Chapter 16 Shadow Flicker

Ballinla Wind Farm

Ballinla Wind Farm Ltd

July 2025

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Project No.	Doc. No.	Rev.	Date	Prepared By	Checked By	Approved By	Status
23882	6019	A	07/07/2025	CF	GT	GT	Final

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16. Shadow Flicker

16.1 Introduction

Shadow flicker is an effect that can occur when the shadow of a moving wind turbine blade passes over a small opening (e.g. a window) causing a flickering effect to be perceived. The likelihood and duration of this effect occurring depends upon certain combinations of relative sun, turbine and window locations, turbine orientation, times of day, days of the year and weather conditions. The flickering may have the potential to cause disturbance and annoyance to residents if it affects occupied rooms of a property.

This Chapter provides an assessment of the potential shadow flicker effect on residential amenity resulting from the Proposed Development. The specific objectives of the report are to:

- Summarise the assessment methodology used in completing the assessment.
- Describe the potential shadow flicker impact of the Proposed Development.
- Assess the potential for cumulative shadow flicker with other existing and/or permitted wind farms.
- Describe the mitigation measures proposed to address any likely significant effects.

The Applicant has a company policy of zero shadow flicker impact from its developments. This shadow flicker assessment will also assess the impact of the Proposed Development when using the standard shadow flicker control modules that will be implemented as part of this policy.

16.2 Assessment Methodology

16.2.1 Scope of Assessment

In general, the shadow flicker assessment methodology involves the identification of houses and other sensitive receptors within a defined study area, which have the potential to be adversely impacted by shadow flicker. The Wind Energy Development Guidelines (2006) provide that *"At distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low"*. In line with best practice guidance, the study area is usually limited to a distance (between a house and wind turbine) equivalent in length to 10 of the proposed wind turbine rotor diameters. Determining shadow flicker based on using the 10-rotor diameter rule has been widely accepted across different European countries and is deemed to be an appropriate assessment area (Parsons Brinckerhoff, 2011).

Computer software is then used to predict the occurrence of shadow flicker at each house within the study area, which is known to over-estimate the possible impact. This is explained in more detail in Section 16.3.4.

The results are compared against the criteria in the existing 2006 Wind Energy Development Guidelines. Consideration was also given to the 2019 Draft Revised Wind Energy Development Guidelines and the Offaly County Development Plan (2021-2027) Development Management Standards.

Under the WEG (2006) guidance shut down periods cover the periods of potential nuisance in excess of 30 hrs per year. The applicant is committed to a zero-shadow flicker strategy which means that the turbines shadow flicker module will be programmed to shut down whenever the conditions for shadow flicker at a property are met.

The Applicant for the Proposed Development has a zero Shadow Flicker policy in line with the Draft Revised Wind Energy Development Guidelines (2019). Zero Shadow Flicker as outlined in this policy will also be assessed.

16.2.2 Study Area

The study area for the Proposed Development was calculated with respect to the proposed candidate turbine type with a rotor diameter of 162m, resulting in a study area of 1.629km from each turbine. The study area is shown in Figure 16-2. All sensitive receptors within this area were identified using Eircode data, planning searches and review of mapping and aerial photography. Houses in close proximity to the Proposed Development were identified during the various site walkovers undertaken during the EIAR site visits.

16.2.3 Competency of Assessor

This technical assessment was undertaken Jeremy King and Caitriona Fox (MWP).

Jeremy is the lead GIS technician in MWP assisting the Civil and Environmental departments. Jeremy has qualifications in Computer Aided Design (CAD) and GIS. Jeremy has prepared numerous shadow flicker prediction models which form part of the assessments for inclusion in Environmental Impact Assessment Reports.

Caitriona is an Environmental Consultant with over 20 years environmental consultancy experience. She is an Environmental Impact Assessment practitioner and has taken on the role of EIA Project Manager for a variety of large-scale EIA projects including wind farms, commercial, industrial and tourism developments. She has extensive experience in the management and compilation of environmental reports and has authored numerous specialist reports including shadow flicker assessments, air and climate impact assessments, population and human health impact assessment, landscape impact assessment, and material assets assessment for project EIAs.

16.2.4 Statement on Limitations and Difficulties Encountered

No limitations or difficulties were encountered when undertaking this assessment or compiling the chapter.

16.3 Factors relating to Shadow Flicker Occurrence

The key factors related to shadow flicker occurrence are discussed below.

16.3.1 Spatial Relationship

At distances of greater than approximately 500m between a turbine and a receptor, shadow flicker generally occurs only at sunrise or sunset when the cast shadows are long. It is generally considered that the occurrence of shadow flicker is very low “at distances greater than 10 rotor diameters from a turbine”[1] or at a distance greater than 1 kilometre (km). This is because at such separation distances the rotor of a wind turbine will not appear to be chopping light, but the turbine will be regarded as an object with the sun behind it[2].

