Derrybrien Wind Farm Project

Gort Wind Farms Ltd.

Remedial Environmental Impact Assessment Report
Chapter 6 - Shadow Flicker

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6.1 Introduction

6.1.1 Chapter Scope

This chapter examines the potential for Shadow Flicker occurrence from the historic, current and future operations of Derrybrien Wind Farm on sensitive receptors in the surrounding area.

The Wind Energy Development Guidelines as issued by the Department of Environment, Heritage and Local Government, (DoEHLG, 2006) defines Shadow Flicker as a phenomenon that can occur where the blades of a wind turbine cast a shadow over a window in a nearby house or building and the rotation of the blades causes the shadow to flick on and off. This effect lasts only for a short period and happens only in specific combined circumstances such as:

- The sun not being obscured and at a low angle (after dawn and before sunset), and,
- The turbine(s) being directly between the sun and the affected property, and
- There being sufficient wind for the turbine to be in operation

Each latitude on the globe has its own shadow signature. In the northern hemisphere the sun stays in the southern part of the sky in winter and shadows are distributed in a V-shaped area to the north of a turbine. In summer the sun rises to the northeast and sunset is in the northwest, meaning that summer shadows are distributed in an A-shaped area, with the turbine in the tip of the A. In the northern hemisphere, there is no potential Shadow Flicker occurrence at receptors located due south of a wind turbine because the arc of the sun's movement is such that sunshine from the north does not occur.

The extent and impact of Shadow Flicker occurrence depends on the relative positions and orientation of nearby sensitive receptors and wind turbines, the presence of a narrow window opening facing the wind farm, the absence/presence of vegetation or other obstructions between the receptor and the wind farm.

The Guidelines (DoEHLG, 2006) identify that where Shadow Flicker occurrence could be a problem, developers should provide calculations to quantify the effect and where appropriate take measure to prevent or ameliorate the potential effect, such as turning off particular turbines at certain times. It is recommended that Shadow Flicker at neighbouring offices and dwellings within 500m of a wind turbine should not exceed 30 hours per year or 30 minutes per day. It is noted in the Guidelines that at distances greater than 10-rotor diameters from a turbine, the potential for shadow is low.

The Department for Energy and Climate Change (DECC, 2011) in the United Kingdom (UK) published a review carried out by Parsons Brinkerhoff to update the UK Shadow Flicker Evidence Base. A broad review and assessment of international guidance and best practice assessment methodologies was presented. Shadow Flicker was addressed in the companion guide to the Planning Policy Statement

"*Companion Guide to PPS22"* (ODPM, 2004) and cited in the Parsons Brinkerhoff (DECC, 2011) report stating the following:

> • *Shadow flicker only occurs inside buildings where the flicker appears through a narrow window opening;*
>
> • *Only properties within 130 degrees either side of north of the turbines can be affected at UK latitudes;*
>
> • *Shadow flicker has been proven to occur only within ten rotor diameters of a turbine position.*

A more recent study by LUC (2017) has recognised that Shadow Flicker may occur beyond the 10-rotor diameter threshold. This assessment considers the impacts over a wider distance. However, in reality, Derrybrien Wind Farm is widely removed from the nearest unoccupied dwelling (25-rotor diameter distance) and occupied dwellings (40-rotor diameter distance) and as such Shadow Flicker occurrence will be imperceptible or unnoticeable.

The DECC (2011) report further established that the ten-rotor diameter rule has been widely accepted across the globe (including eighteen European countries, the USA and Australia) and is deemed to be an appropriate area to assess Shadow Flicker occurrence. At distances greater than ten rotor diameters from a turbine, a shadow cast by the rotating blade will have dissipated due to light refraction to the extent that it will not be strong enough to result in the rapid change or flicker of the light incoming to a window of a property.

PPS22 (ODPM, 2004) stated that:

> *"At distance, the blades do not cover the sun but only partly mask it, substantially weakening the shadow. This effect occurs first with the shadow from the blade tip, the tips being thinner in section than the rest of the blade. The shadows from the tips extend the furthest and so only a very weak effect is observed at distance from the turbines."* (Page 177).

