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September 30, 2014

Via Electronic Filing

Ms. Barcy McNeal
Public Utilities Commission of Ohio
Administration/Docketing
180 East Broad Street, 11th Floor
Columbus, OH 43215-3793

Re: Letter of Notification of Compliance for 6011 Greenwich Windpark, LLC, Case No. 13-990-EL-BGN

Dear Ms. McNeal:

On August 25, 2014, the Ohio Power Siting Board ("Board") issued 6011 Greenwich Windpark, LLC ("Greenwich) a Certificate of Environmental Compatibility and Public Need subject to a number of conditions ("Order").

Condition No. 16 of the Order requires the following:

The facility shall be operated so that the turbine shadow flicker does not exceed 30 hours per year for any nonparticipating sensitive receptor. Applicant shall confirm with Staff that the minimization measure or mitigation has been completed for the two receptors that the model and site specific analysis showed to - be in excess of 30 hours per year of shadow flicker. The analysis shall show how modeled shadow flicker impacts have been reduced to 30 or fewer hours per year for each such receptor. The analysis shall be provided to Staff at least 30 days prior to the preconstruction conference, for review and confirmation that it complies with this condition. This analysis may incorporate shadow flicker reductions from trees, vegetation, buildings, obstructions, turbine line of sight, operational hours, wind direction, sunshine probabilities, and other mitigation confirmed by Staff to be in compliance with this condition. After commencement of commercial operation. Applicant shall conduct further review of the impact and possible mitigation of all facility related shadow flicker complaints through its complaint resolution process.

In compliance with Condition No. 16 of the Board's Order, attached is a copy of the updated Shadow Flicker Report for Greenwich. This report considers the slight change in the project area layout, and updates the Shadow Flicker Report filed as Exhibit P to Greenwich's Application. The findings of the updated report do not differ from the previously filed Shadow Flicker Report (Exhibit P), which found:

- There is no increase in the number of homes that may be impacted by shadow flicker located within 10 rotor diameters of a proposed wind turbine.
- There is no increase in the number of homes that may be affected by more than 30 hours of shadow flicker annually.

If you have any questions please call at the number listed above.

Sincerely,

Sally W. Bloomfield

Attachment

Cc: Grant Zeto (w/Attachment)
Parties of Record (w/Attachment)

Shadow Flicker Report

Project: **Greenwich Wind Farm**

Location: **Greenwich Township, Huron County, OH**

Commercial-in-Confidence

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Document Approval

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Revision History

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20130308_Greenwich_ShadowFlickerReport_MEB	MEB	First Revision	2013/03/21
20130712_Greenwich_Shadow_Flicker_Report REVISED DRT3-1.docx	DO	Update for Turbine Rev U	2013/07/12
20140325_Greenwich_Shadow_Flicker_Report FINAL	DO	Update to Turbine Numbers	2014/03/25
20140923_Greenwich_Shadow_Flicker_Report FINAL.docx	DO	Update to modeled houses	2014/09/23

Referenced Documents

Ref	Document ID	Location or Link	Date
1			
2			

Important Notices

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1 Executive Summary

Windlab Systems Pty Ltd carried out an assessment of the shadow flicker durations for houses surrounding the proposed Greenwich Wind Farm. On behalf of the Applicant, Windlab Systems Pty Ltd (Windlab) has prepared this report in satisfaction of the requirements set forth in Section 4906-17-08(A)(6) of the Ohio Administrative Code (OAC).

6011 Greenwich Windpark LLC (the Applicant), is proposing to develop a wind-powered electric generating facility in Huron County, Ohio (Appendix A, Figure A-1). The Greenwich Wind Farm is anticipated to include 25 wind turbines (Appendix A, Figure A-2) with a maximum rated power output of 2.4 megawatts (MW) each, for a total generating capacity of 60 MW. While the exact turbine model to be used at the facility has not yet been determined, this report assumes use of the Nordex N117-2400. This model was selected because the N117-2400 represents a worst-case analysis with respect to shadow flicker.

Computer modeling results indicate that 200 houses are located within the area of possible turbine shadow flicker (10 blade diameters). Seven houses are predicted to exceed 30 hours per year of shadow flicker; with three of these seven only slightly exceeding the threshold. As this study did not include site specific conditions (window directions, door locations, adjacent structures or nearby tree lines) it is unlikely that shadow flicker at these three houses will in fact exceed the annual threshold. However, two non-participating structures and two participating structures remain in excess of this threshold.

2 Context

Shadow flicker refers to the moving shadows that an operating wind turbine casts on surrounding areas when rotor blades pass in front of the sun, causing a flickering effect while the rotor is in motion. When the sun is high, shadows are confined to areas surrounding the turbine structure base. However, in the morning and late afternoon – when the sun is at a lower azimuth – shadows can cast out further to adjacent properties. Shadow flicker does not occur when fog or clouds obscure the sun, or when turbines are not operating. Shadow flicker is most pronounced in northern latitudes during winter months due to the lower angle of the sun in the sky.

The distance between a wind turbine and a potential shadow flicker receptor affects the intensity of the shadows cast by the blades, and therefore the intensity of flickering. Shadows cast close to a turbine will be more intense, distinct, and focused. This is because a greater proportion of the sun's disc is intermittently blocked by the turbine. Obstacles such as terrain, vegetation, and/or buildings occurring between receptors and wind turbines may significantly reduce or eliminate shadow flicker effects. The UK wind industry typically assesses shadow flicker out to a distance of 10 rotor diameters from each turbine. The intensity of the shadows decreases with distance; distances beyond 10 rotor diameters[1] (approximately 1,170 meters in this case), shadow flicker effects are essentially undetectable.

Shadow flicker is not considered a health-related issue, as blade pass frequencies for modern commercial-scale wind turbines are so low they are considered harmless. According to the British Epilepsy Association (2007), approximately five percent of individuals with epilepsy have sensitivity to light, and most people with photo-sensitive epilepsy are sensitive to flickering around 16-25 Hz (Hertz or Hz = 1 flash per second), although some people may be sensitive to rates as low as 3 Hz and as high as 60 Hz. Modern wind turbines are usually built to operate at a frequency of 1 Hz or less. There is no evidence that wind turbines operating at this frequency can trigger seizures (British Epilepsy Association, 2007)[2]. Therefore, the primary concern with shadow flicker is the annoyance it could cause for adjacent receptors (i.e., within a distance equivalent to approximately 10 rotor diameters).

Shadow flicker location and duration can be predicted using computer modeling programs and input data regarding turbine characteristics and weather conditions. A "worst-case" shadow flicker scenario could be predicted based on the assumptions that there are no clouds or fog, wind conditions allow continuous turbine operation, the turbine rotor is continuously perpendicular to the sun, and the turbine rotor is always positioned between the receptor and the sun. However, this "worst case" is not what would actually occur, as turbines are not in continuous operation, are not always aligned perpendicular to the sun, and are not always positioned between the receptor and the sun. In addition, sunlight intensity and duration vary daily and seasonally, and obstacles that block shadows (terrain, vegetation, and buildings) exist in the landscape.

[1] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48052/1416-update-uk-shadow-flicker-evidence-base.pdf

[2] British Epilepsy Association. 2012. *Photosensitive Epilepsy* [website]. Available at: http://www.epilepsy.org.uk/info/photosensitive-epilepsy (Accessed March 6, 2013). Epilepsy Action, Yeadon Leeds, UK.

3 Shadow Flicker Methodology

3.1 Site Location

The Facility will be sited on privately-owned leased land in the southeastern portion of Huron County, in Greenwich Township. The Facility is generally intersected by State Route 224 and State Route 13; bound by Alpha Road to the north, Ninevah Road to the east, Plymouth East Road to the west and Richland County to the south. (See Figure A-1 and Figure A-2 provided in Appendix A.)

Land use in the vicinity of the Facility includes agriculture, with large woodlots and tree rows for wind breaks. The land elevations are in the range of 950 to 1,200 feet above mean sea level (AMSL). The Facility is located in an area that is primarily developed, with farms and rural residences interspersed along area roadways. More concentrated development occurs within the nearby Village of Greenwich.

3.2 House Locations

All buildings within 1,170m or 3,839ft (10 blade diameters) were considered in this analysis, as this is the maximum distance from a turbine that shadow flicker is likely to occur. Refer to Figure A-2 in Appendix A for a map detailing all residential structures located within 10D of turbine locations. Within this distance, there are 200 residential homes (see Table B-1, Appendix B, for coordinates and details of house locations).

3.3 Proposed Wind Facility Layout

The Greenwich Wind Farm is anticipated to include 25 wind turbines with a maximum rated power output of 2.4 megawatts (MW) per turbine, for a total generating capacity of 60 MW.

While the exact turbine model to be used at the Facility has not yet been determined, this report assumes use of the Nordex N117-2400. This model was selected because the N117-2400 represents a worst-case analysis with respect to shadow flicker. The Nordex N117-2400 machine has a hub height of 91m and blade diameter of 117m.

Preliminary turbine coordinates are presented in Table B-2 in Appendix B and Figure A-2 in Appendix A.

3.4 Methodology

This report has been prepared to satisfy the requirements set forth in OAC Section 4906-17-08 (A)(6), which requires "*The applicant shall evaluate and describe the potential impact from shadow flicker at adjacent residential structures and primary roads, including its plans to minimize potential impacts if warranted.*"

To satisfy this requirement, Windlab conducted a shadow flicker modeling analysis for the proposed Greenwich Wind Farm. The model calculates the number of hours per year that the sun is likely to be located behind the rotor disk of a turbine as seen by an observer at each house location. The observer is assumed to be 2m above ground level. The model calculates the sun's location every minute of the year, and if the sun is located behind the turbine rotor at that time, then 1 minute is added to the total shadow flicker time for that house. For each model run, three orientations are considered for the turbine rotor: mostly perpendicular to the bearing towards the

house (>60^0), mostly parallel to the bearing towards the house (<30^0), and an oblique angle (30^0-60^0). The wind rose information is used to calculate the percentage of the time that the turbine rotor is likely to be in each orientation, and the shadow flicker results for each orientation are weighted accordingly. The final shadow flicker results are then determined by multiplying the answers by the percentage of the time for the appropriate month that the sun is expected to be shining, and by the percentage of time that the wind is expected to be above the cut-in wind speed.

Input variables and assumptions used for shadow flicker modeling calculations for the proposed Facility include:

- Eastings and Northing coordinates of 25 proposed wind turbine locations;
- Elevations (AMSL) of proposed turbine locations;
- Turbine hub height and rotor diameter (91m and 117m respectively);
- Turbine cut in wind speeds (3 m/s);
- Eastings and Northing coordinates for 200 residential houses (involved and non-participating) within 1,170 meters of turbine locations;
- Elevations (ASL) for each residential house;
- Annual wind rose data collected from the long term record mast within the proposed wind farm facility (Appendix C, Table C-1). This was required to determine the approximate directional frequency of rotor orientation throughout the year;
- Wind speed probability distribution function to account for the wind being above generation speeds (turbine cut in wind speed);
- The average monthly percent of available sunshine values, obtained from NOAA “Comparative Climatic Data for the United States through 2009” (Appendix C, Table C-2).

