FEHILY TIMONEY
30 YEARS

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE and PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED CROAGHAUN WIND FARM, CO. CARLOW

VOLUME 2 – MAIN EIAR

CHAPTER 8 - BIODIVERSITY

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8. BIODIVERSITY

8.1 Introduction

The ecological appraisal for the project was undertaken by Fehily Timoney and Company (FT). A series of ecological surveys were undertaken throughout the proposed wind farm site (including at the site of turbines, access tracks, borrow pits, compound and substation) as well as the route of proposed underground grid connection route and turbine delivery route (including watercourse crossings of routes). FT carried out ecological walkover surveys, habitat surveys, botanical surveys, invasive species surveys and mammal surveys (including bats). Two years of bat surveys have been completed within the study area during the years 2019 and 2020. The surveys encompassed habitat and preliminary roost assessments, summer roost inspection, winter roost inspection, bridge roost inspection, activity surveys (transects) and static detector surveys. Monthly activity bat surveys were undertaken within and near the boundary of the proposed wind farm site from June to September 2019, static detectors surveys were undertaken May to September 2019 and winter roosts surveys were undertaken on 27th March 2020 followed by a survey of watercourse crossings on 9th October 2020.

Malachy Walsh and Partners (MWP) carried out bird surveys of the study area (study area for Croaghaun formally known as Deerpark) during the winters of 2017-2018, 2018-2019, 2019-2020 as well as the summers of 2018, 2019. Whilst Triturus Environmental Services undertook surveys of the aquatic ecology in 2019 and 2020 (walkover surveys, catchment wide electro-fishing, White-clawed Crayfish Survey, Freshwater Pearl Mussel Survey, biological water quality surveys) as well the evaluation of the impact of the proposed development on aquatic ecology. Ecological surveys and assessment reports of proposed replant lands was undertaken by MKO planning and environmental consultants.

Based on the results of these various ecological studies, FT considered potential direct, indirect and cumulative impacts of the proposed development on the existing ecological receptors and proposed appropriate mitigation measures to minimise these potential impacts.

The purpose of this evaluation was to:

- Provide a baseline by undertaking a desktop review of available ecological data for both the receiving environment and greater area, including a review of European sites within 15km and NHAs / pNHAs within 10 km of the study area;
- Further add to baseline information by undertaking ecological field surveys of the receiving environment including, where required, the proposed Croaghaun Wind Farm Development, turbine delivery routes and grid connection routes;
- Identify flora and fauna present within the footprint of all elements of the project so as to identify the receiving environment;
- Evaluate the ecological significance of the receiving environment;
- Appraise the potential impacts of the project on the ecology of the receiving environment including the proposed Croaghaun main wind farm site, turbine delivery route, grid connection route and replant lands;
- Consider measures to mitigate the potential negative impact(s) of the project on the ecology of the receiving environment.

8.1.1 Study Area

A detailed description of the project assessed in this EIAR is provided in Chapter 3 and is comprised of three main elements:

- The wind farm (hereinafter referred to as the **'main wind farm site'**);
- Turbine delivery route (hereinafter referred to as the **'turbine delivery route'** or **'TDR'**);
- Grid connection (hereinafter referred to as the **'grid connection'**.

The main wind farm site includes the wind turbines, internal access tracks, hard standings, the permanent meteorological mast, recreational amenity trail and associated signage, onsite substation, internal electrical and communications cabling, temporary construction compound, drainage infrastructure and all associated works related to the construction of the wind farm. The grid connection includes the buried grid connection cable route from the on-site substation to the existing grid substation at Kellistown, Co. Carlow and the proposed off-site substation, also at Kellistown. The turbine delivery route includes all aspects of the route from the M11/N30 junction to the site entrance including proposed temporary accommodation works to facilitate the delivery of wind turbine components. Replanting lands at Sroove Co. Sligo and Crag Co. Limerick have also been assessed. Reports detailing environmental assessments carried out on these sites are contained in Appendix 3.3 and 4.4 of this EIAR.

Felling

Felling to facilitate the project is to be assessed as part of the main project, however ongoing commercial forestry operations are assessed cumulatively. It is being assumed that clearance felling shall commence at the beginning of the construction programme for the purposes of assessing a worst-case scenario however it could be carried out in advance of the main civils BoP contract works.

Decommissioning

Decommissioning of the wind farm will be as per the description in Chapter 3.

Please Note: Study Area refers to the respective study areas for each habitat / species within which ecological surveys were undertaken. In every instance the study area encompasses a larger area to the planning boundary. The details of individual study areas for habitats / species are provided in the methodology section (section 8.2).

Proposed Development Site refers to the planning boundary for the proposed Croaghaun Wind Farm as well as the footprint of the TDR and grid connection. In this regard this definition is different to the same definition in other chapters.

The main wind farm site is located within the townlands of Rossacurra, Cranemore, Kilbrannish North, Bealalaw, Raheenliegh and Aclare County Carlow. The proposed grid connection will travel through the townlands of Kellistown East, Kellistown West, Rathtoe, Ballycurragh, Ballynunnery, Gilbertstown, Bendinstown, Ardbeam, Elmicon, Killknock, Killane, Raheenkillane, Killmaglush, Turtane, Ballaghmore, Shangarry, Cappawater, Lasmaconly, Mystall, Ballinrush, Cronruss, Aclare and Rossacurra. The TDR is located within the townlands of Killbranish South, Killbranish North, Deerpark New, Barnahask, Clonmullen, Newtownberry, Carrickduff, Skeahanagh, Farmley, Collnahorna, Ballynahallin, Ballynabarney, Ryland Upper, Ryland Lower, Coolattin, Moyeady, Tombrick, Mountfin Lower, Ballinturner, Tomgarrow, Tomacurry, Clavass and Kilcanon. The planning boundary is a smaller area within the study area site which surrounds the wind farm infrastructure.

The area of the proposed wind farm is rural in nature with the closest settlements being Myshall Village ca. 1.5km north west of the site and Kildavin village located ca. 4km north east of the site with the town of Bunclody located ca. 5.5km east of the wind farms site. The proposed wind farm site is located at Croaghaun Mountain, along the northern-most peak of the Blackstairs Mountains, north of Mount Leinster. The wind turbines ranges in elevation from 420 m OD to 310 m OD and comprises 7 wind turbines with a tip height of up to 178 m.

The main wind farm site is largely covered in coniferous plantation and contains walking trails and an associated car park. Corine 2018 (EPA mapviewer) categorises landcover for most of the site as conifer forest with peat bog and transitional woodland scrub present to a lesser extent. The Geological Survey of Ireland's (GSI) online mapviewer indicates that the site is underlain by Maulin Formation (slate and siltstone) and Ballybeg Member bedrock (psammites, schists and phyllites). The EPA mapviewer (Teagasc subsoils) indicated that the site's subsoils mainly comprise bedrock at the surface, till (diamictons) present to a lesser extent along the edges of the site and a single limited area of blanket peat.

8.1.2 The Main Wind Farm Site

There are 8 crossing points within the main wind farm site, over a small stream and road cross drains. No existing drains need to be diverted due to the construction of the wind farm.

Some drain clearing will be required at existing crossings, where they have become blocked, to maintain the continuity of flows. These existing pipes may need replacing if they are found to be in a collapsed state.

The main wind farm site is situated within one sub-catchment as defined by the WFD. This waterbody is known as:

- Slaney_SC_050 (12_8)

The main wind farm site is situated within five sub-basins as defined by the WFD and shown on Figure 10-2, Chapter 10 – Hydrology and Water Quality. These waterbodies are as follows:

- Clashavey_River_010 – IE_SE_12C00500
- Kildavin_Stream_010_010 – IE_SE_12K040800
- Clody_010 – IE_SW_12C030080
- Burren_020 – IE_SE_14B050110
- Douglas (Ballon)_010 – IE_SE_12D030200

The Burren_020 sub basin forms part of the Barrow Catchment (catchment id: 14), whilst the other four sub basins form part of the Slaney and Wexford Harbour catchment (catchment id: 12). No turbines are planned in Burren_020 sub-basin.

A site walkover survey took place on 19th November 2019 and on 29th August 2020 to examine the existing drainage and hydrological features at the site. The existing drainage system is based on surface water being collected in drainage ditches located along the forest access tracks. Water from drains is discharged overland downslope of the access tracks. The existing drainage system is based on surface water being collected in drainage ditches located along the access road. Water from drains is discharged overland downslope of the access road. Existing tracks are present throughout the site.

During the site visits 8 crossing points were recorded, over the small stream and road cross drains were identified and shown in Figure 10-5, Chapter 10 – Hydrology and Water Quality. Due to the locations of these crossing points, two of the 8 drain into the Clody_010 sub-basin, whilst the other 6 drain into Clashavey_River_010 sub-basin.

Turbines T1 and T4 are within Clashavey_River_010 - IE_SE_12C00500 waterbody catchment. Turbine T6 is within Kildavin_Stream_010 – IE_SE_12K040800 sub-basin. Turbines T2, T3, T5 and T7 are within Clody_010 – IE_SW_C030080 waterbody.

Surface runoff from turbines T1 and T4 drains to the Clashavey River which is a tributary of the River Slaney. The Clashavey river rises to an elevation of 300m OD approximately 0.25km south-west of the turbine T1. The Clashavey River runs in a northern direction for approximately 4.65km where it turns to the east where it joins the River Slaney approximately 6.3km north-east of the turbine T4.

Surface runoff from turbine T6 drain to the Kildavin Stream which rises to an elevation of 205m OD approximately 0.87km north of turbine T6. The Kildavin Stream flows in a north-eastern direction for approximately 2.9km where it turns to the east where it continues to flow for approximately 2.1km before it joins the River Slaney.

Surface runoff from turbines T2, T3 and T5 drains into the Kilbrannish-South Stream and from T7 towards the Kilbrannish-North Stream. Both streams run in south-eastly direction for approximately 2.8km where they join the River Clody. The River Clody flows to the west for approximately 6.8km where it joins the River Slaney.

8.1.3 Grid Connection

The proposed 38kV grid connection from the on-site substation to the existing 110/220 kV substation at Kellistown crosses watercourses at up to 9 locations as shown on Figure 10-5 Chapter 10 – Hydrology and Water Quality. These crossings are listed in Table 8-1. The method of crossing over the watercourses is proposed for each crossing location.

The proposed grid connection trench will be 600 mm wide and 1200 mm deep. Where the proposed grid connection cable route encounters minor culverts, the ducts will be installed above or below the culvert depending on its depth in accordance with construction methodologies outlined in the CEMP (Volume 3, Appendix 3.1). The cable ducting will be installed so as not to impact the existing culvert.

Table 8-1: Grid Connection Crossing Method

Feature ID	ITM_X	ITM_Y	Grid cable method crossing
GCR-WCC1	679096.96	670298.85	HDD in public road corridor
GCR-WCC2	679110.52	670057.43	HDD in public road corridor
GCR-WCC3	679529.02	670126.05	HDD in public road corridor
GCR-WCC4	680262.95	665039.41	HDD in public road corridor
GCR-WCC5	680437.80	662507.73	HDD in public road corridor
GCR-WCC6	681594.32	659057.55	Ducts laid in flat profile within concrete bridge beam in road deck
GCR-WCC7	684252.84	659716.09	HDD in private field
GCR-WCC8	679645.23	670366.41	HDD in private field
GCR-WCC9	681641.77	660121.93	HDD in private field

For crossings where HDD has been identified as the preferred crossing method, open cut trenching methods shall be permitted in dry conditions where there is no-flow in the watercourse and there is no risk of in-stream works. In such instances, cable ducts will be laid under the stream bed which would then be fully reinstated to its pre-existing condition.

The grid connection between the proposed on-site 38kV substation and the existing 110/220kV substation at Kellistown is within six sub-basins as defined by the WFD. These are:

- Clashavey_River _010 - IE_SE_12C00500,
- Douglas_(Ballon)_010 – IE_SE_12D030200,
- Burren_030 – IE_SE_14B050200,
- Ballaghmore_Distibutary_010 – IE_SE12B120990,
- Burren_040 – IE_SE_14B050310,
- Burren_050 – IE_SE_14B050400.

8.1.4 Turbine Delivery Route (TDR)

Large components associated with the wind farm construction will be transported to site via the identified turbine delivery route (TDR). It is expected that turbine deliveries shall approach the site from the East via Dublin Port, the M11, the N80 and the L2026 Barkers Road through the town of Bunclody. Turbine delivery vehicles shall turn at Kilbrannish North and enter the site from the West.

The TDR and general location of accommodation works are shown in Figure 3-3, Chapter 3 – Description of the Proposed Development.

The location and nature of proposed temporary accommodation works are described in further detail in Chapter 13, Traffic and Transportation. Key elements of the temporary accommodation works for the delivery of turbines are summarised below in Table 8-2:

Table 8-2: Temporary accommodation works at along the TDR

No.	Road Name	Additional Works
16	M11 / N30 Interchange Roundabout	Road signs, road lights and safety barrier to be temporarily removed.
18	N30 / N11 Roundabout	Load bearing surface through the centre of the roundabout island to be created. Temporary removal of street furniture
20	N80 Overhanging Tree Canopy	Tree canopy vegetation to be cut back along the N80 and the rest of the access route
26	N80 Left Bend Bunclody	Street furniture obstructions to be removed
29	N80 / L2026 Junction	Removal of street furniture, removal of low wall and trees. Preparation of local load bearing surfaces for vehicle over-run. Removal of overhead utilities and obstructions
30	L2026 West of Bunclody	Preparation of local load bearing surface and localised vegetation trimming. Removal of stone wall. Removal of street furniture.
31	L2026 West of Bunclody	Minor oversail of the northern verge through the right bend will be required. No trimming, vegetation clearance, felling or excavation works are required at the location.
34	L2026 East of Ballymurtagh	Hedgerows to be trimmed.
36	L2026 Entering Ballymurtagh	Hedgerows to be trimmed.
38	L2026 West of Ballymurtagh	The road will need to be widened, hedgerows and treelines trimmed and an existing roadside drain culverted.
41	L2026 East of Kilbranish	Removal of street furniture and trees at verge edge. Areas of load bearing surface required as well as reprofiling works may be required.
42	L2026 East of Kilbranish	The northern verge requires a load bearing surface and the reprofiling, street furniture removed and tree vegetation removed along southern verge.
43	L2026 Kilbranish	Removal of street furniture, trees and vegetation and road widening and localised load bearing surface to verges. Construction of a temporary bridge crossing.
44	L2026 Kilbranish	south of the road through the right bend a load bearing surface to be laid. Trees and vegetation to be trimmed. Drain culverted. The existing junction to be reprofiled.
46	L2026 West of Kilbranish	Vegetation to be cleared along eastern verge on the inside of the right bend.

No.	Road Name	Additional Works
47	L2026 West of Kilbranish	Load bearing surface to be laid on northern verge through the left bend, an existing drain to be culverted and vegetation trimmed.
48, 49	L2026 West of Kilbranish and Proposed Site Entrance Left Bend	Vegetation to be cleared and trees trimmed. Load bearing surface to be laid at existing site entrance and drain culverted.
50	L2026 West of the Proposed Site Entrance	The road will need to be widened and existing drainage ditch to be culverted.
51	L2026 West of the Proposed Site Entrance	Road surface to be widened and surface smoothed.
52	Proposed Turning Point	Extension of existing car park hard standing to facilitate vehicle turning. Load bearing surface to existing field. Removal of trees and vegetation.

There are a total of 14 watercourse crossings along the TDR from the roundabout at M11-N30 to the site entrance:

- Toom 12 (12T49)
- Slaney (12S02)
- Moyne Lower (12M71)
- Moyne 12 (12M82)
- Marshalstown 12 (12M61)
- Tomgarrow 12 (12T37)
- Mountfin Lower (12M57)
- Tombrick 12 (12T34)
- Glasha 12 (12G01)
- Newtownbarry 12 (12N14)
- Clody (12C03)
- Unnamed Stream (tributary of the River Clody, just west of townland Bunclody)
- Deerpark New (12D25)
- Kilbrannish North (12K82)

No modifications were identified as being required at these stream crossings, except for the crossing at turbine delivery work location no. 43 at L2026 Kilbranish North Stream of Deerpark_New stream (EPA code_12D25) which is a tributary of the Slaney River. It is proposed to cross the stream via a temporary bridge.

8.1.5 Replant Land

As it is proposed to fell approximately 24.4 Ha of coniferous forestry for the proposed development[1], potential replanting sites have been identified at Crag Co. Limerick and Sroove, Co. Sligo. The total area identified for replanting is 34.8ha. The Sroove site has been granted technical approval and planted. A technical approval application for the Crag site has been submitted by the applicant to forest service. If these replant lands become unavailable, other similarly approved lands will be used for replanting should the proposed project receive planning permission. Site surveys were undertaken on September and October 2020.

The replanting impact assessment which considers potential impacts on ecology and designated sites is included for each site in Appendix 3-3 and Appendix 3-4 of Volume 3 of the EIAR.

[1] Replacement replanting of forestry in Ireland is subject to licence in compliance with the Forestry Act 2014 as amended. The consent for such replanting is covered by statutory instrument S.I. No. 191/2017 - Forestry Regulations 2017 as amended. This legislation provides for development of afforestation and forest road construction project's compliance with the Environmental Impact Directive insofar as it applies to forestry development.

8.2 Methodology

8.2.1 Relevant Guidance

The methodology for this appraisal has been devised in consideration of the following relevant guidance published by the Environmental Protection Agency (EPA) including '*Guidelines on the information to be contained in Environmental Impact Statements* (2002), reference was also made to the revised draft (August 2017) '*Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)*', reference was also made to the draft (September 2015) guidelines and '*Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment*' (DoHPLG, 2018).

Additional guidance available from the EU such as '*Guidance document on wind energy developments and EU nature legislation*' (2020) and '*Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment'* (2013) has also been considered. The appraisal also takes account of '*Guidelines for Ecological Impact Assessment in the United Kingdom*' (2006), CIEEM (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition, CIEEM (2019) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (Version 1.1) all published by the Chartered Institute of Ecology and Environmental Management (CIEEM).

The Heritage Council publication '*Best Practice Guidance for Habitat Survey and Mapping'* (Smith *et al*., 2011) is also referenced.

Relevant guidance published by the National Roads Authority (NRA) such as '*Guidelines for Assessment of Ecological Impacts of National Road Schemes'* (2009a), and '*Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*' (2008a) have also been followed.

Relevant guidance from Scottish Natural Heritage (SNH) in relation to birds such as SNH *Recommended bird survey methods to inform impact assessment of onshore windfarms (2017)*. '*Survey Methods for use in assessing the impacts of onshore wind farms on bird communities (2010)*' and '*Assessing the cumulative impact of onshore wind energy developments (2012)*' have also been utilised.

Documentation and guidance available from Carlow County Council (CCC) such as the '*Carlow County Development Plan: 2015-2021*' has been reviewed and utilised where relevant.

In addition, to comprehensively research and so understand the existing behaviour of bats within the study areas the approach detailed in the following guidelines were followed:

- *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* (SNH, 2019)
- *Bat Survey Guidelines: Traditional Farm Buildings Scheme* (Aughney *et al*., 2008)
- *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn).* (BCT/Collins, 2016) *The Bat Conservation Trust, London.*
- *Bat Surveys: Best Practice Guidelines* (2^{nd} edition) (Hundt, 2012);
- *Wind Turbine/Wind Farm Development Bat Survey Guidelines* (Bat Conservation Ireland, 2012);
- *Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes (NRA, 2006a);*
- *Bats and Onshore Wind Turbines – Interim Guidance (3nd Edition) (Carlin, 2014);*
- *Guidelines for the Treatment of Bats during the Construction of National Road Schemes (NRA, 2006b);*
- *Bat survey – NIEA Specific Requirements for wind farm (NIEA, 2014);*
- *Guidelines for Consideration of Bats in Wind Farm Projects (Rodrigues, 2008).*

- *Rodrigues, L. Bach, M. J. Cubourg-Savvage, B. Karapandza, D. Kovac, T. Kervyn, J. Dekker, A. Kepel, P. Bach, J. Collins, C. Harbusch, K. Park, B. Micevski, J. Minderman (2015): Guidelines for consideration of bats in wind farm projects - Revision 2014.EUROBATS Publication Series No. 6 (English Version) UNEP/EUROBATS Sccretarist, Bonn, Germany, 133 pp.*

Relevant guidance published by the National Roads Authority (NRA), and applicable to assessing watercourses in Ireland, was also followed, including '*Guidelines for the Assessment of Ecological Impacts of National Road Schemes – Revision 2*' (NRA 2009a), '*Ecological surveying techniques for protected flora and fauna during the planning of National Road Schemes – Version 2*' (NRA 2009b), '*Environmental Impact Assessment of National Road Schemes – A practical guide*' (NRA 2008b) and '*Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*' (NRA 2008a).