Computer models utilised for the prediction of Shadow Flicker occurrence cannot take the dissipation of shadow into account, and therefore show theoretical Shadow Flicker occurrence out to distances of many kilometres from a wind turbine. Extremely low level of shadow flicker will occur but would be imperceptible, as shadow dissipates with distance from the turbine.

As detailed in the rEIAR Chapter 4 (Population and Human Health), consideration is given to the potential health concerns associated with photosensitive Epilepsy attributable to flickering light. The DECC (2011) presents the following information;

> *"The operating frequency of a wind turbine will be relevant in determining whether or not shadow flicker can cause health effects in human beings. The National Society for Epilepsy advises that only 3.5 % of the 1 in 200 people in the UK who have epilepsy suffer from photosensitive epilepsy. The frequency at which photosensitive epilepsy may be triggered varies from*

person to person but generally it is between 2.5 and 30 flashes per second (hertz). Most commercial wind turbines in the UK rotate much more slowly than this, at between 0.3 and 1.0 hertz. Therefore, health effects arising from shadow flicker will not have the potential to occur unless the operating frequency of a particular turbine is between 2.5 and 30 hertz and all other pre-conditions for shadow flicker effects to occur exist." (Page 22).

In terms of effects giving rise to photosensitive epilepsy the general specification for the Vestas V52 850kW machine erected at Derrybrien Wind Farm indicates that the variable rotor speed range is 14.0 - 31.4 revolutions per minute (RPM). For the three bladed wind turbine this gives rise to a range of 42 to 94.2 blade flickers per minute. This equates to 0.7 to 1.57 flickers per second (Hertz) which is below the trigger level for photosensitive epilepsy.

In December 2019, the Draft Revised Wind Energy Development Guidelines (DoHPLG, 2019) were issued for public consultation by the Department of Housing, Planning and Local Government. The proposed revision to Shadow Flicker does not define a specific assessment approach for Shadow Flicker assessment but does remove the allowable Shadow Flicker budget referred to above (DoEHLG, 2006). Further emphasis is placed on the elimination of Shadow Flicker occurrence through appropriate design intervention and / or automated turbine shutdown through technological improvements, and as first suggested in the 'preferred draft approach" ((DoHPCLG / DoCCAE, 2017).

The following technical assessment predicts the impact for the worst-case theoretical Shadow Flicker occurrence from Derrybrien Wind Farm, and discusses alleviation / mitigation measures, where necessary. The modelling approach is purposely conservative to ensure any possible impacts are assessed / reported, thus giving appropriate consideration to the Draft Revised Wind Energy Development Guidelines (DoHPLG, 2019). The assessment considers all sensitive receptors within a 2km buffer of wind turbines, which according to the abovementioned guidance and best practice approaches is significantly beyond areas that could be impacted by actual Shadow Flicker occurrence.

All sensitive receptors in the vicinity of Derrybrien Wind Farm are situated at least 25 rotor diameters from any turbine location. The closest potential sensitive receptor has been confirmed as an unoccupied structure at just over 1.3km from turbine T46 (some 25 rotors diameters distance). The nearest occupied dwelling is at least 40 rotor diameters or 2.08km from any turbine location (Turbines T23 / T70 being closest), and although calculated theoretical Shadow Flicker may occur at these distances, any shadows will have dissipated or will be imperceptible.

To ensure consideration of all potential sensitive receptors that may have been present at any stage during the operational phase of Derrybrien Wind Farm to date, aerial imagery was reviewed from 2005 (OSI, 2005), 2005-2012 (OSI, 2012) and 2020 (Google Earth, 2020). No additional sensitive receptors were identified within the ten rotor diameters of a turbine since first operation in 2006. Furthermore, an

examination of the Planning Register was carried out and no potential applications were identified.

To assess potential cumulative Shadow Flicker occurrence, the current industry best practice guidelines (IWEA, 2012) stipulates that all wind farm developments within 2km should be considered. Sonnagh Old Wind Farm (GCC Reg. Ref. 00/3234), located 3.3km to the north west of Derrybrien Wind Farm was considered from a theoretical cumulative perspective. Within the overlapping buffers of 2km from all turbines between Derrybrien Wind Farm and Sonnagh Old Wind Farm, there are no sensitive receptors present and thus it can be assumed that there is no cumulative Shadow Flicker impact.

