Section 26. SHADOW FLICKER

Epsilon Associates, Inc. conducted a shadow flicker analysis of the proposed turbine locations of the Project (Exhibit 26-1). The shadow flicker modeling was conservatively conducted for 33 turbines, which includes three alternate turbine locations. The Applicant will build upon only 30 of the turbine sites identified. As described in Section 1, the Project will use Vestas V150 4.2 turbines with a hub height of 125 m, a rotor diameter of 150 m, and a maximum height of 200 m (656 ft) with the blade fully extended.

MDEP limits shadow flicker effects on any occupied building located on property not owned or leased by the applicant or subject to a shadow flicker easement to 30 hours of shadow flicker per year.[19] The State of Maine specifies that a shadow flicker model should include impacts to any occupied building within 1 mile radially from any proposed turbine location. Therefore, the analysis includes shadow flicker calculations out to 1 mile (1,609 meters) from each turbine location.

The shadow flicker analysis was conducted to predict the annual duration of shadow flicker at sensitive receptors in the vicinity of the project. Shadow flicker was modeled using the shadow module within the software package, WindPRO version 3.3.274. Anticipated shadow flicker in the area surrounding the wind turbines was calculated based on the following data inputs:

- Location of the wind turbines;
- Location of the discrete receptor points;
- Wind turbine dimensions;
- Flicker calculation limits;
- Terrain data;
- Wind and sunshine probabilities based upon historical weather data.

The modeling receptor dataset includes 220 dwellings and campsites within the project area. All receptor locations were treated conservatively as sensitive receptors. Each location was assumed to have a window facing all directions to further yield conservative results. Based on the conservative methodology the following results were modeled:

- 198 of the modeling locations would experience 0 hours of shadow flicker;
- 11 locations were predicted to experience less than 10 hours per year;
- 9 locations were predicted to experience between 10 and 30 hours per year; and
- 2 locations were predicted to experience over 30 hours of shadow flicker. Both of these locations are remote hunting camps and participating receptors located on leased land.

[19] 06-096 CMR Chapter 382.4.

EXHIBIT 26-1: SHADOW FLICKER ANALYSIS REPORT

SHADOW FLICKER MODELING ANALYSIS

Downeast Wind

Washington County, Maine

Prepared for:

Apex Clean Energy, Inc.
310 4th Street NE, Suite 200
Charlottesville, VA 22902

Prepared by:

Epsilon Associates, Inc.
3 Mill & Main Place, Suite 250
Maynard, MA 01754

March 12, 2021

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1.0 EXECUTIVE SUMMARY

Downeast Wind (the Project) is a proposed 126-megawatt (MW) wind power generation facility expected to be composed of 30 wind turbines in Washington County, Maine. The Project is being developed by Apex Clean Energy, Inc. (Apex). Epsilon Associates, Inc. (Epsilon) has been retained by TRC Companies, Inc. (TRC) to conduct a shadow flicker analysis for the proposed wind turbines for this Project. This report presents the results of the shadow flicker analysis.

Shadow flicker modeling was conservatively conducted for 33 turbines, which includes three (3) alternate wind turbine locations. All wind turbines for this Project are proposed to be Vestas V150-4.2 units. The purpose of this assessment is to predict the annual duration of shadow flicker at sensitive receptors in the vicinity of the Project to address the state and local regulations with regards to shadow flicker.

Using the Project specific data provided by Apex, the annual expected duration of shadow flicker was modeled at all specified structures, all conservatively modeled as "sensitive receptors." The maximum expected annual duration of shadow flicker at a modeling receptor resulting from the operation of the 33 proposed wind turbines is 55 hours, 11 minutes. This is at a participating receptor on property leased by the Project for the anticipated duration of the Project's life. The maximum expected annual duration of shadow flicker at a non-participating modeling receptor is 10 hours, 54 minutes, which is less than the State limit of 30 hours per year. The modeling results are conservative in that modeling receptors were treated as "greenhouses" and the surrounding area was assumed to be without vegetation or structures ("bare earth").

2.0 INTRODUCTION

The proposed Downeast Wind Project, to be located in Washington County, Maine, will consist of 30 Vestas wind turbines. The wind turbines will be Vestas V150-4.2 units with a hub height of 125 meters and a rotor diameter of 150 meters.

With respect to wind turbines, shadow flicker can be defined as an intermittent change in the intensity of light in a given area resulting from the operation of a wind turbine due to its interaction with the sun. Indoors, an observer experiences repeated changes in the brightness of the room as shadows cast from the wind turbine blades briefly pass by the windows as the blades rotate. In order for this to occur, the wind turbine must be operating, the sun must be shining, and the window must be within the shadow region of the wind turbine, otherwise there is no shadow flicker. A stationary wind turbine would only generate a stationary shadow, similar to any other structure.

This report presents the findings of the shadow flicker modeling in Washington County, Maine for 33 wind turbines, which includes 3 alternate locations. The wind turbines were modeled with the WindPRO software package using information provided by Apex and TRC. The expected annual duration of shadow flicker was calculated at 220 discrete modeling locations and shadow flicker isolines for the area surrounding the Project were generated. The results of this analysis are found within this report.

3.0 REGULATIONS

3.1 Federal Regulations

There are no federal community shadow flicker regulations applicable to this Project.

3.2 Maine State Regulations

The State of Maine Department of Environmental Protection Wind Energy Act Standards Chapter 382 contains the following text regarding shadow flicker:

> ***Shadow Flicker.*** *An applicant must demonstrate that the generating facilities of a proposed wind energy development have been designed to avoid unreasonable adverse shadow flicker effects at any occupied building located on property not owned by the applicant, subject to a lease for a duration at least as long as the anticipated project life, or subject to an easement for shadow flicker in excess of 30 hours per year.*
>
> *A. An applicant must submit a shadow flicker analysis based on WindPRO, or other modeling software approved by the Department. The analysis must assume that all shadows cast by rotating turbine blades on occupied buildings are unobstructed, and shall not take into account any existing vegetative buffers. The shadow flicker analysis shall model impacts to any occupied building within one mile, measured horizontally, from a proposed turbine.*
>
> *B. A proposed development may not result in shadow flicker effect occurring at an occupied building for more than 30 hours per calendar year. An applicant may request that this general restriction be waived by showing that 30 hours or less of shadow flicker per year will occur during times when an affected public building is in use, or where an affected private building is used seasonally or intermittently such that occupants will experience 30 hours or less of shadow flicker per year. An applicant may also qualify for a waiver by submitting evidence of agreements or easements with affected property owners in which the property owners state that they do not object to the projected level of shadow flicker.*
>
> *C. If the shadow flicker analysis predicts that any occupied building will receive more than 30 hours of shadow flicker per calendar year, the applicant may propose mitigation measures to reduce this impact to 30 hours or less per calendar year.*

3.3 County Regulations

Epsilon is not aware of any ordinances with respect to shadow flicker in Washington County.

3.4 Local Regulations

3.4.1 Town of Columbia

The Town of Columbia has enacted a Wind Turbine Ordinance. The ordinance does not include any limits on shadow flicker, but does require adherence to the DEP standards, which are summarized above. Specifically, the ordinance reads as follows in the General Standards section:

> *All DEP Rules and General Standards regarding a WES as of the date of passage of this Ordinance shall be adhered to …. Should the DEP standards (See Appendix B and Appendix C) become less stringent in the future, the current standards (as of the date of adoption of this ordinance) shall prevail.*

The project meets the DEP shadow flicker standards and therefore complies with the requirements of the Town of Columbia. The Columbia ordinance also includes requirements for mitigation waivers, but the Project does not need mitigation waivers to meet the shadow flicker standards and therefore those provisions are not applicable.

4.0 SHADOW FLICKER ANALYSIS

4.1 Modeling Methodology

Shadow flicker was modeled using a software package, WindPRO version 3.3.274. WindPRO is a software suite developed by EMD International A/S and is used for assessing potential environmental impacts from wind turbines. Using the Shadow module within WindPRO, worst-case shadow flicker in the area surrounding the wind turbines was calculated based on data inputs including: location of the wind turbines, location of discrete receptor points, wind turbine dimensions, flicker calculation limits, and terrain data. Based on these data, the model was able to incorporate the appropriate sun angle and maximum daily sunlight for this latitude into the calculations. The resulting worst-case calculations assume that the sun is always shining during daylight hours and that the wind turbine is always operating. The WindPRO Shadow module can be further refined by incorporating sunshine probabilities and wind turbine operational estimates by wind direction over the course of a year. The values produced by this further refinement, also known as the "expected" shadow flicker, are presented in this report.