8.2.2 Legislative Context

A diversity of flora and fauna, rare at a national level, are protected under the provisions of the Wildlife Act 1976, as amended, and the orders and regulations made thereunder, such as the Flora Protection Order (2015). The Habitats Directive 1992 has been transposed into Irish law, for the purposes of this application for permission by Part XAB of the Planning and Development Act 2000, as inserted. In addition, certain other obligations of the Habitat Directive have been transposed by the European Communities (Birds and Natural Habitats) Regulations 2011, as amended.

Section 171 of the Fisheries (Consolidation) Act 1959 creates the offence of throwing, emptying, permitting or causing to fall onto any waters deleterious matter. Deleterious matter is defined as not only as any substance that is liable to injure fish but is also liable to damage their spawning grounds or the food of any fish or to injure fish in their value as human food or to impair the usefulness of the bed and soil of any waters as spawning grounds or other capacity to produce the food of fish.

Under Section 3 of the Local Government (Water Pollution) Act, 1977 (as amended by Sections 3 and 24 of the 1990 Act) it is an offence to cause or permit any polluting matter to enter waters. Suspended solids would be a key parameter here. Likewise, any visual evidence of oil/fuel in the river would constitute an offence.

8.2.3 Consultation

The full list of the bodies consulted as part of the proposed development are presented in Chapter 5, EIA Scoping, Consultation and Key Issues. Consultation was undertaken with the following list of consultees specifically related to Biodiversity:

- The Development Application Unit (DAU)/ National Parks and Wildlife Service (NPWS)
- Inland Fisheries Ireland (IFI)
- Birdwatch Ireland
- Bat Conservation Ireland (BCI)
- The Environmental Protection Agency (EPA)
- An Taisce
- Irish Peatland Conservation Council
- Irish Raptor Study Group
- Irish Red Grouse Association
- Irish Wildlife Trust (IWT).

In addition, on the 14th of September 2020 a formal request was made to the NPWS (through the DAU) by email for a meeting; no reply was received.

8.2.3.1 Responses

Please see Table 8-3 below for a summary of responses received from the agencies/bodies specifically related to ecology:

Table 8-3: Results of Consultation

Consultee	Key Points Raised
Birdwatch Ireland	No response received to date.
EPA	No comment in relation to the project (response received 10th January 2020).
Inland Fisheries Ireland (IFI)	Comprehensive responses (initial response to project outline dated 6th January 2020 followed by focused response in light of detailed information dated 21st September 2020). Noted the main wind farm site encompasses the upper reaches of the Clashavey and Clody Rivers which drain to the Slaney, and Burren River, which flows to the Barrow. The importance of both the Slaney and Barrow to aquatic species, in addition to their designation as SACs was highlighted. The importance of the Clody, Clashavey and Burren rivers as Salmon spawning systems was also stressed. A particular concern raised was the potential that peat soils/subsoils in the area are extremely sensitive to erosion. The importance of avoiding rather than mitigating erosion was stressed, and clarification on extent of excavations was requested; recommended biological sampling of watercourses rather than grab sampling; general observation that deleterious substances arising from construction activities could affect aquatic habitats and species unless proper safeguards are implemented; ensure that silt/suspended solids discharges are minimised; natural flow paths should not be interrupted; imported material for road construction should not be liable to break down and generate sediment; concrete operations be conducted in such a way as to prevent uncured concrete entering watercourse; all oils and fuels should be stored in secure bunded areas; oil/fuel spill kits should be carried by all plant and equipment; temporary oil interceptor facilities should be installed and maintained where site works involve the discharges of drainage water to receiving rivers and streams; adhere to the precautionary principle and environmental legislation.
NPWS (Development Applications Unit)	Acknowledged receipt of consultation documents (19th December 2019). No other response to date.

8.2.4 Desktop Study

8.2.4.1 Designated Nature Conservation Sites

Nationally designated sites within 10 km of this project, such as Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs) have been identified. European sites within 15km of the proposed development namely Special Areas of Conservation (SACs)[2] and Special Protection Areas (SPAs) for birds were identified as part of this ecological assessment using the Map Viewer at www.npws.ie.

[2] Note: At present many SACs in Ireland are currently 'candidate' SACs, and referred to as cSACs. The relevant Statutory Instruments for the SACs in Ireland have not yet been made, however, these "candidate" sites must still be afforded the same level of protection as if they were SACs in accordance with the Habitats Directive.

These designated sites are described in Section 8.3. A separate Natura Impact Statement (NIS) was prepared to evaluate the potential effects to European sites as a result of the proposed development.

8.2.4.2 Flora and Fauna

A desk study was carried out to collate and review available information, datasets and documentation sources pertaining to the site's natural environment. Records available on the NPWS and the National Biodiversity Data Centre websites were reviewed, in addition to records of rare/sensitive species within the 10km grid squares overlapped by a 5 km buffer surrounding the study area obtained by request from NPWS (received 20th August 2020).

Other data sources include Ireland's Wetlands and their Waterbirds: Status and Distribution (Crowe 2005), the Atlas of Wintering Birds in Britain and Ireland (Lack, 1986), the Atlas of Breeding Birds in Britain and Ireland (Sharrock, 1976) and the Breeding and Winter Birds of Britain and Ireland Bird Atlas 2007-11 (Balmar *et al.*, 2013).

Botanical species were assessed in accordance with their occurrence on the Flora Protection Order 2015 and the Ireland Red List No. 10: Vascular Plants (Wyse *et al.*, 2016).

Other sources included:

- OSI Aerial photography and 1:50000 mapping;
- NPWS website (mapviewer) as well as rare and protected data obtained by request on 20th August 2020;
- National Biodiversity Data Centre (NBDC) website and data obtained on 10th September 2020;
- Teagasc Soil area maps;
- BCI records obtained by request on 23rd September 2020;
- Geological Survey Ireland (GSI) area maps;
- EPA website datasets (soil, surface water quality, ground water quality, designated sites);
- IFI; and
- South Eastern River Basin District (SERBD) datasets (Water Framework Directive).

8.2.5 Field Study

8.2.5.1 Habitats

The habitats within the study area encompassing the main wind farm site, the footprint of the proposed grid connection route and turbine delivery route (TDR) were identified and classified, according to 'A Guide to Habitats in Ireland' (Fossitt, 2000). The habitat survey of the main wind farm site was undertaken between 18th – 19th June 2019. A habitat survey along the grid connection and turbine delivery route were undertaken between the 13th – 15th July 2020. Annex I Habitat Assessments / relevé surveys within the wind farm development site were carried out between the 10th and 11th of July 2019. The results of the main wind farm habitat survey were updated following habitat surveys undertaken between the 17th and 18th of September 2020. The dominant plant species present in each habitat type was recorded. Habitats have been appraised and evaluated according to their occurrence as protected habitats under Annex I of the EU Habitats Directive (92/43/EEC) and for their capacity to support rare, threatened and endangered species. The methodology used to assess the impact on habitats is based on NRA guidelines (2009 a and b), CIEEM guidelines and EPA guidelines.

The habitat mapping exercise had regard to the 'Best Practice Guidance for Habitat Survey and Mapping' (Smith *et al*., 2011) published by the Heritage Council.

Scientific and common names for plants follow Parnell and Curtis (2012) and Blamey *et al*., (1996), respectively. In addition to habitat identification, each habitat was assessed for its ecological significance, based on the National Roads Authority (NRA) Site Evaluation Scheme (NRA, 2009a) (see Table 8-11).

Habitat boundaries and associated attribute data were mapped using desk-based GIS software, namely ArcGIS 10.4.1, which was also used to calculate habitat areas and lengths.

In addition, a detailed assessment of the vegetation composition and cover of heath habitats and mosaics was undertaken in accordance with the methodology outlined in the *'Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland'*.

A brief overview of the methodology used during the Annex I Habitat Assessments is given below:

- Prior to undertaking the assessment, a number of random monitoring stops for each habitat/mosaic area were generated using GIS. The exact number of monitoring stops was dictated by the size of the habitat to be assessed as outlined in the NPWS Guidance (Refer to '*upland vegetation and habitats'* guidance referenced above).
- At each monitoring stop a comprehensive relevé was recorded.
- Each relevé was 2 m x 2 m in size.
- The diversity and abundance/cover of the vegetation present was noted at each relevé. Cover was recorded using the DAFOR scale.
- Unknown species were collected using specimen bags that were clearly labelled with the date, relevé code and site name.
- Digital photographs were taken of each monitoring stop to record the vegetation.

8.2.5.2 Mammals

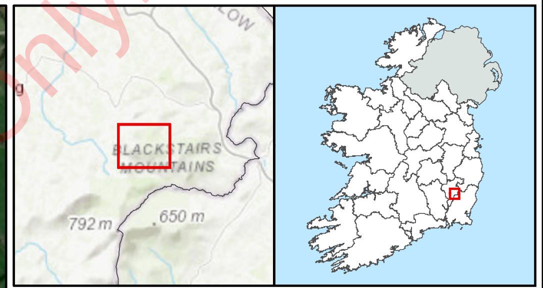
Mammal surveys were undertaken between the 17th and 18th of September 2020 and on the 9th of October 2020. During these surveys the footprint of the development was surveyed for signs of mammal activity; this included the footprint of vegetation clearance and earthworks, as well as a buffering distance of 150m from all proposed infrastructure. Sightings, tracks or signs (including droppings, resting places, burrows and setts) of mammals occurring within, or in the vicinity, of the site footprint were recorded using field notes and/or handheld GPS units subsequently digitised using ArcGIS.

Surveys were undertaken in accordance with the NRA's (2009b) '*Ecological Surveying Techniques for Protected Flora and Fauna During the Planning of National Road Schemes'* and the JNCC's (2004) '*Common Standards Monitoring Guidance for Mammals'*.

Trail cameras were places at any burrow deemed as being 'potentially in use' to ascertain what, if anything, was using it. Three trail cameras were placed at burrows in the south west of the site. Cameras were deployed on the 18th of September 2020 and collected on the 9th of October 2020 giving a total of 21 field days. See Figure 8-1 for trail camera locations.

Aquatic otter were surveyed as part of the aquatic ecology surveys and this is described in section 8.2.5.5.

Path: R:\Map Production\2019\P1913\Workspace\EIAR\P1913_GIS_Fig8-1_TrailCameraLocations_A3.mxd



Trail Camera
Proposed Turbine
Proposed Development
Proposed Croaghaun

TITLE: Trail Camera Locations	
PROJECT: Croaghaun Wind Farm	
FIGURE NO: 8.1	
CLIENT: Coillte	
SCALE: 1:10000	**REVISION:** 0
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8.2.5.3 Bats

Bat surveys have been completed within the study area during the years 2019 and 2020. The surveys encompassed habitat and preliminary roost assessments, summer roost inspection, winter roost inspection, bridge roost inspection, activity surveys (transects) and static detector surveys. The methodologies for surveys undertaken within the wind farm study area described here are extracted from the 2019/2020 bat report (Appendices 8.5).

These surveys followed the specific guidelines set out by the Bat Conservation Trust in Bat Surveys: Good Practice Guidelines (Hundt, 2012 and Collins, 2016). The locations of static detectors and methodology for static detector surveys followed the requirements of 'Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation' (SNH, 2019).

Habitat Assessment

Walkover surveys to search for potential bat habitat were conducted throughout the survey period, with a focused bat habitat assessment survey carried out in August 2019. During this survey habitat types within the site were recorded and assessed for their suitability to support bats. Suitability was assessed according to Collins (2016) which provides a grading protocol for roosting habitats and for commuting and foraging areas. Suitability categories, divided into 'high', 'moderate' and 'negligible', are described in the 2019/2020 Bat Survey Report included in Appendix 8.4.

Preliminary Roost Assessment

Walkover surveys of areas identified as potential roosting habitats during the desk top study were undertaken in August 2019, and in July 2020 for the grid connection and TDR. The proposed development site was walked and habitats of potential value to bats were noted and marked on a map. The value of each feature (trees and buildings) was noted according to its potential for use by bats for roosting. The value of habitat features for bats was defined in accordance with Bat Surveys: Good Practice Guidelines publication (Collins, 2016) as detailed in the accompanying 2019/2020 Bat Survey Report).

Detailed Roost Inspection

A detailed internal and external inspection of all structures within the main wind farm study area plus a 300m buffer (as per SNH, 2019 guidance) was carried out from ground-level to identify potential roosting locations and field signs including bat droppings, bat carcasses, feeding remains (particularly butterfly and moth wings), urine staining and the presence of areas of cleared cobwebs. Structures were assessed as having either 'high', 'medium', 'low' or 'negligible' potential to support roosting bats and categorised using definitions in Collins (2016), see Table 8-4.

Detailed Roost Inspection – Trees

Detailed inspection of the exterior of trees was undertaken between the 18th and 19th of July 2019 to look for features that bats could use for roosting (Potential Roost Features, or PRFs) from ground level. The aim of the surveys was to determine the actual or potential presence of bats and the need for further survey and/or mitigation.

A detailed inspection of each potential tree roost within the main wind farm site plus a 300m buffer (as per SNH, 2019 guidance) was undertaken. The inspection was carried out in daylight hours from ground level, and information was compiled on the tree, PRFs and evidence of bats.

All trees surveyed were numbered and marked on a map and a description of each PRF observed was recorded. PRFs that may be used by bats include:

- Rot holes;
- Hazard beams;
- Other horizontal or vertical cracks or splits (e.g. frost cracks) in stems or branches;
- Lifting bark;
- Knotholes arising from naturally shed branches or branches previously pruned back to the branch collar;
- Man-made holes (e.g. flush cuts) or cavities created by branches tearing out from parent stems;
- Cankers in which cavities have developed;
- Other hollows or cavities;
- Double leaders forming compression forks with included bark and potential cavities;
- Gaps between overlapping stems or branches;
- Partially detached ivy with stem diameters in excess of 50mm; and
- Bat or bird boxes.

Signs of a bat roost (excluding the actual presence of bats), include:

- Bat droppings in, around or below a PRF;
- Odour emanating from a PRF;
- Audible squeaking at dusk or in warm weather; and
- Staining below the PRF.

It should be noted that bats or bat droppings are the only conclusive evidence of a roost and many roosts have no external signs. Trees were categorised according to the highest suitability PRF present.

Detailed Roost Inspection - Buildings

All buildings within the main wind farm site (plus 300m buffer) were subject to a visual inspection for evidence of, and potential for, bats on 27th March 2020 and on 13th July 2020. The exterior of the structures were visually assessed for potential bat access points and evidence of bat activity using binoculars, a high-powered torch and an endoscope (Explorer Premium 8803 with 9 mm camera). Features such as crevices and small gaps in the building structure, such as between the brick or stonework, beneath roofing material, at eaves and around window frames which had potential as bat access points into the buildings were inspected. Evidence that these features/ access points were actively being used by bats includes staining within the gaps, urine staining and bat droppings. Indicators that potential access points are not actively used by bats include general detritus and cobwebs within the access point. A note of potential features used by bats was made where present.

Where possible, internal inspections of these structures was undertaken. Internal inspections involved looking for features that may be suitable for roosting bats, such as joints and crevices in wood, holes or crevices between stonework in the walls and searching for bat droppings, urine stains and feeding signs on the floor.

Detailed Roost Inspection – Watercourse Crossings

Watercourse crossings within the main wind farm site, grid connection and TDR were inspected on 9th October 2020.

Bridges were searched for potential roosting features such as cracks and crevices, gaps in stonework and thick growths of mature ivy were searched for and signs of bat occupancy including droppings, oil/staining and feeding remains. The survey was carried out with regard to Collins (2016) and Aughney *et. al.,* (2008). The exterior of the structures were visually assessed for potential bat access points and evidence of bat activity using binoculars, a high-powered torch and an endoscope (Explorer Premium 8803 with 9 mm camera).

Table 8-4: Potential Suitability of Habitats for Bats (Collins, 2016)

Suitability	Description of Roosting Habitats	Commuting and Foraging Habitats
Negligible	Negligible habitat features on site likely to be used by roosting bats.	Negligible habitat features on site likely to be used by commuting or foraging bats.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation). A tree of sufficient size and age to contain PRFs but with none seen from the ground or features seen with only very limited roosting potential.	Habitat that could be used by small numbers of commuting bats such as gappy hedgerow or un-vegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitat. Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only- the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
High	A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.	Continuous, high quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree-lined watercourses and grazed parkland. Site is close to and connected to known roosts.

Bat Activity/Transect Surveys

Four transect routes were surveyed in total each month June to September 2019 in accordance with the best practice guidelines (Collins, 2016). As such a total of 5 activity surveys were completed during the activity season. Surveys targeted a range of foraging and commuting habitats present within the study area, those associated with linear features such as roadside margins, woodland plantation edges, hedgerows, treelines and waterbodies. All transect surveys were conducted at dusk. They commenced 30 minutes before sunset and were completed within 2 hours after sunset.

Transects were undertaken on foot or vehicle (driven at 15km/h) and bats were recorded in real time by a minimum of two surveyors. Surveyors were equipped with a Frequency Division Detector System and Batbox Duet detector. Frequency Division detectors record bat ultrasonic calls on a continuous basis and stores the information onto an internal SD memory card. The bat detectors used a Full Spectrum Analysis to make the real-time recorded calls visible for display purposes. Each time a bat is detected, an individual time and GPS stamped (date and time to the second) file is recorded.

Surveyors stopped regularly in areas of particularly suitable bat foraging and commuting habitat. Bats were identified by their ultrasonic calls coupled with behavioural and flight observations in the field and on computer by sound analysis of recorded echolocation and social calls with dedicated software (BatExplorer spectrogram sound analysis software Version 2.1.6.0).

The details of the 2019 activity survey are included below in Table 8-5. See Figure 8-2 for transect routes.

Table 8-5: Bat Activity Survey Details 2019

Date	Sunset	Weather Conditions
28/06/2019	21:54	2/8, F1, Dry, 19ºC
31/07/2019	21:21	4/8, F1, Dry, 19ºC
15/08/2019	20:53	4/8, F1, Dry, 16ºC
26/09/2019	20:24	6/8, F2, Dry, 11ºC

Static Detector Surveys (2019)

Song Meter SM4BAT (automated static recording detectors) were deployed at 9 locations within the site, for a minimum of 10 nights each three survey periods: in 2019 spring (May), summer (July) and autumn (mid-August to November) following methods described in SNH (2019). Locations covered the proposed turbine layout (refer to Figure 8-2). Detectors were programmed to commence half an hour before sunset and finish half an hour after sunrise to ensure that bat species that emerge early in the evening and return to roosts late are recorded. Survey details are provided in Table 8-6 below.

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Table 8-6: Location and total deployment time for static detectors in 2019

Detector ID No.	Turbine No.	Habitat types	First recording (Spring)		Second recording (Summer)		Third recording (Autumn)	
			Date deployed	Number of nights deployed[3]	Date deployed	Number of nights deployed	Date deployed	Number of nights deployed
2	N/A	Conifer Plantation (WD4)	21/05/2019	14	11/07/2019	17	15/08/2019	18
3	N/A	Dry siliceous heath (HH1)	21/05/2019	14	11/07/2019	14	15/08/2019	18
4	T3	Improved agricultural grassland (GA1)	21/05/2019	14	11/07/2019	14	15/08/2019	18
5	T2	Conifer Plantation (WD4)	21/05/2019	14	11/07/2019	14	15/08/2019	18
6	T5	Conifer Plantation (WD4)	21/05/2019	14	11/07/2019	14	15/08/2019	12
7	T4	Conifer Plantation (WD4)	21/05/2019	14	11/07/2019	14	15/08/2019	38

[3] Note that data was recorded for the morning on the date of collection. Thus, if a detector was left out on 09/05/2019 and collected on 20/05/2019, the detector would have been left out for a total of 11 complete nights. However, there would be 12 unique dates where data was (potentially) recorded. Ecobat automatically includes every distinct date as a night and so reports one more night than is actually recorded.

Detector ID No.	Turbine No.	Habitat types	First recording (Spring)		Second recording (Summer)		Third recording (Autumn)	
			Date deployed	Number of nights deployed[3]	Date deployed	Number of nights deployed	Date deployed	Number of nights deployed
8	T6	Conifer Plantation (WD4)	21/05/2019	14	11/07/2019	14	15/08/2019	30
9	T1	Recently felled woodland (WS5)	21/05/2019	14	11/07/2019	14	15/08/2019	18
11	T7	Conifer Plantation (WD4)	21/05/2019	14	11/07/2019	14	15/08/2019	29

Bat Survey Analysis

All recordings during static and transect surveys were made in full spectrum sonograms (2-d sound pictures) real time recordings, retaining all amplitude and harmonic information from the original bat call, that are digitally stored on the SD card (or micro SD cards depending on the model) and downloaded for analysis. It is these recordings that were analysed using bat call analysis software BatExplorer spectrogram sound analysis software Version 2.1.6.0. The static detector data was analysed with Kaleidoscope 5.1.9g software.

These results are depicted on a graph showing the number of bat passes per species per hour/night. Each bat pass does not correlate to an individual bat but is representative of bat activity levels. Some species such as the pipistrelles will continuously fly around a habitat and therefore it is likely that a series of bat passes within a similar time frame is one individual bat. On the other hand, Leisler's bats tend to travel through an area quickly and therefore an individual sequence or bat pass is more likely to be indicative of individual bats.

