SHADOW FLICKER MODELING REPORT

South Hill Road Wind Project
Town of Villenova, New York

Prepared for:

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July 24, 2023

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1.0 EXECUTIVE SUMMARY

The South Hill Road Wind Project (the Project) is a proposed wind power generation facility expected to consist of three wind turbines in the Town of Villenova, Chautauqua County, New York. The Project is being developed by New Leaf Energy, Inc. (New Leaf). Epsilon Associates Inc. (Epsilon) has been retained by New Leaf to conduct a shadow flicker modeling study for this Project. This report presents results of the shadow flicker modeling of the proposed wind turbines in Villenova.

Shadow flicker modeling was conducted for two different scenarios: three Vestas V163-4.5 wind turbines; and three GE 3.4-140 wind turbines. The purpose of this analysis is to predict the annual durations of wind turbine shadow flicker at nearby receptors.

For the Vestas V163-4.5 wind turbine, the maximum expected annual duration of shadow flicker at a modeling receptor is 35 hours, 0 minutes per year, this occurs at receptor 73. For the GE 3.4-140 wind turbine, the maximum expected annual duration of shadow flicker at a modeling receptor is 25 hours, 59 minutes per year, this occurs at receptor 74. The modeling results are conservative in that modeling receptors were treated as “greenhouses” (i.e., having windows on all sides) and the surrounding area was assumed to be without vegetation or structures (“bare earth”).

2.0 INTRODUCTION

The proposed Project will consist of three wind turbines. New Leaf is considering two different wind turbines: a Vestas V163-4.5 unit with a hub height of 98 meters, or a GE 3.4-140 unit with a hub height of 98 meters. Figure 2-1 shows the locations of the wind turbines in Chautauqua County over aerial imagery.

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. An indoor observer experiences repeated changes in the brightness of the room as shadows cast from the wind turbine blades briefly pass by 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 only generates a stationary shadow similar to any other structure.

This report presents the findings of a shadow flicker modeling study for the Project. The wind turbines were modeled with the WindPRO software package using information provided by New Leaf. The expected annual duration of shadow flicker was calculated at modeling receptors. Shadow flicker isolines for the area surrounding the Project were generated. The results of the modeling are found within this report.

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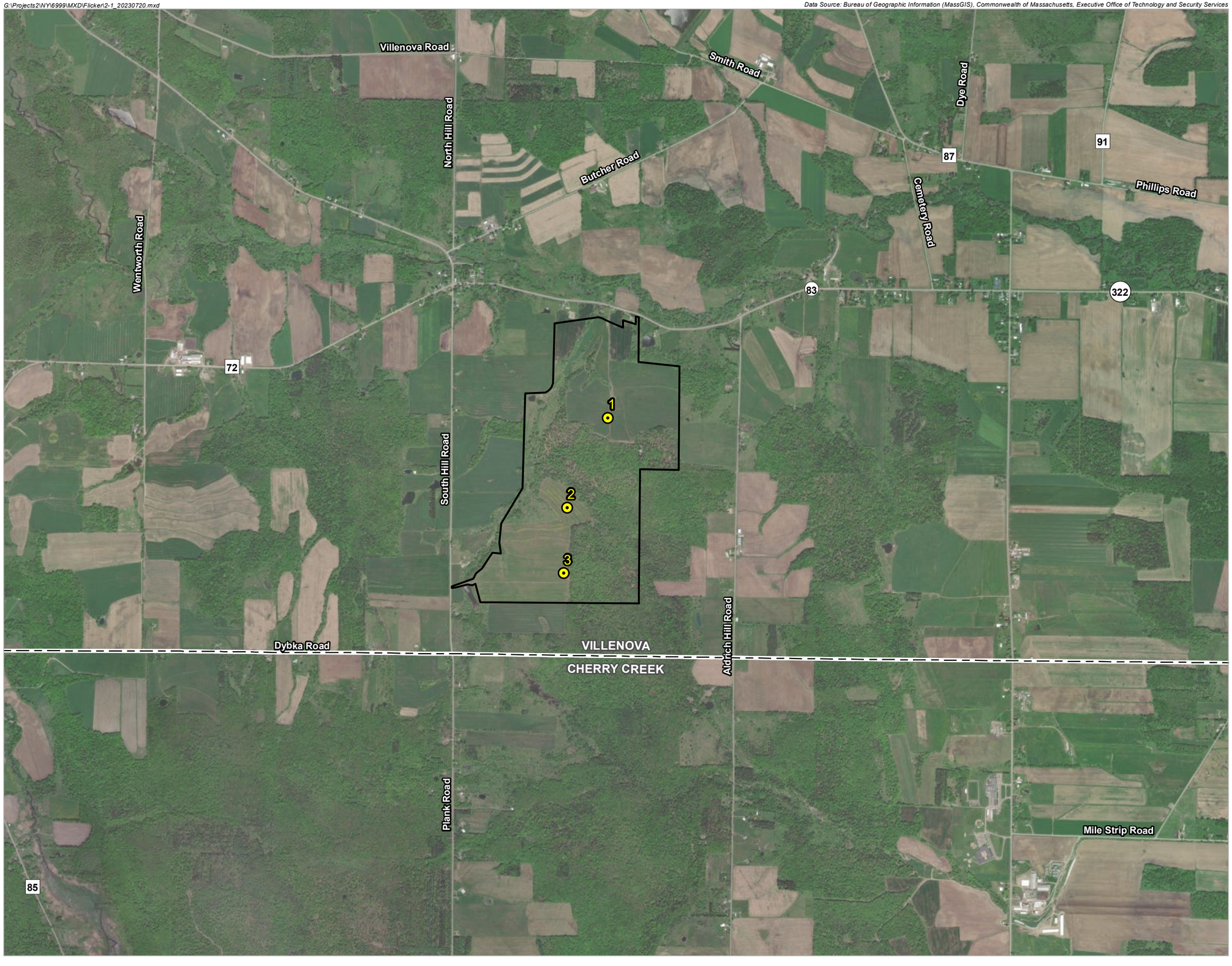
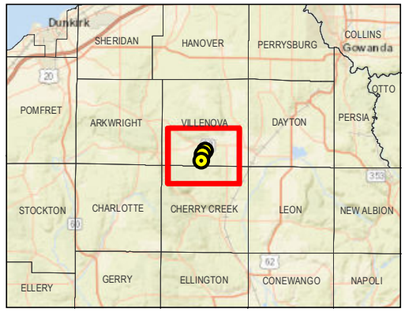
Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services