The proposed wind turbine layout (LAY-039) for the Project was provided by Apex on December 18, 2020. A total of 33 Downeast Wind turbines were included in the analysis. The locations for the wind turbines, all to be located in Washington County, are presented in Figure 4-1. Each wind turbine has the following characteristics based on the technical data provided by TRC:

- Rated Power = 4,200 kW
- Hub Height = 125 meters (above ground level)
- Rotor Diameter = 150 meters
- Cut-in Wind Speed = 3 m/s
- Cut-out Wind Speed = 24.5 m/s

The State of Maine specifies that a shadow flicker model should include impacts to any occupied building within 1 mile radially from any proposed wind turbine. Therefore, this analysis included shadow flicker calculations out to 1 mile (1,609 meters) from each wind turbine.

A modeling receptor dataset was provided by Apex on May 22, 2020 for modeling receptors within the Project Area in Washington County. This modeling receptors dataset contained dwellings and campsites within the Project Area. In total, there were 229 receptors contained in the dataset. Nine of these modeling receptors extended beyond the Project Area and were more than five miles away from any of the proposed wind turbines. As a result, these nine receptors were removed and not included in the analysis. In total, 220 receptors from the dataset were then included and input into the model. Campsites within the dataset were designated with a "C" throughout the analysis. These campsites are identifiable in Appendix A. All receptors were conservatively treated as sensitive receptors and modeled as discrete points and are shown on Figure 4-1. Each modeling point was assumed to have a window facing all directions ("greenhouse" mode) which yields conservative results. Participation status for each of the 220 modeling receptors was assigned based on information provided in the dataset. The model was set to limit calculations to 1,609 meters from a wind turbine, the equivalent of 1

mile. Consequently, shadow flicker at any of the 220 modeling receptors greater than the corresponding limitation distance from a wind turbine was zero. In addition to modeling discrete receptors, shadow flicker was calculated at grid points in the area surrounding the modeled wind turbines to generate flicker isolines. A 20-meter spacing was used for this grid.

The terrain height contour elevations for the modeling domain were generated from elevation information derived from a National Elevation Database (NED) developed by the U.S. Geological Survey and processed by the U.S. Department of Agriculture. Conservatively, obstacles which may block the line-of-sight between a wind turbine and receptor, i.e., buildings and vegetation, were excluded from the analysis. In addition, shadow flicker was calculated only when the angle of the sun was at least 3° above the horizon.

Monthly sunshine probability values were input for each month from January to December. These numbers were obtained from a publicly available historical dataset for Portland, Maine from the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI).[1] Table 4-1 shows the percentage of sunshine hours by month used in the shadow flicker modeling. These values are the percentages that the sun is expected to be shining during daylight hours.

The number of hours the wind turbines are expected to operate for the 16 cardinal wind directions was input into the model. Ten-minute wind speed and direction data were provided by Apex for two years of on-site meteorological data from the years 2017 & 2018 at a height of 125 meters, representing the wind speeds at the proposed hub height. Epsilon processed the data into a joint frequency distribution of wind speed and wind direction, which allowed for the determination of operational hours per wind direction sector. These hours per wind direction sector are used by WindPRO to estimate the "wind direction" and "operation time" reduction factors. Based on this dataset, the wind turbines would operate 93% of the year due to cut-in and cut-out specifications of the proposed wind turbines. Table 4-2 shows the distribution of operational hours for the 16 wind directions. The reduction factors in Tables 4-1 and 4-2 are only applied to the expected hours per year of shadow flicker calculations. The number of days per year and maximum minutes per day, are both calculated as if the sun is always shining and the wind is always blowing above cut-in speed and below cut-out speed. These are conservative estimates.

[1] NCEI (formerly NCDC), http://www1.ncdc.noaa.gov/pub/data/ccd-data/pctpos15.dat. Accessed in January 2021.

Table 4-1 Monthly Percent of Possible Sunshine

Month	Possible Sunshine
January	57%
February	58%
March	53%
April	55%
May	53%
June	55%
July	62%
August	63%
September	60%
October	58%
November	47%
December	49%

Table 4-2 Operational Hours per Wind Direction Sector

Wind Sector	Operational Hours
N	442
NNE	517
NE	409
ENE	241
E	167
ESE	175
SE	180
SSE	423
S	603
SSW	633
SW	713
WSW	649
W	656
WNW	879
NW	889
NNW	552
Annual	8,128

4.2 Results

Following the modeling methodology outlined in Section 4.1, WindPRO was used to calculate shadow flicker at the 220 discrete modeling points in Washington County and to generate shadow flicker isolines based on the grid calculations.

Appendix A presents the shadow flicker modeling results for the 220 receptors in Washington County. The predicted expected annual shadow flicker duration ranged from 0 hours, 0 minutes per year to 55 hours, 11 minutes per year. The majority of the modeling locations (198) were predicted to experience no annual shadow flicker. Eleven (11) locations were predicted to experience some shadow flicker, but less than 10 hours per year. The modeling results showed that nine (9) locations would be expected to have 10 to 30 hours of shadow flicker per year, while two (2) locations would be expected to have over 30 hours of shadow flicker per year. Both of these locations are participating receptors and fall on property leased by the Project. Figure 4-2 displays the modeled flicker isolines over aerial imagery, in relation to modeled wind turbines and receptors.

G:\Projects2\ME\5685\MXD\Aerial.mxd

Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services

LEGEND

- Primary Vestas V150-4.2 SE Turbine
- Alternate Vestas V150-4.2 SE Turbine
- Participating Receptor
- Non-Participating Receptor
- Project Boundary
- Town Boundary

Scale 1:54,000
1 inch = 4,500 feet

0 2,250 4,500 Feet

Basemap: Bing Aerial Imagery

Downeast Wind Washington County, Maine

Figure 4-1
Aerial Locus

G:\Projects2\ME\5685\MXD\Flicker_Index_LAY39_210226.mxd

Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services

LEGEND

- Map Sheet
- Primary Vestas V150-4.2 SE Turbine
- Alternate Vestas V150-4.2 SE Turbine
- Participating Receptor
- Non-Participating Receptor
- Project Boundary
- Town Boundary

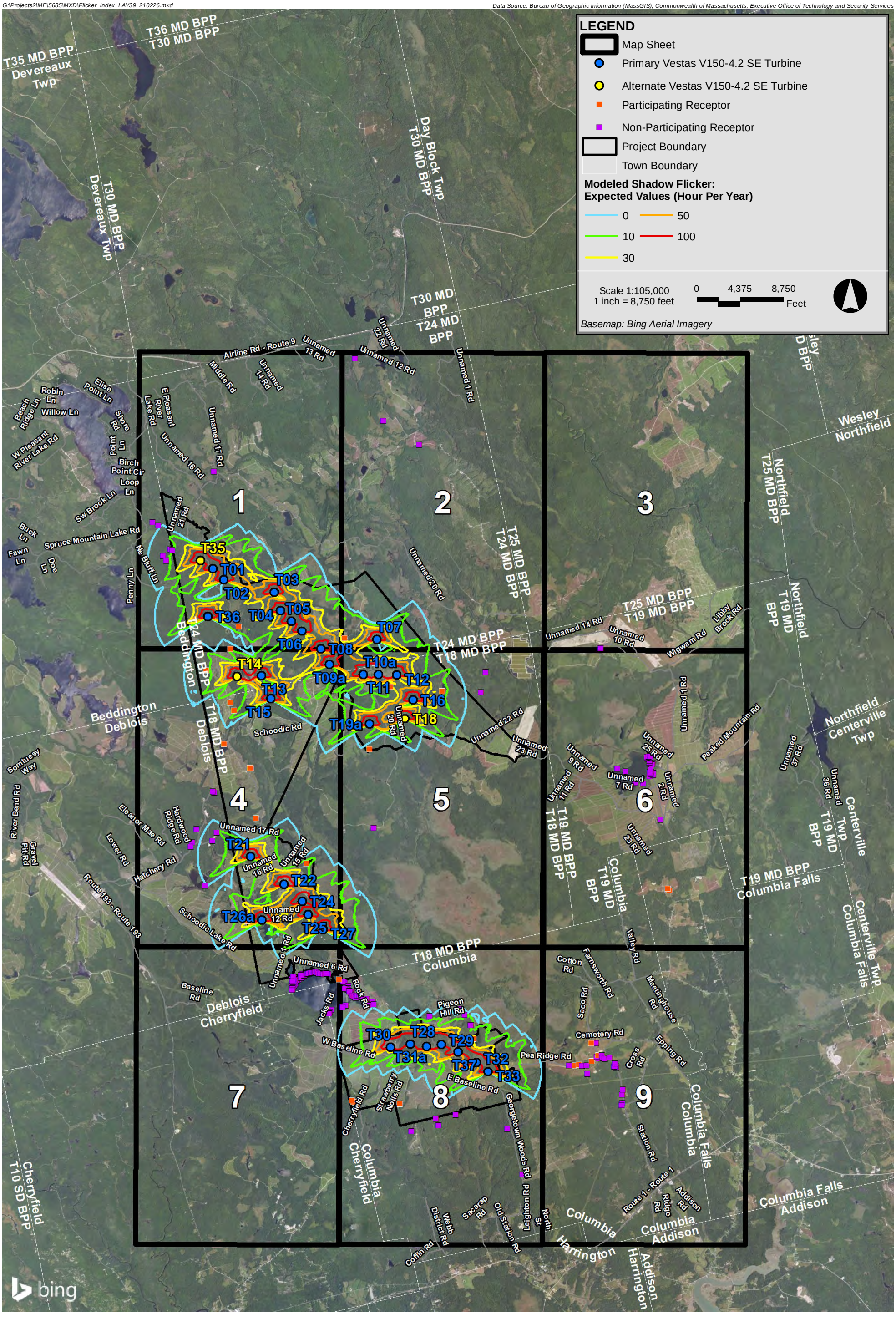
Modeled Shadow Flicker: Expected Values (Hour Per Year)