The model is conservative for several reasons:

- It omits large topographical features that may obscure turbines from an observer, or that may shade a turbine at the precise time when a turbine is predicted to shade an observer.
- The possible screening effect of trees and buildings, adjacent to residential structures, were not taken into consideration.
- The number and/or orientation of windows and doors, in residential structures, were not taken into consideration.
- It includes time that an observer would be shaded by the turbine nacelle, when in reality no shadow flickering would occur.
- The model “double counts” flicker duration in instances where two or more turbines are simultaneously causing shadow flicker to occur at one receptor.
- A residence/observer is defined as a one dimensional point, located 2 meters above ground level. Therefore, actual structure dimensions are not taken into consideration.
- The model calculations include the cumulative sum of shadow hours for all Facility turbines.

As a result of the above-stated variables, the predicted hours of shadow flicker are likely to be conservative (over-estimated).

4 Modeling Results

Output from the model includes the following data:

- Calculated shadow flicker duration (hours per year) at each house (receptor) located within 10D (1,170M) of a turbine;
- The approximate day of year that dwelling locations are likely to experience the longest duration of shadow flicker. [Note: this date may vary 1-2 days from year to year. At most locations there will be two dates with equally long duration, symmetric around the summer or winter solstice];
- Estimated number of minutes of shadow flicker on the worst day;
- A graph showing the annual path of the sun, through the sky, relative to the house location; and
- Map (surface) showing the extent of shadow flicker over the entire wind facility.

All of these data are presented in Table D-1 included in Appendix D.

A summary of the projected shadow flicker at each of the 200 residential structures located within 1,170 meters of a proposed turbine is presented below:

- 104 (52%) will experience no shadow flicker,
- 53 (27%) may be affected <10 hours/year,
- 26 (13%) may be affected 10 to <20 hours/year,
- 10 (5%) may be affected 20 to <30 hours/year,
- 7 (3%) may be affected by more than 30 hours/year.

With respect to regulatory thresholds, no national, state, county, or local standards currently exist for allowable frequency or duration of shadow flicker from wind turbines at the proposed Facility site. However, standards developed by some states and countries provide guidance in this regard. The Ohio Power Siting Board has used 30 annual hours of shadow flicker as a threshold of acceptability in reviewing and approving commercial wind power projects (OPSB, 2008, 2009a, 2009b, 2009c, 2009d). International guidelines from Europe have suggested 30 hours of shadow flicker per year as the threshold of significant impact, or the point at which shadow flicker is commonly perceived as an annoyance (DECC, 2011)[3]. Accordingly, a threshold of 30 shadow flicker hours per year was applied to the analysis of the proposed Greenwich Wind Farm to identify any potentially significant impacts on area residences.

The residential structures that are predicted to exceed the 30-hour annual threshold are presented on the follow page in Table 4-1. Analysis of these individual dwellings is provided between Section 4.1 and Section 4.7. Refer to Appendix A, Figure A-3 for a map of predicted shadow flicker over the Greenwich Wind Farm.

[3] Department of Energy and Climate Change (DECC). 2011. Update of UK Shadow Flicker Evidence Base: Final Report. Parsons Brinckerhoff, London, UK, p. 5.

Table 4-1: Structures Predicted to Exceed 30 Hours of Shadow Flicker per Year

House ID #	Easting	Northing	Elevation [ft]	Nearest Turbine [ft]	Shadow Flicker [hr/yr]	Worst day [date]	Worst day [min]	House Status
157	375225	4540411	1138	1742	63.0	24-July	39	Involved Landowner
53	377212	4544543	1040	1473	42.6	16-Jan	20	Non-Participating
158	373019	4540404	1093	1847	41.4	14-July	23	Involved Landowner
162	375230	4539944	1165	1342	41.0	19-Aug	29	Non-Participating
126	375095	4541542	1115	1913	34.7	22-June	20	Non-Participating
52	377339	4544584	1040	1572	34.0	15-Sept	22	Non-Participating
51	377229	4544617	1040	1663	31.1	2-Jan	20	Non-Participating

4.1 HOUSE 157

House 157 is potentially affected by shadow flicker from 4 turbines. See Figure 4-1 below for the graphical representation of the sun's path relative to the house location and surrounding turbines. The owner of this house is a landowner involved in the project.

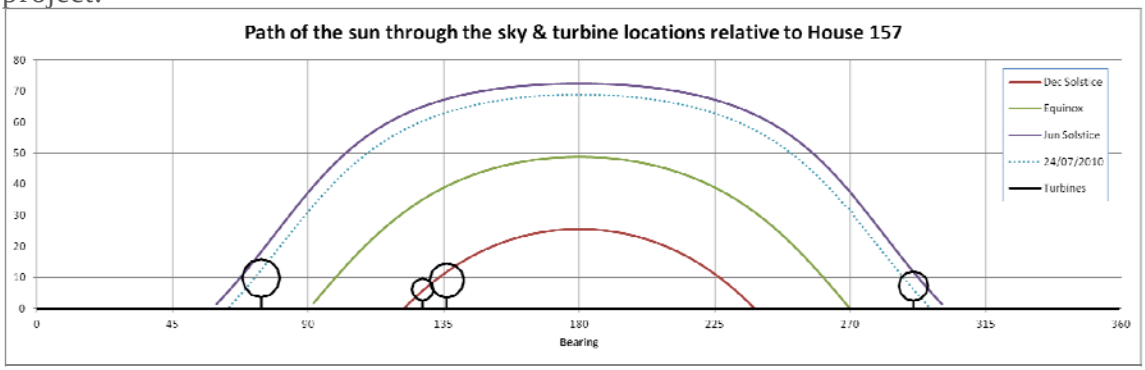


Figure 4-1: Graph of the path of the sun relative to House 157.

House 157 is predicted to experience 63 hours of shadow flicker throughout the year, the worst day being the 24th of July where the house is subjected to a total of 39 minutes of shadow flicker. The shadow flicker is a result of turbine numbers 8, 11, 12 and 13 at approximately 291, 128, 74 and 136 degrees[4] respectively from the house location. Actual shadow flicker experienced at this location is expected to be less than modeled, due to a number of factors:

- Trees surrounding the house and buildings located to the south would likely provide vegetative and structural screening from a number of turbine locations, see Figure 4-2 & Figure 4-3 below; and

[4] Note that all bearings quote in this report are relative to Grid North, which is about 1 degree less than those relative to True North.

- The location of windows and doors in the house was not considered in the analysis.

Figure 4-2: Proximity of trees and buildings surrounding house 157 that potentially provide shielding from the shadow flicker of nearby turbines.

Figure 4-3: Street view of house 157 with trees and buildings that potentially provide shielding from the shadow flicker of nearby turbines.

Figure 4-4: Relative location of turbines 8, 11, 12 & 13, which are modeled to potentially cause shadow flicker for house 157.

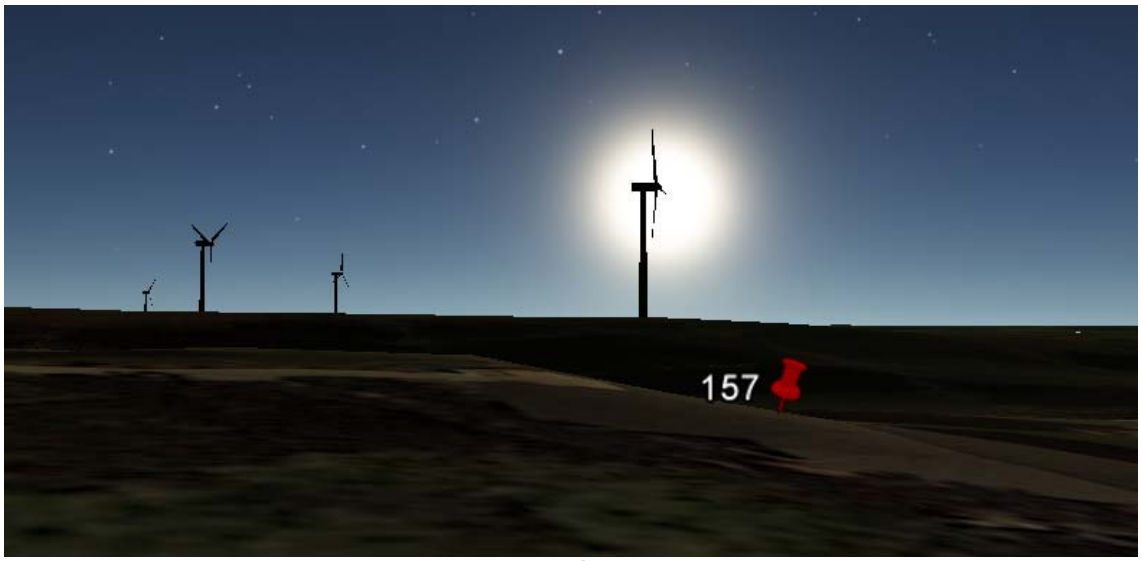


Figure 4-5: WTG 8 relative to house 157 shortly before sunset on July 24.

Figure 4-6: WTG 12 relative to house 157 on the morning of July 25.

Figure 4-7: WTG 11 and 13 relative to house 157 on the morning of Dec 21.

4.2 HOUSE 53

House 53 is potentially affected by shadow flicker from 3 turbines. See Figure 4-8 for the graphical representation of the sun's path relative to the house location and surrounding turbines. The owner of this house is a non-participating landowner of the project.

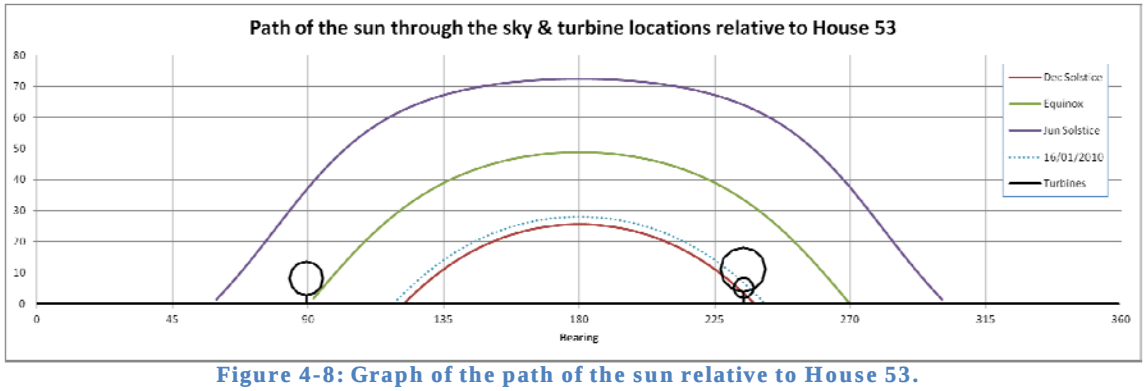


Figure 4-8: Graph of the path of the sun relative to House 53.

House 53 is predicted to experience 42.6 hours of shadow flicker throughout the year, the worst day being the 16th of January where the house is subjected to a total of 20 minutes of shadow flicker. The shadow flicker is a result of turbine numbers 19, 21 and 22 at approximately 234, 235 and 89 degrees respectively from the house location. Actual shadow flicker experienced at this location is expected to be less than modeled, due to a number of factors:

- Some double counting of shadow flicker due to the two turbines at a bearing of ~235 degrees (WTG 19 and 21) on/or around the December Solstice;
- A number of trees, tree lines, and dense woodlands (approx 50ft high) surrounding the house to the east and south would likely provide vegetative screening from the turbine locations at the bearings of 89 and 235 degrees, see Figures 4-9 & 4-10 below; and
- The location of windows and doors in the house was not considered in the analysis.

Figure 4-9: Proximity of trees and buildings surrounding house 53 that potentially provide shielding from the shadow flicker of nearby turbines.