The static data was uploaded and analysed using the Ecobat tool. This analysis was undertaken for each survey period separately. Where groups of detectors were deployed for different dates within a survey period, those that were deployed for the same dates were analysed together (details are provided for each survey period below).

The reference range datasets were stratified to include:

- Only records from within 30 days of the survey date.
- Only records from within 100 km^2 of the survey location.
- Records using any make of bat detector.

The Ecobat tool provides a series of summary tables to enable analysis of the bat activity level at each static location. These are presented below, and categorisation of activity level is based on the following table:

Table 8-7: Percentile Score and Categorised Level of Bat Activity

Percentile	Bat Activity
81 to 100	High
61 to 80	Moderate to High
41 to 60	Moderate
21 to 40	Low to Moderate
0 to 20	Low

Raw data upon which the Ecobat analyses were based is presented in Appendix C of the bat report (Appendix 8.4).

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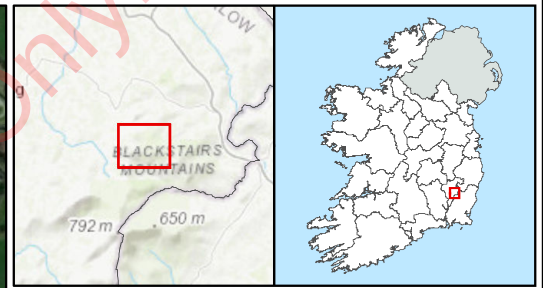
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community



Proposed Turbine Layout
Static Detectors
Proposed Development Boundary
Transect 1
Transect 2
Transect 3
Proposed Croaghaun Loop

0 0.125 0.25 0.5 Kilometers

TITLE: Bat Activity Survey Transects and Static Detector Locations 2019	
PROJECT: Croaghaun Wind Farm	
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8.2.5.4 Avifauna

Target Species

The following criteria has been utilised to select target species for the current study. Scottish Natural Heritage (SNH) guidance (SNH, 2017) on the assessment of the effects of wind farms on ornithological interests suggests that there are four important species lists from which target species can be drawn, as follows:

- Species listed on Annex 1 of the Birds Directive (EC, 2009)
- Red-listed birds of Conservation Concern
- Schedule 1 of the Wildlife and Countryside Act 1981 (not applicable in Ireland) and;
- Regularly occurring migratory species.

In addition to the above, consideration was given to species identified locally as being of conservation concern, regionally or those particularly susceptible to impact from wind farm development. Note that not all species on the above lists would be categorised as target species, e.g. most passerine species and general lowland farmland birds are not considered to be particularly susceptible to impacts from wind farms (SNH, 2017). Target species identified during avifauna surveys can be found in Table 8-8 below.

In the Irish context, it has been suggested that target species should be taken from species of conservation concern in Ireland (BOCCI) (Colhoun and Cummins, 2013), those likely to occur within the vicinity of the proposed wind farm, and those most at risk from particular impacts such as disturbance and displacement (Nairn, R. and Partridge, K., 2013).

'Birds of Conservation Concern in Ireland' (BoCCI) are classified into three separate lists; red, amber and green. Red-listed species are of high conservation concern, Amber-listed species are of medium conservation concern and Green-listed species are considered to be of no conservation concern (Colhoun and Cummins, 2013).

To date three BoCCI lists have been published with the current list by Colhoun and Cummins (2013) superseding the two former lists by Lynas *et al*., (2007) and Newton *et al*., (1999). The conservation status of bird species found in this study was assessed using the most recent (2013) BoCCI List (Colhoun and Cummins, 2013).

Additionally, a review of the bird species listed on Annex I of the EU Birds Directive (2009/147/EC) was undertaken in assessing the conservation status of birds. Annex I species are often afforded additional protection through the designation of Special Protection Areas (SPAs) throughout EU countries in addition to existing National legislation.

Table 8-8 below outlines the 14 species for which past records exist within the 10km grid square[4] (S85) which overlaps with the proposed main wind farm site and which meet one or more of the SNH (2017) criteria outlined above. As the grid route will be underground and mainly under public roads, the chance of avian disturbance is very low relative to existing disturbance from traffic. Also, there is no chance of collision with cables. The same is true for the TDR, and any disturbance relative to the baseline is low. Where grid route was off-road, habitats were dominated by agricultural land, which are of low value for birds (plus they are common in the wider landscape). The off-road section near the top of the main wind farm site was encapsulated in the 10 km square search. Assessment of habitat suitability for birds was undertaken during site walkovers, which re-confirmed these findings. To ensure other species which may be sensitive to wind farms were not missed during surveys all other species of gull, wader, duck, goose, swan as well as Cormorant (*Phalacrocorax carbo*) and Heron (*Ardea cinerea*) were included as secondary species. See below table for list of target and secondary species.

[4] National Biodiversity Data Centre (NBDC) website

Table 8-8: Target Species (10km Grid Square S85) and Associated Suitable Breeding Habitat

Species	Suitable Breeding Habitat
Target Species	
Hen Harrier (*Circus cyaneus)*	Uplands and bogs, heather moorland, young forestry plantations and coastal wetlands
Short-eared Owl (*Asio flammeus*)	Trees, buildings, cliffs/quarries
Sparrowhawk (*Accipiter nisus*)	Trees
Common Buzzard (*Buteo buteo*)	Trees, cliffs/quarries
Kestrel (*Falco tinnunculus*)	Trees, buildings, cliffs/quarries
Long-eared Owl (*Asio otus*)	Trees, buildings, cliffs/quarries
Northern Lapwing (*Vanellus vanellus*)	Lowland wet grassland, arable farmland, cutover bog with pools and wet grassland
Eurasian Curlew (*Numenius arquata*)	Bog
Whooper Swan (*Cygnus cygnus*)	Lowland open farmland and inland wetlands
Woodcock (*Scolopax rusticola*)	Woodland and bog woodland
Red Grouse (*Lagopus lagopus*)	Mountains, moorland, lowland blanket bog and raised bogs; associated with heather
Black-headed Gull (*Larus ridibundus*)	Coast and large lakes in western Ireland
Herring Gull (*Larus argentatus*)	Widespread; coast and inland lakes, marsh and bogs
Golden Plover (*Pluvialis apricaria*)	Heather moors, blanket bogs, acidic grassland in the uplands northwest Ireland
Target/Secondary Species	
Gulls	Coastal and various inland wetland habitats
Waders	Coastal and various inland wetland and bog habitats
All geese, swans and duck species	Wetlands, Lake/Lowland River Fringes
Cormorant (*Phalacrocorax carbo*)	Coastal habitat and inland waterbodies
Heron (*Ardea cinerea*)	The edge of wetlands, rivers, streams and marshy ground

Overview of methods of current surveys

Initial walkovers of the site were carried out to enable the identification of suitable survey locations.

Field surveys were undertaken to gather detailed information on bird distribution and flight activity in order to predict the potential effects of a wind farm development on birds. The field surveys comprised two main elements; vantage point (VP) watches and targeted distribution and abundance surveys which comprised:

- VP watches undertaken over two and a half years at 6 VPs (winter 2017/18, winter 2018/19, winter 2019/20, Summer 2018, Summer 2019)

- Transect/point count surveys (winter 2017/18, winter 2018/19, winter 2019/20, Summer 2018, Summer 2019,)
- Hinterland survey (winter 2017/18)
- Winter walkover survey to search for evidence of Red Grouse, Merlin and Golden Plover (winter 2017-18).
- Red Grouse survey (winter 2018/19)
- Red Grouse and Golden Plover Walkover (Winter 2019/2020)
- Breeding Bird Walkover Survey to search for evidence of breeding raptors and waders (Summer 2018, 2019)
- Red Grouse, Woodcock and Nightjar (*Caprimulgus europaeus)* (summer 2018)
- Nocturnal transect survey for Woodcock and Nightjar (Summer 2019).

Vantage Point (VP) Watches / Flight Activity Surveys

Selection of VP Locations

Vantage point (VP) surveys were carried out with regard to 'Recommended bird survey methods to inform impact assessment of onshore wind farms' (SNH, 2017).

VP surveys were carried out by suitably qualified personnel over:

- three winter seasons:
  - A seven month period spanning September 2017 to March 2018 (inclusive),
  - a six month period spanning October 2018 to March 2019 (inclusive), and
  - a six month period spanning October 2019 to March 2020(inclusive),
- Two summer seasons:
  - a six month period spanning April to September 2018 (inclusive), and
  - a six month period spanning April to September 2019 (inclusive).

The overall aim of these surveys was to quantify the level of flight activity and its distribution over the flight activity survey area and to determine bird usage of the site. The flight activity survey area was taken to be that area encompassing the potential development area and 500m beyond the development boundary as potential collision risk, habitat loss and displacement could affect birds outside the proposal site (Figure 8-11). Thus, the flight activity area was considerably larger than that required by SNH (2017) guidance, which states that the flight activity survey area should correspond to 500m circular buffers drawn around the location of each proposed turbine. Vantage points are ideally located on elevated areas, or other areas, which provide clear views over the survey area. Achieving maximum visibility over as much of the site as possible is important for these surveys.

According to SNH (2017) vantage points should be located so as to allow full coverage of the flight activity survey area such that no point is greater than 2km from a VP. In order to minimise observer effect on bird behaviour VPs should ideally be located outside the survey area but should be located as close as possible. SNH (2017) stipulates that where VPs are located within the survey area they should not be used simultaneously with other VPs which overlook them to minimise potential observer effect on birds.

With regards to the proposed wind farm site, VP locations were selected so as to provide maximum site coverage. Factors which limited selection of VP locations included the forested nature of the site and the undulating typography of the landscape.

The locating of some of the VPs within the survey area achieved visual coverage of the site in line with SNH (2017) guidance. Only one of the VPs located within the survey area (VP2) is overlooked by another VP (VP3). Overlap in VP surveys conducted at both of these locations over the course of the winter survey period was minimised to reduce the risk of surveyor presence affecting bird behaviour. Surveyor presence did not affect bird behaviour during any of the VP surveys which were carried out; including where surveys at VP2 and VP3 were conducted simultaneously. This was reflected in the flight paths recorded for the various target and secondary species with birds regularly recorded flying in relatively close proximity to surveyors. If observer presence influenced bird behaviour, we would expect to see alterations in flight path to avoid the surveyor. This was not the case and no obvious alterations in flight paths were observed.

Initially, five VP locations were selected to cover the site (VP1 – VP5). In November 2017 it was decided to add another VP (VP6) in the south-western corner of the site to increase the observable area of the flight activity survey area. Additional survey hours were carried out at the new VP to ensure that the full 36 hours per VP location were completed for each winter and summer seasons. Thus, survey effort across all VP locations was per the recommended amount stated in SNH (2017) guidance. The Irish Transverse Mercator (ITM) grid co-ordinate locations of each VP are provided in Table 8-9 below. Figures showing the location of each VP and the viewsheds from each VP in order to show the extent of site coverage are provided in Appendix 8.2. Full details on individual VP surveys including survey dates, times and weather conditions can be found in Appendix 8.2.

Table 8-9: Vantage Point Locations

VP No.	ITM Grid Co-ordinates
1	686588, 657138
2	685532, 657551
3	684773, 657714
4	684550, 658058
5	683154, 656704
6	683366, 656645

Viewshed Analysis of VP Locations

Viewshed analysis was undertaken for each VP location to determine visual coverage of the survey area (taken to encompass the site and the flight activity survey area). Viewsheds were set to observer height of 2m showing a view of everything over 25m height. Viewsheds encompassed a 2km radius with 3600 view. Each viewshed was then cropped to an 1800 arc showing the relevant direction of view. Viewshed analysis determined that, based on the VP locations selected, visual coverage of approximately 86.5% of the survey area was achieved. As previously mentioned, the original flight activity survey area was much larger than that required by SNH (2017) guidance, which states that the flight activity survey area is that covered by circular 500m buffers drawn around the location of each proposed turbine. When this is considered, the coverage of the 500m buffers by the combined viewsheds increases to 96%, thereby ensuring near complete coverage of the flight activity survey area by VP surveys in line with SNH (2017) guidance.

The factors limiting visual coverage of the site have already been outlined above in 'Selection of VP Locations'. Figures showing the viewsheds from each VP in order to show the extent of site coverage are provided in Appendix 8.2.

The main part of the survey area not visually covered by the VP viewsheds comprises the north-western and north-eastern corners of the flight activity survey area. These areas comprise mainly mature forestry and agricultural land (see Figures in Appendix 8.2 for viewshed coverage). These areas were partially encompassed by walked transects and point count surveys which were conducted on a monthly basis throughout the survey period (See Figures in Appendix 8.2 for transect route and point count locations).

Flight Data Recording

During VP surveys the flight behaviour of target species was recorded. Based on the precautionary principle flight behaviour of secondary species was also recorded; however, recording of secondary species was subsidiary to recording of target species (SNH, 2017). At the time of each species observation the following information was recorded:

- The time that the bird was detected;
- The flight duration (seconds) within various flight height categories (0-50m, 50-100m, 100- 200m and >200m);
- Sex and age of the bird(s) (adult/juvenile), where possible to determine;
- Type of activity/behaviour such as hunting, flying, displaying etc;
- Estimation of actual flight height;
- Habitat(s) where the bird was observed;
- Weather conditions at time of sighting including wind speed and direction.

Once an initial sighting was made, each target or secondary species was observed until lost from view. Flight paths were recorded as observed, including where birds travelled or were observed outside of the flight activity survey area; such that all flight activity within the broader landscape was encompassed. Flight paths were mapped in the field on OSI 1:25 000 mapping.

Details on flight behaviour for each individual target/secondary species observed, including a unique map identifier code which corresponds to a mapped flight path, are provided in tabulated format in Appendix 8.2. All flight paths are provided in Appendix 8.2. Summaries and monthly peak counts of all non-target species of conservation concern recorded during VP surveys are provided in Appendix 8.2.

Distribution and Abundance Surveys

Distribution and abundance surveys were carried out to record numbers and distributions of breeding, wintering and migrant birds using the site that might be affected either directly or indirectly by the proposal (e.g. collision risk, habitat loss, displacement effects).

Transect and Point Count Surveys

A transect survey is a survey along a defined route within the survey area. The overall aim of the transect surveys was to assess general bird distribution throughout the site and gather data on bird usage of the site.

Transect surveys were completed on a monthly basis for three winter seasons; between September 2017 and March 2018, October 2018 and March 2019, and October to November 2019 and January to March 2020 and two summer seasons; April and September 2018, April and September 2019. All bird species seen or heard, typically within 100m of the transect route, were recorded, although the typography of the landscape often allowed for detection of birds at greater distances.

The transect route was selected to provide representative coverage of all habitats, both open and closed, occurring within the site e.g. clearfell forestry, young/mature forestry, scrub etc. The transect route followed an existing forestry access track which runs through the site.

Birds were also surveyed using point count methodologies. Point counts were conducted during each monthly transect survey. A total of 25 point count locations were surveyed during each individual transect survey.

Point count locations were sited at approximately 0.5km intervals along the overall length of the designated transect route. All birds seen or heard during this period were recorded.

A map showing the transect survey route and point count locations within the proposed wind farm site is included in the Figures in Appendix 8.2. Details on each transect survey carried out including survey date, time and weather conditions can be found in Appendix 8.2. Tabulated results of peak counts for all species recorded during monthly transect and point count surveys are provided in Appendix 8.2.

Other Winter Surveys

Initial Walkover Survey 2018

A walkover survey was carried out on the 24th January 2018 to search for evidence of Red Grouse, Merlin and Golden Plover in parts of the site which had been identified as having potential for these species to occur. The walkover survey focussed on two main areas of the study area comprising heather moorland/heath located within the north-western corner of the study area and outside the site boundary, and that area of the study area located between VP2 and VP3. A map showing the areas encompassed by the walkover survey is included in the Figures in Appendix 8.2.

Driven Hinterland Survey

Driven hinterland surveys were conducted in the area surrounding the potential development area throughout the winter season. These surveys aimed to identify areas of the surrounding hinterland which were being used, or had the potential to be used, by waders, swans, geese and other over-wintering species. The hinterland survey area encompassed areas of suitable habitat outside of the site, including ponds at Kildavin Quarry, which is an I-WeBS site (Kildavin Cemex Pit Site Code 0P312) and is located approximately 2.8km north-east of the site boundary. A map showing the areas encompassed by the hinterland surveys is included in the Figures in Appendix 8.2.

Red Grouse Tape Lure Survey

A tape-lure survey for Red Grouse was conducted on the 22nd February 2019 in areas identified as having potential for this species to occur (see Figures in Appendix 8.2 for red grouse transect survey areas). This survey was carried out under licence from the NPWS (Section 35 Licence No. 23/2019).

Red Grouse and Golden Plover Walkover Surveys

Three walkover surveys were carried out on the 27th February 2020 to detect the presence of red grouse and golden plover. The surveys were undertaken in three different areas identified as having potential for these species to occur (see Figures in Appendix 8.2 for walkover survey area locations). All three walkover survey areas have gently undulating topography, while Area 1 and Area 2 are classed as 'Peat bogs' and Area 3 as 'Moors and heathlands'.

<u>Other Breeding Season Surveys</u>

Breeding Bird Walkover Surveys

Breeding walkover surveys were undertaken in the Summers of 2018 and 2019 to detect the presence of breeding raptors and waders within 2km of the study area. Any sightings of target species exhibiting potential breeding behaviour were investigated to determine breeding status within the study area.

A walkover survey to search for evidence of breeding Red Grouse, Woodcock and Nightjar was conducted on the 27th June 2018 in those parts of the study area which had been identified as having potential for these species to occur. During this walkover survey any evidence of other moorland breeding species, including waders, was recorded where encountered. This walkover survey focussed on the central section of the study area (between VP1 and VP3 approximately), and an area of heath located in the north-western corner of the study area approximately 100m beyond the site boundary. A map showing the areas encompassed by the walkover survey is included in the Figures in Appendix 8.2.

Night Time Transects Survey

A night-time transect survey was undertaken to detect evidence of breeding crepuscular/nocturnal species Woodcock and Nightjar. This transect was carried out on the night of the 26th June 2019 between the hours of 22.40 and 01.50. The transect survey route was primarily in the mid-west section of the development site between PC3 and PC16 predominantly through non-native conifer forestry. The transect route is shown on a map of the study area in the Figures in Appendix 8.2.

8.2.5.5 Aquatic Ecology

Surveys to inform the aquatic ecology assessment were completed during 2019 and 2020. The surveys included walkover surveys, catchment wide electro-fishing, White-clawed Crayfish Survey, Freshwater Pearl Mussel Survey, biological water quality surveys. Figure 8-4 gives the location of the proposed Croaghaun Wind Farm and cable route with respect to the Blackstairs Mountain pNHA/SAC (000770) and Slaney River Valley pNHA/SAC (000781) and watercourses in the River Slaney and River Barrow catchments.

Selection of Watercourse for Appraisal

All freshwater watercourses which could be affected directly or indirectly by the proposed wind farm development were considered as part of the current assessment. This included watercourses draining the proposed wind farm site as well as those crossed by the proposed grid connection route (see Table 8-10, Figure 8-3).

A total of 25 sites were selected for detailed aquatic assessment. The nomenclature for the watercourses surveyed is as per the Environmental Protection Agency's (EPA) online map viewer.

Surveys at each site included a fisheries assessment (electro-fishing, habitat appraisal), White-clawed Crayfish survey (trapping and sweep netting), Freshwater Pearl Mussel survey (Stage 1), and biological water quality sampling (Q-sampling). This approach informed the overall aquatic ecological evaluation of each site in context of the proposed wind farm development.