0 50 10 100 30

Scale 1:105,000
1 inch = 8,750 feet

0 4,375 8,750 Feet

Basemap: Bing Aerial Imagery



Downeast Wind **Washington County, Maine**

Epsilon ASSOCIATES INC.

Figure 4-2, Index
Shadow Flicker Modeling Results

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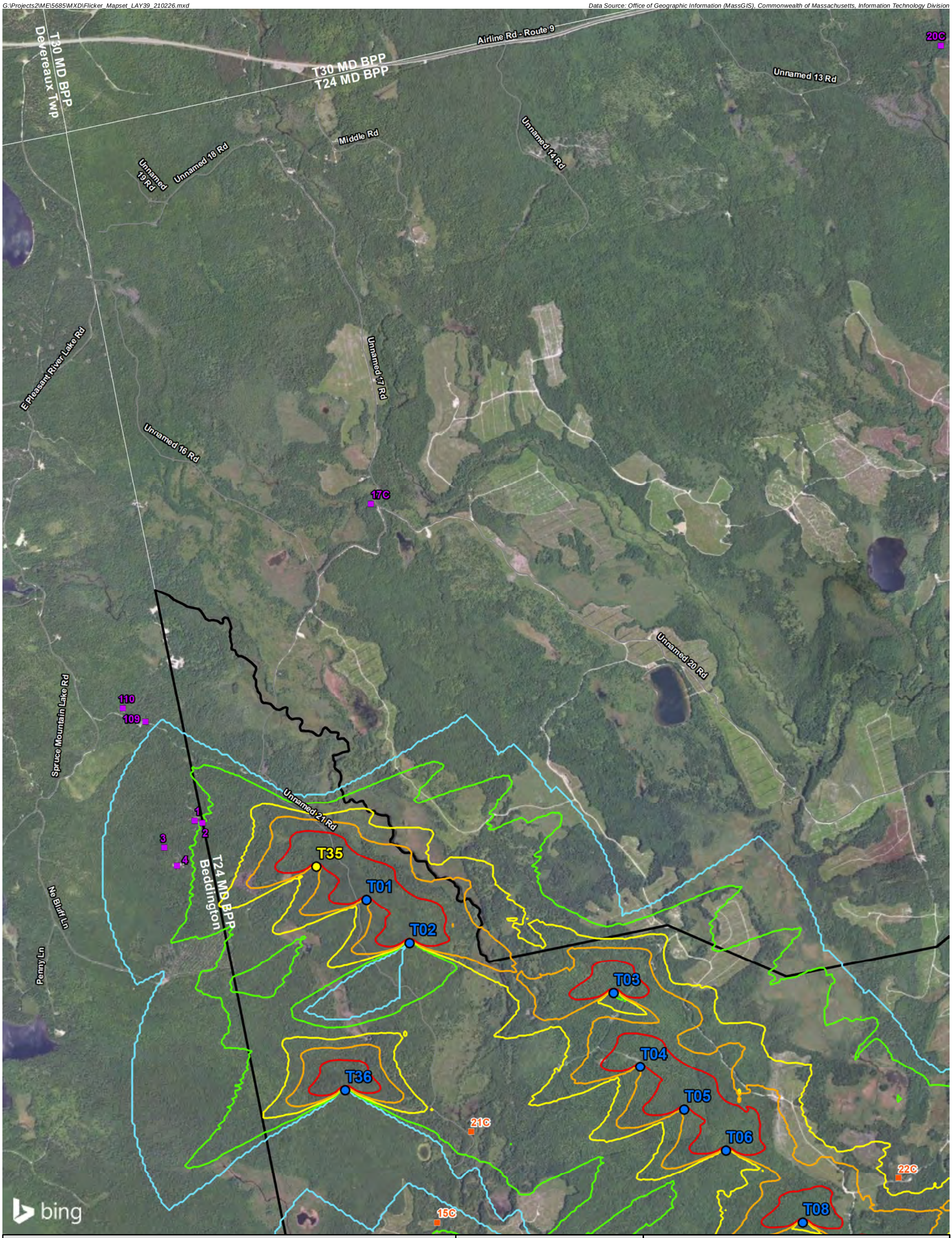
Data Source: Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division



LEGEND

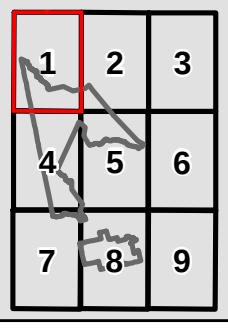
- Primary Vestas V150-4.2 SE Turbine
- Alternate Vestas V150-4.2 SE Turbine
- Participating Receptor
- Non-Participating Receptor
- Project Boundary
- Town Boundary

Modeled Shadow Flicker: Expected Values (Hour Per Year)

- 0
- 10
- 30
- 50
- 100

Scale 1:27,600
1 inch = 2,300 feet

0 1,150 2,300 Feet



Downeast Wind Washington County, Maine

Epsilon Associates Inc.

Figure 4-2, Map 1 of 9
Shadow Flicker Modeling Results

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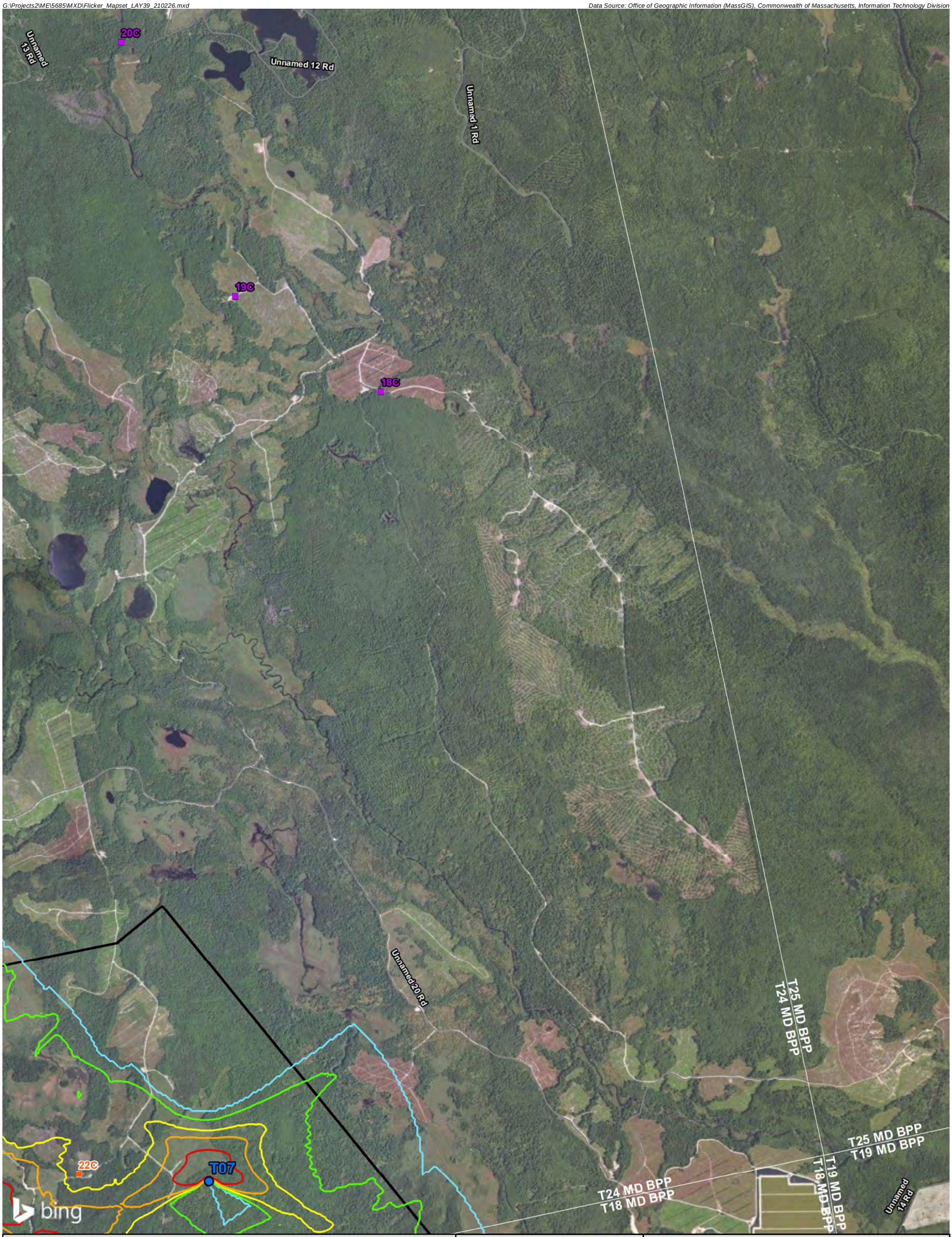
Data Source: Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division



