View Point 29

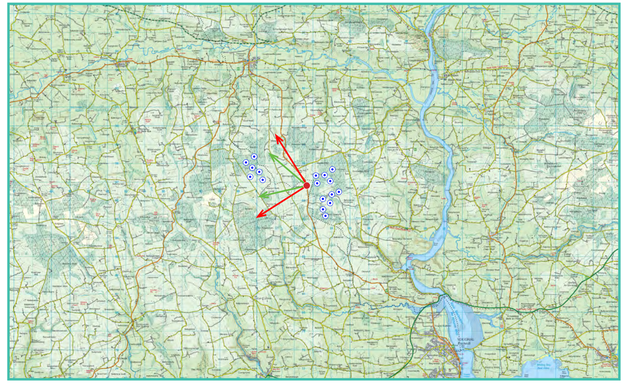
Breeda

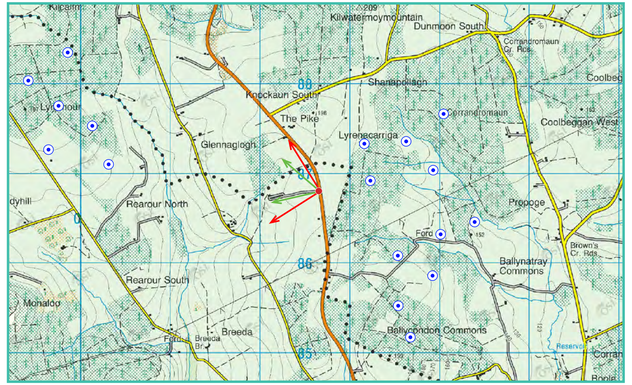
Photomontage 29 West

View Point: View from the R634 regional road in the townland of Breeda. This viewpoint is located along a designated scenic route in the Cork County Development Plan 2014. This viewpoint is located approximately 570m west of the nearest turbine (T5). Additional 90° and 53.5° views are shown from this viewpoint in order to show all the turbines visible from this location.

View point grid reference	E 602,613 N 586,856
Date of image taken	17.06.2022
Time of image taken	13:08
View point elevation	179m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	283°
Horizontal extent of proposed turbines	21°
Distance to nearest proposed turbine	570m (T5)
Number of proposed turbines visible	6/17
Turbine Hub Height	93.5m
Turbine Tip Height	150m
Turbine Rotor Diameter	113m
Camera	Canon 5D Mark III / Full Frame Sensor.
Lens	50mm Lens
Tripod	Manfrotto 190X extended to approx 1.5m.
Map Licence	© Ordnance Survey Ireland. All rights reserved. Licence number CYAL50267517

View point relative to 20km radius.


View point relative to wind farm site.



Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Wind Farm

Existing Wind Farms

Proposed Met Mast

Prepared by

MKO
Planning & Environmental Consultants
Tuam Road, Galway.

Tel: (091) 73 56 11
E-mail: info@mkoireland.ie
Website: www.mkoireland.ie

90° View Extent

53.5° View Extent

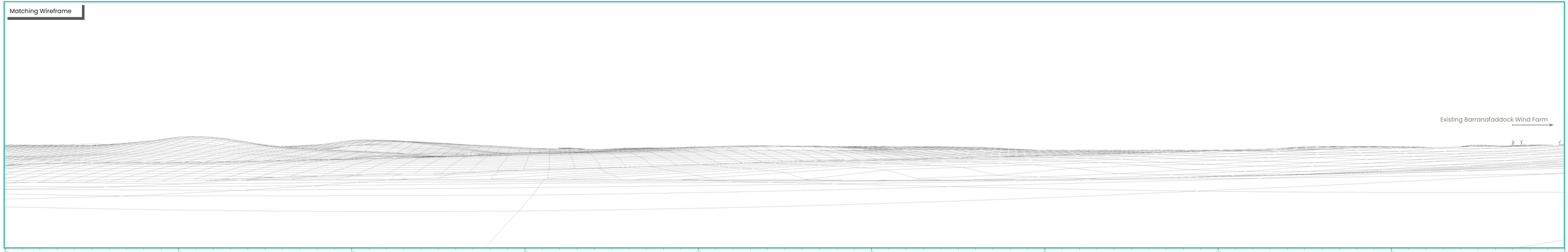
0° Included Horizontal Angle (90°)

45°

90°

Existing View at 90°

Matching Wireframe



View Direction (Degrees)

0° Included Horizontal Angle (90°) 45° 90°

Proposed Photomontage with Cumulative at 90°

Matching Wireframe

0° Included Horizontal Angle (53.5°)

26.5°

53.5°

0° Included Vertical Angle (18.2°)

9.1°

18.2°

Proposed Photomontage with Cumulative at 53.5°

100°

110°

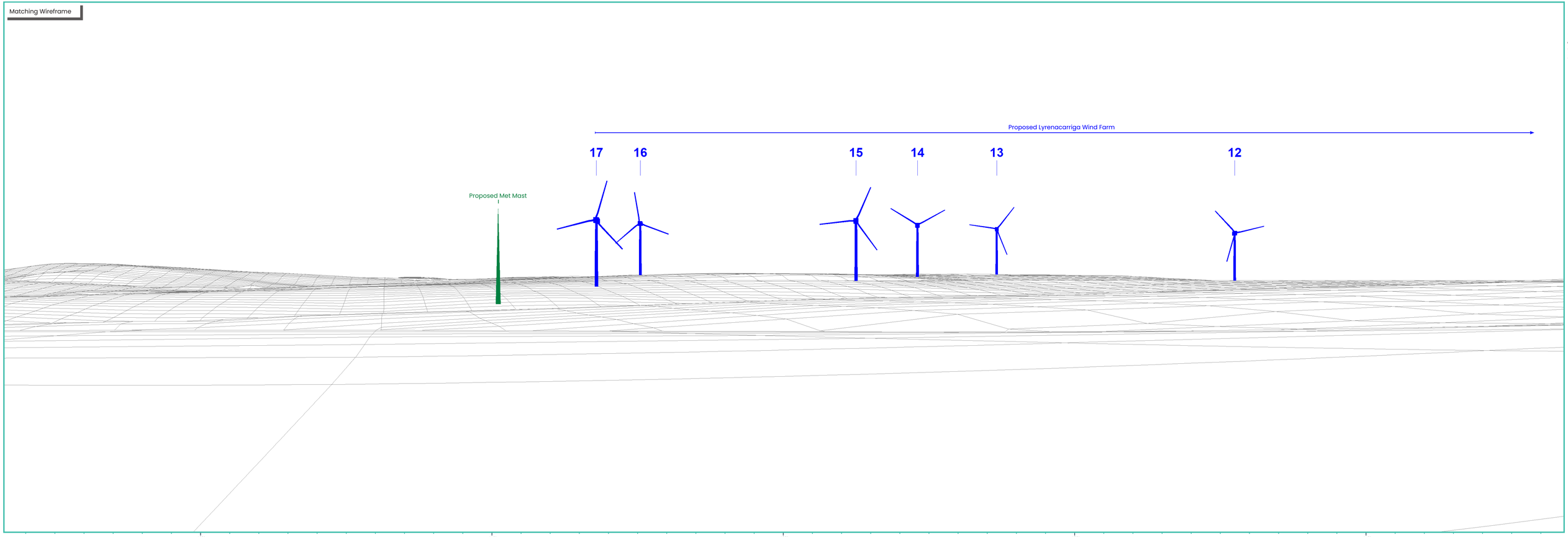
120°

130°

140°

View Direction (Degrees)

Matching Wireframe



View Point 29

Breeda

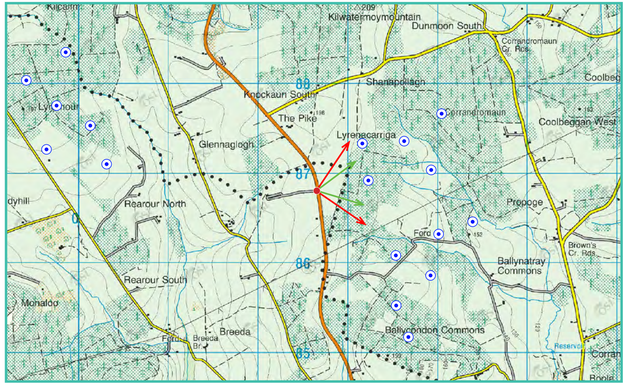
Photomontage 29 North East

View Point: View from the R634 regional road in the townland of Breeda. This viewpoint is located along a designated scenic route in the Cork County Development Plan 2014. This viewpoint is located approximately 570m west of the nearest turbine (T5).

View point grid reference	E 602,613 N 586,856
Date of image taken	17.06.2022
Time of image taken	13:08
View point elevation	179m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	79°
Horizontal extent of proposed turbines	67°
Distance to nearest proposed turbine	570m (T5)
Number of proposed turbines visible	7/17
Turbine Hub Height	93.5m
Turbine Tip Height	150m
Turbine Rotor Diameter	113m
Camera	Canon 5D Mark III / Full Frame Sensor.
Lens	50mm Lens
Tripod	Manfrotto 190X extended to approx 1.5m.
Map Licence	© Ordnance Survey Ireland. All rights reserved. Licence number CYAL50267517

View point relative to 20km radius.


View point relative to wind farm site.



Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Wind Farm

Existing Wind Farms

Proposed Met Mast

Prepared by

MKO
Planning & Environmental Consultants
Tuam Road, Galway.

Tel: (091) 73 56 11
E-mail: info@mkoireland.ie
Website: www.mkoireland.ie

90° View Extent

53.5° View Extent

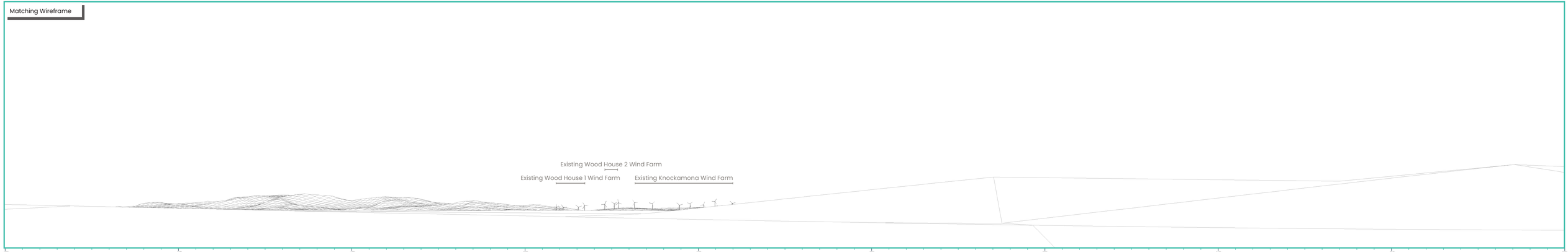
0° Included Horizontal Angle (90°)

45°

90°

Existing View at 90°

Matching Wireframe



View Direction (Degrees)

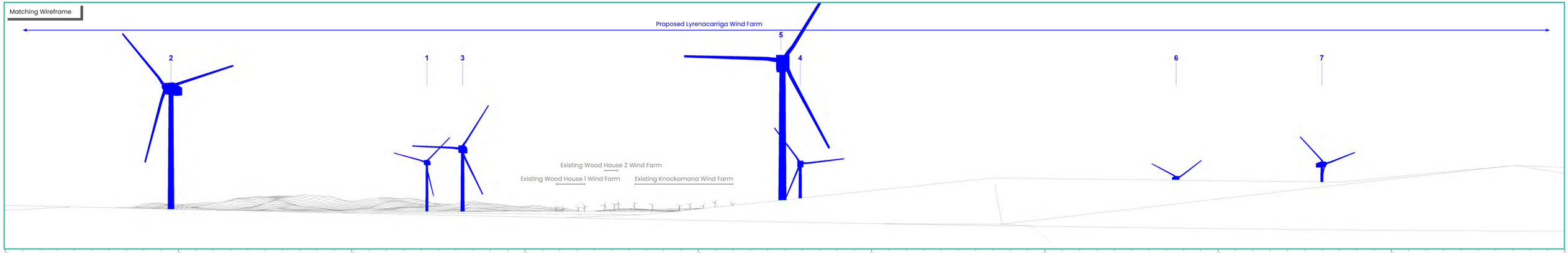
0° Included Horizontal Angle (90°)

45°

90°

Proposed Photomontage with Cumulative at 90°

Matching Wireframe



View Direction (Degrees)

0° Included Horizontal Angle (53.5°)

26.5°

53.5°

0° Included Vertical Angle (18.2°)

9.1°

18.2°

Proposed Photomontage with Cumulative at 53.5°

100°

110°

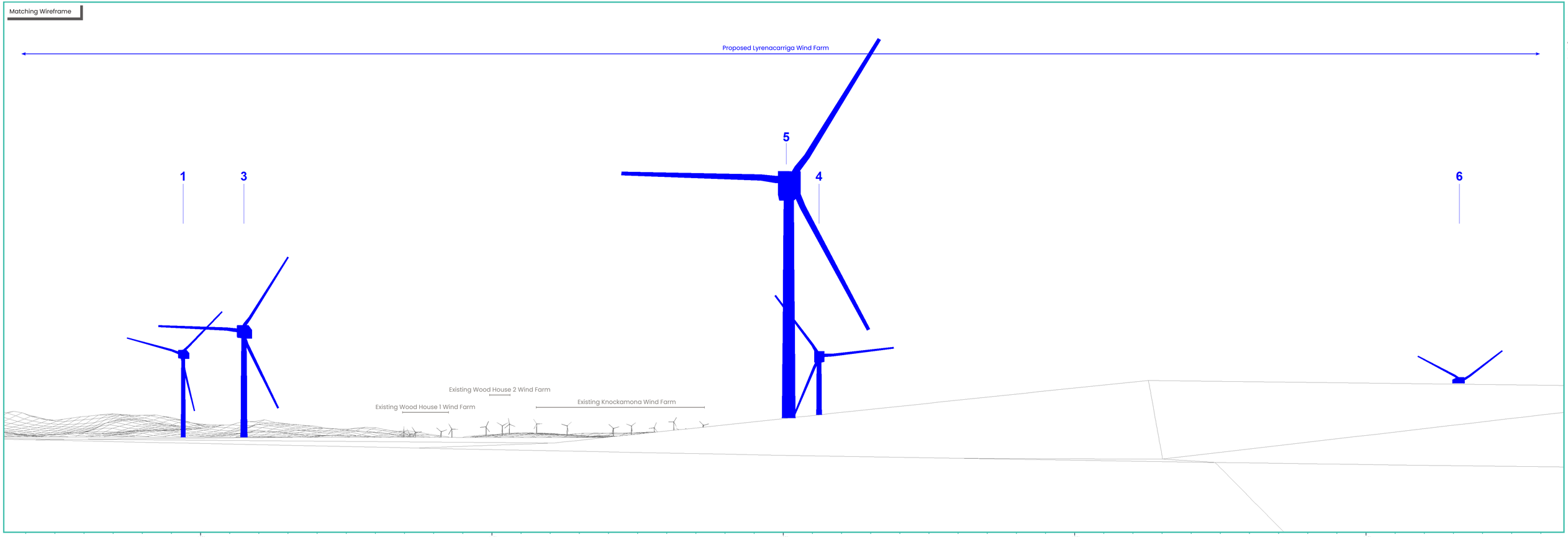
120°

130°

140°

View Direction (Degrees)

Matching Wireframe

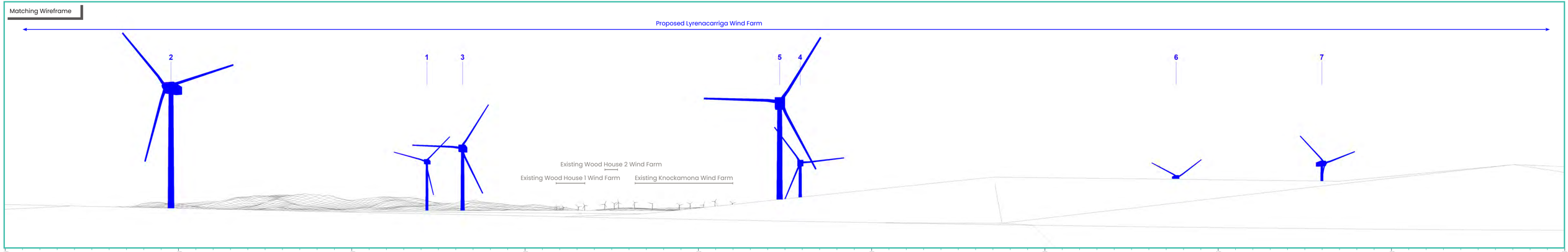


TURBINE T5 ALTERNATIVE LOCATION

0° Included Horizontal Angle (90°) 45° 90°

Proposed Photomontage with Cumulative at 90° (with alternative T5 location)

Matching Wireframe



View Direction (Degrees)

0° Included Horizontal Angle (53.5°)

26.5°

53.5°

Proposed Photomontage with Cumulative at 53.5° (with alternative T5 location)

0° Included Vertical Angle (18.2°)

9.1°

-18.2°

100°

110°

120°

130°

140°

View Direction (Degrees)

Matching Wireframe

Proposed Lyrenacarriga Wind Farm

1

3

5

4

6

Existing Wood House 2 Wind Farm

Existing Wood House 1 Wind Farm

Existing Knockamona Wind Farm

100°

110°

120°

130°

140°

View Direction (Degrees)

0° Included Vertical Angle (18.2°)

9.1°

18.2°

View Point 29

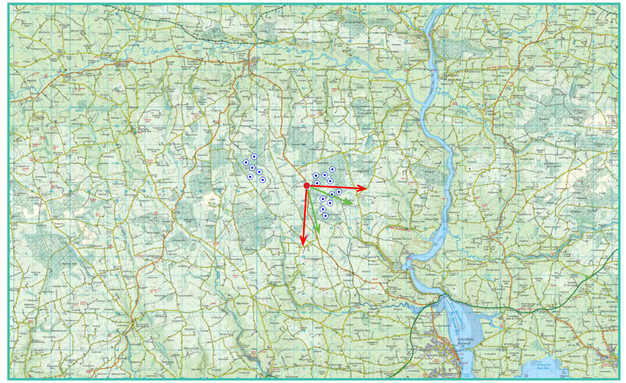
Breeda

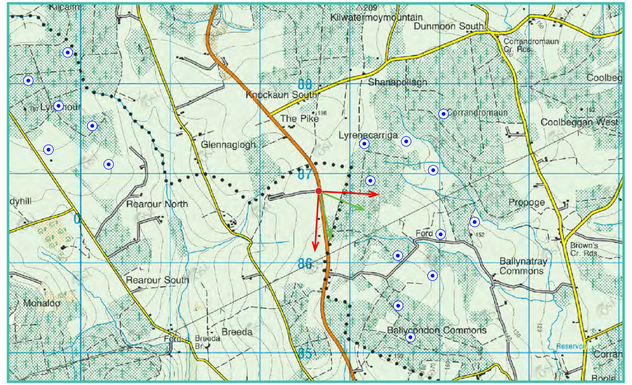
Photomontage 29 South East

View Point: View from the R634 regional road in the townland of Breeda. This viewpoint is located along a designated scenic route in the Cork County Development Plan 2014. This viewpoint is located approximately 570m west of the nearest turbine (T5).

