
WBOU	Woodbourne	9/1/2016	Sullivan	41.745050	-74.588330	99.73
MEDU	Medusa	8/24/2016	Albany	42.468900	-74.165600	101.89

Station ID	Station Name	Date Commissioned	County	Latitude (NAD83)	Longitude (NAD83)	Distance to Nearest Turbine (km)
BURD	Burdett	5/23/2016	Schuyler	42.410420	-76.771760	104.92
ELDR	Eldred	8/25/2016	Sullivan	41.539610	-74.879920	105.32
JORD	Jordan	11/17/2015	Onondaga	43.069800	-76.470060	105.43
JOHN	Johnstown	3/22/2016	Montgomery	42.984283	-74.301767	108.01
DUAN	Duanesburg	7/22/2016	Schenectady	42.803190	-74.173610	108.85
CSQR	Central Square	11/5/2015	Oswego	43.326130	-76.104450	108.98
TANN	Tannersville	2/1/2017	Greene	42.170710	-74.113430	109.60
OSCE	Osceola	6/22/2016	Lewis	43.499150	-75.711750	115.79
ELMI	Elmira	6/30/2016	Chemung	42.113320	-76.836640	116.51
WATE	Waterloo	11/4/2015	Seneca	42.879660	-76.812550	118.01
WGAT	Woodgate	8/29/2016	Oneida	43.532408	-75.158597	119.34
VOOR	Voorheesville	8/16/2016	Albany	42.652420	-73.975620	120.06
PENN	Penn Yan	5/24/2016	Yates	42.655780	-76.987460	124.52
HFAL	High Falls	11/17/2016	Ulster	41.798800	-74.123120	125.60
OTIS	Otisville	12/10/2015	Orange	41.482490	-74.503680	126.87
TYRO	Tyrone	5/23/2016	Schuyler	42.406110	-77.053900	128.15
REDF	Redfield	6/21/2016	Oswego	43.622180	-75.877690	132.26
PISE	Piseco	3/25/2017	Hamilton	43.464740	-74.504320	133.31
REDH	Red Hook	8/2/2016	Dutchess	42.001680	-73.883910	133.33
WALL	Wallkill	6/23/2016	Ulster	41.634090	-74.153700	134.44
EDIN	Edinburg	7/15/2016	Saratoga	43.228190	-74.112930	136.08
GFLD	Glenfield	8/29/2016	Lewis	43.716800	-75.409250	137.73
KIND	Kinderhook	8/30/2016	Columbia	42.410010	-73.715570	138.82
WOLC	Wolcott	3/9/2016	Wayne	43.228680	-76.842610	140.08
OSWE	Oswego	7/7/2016	Oswego	43.443183	-76.553233	140.21
BSPA	Ballston Spa	8/18/2016	Saratoga	43.022800	-73.874980	140.72
SCHO	Schodack	1/11/2017	Rensselaer	42.506310	-73.685840	141.50
OLDF	Old Forge	9/2/2016	Herkimer	43.741570	-74.977860	145.27
HARR	Harrisburg	6/21/2016	Lewis	43.803520	-75.688530	148.81
ADDI	Addison	8/10/2016	Steuben	42.040360	-77.237260	150.52

Station ID	Station Name	Date Commissioned	County	Latitude (NAD83)	Longitude (NAD83)	Distance to Nearest Turbine (km)
CLIF	Clifton Springs	7/13/2016	Ontario	43.014790	-77.185180	151.89
WARW	Warwick	4/14/2016	Orange	41.240360	-74.390560	154.42
BEAC	Beacon	8/22/2016	Dutchess	41.528750	-73.945270	155.29
SCHA	Schaghticoke	6/20/2016	Rensselaer	42.896970	-73.614050	155.57
BELL	Belleville	4/28/2016	Jefferson	43.789620	-76.113730	155.97
SBRI	South Bristol	2/19/2016	Ontario	42.752170	-77.359310	156.48
COPA	Copake	8/3/2016	Columbia	42.136590	-73.519880	158.29
COHO	Cohocton	5/17/2016	Steuben	42.511780	-77.437620	159.67
COPE	Copenhagen	2/5/2016	Lewis	43.920564	-75.607866	160.98
RAQU	Raquette Lake	11/10/2016	Hamilton	43.822752	-74.625091	163.30
DOVE	Dover Plains	12/9/2016	Dutchess	41.773670	-73.575420	166.79
SCHU	Schuylerville	8/9/2015	Saratoga	43.116996	-73.578284	167.04
CROG	Croghan	11/2/2016	Lewis	43.974960	-75.201000	167.46
STEP	Stephentown	12/8/2015	Rensselaer	42.526200	-73.359060	168.45
ILAK	Indian Lake	7/26/2016	Hamilton	43.790670	-74.239330	175.28
GFAL	Glens Falls	3/10/2017	Warren	43.340870	-73.602020	177.27
ONTA	Ontario	11/1/2016	Wayne	43.259410	-77.373310	177.87
SUFF	Suffern	8/17/2016	Rockland	41.130380	-74.089870	178.93
SOME	Somers	2/28/2017	Westchester	41.310370	-73.767110	182.44
HART	Hartsville	8/9/2016	Steuben	42.211221	-77.689733	182.56
BREW	Brewster	3/30/2017	Putnam	41.440420	-73.576790	185.68
RUSH	Rush	7/12/2016	Monroe	43.000990	-77.637390	185.73
CHES	Chestertown	12/6/2015	Warren	43.653900	-73.777360	187.63
PHIL	Philadelphia	7/8/2016	Jefferson	44.193540	-75.715910	192.06
NEWC	Newcomb	10/18/2016	Essex	43.973290	-74.222730	193.12
CAPE	Cape Vincent	4/27/2016	Jefferson	44.104520	-76.326860	194.80
YORK	York	8/9/2016	Livingston	42.855040	-77.847760	197.96
WHIT	Whitehall	8/26/2015	Washington	43.485073	-73.423071	198.17
GROV	Grove	7/20/2016	Allegany	42.489510	-77.949460	201.69
EDWA	Edwards	8/16/2016	St. Lawrence	44.321500	-75.243790	205.48