LEGEND

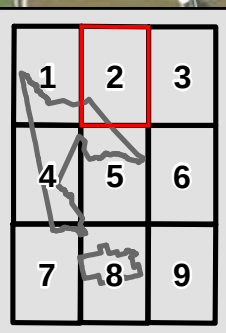
- Primary Vestas V150-4.2 SE Turbine
- Alternate Vestas V150-4.2 SE Turbine
- Participating Receptor
- Non-Participating Receptor
- Project Boundary
- Town Boundary

Modeled Shadow Flicker: Expected Values (Hour Per Year)

- 0
- 10
- 30
- 50
- 100

Scale 1:27,600
1 inch = 2,300 feet

0 1,150 2,300 Feet



Downeast Wind Washington County, Maine

Epsilon Associates Inc.

Figure 4-2, Map 2 of 9
Shadow Flicker Modeling Results

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Data Source: Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division

LEGEND

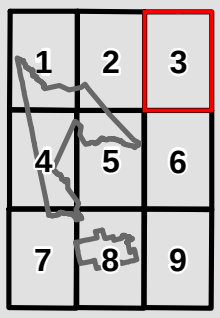
- Primary Vestas V150-4.2 SE Turbine
- Alternate Vestas V150-4.2 SE Turbine
- Participating Receptor
- Non-Participating Receptor
- Project Boundary
- Town Boundary

Modeled Shadow Flicker: Expected Values (Hour Per Year)

- 0
- 50
- 10
- 100
- 30

Scale 1:27,600
1 inch = 2,300 feet

0 1,150 2,300 Feet



Downeast Wind Washington County, Maine

Epsilon Associates Inc.

Figure 4-2, Map 3 of 9
Shadow Flicker Modeling Results

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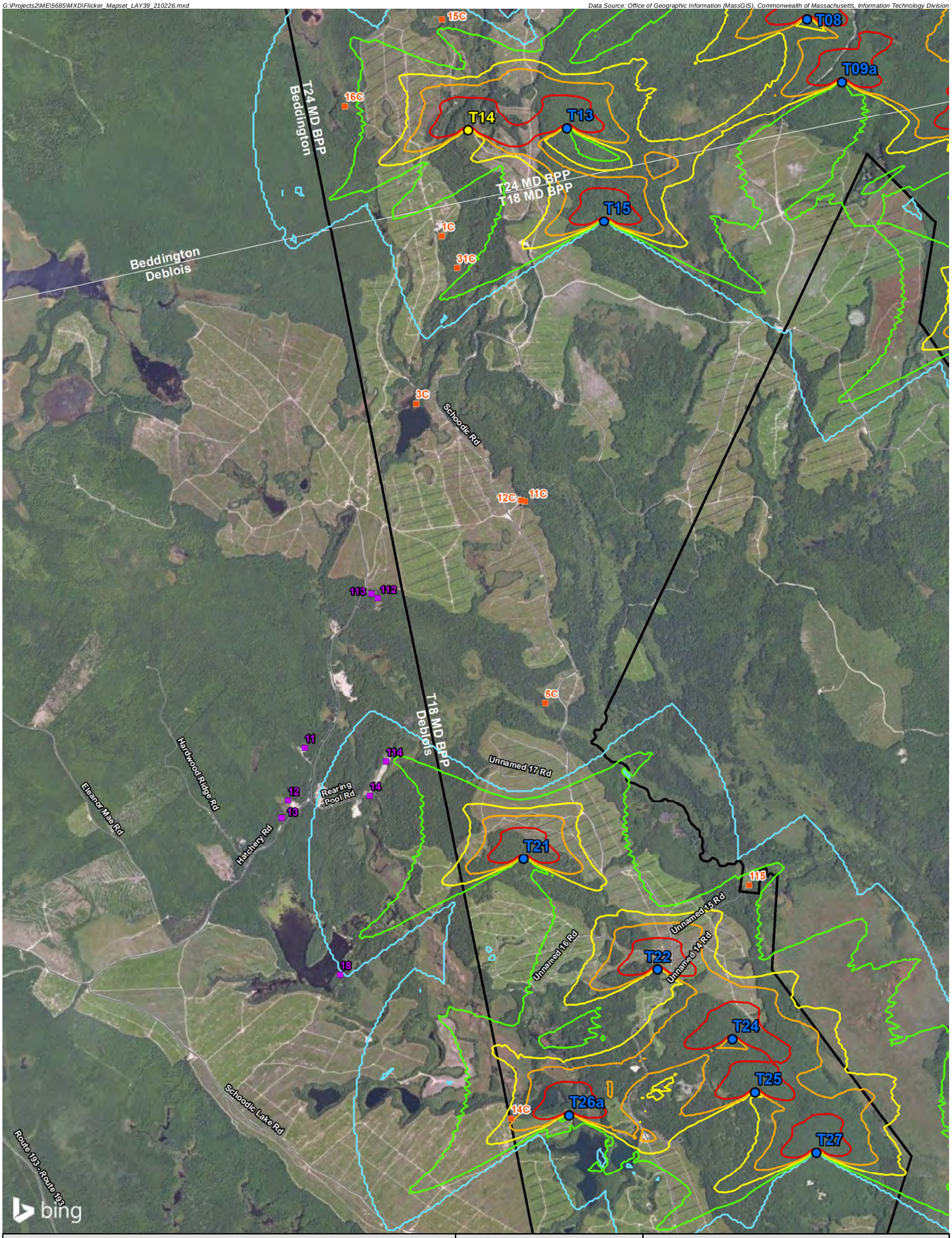
Data Source: Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division



LEGEND

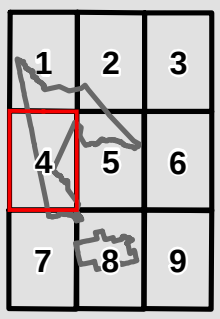
- Primary Vestas V150-4.2 SE Turbine
- Alternate Vestas V150-4.2 SE Turbine
- Participating Receptor
- Non-Participating Receptor
- Project Boundary
- Town Boundary

Modeled Shadow Flicker: Expected Values (Hour Per Year)

- 0
- 10
- 30
- 50
- 100

Scale 1:27,600
1 inch = 2,300 feet

0 1,150 2,300 Feet



Downeast Wind Washington County, Maine

Epsilon Associates Inc.