View point grid reference	E 602,613 N 586,856
Date of image taken	17.06.2022
Time of image taken	13:08
View point elevation	179m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	138°
Horizontal extent of proposed turbines	29°
Distance to nearest proposed turbine	570m (T5)
Number of proposed turbines visible	6/17
Turbine Hub Height	93.5m
Turbine Tip Height	150m
Turbine Rotor Diameter	113m
Camera	Canon 5D Mark III / Full Frame Sensor.
Lens	50mm Lens
Tripod	Manfrotto 190X extended to approx 1.5m.
Map Licence	© Ordnance Survey Ireland. All rights reserved. Licence number CYAL50267517

View point relative to 20km radius.


View point relative to wind farm site.



Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Wind Farm

Existing Wind Farms

Proposed Met Mast

Prepared by

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90° View Extent

53.5° View Extent

0° Included Horizontal Angle (90°)

45°

90°

Existing View at 90°

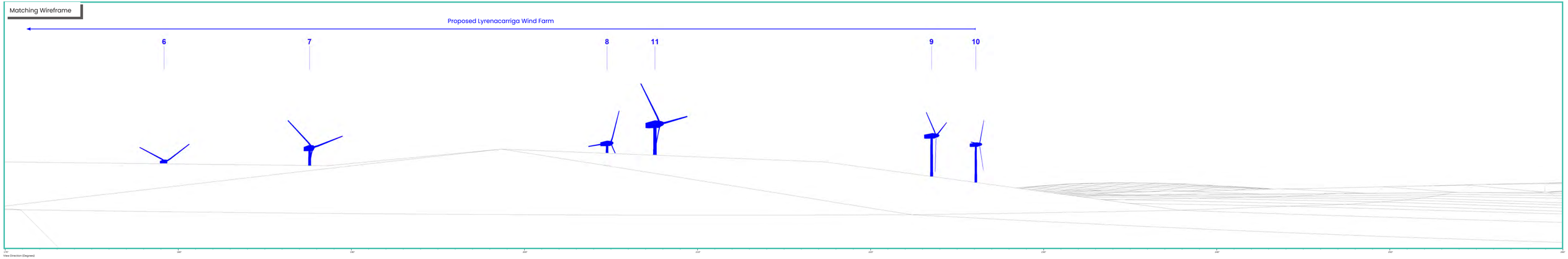
Matching Wireframe

View Direction (Degrees)

0° Included Horizontal Angle (90°) 45° 90°

Proposed Photomontage with Cumulative at 90°

Matching Wireframe



0° Included Horizontal Angle (53.5°)

26.5°

53.5°

0° Included Vertical Angle (18.2°)

9.1°

-18.2°

Proposed Photomontage with Cumulative at 53.5°

100°

110°

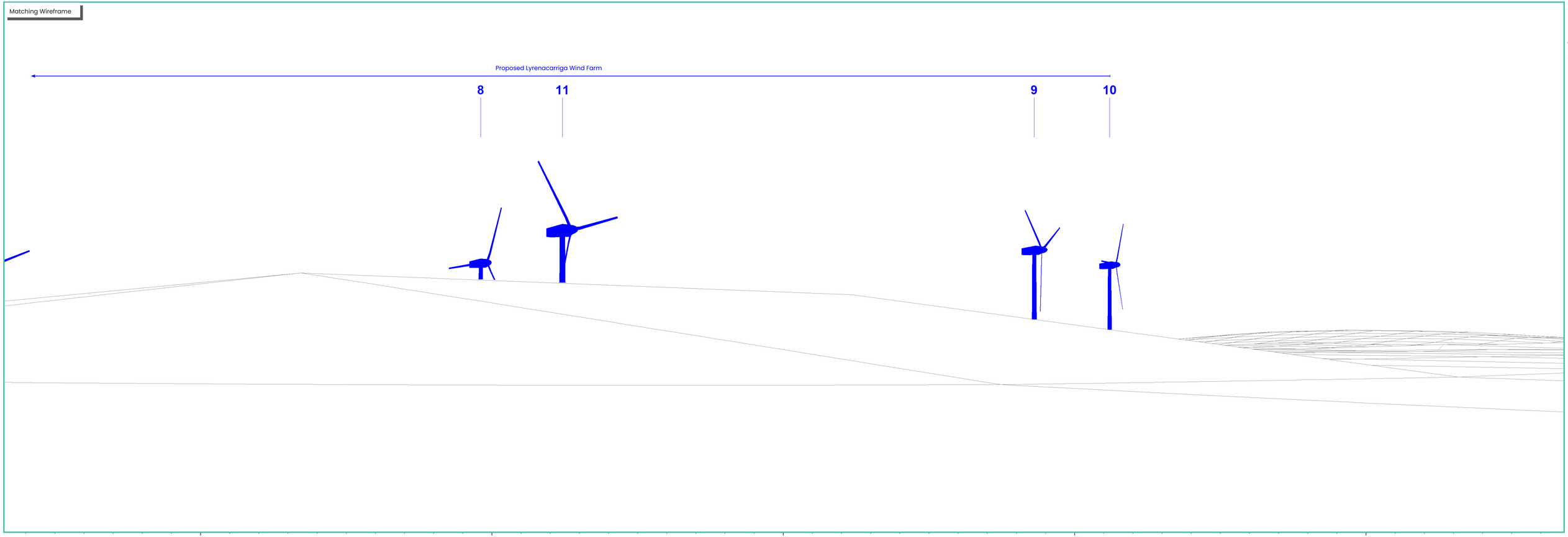
120°

130°

140°

View Direction (Degrees)

Matching Wireframe



APPENDIX 6

FI TOBAR REPORT

Appendix 6 Further Information and third party responses to concerns raised regarding the Proposed Lyrenacarriga WF, Counties Cork and Waterford

Author: Annette Quinn

Client: MKO Ireland Ltd

C/O MKO Tuam Road,

Galway

Date: 01/07/2022

Table of Contents

1 INTRODUCTION

Tobar Archaeological Services Ltd prepared the archaeology and cultural heritage chapter of the EIAR which accompanied the planning application for a proposed wind farm at Lyrenacarriga, Counties Waterford and Cork. This document consists of the responses to a request for Further Information (ABP Ref 309121-21 issued by An Bord Pleanala as well as addressing third party concerns.

Miriam Carroll and Annette Quinn are directors of Tobar Archaeological Services LTD. Miriam and Annette both graduated from University College Cork in 1998 with a Masters degree in Methods and Techniques in Irish Archaeology. Both are licensed by the Department of Housing, Local Government and Heritage to carry out excavations and are members of the Institute of Archaeologists of Ireland. Annette Quinn and Miriam Carroll have been working in the field of archaeology since 1994 and have undertaken numerous projects for both the private and public sectors including excavations, site assessments (EIAR) and surveys. Miriam Carroll and Annette Quinn are directors of Tobar Archaeological Services which has been in operation for 19 years.

1.1 An Bord Pleanála request for Further Information

The request for further information largely reflected the concerns of Waterford County Council: '*the potential impact of the proposed development on the setting of historic houses/castles and demesnes along the Blackwater River Valley from Villierstown to Youghal Bridge on both banks of the River*'.

1.1.1 Responses

1.1.1.1 Concerns regarding the 5km Distance and Methodology utilised in the Chapter 14 of the EIAR:

Concerns were raised regarding the 5km study area in chapter 14 of the EIAR. Details regarding the methodology utilised are presented in Chapter 14 section 14.2.5. There is no legislative distance or industry standard approach for the assessment of impacts on the setting of cultural heritage assets, more specifically, built heritage. All SMRs, RMPs, RPS, and NIAH structures within 5km of each turbine were included in the EIAR in order to assess potential effects on setting. This is based on professional judgement and experience. The majority of RPS structures consist mainly of items such as houses, castles, gate lodges all of which are located on private land to which the public have limited or no access. Their visitor numbers are confined mainly to the landowners therefore. National Monuments in State Care, however, have public access and have conceivably higher visitor numbers and therefore potential effects on setting on the latter are extended to 10km.

1.1.1.2 Concerns regarding lack of assessment of Built Heritage Protected Structures

The County Development Plan contains a list of Protected Structures to which a number of objectives and policies apply. A protected structure is a structure that a planning authority considers to be of special interest from an architectural, historical, archaeological, artistic, cultural, scientific, social or technical point of view. If you are the owner or occupier of a protected structure, you are legally obliged to prevent it becoming endangered, whether through damage or neglect. Protection is given to these structures under Part IV of the Planning and Development Act 2000 and a structure must be listed on the planning authority's Record of Protected Structures (RPS) to qualify for protected status

under the Act. Each planning authority is obliged to keep a RPS as part of its development plan. There are no instances where the proposed development contravenes the policies of the County Development Plans of Cork or Waterford in that neither a Protected Structure nor its associated curtilage will be impacted. There are no such structures within the footprint of the proposed development site. The policies of the CDP focus on the reuse, regeneration, administration of incentives / grant schemes for improvement to Protected structures, the maintenance and protection of structures listed in the RPS.

Policy AH 5 addresses the protection of the main building and curtilage of Protected Structures from any works which would visually or physically detract from the special character of the main structure or any structures within the curtilage.

There are no instances where either the main building or associated curtilage or structures within the curtilage will be significantly or adversely impacted by the proposed development. The ability to see turbines from a structure does not necessarily indicate a significant or adverse effect. Chapter 14 acknowledges the following regarding structures within 5km of the proposed turbines '*The Zone of Theoretical Visibility suggests that 13-17 turbines may be visible from the majority of locations where RMPs/RPS and NIAH structures are located within 5km from the proposed Turbines. This impact is considered to be slight/moderate. No RPS or NIAH is located in the immediate vicinity of any of the proposed turbines. All built heritage structures are situated at a remove from the proposed turbine locations. In the wider landscape setting, the ZTV (used in the LVIA Chapter 12) shows that there may be varying levels of visibility from the locations of the built heritage structures and some where there is no visibility, in particular from the south*'. Detailed assessment through the use of GIS was undertaken to arrive at this conclusion.

1.1.1.3 Concerns regarding the Impact on the setting of Ballynatray House and Demesne and Molana Abbey

As specified above and in chapter 14 of the EIAR (Section 14.4.5.3), the Zone of Theoretical Visibility (ZTV) model, which was utilised in the LVIA chapter, was also used as part of the Cultural Heritage Assessment to ascertain what, if any, visibility would be possible from various cultural heritage assets. Detailed GIS analysis was undertaken to arrive at a number of conclusions regarding the effects on setting as a result of the proposed turbines. Molana Abbey and Ballynatray House (NIAH ref 22903718) in Ballynatray demesne were located within the 5km assessment zone and therefore included in the analysis. Both are located in an area of the ZTV that has no visibility of the proposed turbines. This is due to topography and the nature of river valleys which tend to be lower in the landscape and heavily tree covered. No impacts on the setting of these structures will occur.

1.1.1.4 Concerns regarding Houses, Demesnes and general built heritage along the Blackwater valley from Villierstown to Youghal Bridge

The majority of this area is located outside the 5km study area as defined in Chapter 14 of the EIAR within which cultural heritage assets are assessed for potential effects on setting. For the avoidance of doubt, however, the concerns regarding built heritage outside this study area is addressed here. The Blackwater River valley from Villierstown to Youghal Bridge is topographically lower than the surrounding landscape and this is the nature of such river valleys. Accordingly, the majority of the area, including the river and lands to the east and west of same are located outside the zone of theoretical visibility. In other words, the zone of theoretical visibility shows that there is no visibility of any turbines from the majority of the areas of concern along the valley. A number of third party submissions also expressed concerns regarding built heritage along the Blackwater Valley and in this regard a number of specific submissions and highlighted structures are addressed here.

A third party submission (Eachtra Archaeological Projects) raised concerns regarding impacts on the unique architectural and archaeological heritage of the Blackwater River Valley. No specific

structures are addressed in the letter, however, an extensive document on the built and natural heritage of the area was attached to the submission. The latter is a detailed document on the Blackwater River Valley which was written for the sole purpose of entering a bid to obtain tentative UNESCO World Heritage Status. At the time of writing this response document, no such status was granted. The letter specifies that the heritage of the area, which '*exists under a wide range of legislative protection must be preserved for current and future generations*'. The document attached to the letter provides an overview of the legislation that protects the heritage of the area. There are no instances where the proposed development contravenes any legislation regarding the archaeological heritage and there are no instances where any works to a monument are proposed. All known archaeological and architectural heritage structures will be preserved for future generations. For the avoidance of doubt, the following structures located along the Blackwater River Valley are discussed in the context of the proposed development and impacts on setting.

Table 1: Houses, Castles and Demesnes along the Blackwater valley

Name	NIAH / RMP	ITM E, N	ZTV Result
Strancally House	22903401 and 22903402	E608607, N590580	No Visibility
Strancally Castle Tower House	WA034-034	E610130, N586082	No Visibility
Ballynatray House	22903712	E608051, N583234	No Visibility
Molana Abbey	WA037-011001	E607945, N582893	No Visibility
Templemichael Castle Tower House	WA037-014001	E608026, N582369	No Visibility
Tourin House Demesne and Tourin Castle	2290291 WA029-010	E609303, N596495 E609553, N596518	No Visibility
Dromana House and Dromana Castle	22902918 WA029-021001	E609215,N595127 E609200, N595130	No Visibility
Camphire House and castle.	22819027 WA029-033	E609227, N593003 E609247, N593012	Theoretical visibility of approx. 8 -12 turbines
17th century house at Headborough	WA029-041	E607636, N591580	Theoretical visibility of 4 to 8 turbines.

D'Loughtane House	WA037-015	E610388, N582843	Theoretical visibility of 12 to 17 turbines.

Camphire House and castle

Views from Camphire House are largely restricted due to the dense vegetation and woodland surrounding the site. Given that this location is on the edge of the ZTV (which means that limited extents of the turbines will be seen even were open, unobstructed views available), combined with the presence of a mature deciduous treeline upon the ridgeline, there is likely limited to no views of the proposed turbines. In this regard visual effects on setting will be imperceptible. This is also assessed in Section 1.2.2 of the RFI LVIA Report and on Figures 1-3 to 1-6 of that same document.

17th century house at Headborough

The 17th Century House at Headborough is surrounded by mature woodland. Mature woodland present in the grounds / demesne of the house screen the proposed development from view. This is similarly the case with views from the house itself, which similar to Camphire House above is just within the ZTV and is surrounded by mature trees. There will be limited to no views of the proposed turbines. In this regard visual effects on setting will be imperceptible. This is also assessed in Section 1.2.2 the RFI LVIA Report and on Figures 1-3 to 1-6 of that same document.

D'Loughtane House

Since the ZTV shows theoretical visibility of 12 -17 turbines a photomontage was undertaken from the house in the direction of the proposed development. The results show that 11 turbines will be partially visible (approximately from mid shaft to blade tip) with only the blade tips of the remainder visible. At the distance of 6.4km to the nearest turbine (T6), this effect is considered to be not significant (An effect which causes noticeable changes in the character of the environment but without significant consequences., EPA Guidelines 2022). The photomontage is presented in the Appendix 1 of the RFI LVIA Report, PM23 and further addressed in the RFI LVIA Report document at Section 1.2.2.2.

The general findings of the EIAR in terms of impacts on architectural heritage structures (assessed within 5km of the nearest turbine) also concluded that all built heritage structures are situated at a remove from the proposed turbine locations. In the wider landscape setting, the ZTV showed varying levels of visibility from the locations of the built heritage structures and some where there is no visibility, in particular from the south. The ZTV is based on the worst-case scenario as it does not take natural screening or vegetation into account. In reality, the latter is likely to minimise any potential effects on setting. The residual impacts, where an impact has been identified are considered to be slight in general. No adverse or significant impacts were identified as part of the EIAR conclusions or as part of the further information provided above which focus on specific structures.

1.1.1.5 Concerns regarding Houses, Demesnes and general built heritage along the Bride river valley from Tallow to the confluence with the Blackwater

The Bride river valley mainly falls within the ZTV, in particular, towards the western end. Large portions of the eastern end of the river valley surrounding Snugborough fall outside the ZTV. The following built heritage structures are addressed in terms of potential effects on setting.

Table 2: Houses, Castles and Demesnes along the Bride river valley

Name	NIAH / RMP	ITM E, N	ZTV Result	Further Assessment Required
Lisfinny House / Demesne and castle	NIAH 22902807 RMP WA028-013	E599155, N594596	Theoretical visibility of 12 -17 turbines	See Photomontage 50
Kilmore House	NIAH 22902802	E601001, N592192	Theoretical visibility of between 8 and 12 turbines.	See below
Sapperton House	NIAH 22902901	E604708, N593151	No Visibility	No
Ballynaraha Castle	RMP WA029-028	E605950, N594133	Theoretically 12 – 17 turbines will be visible.	See Photomontage M24

Lisfinny House / Demesne and castle

Since the ZTV shows theoretical visibility of between 12 and 17 turbines, a photomontage was prepared in order to ascertain what if any visibility is possible and the degree of visibility from the monument. The Photomontage (PM 26) is presented in the Appendix 1 of the RFI LVIA Report and shows that turbines 1 -10 will be barely discernible with the remainder of the turbines visible from approximately mid shaft to blade tip. At the distance of 6.2km to the nearest turbine (T12), the overall significance of effects are considered to be not significant (An effect which causes noticeable changes in the character of the environment but without significant consequences). A change to the views from the monument are acknowledged but without significant or adverse consequences.

Kilmore House

The site of the house itself is not accessible to the public and access could not be obtained during the site visit. Similar to the above, this site is located on the edge of the ZTV and therefore visibility is limited even where there is open visibility in the direction of the Proposed Development. **Error! Reference source not found.** below is an aerial view of Kilmore House, showing a large area of woodland surrounding the site. With the direction of the Proposed Development to the south, it is clear from the aerial imagery that there will be limited to no visibility of the Proposed Development from this site, as a result of screening from the vegetation (deciduous woodland) and the fact that there is already likely limited visibility indicated on the ZTV. The overall effects will therefore be imperceptible. This structure is also discussed further in Section 1.2.2 of the RFI LVIA Report.