Figure 4-10: Street view of house 53 with trees and buildings that potentially provide shielding from the shadow flicker of nearby turbines.

Figure 4-11: Relative location of turbines 19, 21 & 22 which are modeled to potentially cause shadow flicker at house 53.

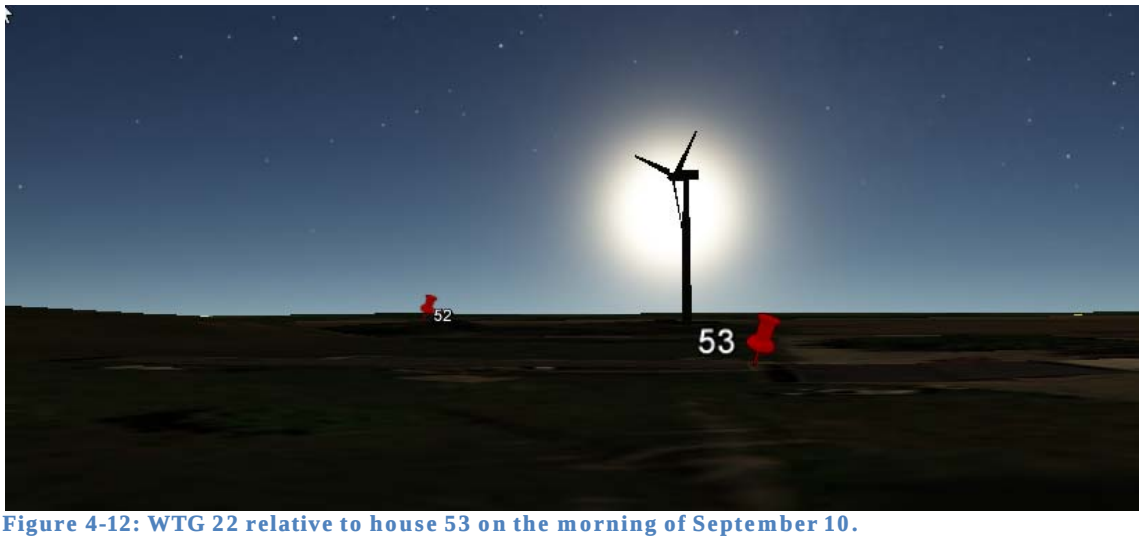


Figure 4-12: WTG 22 relative to house 53 on the morning of September 10.

Figure 4-13: WTG 19 and 21 relative to house 53 on the worst day for shadow flicker (January 16) shortly before sun-set. There is substantial woodland in this direction between the house and turbine that would likely screen much of the shadow flicker. Note that some double counting of the shadow flicker is likely due to the two turbines being almost in line. Other turbines visible in this image are located further than 1,170 m away and therefore would not subject house 53 to shadow flicker.

4.3 HOUSE 158

House 158 is potentially affected by shadow flicker from 3 turbines. See Figure 4-14 for the graphical representation of the sun's path relative to the house location and surrounding turbines. The owner of this house is a landowner involved in the project.

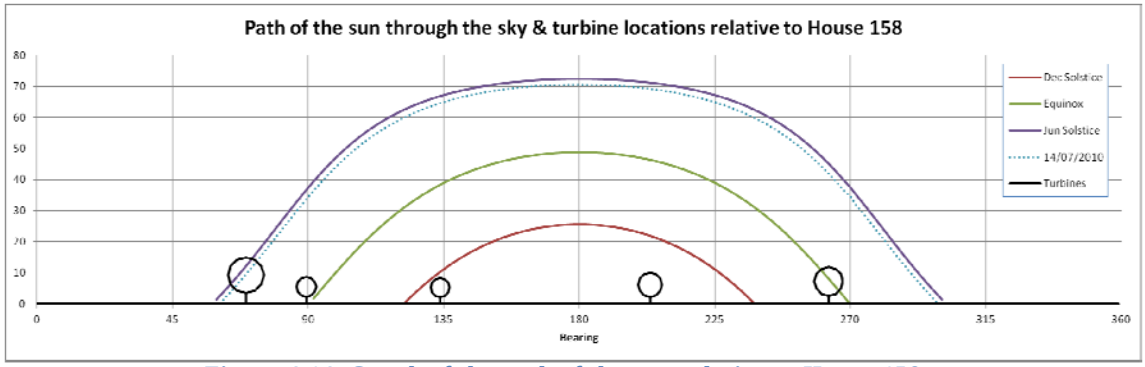


Figure 4-14: Graph of the path of the sun relative to House 158.

House 158 is predicted to experience 41.4 hours of shadow flicker throughout the year, the worst day being the 14th of July where the house is subjected to a total of 23 minutes of shadow flicker. The shadow flicker is a result of turbine numbers 1, 6 and 10 at approximately 263, 69 and 89 degrees respectively from the house location. Two other turbines are within 1,170m; however, they do not cause any shadow flicker. Actual shadow flicker experienced at this location is expected to be less than modeled, due to a number of factors:

- There is dense woodland approximately 50ft in height surrounding the eastern and western side of the house that may potentially screen the shadow flicker from turbines 1, 6 and 10, see Figure 4-15 & 16 below; and
- The location of windows and doors in the house was not considered in the analysis.

Figure 4-15: Surrounding trees and buildings would potentially provide shielding for house 158 from the shadow flicker of nearby turbines.

Figure 4-16: Street view of house 158 with trees and buildings that potentially provide shielding from the shadow flicker of nearby turbines.

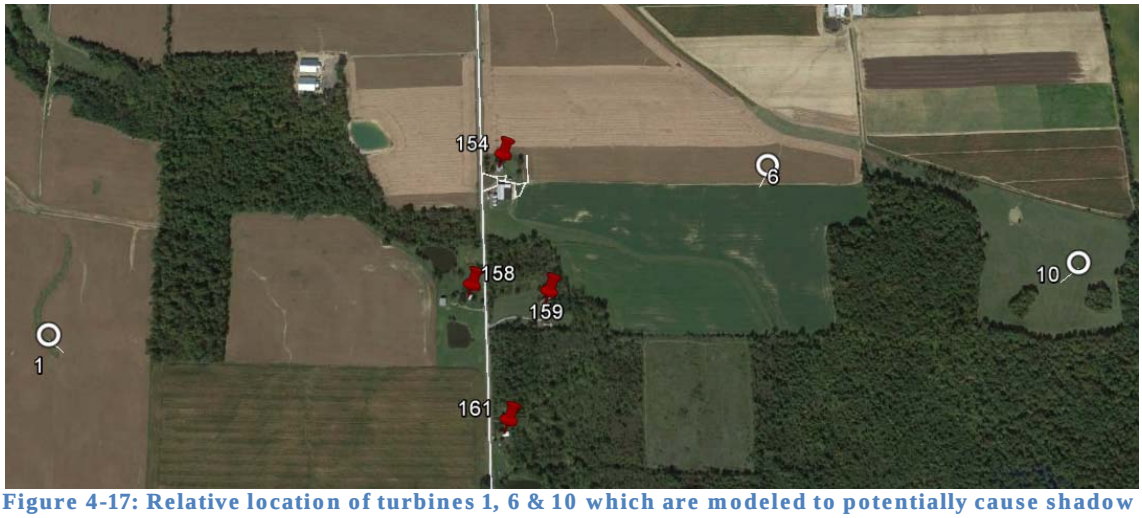


Figure 4-17: Relative location of turbines 1, 6 & 10 which are modeled to potentially cause shadow flicker at house 158.

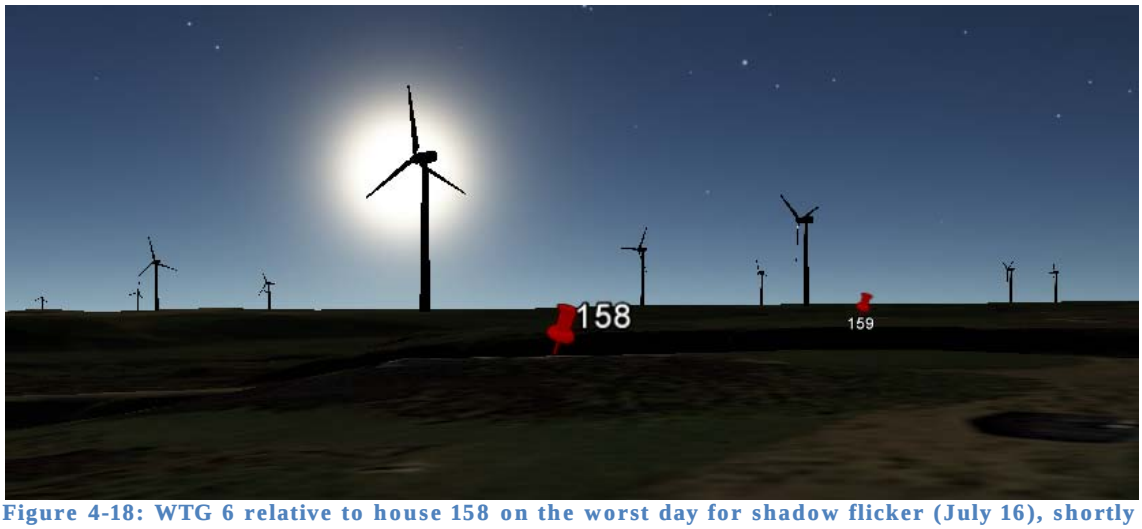


Figure 4-18: WTG 6 relative to house 158 on the worst day for shadow flicker (July 16), shortly after sun-rise. Other turbines visible in this image, with the exception of WTG 10 (located just to the left of house 159), are located further than 1,170m away and therefore would not subject house 158 to shadow flicker.

Figure 4-19: WTG 1 relative to house 158 during the late afternoon of March 15.

4.4 HOUSE 162

House 162 is potentially affected by shadow flicker from 3 turbines. See Figure 4-20 for the graphical representation of the sun's path relative to the house location and surrounding turbines. The owner of this house is a non-participating landowner of the project.

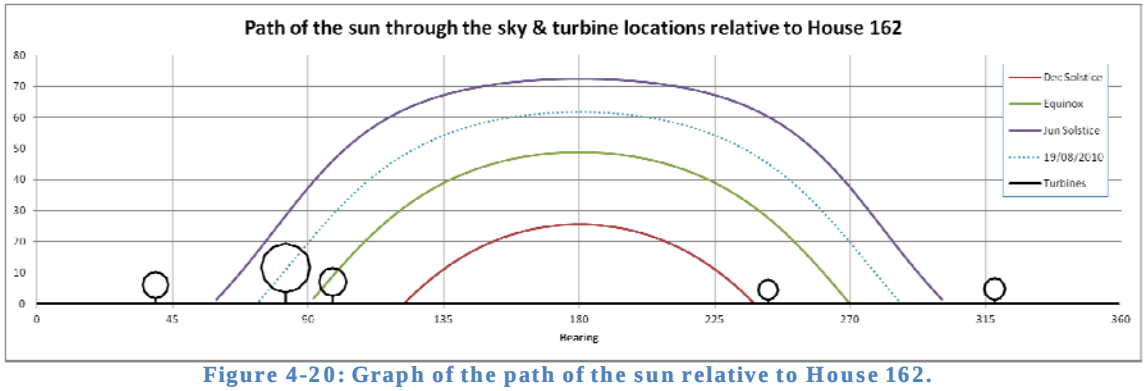


Figure 4-20: Graph of the path of the sun relative to House 162.