Table 8-10: Location of the aquatic ecology sites assessed for the proposed Croaghaun Wind Farm project

Site	Waterbody name	EPA code	Location/townland	ITM (x)	ITM (y)	Location relative to development
A1	Kilbrannish South Stream	12K81	Kilbrannish South	684131	656544	Downstream of proposed wind farm
A2	Kilbrannish North Stream	12K82	Kilbrannish North	685267	657025	Turbine delivery works location no. 43 along TDR; downstream of proposed wind farm
A3	River Clody	12C03	Kilbrannish South	686108	655320	Downstream of proposed wind farm
A4	River Clody	12C03	Barnahask Bridge	689602	654915	Downstream of proposed wind farm
A5	River Slaney	12S02	Slaney Bridge	691308	656980	Downstream of proposed wind farm
B1	Raheenleigh Stream	14R22	Raheenleigh	682670	657322	Downslope of proposed amenity trail
B2	Burren River	14B05	Raheenleigh	681691	657284	Downstream of proposed amenity trail catchment area
B3	Burren River	14B05	Rathnageeragh	679605	657842	Downstream of proposed amenity trail catchment area
B4	Ballykeally Stream	14B55	Killane	680124	665142	Intersects grid route (GCR-WCC4); downstream of proposed amenity trail catchment area
B5	Burren River	14B05	Killane Bridge	679981	665389	Downstream of grid route (GCR-WCC4); downstream of proposed amenity trail catchment area
B6	Burren River	14B05	Ballynunnery Bridge	679796	665985	Intersects grid route (GCR-WCC2); downstream of proposed amenity trail catchment area
B7	Garreenleen Stream	14G24	Bendinstown	679115	667763	Intersects grid route (GCR-WCC3)
B8	Bendinstown Stream	14B70	Ballynunnery	677804	668116	Intersects grid route (GCR-WCC1)
B9	Ardbearn 14 Stream	14A21	Ballycurragh	679104	670060	Downstream of grid route

Site	Waterbody name	EPA code	Location/townland	ITM (x)	ITM (y)	Location relative to development
B10	Kilmaglush Stream	12K42	Kilmaglush	680149	662381	Intersects grid route (GCR-WCC5)
C1	Douglas River	12D03	Bealalaw	681590	659066	Intersects grid route (GCR-WCC6)
C2	Douglas River	12D03	Myshall Bridge	682098	660850	Downstream of grid route (GCR-WCC9)
C3	Douglas River	12D03	Sragh Bridge	684404	664007	Downstream of grid route (GCR-WCC9)
D1	Clashavey River	12C10	Rossacurra	684297	658352	Within wind farm site; downstream of proposed wind farm access track (existing culvert crossing)
D2	Rossacurra Stream	12R37	Rossacurra	683926	659547	Upstream of grid route (GCR-WCC7)
D3	Clashavey River	12C10	R724 bridge, Moneygrogh	685157	661241	Downstream of Proposed Wind Farm and Grid Route (GCR-WCC7)
D4	Clashavey River	12C10	Whitemill Bridge	687108	662859	Downstream of Proposed Wind Farm and Grid Route (GCR-WCC7)
E1	Kildavin Stream	12K04	Cranemore	685516	658973	Within proposed T6 catchment area
E2	Old Deerpark Stream	12O08	Cranemore	686530	658412	Adjacent to proposed T6 catchment area
E3	Kildavin Stream	12K04	R724 bridge, Kildavin	688871	659730	Within proposed T6 catchment area

Walkover Surveys

Walkover surveys of the watercourses within the footprint of the main wind farm site, TDR and grid connection route crossing sites were conducted Wednesday 25th to Saturday 28th September 2019. An additional survey site, B10 (Kilmaglush Stream) was surveyed on Saturday 7th November 2020. Survey effort focused on both instream and riparian habitats approx. 100m upstream and 100m downstream of each sampling point (see Figure 8-3). The watercourses at each survey site were described in terms of the important aquatic habitats/species. This helped to evaluate species and habitats of ecological value in the vicinity of each site. The aquatic baseline prepared would inform mitigation for the wind farm development.

A broad aquatic habitat assessment was conducted utilising elements of the methodology given in the Environment Agency's 'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003' (EA, 2003) and the Irish Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000). All sites were assessed in terms of:

- Physical watercourse/waterbody characteristics (i.e. width, depth etc.)
- Substrate type, listing substrate fractions in order of dominance (i.e. bedrock, boulder, cobble, gravel, sand, silt etc.);
- Flow type, listing percentage of riffle, glide and pool in the sampling area;
- An appraisal of the aquatic macrophyte community at the sampling sites.
- Riparian vegetation composition.

Otter sign survey

The presence of otter (*Lutra lutra*) at each aquatic survey site was determined through the recording of otter signs. These included holts, couches, spraints, latrines, slides and prints which are useful determinants of otter utilisation of watercourses. The location of signs was recorded via handheld GPS.

Electrofishing

An electro-fishing survey of the watercourses within the footprint of the proposed windfarm and at the proposed grid connection route crossing points was conducted on Wednesday 25th to Saturday 28th September 2019, under the conditions of a Department of Communications, Climate Action and Environment (DCCAE) license. The survey was undertaken in accordance with best practice and Section 14 licencing requirements.

For detailed survey methodology, please refer to the Aquatic Report in Appendix 8.3.

White-clawed Crayfish

A survey for White-clawed Crayfish (*Austropotamobius pallipes*) of the watercourses within the footprint of the proposed windfarm and at the proposed grid connection route crossing points was undertaken using a combination of hand searching (sweep netting) and bathyscope use, trapping and mustelid spraint walkover surveys. Furthermore, a desktop review of known distributions of Crayfish within the wider Croaghaun catchment was undertaken and a sensitive species data request was sent to the National Parks and Wildlife Service (received 31st March 2020).

For detailed survey methodology, please refer to the Aquatic Report in Appendix 8.3.

Freshwater Pearl Mussel Surveys

Stage 1 Freshwater Pearl Mussel surveys were carried out by Sweeny Consultancy staff on June 11th 2020. Seven survey sites were selected; three on the Slaney main channel and one each on the Clashavey River, the Kildavin Stream, the River Clody and the Douglas River. A minimum of 500m of channel was surveyed at each site. . Given the extensive freshwater pearl mussel surveys carried out on the Burren River in the 2009-2019 period, it was considered that there was sufficient data available to determine that the species is absent from the River Burren and, thus, the river was not surveyed. Pearl mussel surveys were carried out under licence number C15/2020, issued by the National Parks and Wildlife Service (NPWS). The survey methodology used was in accordance with the Stage 1 and 2 guidelines given in Irish Wildlife Manual No. 12, NPWS (Anon., 2004).

Furthermore, a suitability assessment for freshwater pearl mussel was undertaken at the n=25 aquatic survey sites.

For detailed survey methodology, please refer to the Aquatic Report in Appendix A in Aquatic Ecology Appendix 8.3.

Biological Water Quality (Q sampling) Surveys

Biological water quality was assessed at the aquatic survey sites via Q-sampling during September 2019, with an additional site (B10) sampled in November 2020. Given the unsuitability of one site for Q-sampling (site B1, no water present), a total of n=24 sites were sampled. These comprised aquatic sites A1, A2, A3, A4, A5, B2, B3, B4, B5, B6, B7, B8, B9, B10, C1, C2, C3, D1, D2, D3 and D4 (see Figure 8-3).

Macro-invertebrate samples were converted to Q-ratings as per Toner et al. (2005). All riverine samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a two-minute sample, as per ISO standards for water quality sampling (ISO 10870:2012). Large cobble was also washed at each site where present and samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification. Any rare invertebrate species were identified from the NPWS Red List publications for water beetles (Foster et al., 2009), stoneflies (Feeley et al., 2020), mayflies (Kelly-Quinn and Regan, 2012) and other relevant taxa (i.e. Byrne et al., 2009; Nelson et al., 2011).

Biosecurity

A strict biosecurity protocol including the Check-Clean-Dry approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites.

Surveys were undertaken at sites in a downstream order to minimise the risk of upstream propagule mobilisation. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced.

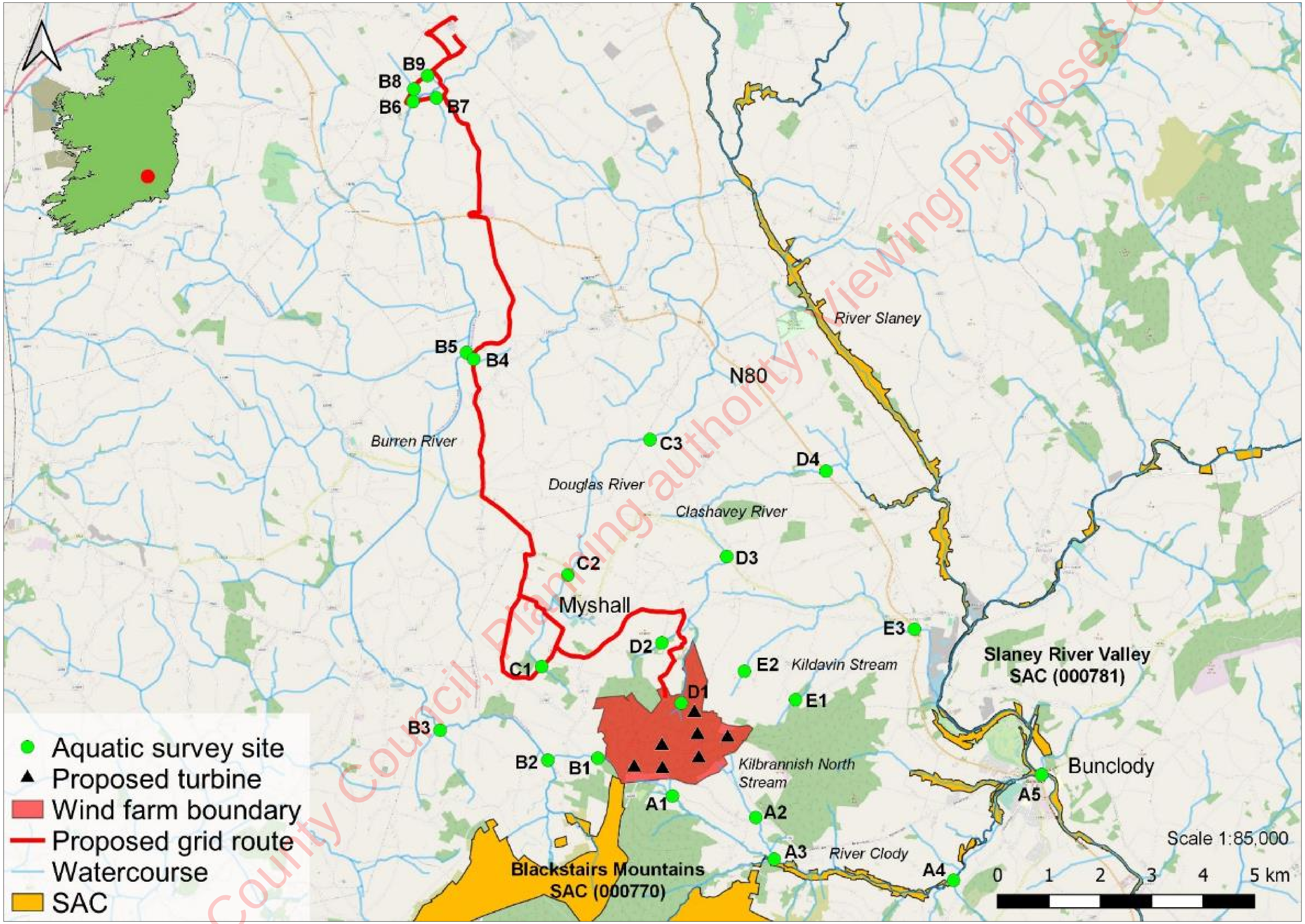

Figure 8-3: Wind farm, grid connection route, river network and aquatic ecology survey sites

8.2.6 Ecological Resource Evaluation

The value of the ecological resources/receptors at the subject site was evaluated using the ecological evaluation guidance given in the NRA guidance on assessment of ecological impacts of National Road Schemes (NRA, 2009a).

This guidance provides ratings for resources based primarily on geographic context and allows for resources at International, National, County and Local (higher and lower value) levels. Key ecological receptors (for assessment) are those deemed to be above the 'Local Importance (lower value) evaluation. Evaluation criteria are outlined below in Table 8-11.

Table 8-11: Ecological Resource Evaluation Criteria (from NRA, 2009)

Resource Evaluation	Defining Criteria
International Importance	'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA), candidate Special Area of Conservation (cSAC) or proposed Special Protection Area (pSPA). Sites that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended). Features essential to maintaining the coherence of the Natura 2000 Network. Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive. Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or Species of animal and plants listed in Annex II and/or IV of the Habitats Directive. Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971). World Heritage Site (Convention for the Protection of World Cultural and Natural Heritage, 1972). Biosphere Reserve (UNESCO Man and The Biosphere Programme). Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979). Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979). Biogenetic Reserve under the Council of Europe. European Diploma Site under the Council of Europe. Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).
National Importance	Site designated or proposed as a Natural Heritage Area (NHA). Statutory Nature Reserve. Refuge for Fauna and Flora protected under the Wildlife Acts. National Park. Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park.

Resource Evaluation	Defining Criteria
	Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Site containing 'viable areas' of the habitat types listed in Annex I of the Habitats Directive.
County Importance	Area of Special Amenity. Area subject to a Tree Preservation Order. Area of High Amenity, or equivalent, designated under the County Development Plan. Resident or regularly occurring populations (assessed to be important at the County level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance. County important populations of species, or viable areas of semi-natural habitats or natural heritage features identified in the National or Local BAP, if this has been prepared. Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county. Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.
Local Importance (Higher Value)	Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared; Resident or regularly occurring populations (assessed to be important at the Local level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Sites containing semi natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality; Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.
Local Importance (Lower Value)	Sites containing small areas of semi natural habitat that are of some local importance for wildlife; Sites or features containing non-native species that are of some importance in maintaining habitat links.

8.2.7 Avifauna Receptor Evaluation

Avifauna resources are to be initially evaluated as to whether or not they constitute key receptors for the assessment following NRA guidance as outlined in Table 8-11, previously. For the purposes of impact assessment, a receptor 'importance value' or sensitivity, following published guidance as in Percival (2007), SNH (2014, 2017) and literature review of published information on birds and wind farms (Pearce-Higgins J. L., 2009; Pearce-Higgins J. S., 2012; Drewitt A. L., 2006; Drewitt and Langston, 2008 and Masden, 2009) is to be calculated. Where provided receptor values from Percival (2007) are below those recommended in guidance within the Irish context (NRA, 2009a); then the evaluation has been increased in line with the recommended Irish evaluation as a precautionary principle. Table 8-12 illustrates the combined receptor evaluation criteria used to assign sensitivity levels to key receptors.

Table 8-12: Avian Resource Evaluation Criteria

Sensitivity of key receptor	Percival 2007 criteria	NRA Resource Evaluation	NRA Criteria	Combined Criteria
Very High.	Species is cited interest of SPA. Species present in Internationally important numbers.	International Importance.	Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive	Species is cited interest of SPA. Species present in Internationally important numbers. Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive
High	Other non-cited species which contribute to integrity of SPA. Ecologically sensitive species (<300 breeding pairs in UK) and less common birds of prey. Species listed on Annex 1 of the EU Birds Directive. Regularly occurring relevant migratory species which are rare or vulnerable	National Importance	Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list	Other non-cited species which contribute to integrity of SPA. Ecologically sensitive species (<300 breeding pairs nationally) and less common birds of prey. Species listed on Annex 1 of the EU Birds Directive. Regularly occurring relevant migratory species which are rare or vulnerable Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species protected under the Wildlife Acts;

Sensitivity of key receptor	Percival 2007 criteria	NRA Resource Evaluation	NRA Criteria	Combined Criteria
				and/or Species listed on the relevant Red Data list (in this case BOCCI Red list).
Medium	Species present in regionally important numbers (>1% of regional population). Species occurring within SPA's but not crucial to the integrity of the site. Species listed as priority species in the UK BAP subject to special conservation measures	County Importance	Resident or regularly occurring populations (assessed to be important at the County level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; County important populations of species. Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.	Species present in regionally important numbers (>1% of regional population). Species occurring within SPA's but not crucial to the integrity of the site. Resident or regularly occurring populations (assessed to be important at the County level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; County important populations of species. Species that are rare or are undergoing a decline in quality or extent at a national level.
Low	Species covered above which are present very infrequently or in very low numbers. Any other species of conservation interest not covered above, e.g. species listed on the red or amber lists of the BoCC.	Local Importance (High Value)	Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared; Resident or regularly occurring populations (assessed to be important at the Local level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list.	Locally important populations of priority species identified in the Local BAP, if this has been prepared; Resident or regularly occurring populations (assessed to be important at the Local level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Amber listed species.
Negligible	Species that remain common and widespread	Local Importance (Low Value)	n/a	Species that remain common and widespread. Green Listed Species.

8.2.8 Aquatic Receptor Evaluation

Ecological features are assessed on a scale ranging from international-national-county-local (see Table 8-11). The local scale is approximately equivalent to one 10 km square but can be operationally defined to reflect the character of the area of interest.

Watercourses, evaluated following the NRA (2009a) criteria were evaluated on the basis of a number of characteristics and features defined as follows:

- Aquatic habitat refers to the in-water conditions of any watercourse; including substrate and stream structure (i.e. proportion of riffles, runs and pools).
- The fisheries value of a watercourse refers to its suitability for fish, primarily Salmonids (Salmon and Trout), and to the associated value for recreational angling purposes.
- Annex II species are those that are listed under the EU Habitats Directive (92/43/EEC).
- Annex I habitats are those that are listed under the EU Habitats Directive, including Priority Habitats.
- The evaluation of water quality uses a five-point biotic index (Q-value) based on the presence and relative abundance of various invertebrates using the Environmental Protection Agency's (EPA) standard technique.

8.2.9 Assessing Effect Significance

Once the value of the identified ecological receptors (features and resources) was determined, the next step was to assess the potential effect or impact of the project on the identified key ecological receptors.

Table 8-13 to Table 8-18 outline the EPA evaluation criteria utilised in this appraisal of the Environmental Factor, Biodiversity. This criteria is included in the Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA, August 2017).

Table 8-13: Probability of Effects (EPA, 2017)

Likely Effects	Unlikely Effects
The effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented.	The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented.

Table 8-14: Quality of Effects (EPA, 2017)

Quality of Effect	Description
Positive Effect	A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or removing nuisances or improving amenities)
Neutral Effect	No effects or effects that are imperceptible, within the normal bounds of variation or within the margin of forecasting error.

Quality of Effect	Description
Negative/Adverse Effect	A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).

Table 8-15: Significance of Effects (EPA, 2017)

Significance of Effect	Description
Imperceptible	An effect capable of measurement but without significant consequences
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging trends
Significant	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment
Profound	An effect which obliterates sensitive characteristics

Table 8-16: Duration of Effects (EPA, 2017)

Duration of Effect	Description
Momentary Effects	Effects lasting from seconds to minutes
Brief Effects	Effects lasting less than a day
Temporary Effects	Effects lasting less than a year
Short-term Effects	Effects lasting one to seven years
Medium-term Effects	Effects lasting seven to fifteen years
Long-term Effects	Effects lasting fifteen to sixty years
Permanent Effects	Effects lasting over sixty years

Table 8-17: Types of Effects (EPA, 2017)

Type of Effect	Description
Effect/Impact	A change resulting from the implementation of a project
Likely Effects	The effects that are specifically predicted to take place – based on an understanding of the interaction of the proposed project and the receiving environment.
Indirect Effects (a.k.a. secondary effects)	Effects on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway
Cumulative Effects	The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects.
'Do Nothing' Effects	The environment as it would be in the future should the subject project not be carried out.
'Worst Case' Effects	The effects arising from a project in the case where mitigation measures substantially fail
Indeterminable Effects	When the full consequences of a change in the environment cannot be described.
Irreversible Effects	When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.
Reversible Effects	Effects that can be undone, for example through remediation or restoration
Residual Effects	The degree of environmental change that will occur after the proposed mitigation measures have taken effect
Synergistic Effects	Where the resultant effect is of greater significance than the sum of its constituents (e.g. combination of SOx and NOx to produce smog).

Table 8-18: Definition of Terms – Source, Pathway, Receptor (EPA, 2017)

Term	Description
Source	The activity or place from which an effect originates
Pathway	The route by which an effect is conveyed between a source and a receptor.
Receptor	Any element in the environment which is subject to effects.
Effect/Impact	A change resulting from the implementation of a project

Table 8-19: Confidence levels of predictions of impacts (NRA, 2009a)

Confidence level category	
Near certain	>95% chance of occurring as predicted
Probably	50-95% chance of occurring as predicted
Unlikely	5-50% chance of occurring as predicted
Extremely unlikely	<5% chance of occurring as predicted

Assessment of Effect Type and Magnitude

Assessment of effects takes into account construction, operational and decommissioning effects with reference to the potential for direct, indirect and cumulative effects. The assessment also takes account of any residual effects that may persist following the implementation of any mitigation or best practice design. The characterisation of effects reflects the ecological structure and function upon which the key ecological receptors depend. Detailed assessment of effects takes into account the magnitude of effects affecting populations.

This EIAR uses the EPA classification of effects in order to describe the quality, significance, duration and type of effect. Effects on avifauna are to be assessed following published guidance by Percival (2003). Once key avian receptors have been selected and assigned an evaluation of importance or sensitivity, the significance of potential effects are rated as a product of both the magnitude of the predicted effect and the sensitivity if the key receptor affected. The magnitude of effect is based on probability of the likely effect occurring.

The criteria outlined in Table 8-20 below has been developed by Percival (2003) to determine the magnitude of potential effects on a species. Methodology for assessing sites outside of European Sites (i.e. SPAs) state '*the test of significance of an impact will be whether the wind farm impact is causing a significant change to the population its range or distribution*' (Percival, 2003). It is important to consider availability of alternative habitat elsewhere during this assessment (Percival, 2003).