[1] Extract from the DoEHLG 2006 Guidelines, on occurrence of shadow flicker

[2] http://xn--drmstrre-64ad.dk/wp-content/wind/miller/windpower%20web/en/tour/env/shadow/shadow2.html

Figure 16.1 shows an approximation of the shadow cast by a turbine at various times during the day, where the red shading represents the area where shadow flicker may occur.

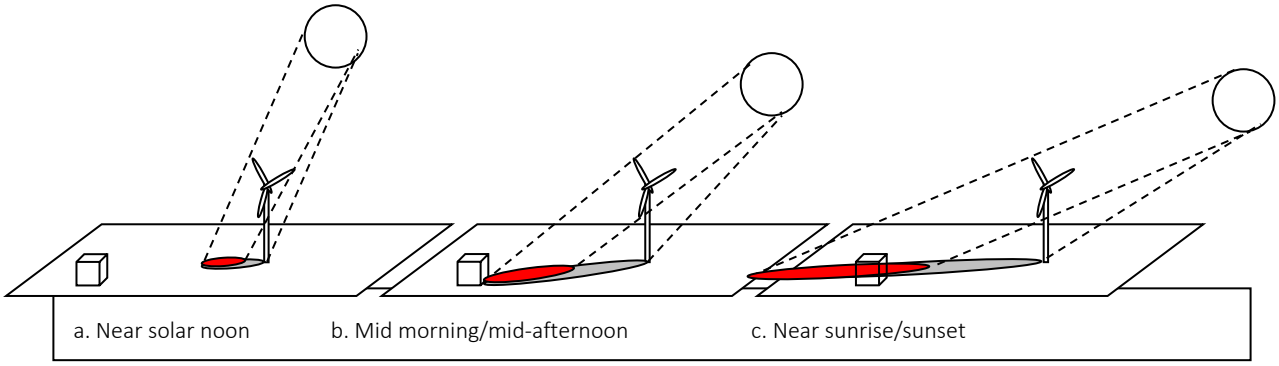

Figure 16-1: Approximation of Shadow Cast[3]

16.3.2 Wind Direction

The angle between the sun and the rotor plane also plays a determining role for both shadow flicker occurrence and intensity. The rotor plane is determined by the direction of the wind: because the turbine rotor continuously yaws to face the wind, the rotor plane will always be perpendicular to the wind direction. Shadow flicker will be most pronounced when the rotor plane is perpendicular to the sun-receptor line of sight.

16.3.3 Sunshine Hours

The shadow flicker analysis assumes the sun is always shining. It is reasonable to factor any results by the percentage of time the sun is actually shining. Ireland normally gets between 1100 and 1600 hours of sunshine each year. The sunniest months are May and June. During these months, sunshine duration averages between 5 and 6.5 hours per day over most of the country. The extreme southeast gets most sunshine, averaging over 7 hours a day in early summer. December is the dullest month, with an average daily sunshine ranging from about 1 hour in the north to almost 2 hours in the extreme southeast. Over the year as a whole, most areas get an average of between 3 1/4 and 3 3/4 hours of sunshine each day[4].

The Met Éireann weather station at Mullingar is the nearest weather and climate monitoring station to the Application Site. Publicly obtainable sunshine data for this weather station is available for the period 1971-2000[5].

It was possible using the 30-year average sunshine data available from Met Éireann for Mullingar to estimate the percentage of time shadow flicker could actually occur. These are presented in Table 16-2 in Section 16.6. Based on this data, the conditions necessary for shadow flicker (clouds not present) are only predicted to be present for approximately 28% of the day on average.

[3] Shadow Flicker Assessment Helimax Energy, Dec 2008

[4] http://met.ie

[5] https://www.met.ie/cms/assets/uploads/2024/07/Mullingar-1971-2000-averages.html

16.3.4 Theoretical Model Worst Case Assumptions

Shadow flicker was calculated for the proposed wind turbines using industry-standard simulation software *Wind Farm*, a tool which has been successfully applied to similar studies around the world. This software identifies the study area for the assessment based on the candidate turbine dimensions. Simulations were carried out for the proposed candidate turbine, namely.

- A wind turbine with a tip height of 185m, hub height of 104m and rotor diameter of 162m.

The model uses Ordnance Survey Ireland digital 10m height contour data as its only topographical reference. Simulations are run on a 'bare earth scenario' without allowing for the obscuring effect of vegetation or other obstacles between the location of the residence and the position of the sun in the sky. Nor does the model consider any obscuring features around residences itself, which would minimise views of the site and hence further reduce the potential for shadow flicker, thus the *WindFarm* model uses a conservative assessment scenario when reporting shadow flicker results for the existing environment. The model assumes that:

1. The sun will always be shining during daylight hours, with no cloud cover or fog i.e. bright sunshine every day.
2. The wind will blow continuously throughout the day and always above cut-in speed, i.e. the turbine will always be rotating.
3. The wind will always be blowing from a direction such that the turbine rotor is aligned with the sun-receptor line. In other words, the rotor will yaw in parallel with the sun such that the rotor blades are always perpendicular to the sun-receptor view line.
4. There will be no screening by intervening structures, vegetation or trees (other than topography), i.e. a bare earth scenario.
5. Assumed a North, South, East, and West facing façade window of dimensions 1m x 1m for each dwelling with a 2 m height above ground.