6.1.2 Statement of Authority

The technical assessment was prepared by Andrew Gardner (ESB). His qualifications include a Master's degree in Science in Ecology and Environmental Management (2009) and a Bachelor of Science in Environmental Studies and Sports Studies (2004) from the University of Liverpool. He has more than 15 years' experience undertaking assessments for wind farm developments, including Shadow Flicker assessment on behalf of ESB and other industry developers.

6.1.3 Methodology

The assessment of impacts has been undertaken with reference to the most appropriate guidance documents relating to Shadow Flicker for the project. These can be summarised as:

- Wind Energy Development Guidelines (DoEHLG, 2006), Department of Environment, Heritage and Local Government. Government of Ireland.
- Revised Wind Energy Development Guidelines (DoHPLG, 2019) Department of Housing, Planning and Local Government, Government of Ireland.
- Best Practice Guidelines for the Irish Wind Energy Industry, Irish Wind Energy Association (IWEA, 2012).
- Update of UK Shadow Flicker Evidence Base, Department for Energy and Climate Change, United Kingdom (Parsons Brinkerhoff) (DECC, 2011).
- Information Note: Review of the Wind Energy Development Guidelines 2006 "Preferred Draft Approach" (DoHPCLG / DoCCAE, 2017).

In addition to the specific guidance documents the following guidelines were considered and consulted for the purposes of this chapter:

- EPA Guidelines on the information to be contained in environmental impact assessment reports, Environmental Protection Agency, August 2017 (EPA, 2017).

- EPA Advice notes for Preparing Environmental Impact Statements, Draft September 2015 (EPA, 2015)

The technical assessment models the potential for worst-case theoretical Shadow Flicker occurrence from the current and future operations of Derrybrien Wind Farm and includes all sensitive receptors within a 2km radius of Derrybrien Wind Farm.

The modelling has been carried out using EMD WindPRO v3.3 computer software. The specialised SHADOW module calculates times throughout the year when the disc outlined by a rotating turbine blade viewed from the window of a business or house is in line with the sun and, therefore, when a potential for Shadow Flicker occurrence exists.

A zone of visual influence calculation, using a digital terrain model, is performed before the flicker calculation to ensure that all visible wind turbines contribute to calculated flicker values. The module allows for the calculation and documentation of flickering effects at specified sensitive receptors in terms of hours per year and minutes per day.

The SHADOW module can calculate the theoretical “worst case” results (no cloud cover, turbines always rotating and wind direction always resulting in turbines facing sensitive receptors") or the "real expected values", based on assumptions on solar statistics and operating hours divided by wind direction.

Greenhouse mode is utilised to ensure that sensitive receptors do not face any direction, but instead face all directions, for instances where more than one turbine may cause potential Shadow Flicker occurrence.

The assessment has been conservative and modelled the worst-case theoretical scenario for each appropriate sensitive receptor location, whereby all limiting factors in the software module have been removed. The exposure threshold has been set to capture to all potential shadows cast, including the full blade length.

The calculations were conducted based on a notional window measuring 5m wide x 5m high and directly facing all turbines (greenhouse mode), with the bottom of the window assumed to be at height of 1m above the ground. This represents the equivalent of an approximate ground floor window that extends to the equivalent height of a two-storey building (6m).

Further to the above, the following was assumed in the analysis:

- All sensitive receptors have windows that are not obscured by curtains or blinds.
- There is no intervening vegetation (such as trees), or objects between turbines and receptors.

The input and source of data used in this assessment are as follows:

- Terrain elevation model - sourced from Ordnance Survey Ireland.
- Sensitive receptor locations - derived from the An Post Geodirectory (2019) and further assessed utilising aerial photography from 2005 (OSI, 2005), 2005-2012 (OSI, 2012), and 2020 (Google Earth, 2020) and site survey.
- Current turbine locations - Derrybrien Wind Farm and Sonnagh Old Wind Farm as-built turbine locations (Refer to Appendix A).
- Wind turbine dimensions as sourced from the original equipment manufacturer, and developers.

6.1.4 Difficulties Encountered

No difficulties were encountered during the technical assessment. The model inputs as referred to in Section 6.1.3 were identifiable.