Figure 4-2, Map 4 of 9
Shadow Flicker Modeling Results

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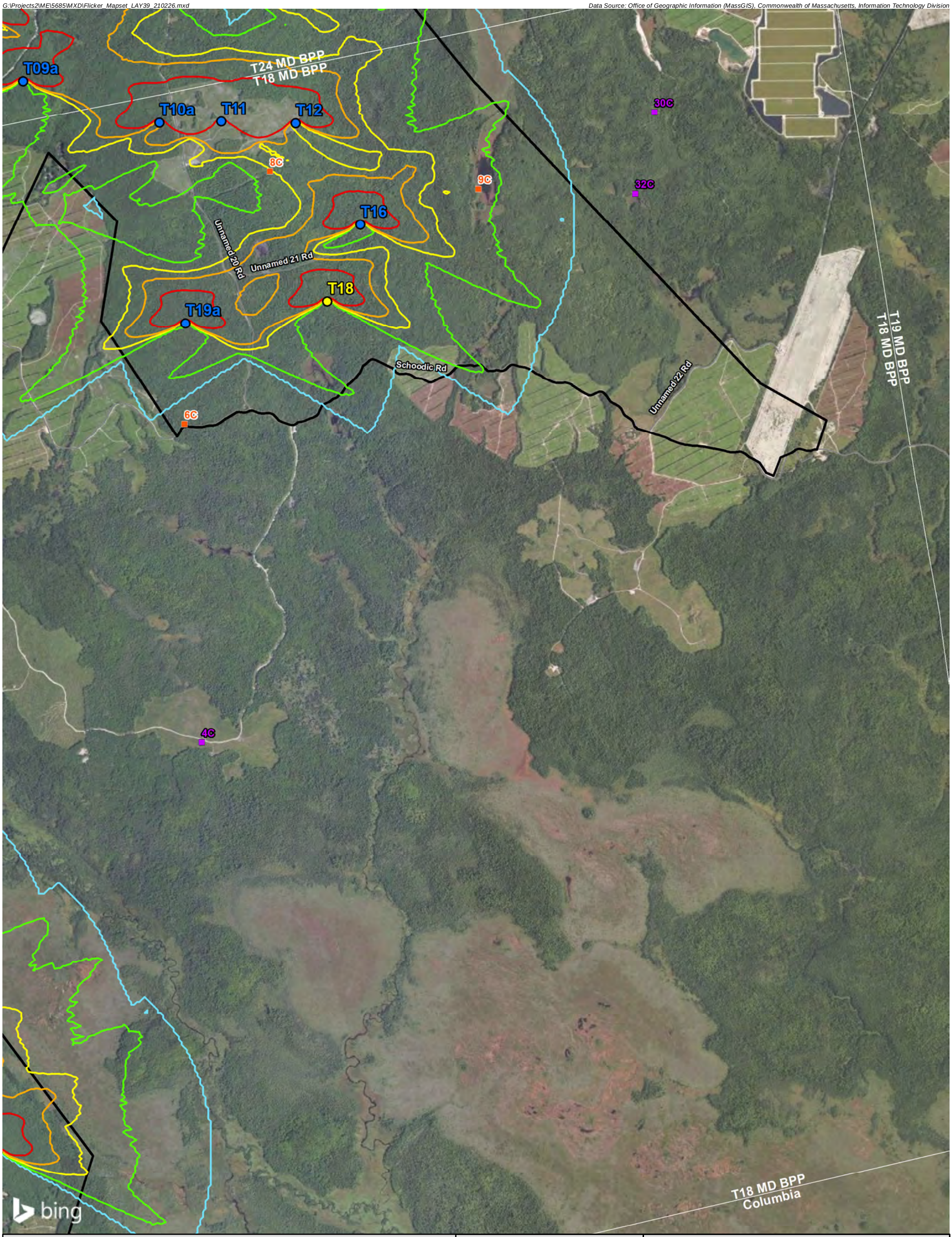
Data Source: Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division



LEGEND

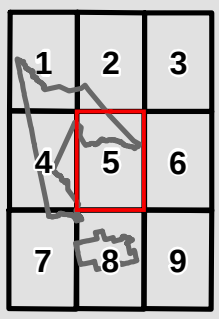
- Primary Vestas V150-4.2 SE Turbine
- Alternate Vestas V150-4.2 SE Turbine
- Participating Receptor
- Non-Participating Receptor
- Project Boundary
- Town Boundary

Modeled Shadow Flicker: Expected Values (Hour Per Year)

- 0
- 10
- 30
- 50
- 100

Scale 1:27,600
1 inch = 2,300 feet

0 1,150 2,300 Feet



Downeast Wind Washington County, Maine

Epsilon Associates Inc.

Figure 4-2, Map 5 of 9
Shadow Flicker Modeling Results

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Data Source: Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division

LEGEND

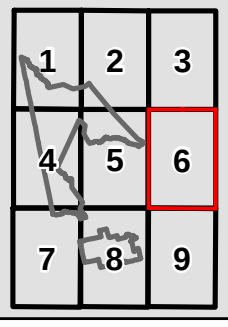
- Primary Vestas V150-4.2 SE Turbine
- Alternate Vestas V150-4.2 SE Turbine
- Participating Receptor
- Non-Participating Receptor
- Project Boundary
- Town Boundary

Modeled Shadow Flicker: Expected Values (Hour Per Year)

- 0
- 10
- 30
- 50
- 100

Scale 1:27,600
1 inch = 2,300 feet

0 1,150 2,300 Feet



Downeast Wind Washington County, Maine

Epsilon Associates Inc.

Figure 4-2, Map 6 of 9
Shadow Flicker Modeling Results

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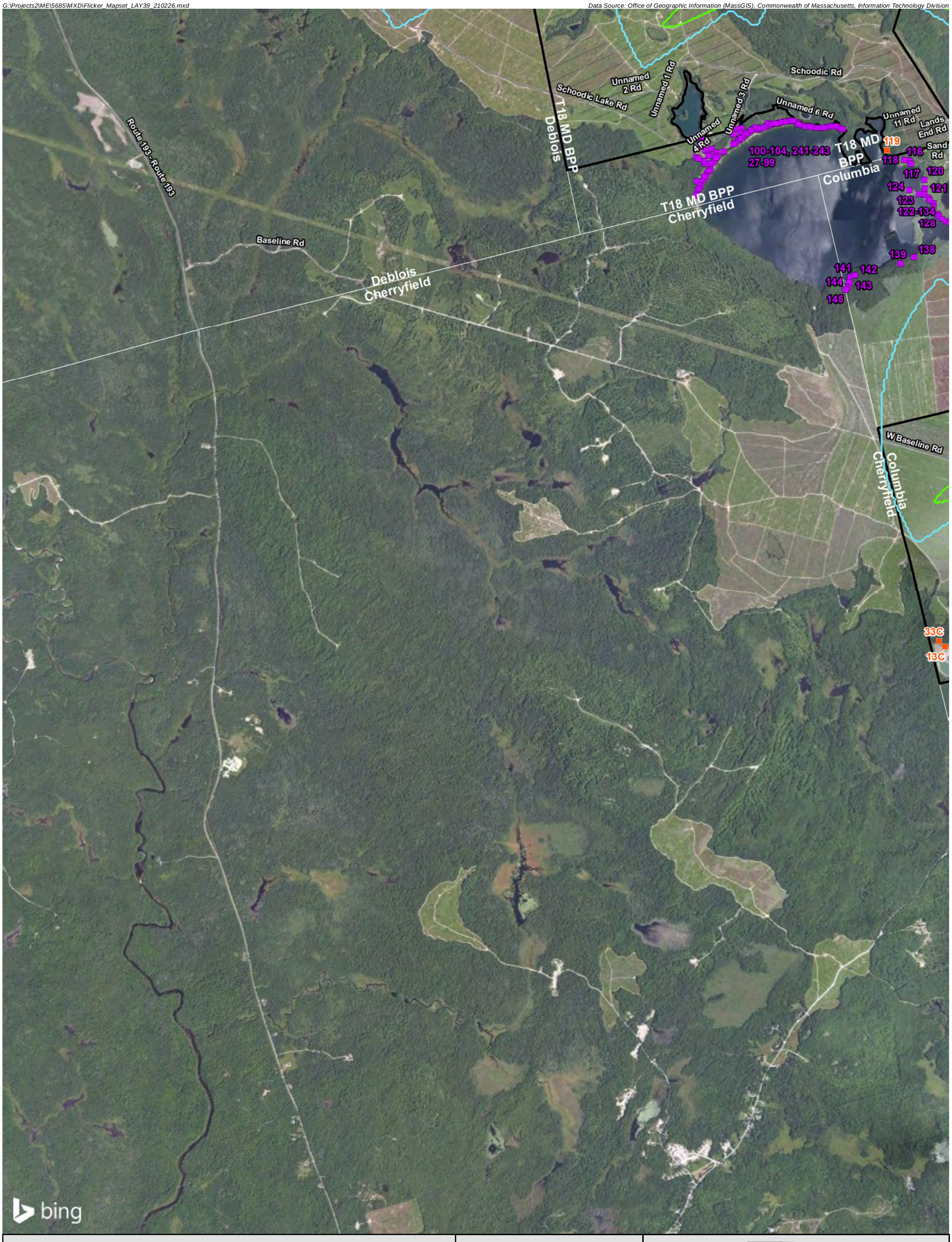


LEGEND

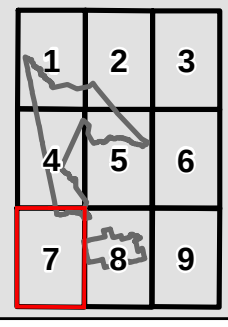
- Primary Vestas V150-4.2 SE Turbine
- Alternate Vestas V150-4.2 SE Turbine
- Participating Receptor
- Non-Participating Receptor
- Project Boundary
- Town Boundary

Modeled Shadow Flicker: Expected Values (Hour Per Year)

0 — 50
10 — 100
30

Scale 1:27,600
1 inch = 2,300 feet

0 1,150 2,300 Feet



Downeast Wind Washington County, Maine

Epsilon Associates Inc.