Plate 1-1: Aerial View of Kilmore House (also presented in the RFI LVIA Report)

Ballynaraha Castle

Since the ZTV shows theoretical visibility of between 12 and 17 turbines, a photomontage was prepared in order to ascertain what, if any, visibility is possible and the degree of visibility from the monument. The Photomontage is presented in Appendix 1 of the RFI LVIA Report (PM 24) and addressed in Section 1.2.2.2 of the RFI LVIA Report. The photomontage shows that turbine 6 will be visible at a distance of 6.7km. At the distance of 6.7km to the nearest turbine (T1), the overall significance of effects are considered to be imperceptible to not significant since a large tract of woodland and hedgerow has effectively screened the remainder of the turbines.

1.2 Local Authority Submissions

1.2.1 Cork County Council

Cork County Council's Archaeologist assessed Chapter 14 of the EIAR with regard to archaeology and the cultural heritage. The Planning Authority is satisfied with the report and the mitigation measures outlined in Section 14.4.3.3. No further information is required in this regard.

1.2.2 Waterford County Council

Waterford County Council's Conservation Officer raised a number of concerns regarding the Built Heritage including:

- The visual impact on Built Heritage along the Blackwater and Bride Rivers (Blackwater, and the section of the Bride from Tallow to the confluence with the Blackwater) and their settings, including Molana Abbey and Ballynatray House

- The impact on bridges, boundaries on the haul routes to the site and access roads (With regard to the haul routes mitigation measures regarding the temporary protection or stabilising works to ensure the protection of the Built Heritage, in particular bridges along the Regional and Local Roads, should be considered and Road Designs comments are noted also).

The comments by the Conservation Officer raised concerns regarding the distance of 5km within which built heritage and archaeology (RPS, NIAH and RMP/SMR) were assessed. Concerns were also raised regarding the visual impact on Ballynatray House/Molana Abbey.

In summary WCC have concerns regarding '*the adequacy and completeness of the assessment of the potential impact of the proposed development on the character and assessment of the Built Heritage in the wider area and acknowledges that while some assessment has taken place within 5km buffer of the development there are significant Protected Structures including structures with associated Demesne which may be impacted upon and the submitted details is not present or clear*'.

1.3 Third Party Concerns

1.3.1 Johnny and Mary Mills

Concerns were raised (Johnny and Mary Mills) regarding several archaeological findings in the area and that the construction of the windfarm will **damage the ancient artefacts and prevent them being found in the future**.

Response: Potential damage to 'ancient artefacts' was already addressed in the EIAR and an extract from same is as follows: '*The construction stage effects on archaeological heritage were addressed and assessed in detail in Section 14.4.3 of Chapter 14 where direct impact (physical impact) on monuments and sites are addressed. The construction phase of the development consists largely of earthmoving activities such as topsoil removal. The potential impacts on the known and potential archaeological, architectural and cultural heritage of the area are outlined with detailed mitigation measures. The impacts are described according to each element of the Proposed Development, turbines, grid connection, delivery routes etc. These mitigation measures are reiterated here again.*

There will be no direct effects to the known cultural heritage resource as a result of the construction activities. Three recorded monuments are located within the EIAR site boundary and in order to protect these monuments or sites of the monuments from accidental damage a protective buffer zone around the recorded monuments will be established'.

In terms of potential effects to 'ancient artefacts' these are also directly addressed in Chapter 14 Section 14.4.3.3 where it highlights that '*the potential for the development area to contain as yet unrecorded sub-surface sites and artefacts is likely to be low within the forested section of land and medium within the green-field sections of the proposed development*'. It was specified in chapter 14 that the excavation of topsoil for the new turbine bases, hardstands, and sections of roads and cable route where they are located on undisturbed ground and green fields may impact on any new sub-surface sites, if present. The section of cable route adjacent to the stream is also regarded as an area of archaeological potential given the preference for such locations for monuments such as fulachta fiadh. Detailed mitigation measures were provided and described in the EIAR and will be implemented during construction in order to avoid damaging any sites or artefacts. The mitigation

measures I are described in the EIAR and the following which is a direct extract from the EIAR, chapter 14.

'*Pre-development licensed archaeological testing of the following:*

- *Proposed cable route in greenfield areas*
- *Turbines/Hardstands for T3, T4, T6, T7, T14, T16 and T17*
- *New roads where they are proposed in green fields*
- *Proposed new road along haul route*

Archaeological monitoring (under licence from the National Monuments Service) of any further geotechnical / engineering trial pits or investigations and a report detailing the results of same.

Archaeological monitoring under licence of all ground works during construction. The National Monuments Service will be informed of such findings to discuss how best to proceed. If archaeological finds, features or deposits are uncovered during archaeological monitoring, the developer will be prepared to provide resources for the resolution of such features whether by preservation by record (excavation) or preservation in situ (avoidance). Once the project is completed, a report on the results of the monitoring will be compiled and submitted to the relevant authorities'.

1.3.2 Maria Conran

Concerns were raised regarding Kilcalf School House, the gates and railings of which are a protected structure (Ref WA750774) and listed in the NIAH. As this structure falls within the 5km study area it is included in the assessment in Chapter 14 of the EIAR in Section 14.3.3.2.

The ZTV used in the LVIA chapter was also used in Chapter 14 and in Section 14.4.5.3 the following was concluded: '*The Zone of Theoretical Visibility suggests that 13-17 turbines may be visible from the majority of locations where RMPs/RPS and NIAH structures are located within 5km from the proposed Turbines. This impact is considered to be slight/moderate. No RPS or NIAH is located in the immediate vicinity of any of the proposed turbines. All built heritage structures are situated at a remove from the proposed turbine locations. In the wider landscape setting, the ZTV (used in the LVIA Chapter 12) shows that there may be varying levels of visibility from the locations of the built heritage structures and some where there is no visibility, in particular from the south*'.

In summary, it was acknowledged in Chapter 14 that the potential effects on such structures was slight/moderate, slight being defined in the EPA Guidelines (2022) as '*An effect which causes noticeable changes in the character of the environment without affecting its sensitivities*' and a moderate effect as '*An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends*'.

No Very significant or profound effects will occur since these effects would result in either 'An effect which, by its character, magnitude, duration or intensity, significantly alters most of a sensitive aspect of the environment' or in the case of a Profound Effect where it is defined as 'An effect which obliterates sensitive characteristics'.

1.3.3 Maurice Hennessey

A number of concerns were raised and are addressed separately below:

2.1: The third party raised concerns over the limitations regarding access to the recorded monuments within the EIAR boundary and that they were not accessed due to dense overgrowth and the uncertainty regarding their location as a result.

Response: Section 3.6.2 of the EPA Guidelines requires that the EIAR assessment take cognisance of any limitations when establishing the baseline data and existing environment within which, in the case of Chapter 14, cultural heritage assets may occur. The EPA guidelines state the importance of drawing attention within the EIAR to limitations about factors that may affect the reliability of baseline data. These can include the availability, completeness, accuracy, age, accessibility and compatibility of data. These monuments are described in Section 14.3.2.2.1 of the EIAR where the original Archaeological Survey of Ireland descriptions were also provided. There is no doubt as to the location of the monuments having used previous survey descriptions as well as historic mapping. The limitation lies solely in accessibility. Regardless of the accessibility or otherwise, the three recorded monuments are protected under National Monuments legislation and protective buffer zones around same will be implemented as appropriate mitigation accordingly. An extract from Chapter 14 Section 14.4.3.2 is as follows: '*They (the monuments) are situated away from the proposed infrastructure (including hardstands, turbine bases, construction compounds, borrow pits, new roads and the proposed substation). The monuments have been designed out of the proposed site layout and therefore they have been mitigated by avoidance. No construction effects will occur in this regard. Protective buffer zones around each monument is required as mitigation however and this has been incorporated into the Construction and Environmental Management Plan (CEMP). (The statutory SMR zones surrounding the monuments will act as buffer zones).*

Section 2.2 and 2.3: Code of Practice between Coillte and the Minister for the Environment and Local Government

Response: The Coillte code of practice sets out guidelines for afforestation and clearance in terms of impacts on archaeology. The aim of the archaeological assessment undertaken as part of the EIAR is to establish the current baseline data available and to assess the monuments in their current setting (i.e. the Existing Environment). Any requirement for the principles of the Code of Practice to be implemented precedes that of the proposed development. The third party asserts that the monuments are unidentified. The EIAR states that the monuments were inaccessible and this was the baseline environment required to be described as part of the assessment. Any potential inaccessibility issues pre-date the assessment. Mitigation measures in the form of buffer zones will be implemented prior to construction to protect the areas of the monuments. The monuments are designed out of the proposed development and any requirement for clear-felling outside the proposed development is a matter for Coillte and such works would fall under the Coillte Code of Practice therefore. The code of practice will ensure the protection of the monuments however.

Section 2.4: Raised concerns over the area of Turbine 8 and borrow pit west of T12 and the lack of a statement from the author of Chapter 14 that these areas did not contain above ground archaeological features:

Response: Section 14.3.2.5 of Chapter 14 states that no new above ground features or sites were encountered within any of the areas proposed for development including the area of the proposed turbines, roads and other infrastructure. This means that no new archaeological sites or monuments were recorded during fieldwork. The area of Turbine 8 was visited on the 26th July 2022. While this area is under coniferous forestry it was accessible on foot. No above-ground archaeological sites or monuments were noted during the site walk-over. Additional photos have been provided here.

Plate 1-2: Area of proposed turbine 8 looking south.

Plate 1-3: Area of proposed turbine 8 looking East.

Plate 1-4: Borrow pit west of T12 looking East.

Section 2.5: **Destruction of an old laneway / access to Turbine 16.**

Response: As described in Section 14.3.3.4.1 of the EIAR, a small historic settlement is located outside the EIAR boundary to the north of T16. This will be preserved in situ resulting in no direct construction effects. Part of the associated historic road (southwestern section) will be utilised as the new access road to T16 and therefore direct impacts are anticipated and acknowledged. The laneway is a non-statutory item of local cultural heritage and accordingly mitigation measures are proposed. A photographic and descriptive record of the boundary removal will be undertaken by the monitoring archaeologist in advance of groundworks associated with T16.

Section 2.6: Potential Bronze Age monuments along the proposed collector network cable route.

Response: This section of the third party submission is an extract from Chapter 14 which states that '*It is proposed to connect the two turbine clusters via an underground cable located within existing agricultural land and within the public road corridor. One watercourse (stream) was encountered where the cable route crosses the Rearour North and Breeda townland boundary. This stream was accessible, shallow and clear on the day of survey and no archaeological features were noted. A rushy field in pasture to the east of the river may be regarded as an area of archaeological potential. Fulachta fia and burnt mounds, low visibility monuments, are often found in such locations adjacent to a water source. This monument type may span from the Bronze Age (c. 2400-500 BC) to the early medieval period (5th - 12th century AD. They consist of a circular or irregularly shaped mound of material consisting of burnt stones, ash and charcoal and often have no surface evidence of a trough*

or depression. Levelled examples can appear as a spread containing burnt stones. Impacts relating to sub-surface archaeology is addressed in Section Error! Reference source not found. of the EIAR'.

It is a requirement of the assessment to highlight areas of archaeological potential so that they can effectively be mitigated either at the pre-construction or construction stage. In this regard the following will be implemented

Pre-development licensed archaeological testing of the following:

- Proposed cable route in greenfield areas
- Turbines/Hardstands for T3, T4, T6, T7, T14, T16 and T17
- New roads where they are proposed in green fields
- Proposed new road along haul route

Archaeological monitoring (under licence from the National Monuments Service) of any further geotechnical / engineering trial pits or investigations and a report detailing the results of same.

Licensed Archaeological monitoring will be undertaken of all ground works during construction. The National Monuments Service will be informed of such findings to discuss how best to proceed. If archaeological finds, features or deposits are uncovered during archaeological monitoring, the developer will be prepared to provide resources for the resolution of such features whether by preservation by record (excavation) or preservation in situ (avoidance). Once the project is completed, a report on the results of the monitoring will be compiled and submitted to the relevant authorities.

Section 2.7 – 2.9

Response: These sections are merely extracts from the EIAR Chapter 14 that serve to highlight areas of archaeological potential, monuments within the 5km and 10km study area and repeats the findings of the EIAR that theoretically 13-17 turbines may be visible from many areas within 5km in accordance with the results of the ZTV. This third party submission also states that a Looped Bronze Spearhead was found at Kilwaterymountain. Again, this is an extract from Section 14.3.2.4 of Chapter 14 where the author has assessed the artefact bearing potential of the surrounding environment of the proposed windfarm.

Section 2.10 Granada Convention for the Protection of the Architectural Heritage.

Response: This section of the third party asserts that the Granada Convention has not be complied with in light of the apparent lack of 'identification' of the recorded monuments within the EIAR boundary and the Coillte Code of practice not being complied with. The Granada Convention reflects the obligations of each European member state to maintain an inventory of structures of architectural heritage merit. Irelands obligations were fulfilled by compiling the National Inventory of Architectural Heritage (NIAH) by the now Department of Housing, Local Government and Heritage. This architectural inventory has no bearing on the recorded monuments within the EIAR boundary or indeed the Coillte code of practice.

There is an apparent misunderstanding by the third party as to the purpose of the Granada Convention and the responsibilities in maintaining the list of structures. The responsibility for maintaining the list of Architectural Heritage Inventory lies with the State through the aforementioned government department.

The Department State that '*The National Inventory of Architectural Heritage (NIAH) is a state initiative under the administration of the Department of Housing, Local Government and Heritage and*

established on a statutory basis under the provisions of the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999. The purpose of the NIAH is to identify, record, and evaluate the post-1700 architectural heritage of Ireland, uniformly and consistently as an aid in the protection and conservation of the built heritage. NIAH surveys provide the basis for the recommendations of the Minister for Housing, Local Government and Heritage to the planning authorities for the inclusion of particular structures in their Record of Protected Structures (RPS)'(https://www.buildingsofireland.ie/about-us/).

It must be reiterated again that the monuments referred to in the third party submission in Section 2.1 above fall under the National Monuments legislation by way of inclusion in the Sites and Monuments Record and the Record of Monuments and Places and has no association with the NIAH formulated under Article 2 of the Granada Convention. Furthermore, the monuments are not 'unidentified' as asserted by the third party but were merely not accessible due to dense overgrowth. The Coillte Code of Practice is between Coillte and the now Department of Housing, Local Government and Heritage, the purpose of which is to provide a framework within existing legislation and policies to enable Coillte to proceed with the management of its forests in a manner that ensures the safeguarding of the State's archaeological heritage. Any forest management policies within the proposed development site pre-date the assessment therefore. The Forestry and Archaeology Guidelines July 2016 also seek to protect archaeological monuments within areas of forest activities. Any future forest activities would also fall under the Code of Practise and the Forestry and Archaeology Guidelines (2016).

Section 2.11 Contravention of Cork County Development Plan HE3-6

Response: Chapter 14 of the EIAR Section 14.1.3.1.5 details the CDP policy HE 3-6: Archaeology and Infrastructure Schemes which states the following '*Have regard to archaeological concerns when considering proposed service schemes (including electricity, sewerage, telecommunications, water supply) and proposed roadwork's (both realignments and new roads) located in close proximity to Recorded Monuments and Places and their known archaeological monuments*'.

The policy merely states that regard should be had to archaeological concerns when considering proposed developments. The assessment process (Chapter 14 of the EIAR) has presented all available baseline data and a detailed suite of mitigation measures where potential impacts may occur. Furthermore, Cork County Council Archaeologist assessed Chapter 14 of the EIAR with regard to archaeology and the cultural heritage. The Planning Authority is satisfied with the report and the mitigation measures outlined in 14.4.3.3. No further information is required in this regard by Cork County Council.

Section 2.12 Contravention of Cork County Development Plan HE 4-2 (f)

Response: Section 14.1.3.1.6 of Chapter 14 provides details regarding HE 4-1: Record of Protected Structures policies. Cork County Council's Archaeologist assessed Chapter 14 of the EIAR with regard to archaeology and the cultural heritage. The Planning Authority is satisfied with the report and the mitigation measures outlined in 14.4.3.3. No further information is required in this regard by Cork County Council.

Section 12.13 Contravention of Waterford County Development Plan Objective AH3.

Response: Waterford County Council have requested further information as well as an Bord Pleanala regarding visual impacts on Built Heritage. All concerns are addressed in Section 1.2.1 above.

1.3.4 Niall Slevin

This third party submission raises concerns regarding 'The Thatch Cottage' at Glennaglogh. There is one thatch house listed in the Record of Protected Structures WA750529 in the County Waterford Development plan as being located in Glennaglogh. No locational information is provided in the list

of protected structures such as a coordinate. A digital dataset with coordinates of protected structures was requested from the Conservation Officer by email in 2020 to which no response was received. Resultingly the Record of Protected structures could not be plotted on the project base mapping since no coordinates are provided in the County Development Plan.

An Eircode is provided with the third party submission and in this regard according to the ZTV, 13 to 17 turbines may theoretically be visible from this location as acknowledged by the EIAR Chapter 14. No direct effects to the protected structures will occur however. Visual effects on setting are considered to be slight/moderate as stated in Section 14.4.5.3 of Chapter 14. An extract from the EIAR states the following '*The Zone of Theoretical Visibility suggests that 13-17 turbines may be visible from the majority of locations where RMPs/RPS and NIAH structures are located within 5km from the proposed Turbines. This impact is considered to be slight/moderate. No RPS or NIAH is located in the immediate vicinity of any of the proposed turbines. All built heritage structures are situated at a remove from the proposed turbine locations. In the wider landscape setting, the ZTV (used in the LVIA Chapter 12) shows that there may be varying levels of visibility from the locations of the built heritage structures and some where there is no visibility, in particular from the south*.

1.3.5 Paddy Massey

Response: It is considered that all concerns regarding built heritage along the Blackwater Valley in terms of impacts on visual setting have been addressed and can be referred to in Section 1.2.1 above. As it stands, the robust document compiled by Dr. Olley provides an extensive overview of the Munster Blackwater Valleys natural and cultural heritage in an attempt to gain tentative World Heritage Status for the region. Currently the baseline data provided in Chapter 14 of the EIAR is such that the Blackwater Valley is not included in the current UNESCO World Heritage tentative list.