Table 8-20: Determination of Magnitude Effects (Percival, 2003)

Magnitude	Description
Very High	Total loss or very major alteration to key elements/ features of the baseline conditions such that the post development character/ composition/ attributes will be fundamentally changed and may be lost from the site altogether. *Guide: < 20% of population / habitat remains*
High	Major loss or major alteration to key elements/ features of the baseline (pre-development) conditions such that post development character/ composition/ attributes will be fundamentally changed. *Guide: 20-80% of population/ habitat lost*
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition/attributes of baseline will be partially changed. *Guide: 5-20% of population/ habitat lost*

Magnitude	Description
Low	Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible but underlying character/composition/attributes of baseline condition will be similar to pre-development circumstances/patterns. *Guide: 1-5% of population/ habitat lost*
Negligible	Very slight change from baseline condition. Change barely distinguishable, approximating to the "no change" situation. *Guide: < 1% population/ habitat lost*

The significance of potential effects is assessed by cross tabulating the magnitude of effects and bird sensitivity to predict significance of each potential effect. Population status, distribution and trends of potentially affected species such as migratory winter birds should be taken into consideration when undertaking the assessment. Significant ratings are interpreted as follows, **very low** and **low** should not normally be of concern however normal design care should be undertaken to minimise effects, **medium** represents a potentially significant effect that requires careful individual assessment, while **very high** and **high** represents a highly significant effect on bird populations. A significance matrix table, combining magnitude and sensitivity to assess overall significance is presented in Table 8-21.

Table 8-21: Significance matrix: combining magnitude and sensitivity to assess significance (Percival, 2003)

Significance		Sensitivity			
		Very High	High	Medium	Low
Magnitude	Very High	Very High	Very High	High	Medium
	High	Very High	Very High	Medium	Low
	Medium	Very High	High	Low	Very Low
	Low	Medium	Low	Low	Very Low
	Negligible	Low	Very Low	Very Low	Very Low

8.3 Description of the Existing Environment

The ecology of the existing environment is described within this section.

8.3.1 Site Description

The proposed wind farm site is located south of Myshall, Co. Carlow in an upland area in the vicinity of Croaghaun, a 507m-high point located at the northern reaches of the Blackstairs Mountains range. Both the River Slaney and River Barrow catchments fall within the footprint of the proposed wind farm. The watercourses to the north, east and south of Croaghaun drain to the River Slaney (Slaney_SC_050), whilst the Burren River sub-catchment, to the west of Croaghaun drains to the River Barrow (Barrow_SC_090) (see Figure 8-3).

The Croaghaun study area is underlain predominantly by siliceous substrata, with Siluro-Devonian granitic rocks and appinite to the west and north, with Lower-Middle Ordovician slate, sandstone, greywacke, conglomerate to the east (Geological Survey of Ireland online map viewer). Land use practices throughout the study area are dominated by improved agricultural pasture, with coniferous afforestation present on Croaghaun and much of surrounding upland areas.

8.3.1.1 Description of the Watercourses in the study area

The River Clody (EPA code: 12C03) is a tributary of the River Slaney which rises on Mount Leinster in the Blackstairs Mountains. It flows in an easterly direction for approx. 20km km before joining the Slaney immediately upstream of Bunclody on the Carlow/Wexford border. Survey sites A3 and A4 are located on the River Clody (Figure 8-3). There is a total of four EPA biological monitoring stations which have been recently monitored on the river (since 2007). The uppermost of these (station code: RS12C030080) was located approx. 100m upstream of survey site A3 (upper river) and was assessed in 2019 as having Q4-5 (high status) water quality. Station RS12C030100, located approx. 400m downstream of site A3 achieved Q4 (good status) water quality in 2007. Water quality of Q4-5 (high status) was also achieved at survey site A4 at Barnahask Bridge (station code: RS12C030200) in 2019. However, the water quality declined to Q3-4 (moderate status) at Clody Bridge (RS12C030300) in Bunclody in 2019.

The major river within the study area, and the largest in southeast Ireland, the River Slaney (EPA code: 12S02) rises on Lugnaquilla Mountain in the western Wicklow Mountains and flows west, and then south, through counties Wicklow, Carlow and Wexford for approx. 118km, before entering the Irish Sea at Wexford town. The Slaney drains an area of some 1700km^2.There are a number of EPA biological monitoring stations within the vicinity of the study area which have recent data. The Slaney achieved Q4 (good status) water quality at Slaney Bridge (station number; RS12S021800) (survey site A5) in 2019. The river also achieved Q4 (good status) downstream of Clohamon Weir (RS12S022000) in 2019, >4km downstream of survey site A5. However, approx. 5km upstream of this survey site, at Kilcarry Bridge (RS12S021600) the Slaney only achieved Q3-4 (moderate status) water quality in 2019. Watercourses within the Slaney catchment (encompassing Wexford Harbour) are under significant pressure from agricultural enrichment (O'Boyle et al., 2019)

The Burren River (EPA code: 14B05) rises on Slievebawn in the Blackstairs Mountains and flows over Caledonian granite through an agricultural landscape in a northerly direction, then westerly, for approx. 40km before joining the River Barrow in Carlow town. There are a number of biological monitoring stations within the vicinity of the study area which have recent data. The uppermost station at Burren Bridge (RS14B050020) was located approx. 300m upstream of survey site B2 and achieved Q4 (good status) water quality in 2019. The river at Milltown Bridge (RS14B050060), located between survey sites B3 and B5, achieved Q3-4 (moderate status) in 2014.

Ullard Bridge (RS14B050100), located 2.7km upstream of survey site B5, achieved Q3-4 (moderate status) in 2017. Ballintrane Bridge (RS14B050200), upstream of survey site B6, also achieved Q3-4 (moderate status) water quality in 2017. Monitoring stations further downstream of the study area at Rathtoe Bridge (RS14B050300), Ballycrogue (RS14B050400) and Hanover Bridge (RS14B050485) also achieved Q3-4 (moderate status) between 2014 and 2017.

The Douglas River (EPA code: 12D03) is a tributary of the River Slaney which rises at Bealalaw near Croaghaun (within proposed wind farm boundary) which meanders through an agricultural landscape for approx. 15km in a northerly then easterly direction before adjoining the Slaney near Aghade Bridge. There were four monitoring stations on the Douglas River which had recent data. At Myshall Bridge (RS12D030100) (survey site C2) the river achieved Q3-4 (moderate status) in 2019. At Sragh Brudge (RS12D030200) (survey site C3) the river achieved Q4 (good status) in 2019. At Sandbrooke Bridge (RS12B120990), the river achieved Q3-4 (moderate status) in 2019 whilst there was a water quality of Q4 (good status) at Castlegrace Bridge (RS12D030400), again in 2019.

Rising on Croaghaun (within the proposed wind farm boundary), the Clashavey River (EPA code: 12C10) was a small, mostly upland river which flowed for approx. 10km in an easterly direction before joining the Slaney at Kilcarry Bridge. There was a single EPA monitoring station on the Clashavey River at Clashavey Bridge (RS12C100500), located c.0.5km downstream of survey site C4. The river achieved Q3-4 (moderate status) water quality in 2019.

The Kildavin Stream (EPA code: 12K04) was a small mostly upland watercourse which rose on the north-western side of Croaghaun and flowed in an easterly direction for approx. 7km before joining the River Slaney between Kildavin and Bunclody. There were two EPA monitoring stations on the river with recent data. At the N80 road crossing (RS12K040700) (survey site E3), upstream of Kildavin WWTP, the river achieved Q4 (good status) in 2019. Downstream of the WWTP (RS12K040800), at Conway Concrete Ltd.'s quarry, the river achieved Q3-4 (moderate status) water quality in 2019.

8.3.2 Designated sites

8.3.2.1 Sites of International Importance

Candidate Special Areas of Conservation (SACs)

Candidate Special Areas of Conservation (SACs) are protected under the European Union (EU) 'Habitats Directive' (92/43/EEC), as implemented in Ireland by the European Communities (Natural Habitats) Regulations, 1997. There are four SACs within 15km of the proposed Croaghaun Wind Farm Study Area. The full NPWS site synopses for designated areas are available on www.NPWS.ie.

Special Protection Areas (SPAs)

Special Protection Areas (SPAs) are designated under the EU Birds Directive (2009/147/EC) ('The Birds Directive'). There are no SPA within 15km of the study area. See Table 8-22 for more information.

8.3.2.2 Sites of National Importance

Sites of National Importance in Ireland are termed Natural Heritage Areas (NHA) and proposed Natural Heritage Areas (pNHA).

While the Wildlife (Amendment) Act 2000 has been passed into law, pNHAs will not have legal protection until the consultative process with landowners has been completed; this process is currently ongoing. No NHAs and five pNHAs are present within 10 km of the proposed wind farm, while a further two pNHAs are present within 10 km of the proposed grid connection route. A further three pNHAs are within 10km of the TDR.

Figure 8-4 and Figure 8-5 show the location of the designated sites in relation to the proposed turbine locations. The closest designated site to the wind farm is Blackstairs Mountains pNHA, which is located 18m from the project boundary and 400m from the closest element of infrastructure. The closest national site after Blackstairs Mountains pNHA is John's Hill pNHA, located 1.5km from the project boundary (eastern edge of planning boundary) and 2km from the closest element of infrastructure (turbine 6). See Table 8-23 for more information.

An Appropriate Assessment (AA) Screening Report and Natura Impact Statement (NIS) have been completed in order to appraise the likely significant effects of the proposed development either alone or in combination with other plans or projects on European Sites (cSACs and SPAs); and accompanies this planning application.

Table 8-22: Summary of European Sites within 15 km of the project

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	Distance to grid connection (km)	Distance to TDR (km)
Blackstairs Mountains SAC	000770	• Northern Atlantic wet heaths with *Erica tetralix* [4010] • European dry heaths [4030]	0.4	1.8	0.0
Slaney River Valley cSAC	000781	• Estuaries [1130] • Mudflats and sandflats not covered by seawater at low tide [1140] • Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] • Mediterranean salt meadows (*Juncetalia maritimi*) [1410] • Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] • Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0] • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae*) [91E0] • *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029] • *Petromyzon marinus* (Sea Lamprey) [1095] • *Lampetra planeri* (Brook Lamprey) [1096]	2.3	4.0	0.0

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	Distance to grid connection (km)	Distance to TDR (km)
		• *Lampetra fluviatilis* (River Lamprey) [1099] • *Alosa fallax fallax* (Twaite Shad) [1103] • *Salmo salar* (Salmon) [1106] • *Lutra lutra* (Otter) [1355] • *Phoca vitulina* (Harbour Seal) [1365]			
River Barrow and River Nore cSAC	002162	• Estuaries [1130] • Mudflats and sandflats not covered by seawater at low tide [1140] • Reefs [1170] • Salicornia and other annuals colonising mud and sand [1310] • Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)* [1330] • Mediterranean salt meadows (*Juncetalia maritimi*) [1410] • Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] • European dry heaths [4030] • *Hydrophilous tall* herb fringe communities of plains and of the montane to alpine levels [6430] • Petrifying springs with tufa formation (*Cratoneurion*) [7220] • Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0] • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae*) [91E0] • *Vertigo moulinsiana* (Desmoulin's Whorl Snail) [1016] • *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029] • *Austropotamobius pallipes* (White-clawed Crayfish) [1092] • *Petromyzon marinus* (Sea Lamprey) [1095] • *Lampetra planeri* (Brook Lamprey) [1096]	6.5	7.8	6.6

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	Distance to grid connection (km)	Distance to TDR (km)
		• *Lampetra fluviatilis* (River Lamprey) [1099] • *Alosa fallax fallax* (Twaite Shad) [1103] • *Salmo salar* (Salmon) [1106] • *Lutra lutra* (Otter) [1355] • *Trichomanes speciosum* (Killarney Fern) [1421] • *Margaritifera durrovensis* (Nore Pearl Mussel) [1990]			
Screen Hills SAC	000708	• Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3110] • European dry heaths [4030]	>15 km	>15 km	14.5 km

Table 8-23: Summary of National Sites within 10 km of the project

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	Distance to grid connection (km)	Distance to TDR (km)
Blackstairs Mountains pNHA	000770	• Wet Heath • Dry Heath	0.4	1.9	0.0
John's Hill pNHA	000808	• Bog Orchid (*Hammarbya paludosa*) and corresponding Bog habitat	2	3.4	1.5
Slaney River Valley pNHA	000781	• Tidal rivers • Mud shores • Upper salt marsh • upland/lowland river • Oak-birch-holly woodland • Wet pedunculate oak-ash woodland • Freshwater Pearl Mussel (*Margaritifera margaritifera*) • Sea Lamprey (*Petromyzon marinus*) • Brook Lamprey (*Lampetra planeri*) • River Lamprey (*Lampetra fluviatilis*) • Twaite Shad (*Alosa fallax*) • Salmon (*Salmo salar*) • Otter (*Lutra lutra*) • Harbour Seal (*Phoca vitulina*)	3.6	4.8	0.0

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	Distance to grid connection (km)	Distance to TDR (km)
Bunclody Slate Quarries pNHA	000750	• Bird's-foot (*Ornithopus perpusillus*) • Small Cudweed (*Logfia minima*) • Pale Dog Violet (*Viola lacteal*) • Heath	5.5	7	1.7
Ardistan Fen pNHA	000788	• Calcareous Fen	>10	2.2	>10
Ballymoon Esker pNHA	000797	• Esker • Calcareous grassland • Green-winged Orchid (*Orchis morio*) • Basil Thyme (*Acinos arvensis*) • Bee Orchid (*Ophrys apifera*)	>10	6.6	>10
Cloghristick Wood pNHA	000806	• Woodland	>10	8.8	>10
Ballynabarney Wood pNHA	000746	• Woodland	>10	>10	0.3
Clone Fox Covert pNHA	000755	• Oak woodland	>10	>10	2.6
Killoughrum Forest pNHA	000765	• Woodland • Wet woodland • Narrow-leaved Helleborine (*Cephalanthera longifolia*) • Greater Broomrape (*Orobanche rapum-genistae*)	>10	>10	7.2

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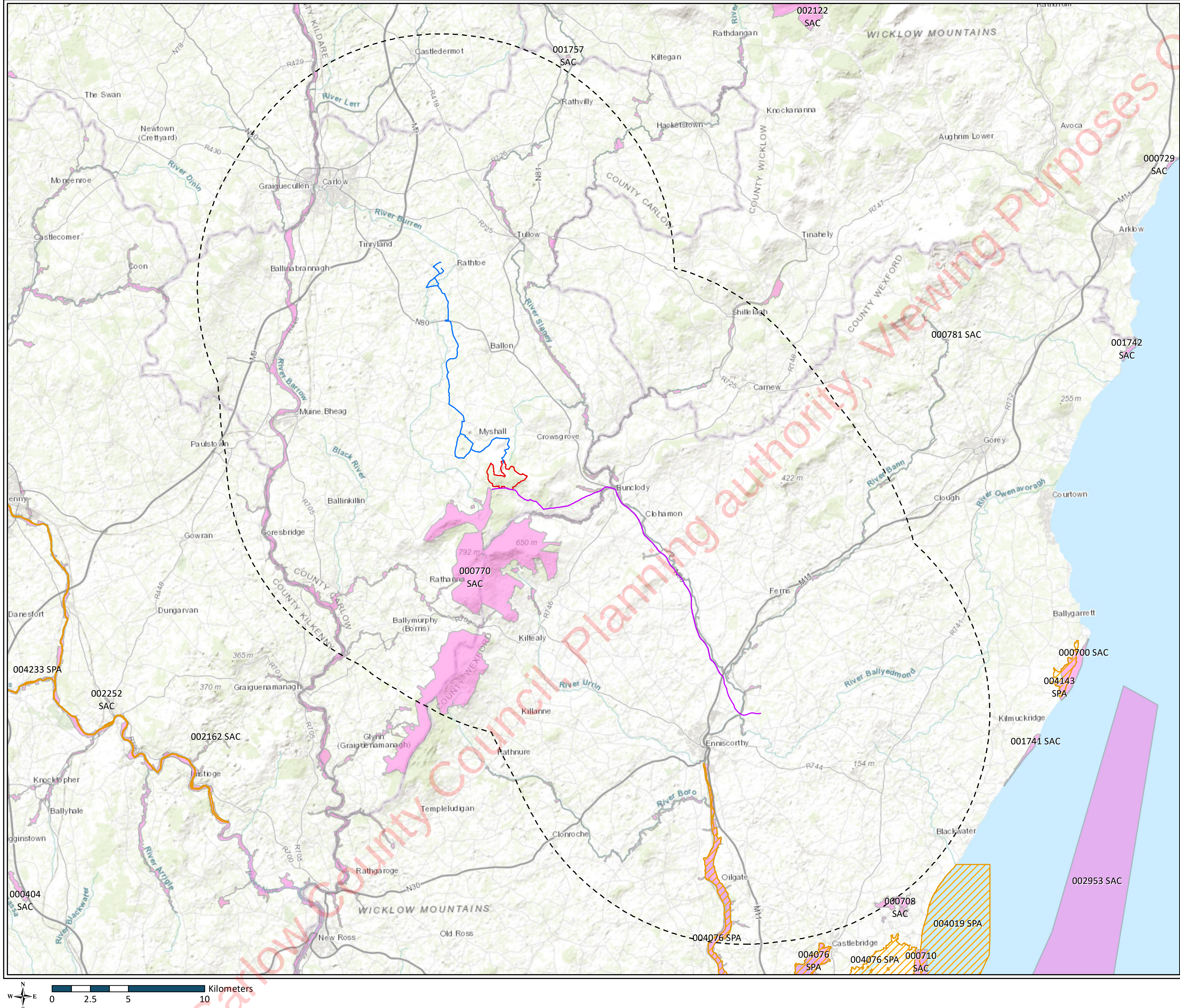

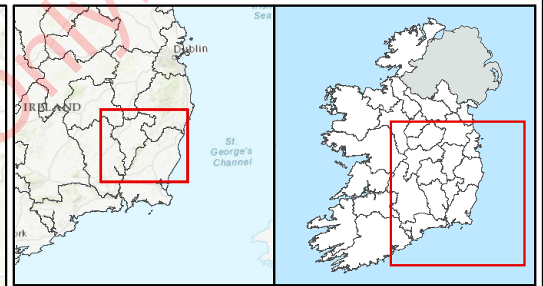

- Proposed Turbine Layout
- Proposed Grid Connection Route
- Proposed Turbine Delivery Route
- Proposed Development Boundary
- 15km Buffer Zone
- Special Protection Area (SPA)

SPAs within 15km of TDR

Code, Name, Distance (km)

004076, Wexford Harbour and Slobs, 4.0

- Special Area of Conservation (SAC)

SACs within 15km of Development Boundary

Code, Name, Distance (km)

000770, Blackstairs Mountains SAC, 0.001
000781, Slaney River Valley SAC, 1.9
002162, River Barrow And River Nore SAC, 6.1

SACs within 15km of Grid Connection Route

Code, Name, Distance (km)

000770, Blackstairs Mountains SAC, 1.9
000781, Slaney River Valley SAC, 3.7
002162, River Barrow And River Nore SAC, 7.8

SACs within 15km of Turbine Layout

Code, Name, Distance (km)

000770, Blackstairs Mountains SAC, 0.4
000781, Slaney River Valley SAC, 2.3
002162, River Barrow And River Nore SAC, 6.5

SACs within 15km of TDR

Code, Name, Distance (km)

000708, Screen Hills SAC, 14.5
000770, Blackstairs Mountains SAC, 0.0075
000781, Slaney River Valley SAC, 0
002162, River Barrow And River Nore SAC, 6.6