South Hill Road Wind Project Villenova, New York

Epsilon Associates Inc.

LOCUS



SCALE

1:24,000
1 inch = 2,000 feet

0 1,000 2,000 Feet

N

LEGEND

- Proposed Wind Turbine
- Project Boundary

Figure 2-1

Aerial Locus

3.0 SHADOW FLICKER MODELING

3.1 Modeling Methodology

Shadow flicker was modeled using a software package, WindPRO version 3.6. 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 are known as the "expected" shadow flicker. Expected annual shadow flicker durations are presented in this section.

This analysis is for the wind turbine array dated June 30, 2023. The locations of the wind turbines are shown in Figure 3-1 and the coordinates are provided in Appendix A. The wind turbines will either be Vestas V163-4.5 units with a 163-meter rotor diameter and a hub height of 98 meters, or GE 3.4-140 units with a 140-meter rotor diameter and a hub height of 98 meters. The wind turbines have the following characteristics based on the technical data provided by New Leaf:

			V163-4.5	GE 3.4-140
♦	Rated Power	=	4,500 kW	3,400 kW
♦	Hub Height	=	98 meters	98 meters
♦	Rotor Diameter	=	163 meters	140 meters
♦	Cut-in Wind Speed	=	3 m/s	3 m/s
♦	Cut-out Wind Speed	=	24 m/s	26 m/s[1]

To-date, there are no federal, state, or local regulations regarding the maximum radial distance from a wind turbine to which shadow flicker should be analyzed applicable to this Project. In the United States, shadow flicker is commonly evaluated out to a distance of ten times the rotor diameter. According to the Massachusetts Model Bylaw for wind energy facilities, shadow flicker impacts are minimal at and beyond a distance of ten rotor diameters. Defining the shadow flicker calculation area has also been addressed in Europe where the ten times rotor diameter approach has been accepted in multiple European countries.[2] Some jurisdictions conservatively require a larger calculation area. The New Hampshire Site Evaluation Committee through rulemaking docket 2014-04 adopted rules on December 15, 2015 outlining

[1] Identified as "preliminary" by GE.

[2] Parsons Brinckerhoff, "Update of UK Shadow Flicker Evidence Base" Prepared for Department of Energy and Climate Change, 2011.

application requirements and criteria for energy facilities, including wind energy facilities. As part of these revised regulations, Site 301.08(a)(2) requires an evaluation distance of at least 1 mile from a wind turbine.[3] Section 16-50j-94, part (g), of the Regulations of Connecticut State Agencies identifies the components required in a shadow flicker evaluation report which includes the calculation of shadow flicker from each proposed wind turbine to any off-site occupied structure within a 1.25 mile radius.[4] For this Project, ten times the largest rotor diameter of the proposed wind turbines corresponds to a distance of 1.01 miles (1,630 m). Conservatively, this analysis includes shadow flicker calculations out to 1.25 miles (2,012 m) from each wind turbine in the model for the proposed layout.