House 162 is predicted to experience 41 hours of shadow flicker throughout the year, the worst day being the 19th of August where the house is subjected to a total of 29 minutes of shadow flicker. The shadow flicker is a result of turbine numbers 5, 11 and 13 at approximately 242, 98 and 83 degrees respectively from the house location. Two other turbines are within 1,170m; however they will not cause any shadow flicker. Actual shadow flicker experienced at this location is expected to be less than modeled, due to a number of factors:

- Trees immediately surrounding the house may provide some vegetative screening;
- A building/barn located 25m east of the house may provide structural screening from the flickering from turbines 11 & 13, see Figure 4-21 & 22 below; and
- The location of windows and doors in the house was not considered in the analysis.

Figure 4-21: Proximity of trees, and the barn to the east of house 162 that may provide shielding from the shadow flicker of nearby turbines.

Figure 4-22: Street view of house 162 with barn and trees that may provide shielding from the shadow flicker of nearby turbines.

Figure 4-23: Relative location of turbines 5, 11 and 13 which are modeled to potentially cause shadow flicker at house 162.

Figure 4-24: WTG 13 relative to house 162 during the morning of August 19. WTG 11 is also visible on the right.

Figure 4-25: WTG 5 relative to house 162 during the evening of November 13. Other turbines visible in this image are further than 1170m away, and therefore would not subject house 162 to shadow flicker.

4.5 HOUSE 126

House 126 is potentially affected by shadow flicker from 3 turbines. See Figure 4-26 for the graphical representation of the sun's path relative to the house location and surrounding turbines. The owner of this house is a non-participating landowner of the project.

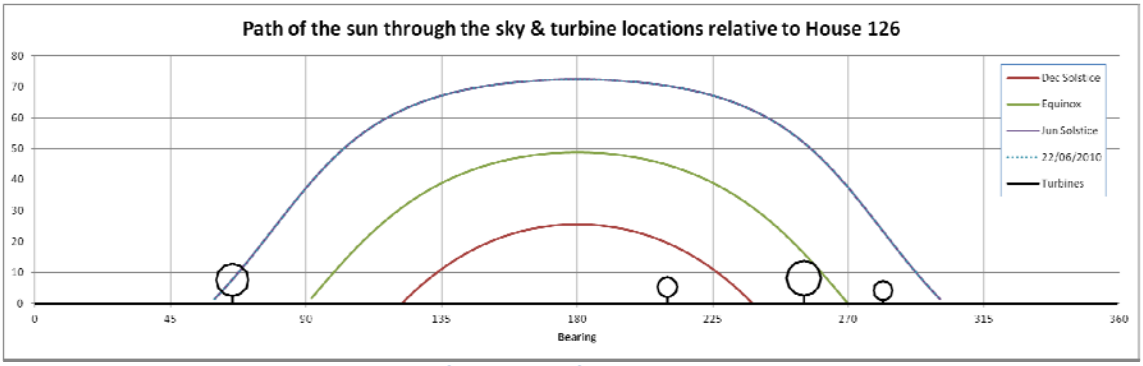


Figure 4-26: Graph of the path of the sun relative to House 126.

House 126 is predicted to experience 34.7 hours of shadow flicker throughout the year, the worst day being the 22nd of June where the house is subjected to a total of 20 minutes of shadow flicker. The majority of the shadow flicker is a result of turbine number 15, at approximately 65 degrees from the house location, and from turbine 9 at an angle of approximately 255 degrees. A small amount of flicker may result from turbine 7 at a bearing of 281 degrees. Actual shadow flicker experienced at this location is expected to be less than modeled, due to a number of factors:

- A number of trees and buildings surrounding the house would likely provide vegetative and structural screening from turbines 7, 9 & 15, see Figure 4-27 & 28 below; and
- The location of windows and doors in the house was not considered in the analysis.

Figure 4-27: Proximity of trees and buildings surrounding house 126 that potentially provide shielding from the shadow flicker of nearby turbines.

Figure 4-28: Street view of house 126 with trees and buildings that potentially provide shielding from the shadow flicker of nearby turbines.

Figure 4-29: Location of WTGs 7, 9 & 15 which are modeled to potentially cause shadow flicker at house 126.

Figure 4-30: WTG 15 on the morning of June 22 relative to house 126. Note that turbines in the background are further than 1170m and therefore would not subject house 126 to shadow flicker.

Figure 4-31: WTG 9 on the evening of Oct 12 relative to house 126. WTG 7 is also visible on the far right. Note that the other turbines in the background are further than 1170 m and would therefore not subject house 126 to shadow flicker.

4.6 HOUSE 52

House 52 is potentially affected by shadow flicker from 3 turbines. See Figure 4-31 for the graphical representation of the sun's path relative to the house location and surrounding turbines. The owner of this house is a non-participating landowner of the project.

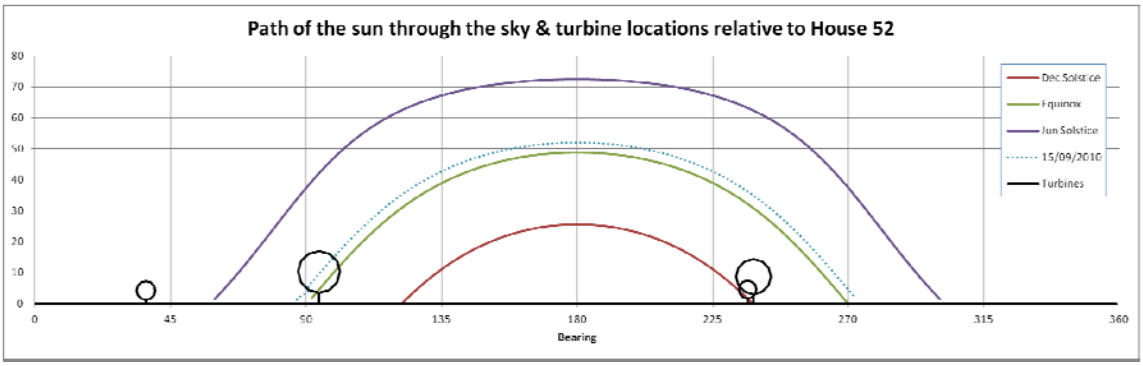


Figure 4-32: Graph of the path of the sun relative to House 52.

House 52 is predicted to experience 34 hours of shadow flicker throughout the year, the worst day being the 15th of September where the house is subjected to a total of 22 minutes of shadow flicker. The shadow flicker is a result of turbine numbers 19, 21 and 22 at approximately 238, 237 and 94 degrees respectively from the house location. Actual shadow flicker experienced at this location is expected to be less than modeled, due to a number of factors:

- Some double counting of the shadow flicker due to the two turbines located at a bearing ~238 degrees (WTG 19 and 21);

- A number of trees and woodlands (approx 50ft high) surrounding the house would likely provide vegetative screening from turbine locations at the bearings of 94 and ~238 degrees, see Figure 4-32 & 33 below; and
- The location of windows and doors in the house was not considered in the analysis.

Figure 4-33: Proximity of trees and buildings surrounding house 52 that may provide shielding from the shadow flicker of nearby turbines.

Figure 4-34: Street view of house 52 with dense trees that potentially provide shielding from the shadow flicker of nearby turbines.

Figure 4-35: Relative location of WTGs 19, 21 & 22 which are modeled to potentially cause shadow flicker at house 52.

Figure 4-36: WTG 22 relative to house 52 on the morning of September 15. Significant woodlands located between house 52 and WTG 22 would likely screen much of the shadow flicker.

Figure 4-37: WTGs 19 and 21 relative to house 52 during the evening of January 16. Woodlands located between the house and turbine that would likely screen much of the shadow flicker. Note that other turbines visible in this image are located further than 1,170m away and therefore would not subject house 52 to shadow flicker.

4.7 HOUSE 51

House 51 is potentially affected by shadow flicker from 3 turbines. See Figure 4-37 for the graphical representation of the sun's path relative to the house location and surrounding turbines. The owner of this house is a non-participating landowner of the project.

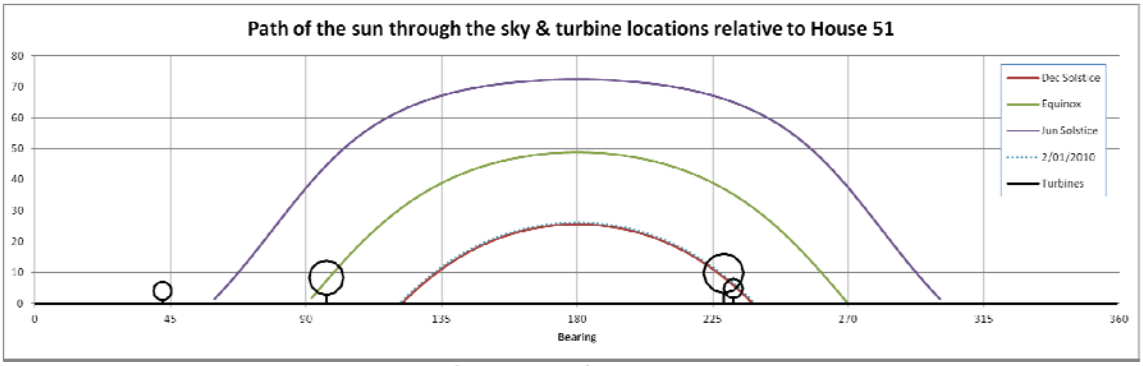


Figure 4-38: Graph of the path of the sun relative to House 51.

House 51 is predicted to experience 31.1 hours of shadow flicker throughout the year, the worst day being the 2nd of January where the house is subjected to a total of 20 minutes of shadow flicker. The shadow flicker is a result of turbine numbers 19, 21 and 22 at approximately 229, 232 and 97 degrees respectively from the house location. Actual shadow flicker experienced at this location is expected to be less than modeled, due to a number of factors:

- Some double counting of the shadow flicker due to the two turbines located at a bearing of ~230 degrees (WTG 19 and 21);
- A shed and a number of trees and dense woodlands (approx 50ft high) to the southwest of the house would likely provide vegetative screening from the turbine locations at the bearings of ~230 degrees, see Figure 4-38 & 39 below; and
- The location of windows and doors in the house was not considered in the analysis.

Figure 4-39: Proximity of trees and buildings surrounding house 51 that potentially provide shielding from the shadow flicker of nearby turbines.

Figure 4-40: Street view of house 51 with trees that potentially provide shielding from the shadow flicker of nearby turbines.

Figure 4-41: Relative locations of turbines 19, 21 & 22 which are modeled to potentially cause shadow flicker at house 51.