TITLE:	European Sites within 15km of the Main Wind Farm, GCR and TDR		
PROJECT:	Croaghaun Wind Farm		
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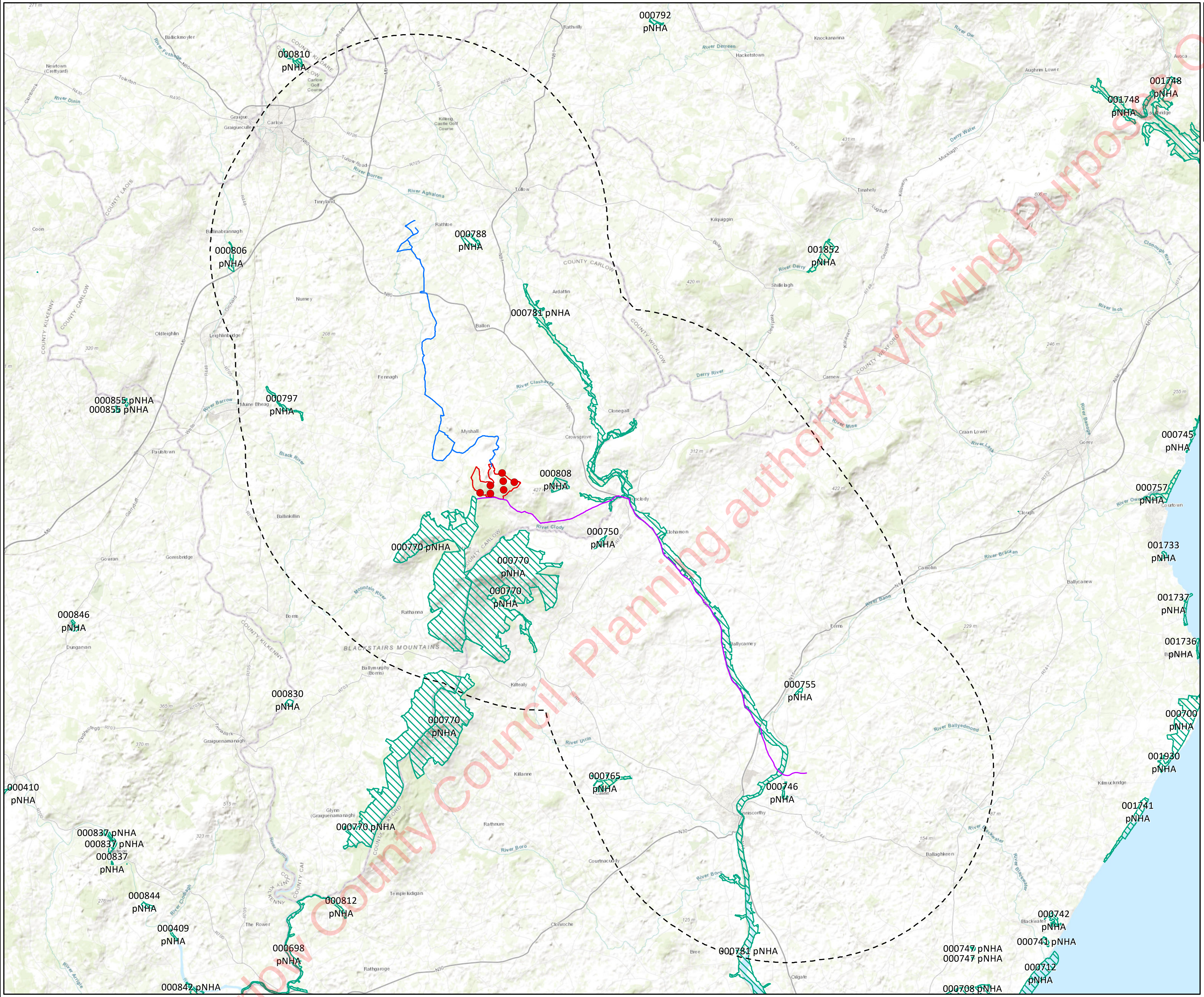

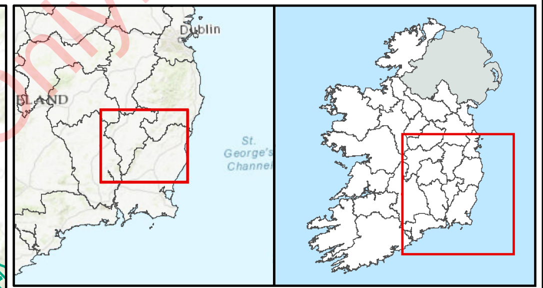

- Proposed Turbine Layout
- Proposed Grid Connection Route
- Proposed Turbine Delivery Route
- Proposed Development Boundary
- 10km Buffer Zone
- Proposed Natural Heritage Area (pNHA)

pNHAs within 10km of Main Wind Farm Site

Code, Name, Distance (km)

000750, Bunclody Slate Quarries, 5.2
000770, Blackstairs Mountains, 0.018
000781, Slaney River Valley, 3.1
000797, Ballymoon Esker, 9.1
000808, John's Hill, 1.5

pNHAs within 10km of Grid Connection Route

Code, Name, Distance (km)

000750, Bunclody Slate Quarries, 7
000770, Blackstairs Mountains, 1.9
000781, Slaney River Valley, 4.8
000788, Ardristan Fen, 2.2
000797, Ballymoon Esker, 6.6
000806, Cloghristick Wood, 8.8
000808, John's Hill, 3.4

pNHAs within 10km of Turbine Layout

Code, Name, Distance (km)

000750, Bunclody Slate Quarries, 5.5
000770, Blackstairs Mountains, 0.4
000781, Slaney River Valley, 3.6
000808, John's Hill, 2

pNHAs within 10km of TDR

Code, Name, Distance (km)

000746, Ballynabarney Wood, 0.3
000750, Bunclody Slate Quarries, 1.7
000755, Clone Fox Covert, 2.6
000765, Killoughrum Forest, 7.2
000770, Blackstairs Mountains, 0.029
000781, Slaney River Valley, 0
000808, John's Hill, 1.5

TITLE: Nationally Designated Sites within 10km of the Proposed Development

PROJECT: Croaghaun Wind Farm

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8.3.2.3 Other Designated Sites

Nature Reserves

There are no nature reserves within 10km of the proposed development. The closest sites are Glenealo Valley Nature Reserve, Co. Wicklow (36km northeast), Wexford Wildfowl Reserve, Co. Wexford (39km southeast) and Ballykeefe Wood Nature Reserve, Co. Kilkenny (41km west) of the main wind farm site and grid connection. There are no nature reserves within 10km of the TDR. The closest nature reserve to the TDR is Wexford Wildfowl Reserve located 18.17km south east of the intersection of the TDR route and the M11.

Ramsar Sites

There are no Ramsar sites within 10km of the proposed development. The closest Ramsar sites are Wexford Wildfowl Reserve, Co. Wexford (which overlaps with the nature reserve), the Raven, Co. Wexford (43km southeast) and Bannow Bay, Co. Wexford (47km south) of the proposed Croaghaun Wind Farm/grid connection. There are no Ramsar Sites within 10km of the TDR. The closest Ramsar Site to the TDR is Wexford Wildfowl Reserve located 18.17km south east of the intersection of the TDR route and the M11.

8.3.3 Rare and Protected Flora

Detailed botanical surveys (relevé surveys) carried out are described in Section 8.3.5.1 and were carried out in heath habitat within the main wind farm site. Croaghaun wind farm site is located within Ordnance Survey National Grid 10km Square S85. This 10km grid square was searched for records of plant species through the National Biodiversity Data Centre (NBDC) website (the latest search on the 10th September 2020). This list was then compared to the lists of species protected under the Flora (Protection) Order of 2015; the Ireland Red List No. 10: Vascular Plants (Wyse *et al.*, 2016) and the Ireland Red List No. 8: Bryophytes (Lockhart *et al.*, 2012). In addition, data on rare/protected species recorded in 10km grid squares within a 5km radius of the wind farm site and cable route was obtained from NPWS (received 20th August 2020); this encompassed grid squares S75, S76, S77, S85, S86, S87, S95 S96. The 1 km grid squares overlapping the proposed grid route were also searched; there are no records of rare flora within these grid squares.

Table 8-24 presents details of the rare and protected plant species found within the 10km squares S75, S76, S77, S85, S86, S87, S95 S96. Information on habitats was completed using; Webb's '*An Irish Flora*', 8th edition, 2012., The British Bryological society's '*Mosses and Liverworts of Britain and Ireland a field guide*', first edition, 2010 and the Lichens of Ireland[5] website (www.habitas.org.uk).

Seven species are within the 10km grid square (S85) which overlaps the proposed wind farm site; Blunt-leaved Earwort (*Diplophyllum obtusifolium*), Bog Orchid (*Hammarbya paludosa*), Fir Clubmoss (*Huperzia selago*), Heath Cudweed (*Gnaphalium sylvaticum*), Reindeer Lichen (*Cladonia ciliata var. tenuis*), Reindeer Moss (*Cladonia rangiferina*), Russow's Bog-moss (*Sphagnum russowii*). Three of the species are historic records (1985 and older), namely Heath Cudweed, Reindeer Lichen, Reindeer Moss.

Within the proposed wind farm site heath habitat is broadly suitable for Reindeer Lichen, Reindeer Moss. However, these species were not observed in the heath habitat during surveys including the dedicated relevé surveys of heath. The wind farm site is dominated by conifer woodland and it does not provide suitable habitat for any of the other rare and protected flora. No rare or protected flora was found within the main wind farm site, the grid connection or the TDR during surveys.

[5] Simms, M. J., (2016). Cladonia ciliata var. tenuis (Flörke) Ahti. [In] LichenIreland. http://www.habitas.org.uk/lichenireland/species.asp?item=18358 Accessed on 2020-09-11

Table 8-24: Historic Records of protected flora within the 10km Grid Squares (S75, S76, S77, S85, S86, S87, S95 S96) in which the Study Area is located

Species	Grid Square	Location of Record	Year of Last Record	Survey/Dataset	Conservation Status	Habitat	Result of surveys for Croaghaun
Annual Knawel *Scleranthus annuus*	S76	Fenagh	Historical Record 1979	NPWS Rare/Threatened Plants Database	Flora (Protection) Order, 2015 (FPO (2015)) Vulnerable	Waste land and along roadsides on dry sandy soils. Rare in the north-east, very rare, declining elsewhere (Parnell and Curtis, 2012).	Species not found during surveys.
Basil Thyme *Clinopodium acinos* *(Acinos arvensis)*	S76, S77, S86, S95, S96	Ballymoon, Powerstown Cross, Milford, Huntington sand pits, Drumderry gravel pit, Clonegal	2019	NPWS Rare/Threatened Plants Database and Herbarium and Literature Database 19/02/2013 Online Atlas of Vascular Plants 2012-2020 The Flora of County Wexford	FPO (2015) Near Threatened	Field margins and sandy or gravelly places in the centre and south-east; rare (Parnell and Curtis, 2012).	Species not found during surveys.
Blunt-fruited Pottia *Tortula modica*	S77	Brownes Hill, Co. Carlow	Historic Record 1867	Bryophytes of Ireland	Vulnerable	Disturbed ground, coastal slopes, quarries, beside tracks/ paths and walls. Grows in County Carlow/Wexford (BBS, 2010).	Species not found during surveys.
Blunt-leaved Earwort *Diplophyllum obtusifolium*	S85, S95	Croaghan Mountain, Bunclody, Co. Carlow	2002	Rare and Threatened Bryophyte Survey 2002 Bryophytes of Ireland	Near Threatened	Pioneer species of acidic open soil, in the north and west it is characteristic of bare iron-stained soil banks located in forestry plantations but will also grow in disused quarries and along the sides of paths. Grows in Carlow/Wexford area (BBS, 2010).	Species not found during surveys.
Bog Orchid *Hammarbya paludosa*	S85	Bunclody, Deer Park	2019	NPWS Rare/Threatened Plants Database	Near Threatened	Wet spongy bogs generally in tuffs of Sphagnum; very rare (Parnell and Curtis, 2012).	Species not found during surveys.

Species	Grid Square	Location of Record	Year of Last Record	Survey/Dataset	Conservation Status	Habitat	Result of surveys for Croaghaun
				Online Atlas of Vascular Plants 2012-2020			
Cliff Scalewort *Porella cordaeana*	S76	Aghade Bridge	Historic Record 1969	Bryophytes of Ireland	Near Threatened	Silty bases of rocks and trees along lowland rivers; locally frequent. Sometimes found on base rich siliceous rocks within wooded ravines, sheltered cliffs on higher ground and on boulders at the edge of lakes. (BBS, 2010).	Species not found during surveys.
Common Extinguisher-moss *Encalypta vulgaris*	S76	Unknown	Historic Record 1981	Bryophytes of Ireland	Near Threatened	Base rich substrates, generally a lowland species. Grows in County Carlow (BBS, 2010).	Species not found during surveys.
Corncockle *Agrostemma githago*	S86	Ballintemple-Slaney	Historic Record 1881	NPWS Rare/Threatened Plants Database	Conservation status unknown. Considered extinct in 1988 Red List (Curtis and McGough)	Not included in Webb's An Irish Flora (Parnell and Curtis, 2012).	Species not found during surveys.
Cornflower *Centaurea cyanus*	S95, S75, S77	Bunclody, Carlow Town, Kilcruit, Bagenalstown, Co. Carlow	2016; all other records are historic)	NPWS Rare/Threatened Plants Database, Herbarium and Literature Database 19/02/2013, Miscellaneous Vascular Plant Records 2017	Conservation status unknown. Considered extinct in 1988 Red List (Curtis and McGough)	Once an agricultural weed of cereal and flax seeds and now almost extinct. Grows along road sides; scattered and very rare (Parnell and Curtis, 2012).	Species not found during surveys.

Species	Grid Square	Location of Record	Year of Last Record	Survey/Dataset	Conservation Status	Habitat	Result of surveys for Croaghaun
Fir Clubmoss *Huperzia selago*	S85	Mount Leinster	2019	Records provided by BSBI to NPWS 2017 Online Atlas of Vascular Plants 2012-2020	EU Habitats Directive Annex V Not evaluated in Red List	Mostly grows above 300m on montane cliffs and wet heaths and sometimes on lowland bogs; frequent but local (Parnell and Curtis, 2012).	Species not found during surveys.
Green-winged Orchid *Orchis morio*	S75, S76, S86, S87,	Ballymoon, Ballymartin, Rathglass Bridge, Tullow, Aghade, Borris	2009	NPWS Rare/Threatened Plants Database, National Vegetation Database Data from NBDC, Herbarium and Literature Database 19/02/2013, Wicklow RPS historical records Orchid Ireland records	Vulnerable	Meadows, pastures and sandhills; in the centre and parts of the east of Ireland; rare elsewhere (Parnell and Curtis, 2012).	Species not found during surveys.
Hairy Violet *Viola hirta*	S95	Clohamon, Slaney	Historic Record 1881	NPWS Rare/Threatened Plants Database	Vulnerable	Sand dunes, dry grassland and limestone rocks in the southern half of Ireland; rare (Parnell and Curtis, 2012).	Species not found during surveys.
Heath Cudweed *Gnaphalium sylvaticum*	S85, S86, S96	Myshall, St Johns Hill Shillelagh, Co. Wicklow	Historic Record 1898	Herbarium and Literature Database 19/02/2013 NPWS Rare/Threatened Plants Database	FPO (2015) Endangered	Upland pastures and damp sandy places, mainly in the north; where it is rare and in decline (Parnell and Curtis, 2012).	Species not found during surveys.
Henbane *Hyoscyamus niger*	S77	Brownes Hill, Co. Carlow	Historic Record 1866	NPWS Rare/Threatened Plants Database	Near Threatened	Rare, on sandy or stony shores throughout Ireland. Often impermanent is rare and declining in the centre of Ireland (Parnell and Curtis, 2012).	Species not found during surveys.
Lesser Snapdragon	S76, S95,	Bunclody, Powerstown	Unknown	Herbarium and Literature Database 19/02/2013	FPO (2015) Endangered	Arable land in the southeast and southwest where it is rare;	Species not found during surveys.

Species	Grid Square	Location of Record	Year of Last Record	Survey/Dataset	Conservation Status	Habitat	Result of surveys for Croaghaun
Misopates orontium						elsewhere it is very rare (Parnell and Curtis, 2012).	
Meadow Saffron *Colchicum autumnale*	S77	Carlow	Historic Record 1836	NPWS Rare/Threatened Plants Database	Endangered	Meadows and river banks; only known to grow in the Nore and Barrow Valleys, unknown elsewhere (Parnell and Curtis, 2012)	Species not found during surveys.
Musk Thistle *Carduus nutans*	S75, S76, S95	Strahart, Bagenalstown	1991	NPWS Rare/Threatened and Scarce (Final) Plant Database The Flora of County Wexford	It is considered to be an introduced species (Parnell and Curtis 2012).	Pastures, heaths and roadsides; rare (Parnell and Curtis, 2012).	Species not found during surveys.
Narrow-Leaved Helleborine *Cephalanthera longifolia*	S86	Ballintemple	Historic Record 1885	NPWS Rare/Threatened Plants Database	FPO (2015) Vulnerable	Damp woods and scrub, mainly in the southern half of Ireland; very rare (Parnell and Curtis, 2012).	Species not found during surveys.
Pale Dog-violet *Viola lactea*	S95	Bunclody	Historic Record 1940	NPWS Rare/Threatened Plants Database The Flora of County Wexford	Vulnerable	Heath and silicious rocks in the southern half of Ireland; rare (Parnell and Curtis, 2012).	Species not found during surveys.
Red Hemp-Nettle *Galeopsis angustifolia*	S76, S77	Carlow, Kildare	Historic Record 1898	BSBI Atlas Square Record NPWS Rare/Threatened Plants Database	FPO (2015) Vulnerable	Calcareous gravels, particularly eskers in the east-centre of the country; rare (Parnell and Curtis, 2012).	Species not found during surveys.
Reindeer Lichen *Cladonia ciliata* var. *tenuis*	S85	Mount Leinster	Historic Record 1974	BLS Lichen Recording Card	EU Habitats Directive Annex V No Red List for Lichens	Grows amongst heather stems on moorland and bogs; occasional to frequent.	Species not found during surveys.

Species	Grid Square	Location of Record	Year of Last Record	Survey/Dataset	Conservation Status	Habitat	Result of surveys for Croaghaun
Reindeer Moss *Cladonia rangiferina*	S85	Mount Leinster, Bunclody Kilcarry Bridge, River Slaney	Historic Record 1985	BLS Lichen Recording Card	EU Habitats Directive Annex V No Irish Red List for Lichens	Exposed uplands on heath and cliff edges; scattered across the uplands of Ireland accept for the south (Simms, 2016).	Species not found during surveys.
River Bristle-moss *Orthotrichum rivulare*	S86	Aghade Bridge	Historic Record 1969	Bryophytes of Ireland	Near Threatened	Trees besides silty rivers and sometimes rocks or masonry. Grows in County Carlow (BBS, 2010).	Species not found during surveys.
Round-fruited Grimmia *Grimmia orbicularis*	S75,	Ballyteigelia Bridge, Co. Kilkenny	2005	Rare and Threatened Bryophyte Survey Kerry and South Midlands 2005 Bryophytes of Ireland	Vulnerable	Not included in the BSBI guide (2010) or their website.	Species not found during surveys.
Russow's Bog-moss *Sphagnum russowii*	S85	Mount Leinster	2008	Bryophytes of Ireland	EU Habitats Directive Annex V Near Threatened	Moderately enriched sites, in woodland, flushed grassland, rocky banks and moors and sometimes bogs. Also, humid northeast and northwest facing banks dominated by heather. Grows in County Carlow/Wexford area (BBS, 2010).	Species not found during surveys.
Saw-wort *Serratula tinctoria*	S76	New Ross, Co. Wexford	Historic Record 1952	Herbarium and Literature Database 19/02/2013 NPWS Rare/Threatened Plants Database	Regionally Extinct	This species grew in New Ross but has not been seen in recent times (Parnell and Curtis, 2012).	Species not found during surveys.
Shepherd's-needle *Scandix pecten-veneris*	S76	Nurney, Co. Carlow	Historic Record 1897	NPWS Rare/Threatened Plants Database	Regionally Extinct	Tilled fields; very rare, maybe extinct (Parnell and Curtis, 2012).	Species not found during surveys.

Species	Grid Square	Location of Record	Year of Last Record	Survey/Dataset	Conservation Status	Habitat	Result of surveys for Croaghaun
Small Cudweed *Filago minima*	S95, S96	Ballyprecas, Drumderry, Shillelagh,	2014	Miscellaneous Rare Plant Records Sept 2013 NPWS Rare/Threatened Plants Database	Near Threatened	Sandy and gravelly places; frequent in the north, southeast and southwest of the country, rare elsewhere (Parnell and Curtis, 2012).	Species not found during surveys.
Tufted Feather-moss *Scleropodium cespitans*	S86, S87	Aghade Bridge	Historic Record 1969	Bryophytes of Ireland	Near Threatened	Roots and trunks of trees and rocks/ boulders by lowland rivers and streams which occasionally flood; will also grow on tarmac. Grows in the Carlow/Wexford area (BBS, 2010).	Species not found during surveys.
Upright Brown Grimmia *Schistidium strictum*	S86	Blackstairs Mountain	Historic Record 1972	Bryophytes of Ireland	Near Threatened	Exposed calcareous, sandstone or igneous upland rock faces/crags. Will sometimes grow on sandstone boulders/rocks in gorges/ gullies. Grows in the Carlow/Wexford area (BBS, 2010).	Species not found during surveys.
Woodsy Thyme-moss *Plagiomnium cuspidatum*	S95	Bunclody	2005	Bryophytes of Ireland	Near Threatened	An occasional species mainly found growing in the lowlands on soil, rock, tree bases and stumps in base rich habitats. Grows in the Carlow/Wexford area (BBS,2010).	Species not found during surveys.
Wulfsberg's Tamarisk-moss *Heterocladium wulfsbergii*	S86	Mount Leinster	Historic Record 1867	Bryophytes of Ireland	Near Threatened	Not included in the BSBI guide (2010) or their website.	Species not found during surveys.