Epsilon generated a modeling receptor dataset consisting of 105 receptors via desktop analysis. The dataset is representative of structures within the vicinity of the project. Each modeling point was assumed to have a window facing all directions ("greenhouse" mode) which yields conservative results. All modeling receptors are identified in Figure 3-1. The model was set to limit calculations to 2,012 meters from a wind turbine, the equivalent of 1.25 miles. Consequently, shadow flicker at any of the 105 modeling receptors greater than the corresponding limitation distance from a wind turbine was zero. In addition to modeling discrete points, shadow flicker was calculated at grid points in the area surrounding the modeled wind turbine to generate flicker isolines. A 20-meter spacing was used for this grid as shown in Figure 3-2 and Figure 3-3.

The terrain height contour elevations for the modeling domain were generated from elevation information derived from the National Elevation Dataset (NED) developed by the U.S. Geological Survey. Conservatively, obstacles, i.e., buildings and vegetation, were excluded from the analysis. This is effectively a "bare earth" scenario which is conservative. When accounted for in the shadow flicker calculations, such obstacles may significantly mitigate or eliminate the flicker effect depending on their size, type, and location. In addition, shadow flicker durations were 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 Buffalo, New York from the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI).[5] Table 3-1 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 turbine is expected to operate for the 16 cardinal wind directions was input into the model. An hourly dataset for a one year period of wind directions and scaled wind speed was

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[3] State of New Hampshire Site Evaluation Committee Site 300 Rules (2015), available at http://www.gencourt.state.nh.us/rules/state_agencies/site100-300.html Accessed in July 2023.

[4] State of Connecticut CSC Wind Regulations (2014), available at https://eregulations.ct.gov/eRegsPortal/Browse/RCSA?id=Title_16Subtitle_16-50jSection_16-50j-94&content=shadow%20flicker/ Accessed in July 2023.

[5] NCEI (formerly NCDC), https://www1.ncdc.noaa.gov/pub/data/ccd-data/pctpos20.dat. Accessed in April 2023.

provided by New Leaf for a height of 98 meters. Epsilon used this data to calculate the typical annual number 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 88% of the year. Table 3-2 shows the distribution of operational hours for the 16 wind directions.

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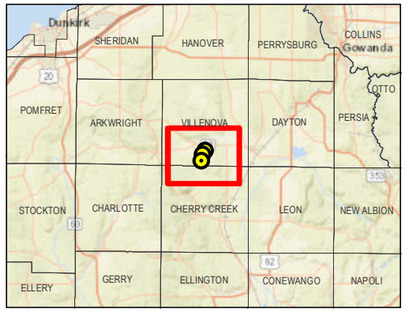
Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services

South Hill Road Wind Project Villenova, New York

Epsilon ASSOCIATES INC.

LOCUS



SCALE

1:24,000
1 inch = 2,000 feet

0 1,000 2,000 Feet

N

LEGEND

- Proposed Wind Turbine
- Project Boundary
- Modeling Location

Villenova Road
Smith Road
Dye Road
North Hill Road
Butcher Road
Cemetery Road
Phillips Road
Wentworth Road
A1
A2
B1
B2
C1
C2
1
2
3
South Hill Road
Aldrich Hill Road
Dybka Road
VILLENOVA
CHERRY CREEK
Plank Road
Mile Strip Road
72
87
91
83
322
85

Figure 3-1, Index Sheet

Shadow Flicker Modeling Locations

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

South Hill Road Wind Project Villenova, New York

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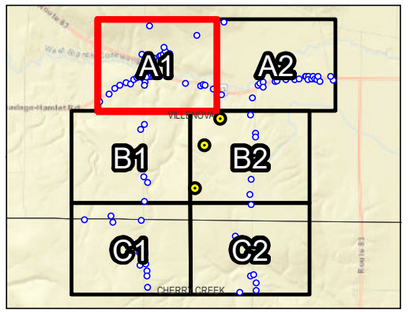
LOCUS



SCALE

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1 inch = 500 feet

0 250 500 Feet

N

LEGEND

- Proposed Wind Turbine
- Project Boundary
- Modeling Location

Figure 3-1, Map Sheet A1

Shadow Flicker Modeling Locations

G:\Projects2\NY\6999\MXD\Flicker\3-1_Mapset_20230720.mxd

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

South Hill Road Wind Project Villenova, New York

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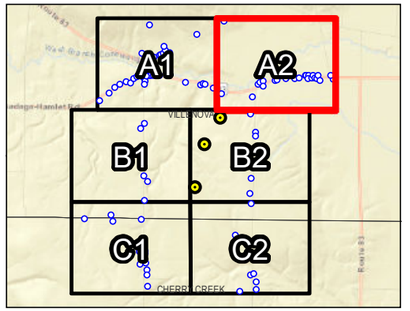
LOCUS