6.2 Baseline Environment

The baseline environment for the assessment of Shadow Flicker occurrence is the commencement of the operational phase of Derrybrien Wind Farm.

Wind turbines locations are presented in Appendix A.

Sensitive receptor locations have been initially identified utilising the An Post Geodirectory (2019), and further assessed using aerial photography. A ground-based survey was carried out to confirm the accuracy of the information considered. The Galway County Council Planning Register was reviewed to confirm the presence of potential future additional receptors currently in planning process. Table 6-1 Sensitive receptor locations within 2km of turbines at Derrybrien Wind Farm (ITM) presents all sensitive receptors identified within 2km of turbines at Derrybrien Wind Farm.

Table 6-1 Sensitive receptor locations within 2km of turbines at Derrybrien Wind Farm (ITM)

Receptor name	Easting	Northing
R01 (Unoccupied)	561034	703694

The appropriate wind turbine parameters were confirmed for the relevant wind farms and are presented in

Table 6-2.

Table 6-2 Wind turbine models and dimensions

Wind Farm Name	Turbine Model	Turbine Hub Height	Rotor Diameter
Derrybrien Wind Farm	Vestas V52 850kW	49.0m	52.0m
Sonnagh (Old) Wind Farm	Vestas V52 850kW	44.0m	52.0m

6.3 Impact of the Development

6.3.1 Impacts which have occurred

6.3.1.1 Construction: circa June 2003-March 2006

Shadow Flicker occurrence can only be present during the operational phase of a project, when wind turbines are rotating. There can be no impact during construction.

6.3.1.2 Offsite peat slip works: Oct 2003-end 2005

Shadow Flicker occurrence can only be present during the operational phase of a project, when wind turbines are rotating. There was no impact during the period of offsite peat slip works.

6.3.1.3 Operation Phase: 2006 - Mid 2020

Shadow Flicker analysis was carried out for a single sensitive receptor (R01) identified within a 2km radius of wind turbines at Derrybrien Wind Farm, using EMD WindPRO v3.3 software to predict the potential for shadow flicker occurrence. The nearest sensitive receptor is the unoccupied structure (R01), at a distance of 1.3km from the nearest turbine and the no other occupied sensitive receptors are within 2.08km.

No intervening vegetation between the turbines and the sensitive receptor location has been considered and is reflective of the conservative modelling approach.

The extent of shadow casting is determined principally by (a) the turbine's hub height and (b) the size of the turbine's rotor blade diameter.

The Shadow Flicker assessment results for Derrybrien Wind Farm based on a rotor diameter of 52 m (and hub height of 49 m) is presented, for sensitive receptors, in **Error! Reference source not found.**. Copies of the results sheets from WindPRO v3.3, are also included in Appendix B. The rotor diameter of wind turbine generators at Derrybrien Wind Farm is 52m. The nearest property (unoccupied) is located circa 25 rotor diameters from the nearest property turbine.

Table 6-3 Predicted Potential worst case theoretical Shadow Flicker occurrence from Derrybrien Wind Farm

Shadow Receptor	Expected Shadow Hours / yr	Annual Shadow Days / yr	Maximum Shadow Hours / day
R01	08:36	71	0:09

The specific turbines contributing to theoretical Shadow Flicker occurrence at sensitive receptor R01, are presented in Appendix C (T23, T70 and T71).

Other potential receptors, such as humans or animals (livestock) could be temporarily impacted by the flickering effect within 10 rotor diameters of turbines (520m). Due to the relative remoteness of Derrybrien Wind Farm, and extensive forestry plantation in the site surrounds; expected exposure to humans and livestock would be minimal.

No complaints or notifications for Shadow Flicker occurrence were received by Gort Wind Farm Ltd. during the operational phase of Derrybrien Wind Farm.

The predicted worst case theoretical Shadow Flicker that may have occurred at the sensitive receptor R01 during the Operation Phase (2006 - Mid 2020) have no likely significant effects. Any effects would be momentary, and very unlikely to be noticeable due to the receptors distance from the nearest turbine (1.3km).