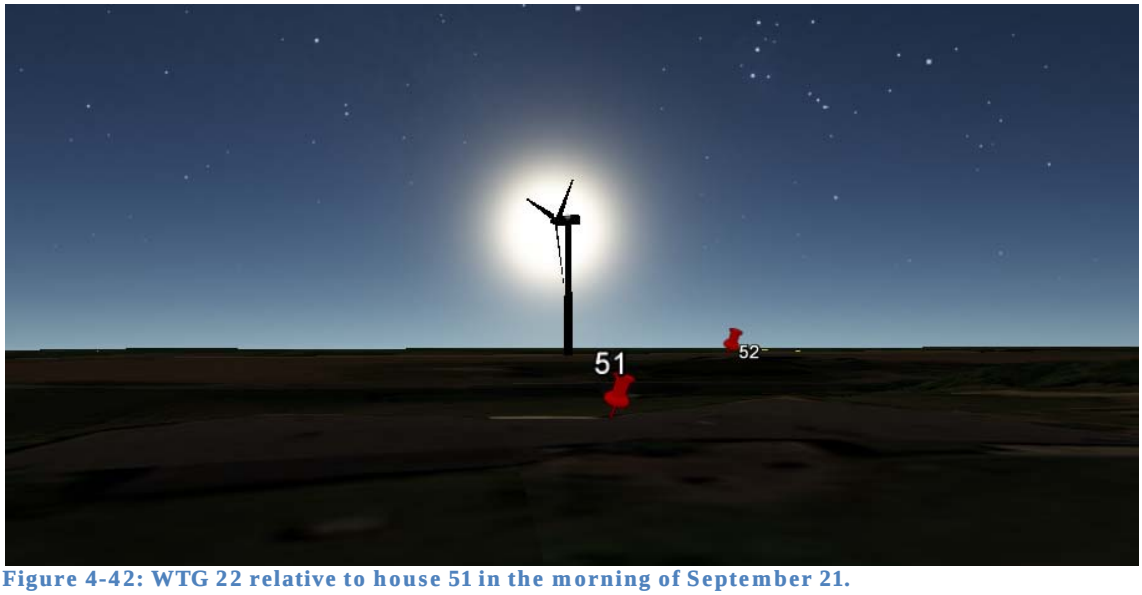


Figure 4-42: WTG 22 relative to house 51 in the morning of September 21.

Figure 4-43: WTGs 19 and 21 relative to house 51 late in the afternoon on January 2. Other visible distant turbines are too far to cause shadow flicker at house 51.

5 Discussion

Computer modeling results indicate that of the 200 houses located within the area of possible turbine shadow flicker (10 blade diameters), seven are predicted to exceed the 30-hours per year threshold. Of these seven homes, three only slightly exceed the threshold by less than 5 hours per year. The model calculations do not take into account the actual location and orientation of windows and doors, or the screening effects associated with existing site-specific conditions such as vegetation and/or buildings. Therefore, computer modeling results cannot definitively be interpreted that shadow flicker at these three dwellings would, in fact, exceed the annual threshold. Of the remaining four homes that exceed the 30-hour annual threshold, two are landowners participating in the project who are receiving monetary compensation; two are non-participating structures.

As mentioned previously, final selection of the turbine make/model for the Greenwich Wind Farm has not been finalized. Therefore, this analysis evaluates the worst-case turbine model under consideration. If the final turbine selection is different than the turbine model used in this analysis, another computer model analysis should be conducted to quantify any potential reductions in anticipated shadow flicker.

If any non-participating receptors remain in excess of 30-hours per year threshold of anticipated cumulative shadow flicker, additional mitigation measures may include curtailment of operation during select times and/or screening (such as vegetative planting or window treatments).

6 Conclusion

On behalf of the Applicant, Windlab Systems Pty Ltd (Windlab) has prepared this report in satisfaction of the requirements set forth in Section 4906-17-08(A)(6) of the Ohio Administrative Code (OAC).

6011 Greenwich Windpark, LLC (the Applicant) is proposing to develop a wind-powered electric generating facility in Huron County, Ohio. The Greenwich Wind Farm is anticipated to include 25 wind turbines for a total generating capacity of 60 MW.

For the analysis, this report assumes use of the Nordex N117-2400, which represents a worst-case analysis with respect to shadow flicker.

As indicated previously in section 5, computer modeling results suggest that 7 structures are predicted to exceed the 30-hours per year threshold as a result of turbine shadow flicker. Of these seven houses, three only slightly exceed the threshold. Considering that this study does not investigate site specific conditions, it is unlikely that shadow flicker at each of these three houses would actually exceed the annual threshold. Of the remaining four homes that exceed the 30-hour annual threshold, two are landowners participating in the project who are receiving monetary compensation; two are non-participating structures.

If, once the Greenwich Wind Farm is operational, any non-participating receptors remain in excess of the 30-hour annual threshold, additional mitigation measures may include curtailment of wind farm operations during select times and/or screening (such as vegetative planting or window treatments).

A Appendix – Figures

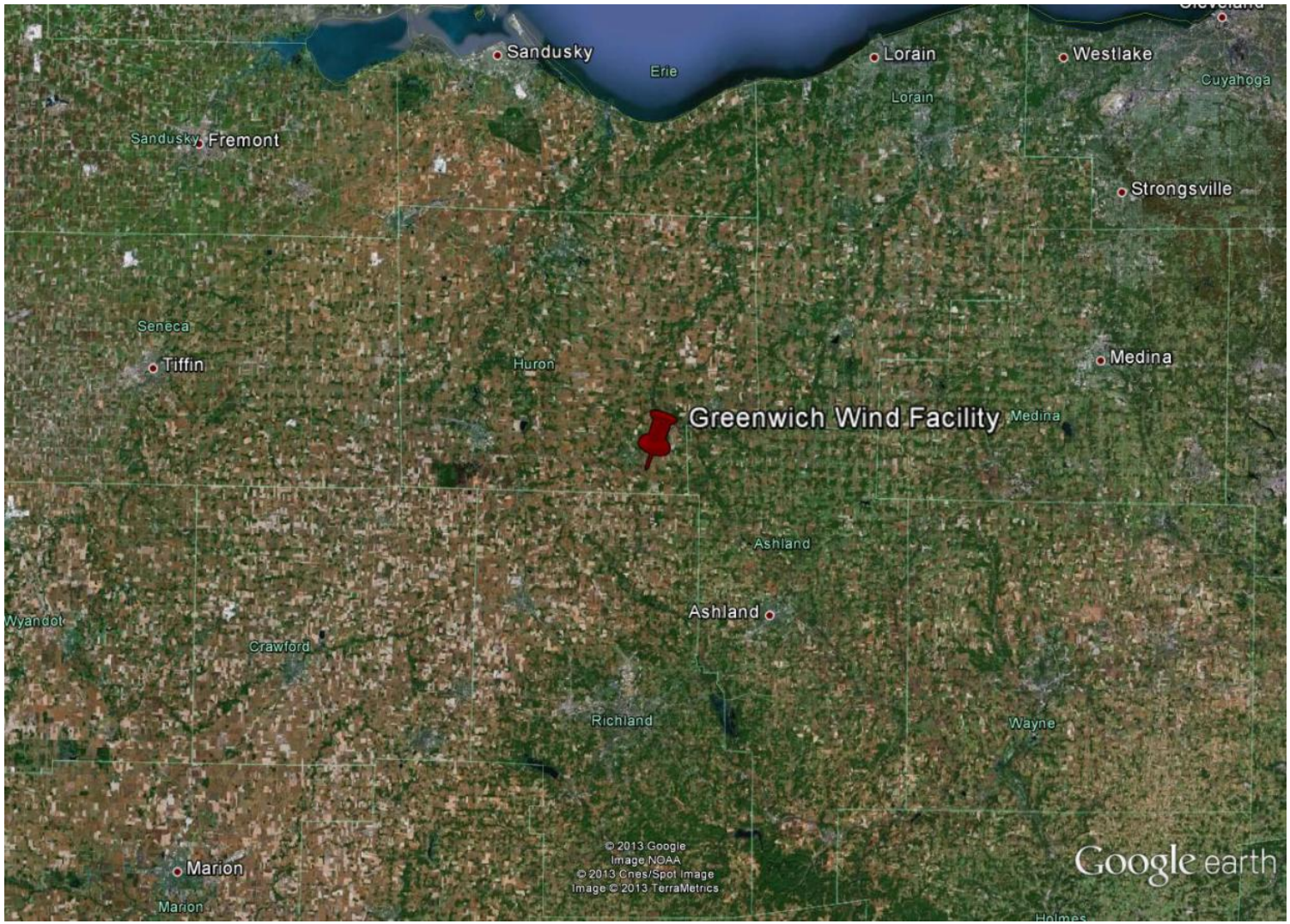


Figure A-1: Location of the Greenwich Wind Farm, proposed by 6011 Greenwich Windpark LLC.