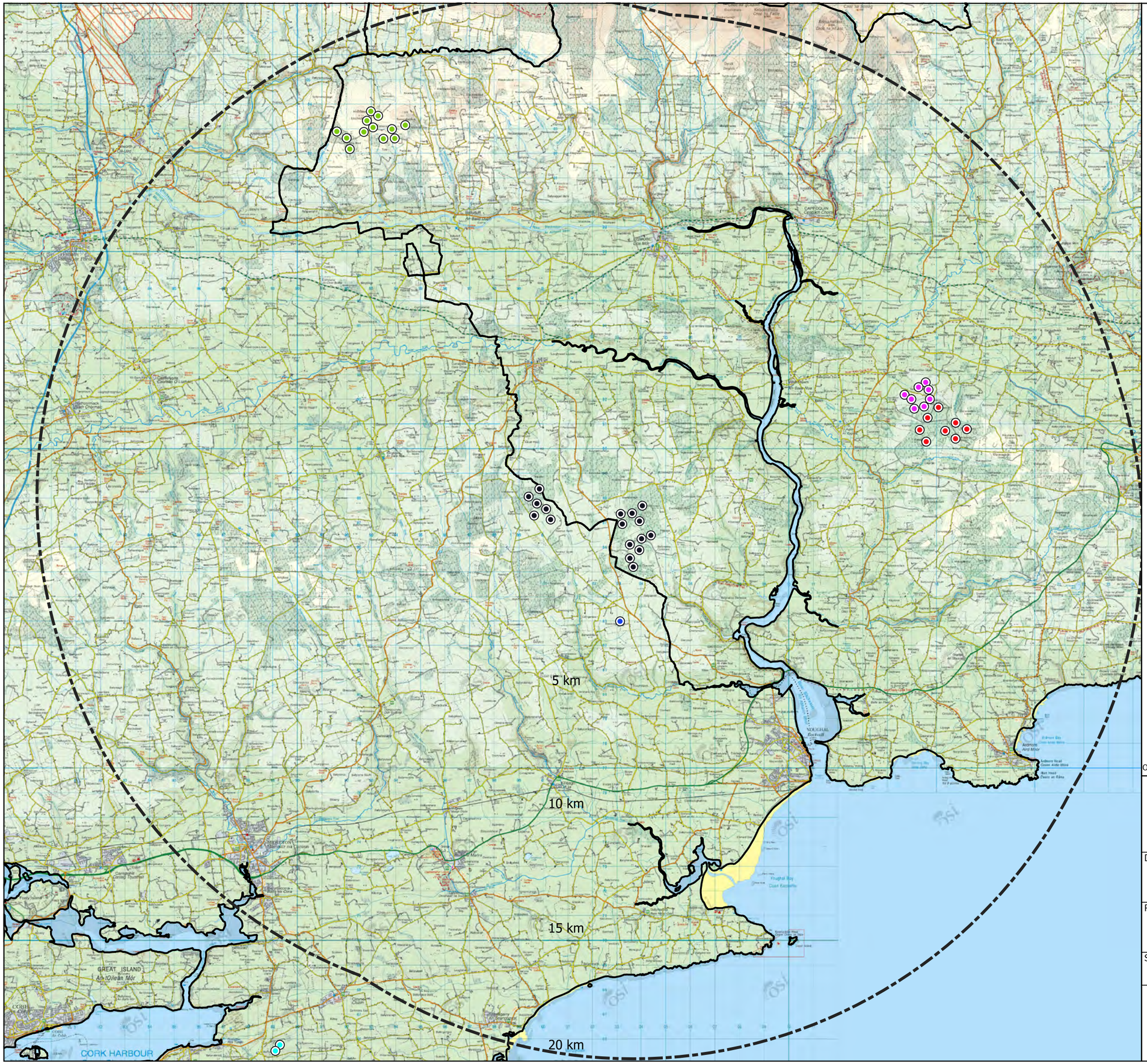
(https://whc.unesco.org/en/statesparties/ie).

2 CONCLUSION

This document comprises a response to a Request for Further Information issued by An Bord Pleanála (Ref. 309121-21) regarding the proposed Lyrenacarriga Wind Farm, Counties Cork and Waterford. It also addresses a number of third party submissions, many of which raised concerns regarding the assessment of potential impacts to the built heritage of the surrounding area. In response to the RFI and the concerns raised in some submissions, photomontages were carried out from a number of structures and are presented in the RFI LVIA Report which should be read in conjunction with this document. It is considered that all concerns regarding the assessment process and the results of same as reached in Chapter 14 of the EIAR are addressed here and that the mitigation measures outlined in the Chapter are appropriate for the amelioration of any potential impacts identified.

APPENDIX 7

FIGURE 2-2A FI



Map Legend

- County Boundary
- 20km Distance from Site
- Proposed Turbines

Other Wind Farms

- Barranafaddock Turbines (Existing)
- Crocane Turbines (Existing)
- Knocknagappagh Wind Farm (Permission Expired)
- Woodhouse Turbines (Existing)
- Knocknamona Turbines (Proposed)

Drawing No.

Figure 2-2a FI

Drawing Title

Other Wind Farms

Project Title

Lyrenacarriga Renewable Energy Development

Scale	Project No.	Date	Drawn By	Checked By
1:150,000	170749e	03.10.2022	JS	MC

APPENDIX 8

SHADOW FLICKER RE-RUN

BRIEFING NOTE

Project Reference	170749-e Lyre WF ABP Further Information
Date & Time	23.09.2022
Subject	Shadow Flicker Outputs
Author(s)	Niamh McHugh, Killian McGovern, James Newell, Ellen Costello, Meabhann Crowe

Introduction

MKO has been commissioned to conduct a Shadow Flicker Assessment of 2 no. scenarios (Scenarios 1 and 2) in relation to turbine locations for the Proposed Lyrenacarriga Wind Farm Development following receipt of a request for Further Information from An Bord Pleanála (ref: ABP-309121-21). These 2 no. Scenarios have been assessed relative to an updated Dwellings database. The Dwellings database includes for two identified sensitive receptors in the form of granted planning permissions for a property/dwelling. These two dwellings are located within the designated set-back distance 600m (4 x tip height) of the proposed turbine 5 location, which was assessed in the Environmental Impact Assessment Report (EIAR) lodged and as submitted to An Bord Pleanála in 2021 (2021 EIAR).

These 2 no. scenarios are as follows:

- Scenario 1: 17 no. Turbines in their Original Locations (2021 EIAR)
- Scenario 2: Move T5 to Outside 700m of Dwellings

Within these scenarios (discussed overleaf), two turbine options have been assessed:

Label	Tip Height (m)	Hub Height (m)	Blade Length (m)	Rotor Diameter (m)
Turbine Option 1	150	83.5	66.5	133
Turbine Option 2	150	93.5	56.5	113

Therefore, the following 6 no. shadow flicker processing outputs have been assessed:

- Scenario 1 (Turbine Option 1)
- Scenario 1 (Turbine Option 2)
- Scenario 2 (Turbine Option 1)
- Scenario 2 (Turbine Option 2)

The results of Turbine Options 1 and 2 under Scenarios 1 and 2 are available to view in Appendix 1 of this document. The Shadow Flicker Assessment was carried out by Niamh McHugh and Killian McGovern both Environmental Scientists, and James Newell a Graphics Technician, all of MKO. This Shadow Flicker Assessment has been reviewed by Ellen Costello, a Project Environmental Scientist of MKO.

Shadow Flicker Prediction Methodology

Shadow Flicker occurs only under certain, combined circumstances. Where shadow flicker does occur, it is generally short-lived.

The occurrence of shadow flicker can be precisely predicted using specialist computer software programmes specifically developed for the wind energy industry, such as WindFarm (ReSoft) or WindFarmer (DNV.GL) or AWS OpenWind or WindPro.

The computer modelling of the occurrence and magnitude of shadow flicker is made possible by the fact that the sun rises and sets in the same position in the sky on every day each year.

Any potential impact can be precisely modelled to give the start and end time (accurate to the second) of any incidence of shadow flicker, at any location, on any day or all days of the year when it might occur. Where a shadow flicker impact is predicted to occur, the total maximum daily and annual durations can be predicted, along with the total number of days.

For the purposes of this shadow flicker assessment, the software package ReSoft WindFarm Version 5.0.1.2 has been used to predict the level of shadow flicker associated with the Lyrenacarriga Wind Farm Development.

Guidance

The current, adopted guidance for shadow flicker in Ireland is derived from the '*Wind Energy Development Guidelines for Planning Authorities 2006*' (DoEHLG), and the '*Best Practice Guidelines for the Irish Wind Energy Industry*' (Irish Wind Energy Association, 2012). The 2006 DoEHLG Guidelines state that at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low.

The DoEHLG 2006 wind energy guidelines recommend that shadow flicker at dwellings within 500 metres of a proposed turbine location should not exceed a total of 30 hours per year or 30 minutes per day.

The adopted 2006 DoEHLG guidelines are currently under review. The DoHPLG released the 'Draft Revised Wind Energy Development Guidelines' in December 2019 for public consultation. The Draft 2019 guidelines recommend local planning authorities and/or An Bord Pleanála impose conditions 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."*

The Draft 2019 Guidelines are based on the recommendations set out in the 'Proposed Revisions to Wind Energy Development Guidelines 2006 – Targeted Review' (December 2013) and the 'Review of the Wind Energy Development Guidelines 2006 – Preferred Draft Approach' (June 2017).

The assessment herein is based on compliance with the current DoEHLG Guidelines limit (30 hours per year or 30 minutes per day).

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Study Area

The study area for the shadow flicker assessment is ten times rotor diameter, as set out in the '*Wind Energy Development Guidelines for Planning Authorities'*, DoEHLG, 2006. All dwellings (including the two identified properties in receipt of planning permission) located within ten rotor diameters of the Lyrenacarriga Wind Farm have been included within this assessment.

Scenario 1 – 17 no. Turbines in their Original Locations (relative to 2021 EIAR)

Scenario A refers to the turbine layout as it currently stands, as assessed in the Environmental Impact Assessment Report (EIAR) lodged and as submitted to An Bord Pleanála in 2021 (2021 EIAR). The results for Turbine Option 1, and for Turbine Option 2 are presented in the attached in Appendix 1 as 'Scenario 1 – Turbine Option 1' and Scenario 1 – Turbine Option 2' respectively. As can be seen in Appendix 1, 'Scenario 1 – Turbine Option 1' leads to a total of 60 no. dwellings experiencing daily shadow flicker exceedances and 7 no. dwellings experiencing annual shadow flicker exceedances. Similarly, 'Scenario 1 – Turbine Option 2' leads to a total of 36 no. dwellings experiencing daily shadow flicker exceedances and 1 no. dwellings experiencing annual shadow flicker exceedances.

Scenario 2 – Move T5 to Outside 700m of Dwellings

Scenario C refers to the turbine layout if T5 were to be moved 165m to the east in order to maintain a 700m setback distance from all dwellings, a set-back distance from dwellings that is set out in the 2021 EIAR. The results for the Turbine Option 1, and for the Turbine Option 2 are presented in the attached in Appendix 1 as 'Scenario 2 – Turbine Option 1' and Scenario 2 – Turbine Option 2' respectively. As can be seen in Appendix 1, 'Scenario 2 – Turbine Option 1' leads to a total of 60 no. dwellings experiencing daily shadow flicker exceedances and 8 no. dwellings experiencing annual shadow flicker exceedances. Similarly, 'Scenario 2 – Turbine Option 2' leads to a total of 38 no. dwellings experiencing daily shadow flicker exceedances and 0 no. dwellings experiencing annual shadow flicker exceedances.

Example Mitigation Measures

An example of the mitigation strategy (i.e. the dates when exceedances will occur and potential turbine curtailment dates) can also be seen in Appendix 1 of this document and relates to Scenario 2: Turbine Option 2.

Summary

Scenario 1 vs. Scenario 2:

As detailed in the results presented above, the variance in results between the scenarios is minimal (± 2 no. dwellings). The movement of turbine no. 5 does not give rise to any significant changes in the number of dwellings in which there are daily shadow flicker exceedances and annual shadow flicker exceedances.

Turbine Option 1 vs. Turbine Option 2 across all scenarios:

For Turbine Option 2, across both scenarios, there is a range of 36-38 properties in which daily shadow flicker exceedances will occur. For Turbine Option 1, there is an increase of approximately 22 dwellings in which daily shadow flicker exceedances will occur i.e 60 properties across all

scenarios. For annual exceedances, Turbine Option 2 gives rise to annual exceedances 1 no. dwellings for Scenario 1 and at 0 no. dwellings for Scenario 2. There is an increase in annual exceedances at a range of 7-8 dwellings for Turbine Option 1 across both scenarios. As detailed above, Turbine Option 1 gives rise to greater daily and annual exceedances which is line with expected results, as Turbine Option 1 has a longer turbine blade and a great rotor diameter than that of Turbine Option 2.

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FI Lyrenacarriga

Appendix 8

Shadow Flicker Turbine Hub 83.5m

Exceedances	No. Of Properties
Daily	56
Annual	7

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Proposed Turbine No.	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Proposed Turbine(s) Giving Rise to Daly Shadow Flicker Exceedance	Mitigation Strategy Required (Daily)	Mitigation Strategy Required (Annual)
1	598514	588721	Dwelling	1060	T13	00:31:12	13:24:00	4:20:45	13	Yes	Yes
2	598645	588003	Dwelling	725	T13	01:02:24	85:36:00	27:45:38	13, 14	Yes	Yes
3	598651	587842	Dwelling	756	T13	01:07:48	103:24:00	33:32:00	13, 14, 16	Yes	Yes
4	598656	588404	Dwelling	776	T13	00:42:00	56:06:00	18:11:37	13	Yes	Yes
5	598687	587517	Dwelling	887	T13	00:35:24	39:12:00	12:42:46	14, 16	Yes	Yes
6	598850	587409	Dwelling	762	T16	00:43:12	89:06:00	28:53:44	14, 16	Yes	Yes
7	598894	588985	Dwelling	1012	T13	00:31:12	34:36:00	11:13:15	12	Yes	Yes
8	598998	586888	Dwelling	753	T16	00:29:24	39:18:00	12:44:43	N/A	No	No
9	599326	586507	Dwelling	869	T16	00:30:36	23:00:00	7:27:32	17	Yes	Yes
10	599748	586235	Dwelling	1054	T17	00:00:00	0:00:00	0:00:00	N/A	No	No
11	600379	588814	Dwelling	707	T12	00:46:48	49:48:00	16:09:01	12	Yes	Yes
12	600493	588853	Dwelling	824	T12	00:40:12	44:36:00	14:27:51	12	Yes	Yes
13	600562	589306	Dwelling	1180	T12	00:27:00	17:18:00	5:36:38	N/A	No	No
14	600549	586316	Dwelling	888	T17	00:00:00	0:00:00	0:00:00	N/A	No	No
15	600654	589321	Dwelling	1252	T12	00:27:36	22:06:00	7:10:02	N/A	No	No
16	600822	586555	Dwelling	823	T17	00:00:00	0:00:00	0:00:00	N/A	No	No
17	601046	587710	Dwelling	962	T17	00:35:24	45:30:00	14:45:21	15, 17	Yes	Yes

18	601073	587560	Dwelling	908	T17	00:36:00	42:36:00	13:48:56	15, 17	Yes	Yes
19	601077	587501	Dwelling	887	T17	00:36:36	43:00:00	13:56:42	15, 17	Yes	Yes
20	601175	587859	Dwelling	1131	T15	00:30:00	36:30:00	11:50:14	17	No	No
21	601232	587219	Dwelling	974	T17	00:33:36	35:48:00	11:36:36	17	Yes	Yes
22	601260	587175	Dwelling	1000	T17	00:32:24	34:48:00	11:17:09	17	Yes	Yes
23	601282	587503	Dwelling	1079	T17	00:30:36	29:24:00	9:32:04	17	Yes	Yes
24	601306	588360	Dwelling	1452	T15	00:00:00	0:00:00	0:00:00	N/A	No	No
25	601370	588387	Dwelling	1521	T15	00:00:00	0:00:00	0:00:00	N/A	No	No
26	601546	588343	Dwelling	1652	T15	00:00:00	0:00:00	0:00:00	N/A	No	No
27	601556	586585	Dwelling	1416	T17	00:00:00	0:00:00	0:00:00	N/A	No	No
28	601596	586485	Derelict	1495	T17	00:00:00	0:00:00	0:00:00	N/A	No	No
29	601655	586422	Dwelling	1577	T17	00:00:00	0:00:00	0:00:00	N/A	No	No
30	601777	585912	Dwelling	1720	T11	00:00:00	0:00:00	0:00:00	N/A	No	No
31	601850	585882	Dwelling	1652	T11	00:00:00	0:00:00	0:00:00	N/A	No	No
32	602048	587698	Dwelling	1106	T2	00:30:00	14:00:00	4:32:25	N/A	No	No
33	602152	586803	Dwelling	1038	T5	00:32:24	53:30:00	17:21:01	2, 5	Yes	Yes
34	602198	585676	Dwelling	1292	T9	00:25:48	10:00:00	3:14:35	N/A	No	No
35	602210	587575	Dwelling	919	T2	00:35:24	36:48:00	11:56:04	2, 5	Yes	Yes
36	602379	587837	Dwelling	858	T2	00:39:00	57:54:00	18:46:38	2	Yes	Yes
37	602444	587867	Dwelling	821	T2	00:41:24	57:00:00	18:29:08	2	Yes	Yes
38	602475	587884	Dwelling	806	T2	00:42:00	56:06:00	18:11:37	2	Yes	Yes
39	602605	586363	Dwelling	836	T5	00:36:00	49:12:00	15:57:21	9, 11	Yes	Yes
40	602608	586548	Dwelling	710	T5	00:37:48	64:00:00	20:45:20	5, 11	Yes	Yes
41	602629	585772	Dwelling	878	T9	00:37:12	79:54:00	25:54:43	9, 10, 11	Yes	Yes
42	602655	586333	Commercial unit	826	T5	00:38:24	69:06:00	22:24:34	9, 11	Yes	Yes
43	602690	585993	Dwelling	805	T11	00:54:36	92:48:00	30:05:44	9, 11	Yes	Yes
44	602718	585838	Dwelling	810	T9	00:41:24	97:42:00	31:41:05	9, 10, 11	Yes	Yes
45	602726	585900	Dwelling	793	T11	00:51:36	99:06:00	32:08:19	9, 10, 11	Yes	Yes
46	602730	586270	Dwelling	763	T11	00:42:00	80:30:00	26:06:24	9, 11	Yes	Yes
47	602738	585979	Dwelling	761	T11	00:57:36	107:18:00	34:47:53	9, 10, 11	Yes	Yes
48	603003	584835	Dwelling	734	T10	00:31:48	19:30:00	6:19:26	10	Yes	Yes
49	603022	584761	Dwelling	762	T10	00:00:00	0:00:00	0:00:00	N/A	No	No
50	603085	584339	Dwelling	1040	T10	00:00:00	0:00:00	0:00:00	N/A	No	No