Shadow flicker effects during this phase are summarised based on EPA Environmental Impact Assessment Report Guidelines (EPA, 2017) as follows:

Quality	*Significance*	*Probability*	*Duration*
Negative	Imperceptible to Not Significant	Unlikely	Momentary over the Long Term

6.3.2 Impacts which are occurring

6.3.2.1 Operation

Shadow Flicker analysis was carried out for a single sensitive receptor (R01) identified within a 2km radius of wind turbines at Derrybrien Wind Farm, using EMD WindPRO v3.3 software to predict the potential for shadow flicker occurrence. The nearest sensitive receptor is the unoccupied structure (R01), at a distance of 1.3km from the nearest turbine and there are no other occupied or unoccupied sensitive receptors within 2.08km.

No intervening vegetation between the turbines and the sensitive receptor location has been considered and is reflective of the conservative modelling approach.

Predicted impact

Results, which are presented in Appendix B, are summarised in Table 6-4, where the worst case theoretical Expected Annual Hours per year, worst case theoretical Maximum Daily Hours per day and worst case theoretical Annual Shadow Days per

year are presented for those sensitive receptors where the presence of Derrybrien Wind Farm contributes to potential of Shadow Flicker occurrence.

The calculations indicate that the single sensitive receptor (R01) has potential theoretical Shadow Flicker occurrence, but predictions do not exceed the guidelines (DoEHLG, 2006) of 30 minutes per day or 30 hours per year. It is worth noting the theoretical predicted maximum expected annual occurrence of 08:36 hours per year at R01, is well below the recommended limit.

As R01 is at least 25 rotor diameters from the nearest turbine location, and although calculated theoretical Shadow Flicker may occur at these distances, any shadows, if they were to occur would likely be imperceptible.

The predicted worst case theoretical Shadow Flicker that may occur at the sensitive receptor R01 during operation have no likely significant effects. Any effects would be momentary, and very unlikely to be noticeable due to the receptors distance from the nearest turbine (1.3km).

Shadow flicker effects during this phase are summarised based on EPA Environmental Impact Assessment Report Guidelines (EPA, 2017) as follows:

Quality	*Significance*	*Probability*	*Duration*
Negative	Imperceptible to Not Significant	Unlikely	Momentary over the Long Term

Table 6-4 Predicted Potential worst case theoretical Shadow Flicker occurrence from Derrybrien Wind Farm

Shadow Receptor	**Expected Shadow Hours / yr**	**Annual Shadow Days / yr**	**Maximum Shadow Hours / day**
R01	08:36	71	0:09

Ambient environmental conditions such as wind direction or general climate have not been necessary to adjust as the assessment indicates that an imperceptible flickering effect would be unlikely to be experienced at the single sensitive receptor (R01) identified due to its distance from turbines.

Modelling with “real expected values” in EMD WindPro v3.3 would further reduce the modelled impacts.

- **Rotor Plane**: It would be highly unusual for the wind and, by extension, the plane of the turbine rotor to track the sun (i.e. to remain continually facing the sun), thereby creating the conditions for a potentially greater level of Shadow Flicker. It is far more likely that, for the vast majority of the time, the plane of the rotor will not be facing the sun and so there will be a significant decrease in the potential for Shadow Flicker during these

periods. In addition, there will be occasions when the rotor plane is parallel to the sun direction and no flicker will occur. The likely orientation of the rotor for each turbine can be factored into the Shadow Flicker calculations using wind measurements taken on site. (An alternative assumption of a random rotor position leads to a reduction of approximately 63% of the theoretical results).

- **Sunshine Hours**: The sun will not be shining during all daylight hours. The long-term mean value is typically less than 30% of daylight hours, but evidently this varies from month to month. Records from the nearest suitable meteorological station, for which such records are available (Shannon Airport), indicate average daily sunshine hours ranging from 1.4 hours in December to 5.8 hours in May (Met Eireann, 2019).
- **Local Wind Regime**: Long-term wind speed records from a meteorological mast within the site boundary can be applied to take account of the wind regime on the site, including factors such as the prevailing wind direction and periods when wind speed is below the turbine cut-in wind speed.
- **Vegetation screening:** The lands around Derrybrien Wind Farm are heavily forested and will provide extensive screening of onsite turbines.
- **Actual views:** further assessment of actual views from the sensitive receptor will likely reduce the predicted values due to blocked views from trees or vegetation, or other obstacles.