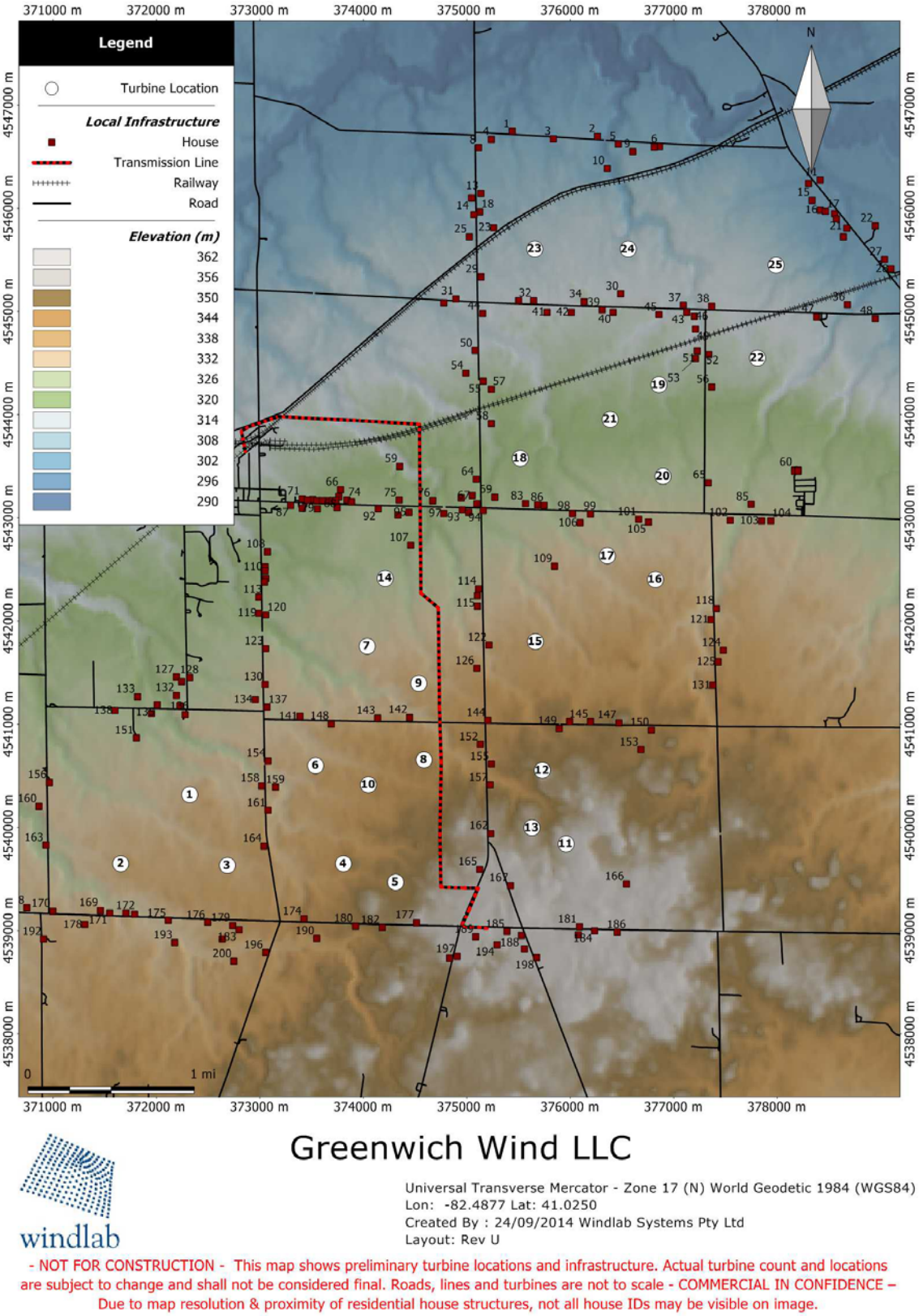
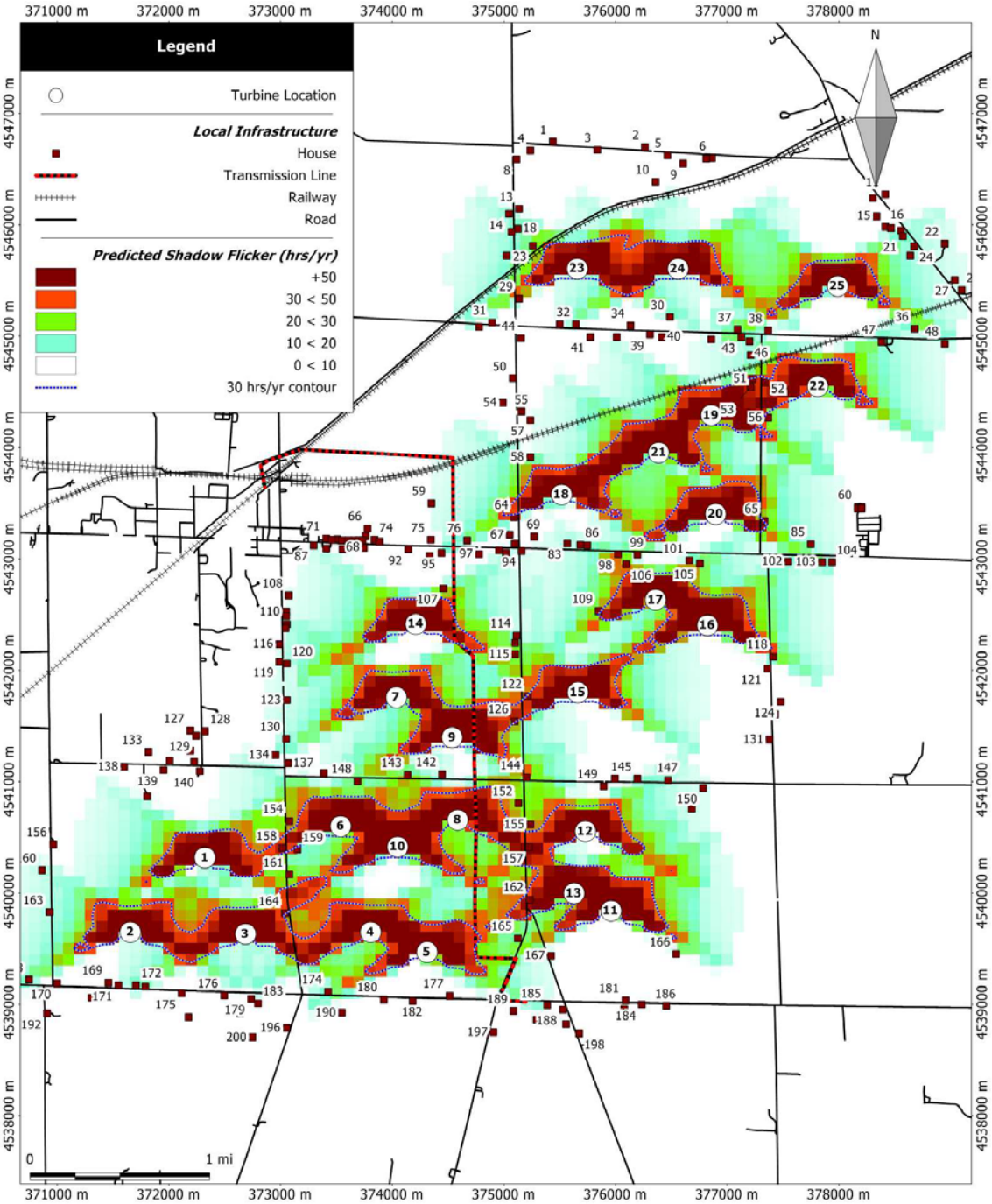


Figure A-2: The Greenwich Wind Farm and location of houses within 10D (1,170m) of turbine locations. The map also provides the elevations of the site area at 1m resolution.



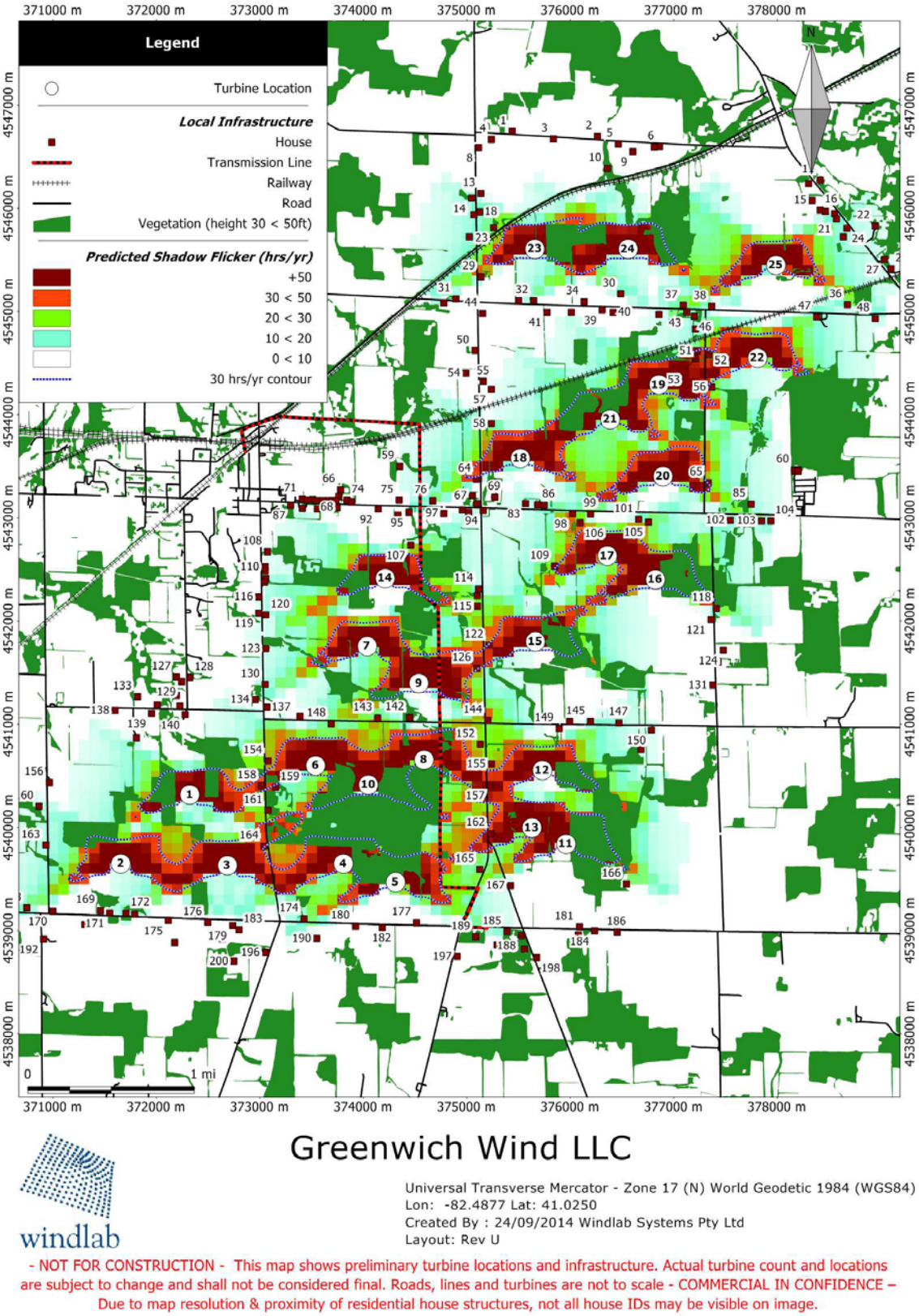
Greenwich Wind LLC

Universal Transverse Mercator - Zone 17 (N) World Geodetic 1984 (WGS84)
Lon: -82.4877 Lat: 41.0250
Created By : 24/09/2014 Windlab Systems Pty Ltd
Layout: Rev U

windlab

- NOT FOR CONSTRUCTION - This map shows preliminary turbine locations and infrastructure. Actual turbine count and locations are subject to change and shall not be considered final. Roads, lines and turbines are not to scale - COMMERCIAL IN CONFIDENCE – Due to map resolution & proximity of residential house structures, not all house IDs may be visible on image.

Figure A-3: Results of the Shadow Flicker Assessment. Note that the map is at a course resolution of 100m and therefore may not be accurate at a finer scale.



Greenwich Wind LLC

windlab

Universal Transverse Mercator - Zone 17 (N) World Geodetic 1984 (WGS84)
Lon: -82.4877 Lat: 41.0250
Created By : 24/09/2014 Windlab Systems Pty Ltd
Layout: Rev U

- NOT FOR CONSTRUCTION - This map shows preliminary turbine locations and infrastructure. Actual turbine count and locations are subject to change and shall not be considered final. Roads, lines and turbines are not to scale - COMMERCIAL IN CONFIDENCE – Due to map resolution & proximity of residential house structures, not all house IDs may be visible on image.

Figure A-4: Results of the Shadow Flicker Assessment with vegetation and woodlots included. Vegetation ranges from 30ft to 50ft in height. The placement of woodlots relative to nearby turbines and houses is likely to impact the actual shadow flicker results. Vegetation was not considered in the analysis of this report.

B Appendix – House and Turbine Locations

Table B-1: Location and identification of all houses within 10D (1170m or 3,839ft) of turbine locations from the Greenwich Wind Farm.

House ID	Easting (m)	Northing (m)	Elevation (ft)	Nearest Turbine (ft)	House Status
1	375437	4546742	994	3809	Non-Participating
2	376263	4546696	988	3727	Non-Participating
3	375835	4546670	997	3550	Non-Participating
4	375239	4546668	994	3753	Non-Participating
5	376464	4546622	994	3373	Non-Participating
6	376864	4546596	997	3422	Non-Participating
7	376809	4546591	997	3360	Non-Participating
8	375112	4546586	997	3691	Non-Participating
9	376604	4546548	1001	3120	Non-Participating
10	376355	4546386	988	2674	Non-Participating
11	378415	4546275	978	3074	Non-Participating
12	378302	4546238	984	2812	Non-Participating
13	375136	4546143	1004	2474	Non-Participating
14	375043	4546096	997	2595	Non-Participating
15	378337	4546079	988	2392	Non-Participating
16	378414	4545983	988	2270	Non-Participating
17	378466	4545967	984	2343	Non-Participating
18	375126	4545965	1007	2123	Non-Participating
19	378554	4545949	984	2507	Non-Participating
20	375068	4545935	1010	2231	Non-Participating
21	378572	4545898	984	2448	Non-Participating
22	378949	4545828	984	3412	Non-Participating
23	375257	4545814	1014	1506	Non-Participating
24	378675	4545807	984	2569	Non-Participating
25	375023	4545725	1010	2136	Non-Participating
26	378641	4545724	984	2356	Non-Participating
27	379036	4545504	984	3465	Non-Participating
28	379097	4545412	991	3661	Non-Participating
29	375134	4545336	1024	1955	Non-Participating
30	376489	4545169	1030	1467	Involved Landowner
31	374896	4545123	1027	2972	Non-Participating
32	375647	4545104	1037	1673	Involved Landowner
33	375501	4545102	1030	1755	Involved Landowner
34	376134	4545095	1033	2185	Non-Participating
35	374777	4545081	1017	3376	Non-Participating