An assumption is also made that the windows of the rooms, where the effects may occur, (i) directly face the development, (ii) that the rooms are occupied and (iii) that the curtains or blinds, if present, are open.

A more realistic simulation would use the following assumptions:

1. The sun will not always be shining. therefore, it is only necessary to calculate shadow flicker for the fraction of time when the sun would be shining.
2. The rotor will not be turning all the time. For example, a turbine would not be rotating during maintenance works or low wind conditions.
3. The rotor blades will not always be perpendicular to the sun-receptor view line.
4. Trees, vegetation, local topography and buildings in the vicinity of the receptor will reduce shadow flicker or eliminate shadow flicker.

16.4 Assessment Criteria

Current assessment criteria are described in the Department of the Environment, Heritage and Local Government, Wind Energy Development Guidelines, 2006. These guidelines are currently under review and replacement Draft Wind Energy Development Guidelines were published in December 2019.

Until the revised guidelines are published in final form, the Government has advised that the current 2006 guidelines remain in force. However, with the Applicant has committed to zero shadow flicker impact, the criteria in both documents can be achieved.

16.4.1 Wind Energy Development Guidelines (2006)

The current 2006 Wind Energy Development Guidelines recommend that shadow flicker at offices and dwellings within 500m of a turbine should not exceed 30 hours per year or 30 minutes per day. The guidelines also state that at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low.

16.4.2 Draft Wind Energy Development Guidelines (2019)

The shadow flicker criteria described in the 2019 Draft Wind Energy Development Guidelines are extracted below.

> *The planning authority or An Bord Pleanála should impose condition(s) to ensure that no existing dwelling or other affected property will experience shadow flicker as a result of the wind energy development subject of the planning application and the wind energy development shall be installed and operated in accordance with the shadow flicker study submitted to accompany the planning application, including any mitigation measures required.*

16.4.3 Offaly County Development Plan 2021-2027

The Offaly CDP (2021-2027) sets out the following relevant shadow flicker criteria for windfarm developments:

Table 16-1: Relevant CDP Objectives

DMS-109 Wind Farms	When assessing planning applications for wind energy developments the Council will have regard to. • the Wind Energy Development Guidelines for Planning Authorities, DoEHLG, (2006) and any amendments to the Guidelines which may be made.
	In addition to the above, the following local considerations will be taken into account by the Council in relation to any planning application. • Impact on human health in relation to noise disturbance (including consistency with the Word Health Organisations 2018 Environmental Noise Guidelines for the European Region), shadow flicker and air quality.

16.5 Receiving Environment

The Study Area for the purpose of the Shadow Flicker assessment is shown in Figure 16-2. In line with best practice, the scope of the assessment area extends to a distance of 10 times the rotor diameter (RD) from each turbine. There are 141 No. residential properties within the boundary of 10 times rotor diameter study area.