Further to the above, turbines will be unavailable for operation at certain times due, for instance, to routine and emergency maintenance, substation outages, etc. These factors also reduce potential Shadow Flicker occurrence, but they are not reflected in the results.

The assessment indicates an extremely low theoretical potential for a flickering effect to occur at the single sensitive receptor (R01) and it is not anticipated that any Shadow Flicker impact will occur.

6.3.2.2 Mid 2020 - end of operational phase

The predictions for theoretical Shadow Flicker occurrence during the continuing operation phase of Derrybrien Wind Farm are a replication of the above results for the periods between initial operations commencing in 2006 through to Mid 2020 as presented in Section 6.3.1.3 and Section 6.3.2.1.

The predicted worst case theoretical Shadow Flicker occurrence that may theoretically occur at sensitive receptor R01 to the end of the operational phase are summarised based on effects specified EPA Environmental Impact Assessment Report Guidelines (EPA, 2017) as follows:

Negative	Imperceptible to Not Significant	Unlikely	Momentary over the Long Term

6.3.2.3 Decommissioning

There no potential for Shadow Flicker occurrence after the decommissioning of Derrybrien Wind Farm.

6.4 Cumulative Impacts

6.4.1 Cumulative impacts which may have occurred

6.4.1.1 Introduction

Shadow Flicker occurs from the shadow cast on a sensitive receptor by wind turbine blades intersecting sunlight. As such, cumulative impacts can only occur with other wind farms. No Shadow Flicker can occur with other cumulative projects as identified in Chapter 2 and the only potential for Shadow Flicker to occur with the Sonnagh Old Wind Farm and the Keeldeery Wind Farm are considered.

6.4.1.2 Sonnagh Old Wind Farm

Sonnagh Old Wind Farm (GCC Reg. Ref. 00/3234) was considered as part of a wider Shadow Flicker analysis to assess potential cumulative impacts using industry best practice (IWEA, 2012). Wind turbine locations are presented in Appendix A. It was identified that there are no sensitive receptors within the overlapping cumulative impact area (2km buffer zone) between both wind farms (Figure 6.1).

On that basis there is no potential cumulative impact for Shadow Flicker occurrence from Derrybrien Wind Farm.

6.4.1.3 Keelderry Wind farm

Keelderry Wind Farm was granted Planning Permission by Galway County Council (Reg. Ref. 00/5248) and on appeal by An Bórd Pleanála (ABP -PL 07 125978) to Keelderry Windfarm Ltd. in July 2002 for a 48 No. wind turbine development approximately 3 km to the west of the Derrybrien Wind Farm. An extension of duration of planning permission until September 2011 was granted in September 2007 (Reg. Ref. 07/3345). Internal access roads were constructed circa 2007 but the rest of the development was never built. Shadow Flicker occurrence can only be present during the operational phase of a project, when wind turbines are rotating. Therefore, no Shadow Flicker can occur.

On that basis there is no potential cumulative impact for Shadow Flicker occurrence from Derrybrien Wind Farm.