51	603114	588174	Dwelling	788	T2	00:34:12	19:06:00	6:11:39		1	Yes	Yes
52	603170	584219	Dwelling	1108	T10	00:00:00	0:00:00	0:00:00	N/A		No	No
53	603997	584136	Dwelling	1157	T10	00:00:00	0:00:00	0:00:00	N/A		No	No
54	604076	584274	Dwelling	1059	T10	00:00:00	0:00:00	0:00:00	N/A		No	No
55	604113	588564	Dwelling	855	T1	00:00:00	0:00:00	0:00:00	N/A		No	No
56	604119	584398	Dwelling	969	T10	00:00:00	0:00:00	0:00:00	N/A		No	No
57	604305	588638	Dwelling	972	T1	00:00:00	0:00:00	0:00:00	N/A		No	No
58	604428	588706	Dwelling	1080	T1	00:00:00	0:00:00	0:00:00	N/A		No	No
59	604493	584864	Dwelling	945	T10	00:42:36	59:24:00	19:15:50		10	Yes	Yes
60	604511	584867	Dwelling	960	T10	00:40:48	55:42:00	18:03:50		10	Yes	Yes
61	604594	585857	Dwelling	705	T6	01:08:24	84:42:00	27:28:07		8	Yes	Yes
62	604600	588586	Dwelling	1060	T1	00:27:00	14:48:00	4:47:59	N/A		No	No
63	604654	588453	Dwelling	989	T1	00:31:48	33:06:00	10:44:04		1	Yes	Yes
64	604701	585856	Dwelling	752	T6	01:00:00	89:30:00	29:01:31	7, 8		Yes	Yes
65	604897	587449	Dwelling	944	T1	00:35:24	47:36:00	15:26:13	1, 4		Yes	Yes
66	604792	588210	Dwelling	939	T1	00:35:24	25:00:00	8:06:28		1	Yes	Yes
67	604818	587518	Dwelling	850	T1	00:39:00	54:00:00	17:30:45	1, 4		Yes	Yes
68	604854	585817	Dwelling	867	T6	00:33:36	52:00:00	16:51:50	7, 8		Yes	Yes
69	604957	587397	Dwelling	1017	T1	00:33:00	35:12:00	11:24:56		1	Yes	Yes
70	605008	586923	Dwelling	785	T6	00:52:12	57:54:00	18:46:38		6	Yes	Yes
71	605266	586328	Dwelling	946	T6	00:34:48	34:30:00	11:11:19		6	Yes	Yes
72	605282	586432	Dwelling	947	T6	00:40:48	32:00:00	10:22:40		6	Yes	Yes
73	605377	586748	Dwelling	1065	T6	00:30:36	15:36:00	5:03:33		6	Yes	Yes
74	600571	589162	Planning Application	1080	T12	00:31:48	33:54:00	10:59:38		12	Yes	Yes
75	605310	586260	Planning Application	1005	T6	00:33:36	22:18:00	7:13:55		6	Yes	Yes
76	600578	586492	Planning Application	736	T17	00:00:00	0:00:00	0:00:00	N/A		No	No
77	599003	586321	Planning Application ID 18/4499 - Cork granted	1176	T16	00:00:00	0:00:00	0:00:00	N/A		No	No

78	598909	586292	Planning Application ID 18/6951 - Cork granted		1251	T16		00:00:00	0:00:00	0:00:00	N/A	No	No
79	598876	587308	Planning Application ID 19/5914 - Cork granted		732	T16		01:00:36	89:06:00	28:53:44	14, 16	Yes	Yes
80	605293	586234	Planning Application ID 18/383 - W'ford granted		995	T6		00:33:36	23:48:00	7:43:06	6	Yes	Yes
81	604240	589061		0	1366	T1		00:00:00	0:00:00	0:00:00	N/A	No	No
82	604171	589043		0	1337	T1		00:00:00	0:00:00	0:00:00	N/A	No	No
83	604183	589037		0	1333	T1		00:00:00	0:00:00	0:00:00	N/A	No	No
84	604258	588965		0	1275	T1		00:00:00	0:00:00	0:00:00	N/A	No	No
85	604307	588937		0	1259	T1		00:00:00	0:00:00	0:00:00	N/A	No	No
86	604315	588931		0	1255	T1		00:00:00	0:00:00	0:00:00	N/A	No	No
87	605450	585949		0	1247	T6		00:28:12	24:12:00	7:50:53	N/A	No	No
88	605444	585872		0	1279	T6		00:28:12	31:54:00	10:20:43	N/A	No	No
89	603877	583927		0	1328	T10		00:00:00	0:00:00	0:00:00	N/A	No	No
90	603083	584058		0	1290	T10		00:00:00	0:00:00	0:00:00	N/A	No	No
91	603155	584011		0	1306	T10		00:00:00	0:00:00	0:00:00	N/A	No	No
92	600468	585862		0	1311	T17		00:00:00	0:00:00	0:00:00	N/A	No	No
93	602068	586784		0	1124	T5		00:30:00	50:12:00	16:16:49	N/A	No	No
94	602665	586822	Planning Permission for dwelling		533	T5		01:09:36	152:24:00	49:25:27	3, 5, 11	Yes	Yes
95	602717	586621	Planning Permission for dwelling		580	T5		00:40:12	74:36:00	24:11:35	5, 11	Yes	Yes
100	598862	587310	PP 195914		728		0	00:59:24	88:12:00	28:36:14	14, 16	Yes	Yes
101	598862	587357	PP 214825		729		0	00:51:36	92:42:00	30:03:47	14, 16	Yes	Yes

102	598638	588151	PP 059256	730	0	00:43:48	83:36:00	27:06:43		13	Yes	Yes
103	600658	586499	PP 184499	768	0	00:00:00	0:00:00	0:00:00	N/A		No	No
104	600573	589079	PP 0949	1024	0	00:33:36	35:54:00	11:38:33		12	Yes	Yes
105	599107	586351	PP 184499	1082	0	00:00:00	0:00:00	0:00:00	N/A		No	No
106	598862	586486	PP 205092	1107	0	00:00:00	0:00:00	0:00:00	N/A		No	No
107	605407	586110	PP 06143	1143	0	00:30:00	19:54:00	6:27:13		6	No	No
108	598986	586238	PP 186951	1239	0	00:00:00	0:00:00	0:00:00	N/A		No	No
109	600445	585900	PP 085349	1270	0	00:00:00	0:00:00	0:00:00	N/A		No	No

Shadow Flicker Turbine Hub 93.5m

Exceedances	No. Of Properties
Daily	33
Annual	1

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Proposed Turbine No.	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Proposed Turbine(s) Giving Rise to Daly Shadow Flicker Exceedance		Mitigation Strategy Required (Daily)	Mitigation Strategy Required (Annual)
1	598514	588721	Dwelling	1060	T13	00:27:36	8:42:00	2:49:17	N/A		No	No
2	598645	588003	Dwelling	725	T13	00:38:24	39:30:00	12:48:36		13	Yes	Yes
3	598651	587842	Dwelling	756	T13	00:38:24	65:12:00	21:08:41		13	Yes	Yes
4	598656	588404	Dwelling	776	T13	00:36:00	22:12:00	7:11:58		13	Yes	Yes
5	598687	587517	Dwelling	887	T13	00:30:00	31:00:00	10:03:13		16	No	No
6	598850	587409	Dwelling	762	T16	00:37:12	59:42:00	19:21:40	14, 16		Yes	Yes
7	598894	588985	Dwelling	1012	T13	00:27:00	28:18:00	9:10:40	N/A		No	No
8	598998	586888	Dwelling	753	T16	00:00:00	0:00:00	0:00:00	N/A		No	No
9	599326	586507	Dwelling	869	T16	00:00:00	0:00:00	0:00:00	N/A		No	No
10	599748	586235	Dwelling	1054	T17	00:00:00	0:00:00	0:00:00	N/A		No	No
11	600379	588814	Dwelling	707	T12	00:39:36	31:42:00	10:16:50		12	Yes	Yes
12	600493	588853	Dwelling	824	T12	00:34:12	23:06:00	7:29:29		12	Yes	Yes
13	600562	589306	Dwelling	1180	T12	00:00:00	0:00:00	0:00:00	N/A		No	No
14	600549	586316	Dwelling	888	T17	00:00:00	0:00:00	0:00:00	N/A		No	No
15	600654	589321	Dwelling	1252	T12	00:00:00	0:00:00	0:00:00	N/A		No	No
16	600822	586555	Dwelling	823	T17	00:00:00	0:00:00	0:00:00	N/A		No	No
17	601046	587710	Dwelling	962	T17	00:30:00	32:48:00	10:38:14		17	No	No
18	601073	587560	Dwelling	908	T17	00:31:12	31:24:00	10:11:00		17	Yes	Yes

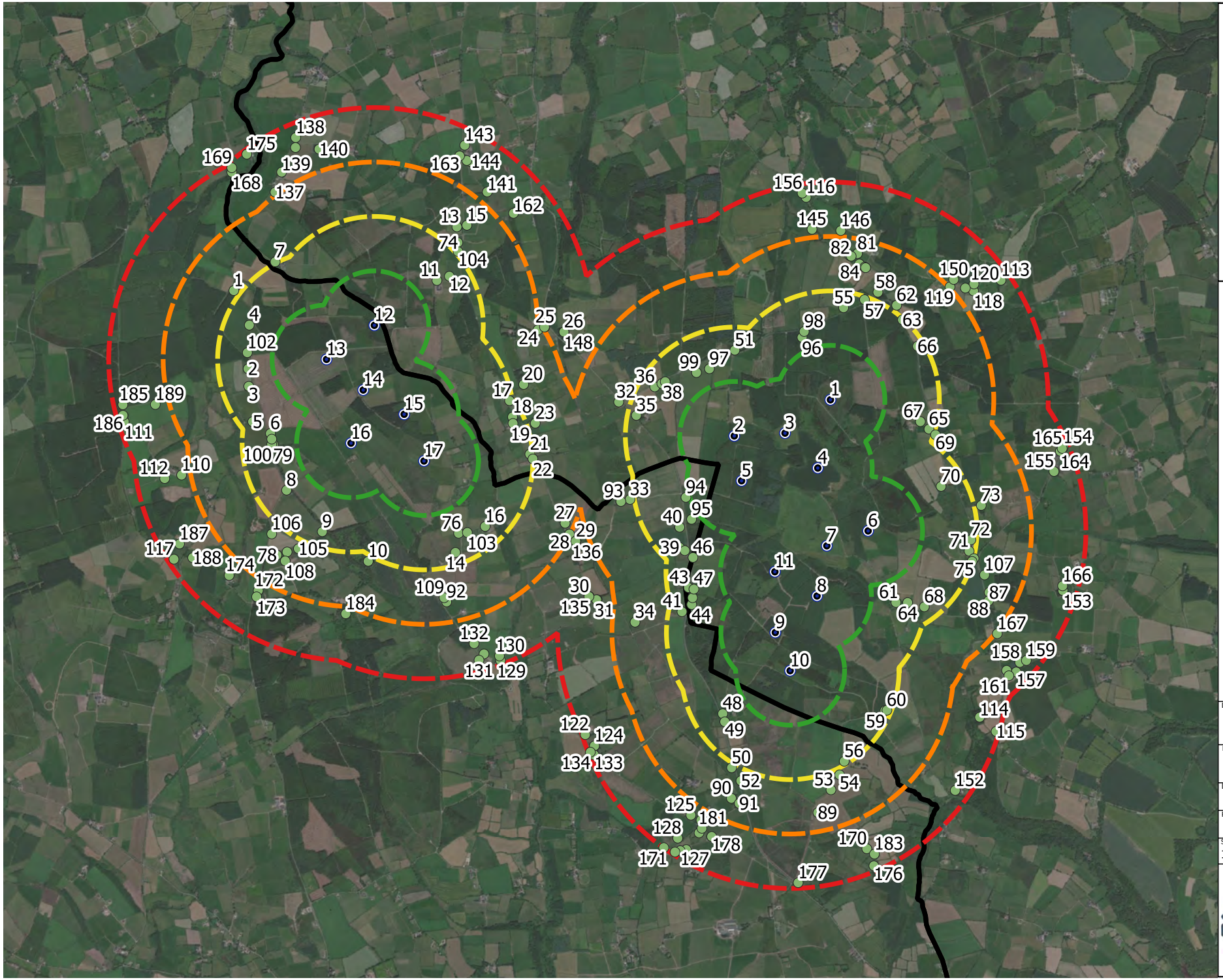
19	601077	587501	Dwelling	887	T17	00:31:48	31:36:00	10:14:53		17	Yes	Yes
20	601175	587859	Dwelling	1131	T15	00:00:00	0:00:00	0:00:00	N/A		No	No
21	601232	587219	Dwelling	974	T17	00:28:48	14:06:00	4:34:22	N/A		No	No
22	601260	587175	Dwelling	1000	T17	00:28:12	13:30:00	4:22:41	N/A		No	No
23	601282	587503	Dwelling	1079	T17	00:26:24	11:54:00	3:51:33	N/A		No	No
24	601306	588360	Dwelling	1452	T15	00:00:00	0:00:00	0:00:00	N/A		No	No
25	601370	588387	Dwelling	1521	T15	00:00:00	0:00:00	0:00:00	N/A		No	No
26	601546	588343	Dwelling	1652	T15	00:00:00	0:00:00	0:00:00	N/A		No	No
27	601556	586585	Dwelling	1416	T17	00:00:00	0:00:00	0:00:00	N/A		No	No
28	601596	586485	Derelict	1495	T17	00:00:00	0:00:00	0:00:00	N/A		No	No
29	601655	586422	Dwelling	1577	T17	00:00:00	0:00:00	0:00:00	N/A		No	No
30	601777	585912	Dwelling	1720	T11	00:00:00	0:00:00	0:00:00	N/A		No	No
31	601850	585882	Dwelling	1652	T11	00:00:00	0:00:00	0:00:00	N/A		No	No
32	602048	587698	Dwelling	1106	T2	00:25:48	11:24:00	3:41:50	N/A		No	No
33	602152	586803	Dwelling	1038	T5	00:27:36	41:24:00	13:25:35	N/A		No	No
34	602198	585676	Dwelling	1292	T9	00:00:00	0:00:00	0:00:00	N/A		No	No
35	602210	587575	Dwelling	919	T2	00:30:36	15:36:00	5:03:33		2	Yes	Yes
36	602379	587837	Dwelling	858	T2	00:33:36	22:30:00	7:17:49		2	Yes	Yes
37	602444	587867	Dwelling	821	T2	00:35:24	27:42:00	8:59:00		2	Yes	Yes
38	602475	587884	Dwelling	806	T2	00:36:00	31:18:00	10:09:03		2	Yes	Yes
39	602605	586363	Dwelling	836	T5	00:31:12	16:12:00	5:15:14		11	Yes	Yes
40	602608	586548	Dwelling	710	T5	00:29:24	26:00:00	8:25:55	N/A		No	No
41	602629	585772	Dwelling	878	T9	00:31:48	42:24:00	13:45:02	9,11		Yes	Yes
42	602655	586333	Commercial unit	826	T5	00:33:00	45:18:00	14:41:28		11	Yes	Yes
43	602690	585993	Dwelling	805	T11	00:34:48	41:18:00	13:23:38	9,11		Yes	Yes
44	602718	585838	Dwelling	810	T9	00:35:24	66:42:00	21:37:52	9,11		Yes	Yes
45	602726	585900	Dwelling	793	T11	00:36:00	65:12:00	21:08:41	9,11		Yes	Yes
46	602730	586270	Dwelling	763	T11	00:36:00	53:12:00	17:15:11		11	Yes	Yes
47	602738	585979	Dwelling	761	T11	00:37:12	47:18:00	15:20:23	9,11		Yes	Yes
48	603003	584835	Dwelling	734	T10	00:28:48	15:54:00	5:09:23	N/A		No	No
49	603022	584761	Dwelling	762	T10	00:00:00	0:00:00	0:00:00	N/A		No	No
50	603085	584339	Dwelling	1040	T10	00:00:00	0:00:00	0:00:00	N/A		No	No
51	603114	588174	Dwelling	788	T2	00:29:24	15:48:00	5:07:27	N/A		No	No

52	603170	584219	Dwelling	1108	T10	00:00:00	0:00:00	0:00:00	N/A		No	No
53	603997	584136	Dwelling	1157	T10	00:00:00	0:00:00	0:00:00	N/A		No	No
54	604076	584274	Dwelling	1059	T10	00:00:00	0:00:00	0:00:00	N/A		No	No
55	604113	588564	Dwelling	855	T1	00:00:00	0:00:00	0:00:00	N/A		No	No
56	604119	584398	Dwelling	969	T10	00:00:00	0:00:00	0:00:00	N/A		No	No
57	604305	588638	Dwelling	972	T1	00:00:00	0:00:00	0:00:00	N/A		No	No
58	604428	588706	Dwelling	1080	T1	00:00:00	0:00:00	0:00:00	N/A		No	No
59	604493	584864	Dwelling	945	T10	00:31:12	32:36:00	10:34:21		10	Yes	Yes
60	604511	584867	Dwelling	960	T10	00:30:36	28:30:00	9:14:34		10	Yes	Yes
61	604594	585857	Dwelling	705	T6	00:37:48	27:00:00	8:45:23		8	Yes	Yes
62	604600	588586	Dwelling	1060	T1	00:24:36	13:00:00	4:12:58	N/A		No	No
63	604654	588453	Dwelling	989	T1	00:30:00	29:24:00	9:32:04	N/A		No	No
64	604701	585856	Dwelling	752	T6	00:33:36	29:36:00	9:35:58		8	Yes	Yes
65	604897	587449	Dwelling	944	T1	00:30:36	30:54:00	10:01:16		1	Yes	Yes
66	604792	588210	Dwelling	939	T1	00:30:36	18:36:00	6:01:56		1	Yes	Yes
67	604818	587518	Dwelling	850	T1	00:33:36	35:24:00	11:28:49		1	Yes	Yes
68	604854	585817	Dwelling	867	T6	00:28:48	37:30:00	12:09:41	N/A		No	No
69	604957	587397	Dwelling	1017	T1	00:28:48	28:18:00	9:10:40	N/A		No	No
70	605008	586923	Dwelling	785	T6	00:36:00	24:54:00	8:04:31		6	Yes	Yes
71	605266	586328	Dwelling	946	T6	00:30:00	17:24:00	5:38:35		6	No	No
72	605282	586432	Dwelling	947	T6	00:30:00	15:48:00	5:07:27	N/A		No	No
73	605377	586748	Dwelling	1065	T6	00:26:24	11:54:00	3:51:33	N/A		No	No
74	600571	589162	Planning Application	1080	T12	00:28:12	30:30:00	9:53:29	N/A		No	No
75	605310	586260	Planning Application	1005	T6	00:28:48	16:42:00	5:24:57	N/A		No	No
76	600578	586492	Planning Application	736	T17	00:00:00	0:00:00	0:00:00	N/A		No	No
77	599003	586321	Planning Application ID 18/4499 - Cork granted	1176	T16	00:00:00	0:00:00	0:00:00	N/A		No	No
78	598909	586292	Planning Application ID 18/6951 - Cork granted	1251	T16	00:00:00	0:00:00	0:00:00	N/A		No	No