House ID	Easting (m)	Northing (m)	Elevation (ft)	Nearest Turbine (ft)	House Status
36	378679	4545065	1007	2615	Involved Landowner
37	377091	4545057	1024	2523	Non-Participating
38	377368	4545048	1033	2205	Non-Participating
39	376309	4545013	1037	2119	Non-Participating
40	376416	4544994	1033	2067	Non-Participating
41	375775	4544994	1033	2067	Non-Participating
42	376010	4544992	1033	2346	Non-Participating
43	377126	4544990	1033	2490	Non-Participating
44	375154	4544979	1030	2654	Non-Participating
45	376859	4544967	1027	2251	Non-Participating
46	377197	4544952	1030	2421	Non-Participating
47	378380	4544949	1024	2106	Involved Landowner
48	378946	4544930	1014	3589	Non-Participating
49	377208	4544830	1030	2146	Non-Participating
50	375077	4544619	1033	3724	Non-Participating
51	377229	4544617	1040	1663	Non-Participating
52	377339	4544584	1040	1572	Non-Participating
53	377212	4544543	1040	1473	Non-Participating
54	374990	4544402	1040	3228	Involved Landowner
55	375160	4544321	1043	2726	Non-Participating
56	377365	4544267	1047	1699	Non-Participating
57	375237	4544247	1043	2405	Non-Participating
58	375234	4543913	1043	1473	Non-Participating
59	374352	4543500	1043	3602	Non-Participating
60	378168	4543466	1063	3753	Non-Participating
61	378203	4543466	1063	3789	Non-Participating
62	378167	4543454	1063	3789	Non-Participating
63	378203	4543453	1063	3832	Non-Participating
64	375092	4543375	1060	1568	Non-Participating
65	377331	4543342	1073	1470	Non-Participating
66	373781	4543274	1056	3166	Non-Participating
67	375054	4543216	1063	1942	Non-Participating
68	373762	4543208	1053	3002	Non-Participating
69	375268	4543202	1063	1499	Non-Participating
70	374947	4543192	1063	2270	Non-Participating
71	373408	4543185	1047	3665	Non-Participating
72	373508	4543178	1047	3415	Non-Participating
73	373460	4543174	1047	3514	Non-Participating
74	373839	4543172	1060	2782	Non-Participating

House ID	Easting (m)	Northing (m)	Elevation (ft)	Nearest Turbine (ft)	House Status
75	374344	4543170	1056	2530	Non-Participating
76	374668	4543168	1056	2904	Non-Participating
77	373661	4543168	1053	3071	Non-Participating
78	373702	4543167	1053	2992	Non-Participating
79	373547	4543166	1047	3304	Non-Participating
80	373735	4543166	1056	2933	Non-Participating
81	373605	4543164	1050	3176	Non-Participating
82	373888	4543156	1063	2664	Non-Participating
83	375569	4543139	1070	1470	Non-Participating
84	375099	4543139	1060	2005	Non-Participating
85	377748	4543132	1076	2946	Non-Participating
86	375683	4543125	1070	1601	Non-Participating
87	373299	4543124	1047	3799	Non-Participating
88	375749	4543124	1070	1693	Non-Participating
89	373746	4543097	1060	2723	Non-Participating
90	373411	4543092	1047	3451	Non-Participating
91	373554	4543088	1050	3100	Non-Participating
92	374142	4543085	1070	2224	Non-Participating
93	374956	4543078	1066	2477	Non-Participating
94	375159	4543072	1060	2047	Non-Participating
95	374439	4543054	1063	2244	Non-Participating
96	375019	4543054	1063	2382	Non-Participating
97	374776	4543044	1063	2785	Involved Landowner
98	376022	4543041	1076	1768	Involved Landowner
99	376193	4543039	1076	1476	Non-Participating
100	374333	4543024	1066	2057	Non-Participating
101	376663	4542985	1083	1562	Non-Participating
102	377547	4542977	1079	2566	Non-Participating
103	377846	4542971	1083	3432	Non-Participating
104	377936	4542970	1083	3707	Non-Participating
105	376756	4542961	1083	1545	Non-Participating
106	376092	4542952	1079	1404	Involved Landowner
107	374459	4542736	1063	1362	Involved Landowner
108	373074	4542672	1043	3839	Non-Participating
109	375849	4542532	1093	1729	Involved Landowner
110	373048	4542524	1056	3842	Non-Participating
111	373052	4542488	1060	3822	Non-Participating
112	373056	4542411	1060	3802	Non-Participating
113	373044	4542378	1060	3842	Non-Participating

House ID	Easting (m)	Northing (m)	Elevation (ft)	Nearest Turbine (ft)	House Status
114	375115	4542312	1083	2480	Non-Participating
115	375102	4542246	1083	2372	Non-Participating
116	372988	4542235	1060	3789	Non-Participating
117	375101	4542144	1083	2182	Non-Participating
118	377414	4542124	1093	2169	Non-Participating
119	372991	4542079	1066	3596	Non-Participating
120	373058	4542058	1070	3363	Non-Participating
121	377361	4542014	1106	2201	Non-Participating
122	375215	4541767	1106	1503	Non-Participating
123	373057	4541733	1079	3219	Non-Participating
124	377478	4541717	1115	3127	Non-Participating
125	377427	4541606	1119	3294	Non-Participating
126	375095	4541542	1115	1913	Non-Participating
127	372192	4541458	1066	3786	Non-Participating
128	372322	4541453	1066	3747	Non-Participating
129	372241	4541416	1066	3632	Non-Participating
130	373052	4541386	1086	3051	Non-Participating
131	377379	4541379	1129	3835	Non-Participating
132	372195	4541281	1070	3209	Non-Participating
133	371816	4541267	1063	3553	Non-Participating
134	372952	4541240	1083	2864	Non-Participating
135	372007	4541188	1066	3061	Non-Participating
136	372227	4541175	1076	2851	Non-Participating
137	373067	4541165	1083	2434	Non-Participating
138	371600	4541132	1073	3593	Non-Participating
139	371953	4541106	1073	2881	Non-Participating
140	372279	4541091	1083	2566	Involved Landowner
141	373388	4541076	1093	1667	Non-Participating
142	374448	4541067	1102	1155	Involved Landowner
143	374139	4541059	1106	1736	Non-Participating
144	375203	4541037	1132	2369	Non-Participating
145	376196	4541024	1138	2201	Involved Landowner
146	375991	4541023	1135	1795	Non-Participating
147	376468	4541017	1158	2881	Non-Participating
148	373691	4541006	1109	1450	Involved Landowner
149	375893	4540960	1148	1473	Non-Participating
150	376785	4540944	1142	3707	Non-Participating
151	371803	4540868	1070	2510	Non-Participating
152	375132	4540804	1138	1880	Involved Landowner

House ID	Easting (m)	Northing (m)	Elevation (ft)	Nearest Turbine (ft)	House Status
153	376682	4540754	1142	3212	Non-Participating
154	373076	4540646	1099	1555	Involved Landowner
155	375237	4540614	1129	1657	Non-Participating
156	370962	4540438	1089	3455	Non-Participating
157	375225	4540411	1138	1742	Involved Landowner
158	373019	4540404	1093	1847	Involved Landowner
159	373153	4540390	1102	1473	Non-Participating
160	370865	4540206	1089	3182	Non-Participating
161	373080	4540164	1106	2100	Non-Participating
162	375230	4539944	1165	1342	Non-Participating
163	370930	4539828	1079	2470	Non-Participating
164	373040	4539819	1115	1355	Involved Landowner
165	375124	4539595	1171	2129	Involved Landowner
166	376542	4539451	1168	2326	Non-Participating
167	375422	4539437	1175	1972	Involved Landowner
168	370747	4539220	1089	3314	Non-Participating
169	371459	4539197	1096	1650	Non-Participating
170	370998	4539190	1102	2648	Non-Participating
171	371549	4539171	1089	1644	Non-Participating
172	371705	4539170	1099	1614	Involved Landowner
173	371791	4539161	1096	1696	Non-Participating
174	373426	4539115	1138	2169	Involved Landowner
175	372115	4539097	1093	2382	Non-Participating
176	372494	4539080	1102	1936	Non-Participating
177	374513	4539079	1171	1467	Non-Participating
178	371305	4539058	1106	2280	Non-Participating
179	372735	4539051	1109	1932	Non-Participating
180	373922	4539045	1145	1909	Non-Participating
181	376086	4539037	1181	2684	Non-Participating
182	374181	4539032	1152	1522	Non-Participating
183	372796	4539010	1115	2090	Non-Participating
184	376235	4538996	1198	2927	Non-Participating
185	375388	4538990	1178	3366	Non-Participating
186	376450	4538985	1175	3251	Non-Participating
187	376075	4538958	1188	2933	Non-Participating
188	375529	4538955	1175	3238	Non-Participating
189	375087	4538939	1175	3097	Non-Participating
190	373549	4538924	1129	2543	Non-Participating
191	372638	4538920	1112	2356	Non-Participating

House ID	Easting (m)	Northing (m)	Elevation (ft)	Nearest Turbine (ft)	House Status
192	370911	4538918	1099	3442	Non-Participating
193	372178	4538884	1099	2972	Non-Participating
194	375290	4538865	1171	3786	Non-Participating
195	375555	4538821	1171	3606	Non-Participating
196	373053	4538789	1119	3028	Non-Participating
197	374908	4538749	1171	3084	Non-Participating
198	375673	4538738	1175	3743	Non-Participating
199	374835	4538735	1168	2972	Non-Participating
200	372749	4538703	1109	3064	Non-Participating

Table B-2: Proposed turbine locations for Greenwich Wind Farm (turbine Rev U)

Turbine Identifier	Easting (m)	Northing (m)	Elevation (ft)
1	372324	4540316	1099
2	371655	4539651	1105
3	372683	4539631	1105
4	373807	4539648	1135
5	374310	4539469	1145
6	373539	4540600	1105
7	374034	4541757	1086
8	374586	4540656	1138
9	374538	4541395	1102
10	374049	4540415	1128
11	375957	4539840	1178
12	375729	4540552	1151
13	375627	4539996	1155
14	374211	4542416	1069
15	375663	4541801	1105
16	376822	4542403	1112
17	376359	4542631	1089
18	375516	4543576	1053
19	376855	4544287	1039
20	376896	4543402	1066
21	376387	4543955	1049
22	377808	4544549	1036
23	375657	4545607	1016
24	376557	4545603	1013
25	377986	4545448	1013

C Appendix – Wind Rose and Sunshine Data

Table C-1: Wind rose data as measured at a 60m mast within the Greenwich Wind Farm.

Sector	0	30	60	90	120	150	180	210	240	270	300	330	All
Freq, %	6.96	7.23	4.70	4.21	5.67	7.63	10.53	15.19	13.92	12.30	6.89	4.76	100.0

Table C-2: Sunshine Probability Data[5]

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sunshine Probability (%)	36.0	41.7	46.3	52.0	58.0	63.0	64.0	62.0	60.7	54.0	35.7	30.0

[5] http://large.stanford.edu/courses/2010/ph240/herron2/docs/CCD-2009.pdf

D Appendix – Modeling Results

Table D-1: Predicted shadow flicker at each house within 10D (1170m or 3,839ft) of turbine locations from the Greenwich Wind Facility.