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1 inch = 500 feet

0 250 500 Feet

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LEGEND

- Proposed Wind Turbine
- Project Boundary
- Modeling Location

Figure 3-1, Map Sheet A2

Shadow Flicker Modeling Locations

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

South Hill Road Wind Project Villenova, New York

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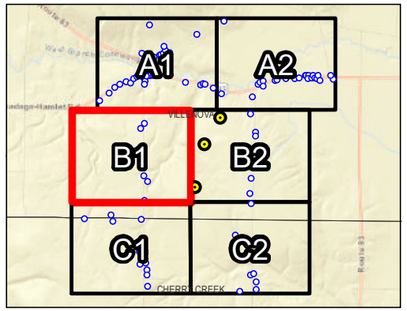

SCALE

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1 inch = 500 feet

0 250 500 Feet

N

LEGEND

- Proposed Wind Turbine
- Project Boundary
- Modeling Location

Figure 3-1, Map Sheet B1

Shadow Flicker Modeling Locations

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

South Hill Road Wind Project Villenova, New York

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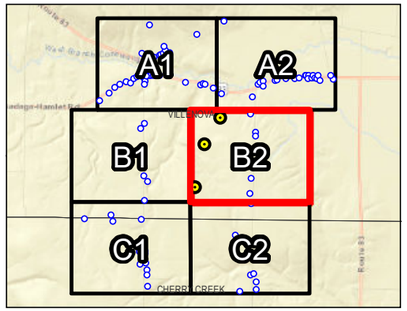
LOCUS



SCALE

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0 250 500 Feet

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LEGEND

- Proposed Wind Turbine
- Project Boundary
- Modeling Location

Figure 3-1, Map Sheet B2

Shadow Flicker Modeling Locations

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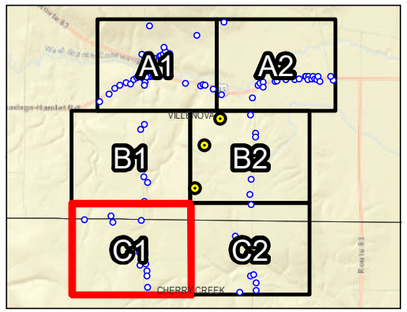
Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services

South Hill Road Wind Project Villenova, New York

Epsilon Associates Inc.

LOCUS



SCALE

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1 inch = 500 feet

0 250 500 Feet

N

LEGEND

- Proposed Wind Turbine
- Project Boundary
- Modeling Location

Figure 3-1, Map Sheet C1

Shadow Flicker Modeling Locations

G:\Projects2\NY\6999\MXD\Flicker\3-1_Mapset_20230720.mxd

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

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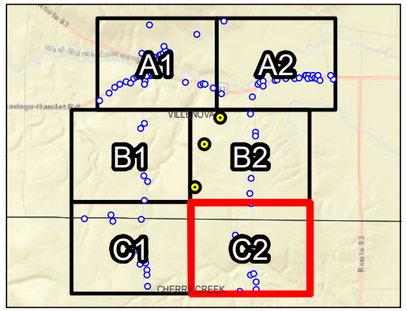

SCALE

1:6,000
1 inch = 500 feet

0 250 500 Feet

N

LEGEND

- Proposed Wind Turbine
- Project Boundary
- Modeling Location

Figure 3-1, Map Sheet C2

Shadow Flicker Modeling Locations

Table 3-1 Monthly Percent of Possible Sunshine

Month	Possible Sunshine
January	31%
February	36%
March	45%
April	54%
May	59%
June	62%
July	66%
August	63%
September	56%
October	44%
November	29%
December	23%

Table 3-2 Operational Hours per Wind Direction Sector

Wind Sector	Operational Hours
N	235
NNE	155
NE	137
ENE	186
E	195
ESE	190
SE	264
SSE	502
S	648
SSW	754
SW	683
WSW	687
W	1286
WNW	948
NW	504
NNW	374
Annual	7748

3.2 Shadow Flicker Modeling Results

Following the modeling methodology outlined in Section 3.1, WindPRO was used to calculate shadow flicker at the 105 discrete modeling receptor points. In addition to the discrete modeling points, shadow flicker isolines were generated based on the grid calculations for the Project.

3.2.1 Shadow Flicker Modeling Results – V163-4.5

Table B-1 in Appendix B presents the modeling results. Expected values are presented.