79	598876	587308	Planning Application ID 19/5914 - Cork granted		732	T16		00:39:00	56:48:00	18:25:14	14, 16		Yes	Yes
80	605293	586234	Planning Application ID 18/383 - W'ford granted		995	T6		00:29:24	17:54:00	5:48:18	N/A		No	No
81	604240	589061		0	1366	T1		00:00:00	0:00:00	0:00:00	N/A		No	No
82	604171	589043		0	1337	T1		00:00:00	0:00:00	0:00:00	N/A		No	No
83	604183	589037		0	1333	T1		00:00:00	0:00:00	0:00:00	N/A		No	No
84	604258	588965		0	1275	T1		00:00:00	0:00:00	0:00:00	N/A		No	No
85	604307	588937		0	1259	T1		00:00:00	0:00:00	0:00:00	N/A		No	No
86	604315	588931		0	1255	T1		00:00:00	0:00:00	0:00:00	N/A		No	No
87	605450	585949		0	1247	T6		00:00:00	0:00:00	0:00:00	N/A		No	No
88	605444	585872		0	1279	T6		00:00:00	0:00:00	0:00:00	N/A		No	No
89	603877	583927		0	1328	T10		00:00:00	0:00:00	0:00:00	N/A		No	No
90	603083	584058		0	1290	T10		00:00:00	0:00:00	0:00:00	N/A		No	No
91	603155	584011		0	1306	T10		00:00:00	0:00:00	0:00:00	N/A		No	No
92	600468	585862		0	1311	T17		00:00:00	0:00:00	0:00:00	N/A		No	No
93	602068	586784		0	1124	T5		00:25:48	12:00:00	3:53:30	N/A		No	No
94	602665	586822	Planning Permission for dwelling		533	T5		01:03:36	121:42:00	39:28:05		5	Yes	Yes
95	602717	586621	Planning Permission for dwelling		580	T5		00:31:48	26:00:00	8:25:55		11	Yes	Yes
100	598862	587310	PP 195914		728		0	00:37:48	57:06:00	18:31:04	14, 16		Yes	Yes
101	598862	587357	PP 214825		729		0	00:37:48	62:18:00	20:12:15	14, 16		Yes	Yes
102	598638	588151	PP 059256		730		0	00:37:48	35:18:00	11:26:53		13	Yes	Yes
103	600658	586499	PP 184499		768		0	00:00:00	0:00:00	0:00:00	N/A		No	No
104	600573	589079	PP 0949		1024		0	00:28:48	23:00:00	7:27:32	N/A		No	No
105	599107	586351	PP 184499		1082		0	00:00:00	0:00:00	0:00:00	N/A		No	No
106	598862	586486	PP 205092		1107		0	00:00:00	0:00:00	0:00:00	N/A		No	No
107	605407	586110	PP 06143		1143		0	00:00:00	0:00:00	0:00:00	N/A		No	No
108	598986	586238	PP 186951		1239		0	00:00:00	0:00:00	0:00:00	N/A		No	No
109	600445	585900	PP 085349		1270		0	00:00:00	0:00:00	0:00:00	N/A		No	No

APPENDIX 9

FIGURE NOISE SENSITIVE RECEPTORS


Map Legend
Turbine Layout
All Dwellings within 2km
500m Turbine Buffer
1000m Turbine Buffer
1500m Turbine Buffer
2000m Turbine Buffer
County Boundary
N
Microsoft product screen shots reprinted with permission from Microsoft Corporation
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Drawing Title
Dwellings within 2km Buffer
Project Title
Lyrenacarriga Wind Farm FI
Drawn By
NMcH
Checked By
MC
Project No.
170749-e
Drawing No.
Figure 1
Scale
1:45305
Date
01.08.2022
MKO
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APPENDIX 10

SHADOW FLICKER T5

BRIEFING NOTE

Project Reference	170749-e Lyre WF ABP Further Information
Date & Time	23.09.2022
Subject	Shadow Flicker Outputs
Author(s)	Niamh McHugh, Killian McGovern, James Newell, Ellen Costello, Meabhann Crowe

Introduction

MKO has been commissioned to conduct a Shadow Flicker Assessment of 2 no. scenarios (Scenarios 1 and 2) in relation to turbine locations for the Proposed Lyrenacarriga Wind Farm Development following receipt of a request for Further Information from An Bord Pleanála (ref: ABP-309121-21). These 2 no. Scenarios have been assessed relative to an updated Dwellings database. The Dwellings database includes for two identified sensitive receptors in the form of granted planning permissions for a property/dwelling. These two dwellings are located within the designated set-back distance 600m (4 x tip height) of the proposed turbine 5 location, which was assessed in the Environmental Impact Assessment Report (EIAR) lodged and as submitted to An Bord Pleanála in 2021 (2021 EIAR).

These 2 no. scenarios are as follows:

- Scenario 1: 17 no. Turbines in their Original Locations (2021 EIAR)
- Scenario 2: Move T5 to Outside 700m of Dwellings

Within these scenarios (discussed overleaf), two turbine options have been assessed:

Label	Tip Height (m)	Hub Height (m)	Blade Length (m)	Rotor Diameter (m)
Turbine Option 1	150	83.5	66.5	133
Turbine Option 2	150	93.5	56.5	113

Therefore, the following 6 no. shadow flicker processing outputs have been assessed:

- Scenario 1 (Turbine Option 1)
- Scenario 1 (Turbine Option 2)
- Scenario 2 (Turbine Option 1)
- Scenario 2 (Turbine Option 2)

The results of Turbine Options 1 and 2 under Scenarios 1 and 2 are available to view in Appendix 1 of this document. The Shadow Flicker Assessment was carried out by Niamh McHugh and Killian McGovern both Environmental Scientists, and James Newell a Graphics Technician, all of MKO. This Shadow Flicker Assessment has been reviewed by Ellen Costello, a Project Environmental Scientist of MKO.

Shadow Flicker Prediction Methodology

Shadow Flicker occurs only under certain, combined circumstances. Where shadow flicker does occur, it is generally short-lived.

The occurrence of shadow flicker can be precisely predicted using specialist computer software programmes specifically developed for the wind energy industry, such as WindFarm (ReSoft) or WindFarmer (DNV.GL) or AWS OpenWind or WindPro.

The computer modelling of the occurrence and magnitude of shadow flicker is made possible by the fact that the sun rises and sets in the same position in the sky on every day each year.

Any potential impact can be precisely modelled to give the start and end time (accurate to the second) of any incidence of shadow flicker, at any location, on any day or all days of the year when it might occur. Where a shadow flicker impact is predicted to occur, the total maximum daily and annual durations can be predicted, along with the total number of days.

For the purposes of this shadow flicker assessment, the software package ReSoft WindFarm Version 5.0.1.2 has been used to predict the level of shadow flicker associated with the Lyrenacarriga Wind Farm Development.

Guidance

The current, adopted guidance for shadow flicker in Ireland is derived from the '*Wind Energy Development Guidelines for Planning Authorities 2006*' (DoEHLG), and the '*Best Practice Guidelines for the Irish Wind Energy Industry*' (Irish Wind Energy Association, 2012). The 2006 DoEHLG Guidelines state that at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low.

The DoEHLG 2006 wind energy guidelines recommend that shadow flicker at dwellings within 500 metres of a proposed turbine location should not exceed a total of 30 hours per year or 30 minutes per day.

The adopted 2006 DoEHLG guidelines are currently under review. The DoHPLG released the 'Draft Revised Wind Energy Development Guidelines' in December 2019 for public consultation. The Draft 2019 guidelines recommend local planning authorities and/or An Bord Pleanála impose conditions 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."*

The Draft 2019 Guidelines are based on the recommendations set out in the 'Proposed Revisions to Wind Energy Development Guidelines 2006 – Targeted Review' (December 2013) and the 'Review of the Wind Energy Development Guidelines 2006 – Preferred Draft Approach' (June 2017).

The assessment herein is based on compliance with the current DoEHLG Guidelines limit (30 hours per year or 30 minutes per day).

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Study Area

The study area for the shadow flicker assessment is ten times rotor diameter, as set out in the '*Wind Energy Development Guidelines for Planning Authorities'*, DoEHLG, 2006. All dwellings (including the two identified properties in receipt of planning permission) located within ten rotor diameters of the Lyrenacarriga Wind Farm have been included within this assessment.

Scenario 1 – 17 no. Turbines in their Original Locations (relative to 2021 EIAR)

Scenario A refers to the turbine layout as it currently stands, as assessed in the Environmental Impact Assessment Report (EIAR) lodged and as submitted to An Bord Pleanála in 2021 (2021 EIAR). The results for Turbine Option 1, and for Turbine Option 2 are presented in the attached in Appendix 1 as 'Scenario 1 – Turbine Option 1' and Scenario 1 – Turbine Option 2' respectively. As can be seen in Appendix 1, 'Scenario 1 – Turbine Option 1' leads to a total of 60 no. dwellings experiencing daily shadow flicker exceedances and 7 no. dwellings experiencing annual shadow flicker exceedances. Similarly, 'Scenario 1 – Turbine Option 2' leads to a total of 36 no. dwellings experiencing daily shadow flicker exceedances and 1 no. dwellings experiencing annual shadow flicker exceedances.

Scenario 2 – Move T5 to Outside 700m of Dwellings

Scenario C refers to the turbine layout if T5 were to be moved 165m to the east in order to maintain a 700m setback distance from all dwellings, a set-back distance from dwellings that is set out in the 2021 EIAR. The results for the Turbine Option 1, and for the Turbine Option 2 are presented in the attached in Appendix 1 as 'Scenario 2 – Turbine Option 1' and Scenario 2 – Turbine Option 2' respectively. As can be seen in Appendix 1, 'Scenario 2 – Turbine Option 1' leads to a total of 60 no. dwellings experiencing daily shadow flicker exceedances and 8 no. dwellings experiencing annual shadow flicker exceedances. Similarly, 'Scenario 2 – Turbine Option 2' leads to a total of 38 no. dwellings experiencing daily shadow flicker exceedances and 0 no. dwellings experiencing annual shadow flicker exceedances.

Example Mitigation Measures

An example of the mitigation strategy (i.e. the dates when exceedances will occur and potential turbine curtailment dates) can also be seen in Appendix 1 of this document and relates to Scenario 2: Turbine Option 2.

Summary

Scenario 1 vs. Scenario 2:

As detailed in the results presented above, the variance in results between the scenarios is minimal (± 2 no. dwellings). The movement of turbine no. 5 does not give rise to any significant changes in the number of dwellings in which there are daily shadow flicker exceedances and annual shadow flicker exceedances.

Turbine Option 1 vs. Turbine Option 2 across all scenarios:

For Turbine Option 2, across both scenarios, there is a range of 36-38 properties in which daily shadow flicker exceedances will occur. For Turbine Option 1, there is an increase of approximately 22 dwellings in which daily shadow flicker exceedances will occur i.e 60 properties across all

scenarios. For annual exceedances, Turbine Option 2 gives rise to annual exceedances 1 no. dwellings for Scenario 1 and at 0 no. dwellings for Scenario 2. There is an increase in annual exceedances at a range of 7-8 dwellings for Turbine Option 1 across both scenarios. As detailed above, Turbine Option 1 gives rise to greater daily and annual exceedances which is line with expected results, as Turbine Option 1 has a longer turbine blade and a great rotor diameter than that of Turbine Option 2.

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FI Lyrenacarriga

Appendix 8

Shadow Flicker Turbine Hub 83.5m

Exceedances	No. Of Properties
Daily	56
Annual	7

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Proposed Turbine No.	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Proposed Turbine(s) Giving Rise to Daly Shadow Flicker Exceedance	Mitigation Strategy Required (Daily)	Mitigation Strategy Required (Annual)
1	598514	588721	Dwelling	1060	T13	00:31:12	13:24:00	4:20:45	13	Yes	Yes
2	598645	588003	Dwelling	725	T13	01:02:24	85:36:00	27:45:38	13, 14	Yes	Yes
3	598651	587842	Dwelling	756	T13	01:07:48	103:24:00	33:32:00	13, 14, 16	Yes	Yes
4	598656	588404	Dwelling	776	T13	00:42:00	56:06:00	18:11:37	13	Yes	Yes
5	598687	587517	Dwelling	887	T13	00:35:24	39:12:00	12:42:46	14, 16	Yes	Yes
6	598850	587409	Dwelling	762	T16	00:43:12	89:06:00	28:53:44	14, 16	Yes	Yes
7	598894	588985	Dwelling	1012	T13	00:31:12	34:36:00	11:13:15	12	Yes	Yes
8	598998	586888	Dwelling	753	T16	00:29:24	39:18:00	12:44:43	N/A	No	No
9	599326	586507	Dwelling	869	T16	00:30:36	23:00:00	7:27:32	17	Yes	Yes
10	599748	586235	Dwelling	1054	T17	00:00:00	0:00:00	0:00:00	N/A	No	No
11	600379	588814	Dwelling	707	T12	00:46:48	49:48:00	16:09:01	12	Yes	Yes
12	600493	588853	Dwelling	824	T12	00:40:12	44:36:00	14:27:51	12	Yes	Yes
13	600562	589306	Dwelling	1180	T12	00:27:00	17:18:00	5:36:38	N/A	No	No
14	600549	586316	Dwelling	888	T17	00:00:00	0:00:00	0:00:00	N/A	No	No
15	600654	589321	Dwelling	1252	T12	00:27:36	22:06:00	7:10:02	N/A	No	No
16	600822	586555	Dwelling	823	T17	00:00:00	0:00:00	0:00:00	N/A	No	No
17	601046	587710	Dwelling	962	T17	00:35:24	45:30:00	14:45:21	15, 17	Yes	Yes

18	601073	587560	Dwelling	908	T17	00:36:00	42:36:00	13:48:56	15, 17	Yes	Yes
19	601077	587501	Dwelling	887	T17	00:36:36	43:00:00	13:56:42	15, 17	Yes	Yes
20	601175	587859	Dwelling	1131	T15	00:30:00	36:30:00	11:50:14	17	No	No
21	601232	587219	Dwelling	974	T17	00:33:36	35:48:00	11:36:36	17	Yes	Yes
22	601260	587175	Dwelling	1000	T17	00:32:24	34:48:00	11:17:09	17	Yes	Yes
23	601282	587503	Dwelling	1079	T17	00:30:36	29:24:00	9:32:04	17	Yes	Yes
24	601306	588360	Dwelling	1452	T15	00:00:00	0:00:00	0:00:00	N/A	No	No
25	601370	588387	Dwelling	1521	T15	00:00:00	0:00:00	0:00:00	N/A	No	No
26	601546	588343	Dwelling	1652	T15	00:00:00	0:00:00	0:00:00	N/A	No	No
27	601556	586585	Dwelling	1416	T17	00:00:00	0:00:00	0:00:00	N/A	No	No
28	601596	586485	Derelict	1495	T17	00:00:00	0:00:00	0:00:00	N/A	No	No
29	601655	586422	Dwelling	1577	T17	00:00:00	0:00:00	0:00:00	N/A	No	No
30	601777	585912	Dwelling	1720	T11	00:00:00	0:00:00	0:00:00	N/A	No	No
31	601850	585882	Dwelling	1652	T11	00:00:00	0:00:00	0:00:00	N/A	No	No
32	602048	587698	Dwelling	1106	T2	00:30:00	14:00:00	4:32:25	N/A	No	No
33	602152	586803	Dwelling	1038	T5	00:32:24	53:30:00	17:21:01	2, 5	Yes	Yes
34	602198	585676	Dwelling	1292	T9	00:25:48	10:00:00	3:14:35	N/A	No	No
35	602210	587575	Dwelling	919	T2	00:35:24	36:48:00	11:56:04	2, 5	Yes	Yes
36	602379	587837	Dwelling	858	T2	00:39:00	57:54:00	18:46:38	2	Yes	Yes
37	602444	587867	Dwelling	821	T2	00:41:24	57:00:00	18:29:08	2	Yes	Yes
38	602475	587884	Dwelling	806	T2	00:42:00	56:06:00	18:11:37	2	Yes	Yes
39	602605	586363	Dwelling	836	T5	00:36:00	49:12:00	15:57:21	9, 11	Yes	Yes
40	602608	586548	Dwelling	710	T5	00:37:48	64:00:00	20:45:20	5, 11	Yes	Yes
41	602629	585772	Dwelling	878	T9	00:37:12	79:54:00	25:54:43	9, 10, 11	Yes	Yes
42	602655	586333	Commercial unit	826	T5	00:38:24	69:06:00	22:24:34	9, 11	Yes	Yes
43	602690	585993	Dwelling	805	T11	00:54:36	92:48:00	30:05:44	9, 11	Yes	Yes
44	602718	585838	Dwelling	810	T9	00:41:24	97:42:00	31:41:05	9, 10, 11	Yes	Yes
45	602726	585900	Dwelling	793	T11	00:51:36	99:06:00	32:08:19	9, 10, 11	Yes	Yes
46	602730	586270	Dwelling	763	T11	00:42:00	80:30:00	26:06:24	9, 11	Yes	Yes
47	602738	585979	Dwelling	761	T11	00:57:36	107:18:00	34:47:53	9, 10, 11	Yes	Yes
48	603003	584835	Dwelling	734	T10	00:31:48	19:30:00	6:19:26	10	Yes	Yes
49	603022	584761	Dwelling	762	T10	00:00:00	0:00:00	0:00:00	N/A	No	No
50	603085	584339	Dwelling	1040	T10	00:00:00	0:00:00	0:00:00	N/A	No	No