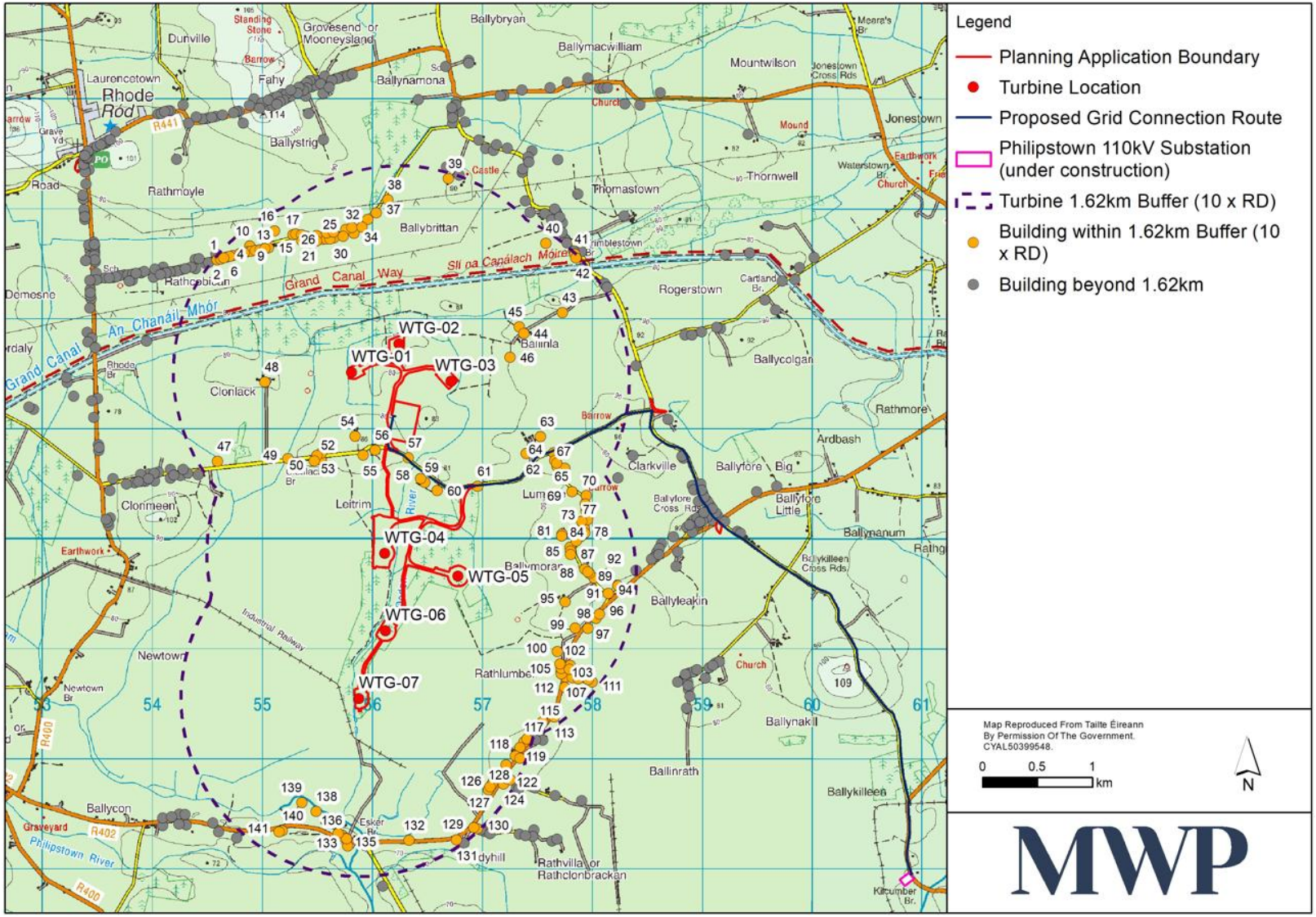

Figure 16-2: Residential Receptors within 10 x Rotor Diameters of a Turbine

16.6 Assessment of Effects

There are no dwellings within 500m of a turbine. Therefore, the Proposed Development would be compliant with the 2006 Wind Energy Development Guidelines recommendation that shadow flicker at offices and dwellings within 500m of a turbine should not exceed 30 hours per year or 30 minutes per day.

The summary of the results of the shadow flicker model output for all houses within the 1.62 km study area (10 rotor diameters) are presented in Table 16-2.

Table 16-2: Predicted Shadow Flicker on All Houses from all turbines within the 1.62km study area

House	Days per year	Max hours per day	Total hours
1	64	0.45	21.9
2	78	0.46	25.3
3	82	0.46	29.7
4	79	0.47	30.9
5	77	0.47	31.4
6	74	0.48	28.6
7	67	0.48	27
8	63	0.48	25.4
9	102	0.47	38.2
10	50	0.46	18.7
11	100	0.47	37.3
12	97	0.46	35.5
13	92	0.46	33.6
14	88	0.47	31
15	85	0.48	28.8
16	82	0.47	30.9
17	74	0.51	31.4
18	71	0.51	30.6
19	68	0.5	30
20	75	0.53	34.2
21	74	0.53	33.8
22	66	0.51	29.7
23	64	0.54	30
24	56	0.5	24.4
25	56	0.52	24.6
26	52	0.5	22.5
27	41	0.47	15.7
28	48	0.49	19.5
29	30	0.36	8.6

House	Days per year	Max hours per day	Total hours
30	42	0.48	16.1
31	24	0.31	5.9
32	0	0	0
33	0	0	0
34	0	0	0
35	0	0	0
36	0	0	0
37	0	0	0
38	0	0	0
39	0	0	0
40	77	0.44	24
41	73	0.45	28.8
42	77	0.45	29.5
43	85	0.57	35
44	139	0.83	79.2
45	152	0.84	85.5
46	141	1.41	113.7
47	74	0.5	33
48	79	1.27	65.1
49	87	0.57	38.5
50	160	0.61	73
51	154	0.57	63.2
52	148	0.61	70.9
53	147	0.53	60
54	123	0.7	65.3
55	87	0.47	32.6
56	29	0.33	7.5
57	11	0.16	1.4
58	73	1.13	56.2
59	84	1.26	71.4
60	108	1.19	93
61	87	0.65	39.3
62	77	0.45	21
63	79	0.78	54.1
64	116	0.62	53.5
65	114	0.52	47.9
66	114	0.5	47.7
67	112	0.51	45.3