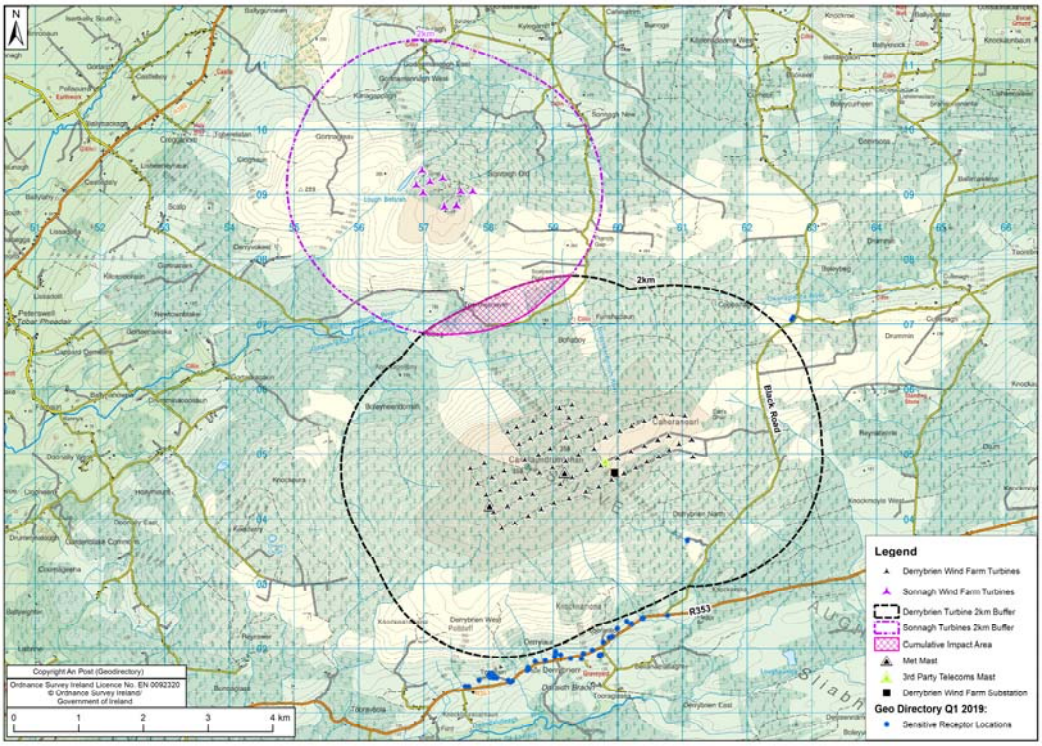

Figure 6-1 Shadow Flicker cumulative impact area

6.4.2 Cumulative impacts which are occurring

There is no potential cumulative impact for shadow flicker occurrence from Derrybrien Wind Farm as detailed in Section 6.4.1.

6.4.3 Cumulative impacts which are likely to occur

There is no potential for a cumulative impact Shadow Flicker occurrence from Derrybrien Wind Farm as detailed in Section 6.4.1.

6.5 Remedial (Mitigation) Measures and Monitoring

6.5.1 Remedial Measures & Monitoring for significant effects

All model predictions are within the Wind Energy Development Guidelines (DoEHLG, 2006) of 30 minutes per day, or 30 hours per year. Therefore, mitigation was not and will not be required.

Shadow flicker from Derrybrien Wind Farm cannot occur in the absence of wind turbines operational on site and hence no Shadow Flicker can occur during construction and there is no potential for Shadow Flicker occurrence after decommissioning.

6.5.2 Mitigation Measures for non-significant effects

The assessment has been carried out based on worst case theoretical modelling and the identified sensitive receptor (R01) will not be significantly affected. It is evident that, without operational constraints, the expected potential occurrence of Shadow Flicker at Derrybrien Wind Farm is well below DoEHLG (2006) Wind Energy Development Guidelines.

If a complaint arises relating to shadow flicker it will be fully investigated and mitigation to prevent a re-occurrence will be put in place.

The mitigation proposed will be in the form of a programmed hard shutdown of the identified wind turbines (T23, T70 and T71 as presented in Appendix C) giving rise to the flicker effect and/or suitable landscaping to provide intervening foliage to shield from any such flicker.

6.6 Residual Impacts

Shadow Flicker occurrence is a temporary impact, which can only occur whilst turbines are in operation. In the unlikely event that momentary Shadow Flicker occurs the mitigation described in 6.5.2 above will be implemented and no residual impact will occur.

6.7 Summary Assessment of Draft WEDG 2019 (DoHPLG, 2019)

Based on the above assessment using a conservative worst-case approach, utilising appropriate industry best practice computational modelling; it can be confirmed that Derrybrien Wind Farm will conform with the requirements detailed in the draft Revised Wind Energy Development Guidelines (DoHPLG, 2019).

Notwithstanding the various potential mitigation measures detailed in 6.5.2 above, the separation distance between the identified sensitive receptor and all wind turbines (minimum 25 rotor diameter distance) at Derrybrien Wind Farm will be sufficient to eliminate the potential for Shadow Flicker occurrence on the grounds that all shadows will have dissipated at that distance.

6.8 Conclusions

It is considered that significant impacts from Shadow Flicker occurrence has not been an issue in the past and will not arise during future operations.

6.9 References

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