Figure 4-2, Map 7 of 9
Shadow Flicker Modeling Results

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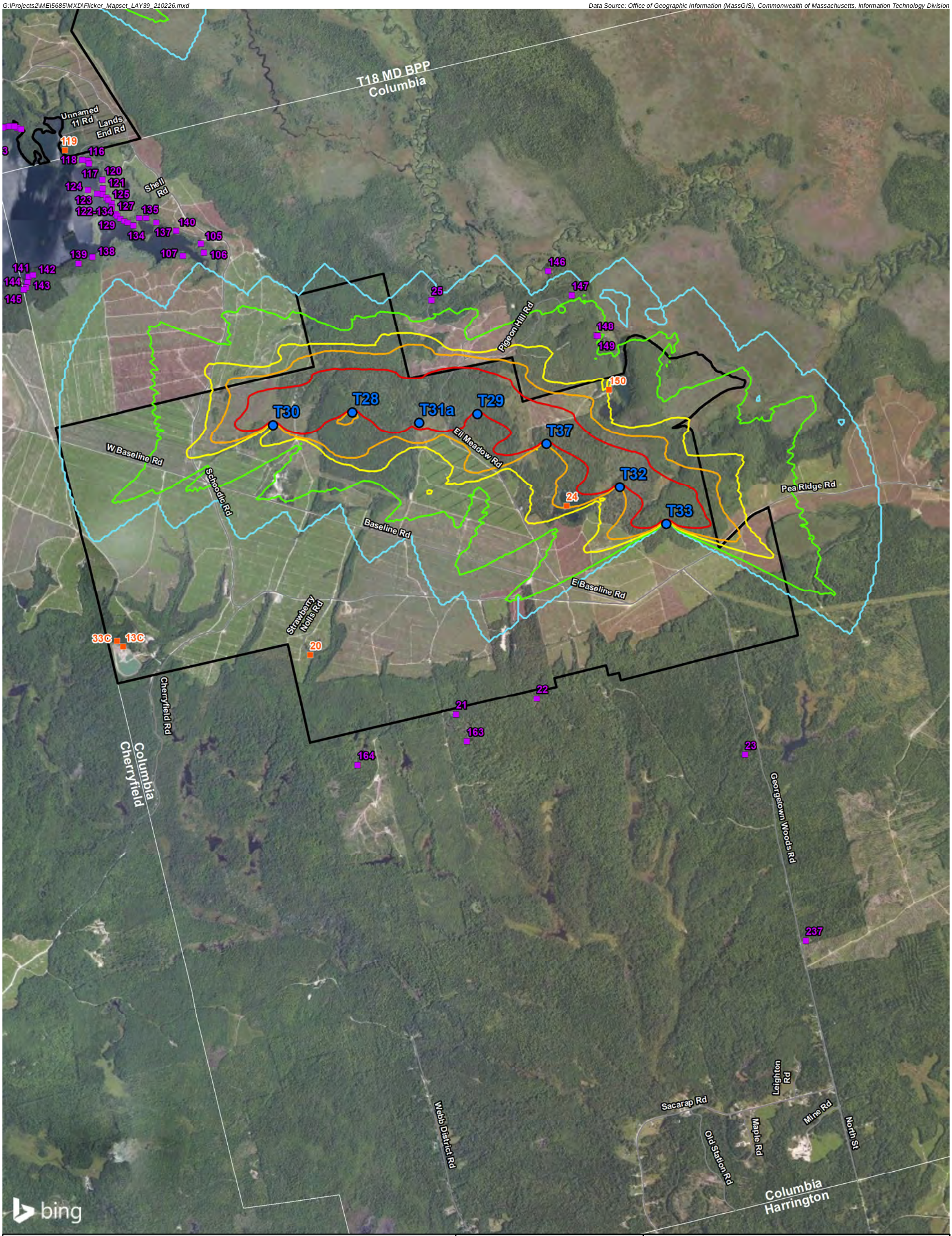
Data Source: Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division



LEGEND

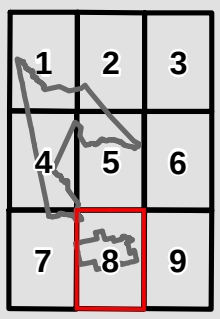
- Primary Vestas V150-4.2 SE Turbine
- Alternate Vestas V150-4.2 SE Turbine
- Participating Receptor
- Non-Participating Receptor
- Project Boundary
- Town Boundary

Modeled Shadow Flicker: Expected Values (Hour Per Year)

- 0
- 10
- 30
- 50
- 100

Scale 1:27,600
1 inch = 2,300 feet

0 1,150 2,300 Feet



Downeast Wind Washington County, Maine

Epsilon Associates Inc.

Figure 4-2, Map 8 of 9
Shadow Flicker Modeling Results

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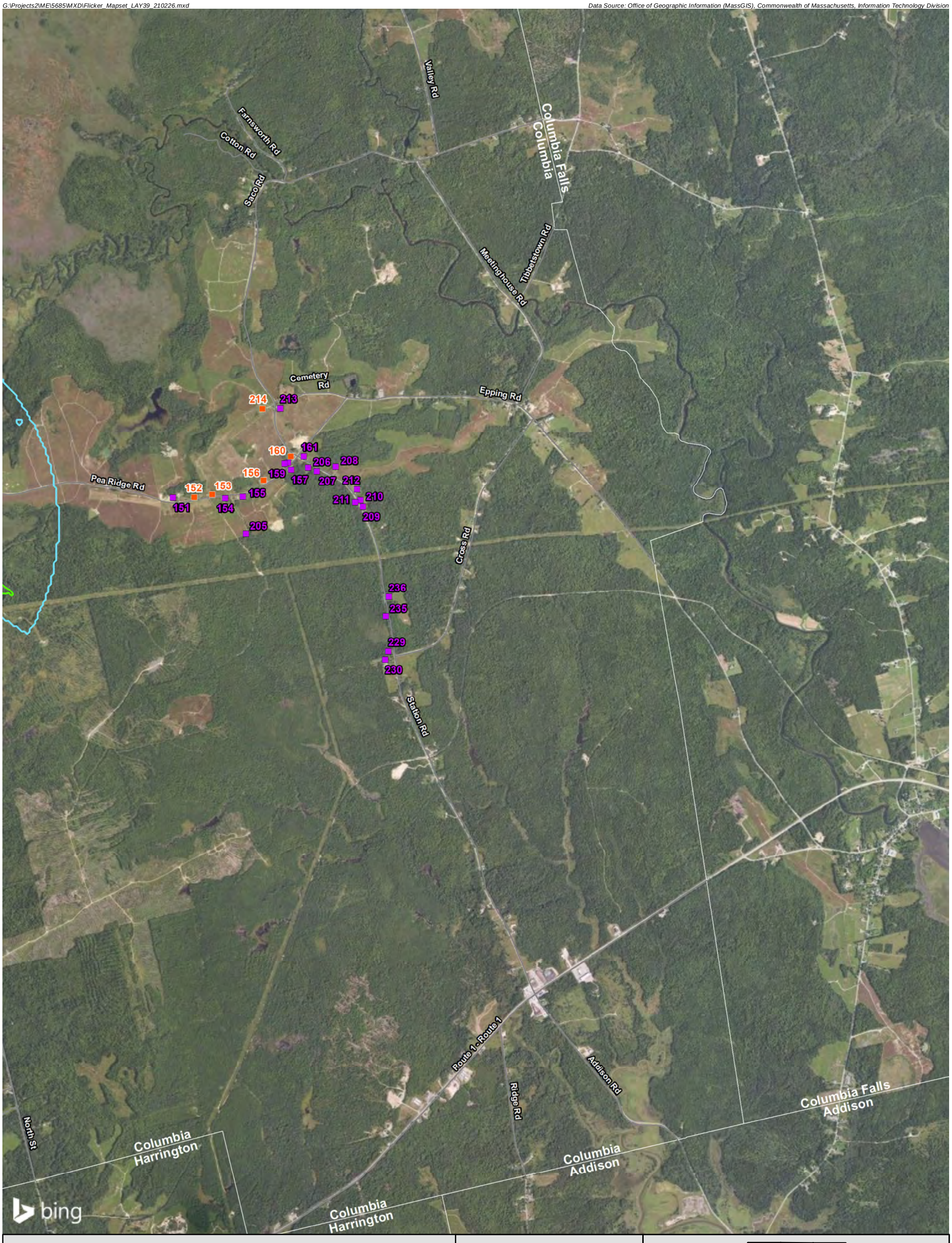


LEGEND

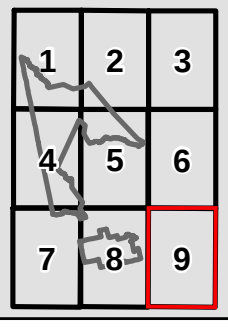
- Primary Vestas V150-4.2 SE Turbine
- Alternate Vestas V150-4.2 SE Turbine
- Participating Receptor
- Non-Participating Receptor
- Project Boundary
- Town Boundary

Modeled Shadow Flicker: Expected Values (Hour Per Year)

- 0
- 10
- 30
- 50
- 100

Scale 1:27,600
1 inch = 2,300 feet

0 1,150 2,300 Feet



Downeast Wind Washington County, Maine

Epsilon Associates Inc.