House	Days per year	Max hours per day	Total hours
68	130	0.52	52.8
69	56	0.54	23.6
70	77	0.5	25
71	45	0.52	18.4
72	44	0.52	18.2
73	45	0.52	18.2
74	43	0.52	17.5
75	43	0.52	17.7
76	45	0.55	19.3
77	45	0.55	19.1
78	44	0.54	18.7
79	43	0.55	18.6
80	44	0.57	19.8
81	83	0.65	36.8
82	81	0.65	37.2
83	45	0.59	21.2
84	49	0.62	23.7
85	48	0.63	23.7
86	48	0.63	23.9
87	44	0.57	20
88	44	0.57	20
89	44	0.56	19.3
90	44	0.56	18.9
91	42	0.54	17.9
92	39	0.49	14.8
93	37	0.46	13.4
94	40	0.49	15.4
95	61	0.67	32.2
96	47	0.51	18.7
97	49	0.52	20.3
98	61	0.55	25.7
99	78	0.6	35.4
100	81	0.53	32.3
101	44	0.43	12.8
102	39	0.42	13.2
103	0	0	0
104	27	0.3	6.3
105	0	0	0

House	Days per year	Max hours per day	Total hours
106	0	0	0
107	0	0	0
108	0	0	0
109	19	0.21	3.2
110	39	0.39	12.4
111	41	0.4	13.4
112	0	0	0
113	0	0	0
114	0	0	0
115	0	0	0
116	86	0.44	30.3
117	77	0.45	25
118	59	0.45	17.1
119	46	0.46	16.5
120	45	0.45	15.6
121	55	0.48	20.7
122	78	0.47	26.7
123	70	0.46	24.4
124	83	0.47	33.1
125	79	0.5	35.1
126	73	0.51	33
127	67	0.51	30.2
128	61	0.51	26.6
129	0	0	0
130	0	0	0
131	0	0	0
132	0	0	0
133	0	0	0
134	0	0	0
135	0	0	0
136	0	0	0
137	0	0	0
138	0	0	0
139	0	0	0
140	0	0	0
141	0	0	0

While National Guidelines would be adhered to, as there are no dwellings within 500m of a turbine, the output from the Shadow Flicker model determines that out of the 141 properties within the 10 RD study area, shadow flicker could theoretically occur at up to 111 properties, under theoretical conservative conditions, while 30 properties would remain unaffected.

Of the 111 properties which could potentially experience shadow flicker, the model predicts that the 30-minute daily threshold would be reached or exceeded at 65 properties and that the 30 hours per annum threshold would be reached or exceeded at 48 properties.

These results however can be considered a very conservative overestimate. As outlined in Section 16.3.4 this is because the model does not take into account the hours when the wind is blowing in the direction needed to orient the turbine perpendicular to the residential dwelling. Furthermore, when this does happen it will not always coincide with a sunny period. An assumption has also been made that there is a clear line of sight between all dwellings and a wind turbine and that there is a window on the potentially affected wall/gable.

A more realistic simulation would be that the sun will not always be shining. therefore, it is only necessary to calculate shadow flicker for the proportion of time when the sun would be shining.

It was possible using the 30-year average sunshine data available from Met Eireann to determine the percentage of time shadow flicker could actually occur. Average sunshine hours used in this assessment are based on average monthly figures from the years 1971 to 2000, from the Mullingar Meteorological Station. These are presented in Table 16-2.

Table 16-3: Average Hours of Sunshine and Average Hours of Day [6]

Month	Mean Daily Duration (hours)	Greatest Daily Duration (hours)	Proportion of daylight hours with sunshine (%)
Jan	1.7	8.1	21
Feb	2.2	9.5	23
Mar	3.0	10.9	28
Apr	4.7	13.6	35
May	5.6	15.4	36
Jun	5.1	16	32
Jul	4.7	15.6	30
Aug	4.5	14.4	31
Sept	3.8	11.7	32
Oct	3.0	10.1	30
Nov	2.1	8.6	24
Dec	1.4	7.3	19
Average	**3.5**	**16**	**28**

From the data in Table 16-2, it can be determined that the conditions necessary for shadow flicker (sunshine hours) are only predicted to be present at approximately 28% of the maximum theoretical hours that have been predicted by the *WindFarm* software. Therefore, the theoretical maximum shadow flicker as predicted by the *WindFarm software* is multiplied by 0.28 (28 percent) to evaluate the more realistic potential shadow flicker impacts from the Ballinla Wind Farm. The results are presented in Table 16-3. The analysis indicates that when the sunshine hours are accounted for, the potential shadow flicker reduces below the 30 hours per year threshold value at all but 1 residential receptor and below the 30-minutes per day threshold at all locations.

[6] Mullingar Meteorological Station1971-2000 (https:// www.met.ie/cms/assets/uploads/2024/07/Mullingar-1971-2000 averages)

Again, this methodology is conservative in that it does not account for times when the turbine blades are not spinning, or when the flicker is blocked from view at a given receptor, or when the rotor is not perpendicular to the sun.