The predicted expected annual shadow flicker duration ranged from 0 hours, 0 minutes per year to 35 hours, 0 minutes per year for all 105 receptors. The maximum expected flicker modeled occurs at receptor 73. Forty-Six of the 105 receptors were predicted to experience no annual shadow flicker. Forty-nine receptors were predicted to experience some shadow flicker but less than 10 hours per year. The modeling results showed that eight receptors would be expected to have between 10 hours and 30 hours of shadow flicker per year. Two receptors are expected to have over 30 hours of flicker per year. Figure 3-2 displays the modeled flicker isolines (expected hours per year) over aerial imagery in relation to the modeled wind turbine and modeling receptors.

3.2.2 Shadow Flicker Modeling Results – GE 3.4-140

Table B-2 in Appendix B presents the modeling results. Expected values are presented.

The predicted expected annual shadow flicker duration ranged from 0 hours, 0 minutes per year to 25 hours, 59 minutes per year for all 105 receptors. The maximum expected flicker modeled occurs at receptor 74. Forty-Seven of the 105 receptors were predicted to experience no annual shadow flicker. Forty-nine receptors were predicted to experience some shadow flicker but less than 10 hours per year. The modeling results showed that nine receptors would be expected to have between 10 hours and 30 hours of shadow flicker per year. Zero receptors are expected to have over 30 hours of flicker per year. Figure 3-3 displays the modeled flicker isolines (expected hours per year) over aerial imagery in relation to the modeled wind turbine and modeling receptors.

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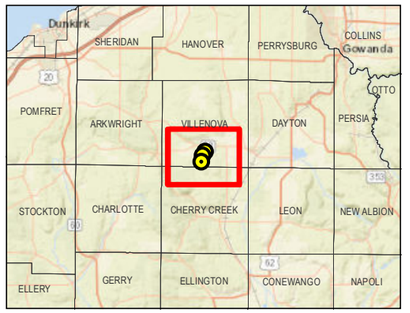
Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services

South Hill Road Wind Project Villenova, New York

Epsilon ASSOCIATES INC.

LOCUS



SCALE

1:24,000
1 inch = 2,000 feet

0 1,000 2,000 Feet

N

LEGEND

- Proposed Vestas V163-4.5 98m HH Wind Turbine
- Project Boundary
- Modeling Location

Modeled Shadow Flicker: Expected Values

(Hours Per Year)

- 0
- 10
- 30
- 50
- 100
- 150

Figure 3-2

Shadow Flicker Modeling Results Vestas V163-4.5

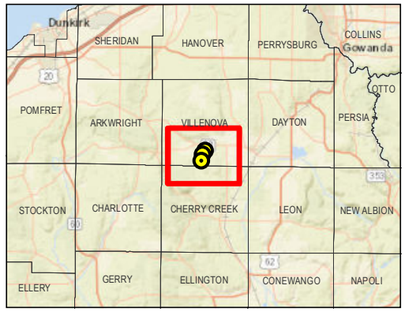
G:\Projects2\NY\6999\MXD\Flicker\3-3_20230720.mxd

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

South Hill Road Wind Project Villenova, New York

Epsilon ASSOCIATES INC.

LOCUS



SCALE

1:24,000
1 inch = 2,000 feet

0 1,000 2,000 Feet

N

LEGEND

- Proposed GE 3.4-140 98m HH Wind Turbine
- Project Boundary
- Modeling Location

Modeled Shadow Flicker: Expected Values

(Hours Per Year)

- 0
- 10
- 30
- 50
- 100
- 150

Villenova Road
Smith Road
Dye Road
North Hill Road
Butcher Road
Cemetery Road
Phillips Road
Wentworth Road
South Hill Road
Aldrich Hill Road
Dybka Road
Plank Road
Mile Strip Road
VILLENOVA
CHERRY CREEK
87
91
83
322
72
85
1
2
3

Figure 3-3

Shadow Flicker Modeling Results GE 3.4-140

Appendix A
Wind Turbine Coordinates

Table A-1.1: Wind Turbine Coordinates - V163-4.5

Wind Turbine ID	Wind Turbine Type	Hub Height (m)	Coordinates NAD 1983 State Plane New York West FIPS 3103 (meters)	
			X (Easting)	Y (Northing)
1	Vestas V163-4.5	98	305581.03	262453.88
2	Vestas V163-4.5	98	305313.12	261864.27
3	Vestas V163-4.5	98	305289.59	261433.74

Table A-1.2: Wind Turbine Coordinates - GE 3.4-140

Wind Turbine ID	Wind Turbine Type	Hub Height (m)	Coordinates NAD 1983 State Plane New York West FIPS 3103 (meters)	
			X (Easting)	Y (Northing)
1	GE 3.4-140	98	305581.03	262453.88
2	GE 3.4-140	98	305313.12	261864.27
3	GE 3.4-140	98	305289.59	261433.74