Figure 4-2, Map 9 of 9
Shadow Flicker Modeling Results

5.0 EVALUATION OF SHADOW FLICKER

5.1 State of Maine

According to the Wind Energy Act Standards of the Department of Environmental Protection, shadow flicker at an occupied building within 1 mile of a wind turbine is limited to 30 hours per year. The shadow flicker modeling results at all modeling receptors have been compared to this limit.

Twenty-two (22) of the 220 modeling locations were predicted to experience shadow flicker from the Project with regards to expected annual shadow flicker. The maximum expected annual duration of shadow flicker at a modeling receptor resulting from the operation of the 33 wind turbines is 55 hours, 11 minutes. This modeling receptor (24) is a participating receptor. In total, there are two (2) receptors that exceed the State limit of 30 hours per year and both of these receptors are participating and are on property leased by the Project. The highest modeled annual duration of shadow flicker at a non-participating receptor (148) is 10 hours, 54 minutes. Shadow flicker at all non-participating occupied buildings, are below the State limit of 30 hours per year; therefore, this Project is in compliance with the State of Maine regulation with respect to shadow flicker.

6.0 CONCLUSIONS

A shadow flicker analysis was conducted to determine the duration of shadow flicker in the vicinity of the proposed Downeast Wind Project within Washington County, Maine. Shadow flicker resulting from the operation of the proposed wind turbine layout was calculated at 220 discrete modeling points, and isolines were generated from a grid encompassing the area surrounding the wind turbines.

The maximum expected annual duration of shadow flicker at a modeling receptor resulting from the operation of the 33 wind turbines is 55 hours, 11 minutes. This modeling receptor is a participant and is located on property leased by the Project. In total, there are two (2) modeling receptors that exceed the State limit of 30 hours per year. Both of these receptors fall on property leased by the Project are therefore participating receptors. The highest modeled non-participating annual duration of shadow flicker is 10 hours, 54 minutes. Shadow flicker at all non-participating buildings is below the State limit of 30 hours per year; therefore, this Project is in compliance with the State of Maine regulation with respect to shadow flicker. The modeling results are conservative in that modeling receptors were treated as "greenhouses" and the surrounding area was assumed to be without vegetation or structures ("bare earth").

Appendix A

Shadow Flicker Modeling Results: Modeling Receptors

Appendix A

Modeling Receptor ID	Participation Status	Coordinates NAD83 UTM Zone 19N (meters)		Annual Expected Shadow Flicker (HH:MM/yr)
		X (Easting)	Y (Northing)	
1	Non-Participating	583153.80	4963419.60	8:55
2	Non-Participating	583210.96	4963403.47	10:03
3	Non-Participating	582924.58	4963217.44	5:57
4	Non-Participating	583019.42	4963078.44	7:18
8	Non-Participating	596283.70	4960412.17	0:00
11	Non-Participating	583947.37	4954885.92	0:00
12	Non-Participating	583823.24	4954488.38	0:00
13	Non-Participating	583772.71	4954354.51	0:00
14	Non-Participating	584438.74	4954525.08	4:45
18	Non-Participating	584213.71	4953167.39	0:00
20	Participating	590151.16	4946502.41	0:00
21	Non-Participating	591251.78	4946051.47	0:00
22	Non-Participating	591859.89	4946173.58	0:00
23	Non-Participating	593434.19	4945748.70	0:00
24	Participating	592083.99	4947624.99	55:11
25	Non-Participating	591065.43	4949181.81	6:35
27	Non-Participating	586858.77	4950322.70	0:00
28	Non-Participating	586861.59	4950261.56	0:00
29	Non-Participating	586898.41	4950341.33	0:00
30	Non-Participating	586930.15	4950314.07	0:00
31	Non-Participating	586925.68	4950366.08	0:00
32	Non-Participating	586977.67	4950324.99	0:00
33	Non-Participating	587069.48	4950304.90	0:00
34	Non-Participating	587000.71	4950240.72	0:00
35	Non-Participating	586992.36	4950224.51	0:00
36	Non-Participating	586971.71	4950214.60	0:00
37	Non-Participating	586967.20	4950170.86	0:00
38	Non-Participating	586943.62	4950141.84	0:00
39	Non-Participating	586915.82	4950098.39	0:00
40	Non-Participating	586865.65	4950080.06	0:00
41	Non-Participating	586873.06	4950011.24	0:00
42	Non-Participating	586965.08	4950282.89	0:00
43	Non-Participating	587014.48	4950297.23	0:00
44	Non-Participating	587021.11	4950269.30	0:00
45	Non-Participating	587009.37	4950256.87	0:00
46	Non-Participating	586925.83	4950213.99	0:00
47	Non-Participating	586955.71	4950157.28	0:00
48	Non-Participating	586935.16	4950123.68	0:00
49	Non-Participating	586925.58	4950114.16	0:00
50	Non-Participating	586905.04	4950078.73	0:00
51	Non-Participating	586893.02	4950049.06	0:00
52	Non-Participating	586880.86	4950025.40	0:00
53	Non-Participating	586860.84	4949975.65	0:00
54	Non-Participating	586951.04	4950270.66	0:00

Modeling Receptor ID	Participation Status	Coordinates NAD83 UTM Zone 19N (meters)		Annual Expected Shadow Flicker (HH:MM/yr)
		X (Easting)	Y (Northing)	
55	Non-Participating	587202.94	4950479.11	0:00
56	Non-Participating	587221.33	4950418.61	0:00
57	Non-Participating	587188.61	4950396.11	0:00
58	Non-Participating	587184.16	4950390.89	0:00
59	Non-Participating	587167.15	4950380.28	0:00
60	Non-Participating	587262.55	4950452.11	0:00
61	Non-Participating	587293.09	4950471.93	0:00
62	Non-Participating	587328.45	4950468.22	0:00
63	Non-Participating	587392.29	4950493.73	0:00
64	Non-Participating	587410.88	4950498.77	0:00
65	Non-Participating	587402.60	4950517.32	0:00
66	Non-Participating	587428.25	4950507.26	0:00
67	Non-Participating	587488.22	4950518.11	0:00
68	Non-Participating	587524.90	4950527.47	0:00
69	Non-Participating	587554.71	4950530.12	0:00
70	Non-Participating	587621.13	4950521.73	0:00
71	Non-Participating	587652.09	4950500.64	0:00
72	Non-Participating	587706.16	4950495.30	0:00
73	Non-Participating	587755.78	4950482.39	0:00
74	Non-Participating	587806.09	4950479.22	0:00
75	Non-Participating	587842.24	4950489.18	0:00
76	Non-Participating	587897.36	4950495.49	0:00
77	Non-Participating	587936.68	4950482.69	0:00
78	Non-Participating	587968.86	4950471.98	0:00
79	Non-Participating	586918.23	4950233.23	0:00
80	Non-Participating	587169.06	4950473.21	0:00
81	Non-Participating	587192.49	4950441.18	0:00
82	Non-Participating	587210.68	4950410.43	0:00
83	Non-Participating	587199.83	4950402.27	0:00
84	Non-Participating	587157.53	4950368.34	0:00
85	Non-Participating	587141.96	4950359.61	0:00
86	Non-Participating	587231.49	4950431.30	0:00
87	Non-Participating	587246.31	4950442.56	0:00
88	Non-Participating	587277.85	4950465.28	0:00
89	Non-Participating	587311.27	4950486.29	0:00
90	Non-Participating	587344.46	4950473.60	0:00
91	Non-Participating	587369.05	4950484.49	0:00
92	Non-Participating	587450.78	4950513.26	0:00
93	Non-Participating	587469.19	4950514.93	0:00
94	Non-Participating	587508.85	4950523.15	0:00
95	Non-Participating	587542.87	4950527.82	0:00
96	Non-Participating	587576.31	4950530.62	0:00
97	Non-Participating	587592.64	4950534.83	0:00
98	Non-Participating	587632.88	4950510.71	0:00