Table 16-4: Shadow Flicker Results adjusted for Average Regional Sunshine Hours

House	Total Hours per year		Max Hours per day	
	(Theoretical Conservative Scenario)	(Adjusted Annual Regional Sunshine Scenario)	(Theoretical Conservative Scenario)	(Adjusted Daily Regional Sunshine Scenario)
1	21.9	6.1	0.45	0.13
2	25.3	7.1	0.46	0.13
3	29.7	8.3	0.46	0.13
4	30.9	8.7	0.47	0.13
5	31.4	8.8	0.47	0.13
6	28.6	8.0	0.48	0.13
7	27	7.6	0.48	0.13
8	25.4	7.1	0.48	0.13
9	38.2	10.7	0.47	0.13
10	18.7	5.2	0.46	0.13
11	37.3	10.4	0.47	0.13
12	35.5	9.9	0.46	0.13
13	33.6	9.4	0.46	0.13
14	31	8.7	0.47	0.13
15	28.8	8.1	0.48	0.13
16	30.9	8.7	0.47	0.13
17	31.4	8.8	0.51	0.14
18	30.6	8.6	0.51	0.14
19	30	8.4	0.5	0.14
20	34.2	9.6	0.53	0.15
21	33.8	9.5	0.53	0.15
22	29.7	8.3	0.51	0.14
23	30	8.4	0.54	0.15
24	24.4	6.8	0.5	0.14
25	24.6	6.9	0.52	0.15
26	22.5	6.3	0.5	0.14
27	15.7	4.4	0.47	0.13
28	19.5	5.5	0.49	0.14
29	8.6	2.4	0.36	0.10
30	16.1	4.5	0.48	0.13
31	5.9	1.7	0.31	0.09
40	24	6.7	0.44	0.12

House	Total Hours per year		Max Hours per day	
	(Theoretical Conservative Scenario)	(Adjusted Annual Regional Sunshine Scenario)	(Theoretical Conservative Scenario)	(Adjusted Daily Regional Sunshine Scenario)
41	28.8	8.1	0.45	0.13
42	29.5	8.3	0.45	0.13
43	35	9.8	0.57	0.16
44	79.2	22.2	0.83	0.23
45	85.5	23.9	0.84	0.24
46	113.7	31.8	1.41	0.39
47	33	9.2	0.5	0.14
48	65.1	18.2	1.27	0.36
49	38.5	10.8	0.57	0.16
50	73	20.4	0.61	0.17
51	63.2	17.7	0.57	0.16
52	70.9	19.9	0.61	0.17
53	60	16.8	0.53	0.15
54	65.3	18.3	0.7	0.20
55	32.6	9.1	0.47	0.13
56	7.5	2.1	0.33	0.09
57	1.4	0.4	0.16	0.04
58	56.2	15.7	1.13	0.32
59	71.4	20.0	1.26	0.35
60	93	26.0	1.19	0.33
61	39.3	11.0	0.65	0.18
62	21	5.9	0.45	0.13
63	54.1	15.1	0.78	0.22
64	53.5	15.0	0.62	0.17
65	47.9	13.4	0.52	0.15
66	47.7	13.4	0.5	0.14
67	45.3	12.7	0.51	0.14
68	52.8	14.8	0.52	0.15
69	23.6	6.6	0.54	0.15
70	25	7.0	0.5	0.14
71	18.4	5.2	0.52	0.15
72	18.2	5.1	0.52	0.15
73	18.2	5.1	0.52	0.15
74	17.5	4.9	0.52	0.15
75	17.7	5.0	0.52	0.15
76	19.3	5.4	0.55	0.15
77	19.1	5.3	0.55	0.15

House	Total Hours per year		Max Hours per day	
	(Theoretical Conservative Scenario)	(Adjusted Annual Regional Sunshine Scenario)	(Theoretical Conservative Scenario)	(Adjusted Daily Regional Sunshine Scenario)
78	18.7	5.2	0.54	0.15
79	18.6	5.2	0.55	0.15
80	19.8	5.5	0.57	0.16
81	36.8	10.3	0.65	0.18
82	37.2	10.4	0.65	0.18
83	21.2	5.9	0.59	0.17
84	23.7	6.6	0.62	0.17
85	23.7	6.6	0.63	0.18
86	23.9	6.7	0.63	0.18
87	20	5.6	0.57	0.16
88	20	5.6	0.57	0.16
89	19.3	5.4	0.56	0.16
90	18.9	5.3	0.56	0.16
91	17.9	5.0	0.54	0.15
92	14.8	4.1	0.49	0.14
93	13.4	3.8	0.46	0.13
94	15.4	4.3	0.49	0.14
95	32.2	9.0	0.67	0.19
96	18.7	5.2	0.51	0.14
97	20.3	5.7	0.52	0.15
98	25.7	7.2	0.55	0.15
99	35.4	9.9	0.6	0.17
100	32.3	9.0	0.53	0.15
101	12.8	3.6	0.43	0.12
102	13.2	3.7	0.42	0.12
104	6.3	1.8	0.3	0.08
109	3.2	0.9	0.21	0.06
110	12.4	3.5	0.39	0.11
111	13.4	3.8	0.4	0.11
116	30.3	8.5	0.44	0.12
117	25	7.0	0.45	0.13
118	17.1	4.8	0.45	0.13
119	16.5	4.6	0.46	0.13
120	15.6	4.4	0.45	0.13
121	20.7	5.8	0.48	0.13
122	26.7	7.5	0.47	0.13
123	24.4	6.8	0.46	0.13