8.3.4 Invasive Non-native Flora

The invasive species listed in Table 8-25 have been recorded within the 10 km grid square (grid square S85) overlapping the main wind farm site. Fourteen invasive plant species have been recorded in the 10km grid square, five of which (Canadian Waterweed, Indian Balsam, Japanese Knotweed, *Rhododendron ponticum* and Three-cornered Garlic) are listed in Schedule III under Regulations 49 and 50 of the EC (Birds and Natural Habitats) Regulations 2011, which makes it an offence to cause the spread of plant species listed on the Schedule. Of these 14 species, only Sycamore was recorded within a 2km grid square which overlaps the proposed wind farm. The 2km square is located within a northern section of the proposed wind farm site where the grid connection route overlaps. Sycamore is a widely spread species of 'Medium Risk' and is not Schedule III listed. Whilst Canadian Waterweed was not recorded within the site, as it can spread within a river system, a search of the closest record to the main wind farm site was undertaken which highlighted that the species is within the River Slaney, 3.6km to the east of the main wind farm site.

Invasive species recorded within 1km grid squares which overlap the grid connection route were also recorded within Table 8-25. Sycamore again was the only species recorded along the grid connection route at two locations which overlap with the wind farm site. Again, whilst Canadian Waterweed was not recorded to overlap with the proposed cable route, a search of the closest records to the site was undertaken and it was found to be in the River Burren, 2.4km upstream of the cable route crossing.

Table 8-25: Invasive Species within 10km of Croaghaun Wind Farm and 1km from the grid connection route

Species	1km (Grid Cable Route)	2km	10km	Invasive Impact	Legal Status	Recorded in study area
Butterfly-bush *Buddleja davidii*	None	None	S85	Medium Risk	None	Observed along the grid connection route.
Canadian Fleabane *Conyza canadensis*	None	None	S85	Medium Risk	None	Not observed
Canadian Waterweed *Elodea canadensis*	Present 2.4km along the Burren River, upstream of grid connection crossing at Ballintrane Bride along the N80 (S797677)	Present in the Slaney River (Drumderry, Bunclody) ca. 3.6km to the east of the main wind farm site S857, S95D.	S85	High Risk	Schedule III	Not observed
Cherry Laurel *Prunus laurocerasus*	None	None	S85	High Risk	None	Observed along the grid connection route (crossing of the N80) and at turbine delivery work locations

Species	1km (Grid Cable Route)	2km	10km	Invasive Impact	Legal Status	Recorded in study area
						numbers 29 and 30 along the TDR.
Himalayan Cotoneaster *simonsii*	None	None	S85	Low Risk	None	Not observed.
Himalayan Honeysuckle *Leycesteria formosa*	None	None	S85	Medium Risk	None	Observed at turbine delivery work location no. 30 along the TDR.
Himalayan Balsam *Impatiens glandulifera*	None	None	S85	High Risk	Schedule III	Observed along the grid connection route; watercourse crossings GCR WCC9 and GCR WCC8.
Japanese Knotweed *Fallopia japonica*	None	None	S85	High Risk	Schedule III	Not observed.
Montbretia *Crocosmia pottsii x aurea = C. x crocosmiiflora*	None	None	S85	Not assessed	None	Observed along the grid connection route.
Rhododendron ponticum	None	None	S85	High Risk	Schedule III	One stand observed within the main wind farm site.
Sycamore *Acer pseudoplatanus*	S8159, S8259	S85J	S85	Medium Risk	None	Observed along the grid connection route and at turbine delivery work location no. 30 along the TDR.
Three-cornered Garlic *Allium triquetrum*	None	None	S85	Medium Risk	Schedule III	Not observed.
Traveller's-joy *Clematis vitalba*	None	None	S85	Medium Risk	None	Observed at turbine delivery work location no. 30 along the TDR.
Wall Cotoneaster *Cotoneaster horizontalis*	None	None	S85	Medium Risk	None	Observed at turbine delivery work location no. 29 along the TDR.

8.3.4.1 Invasive Species Recorded within the Study Area

The main wind farm site

During the site walkovers two invasive species were observed within the main wind farm site. One stand of *Rhododendron ponticum*, a High Risk invasive species was observed within the western area of the site. A single area of Spanish bluebell (*Hyacinthoides hispanica*), a Low Risk invasive species was observed adjacent to an existing access track. Both *Rhododendron ponticum* and Spanish bluebell are Third Schedule listed species. See Figure 8-6 for location of both species.

Plate 8-1: *Rhododendron ponticum* within the west of the site

The grid connection

As outlined in figure 8-7 nine invasive species were recorded during the walkover of the proposed grid connection route. These species are comprised of two High Risk species, two Medium Risk species, two Low Risk Species and three species whose invasiveness has not yet been determined. Of these nine species Himalayan Balsam (*Impatiens grandulifera*), a High Risk species[6] is also a Third Schedule listed species. See Table 8-26 for list of recorded invasive species. Himalayan Balsam was also observed in the vicinity of watercourse crossings GCR WCC 8 (northern off-road section of the route) and GCR WCC9 (southern off-road section). Cherry Laurel was observed at the crossing of the N80.

[6] Kelly, J., O'Flynn, C., and Maguire, C. 2013. Risk analysis and prioritisation for invasive and non-native species in Ireland and Northern Ireland. A report prepared for the Northern Ireland Environment Agency and National Parks and Wildlife Service as part of Invasive Species Ireland.

Table 8-26: Invasive species record along the proposed grid connection route

Species	Invasive Impact	Legal Status
Snowberry *Symphoricarpus albus*	Low Risk	None
Cherry laurel *Prunus laurocerasus*	High Risk	None
Elecampane *Inula helenium*	Not Categorised	None
Redcurrant *Ribes rubes agg.*	Low Risk	None
Himalayan Balsam *Impatiens grandulifera*	High Risk	Schedule III listed
Fuchsia magellanica	Not Categorised	None
Butterfly Bush *Buddleja davidii*	Medium Risk	None
Montbretia *Crocosmis pottsii x aurea = C. x crosmiiflora*	Not Categorised	None
Sycamore *Acer pseudoplatanus*	Medium Risk	None

Plate 8-2: Butterfly Bush, Cherry Laurel, Elecampane and Redcurrant with Snowberry (From top, left to right)

Turbine Delivery Route (TDR)

Botanical / Habitat surveys along the TDR was undertaken between 10th – 11th July 2019. Survey effort during the walkover of the TDR focussed on turbine delivery work locations located in potentially sensitive habitats or where additional construction works are proposed to accommodate the TDR. Five invasive species were recorded at three locations in Bunclody. Of these five invasive species one is classified as High Risk, four Medium Risk. See Table 8-27 for more information. No Third Schedule listed species were recorded along the TDR.

Table 8-27: Invasive species recorded along the TDR

Species	Invasive Impact	Location
No. 29. Bunclody:		
Wall Cotoneaster *Cotoneaster horizontalis.*	Medium Risk	Present within buildings and artificial surfaces (BL3)
Cherry laurel *Prunus laurocerasus*	High Risk	Nearby but outside of trimming zone
No. 30 L2026 West of Bunclody		
Himalayan honeysuckle *Leycestra formosa*	Medium Risk	Planted in a flower bed
Cherry laurel *Prunus laurocerasus*	High Risk	Found growing within (mixed) broadleaved woodland (WD1).
Traveller's-joy *Clematis vitalba*	Medium Risk	Found growing within (mixed) broadleaved woodland (WD1) and within hedgerow to south of point
Sycamore *Acer pseudoplatanus*	Medium Risk	Growing within (mixed) broadleaved woodland (WD1).
No. 31 L2026 West of Bunclody		
Cherry laurel *Prunus laurocerasus*	High Risk	Found growing within (mixed) broadleaved woodland (WD1).

Plate 8-3: Wall Cotoneaster in turbine works location no. 29 Bunclody

Plate 8-4: Cherry Laurel growing in (mixed) broadleaved woodland at turbine works location no. 30 Bunclody

Aquatic Surveys

During aquatic surveys Himalayan Balsam was recorded in the area of the following survey sites/waterbodies:

- Site A4, River Clody, Barnahask
- Site B3, Burren River, Rathnageeragh
- Site B6, Burren River, Bullynunnery Bridge
- Site C2, Douglas River, Myshall Bridge
- Site C3, Douglas River, Sragh Bridge.

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Proposed Turbine Layout
Proposed Development Boundary
Proposed Grid Connection Route
Proposed Turbine Delivery Route
Proposed Croaghaun Loop

Invasive Species

Rhododendron ponticum
Spanish bluebell

TITLE: Invasive Species	
PROJECT: Croaghaun Wind Farm	
FIGURE NO: 8.6	
CLIENT: Coillte	
SCALE: 1:10000	**REVISION:** 0
DATE: 08/12/2020	**PAGE SIZE:** A3

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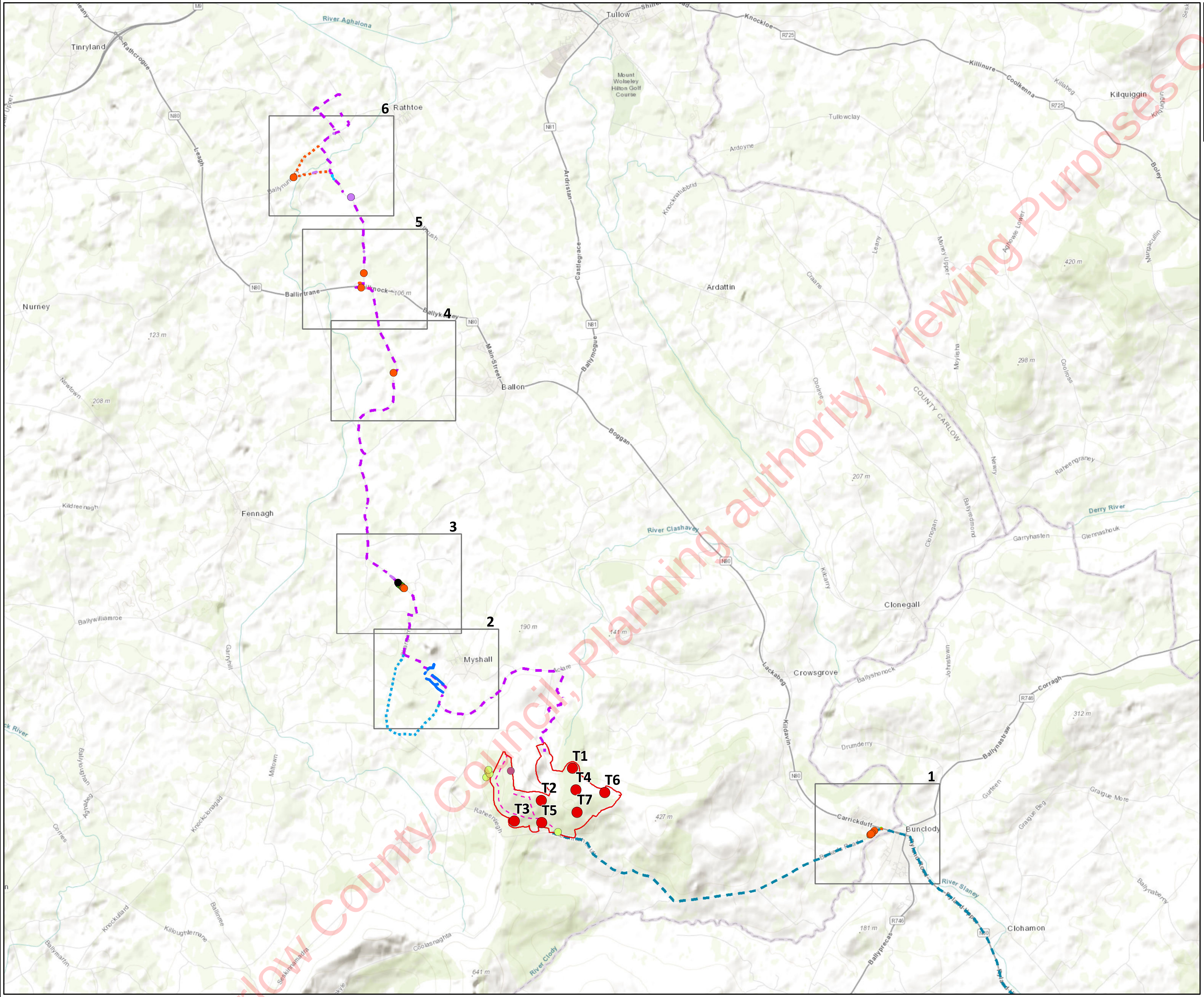

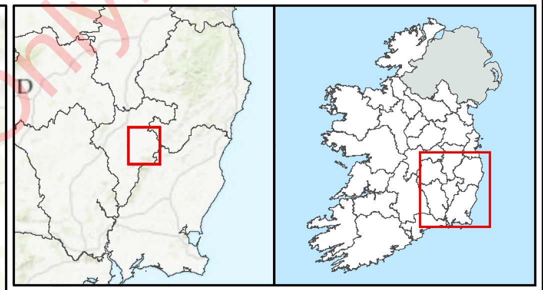

Proposed Turbine Layout
Proposed Development Boundary
Proposed Grid Connection Route
Grid Connection Route Variant 1
Grid Connection Route Variant 2
Proposed Turbine Delivery Route
Proposed Croaghaun Loop

Invasive Species

Buddleja
Cherry laurel
Fuchsia
Fuchsia and redcurrant
Montbretia
Redcurrant
Rhododendron ponticum
Snowberry
Spanish bluebell
Cherry laurel
Elecampane
Himalayan balsam
Snowberry
Traveller's joy
Wall cotoneaster
Himalayan balsam

TITLE: Invasive Species Overview			
PROJECT: Croaghaun Wind Farm			
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DATE:	09/12/2020	**PAGE SIZE:**	A3

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Proposed Turbine Delivery Route

Invasive Species

Cherry laurel

Cherry laurel

Traveller's joy

Wall cotoneaster

TITLE:	Invasive Species Turbine Delivery Route
PROJECT:	Croaghaun Wind Farm
FIGURE NO:	8.7.1
CLIENT:	Coillte
SCALE: 1:5000	**REVISION:** 0
DATE: 09/12/2020	**PAGE SIZE:** A3

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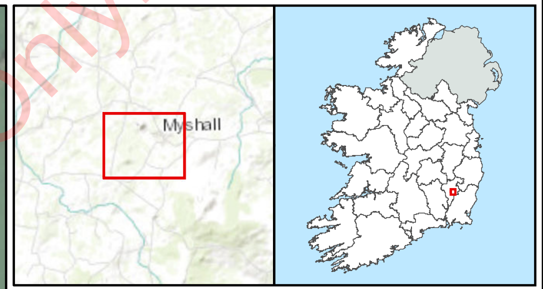

Proposed Grid Connection Route
Grid Connection Route Variant 1
Himalayan balsam
Himalayan balsam

0 0.125 0.25 0.5 Kilometers

TITLE:	Invasive Species Grid Connection Route
PROJECT:	Croaghaun Wind Farm
FIGURE NO:	8.7.2
CLIENT:	Coillte
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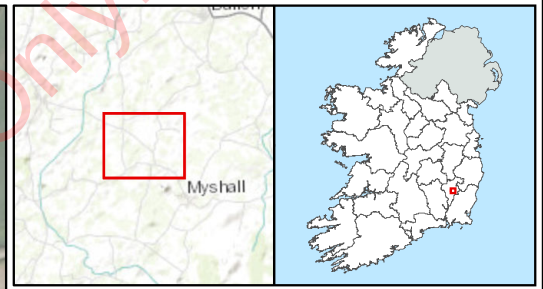

Proposed Grid Connection Route

Invasive Species

- Buddleja
- Cherry laurel
- Fuchsia
- Fuchsia and redcurrant
- Montbretia
- Redcurrant
- Snowberry

TITLE:	Invasive Species Grid Connection Route
PROJECT:	Croaghaun Wind Farm
FIGURE NO:	8.7.3
CLIENT:	Coillte
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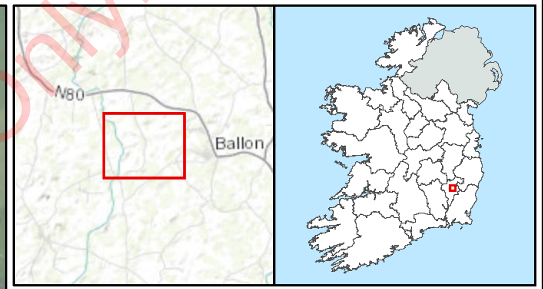

Proposed Grid Connection Route

Invasive Species

Cherry laurel

TITLE:	Invasive Species Grid Connection Route
PROJECT:	Croaghaun Wind Farm
FIGURE NO:	8.7.4
CLIENT:	Coillte
SCALE: 1:5000	**REVISION:** 0
DATE: 09/12/2020	**PAGE SIZE:** A3

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0 0.125 0.25 0.5 Kilometers

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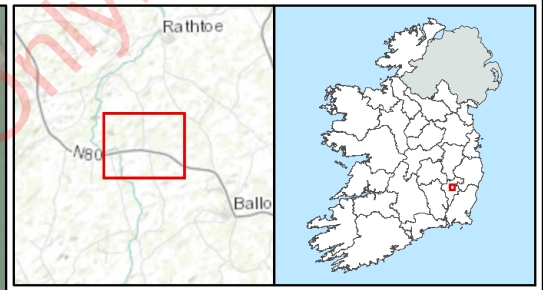

Proposed Grid Connection Route

Invasive Species

- Cherry laurel (point)
- Cherry laurel (line)
- Snowberry
- Traveller's joy

TITLE:	Invasive Species Grid Connection Route
PROJECT:	Croaghaun Wind Farm
FIGURE NO:	8.7.5
CLIENT:	Coillte
SCALE: 1:5000	**REVISION:** 0
DATE: 09/12/2020	**PAGE SIZE:** A3

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0 0.125 0.25 0.5 Kilometers

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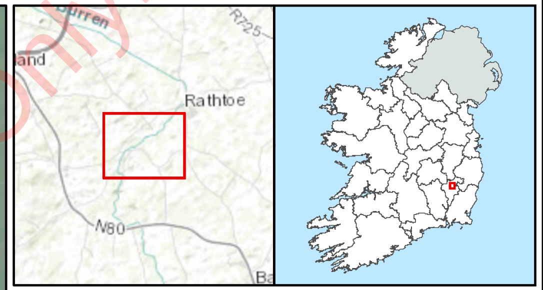

- Proposed Grid Connection Route
- Grid Connection Route Variant 2

Invasive Species

- Cherry laurel
- Snowberry
- Elecampane
- Snowberry
- Himalayan balsam

TITLE:	Invasive Species Grid Connection Route
PROJECT:	Croaghaun Wind Farm
FIGURE NO:	8.7.6
CLIENT:	Coillte
SCALE: 1:5000	**REVISION:** 0
DATE: 09/12/2020	**PAGE SIZE:** A3

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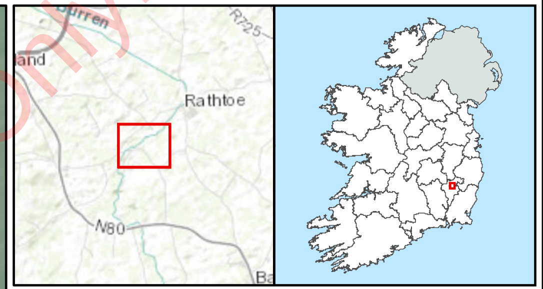

- - - Proposed Grid Connection Route
······ Grid Connection Route Variant 2

Invasive Species

- Cherry laurel
- Snowberry
- Elecampane
- Snowberry
- Himalayan balsam

TITLE:	Invasive Species
PROJECT:	Croaghaun Wind Farm
FIGURE NO:	8.7.
CLIENT:	Coillte
SCALE: 1:5000	**REVISION:** 0
DATE: 09/12/2020	**PAGE SIZE:** A3

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8.3.5 Description of Existing Habitats

8.3.5.1 Main wind farm site

The habitat survey was undertaken between 18th – 19th June 2019. The site was revisited between 10th - 11th of July 2019 to undertake a detailed botanical survey of heath habitat to assess whether or not the vegetation composition corresponded with any Annex I habitat types. The site was then revisited on the 17th and 18th of September 2020 to update any changes to habitats on site. No flora listed on the FPO or as threatened on the Irish Red list were recorded during site walkovers.

The main wind farm site encompasses a mixture of habitat types, with conifer plantation (WD4) dominating. Access tracks categorised mainly as buildings and artificial surfaces (BL1) and to a lesser extent spoil and bare ground (ED2) / recolonising bare ground (ED2) mosaic provide access throughout the site. Dry meadows and grassy verges (GS2) are present along several lengths of access tracks. Pockets of recently-felled conifer woodland (WD4), dry calcareous heath (HH2), scrub (WS1) and improved agricultural grassland (GA1) are also present. Hedgerow (WL1) / treeline (WL2) mosaic is limited and associated with improved agricultural grassland (GA1) within the main wind farm site. The habitats present within the main wind farm site boundary are mapped in Figure 8-8.

Please note that both common and scientific names are given in the first instance, and common names only thereafter.