Appendix B

Shadow Flicker Modeling Results: Modeling Receptors

Table B-1: Shadow Flicker Modeling Results at Discrete Points - Sorted by Receptor ID - V163-4.5

Receptor ID	Coordinates NAD 1983 State Plane New York West FIPS 3103 (Meters)		Worst Case Shadow Flicker Hours per Year	Expected Shadow Flicker Hours per Year
	X (Easting)	Y (Northing)	(HH:MM/year)	(HH:MM/year)
1	303821.18	262889.71	19:10	3:33
2	303974.92	263016.68	11:57	2:16
3	304072.83	263115.35	7:57	1:43
4	304155.43	263166.98	9:19	1:48
5	304266.34	263211.34	12:11	2:11
6	304347.04	263193.75	14:31	2:34
7	304399.43	263272.15	23:03	3:41
8	304448.76	263301.60	26:24	4:03
9	304540.93	263302.75	26:02	3:52
10	304499.76	263326.04	24:52	3:41
11	304542.36	263351.04	18:38	2:41
12	304511.75	263388.94	15:13	2:09
13	304539.57	263432.13	5:51	0:47
14	304539.44	263694.69	0:00	0:00
15	304587.41	263621.94	0:00	0:00
16	304665.31	264179.70	0:00	0:00
17	304675.11	263647.22	0:00	0:00
18	304742.87	263625.29	0:00	0:00
19	304839.04	263666.15	0:00	0:00
20	304858.97	263675.12	0:00	0:00
21	304894.34	263698.04	0:00	0:00
22	304955.63	263720.96	0:00	0:00
23	304926.23	263751.85	0:00	0:00
24	304910.79	263810.15	0:00	0:00
25	305002.96	263710.00	0:00	0:00
26	304623.62	263365.78	8:22	1:08
27	304657.46	263359.84	5:36	0:44
28	304684.89	263361.21	1:37	0:12
29	304685.80	263389.56	0:00	0:00

Table B-1: Shadow Flicker Modeling Results at Discrete Points - Sorted by Receptor ID - V163-4.5

Receptor ID	Coordinates NAD 1983 State Plane New York West FIPS 3103 (Meters)		Worst Case Shadow Flicker Hours per Year	Expected Shadow Flicker Hours per Year
	X (Easting)	Y (Northing)	(HH:MM/year)	(HH:MM/year)
30	304739.30	263432.99	0:00	0:00
31	304664.77	263319.15	13:17	1:51
32	304686.81	263320.70	11:07	1:32
33	304729.94	263320.17	6:53	0:55
34	304791.06	263318.85	0:00	0:00
35	304829.69	263317.53	0:00	0:00
36	305469.23	264014.92	0:00	0:00
37	305927.33	264242.77	0:00	0:00
38	305271.96	263198.33	0:00	0:00
39	305534.65	263161.45	0:00	0:00
40	305572.54	263180.15	0:00	0:00
41	305607.91	263168.53	0:00	0:00
42	305743.29	263104.37	0:00	0:00
43	305885.75	263004.85	13:57	1:53
44	306504.09	263175.09	39:12	6:12
45	306536.43	263205.40	36:31	5:44
46	306594.02	263229.15	34:47	5:29
47	306588.46	263134.17	32:44	5:33
48	306791.04	263229.65	20:22	3:31
49	306826.90	263244.81	18:53	3:16
50	306948.15	263320.08	15:39	2:42
51	306979.47	263269.56	13:06	2:21
52	307103.74	263335.74	10:53	1:57
53	307126.98	263270.07	9:36	1:47
54	307203.26	263275.12	8:23	1:35
55	307302.28	263323.11	7:11	1:21
56	307313.39	263322.10	7:02	1:19
57	307364.92	263322.61	6:30	1:14
58	307348.25	263266.03	6:31	1:19

Table B-1: Shadow Flicker Modeling Results at Discrete Points - Sorted by Receptor ID - V163-4.5