House	Total Hours per year		Max Hours per day	
	(Theoretical Conservative Scenario)	(Adjusted Annual Regional Sunshine Scenario)	(Theoretical Conservative Scenario)	(Adjusted Daily Regional Sunshine Scenario)
124	33.1	9.3	0.47	0.13
125	35.1	9.8	0.5	0.14
126	33	9.2	0.51	0.14
127	30.2	8.5	0.51	0.14
128	26.6	7.4	0.51	0.14

Based on the above the potential effects associated with shadow flicker are assessed as follows:

Table 16-5: Shadow Flicker Effect- Operational Phase Only

Quality of Effect	Significance	Spatial Extent	Duration	Frequency
Negative	Moderate	Localised	Long-term	Occasional

16.7 Zero Shadow Flicker

Shadow flicker control modules, consisting of light sensors and specialised software, will be installed on all turbines, irrespective of the individual turbine shadow flicker impact. This is to prevent operation during periods when shadow flicker is experienced at nearby properties if it is determined there is an issue post construction.

The shadow flicker control module consists of bespoke software, a clock, a timer, a switch, a wind direction sensor and a light sensor. The module can control a specific turbine (or turbines) which would be programmed to shut down on specific dates and specific times when the sun is bright enough, there is sufficient wind to rotate the blades and the wind direction is such that the nuisance shadow flicker could occur.

The installation of a programmable shadow flicker module will allow future conditional control of the turbines in order to eliminate shadow flicker, irrespective of which turbine in the range is installed. The correct operation of the shadow flicker control measures will ensure that there will be no impact from shadow flicker. The operation and performance of the shadow flicker control measures will be monitored on an ongoing basis.

Under the WEG (2006) guidance, shut down periods cover the periods of potential nuisance in excess of 30 hrs per year. The applicant is committed to a zero-shadow flicker strategy which means that the turbines shadow flicker module will be programmed to shut down whenever the conditions for shadow flicker at a property are met, irrespective of which turbine in the range is installed.

Under this approach there would be no shadow flicker experienced at any property, and therefore no impacts on any receptors.

16.8 Do Nothing Scenario

In the 'Do-Nothing' Scenario, the Proposed Development would not be constructed and the potential impacts from shadow flicker on local receptors would not occur. It follows that no mitigation measures would be required under this scenario.

16.9 Cumulative Effects

The only nearby wind farm with potential to have in combination shadow flicker impacts on the identified receptors within the theoretical zone of shadow flicker impact (10 x the rotor diameter) was identified as Cloncreen Wind Farm to the south of the Proposed Development. See Figure 16-3.

Shadow flicker models were also run to consider the cumulative effect of the proposed Ballinla wind turbines along with the nearby Cloncreen wind turbines. As can be seen in the image below there are a number of residential receptors which would potentially experience in combination Shadow Flicker effects by both wind farm developments.

The results of the model indicate that there are zero cumulative shadow flicker impacts on the identified receptors within the theoretical zone of shadow impact from both the Proposed Development and the Cloncreen Wind Farm.