51	603114	588174	Dwelling	788	T2	00:34:12	19:06:00	6:11:39		1	Yes	Yes
52	603170	584219	Dwelling	1108	T10	00:00:00	0:00:00	0:00:00	N/A		No	No
53	603997	584136	Dwelling	1157	T10	00:00:00	0:00:00	0:00:00	N/A		No	No
54	604076	584274	Dwelling	1059	T10	00:00:00	0:00:00	0:00:00	N/A		No	No
55	604113	588564	Dwelling	855	T1	00:00:00	0:00:00	0:00:00	N/A		No	No
56	604119	584398	Dwelling	969	T10	00:00:00	0:00:00	0:00:00	N/A		No	No
57	604305	588638	Dwelling	972	T1	00:00:00	0:00:00	0:00:00	N/A		No	No
58	604428	588706	Dwelling	1080	T1	00:00:00	0:00:00	0:00:00	N/A		No	No
59	604493	584864	Dwelling	945	T10	00:42:36	59:24:00	19:15:50		10	Yes	Yes
60	604511	584867	Dwelling	960	T10	00:40:48	55:42:00	18:03:50		10	Yes	Yes
61	604594	585857	Dwelling	705	T6	01:08:24	84:42:00	27:28:07		8	Yes	Yes
62	604600	588586	Dwelling	1060	T1	00:27:00	14:48:00	4:47:59	N/A		No	No
63	604654	588453	Dwelling	989	T1	00:31:48	33:06:00	10:44:04		1	Yes	Yes
64	604701	585856	Dwelling	752	T6	01:00:00	89:30:00	29:01:31	7, 8		Yes	Yes
65	604897	587449	Dwelling	944	T1	00:35:24	47:36:00	15:26:13	1, 4		Yes	Yes
66	604792	588210	Dwelling	939	T1	00:35:24	25:00:00	8:06:28		1	Yes	Yes
67	604818	587518	Dwelling	850	T1	00:39:00	54:00:00	17:30:45	1, 4		Yes	Yes
68	604854	585817	Dwelling	867	T6	00:33:36	52:00:00	16:51:50	7, 8		Yes	Yes
69	604957	587397	Dwelling	1017	T1	00:33:00	35:12:00	11:24:56		1	Yes	Yes
70	605008	586923	Dwelling	785	T6	00:52:12	57:54:00	18:46:38		6	Yes	Yes
71	605266	586328	Dwelling	946	T6	00:34:48	34:30:00	11:11:19		6	Yes	Yes
72	605282	586432	Dwelling	947	T6	00:40:48	32:00:00	10:22:40		6	Yes	Yes
73	605377	586748	Dwelling	1065	T6	00:30:36	15:36:00	5:03:33		6	Yes	Yes
74	600571	589162	Planning Application	1080	T12	00:31:48	33:54:00	10:59:38		12	Yes	Yes
75	605310	586260	Planning Application	1005	T6	00:33:36	22:18:00	7:13:55		6	Yes	Yes
76	600578	586492	Planning Application	736	T17	00:00:00	0:00:00	0:00:00	N/A		No	No
77	599003	586321	Planning Application ID 18/4499 - Cork granted	1176	T16	00:00:00	0:00:00	0:00:00	N/A		No	No

78	598909	586292	Planning Application ID 18/6951 - Cork granted		1251	T16		00:00:00	0:00:00	0:00:00	N/A	No	No
79	598876	587308	Planning Application ID 19/5914 - Cork granted		732	T16		01:00:36	89:06:00	28:53:44	14, 16	Yes	Yes
80	605293	586234	Planning Application ID 18/383 - W'ford granted		995	T6		00:33:36	23:48:00	7:43:06	6	Yes	Yes
81	604240	589061		0	1366	T1		00:00:00	0:00:00	0:00:00	N/A	No	No
82	604171	589043		0	1337	T1		00:00:00	0:00:00	0:00:00	N/A	No	No
83	604183	589037		0	1333	T1		00:00:00	0:00:00	0:00:00	N/A	No	No
84	604258	588965		0	1275	T1		00:00:00	0:00:00	0:00:00	N/A	No	No
85	604307	588937		0	1259	T1		00:00:00	0:00:00	0:00:00	N/A	No	No
86	604315	588931		0	1255	T1		00:00:00	0:00:00	0:00:00	N/A	No	No
87	605450	585949		0	1247	T6		00:28:12	24:12:00	7:50:53	N/A	No	No
88	605444	585872		0	1279	T6		00:28:12	31:54:00	10:20:43	N/A	No	No
89	603877	583927		0	1328	T10		00:00:00	0:00:00	0:00:00	N/A	No	No
90	603083	584058		0	1290	T10		00:00:00	0:00:00	0:00:00	N/A	No	No
91	603155	584011		0	1306	T10		00:00:00	0:00:00	0:00:00	N/A	No	No
92	600468	585862		0	1311	T17		00:00:00	0:00:00	0:00:00	N/A	No	No
93	602068	586784		0	1124	T5		00:30:00	50:12:00	16:16:49	N/A	No	No
94	602665	586822	Planning Permission for dwelling		533	T5		01:09:36	152:24:00	49:25:27	3, 5, 11	Yes	Yes
95	602717	586621	Planning Permission for dwelling		580	T5		00:40:12	74:36:00	24:11:35	5, 11	Yes	Yes
100	598862	587310	PP 195914		728		0	00:59:24	88:12:00	28:36:14	14, 16	Yes	Yes
101	598862	587357	PP 214825		729		0	00:51:36	92:42:00	30:03:47	14, 16	Yes	Yes

102	598638	588151	PP 059256	730	0	00:43:48	83:36:00	27:06:43		13	Yes	Yes
103	600658	586499	PP 184499	768	0	00:00:00	0:00:00	0:00:00	N/A		No	No
104	600573	589079	PP 0949	1024	0	00:33:36	35:54:00	11:38:33		12	Yes	Yes
105	599107	586351	PP 184499	1082	0	00:00:00	0:00:00	0:00:00	N/A		No	No
106	598862	586486	PP 205092	1107	0	00:00:00	0:00:00	0:00:00	N/A		No	No
107	605407	586110	PP 06143	1143	0	00:30:00	19:54:00	6:27:13		6	No	No
108	598986	586238	PP 186951	1239	0	00:00:00	0:00:00	0:00:00	N/A		No	No
109	600445	585900	PP 085349	1270	0	00:00:00	0:00:00	0:00:00	N/A		No	No

Shadow Flicker Turbine Hub 93.5m

Exceedances	No. Of Properties
Daily	33
Annual	1

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Proposed Turbine No.	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Proposed Turbine(s) Giving Rise to Daly Shadow Flicker Exceedance		Mitigation Strategy Required (Daily)	Mitigation Strategy Required (Annual)
1	598514	588721	Dwelling	1060	T13	00:27:36	8:42:00	2:49:17	N/A		No	No
2	598645	588003	Dwelling	725	T13	00:38:24	39:30:00	12:48:36		13	Yes	Yes
3	598651	587842	Dwelling	756	T13	00:38:24	65:12:00	21:08:41		13	Yes	Yes
4	598656	588404	Dwelling	776	T13	00:36:00	22:12:00	7:11:58		13	Yes	Yes
5	598687	587517	Dwelling	887	T13	00:30:00	31:00:00	10:03:13		16	No	No
6	598850	587409	Dwelling	762	T16	00:37:12	59:42:00	19:21:40	14, 16		Yes	Yes
7	598894	588985	Dwelling	1012	T13	00:27:00	28:18:00	9:10:40	N/A		No	No
8	598998	586888	Dwelling	753	T16	00:00:00	0:00:00	0:00:00	N/A		No	No
9	599326	586507	Dwelling	869	T16	00:00:00	0:00:00	0:00:00	N/A		No	No
10	599748	586235	Dwelling	1054	T17	00:00:00	0:00:00	0:00:00	N/A		No	No
11	600379	588814	Dwelling	707	T12	00:39:36	31:42:00	10:16:50		12	Yes	Yes
12	600493	588853	Dwelling	824	T12	00:34:12	23:06:00	7:29:29		12	Yes	Yes
13	600562	589306	Dwelling	1180	T12	00:00:00	0:00:00	0:00:00	N/A		No	No
14	600549	586316	Dwelling	888	T17	00:00:00	0:00:00	0:00:00	N/A		No	No
15	600654	589321	Dwelling	1252	T12	00:00:00	0:00:00	0:00:00	N/A		No	No
16	600822	586555	Dwelling	823	T17	00:00:00	0:00:00	0:00:00	N/A		No	No
17	601046	587710	Dwelling	962	T17	00:30:00	32:48:00	10:38:14		17	No	No
18	601073	587560	Dwelling	908	T17	00:31:12	31:24:00	10:11:00		17	Yes	Yes

19	601077	587501	Dwelling	887	T17	00:31:48	31:36:00	10:14:53		17	Yes	Yes
20	601175	587859	Dwelling	1131	T15	00:00:00	0:00:00	0:00:00	N/A		No	No
21	601232	587219	Dwelling	974	T17	00:28:48	14:06:00	4:34:22	N/A		No	No
22	601260	587175	Dwelling	1000	T17	00:28:12	13:30:00	4:22:41	N/A		No	No
23	601282	587503	Dwelling	1079	T17	00:26:24	11:54:00	3:51:33	N/A		No	No
24	601306	588360	Dwelling	1452	T15	00:00:00	0:00:00	0:00:00	N/A		No	No
25	601370	588387	Dwelling	1521	T15	00:00:00	0:00:00	0:00:00	N/A		No	No
26	601546	588343	Dwelling	1652	T15	00:00:00	0:00:00	0:00:00	N/A		No	No
27	601556	586585	Dwelling	1416	T17	00:00:00	0:00:00	0:00:00	N/A		No	No
28	601596	586485	Derelict	1495	T17	00:00:00	0:00:00	0:00:00	N/A		No	No
29	601655	586422	Dwelling	1577	T17	00:00:00	0:00:00	0:00:00	N/A		No	No
30	601777	585912	Dwelling	1720	T11	00:00:00	0:00:00	0:00:00	N/A		No	No
31	601850	585882	Dwelling	1652	T11	00:00:00	0:00:00	0:00:00	N/A		No	No
32	602048	587698	Dwelling	1106	T2	00:25:48	11:24:00	3:41:50	N/A		No	No
33	602152	586803	Dwelling	1038	T5	00:27:36	41:24:00	13:25:35	N/A		No	No
34	602198	585676	Dwelling	1292	T9	00:00:00	0:00:00	0:00:00	N/A		No	No
35	602210	587575	Dwelling	919	T2	00:30:36	15:36:00	5:03:33		2	Yes	Yes
36	602379	587837	Dwelling	858	T2	00:33:36	22:30:00	7:17:49		2	Yes	Yes
37	602444	587867	Dwelling	821	T2	00:35:24	27:42:00	8:59:00		2	Yes	Yes
38	602475	587884	Dwelling	806	T2	00:36:00	31:18:00	10:09:03		2	Yes	Yes
39	602605	586363	Dwelling	836	T5	00:31:12	16:12:00	5:15:14		11	Yes	Yes
40	602608	586548	Dwelling	710	T5	00:29:24	26:00:00	8:25:55	N/A		No	No
41	602629	585772	Dwelling	878	T9	00:31:48	42:24:00	13:45:02	9,11		Yes	Yes
42	602655	586333	Commercial unit	826	T5	00:33:00	45:18:00	14:41:28		11	Yes	Yes
43	602690	585993	Dwelling	805	T11	00:34:48	41:18:00	13:23:38	9,11		Yes	Yes
44	602718	585838	Dwelling	810	T9	00:35:24	66:42:00	21:37:52	9,11		Yes	Yes
45	602726	585900	Dwelling	793	T11	00:36:00	65:12:00	21:08:41	9,11		Yes	Yes
46	602730	586270	Dwelling	763	T11	00:36:00	53:12:00	17:15:11		11	Yes	Yes
47	602738	585979	Dwelling	761	T11	00:37:12	47:18:00	15:20:23	9,11		Yes	Yes
48	603003	584835	Dwelling	734	T10	00:28:48	15:54:00	5:09:23	N/A		No	No
49	603022	584761	Dwelling	762	T10	00:00:00	0:00:00	0:00:00	N/A		No	No
50	603085	584339	Dwelling	1040	T10	00:00:00	0:00:00	0:00:00	N/A		No	No
51	603114	588174	Dwelling	788	T2	00:29:24	15:48:00	5:07:27	N/A		No	No

52	603170	584219	Dwelling	1108	T10	00:00:00	0:00:00	0:00:00	N/A		No	No
53	603997	584136	Dwelling	1157	T10	00:00:00	0:00:00	0:00:00	N/A		No	No
54	604076	584274	Dwelling	1059	T10	00:00:00	0:00:00	0:00:00	N/A		No	No
55	604113	588564	Dwelling	855	T1	00:00:00	0:00:00	0:00:00	N/A		No	No
56	604119	584398	Dwelling	969	T10	00:00:00	0:00:00	0:00:00	N/A		No	No
57	604305	588638	Dwelling	972	T1	00:00:00	0:00:00	0:00:00	N/A		No	No
58	604428	588706	Dwelling	1080	T1	00:00:00	0:00:00	0:00:00	N/A		No	No
59	604493	584864	Dwelling	945	T10	00:31:12	32:36:00	10:34:21		10	Yes	Yes
60	604511	584867	Dwelling	960	T10	00:30:36	28:30:00	9:14:34		10	Yes	Yes
61	604594	585857	Dwelling	705	T6	00:37:48	27:00:00	8:45:23		8	Yes	Yes
62	604600	588586	Dwelling	1060	T1	00:24:36	13:00:00	4:12:58	N/A		No	No
63	604654	588453	Dwelling	989	T1	00:30:00	29:24:00	9:32:04	N/A		No	No
64	604701	585856	Dwelling	752	T6	00:33:36	29:36:00	9:35:58		8	Yes	Yes
65	604897	587449	Dwelling	944	T1	00:30:36	30:54:00	10:01:16		1	Yes	Yes
66	604792	588210	Dwelling	939	T1	00:30:36	18:36:00	6:01:56		1	Yes	Yes
67	604818	587518	Dwelling	850	T1	00:33:36	35:24:00	11:28:49		1	Yes	Yes
68	604854	585817	Dwelling	867	T6	00:28:48	37:30:00	12:09:41	N/A		No	No
69	604957	587397	Dwelling	1017	T1	00:28:48	28:18:00	9:10:40	N/A		No	No
70	605008	586923	Dwelling	785	T6	00:36:00	24:54:00	8:04:31		6	Yes	Yes
71	605266	586328	Dwelling	946	T6	00:30:00	17:24:00	5:38:35		6	No	No
72	605282	586432	Dwelling	947	T6	00:30:00	15:48:00	5:07:27	N/A		No	No
73	605377	586748	Dwelling	1065	T6	00:26:24	11:54:00	3:51:33	N/A		No	No
74	600571	589162	Planning Application	1080	T12	00:28:12	30:30:00	9:53:29	N/A		No	No
75	605310	586260	Planning Application	1005	T6	00:28:48	16:42:00	5:24:57	N/A		No	No
76	600578	586492	Planning Application	736	T17	00:00:00	0:00:00	0:00:00	N/A		No	No
77	599003	586321	Planning Application ID 18/4499 - Cork granted	1176	T16	00:00:00	0:00:00	0:00:00	N/A		No	No
78	598909	586292	Planning Application ID 18/6951 - Cork granted	1251	T16	00:00:00	0:00:00	0:00:00	N/A		No	No

79	598876	587308	Planning Application ID 19/5914 - Cork granted		732	T16		00:39:00	56:48:00	18:25:14	14, 16		Yes	Yes
80	605293	586234	Planning Application ID 18/383 - W'ford granted		995	T6		00:29:24	17:54:00	5:48:18	N/A		No	No
81	604240	589061		0	1366	T1		00:00:00	0:00:00	0:00:00	N/A		No	No
82	604171	589043		0	1337	T1		00:00:00	0:00:00	0:00:00	N/A		No	No
83	604183	589037		0	1333	T1		00:00:00	0:00:00	0:00:00	N/A		No	No
84	604258	588965		0	1275	T1		00:00:00	0:00:00	0:00:00	N/A		No	No
85	604307	588937		0	1259	T1		00:00:00	0:00:00	0:00:00	N/A		No	No
86	604315	588931		0	1255	T1		00:00:00	0:00:00	0:00:00	N/A		No	No
87	605450	585949		0	1247	T6		00:00:00	0:00:00	0:00:00	N/A		No	No
88	605444	585872		0	1279	T6		00:00:00	0:00:00	0:00:00	N/A		No	No
89	603877	583927		0	1328	T10		00:00:00	0:00:00	0:00:00	N/A		No	No
90	603083	584058		0	1290	T10		00:00:00	0:00:00	0:00:00	N/A		No	No
91	603155	584011		0	1306	T10		00:00:00	0:00:00	0:00:00	N/A		No	No
92	600468	585862		0	1311	T17		00:00:00	0:00:00	0:00:00	N/A		No	No
93	602068	586784		0	1124	T5		00:25:48	12:00:00	3:53:30	N/A		No	No
94	602665	586822	Planning Permission for dwelling		533	T5		01:03:36	121:42:00	39:28:05		5	Yes	Yes
95	602717	586621	Planning Permission for dwelling		580	T5		00:31:48	26:00:00	8:25:55		11	Yes	Yes
100	598862	587310	PP 195914		728		0	00:37:48	57:06:00	18:31:04	14, 16		Yes	Yes
101	598862	587357	PP 214825		729		0	00:37:48	62:18:00	20:12:15	14, 16		Yes	Yes
102	598638	588151	PP 059256		730		0	00:37:48	35:18:00	11:26:53		13	Yes	Yes
103	600658	586499	PP 184499		768		0	00:00:00	0:00:00	0:00:00	N/A		No	No
104	600573	589079	PP 0949		1024		0	00:28:48	23:00:00	7:27:32	N/A		No	No
105	599107	586351	PP 184499		1082		0	00:00:00	0:00:00	0:00:00	N/A		No	No
106	598862	586486	PP 205092		1107		0	00:00:00	0:00:00	0:00:00	N/A		No	No
107	605407	586110	PP 06143		1143		0	00:00:00	0:00:00	0:00:00	N/A		No	No
108	598986	586238	PP 186951		1239		0	00:00:00	0:00:00	0:00:00	N/A		No	No
109	600445	585900	PP 085349		1270		0	00:00:00	0:00:00	0:00:00	N/A		No	No

APPENDIX 11

HES TEHNICAL NOTE T5 & ASSOCIATED DRAWING

HYDRO ENVIRONMENTAL SERVICES

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Technical Note – Proposed Turbine T5 Relocation

Site:	Proposed Lyrenacarriga Windfarm, Co. Waterford/Co. Cork
Client:	MKO
Date of Site Visit:	12th August 2022
Note Date:	3rd October 2022
Topic:	Proposed Turbine T5 Relocation Assessment
Author:	David Broderick (HES)

1.1. INTRODUCTION

Hydro-Environmental Services (HES) were commissioned by MKO to carry out an assessment of the proposed relocation of turbine T5 at the Lyrenacarriga Windfarm site, Co. Waterford/Co. Cork with regard to potential effects on the receiving Land, Soils/Geology and Water environments.