Receptor ID	Coordinates NAD 1983 State Plane New York West FIPS 3103 (Meters)		Worst Case Shadow Flicker Hours per Year	Expected Shadow Flicker Hours per Year
	X (Easting)	Y (Northing)	(HH:MM/year)	(HH:MM/year)
59	307408.37	263277.65	5:58	1:13
60	307436.66	263323.62	0:00	0:00
61	307462.93	263277.14	0:00	0:00
62	307499.30	263263.00	0:00	0:00
63	307522.03	263318.57	0:00	0:00
64	307548.81	263235.72	0:00	0:00
65	307773.32	263253.65	0:00	0:00
66	307733.11	263319.30	0:00	0:00
67	304582.44	263270.29	28:21	4:14
68	304584.15	263220.41	33:09	5:06
69	304582.78	263171.22	33:53	5:22
70	304582.62	262509.63	61:12	12:29
71	304512.24	262417.02	63:15	13:04
72	304524.94	262072.54	102:04	24:22
73	304568.34	261619.04	106:08	35:00
74	304627.60	261524.32	95:38	31:50
75	304575.74	261202.05	79:14	29:19
76	304529.18	260877.68	0:00	0:00
77	304044.30	260846.78	21:29	8:00
78	304012.79	260955.95	11:52	4:22
79	303559.52	260893.34	4:41	1:42
80	304496.12	260334.14	0:00	0:00
81	304594.06	260348.86	0:00	0:00
82	304594.06	260298.29	0:00	0:00
83	304502.52	260122.89	0:00	0:00
84	304597.90	260140.17	0:00	0:00
85	304617.75	260027.50	0:00	0:00
86	304617.11	259939.80	0:00	0:00
87	304629.91	259741.99	0:00	0:00

Table B-1: Shadow Flicker Modeling Results at Discrete Points - Sorted by Receptor ID - V163-4.5

Receptor ID	Coordinates NAD 1983 State Plane New York West FIPS 3103 (Meters)		Worst Case Shadow Flicker Hours per Year	Expected Shadow Flicker Hours per Year
	X (Easting)	Y (Northing)	(HH:MM/year)	(HH:MM/year)
88	306407.26	262961.23	38:04	7:00
89	306371.65	262667.85	64:25	13:48
90	306457.43	262355.87	66:00	16:32
91	306462.69	262287.88	70:17	17:54
92	306381.76	261844.79	28:03	7:38
93	306382.98	261577.31	29:13	9:17
94	306365.98	261315.50	36:52	13:02
95	306382.17	261152.42	17:28	6:05
96	306117.93	260609.38	0:00	0:00
97	306136.14	260537.75	0:00	0:00
98	306375.08	259938.90	0:00	0:00
99	306426.67	259960.33	0:00	0:00
100	306475.89	259819.04	0:00	0:00
101	306475.89	259697.59	0:00	0:00
102	306190.08	259660.11	0:00	0:00
103	304576.63	263367.41	13:09	1:51
104	304585.58	263319.13	20:24	2:57
105	304615.14	263311.53	19:26	2:47

Table B-2: Shadow Flicker Modeling Results at Discrete Points - Sorted by Receptor ID - GE 3.4-140

Receptor ID	Coordinates NAD 1983 State Plane New York West FIPS 3103 (Meters)		Worst Case Shadow Flicker Hours per Year	Expected Shadow Flicker Hours per Year
	X (Easting)	Y (Northing)	(HH:MM/year)	(HH:MM/year)
1	303821.18	262889.71	14:49	2:45
2	303974.92	263016.68	7:23	1:29
3	304072.83	263115.35	6:13	1:20
4	304155.43	263166.98	7:12	1:22
5	304266.34	263211.34	9:31	1:42
6	304347.04	263193.75	11:20	2:00
7	304399.43	263272.15	18:32	2:58
8	304448.76	263301.60	22:02	3:21
9	304540.93	263302.75	20:37	3:02
10	304499.76	263326.04	19:51	2:55
11	304542.36	263351.04	13:44	1:57
12	304511.75	263388.94	10:40	1:29
13	304539.57	263432.13	1:42	0:13
14	304539.44	263694.69	0:00	0:00
15	304587.41	263621.94	0:00	0:00
16	304665.31	264179.70	0:00	0:00
17	304675.11	263647.22	0:00	0:00
18	304742.87	263625.29	0:00	0:00
19	304839.04	263666.15	0:00	0:00
20	304858.97	263675.12	0:00	0:00
21	304894.34	263698.04	0:00	0:00
22	304955.63	263720.96	0:00	0:00
23	304926.23	263751.85	0:00	0:00
24	304910.79	263810.15	0:00	0:00
25	305002.96	263710.00	0:00	0:00
26	304623.62	263365.78	3:36	0:28
27	304657.46	263359.84	0:43	0:05
28	304684.89	263361.21	0:00	0:00
29	304685.80	263389.56	0:00	0:00

Table B-2: Shadow Flicker Modeling Results at Discrete Points - Sorted by Receptor ID - GE 3.4-140