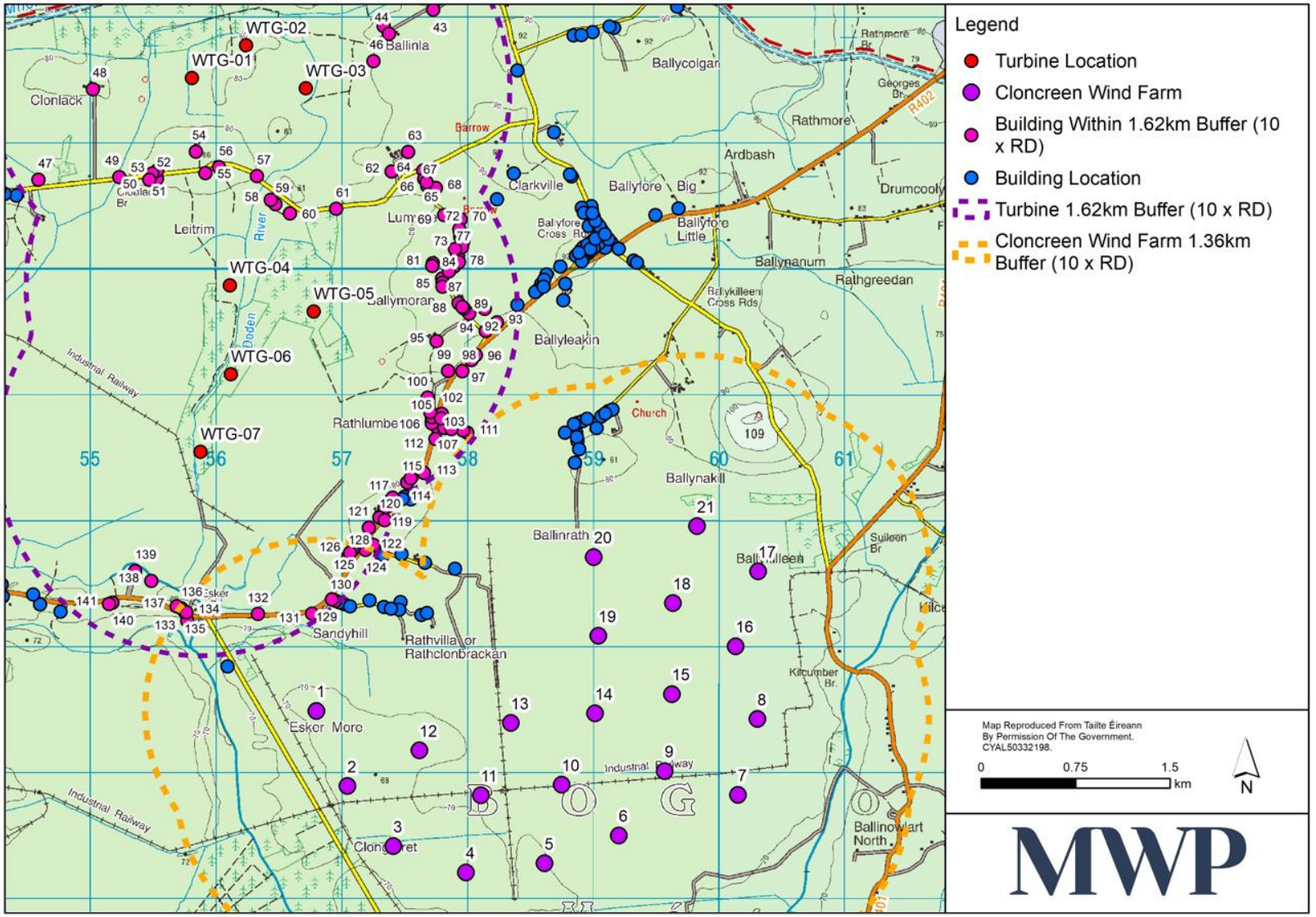

Figure 16-3 : Cumulative Impact Residential Receptors within 10 Rotor Diameters of a Turbine

16.10 Mitigations

The Applicant has a company policy of zero impact from shadow flicker. As standard the developer incorporates shadow flicker control modules on the turbines it installs. This means there will be zero shadow flicker impact from the Proposed Development and no mitigations are required.

16.11 Residual Effect

With the implementation of a zero shadow flicker policy, as provided in section 16.7 above, there is no residual shadow flicker impact.

16.12 Conclusion

The current 2006 Wind Energy Development Guidelines recommend that shadow flicker at offices and dwellings within 500m of a turbine should not exceed 30 hours per year or 30 minutes per day. The proposed development will comply with the recommended threshold criteria. The Applicant also has a zero shadow flicker impact policy which goes beyond the current guidelines and is in line with the 2019 Draft Revised Wind Energy Development Guidelines. The Proposed Development will comply with the Applicants zero shadow flicker impact policy.

The 2006 Wind Energy Development Guidelines state that at distances greater than 10 times rotor diameters from a turbine, the potential for shadow flicker is very low.

The output from the Shadow Flicker model determines that Shadow flicker could theoretically occur at up to 111 properties, under theoretical conservative conditions, within the 10 times rotor diameter study area.

The likelihood and duration of this effect occurring however depends upon certain combinations of factors namely sunshine, turbine and window locations, turbine orientation, weather conditions and intervening structures or vegetation. When average annual sunshine data is considered, the potential annual shadow flicker at all dwellings except one fall well below the best practice threshold of 30 hours per day.

When average daily sunshine data was considered, the shadow flicker potential at all dwellings fell below the 30-minute per day threshold.

However, the applicant is committed to implementing a zero-shadow flicker approach in line with the 2019 Draft Revised Wind Energy Development Guidelines. The shadow flicker control modules that will be installed on the turbines as standard will shut down the turbines when required ensuring that there will be no shadow flicker impact from the Proposed Development.

16.13 References

Offaly Wind Energy Strategy, Offaly County Council Development Plan 2021-2027

https://www.worldweatheronline.com/mullingar-weather-averages/westmeath/ie.aspx

Wind Energy Development Guidelines, DoEHLG (2006)

Draft Revised Wind Energy Development Guidelines, DoEHLG (2019)

http://xn--drmstrre-64ad.dk/wp-content/wind/miller/windpower%20web/en/tour/env/shadow/shadow2.html

http://met.ie

https://www.met.ie/cms/assets/uploads/2024/07/Mullingar-1971-2000-averages.html