Modeling Receptor ID	Participation Status	Coordinates NAD83 UTM Zone 19N (meters)		Annual Expected Shadow Flicker (HH:MM/yr)
		X (Easting)	Y (Northing)	
99	Non-Participating	587686.10	4950491.47	0:00
100	Non-Participating	587724.65	4950491.51	0:00
101	Non-Participating	587782.97	4950482.25	0:00
102	Non-Participating	587826.50	4950480.62	0:00
103	Non-Participating	587880.20	4950494.57	0:00
104	Non-Participating	587918.35	4950492.34	0:00
105	Non-Participating	589326.30	4949607.73	0:00
106	Non-Participating	589349.34	4949539.43	0:00
107	Non-Participating	589189.95	4949515.54	0:00
109	Non-Participating	582781.60	4964166.88	0:00
110	Non-Participating	582609.96	4964268.61	0:00
112	Non-Participating	584499.62	4956013.84	0:00
113	Non-Participating	584452.39	4956048.37	0:00
114	Non-Participating	584562.87	4954782.27	7:24
115	Participating	587303.56	4953847.75	14:50
116	Non-Participating	588471.54	4950235.85	0:00
117	Non-Participating	588482.65	4950213.23	0:00
118	Non-Participating	588430.26	4950240.61	0:00
119	Participating	588300.49	4950312.85	0:00
120	Non-Participating	588582.67	4950090.99	0:00
121	Non-Participating	588584.25	4950026.30	0:00
122	Non-Participating	588583.06	4949981.45	0:00
123	Non-Participating	588542.18	4949987.01	0:00
124	Non-Participating	588471.94	4950014.79	0:00
125	Non-Participating	588613.22	4949955.26	0:00
126	Non-Participating	588652.52	4949913.19	0:00
127	Non-Participating	588651.72	4949885.81	0:00
128	Non-Participating	588683.07	4949834.61	0:00
129	Non-Participating	588695.38	4949819.53	0:00
130	Non-Participating	588625.53	4949938.99	0:00
131	Non-Participating	588717.21	4949796.91	0:00
132	Non-Participating	588746.97	4949779.05	0:00
133	Non-Participating	588773.96	4949767.54	0:00
134	Non-Participating	588815.23	4949744.12	0:00
135	Non-Participating	588860.08	4949802.86	0:00
136	Non-Participating	588911.28	4949800.88	0:00
137	Non-Participating	588989.86	4949767.93	0:00
138	Non-Participating	588506.86	4949508.38	0:00
139	Non-Participating	588403.28	4949457.18	0:00
140	Non-Participating	589138.62	4949703.05	0:00
141	Non-Participating	588025.15	4949357.57	0:00
142	Non-Participating	588058.49	4949371.46	0:00
143	Non-Participating	588016.82	4949315.90	0:00
144	Non-Participating	588004.51	4949278.20	0:00

Modeling Receptor ID	Participation Status	Coordinates NAD83 UTM Zone 19N (meters)		Annual Expected Shadow Flicker (HH:MM/yr)
		X (Easting)	Y (Northing)	
145	Non-Participating	587989.43	4949262.72	0:00
146	Non-Participating	591946.90	4949401.10	0:00
147	Non-Participating	592125.07	4949218.67	7:53
148	Non-Participating	592310.61	4948914.73	10:54
149	Non-Participating	592320.53	4948911.09	10:42
150	Participating	592405.20	4948501.31	29:24
151	Non-Participating	595320.08	4947688.95	0:00
152	Participating	595482.14	4947692.26	0:00
153	Participating	595617.40	4947713.09	0:00
154	Non-Participating	595714.97	4947683.66	0:00
155	Non-Participating	595848.58	4947695.89	0:00
156	Participating	596005.68	4947822.56	0:00
157	Non-Participating	596213.71	4947902.93	0:00
158	Non-Participating	596190.23	4947956.18	0:00
159	Non-Participating	596164.10	4947948.57	0:00
160	Participating	596211.39	4948002.48	0:00
161	Non-Participating	596308.30	4948002.48	0:00
163	Non-Participating	591331.59	4945850.31	0:00
164	Non-Participating	590508.47	4945671.23	0:00
166	Non-Participating	598105.17	4955171.90	0:00
167	Non-Participating	597336.63	4956307.55	0:00
168	Non-Participating	597582.70	4956282.94	0:00
171	Non-Participating	597770.80	4956514.98	0:00
172	Non-Participating	597875.42	4956542.45	0:00
173	Non-Participating	597893.04	4956602.14	0:00
174	Non-Participating	597808.11	4956575.47	0:00
175	Non-Participating	597815.09	4956623.89	0:00
176	Non-Participating	597779.06	4956633.57	0:00
177	Non-Participating	597811.28	4956744.69	0:00
178	Non-Participating	597794.93	4956874.71	0:00
179	Non-Participating	597780.96	4956900.11	0:00
180	Non-Participating	597862.40	4956905.19	0:00
181	Non-Participating	597847.96	4956869.79	0:00
182	Non-Participating	597773.98	4956930.91	0:00
183	Non-Participating	597773.50	4957009.81	0:00
184	Non-Participating	597750.48	4957036.00	0:00
185	Non-Participating	597770.80	4956969.48	0:00
186	Non-Participating	597734.45	4957049.49	0:00
187	Non-Participating	597701.59	4957073.31	0:00
188	Non-Participating	597692.86	4957093.63	0:00
189	Non-Participating	597792.08	4957076.96	0:00
190	Non-Participating	597742.54	4957097.44	0:00
191	Non-Participating	597787.31	4957117.60	0:00
192	Participating	598382.16	4953024.91	0:00

Appendix A

Modeling Receptor ID	Participation Status	Coordinates NAD83 UTM Zone 19N (meters)		Annual Expected Shadow Flicker (HH:MM/yr)
		X (Easting)	Y (Northing)	
193	Participating	598328.19	4953068.30	0:00
205	Non-Participating	595872.19	4947418.04	0:00
206	Non-Participating	596342.85	4947917.91	0:00
207	Non-Participating	596406.88	4947889.33	0:00
208	Non-Participating	596549.75	4947926.38	0:00
209	Non-Participating	596754.54	4947622.10	0:00
210	Non-Participating	596736.55	4947670.26	0:00
211	Non-Participating	596697.92	4947653.85	0:00
212	Non-Participating	596711.15	4947752.81	0:00
213	Non-Participating	596131.60	4948365.62	0:00
214	Participating	595997.06	4948363.24	0:00
229	Non-Participating	596946.18	4946529.62	0:00
230	Non-Participating	596923.16	4946467.70	0:00
235	Non-Participating	596927.92	4946793.41	0:00
236	Non-Participating	596952.26	4946940.35	0:00
237	Non-Participating	593891.44	4944343.85	0:00
241	Non-Participating	586898.50	4950402.13	0:00
242	Non-Participating	587138.95	4950435.99	0:00
243	Non-Participating	586880.44	4950249.83	0:00
1C	Participating	584980.84	4958750.58	4:26
3C	Participating	584788.75	4957485.44	0:00
4C	Non-Participating	589352.86	4954923.64	0:00
5C	Participating	585762.87	4955222.97	0:00
6C	Participating	589221.49	4957327.82	0:00
8C	Participating	589864.90	4959234.64	28:29
9C	Participating	591438.70	4959102.86	18:46
11C	Participating	585610.38	4956745.93	0:00
12C	Participating	585584.03	4956753.46	0:00
13C	Participating	588738.95	4946566.07	0:00
14C	Participating	585505.96	4952083.77	41:22
15C	Participating	584982.88	4960386.99	8:07
16C	Participating	584250.27	4959735.32	6:25
17C	Non-Participating	584482.72	4965809.96	0:00
18C	Non-Participating	590744.14	4966631.81	0:00
19C	Non-Participating	589646.27	4967354.05	0:00
20C	Non-Participating	588784.98	4969271.70	0:00
21C	Participating	585239.00	4961072.64	22:59
22C	Participating	588465.50	4960722.66	22:01
24C	Non-Participating	597033.09	4956652.20	0:00
25C	Non-Participating	596784.19	4956735.88	0:00
30C	Non-Participating	592767.17	4959682.55	0:00
31C	Participating	585098.89	4958512.28	7:21
32C	Non-Participating	592622.98	4959067.93	0:00
33C	Participating	588691.81	4946608.32	0:00