Receptor ID	Coordinates NAD 1983 State Plane New York West FIPS 3103 (Meters)		Worst Case Shadow Flicker Hours per Year	Expected Shadow Flicker Hours per Year
	X (Easting)	Y (Northing)	(HH:MM/year)	(HH:MM/year)
30	304739.30	263432.99	0:00	0:00
31	304664.77	263319.15	7:49	1:04
32	304686.81	263320.70	5:48	0:46
33	304729.94	263320.17	1:40	0:13
34	304791.06	263318.85	0:00	0:00
35	304829.69	263317.53	0:00	0:00
36	305469.23	264014.92	0:00	0:00
37	305927.33	264242.77	0:00	0:00
38	305271.96	263198.33	0:00	0:00
39	305534.65	263161.45	0:00	0:00
40	305572.54	263180.15	0:00	0:00
41	305607.91	263168.53	0:00	0:00
42	305743.29	263104.37	0:00	0:00
43	305885.75	263004.85	0:23	0:02
44	306504.09	263175.09	31:46	5:00
45	306536.43	263205.40	29:28	4:36
46	306594.02	263229.15	28:02	4:24
47	306588.46	263134.17	22:49	3:55
48	306791.04	263229.65	15:25	2:40
49	306826.90	263244.81	14:27	2:30
50	306948.15	263320.08	12:07	2:05
51	306979.47	263269.56	10:18	1:50
52	307103.74	263335.74	8:29	1:30
53	307126.98	263270.07	7:32	1:24
54	307203.26	263275.12	6:36	1:14
55	307302.28	263323.11	5:38	1:03
56	307313.39	263322.10	5:33	1:03
57	307364.92	263322.61	5:01	0:57
58	307348.25	263266.03	5:06	1:01

Table B-2: Shadow Flicker Modeling Results at Discrete Points - Sorted by Receptor ID - GE 3.4-140

Receptor ID	Coordinates NAD 1983 State Plane New York West FIPS 3103 (Meters)		Worst Case Shadow Flicker Hours per Year	Expected Shadow Flicker Hours per Year
	X (Easting)	Y (Northing)	(HH:MM/year)	(HH:MM/year)
59	307408.37	263277.65	4:39	0:56
60	307436.66	263323.62	0:00	0:00
61	307462.93	263277.14	0:00	0:00
62	307499.30	263263.00	0:00	0:00
63	307522.03	263318.57	0:00	0:00
64	307548.81	263235.72	0:00	0:00
65	307773.32	263253.65	0:00	0:00
66	307733.11	263319.30	0:00	0:00
67	304582.44	263270.29	22:39	3:21
68	304584.15	263220.41	27:37	4:13
69	304582.78	263171.22	27:59	4:24
70	304582.62	262509.63	47:55	9:41
71	304512.24	262417.02	50:49	10:23
72	304524.94	262072.54	79:57	18:46
73	304568.34	261619.04	76:17	24:54
74	304627.60	261524.32	77:35	25:59
75	304575.74	261202.05	62:35	23:09
76	304529.18	260877.68	0:00	0:00
77	304044.30	260846.78	16:55	6:18
78	304012.79	260955.95	8:49	3:14
79	303559.52	260893.34	2:50	1:01
80	304496.12	260334.14	0:00	0:00
81	304594.06	260348.86	0:00	0:00
82	304594.06	260298.29	0:00	0:00
83	304502.52	260122.89	0:00	0:00
84	304597.90	260140.17	0:00	0:00
85	304617.75	260027.50	0:00	0:00
86	304617.11	259939.80	0:00	0:00
87	304629.91	259741.99	0:00	0:00

Table B-2: Shadow Flicker Modeling Results at Discrete Points - Sorted by Receptor ID - GE 3.4-140

Receptor ID	Coordinates NAD 1983 State Plane New York West FIPS 3103 (Meters)		Worst Case Shadow Flicker Hours per Year	Expected Shadow Flicker Hours per Year
	X (Easting)	Y (Northing)	(HH:MM/year)	(HH:MM/year)
88	306407.26	262961.23	27:34	5:03
89	306371.65	262667.85	50:38	10:39
90	306457.43	262355.87	51:43	12:52
91	306462.69	262287.88	55:59	14:03
92	306381.76	261844.79	21:44	5:54
93	306382.98	261577.31	22:20	7:04
94	306365.98	261315.50	30:11	10:41
95	306382.17	261152.42	13:23	4:39
96	306117.93	260609.38	0:00	0:00
97	306136.14	260537.75	0:00	0:00
98	306375.08	259938.90	0:00	0:00
99	306426.67	259960.33	0:00	0:00
100	306475.89	259819.04	0:00	0:00
101	306475.89	259697.59	0:00	0:00
102	306190.08	259660.11	0:00	0:00
103	304576.63	263367.41	8:35	1:11
104	304585.58	263319.13	15:21	2:11
105	304615.14	263311.53	14:03	1:59