House ID	Nearest Turbine (ft)	Shadow Flicker [hr/yr]	Worst Day [date]	Worst Day [mins]	House Status
1	3809	0	n/a	0	Non-Participating
2	3727	0	n/a	0	Non-Participating
3	3550	0	n/a	0	Non-Participating
4	3753	0	n/a	0	Non-Participating
5	3373	0	n/a	0	Non-Participating
6	3422	0	n/a	0	Non-Participating
7	3360	0	n/a	0	Non-Participating
8	3691	0	n/a	0	Non-Participating
9	3120	0	n/a	0	Non-Participating
10	2674	0	n/a	0	Non-Participating
11	3074	0	n/a	0	Non-Participating
12	2812	0	n/a	0	Non-Participating
13	2474	0.6	22-Dec	2	Non-Participating
14	2595	7.1	8-Jan	8	Non-Participating
15	2392	0	n/a	0	Non-Participating
16	2270	0	n/a	0	Non-Participating
17	2343	1	22-Dec	3	Non-Participating
18	2123	10.9	1-Feb	10	Non-Participating
19	2507	6.5	2-Jan	9	Non-Participating
20	2231	7.8	31-Oct	12	Non-Participating
21	2448	10.5	10-Jan	10	Non-Participating
22	3412	3.4	26-Oct	10	Non-Participating
23	1506	16.3	26-Oct	20	Non-Participating
24	2569	6.4	31-Oct	13	Non-Participating
25	2136	8	28-Sep	16	Non-Participating
26	2356	7.6	24-Oct	14	Non-Participating
27	3465	3.1	20-Sep	10	Non-Participating
28	3661	2.8	10-Sep	9	Non-Participating
29	1955	12.8	22-Jun	18	Non-Participating
30	1467	6.6	21-Jun	11	Involved Landowner
31	2972	0	n/a	0	Non-Participating
32	1673	3.9	22-Jun	8	Involved Landowner
33	1755	0	n/a	0	Involved Landowner
34	2185	0	n/a	0	Non-Participating
35	3376	0.4	22-Jun	2	Non-Participating
36	2615	8.5	21-Jun	9	Involved Landowner
37	2523	18.9	15-Jul	13	Non-Participating
38	2205	0	n/a	0	Non-Participating
39	2119	0	n/a	0	Non-Participating
40	2067	0	n/a	0	Non-Participating
41	2067	0	n/a	0	Non-Participating
42	2346	1.3	22-Dec	3	Non-Participating
43	2490	12.6	22-Jun	11	Non-Participating
44	2654	0	n/a	0	Non-Participating
45	2251	2.9	31-Oct	9	Non-Participating
46	2421	8.2	24-Jan	8	Non-Participating
47	2106	12	20-Jan	10	Involved Landowner

House ID	Nearest Turbine (ft)	Shadow Flicker [hr/yr]	Worst Day [date]	Worst Day [mins]	House Status
48	3589	4.1	21-Jun	8	Non-Participating
49	2146	7.8	29-Oct	14	Non-Participating
50	3724	0	n/a	0	Non-Participating
51	1663	31.1	2-Jan	20	Non-Participating
52	1572	34	15-Sep	22	Non-Participating
53	1473	42.6	16-Jan	20	Non-Participating
54	3228	0	n/a	0	Involved Landowner
55	2726	0	n/a	0	Non-Participating
56	1699	18.1	2-Sep	21	Non-Participating
57	2405	0	n/a	0	Non-Participating
58	1473	12.8	2-Jan	12	Non-Participating
59	3602	0	n/a	0	Non-Participating
60	3753	0	n/a	0	Non-Participating
61	3789	0	n/a	0	Non-Participating
62	3789	0	n/a	0	Non-Participating
63	3832	0	n/a	0	Non-Participating
64	1568	22.2	22-Jun	24	Non-Participating
65	1470	23.7	19-Aug	24	Non-Participating
66	3166	0	n/a	0	Non-Participating
67	1942	0	n/a	0	Non-Participating
68	3002	0	n/a	0	Non-Participating
69	1499	0	n/a	0	Non-Participating
70	2270	0	n/a	0	Non-Participating
71	3665	0	n/a	0	Non-Participating
72	3415	0	n/a	0	Non-Participating
73	3514	0	n/a	0	Non-Participating
74	2782	0	n/a	0	Non-Participating
75	2530	0	n/a	0	Non-Participating
76	2904	12	5-Jul	13	Non-Participating
77	3071	0	n/a	0	Non-Participating
78	2992	0	n/a	0	Non-Participating
79	3304	0	n/a	0	Non-Participating
80	2933	0	n/a	0	Non-Participating
81	3176	0	n/a	0	Non-Participating
82	2664	0	n/a	0	Non-Participating
83	1470	4.8	20-Jan	7	Non-Participating
84	2005	2	22-Dec	4	Non-Participating
85	2946	6.7	4-Aug	12	Non-Participating
86	1601	7.5	12-Jan	7	Non-Participating
87	3799	2.9	1-Jan	5	Non-Participating
88	1693	6.9	3-Jan	8	Non-Participating
89	2723	0	n/a	0	Non-Participating
90	3451	1.8	22-Dec	4	Non-Participating
91	3100	0	n/a	0	Non-Participating
92	2224	0	n/a	0	Non-Participating
93	2477	0.8	22-Dec	3	Non-Participating
94	2047	4.7	12-Jan	6	Non-Participating
95	2244	0	n/a	0	Non-Participating
96	2382	4.2	1-Jan	7	Non-Participating
97	2785	0	n/a	0	Involved Landowner
98	1768	17.9	21-Jul	13	Involved Landowner
99	1476	10	22-Jun	15	Non-Participating
100	2057	0	n/a	0	Non-Participating
101	1562	10.6	1-Jan	13	Non-Participating

House ID	Nearest Turbine (ft)	Shadow Flicker [hr/yr]	Worst Day [date]	Worst Day [mins]	House Status
102	2566	6.1	2-Jan	8	Non-Participating
103	3432	9.7	13-Jul	11	Non-Participating
104	3707	5.2	21-Jul	10	Non-Participating
105	1545	17.8	11-Jan	14	Non-Participating
106	1404	21.8	1-Jan	20	Involved Landowner
107	1362	13.4	1-Jan	15	Involved Landowner
108	3839	2.1	9-Oct	8	Non-Participating
109	1729	23.9	14-Aug	23	Involved Landowner
110	3842	0	n/a	0	Non-Participating
111	3822	2.2	22-Sep	8	Non-Participating
112	3802	2.4	13-Sep	9	Non-Participating
113	3842	0	n/a	0	Non-Participating
114	2480	8.3	31-Aug	11	Non-Participating
115	2372	13.5	21-Aug	12	Non-Participating
116	3789	2.3	31-Oct	8	Non-Participating
117	2182	16.5	6-Aug	11	Non-Participating
118	2169	15.6	21-Jun	17	Non-Participating
119	3596	2.5	17-Oct	8	Non-Participating
120	3363	2.9	17-Oct	9	Non-Participating
121	2201	0	n/a	0	Non-Participating
122	1503	28.5	27-Aug	25	Non-Participating
123	3219	3.7	11-Sep	11	Non-Participating
124	3127	0	n/a	0	Non-Participating
125	3294	0	n/a	0	Non-Participating
126	1913	34.7	22-Jun	20	Non-Participating
127	3786	0	n/a	0	Non-Participating
128	3747	0	n/a	0	Non-Participating
129	3632	0	n/a	0	Non-Participating
130	3051	6.1	27-Jul	12	Non-Participating
131	3835	0	n/a	0	Non-Participating
132	3209	0	n/a	0	Non-Participating
133	3553	0	n/a	0	Non-Participating
134	2864	0	n/a	0	Non-Participating
135	3061	0	n/a	0	Non-Participating
136	2851	0	n/a	0	Non-Participating
137	2434	0	n/a	0	Non-Participating
138	3593	0	n/a	0	Non-Participating
139	2881	0	n/a	0	Non-Participating
140	2566	0	n/a	0	Involved Landowner
141	1667	0	n/a	0	Non-Participating
142	1155	3.2	3-Feb	8	Involved Landowner
143	1736	19.6	5-Jan	20	Non-Participating
144	2369	20.5	21-Jun	12	Non-Participating
145	2201	4.3	1-Jan	7	Involved Landowner
146	1795	0	n/a	0	Non-Participating
147	2881	6.2	19-Nov	8	Non-Participating
148	1450	16.9	10-Jul	14	Involved Landowner
149	1473	0	n/a	0	Non-Participating
150	3707	2.6	23-Oct	9	Non-Participating
151	2510	0.1	22-Dec	1	Non-Participating
152	1880	21.8	19-Oct	26	Involved Landowner
153	3212	3.5	6-Oct	10	Non-Participating
154	1555	24.5	16-Sep	22	Involved Landowner
155	1657	23.1	8-Sep	28	Non-Participating

House ID	Nearest Turbine (ft)	Shadow Flicker [hr/yr]	Worst Day [date]	Worst Day [mins]	House Status
156	3455	0	n/a	0	Non-Participating
157	1742	63.0	24-Jul	39	Involved Landowner
158	1847	41.4	14-Jul	23	Involved Landowner
159	1473	17.8	17-Sep	15	Non-Participating
160	3182	5.8	13-Jan	6	Non-Participating
161	2100	19.3	15-Aug	25	Non-Participating
162	1342	41	19-Aug	29	Non-Participating
163	2470	5.9	7-Oct	12	Non-Participating
164	1355	27.5	11-Oct	25	Involved Landowner
165	2129	12.7	9-Aug	14	Involved Landowner
166	2326	0.3	21-Jun	1	Non-Participating
167	1972	2.3	12-Sep	8	Involved Landowner
168	3314	11.6	7-Jul	13	Non-Participating
169	1650	0	n/a	0	Non-Participating
170	2648	0	n/a	0	Non-Participating
171	1644	0	n/a	0	Non-Participating
172	1614	10.5	8-Jul	12	Involved Landowner
173	1696	6.7	22-Jun	11	Non-Participating
174	2169	10	23-Jul	13	Involved Landowner
175	2382	0	n/a	0	Non-Participating
176	1936	0	n/a	0	Non-Participating
177	1467	0	n/a	0	Non-Participating
178	2280	0	n/a	0	Non-Participating
179	1932	0	n/a	0	Non-Participating
180	1909	0	n/a	0	Non-Participating
181	2684	0	n/a	0	Non-Participating
182	1522	0	n/a	0	Non-Participating
183	2090	0	n/a	0	Non-Participating
184	2927	0	n/a	0	Non-Participating
185	3366	0	n/a	0	Non-Participating
186	3251	0	n/a	0	Non-Participating
187	2933	0	n/a	0	Non-Participating
188	3238	0	n/a	0	Non-Participating
189	3097	0	n/a	0	Non-Participating
190	2543	0	n/a	0	Non-Participating
191	2356	0	n/a	0	Non-Participating
192	3442	0	n/a	0	Non-Participating
193	2972	0	n/a	0	Non-Participating
194	3786	0	n/a	0	Non-Participating
195	3606	0	n/a	0	Non-Participating
196	3028	0	n/a	0	Non-Participating
197	3084	0	n/a	0	Non-Participating
198	3743	0	n/a	0	Non-Participating
199	2972	0	n/a	0	Non-Participating
200	3064	0	n/a	0	Non-Participating

Summary: Correspondence of 6011 Greenwich Windpark, LLC in Compliance with Condition No. 16 electronically filed by Teresa Orahood on behalf of Sally Bloomfield