The proposed new T5 location is situated approximately 170m northeast of the previously proposed location which was assessed in the 2021 EIAR as part of a 17 no. turbine layout.

The proposed new T5 location will require 189m of additional access road. The turbine hardstand area/footprint will not change.

1.2. APPROACH

HES applied the same baseline assessment and impact assessment approach as carried out in Chapter 9 (Land, Soils and Geology) and Chapter 10 (Hydrology/hydrogeology) of the 2021 EIAR.

A site walkover/inspection of the proposed new T5 location was carried out by David Broderick (HES) on 12th August 2022 with the purpose of assessing location suitability, baseline environment along with any additional hydrological constraints and potential impact pathways to those identified in the 2021 EIAR.

1.3. ASSESSMENT OUTCOME

The baseline environment of the proposed new T5 location and access road is the same as that documented in the 2021 EIAR.

The proposed new T5 location and access road setting is the same as the previously proposed location (i.e. forestry which is underlain by mineral subsoils – sandstone tills).

No additional hydrological constraints or potential impact pathways were identified.

The previously mapped hydrological constraints in the area of the previously proposed and new T5 location are shown in **Figure A** below. The turbine foundation/base is located outside the 75m watercourse buffer zone.

Albeit there will be a slight increase in access road length, the proposed new T5 location will not result in any change of potential effects to those assessed in the 2021 EIAR with regard Land, Soils/Geology and Water environments.

Increases in runoff volumes due to the proposed relocation of T5 will be imperceptible.

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The wind farm drainage plan, which has been revised for the proposed T5 relocation, is attached as **Appendix I** below.

Implementation of the pollution prevention mitigation measures and robust drainage control measures as detailed in Chapter 9 and Chapter 10 of the EIAR means there will be no change in residual effects.

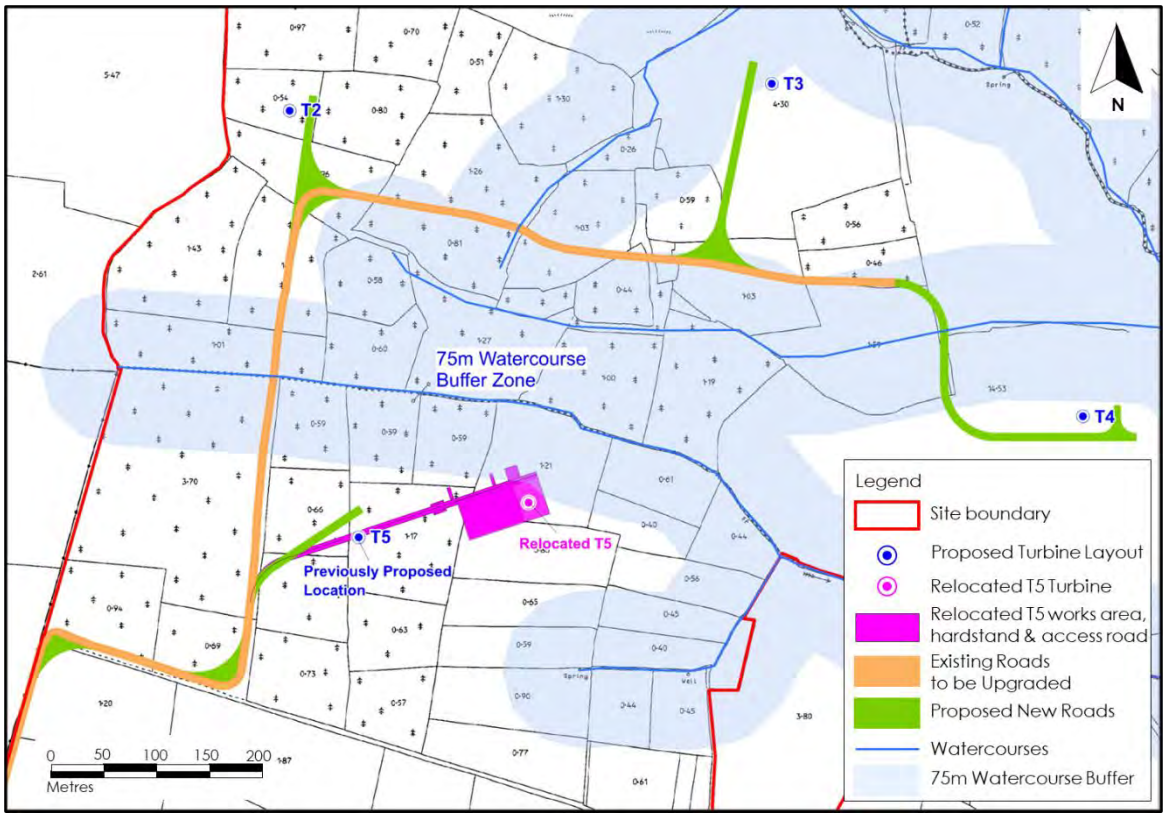

Figure A: Hydrological Constraints Mapping at T5 Location

1.4. CONCLUSION

The baseline environment of the proposed new T5 location and access road is the same as that documented in the 2021 EIAR.

The proposed relocation of T5 will require approximately 189m of additional access road. However, in the content of the overall development footprint, this small increase in access road length will have no potential to result in any significant additional effects.

We have considered the potential effects of the new location in respect of the following environmental impact aspects:

- Soil, subsoil, bedrock excavation volumes;
- Tree felling and water quality/hydrological effects;
- Earthworks and surface water quality effects;
- Oils/fuels/cements and surface water/groundwater quality effects;
- Groundwater level and hydrogeological effects; and,
- Land, soils and geological cumulative effects; and,
- Hydrological and Hydrogeological cumulative effects.

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The proposed relocation of turbine T5 will not result in any new effects or changes in effect magnitude to those assessed in Chapter 9 and Chapter 10 of the submitted 2021 EIAR.

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Appendix I

Revised Drainage Plan

POLLUTION PREVENTION NOTES:

1. Site management proposals are intended to ensure protection against surface water and groundwater pollution, siltation and erosion.
2. Suitable drainage control measures should be in place at all times to prevent conveyance of significant volumes of silt to off site receiving watercourses.
3. Silty water can arise from dewatering excavations, erosion of exposed/disturbed ground, temporary stockpiles, plant and wheel wash, site roads/tracks, and disturbance of existing field drains and ditches.

Discharges

4. Water containing silt will not be pumped directly to any natural watercourse. All discharges to be made over open ground or into existing field drain with silt trap at a minimum of 20m from nearest watercourse unless otherwise stated.
5. No excavated material is to be stored within any surface water buffer zone.
6. Pumped water will be directed into track side ditches and treated in settlement ponds and vegetation swales prior to overland discharge.
7. Pumping of clean water from excavations / or over-pumping in drains/ditches/streams will be completed in a manner that does not cause scour or erosion at the point of release/discharge. This will be done by reducing the flow velocities or by use of splash plates, and other similar discharge controls.
8. Vegetation will NOT be stripped from existing drains/ditches unless absolutely necessary.

Excavations

9. Where deep excavations are proposed cut-off drains will be use to reduce the amount of surface water entering the excavation. This will be the case around turbine base excavations.

Exposed Ground & Stockpiles

10. The amount of exposed ground and temporary stockpiles open at any one time will be minimised, as far as practicable.

Site tracks

11. Use of track side swales with check dams, and/or filtration check dams will reduce silt in runoff water as required.
12. Check dams to be inspected and cleaned regularly.

Refueling

13. Refuelling of mobile plant will be completed in designated refueling areas only, preferably on an impermeable surface and away from field drains / ditches and watercourses / waterbodies.
14. Spill kits and drip trays will be available on site for use as required.

Concrete

15. Care will be taken when completing concrete works on site to ensure no discharges occur.
16. Concrete wash water, and waste concrete will be managed appropriately on site.

If water pollution is identified the following steps would be adhered to:

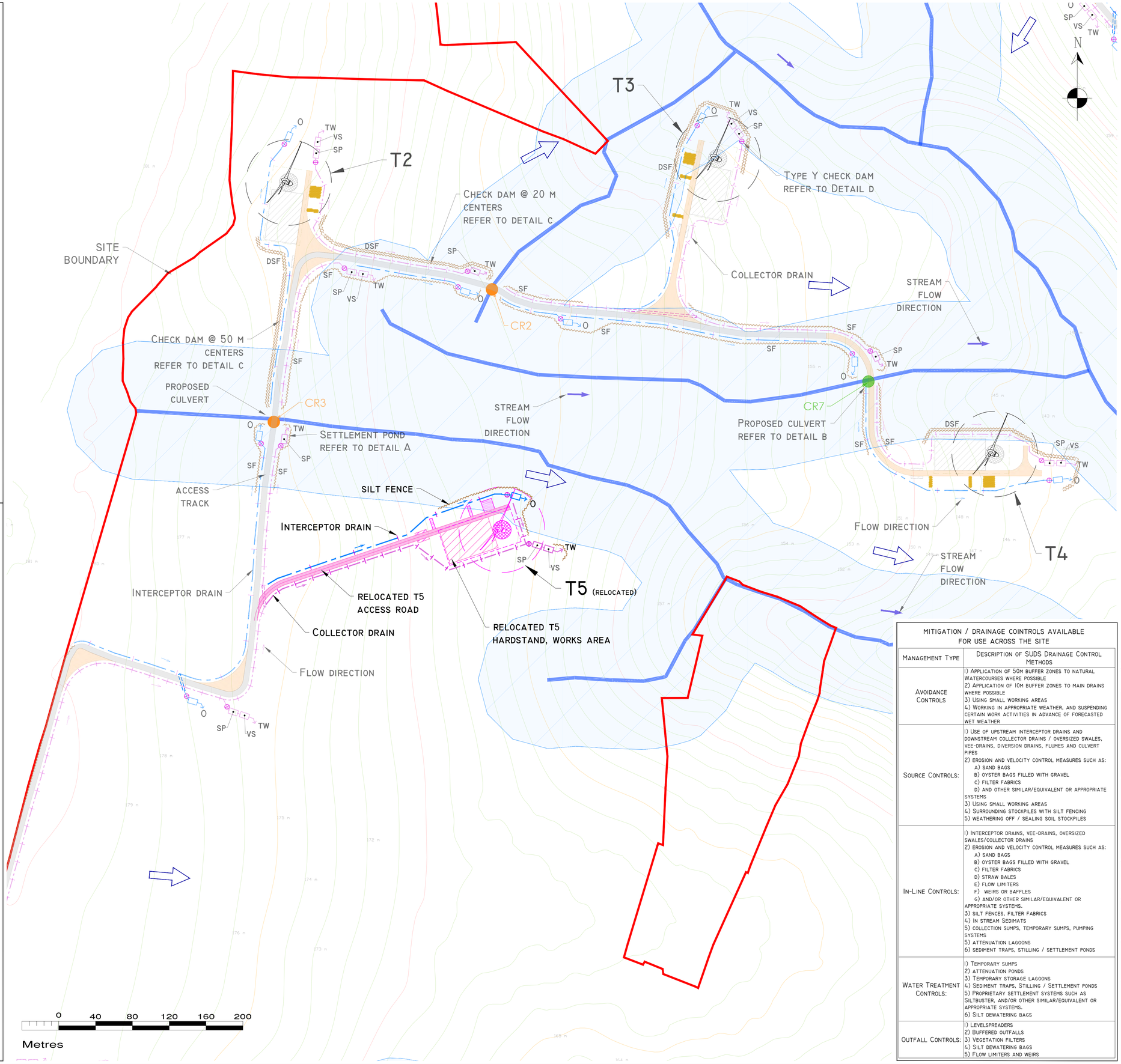
STOP - work in the immediate area should be stopped and the source of the pollution identified.

CONTAIN - the source of the pollution should be bunded using a suitable method. Natural watercourses should be temporarily diverted around the source of pollution.

NOTIFY - The relevant authorities (Site Manager / Fisheries / NPWS / Local Authority etc.) should be notified immediately to ensure that measures can be implemented downstream to protect fisheries and other sensitive areas.

DRAINAGE NOTES:

1. Roadway surfacing design and construction to Engineer's Specification (i.e. by others).
2. Spare straw bales/silt fencing/ or similar, to be stored on site. The level of silt in runoff during construction is to be monitored visually and excessive silt levels in any area to be temporarily managed by placing silt fences, straw bales / or similar or additional check dams at the problem areas. Mobile siltbuster system to be available on-site for use as required also.
3. SUDS system to be constructed prior to, or at the same time as the access tracks. Interim measures such as the placement of straw bales/silt fencing/or similar approved method or additional check dams and silt fences to be employed in all instances where work carried out to construct the access tracks is likely to cause adverse environmental effects through increased silt loadings being generated during the construction phase.
4. Suitable prevention measures should be in place at all times to prevent the conveyance of significant volumes of silt to receiving watercourses. See notes on pollution prevention.
5. Interceptor swales / ditches to be used to collect upstream surface water flows. Regular cross drains / discharge to field ditches/drains will be required to transfer / discharge surface water in interceptor drains to suitable field drain outfall points.
6. Drainage swales / ditches to be excavated adjacent to the access tracks. Regular cross drains to be located along access tracks to prevent excessive volumes of water collecting in the swales / ditches. Locations of cross drains to be agreed with the Engineer on site. Surface water will not be allowed to discharge directly into existing watercourses.
7. Where possible, a buffer zone of >20m to any existing watercourse will be required where over land discharges are proposed from access track swales / ditches.
8. Batters of all proposed swales / ditches to have a slope of between 1 : 1.5 to 1 : 2 depending upon depth of swale/ditch and will be left as cut to re-vegetate with local species.
9. Track side swales / ditches to be shallow with moderate gradients to prevent scouring. In steep areas check dams should be installed to reduce flow velocities and provide source control of silt containment. Where necessary these have been designated in conjunction with settlement ponds and silt traps, prior to discharge.
10. Settlement ponds to be constructed for silt removal at turbine bases and hard stand areas. Pond sizes depends on catchment area served. Sample pond sizes shown on Drawing D501.
11. Straw bales / or similar and silt fences to be used also around spoil heaps to mitigate silt runoff. silt fences may be removed when suitable vegetation cover is established.
12. silt fences to be provide along edge of existing watercourse where works comes within <15m of edge of any ditch / ephemeral channels.
13. Slopes of the swales / ditches to be vegetated or protected from erosion until vegetation has been established. Stripped vegetative layer (soil 'sod' or 'scraw') from excavations to be stored locally and used to line slopes and base of swales / ditches or longitudinal mounds of vegetation swales at field drain discharge points.
14. Areas stripped of vegetation should be kept to a minimum.
15. Clean stone flow control check dams to be made of locally won / geologically similar well graded stone. Aggregate size for stone check dams to be typically 20- 40mm clean stone. On sloping sections of the access tracks, 40mm check dams to be protected from washing away through the placement of 100m stone on the downhill face of the check dam and by wrapping in geotextile.
16. Build up of silt levels at check dams to be removed and disposed of appropriately. Silt levels at check dams to be visually inspected as part of an ongoing drainage maintenance programme during the construction phase. Where check dams become clogged with silt or vegetation, stone check dam to be removed and replaced subsequent to the removal of silt.
17. Spacing and frequency of check dams will be dependent upon longitudinal gradient of swale.
18. Location of filtration check dams (if required) to be agreed on site with Engineer. Settlement ponds to be constructed in a manner where they may be easily infilled at a later date (post completion of the turbine base and hardstand construction). Only suitable materials excavated from the pond to be used to form part of the embankment around the pond.
19. Oil fuel should be stored within bunded containment structures.
20. silt bags will be used on site at field drain discharge locations, as necessary.

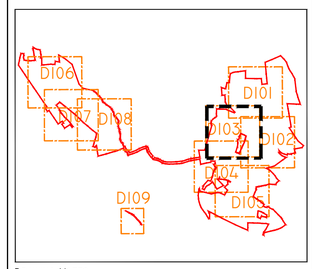


DRAWING LEGEND :

- Rivers/streams
- Rivers/streams 50m buffer
- Upstream Interceptor Drain
- Swales/Downstream Collector Drain
- Direction of flow
- Silt Fences
- Settlement pond - level spreader
- Settlement pond - vegetation filter - level spreader
- Check Dam 'type A'
- Check Dam 'type B'
- Proposed new culverts
- Existing crossing proposed for upgrade
- Interceptor Ditch Culvert
- Collector Ditch Culvert
- O Overland Flow Discharge
- TW Treated Water Discharge
- SP Settlement Pond
- VS Semi-Natural Vegetation Swale / Filter Bed /secondary sp
- Pumping Sump
- Large drainage arrows

(Existing Drainage / Proposed Drainage)

- Relocated T5 turbine, access road, hardstand and works aea
- Site boundary
- Existing ground surface majour contour (10 m interval)
- Existing ground surface intermediate contour (5 m interval)
- Existing ground surface minor contour (1 m interval)
- Turbine and swept area
- Turbine foundation
- Crane platform
- Existing road to be upgraded
- Proposed road



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4. All dimensions are in metres.

MITIGATION / DRAINAGE COINTROLS AVAILABLE FOR USE ACROSS THE SITE

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as: A) sand bags B) oyster bags filled with gravel C) filter fabrics D) and other similar/equivalent or appropriate systems 3) Using small working areas 4) Surrounding stockpiles with silt fencing 5) weathering off / sealing soil stockpiles
In-Line Controls:	1) interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as: A) sand bags B) oyster bags filled with gravel C) filter fabrics D) straw bales E) flow limiters F) weirs or baffles G) and/or other similar/equivalent or appropriate systems. 3) silt fences, filter fabrics 4) In stream Sedimats 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs

Date	Description	Chkd	Signed

Revisions

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Client: Innogy Renewables

Job: Lyrenacarriga WF, Co. Waterford/Co. Cork

Title: Proposed Drainage Layout

Figure No: DI03

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