Station ID	Station Name	Date Commissioned	County	Latitude (NAD83)	Longitude (NAD83)	Distance to Nearest Turbine (km)
WELL	Wellesley Island	4/27/2016	Jefferson	44.307820	-76.008580	208.66
TUPP	Tupper Lake	7/13/2016	Franklin	44.221280	-74.438260	209.88
BELM	Belmont	5/16/2016	Allegany	42.242490	-78.039580	210.69
BRON	Bronx	9/12/2017	Bronx	40.872481	-73.893522	211.78
MANH	Manhattan	7/18/2017	New York	40.767544	-73.964482	217.99
BROC	Brockport	6/16/2016	Monroe	43.208350	-77.965920	218.81
NHUD	North Hudson	9/13/2016	Essex	44.013100	-73.705160	220.85
BATA	Batavia	2/18/2016	Genesee	43.019940	-78.135660	225.20
TICO	Ticonderoga	1/28/2016	Essex	43.874690	-73.418790	225.46
WARS	Warsaw	5/16/2016	Wyoming	42.779930	-78.208890	225.50
STAT	Staten Island	5/3/2017	Richmond	40.604014	-74.148499	225.75
HAMM	Hammond	8/16/2016	St. Lawrence	44.513020	-75.617290	226.68
QUEE	Queens	4/18/2017	Queens	40.734335	-73.815856	228.07
BKLN	Brooklyn	6/19/2017	Kings	40.631762	-73.953678	231.21
GABR	Gabriels	1/20/2016	Franklin	44.417420	-74.178670	238.28
DELE	Delevan	3/8/2016	Cattaraugus	42.418464	-78.423200	240.75
OLEA	Olean	6/2/2016	Cattaraugus	42.091410	-78.407430	243.29
POTS	Potsdam	7/8/2016	St. Lawrence	44.656867	-74.974433	244.99
MEDI	Medina	7/19/2016	Orleans	43.226680	-78.309270	245.63
WFMB	Whiteface Mountain Base	1/29/2016	Essex	44.393236	-73.858829	248.11
WANT	Wantagh	11/10/2016	Nassau	40.655100	-73.506160	250.81
STON	Stony Brook	2/21/2018	Suffolk	40.919120	-73.131680	251.18
EAUR	East Aurora	8/8/2016	Erie	42.713490	-78.631730	258.98
ESSX	Essex	12/5/2015	Essex	44.313604	-73.371896	263.57
LOUI	Louisville	3/26/2016	St. Lawrence	44.871690	-75.056080	267.77
BUFF	Buffalo	3/9/2017	Erie	43.000170	-78.767170	274.74
MALO	Malone	8/15/2016	Franklin	44.852869	-74.328874	278.57
RAND	Randolph	6/2/2016	Cattaraugus	42.149280	-78.900960	282.59
BURT	Burt	6/15/2016	Niagara	43.316990	-78.749030	282.65
SARA	Saranac	7/12/2016	Clinton	44.707585	-73.671150	285.75

Station ID	Station Name	Date Commissioned	County	Latitude (NAD83)	Longitude (NAD83)	Distance to Nearest Turbine (km)
SOUT	Southold	11/10/2016	Suffolk	41.040081	-72.465864	287.73
BRAN	Brant	4/23/2016	Erie	42.594940	-79.021540	290.02
ELLE	Ellenburg	8/30/2016	Clinton	44.895500	-73.845020	297.64
CHAZ	Chazy	7/8/2016	Clinton	44.895650	-73.464610	312.08
FRED	Fredonia	4/23/2016	Chautauqua	42.418170	-79.366600	318.38
CLYM	Clymer	6/1/2016	Chautauqua	42.024470	-79.624080	343.83

Table A-1: New York State Mesonet Weather Stations and Distance to the High Bridge Wind Farm Project