Conifer plantation (WD4)

The conifer plantation dominates the main wind farm site. The habitat was comprised of a single species of 15-20m tall Sitka Spruce (*Picea sitchensis*), a non-native species. The densely planted monoculture offers little in term of botanical biodiversity. However, less dense areas may provide habitat for mammals such as Badger and Red Squirrel. The habitat is considered to be Locally Important (Higher Value).

Plate 8-5: Conifer plantation (WD4)

Buildings and artificial surfaces (BL3)

Existing access tracks provides access throughout the main wind farm site. The access tracks were largely comprised of a limestone surface dressing. This habitat is artificial in nature and is low value for wildlife. It is deemed to be Locally Important (Lower Value).

Plate 8-6: Building and artificial surfaces (BL3)

Spoil and bare ground (ED2) / Recolonising bare ground (ED2) mosaic

There were some tracks adjacent to degraded siliceous dry heath (HH1) and within the conifer plantation (WD4) that were comprised of bare ground which have been compacted as a result of repeated traffic. There were occasional plants growing along the centre of these tracks, such as Colt's Foot (*Tussilago farfara*), Annual Meadow-grass (*Poa annua*), Shepherd's-purse (*Capsella bursa-pastoris*), Dandelion (Taraxacum spp.), and Daisy (*Bellis perennis*). While this habitat can support some plant species, the habitat is common and widespread in the surrounding areas. It is therefore assessed as being of Locally Important (Lower Value).

Plate 8-7: Spoil and bare ground (ED2)/Recolonising bare ground (ED2)

Hedgerows (WL1)

There were hedgerows bordering the agricultural fields to the south and east sections of the main wind farm site. These were relatively low-growing (less than 5m), and comprised primarily of Gorse (*Ulex europaeus)*, Cross-leaved Heath (*Erica tetralix*), Rowan (*Sorbus aucuparia*), Hawthorn (*Crataegus monogyna*). Bramble (*Rubus fructicosus* agg.) and Bracken (*Pteridium aquilinum*) were also abundant. Birds-foot Trefoil (*Lotus corniculatus*), Bush Vetch (*Vicia sepium*), Hart's-tongue Fern (*Asplenium scolopendrium*), Sweet-vernal Grass (*Anthoxanthum odoratum*), and Common Bent (*Agrostis capillaris*) also occurred frequently throughout. This habitat may provide nesting habitat for birds, and commuting/foraging habitat for bats. However, this habitat is common and widespread and in the surrounding area. It is assessed as being Locally Important (Higher Value).

Plate 8-8: Hedgerow (WL1)

Scrub (WS1)

Scrub was recorded within the north-east section of the main wind farm site. This was dominated by Gorse (*Ulex europaeus*), with abundant Bramble (*Rubus fructicosus* agg.), Cross-leaved Heath (*Erica tetralix*), and Bracken (*Pteridium aquilinum*). Blackthorn (*Prunus spinosa*), Grey Willow (*Salix cinerea*), immature Birch (*Betula* sp.), and Creeping Thistle (*Cirsium arvense*) were also abundant. Broom (*Cytisus scoparius*) was recorded occasionally.

This habitat may provide nesting habitat for birds. However, this habitat is common and widespread in the surrounding area. It is assessed as being of Locally Important (Higher Value).

Dry meadows and grassy verges (GS2)

The verge of the tracks within the main wind farm site were bordered by dry meadows and grassy verges (GS2). The habitat was dominated by Yorkshire Fog (*Holcus lanatus*), Cock's-foot *(Dactylis glomerata*), and Nettle (Urtica dioica), Tormentil (*Potentilla erecta*), Common Knapweed (*Centaurea nigra*), Creeping Thistle (*Cirsium arvense*), Ribwort Plantain (*Plantago lanceolatea*), Creeping Bent *(Agrostis stolonifera*), and Germander Speedwell (*Veronica chamaedrys*) are abundant. Coltsfoot (*Tussilago farfara*), immature Gorse (*Ulex europaeus*), Common Mouse-ear (*Cerastium fontanum*), and Meadow Fescue (*Festuca pratensis*) were occasionally present. As such, it also offers foraging habitat for butterflies, birds and bat species. It is assessed as Locally Important (Higher Value).

Plate 8-9: Dry meadows and grassy verges (GS2)

Improved agricultural grassland (GA1)

There were a number of agricultural fields to the south and east of the main wind farm site. These were grazed by sheep during the survey. The habitat was dominated by Perennial Rye-grass (*Lolium perenne*), Yorkshire Fog (*Holcus lanatus*), Cock's-foot *(Dactylis glomerata*), Common Mouse-ear (*Cerastium fontanum*), White Clover (Trifolium repens), and Daisy *(Bellis perennis)* were also frequent throughout this habitat. Meadow fescue (*Festuca pratensis*), creeping buttercup (*Ranunculus repens*), creeping thistle (*Cirsium arvense*), *ribwort* plantain (*Plantago lanceolatea*), and broadleaved dock (*Rumex obtusifolius*) were present occasionally. This habitat is low in biodiversity and is deemed to be Locally Important (Lower Value).

Plate 8-10: Improved agricultural grassland (GA1)

Dry Siliceous Heath (HH1)

The habitat was located in two separate areas; in the east and north of the main wind site on sloped ground. Following an initial walkover of the habitat (18th – 19th June 2019) and categorising the habitat based on its dominant species an Annex I habitat / relevé survey was undertaken as dry siliceous heath (HH1) habitat can correspond with Annex I habitats 'European dry heaths (4030)' and areas with scattered Juniper (*Juniperous communis*) can correspond to '*Juniperous communis* formations on heaths or calcareous grasslands (5130)'. Relevé surveys were undertaken (18th – 19th June 2019) in accordance with NPWS guidance '*upland vegetation and habitats'*. Sixteen relevés (2 m x 2 m) were surveyed in two section of heathland habitat labelled Area A and Area B (area A to the east, area B to the north) and all flora identified along with each species abundance/cover.

The relevé survey results indicated that area A was comprised of 7 to 12 species. Ling and Cross-leaved Heath (*Erica tetralix*) dominated, with Purple Moor-grass (*Molinia caerulia*) abundant, Bilberry (*Vaccinium myrtillis*) alongside Tormentil (*Potentilla erecta*) and Bracken (*Pteridium aquilnium*) were frequent (Bracken located in 10 of 16 relevés), with Green-ribbed Sedge (*Carex binervis*), Common Bent (*Agrostis capillaris*), Rough Hawkbit (*Leontodon hispidus*) and mosses (*Polypodium agg., Rhytidiadelphus loreus, Rhytidiadelphus loreus, Polytrichastrum formosum*) occasional to rare. *Sphagnum capillifolium* subsp. *Capillifolium* was present in a single relevé and rare. Bare ground was found in 6 of 16 relevés and ranged from occasional to rare.

The relevé survey results indicated that area B is comprised of 9 to 13 species. In three relevés Bracken was dominant and where it was dominant young Gorse (*Ulex europaeus*) was abundant and Tormentil, Common Bent, Cross-leaved Heath and Ling were frequent whilst Self-heal (*Prunella vulgaris*), Bramble (*Rubus fruticosus* agg.) and mosses were occasional and Foxglove (*Digitalis purpurea*) rare. Mosses were occasional to rare (*Polypodium agg., Rhytidiadelphus loreus*) and no bare ground was present.

In the other 13 relevés Ling was either dominant with Cross-leaved Heath or Purple Moor-grass. Where Purple Moor-grass or Cross-leaved Heath were not dominant ling was abundant.

Tormentil was frequent by itself and with Bracken. Bracken was present in 9 of the 13 relevés. Gorse was present in two relevés and was frequent. Bramble was present in all thirteen relevés and was frequent to occasional. Mat-grass was present in 11 relevés and occasional. Common Bent was present in four relevés and rare. Mosses were occasional to rare with *Hypnum jutlandicum, Rhytidiadelphus loreus* and *Polypodium agg* the most common species. *Sphagnum capillifolium subsp. Capillifolium* was present in two relevés and rare. Bare ground was present in 7 relevés and was mostly frequent.

Overall, the heath habitat was established with no signs of foraging by wild fauna or grazing by farm animals. The presence of bare ground and limited diversity of moss ground layer and absence of lichens indicates disturbance of the habitat; likely from past burning/management practices. The presence of Bracken (both areas) and Bramble (Area B) indicated the succession of the habitat towards scrub. Both areas of the habitat have different amounts of disturbance and slight differences in their species composition.

Juniper was not present within the heath habitat and therefore the heath habitat on site cannot correspond with Annex I '*Juniperous communis* formations on heaths or calcareous grasslands (5130)' habitat. Whilst the habitat on site is dry heath, releve results confirms that it does not correspond with Annex I habitat 'European dry heaths (4030)' as the habitat contains limited floral diversity with an immature moss ground layer with lichen completely absent from the ground layer. Also, Bracken (both areas) and Bramble (Area B only) is invading the habitat and no sign of grazing are found.

Due to the habitats floral composition and current condition as well as its limit in area it is not deemed to be of National Importance. However, this habitat is not common, is generally limited to the uplands which are under a lot of pressure and potentially provides important habitat for foraging and breeding Snipe and Red Grouse. This habitat is therefore deemed to be of County Importance.

Plate 8-11: Dry Heath (HH2)

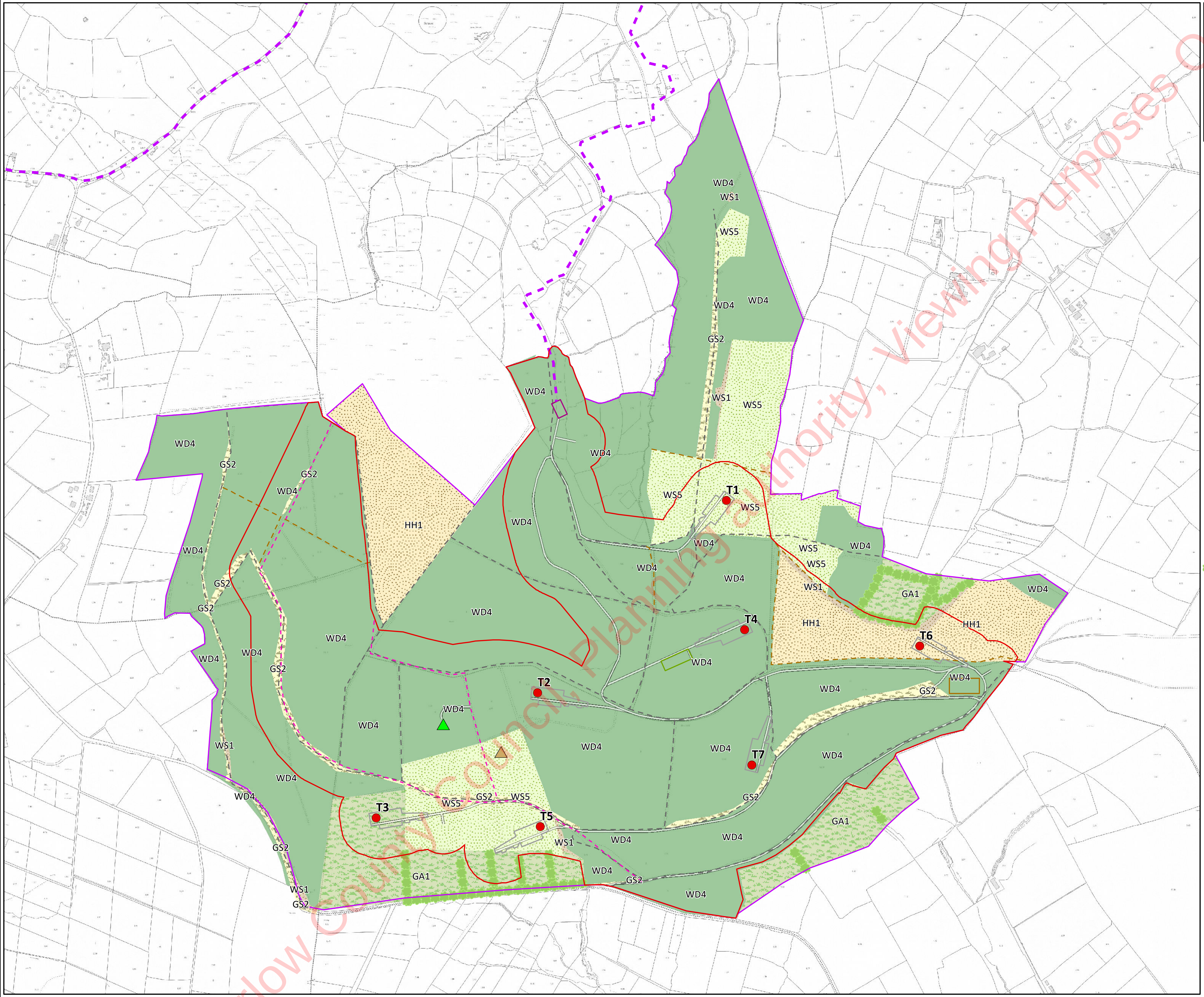
Recently-felled woodland (WS5)

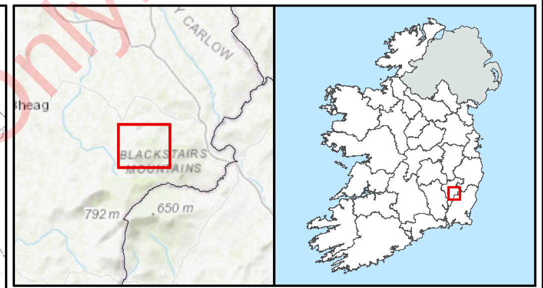
Previously afforested areas have been felled in the northern and southern sections of the main wind farm site. These areas were largely comprised of brash produced during the felling process. This habitat has a low density of plant species as it was formerly covered with conifer plantation, but lower species were beginning to recolonise this area. Bramble (*Rubus fructicosus* agg.), Bracken (*Pteridium aquilinum*), and soft rush (*Juncus effuses*) were the dominant species in this habitat.

Immature grey willow (*Salix cinerea*), gorse (*Ulex europaeus*), immature birch (*Betula* sp.), creeping thistle (*Cirsium arvense*), nettles (*Urtica dioica*), and rosebay willowherb (*Epilobium angustifolium*) were also frequent.

The habitat is of low ecological value but may offer some low-quality foraging habitat for birds of prey. It is assessed as being Locally Important (Lower Value). The habitat is being managed for forestry and would be subject to replanting independent of proposed wind farm.

Plate 8-12: Recently – felled woodland (WS5)





- Proposed Turbine Layout
- Proposed Development Boundary
- Study Area Boundary
- Existing 80m Met Mast
- Proposed Permanent 100m Met Mast
- Proposed Grid Connection Route
- Proposed Internal Access Tracks
- Proposed Croaghaun Loop
- Proposed Turbine Hardstanding
- Proposed Borrow Pit
- Proposed Temporary Compound
- Proposed Substation Compound

Habitat Classification

- BL1, Buildings and artificial surfaces
- ED3, Spoil and bare ground
- WL1, Hedgerows
- HH1, Dry siliceous heath
- WS1, Scrub
- GS2, Dry meadows and grassy verges
- GA1, Improved agricultural grassland
- WD4, Conifer plantation
- WS5, Recently-felled woodland

TITLE: Habitats			
PROJECT: Croaghaun Wind Farm			
FIGURE NO:	8.8		
CLIENT:	Coillte		
SCALE:	1:12500	**REVISION:**	0
DATE:	16/11/2020	**PAGE SIZE:**	A3

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8.3.5.2 Grid Connection

The habitat survey was carried out between the 13th – 15th July 2020 and incorporated a walkover survey of the grid connection route. No flora listed on the FPO or as threatened on the Irish Red list were recorded during site walkovers.

The majority of the grid connection route was located on existing road and is categorised as buildings and artificial surfaces (BL3). The roads were bound by hedgerows (WL1), treelines (WL2) and a mosaic of these habitats. Other habitats include improved agricultural grassland (GA1), arable crops (BC1), recolonising bare ground (ED3) with pockets of scrub (WS1) with one area of conifer plantation (WD4) present. Dry meadows and grassy verges (GS2) were common along road verges. Residential buildings were present (buildings and artificial surfaces (BL3)) and stone walls and other stonework (BL1) form land boundaries with amenity grassland (GA2) associated with gardens surrounding residential properties.

There were two off road sections of the grid connection route; one in the area of Kellistown Substation (northern section of grid connection) and the other within and leaving the northern end of the main wind farm site (southern end of grid connection route). Both off road sections were dominated by improved agricultural grassland (GA1) with hedgerows (WL1) associated with farmland. The southern section also contained conifer plantation (WD4), treelines (WL2) and a farm track categorised as spoil and bare ground (ED2). The section of the grid connection route located within the main wind farm site travels through conifer plantation (WD4).

Both on-road and off-road sections of the proposed grid connection route cross waterbodies; namely eroding/upland rivers (FW1) (southern off-road section only) and depositing/lowland rivers (FW2). Associated bridges are categorised as buildings and artificial surfaces (BL3).

The habitats along the grid connection were mapped in Figure 8-9.

Buildings and artificial surfaces (BL3)

The majority of the grid connection route runs along existing roads. Adjacent to the existing road lie residential properties, agricultural buildings, surrounding grounds, and other structures which also represent this habitat type. This habitat was present both alone and as part of a mosaic with other habitats, such as hedgerows (WL1) and dry meadows and grassy verges (GS2). This habitat is artificial in nature and no value to wildlife whilst older buildings may present some nesting habitat for birds and roosting habitat for bats. Older residential buildings have the potential to support bat roosts whilst agricultural buildings have the potential to support roosting birds such as Swallow (*Hirundo rustica*) and may be Locally Important (Higher Value). The existing road offers no value to local wildlife and is deemed to be Locally Important (Lower Value).

Plate 8-13: Buildings and artificial surfaces (BL3)

Plate 8-14: Hedgerows (WL1)

Hedgerows (WL1)

Hedgerows (WL1) were present along the majority of the route including field boundaries. The quality of these hedgerow range from mature to fragmented. A variety of species were present including Elder (*Sambucus nigra*), Hawthorn (*Crataegus monogyna*), Blackthorn *(Prunus spinosa*), Holly (*Ilex aquifolius*), Dog Rose (*Rosa canina*) and Bramble. Hedgerow near houses were frequently composed of Beech (*Fagus sylvatica*). Alder (*Alnus glutnosa*) was dominant in hedgerows close to watercourse crossings. Hedgerows (WL1) provide foraging habitat for wildlife, breeding habitat for birds and commuting habitat for bats and is deemed to be Locally Important (Higher Value).

Hedgerows (WL1) / treeline mosaic (WL2)

Hedgerows (WL1) / treelines (WL2) mosaic were present along the majority of the grid connection route, bordering roads and as field boundaries. The dominant species included Blackthorn (*Prunus spinosa*), Elder, Hawthorn. Holly, Bramble and Bracken. Hedgerows (WL1) / treelines (WL2) provide foraging habitat for wildlife, breeding habitat for birds and commuting habitat for bats and is deemed to be Locally Important (Higher Value).

Plate 8-15: Hedgerows (WL1) / Treeline (WL2)

Treelines (WL2)

A field boundary north of the main wind farm site was dominated by a mature stand of Hawthorn. This habitat was also present along the proposed grid connection route and was less common than hedgerows (WL1). In general, this habitat was comprised of a variety of species such as Beech, Sycamore (*Acer pseudoplatanus*), Willows, Cherry (*Prunus sp*.), Horse Chestnut (*Aesculus hippocastanum*) and Black Poplar (*Populus nigra*). Sycamore is an invasive species. In the area of the proposed temporary compound the treeline was comprised of Ash with mature Ash present along the northern off-road section of the grid connection route. Whilst this habitat is species poor and contains invasive species, it provides foraging habitat for wildlife, nesting habitat for birds and commuting habitat for bats. This habitat is common in the area and is deemed to be Locally Important (Higher Value).

Plate 8-16: Mature Hawthorn in Treeline (WL2)

Plate 8-17: Mixed species Treeline (WL2)

Improved agricultural grassland (GA1)

Improved agricultural grassland (GA1) located adjacent to the grid connection route were either grazed by cattle or used for silage. Perennial Rye-grass, Yorkshire Fog, and White Clover (*Trifolium repens*) were the dominant species. This habitat is species poor and common in the area and is assessed as being Locally Important (Lower Value).

Plate 8-18: Improved agricultural grassland (GA1)

Arable crops (BC1)

Many of the fields recorded along the grid connection route contained wheat, barley and oats. Also present were maize, potatoes, broad beans and sugar beet. Arable crops (BC1) was a modified habitat which was mostly comprised of species poor monocultures. However, these crops can provide foraging habitat for birds such as Yellowhammer and are therefore deemed to be Locally Important (Higher Value)

Plate 8-19: Arable crops (BC1)

Recolonising bare ground (ED3)

Recolonising bare ground (ED3) was found near some sections of the grid connection and consisted of bare sites that have been cleared for agriculture/industrial purposes where vegetation was recolonising. Ragworts (*Jacobaea sp*.), Willowherb (*Chamaenerion sp./Epilobium sp*), and Coltsfoot dominate. This habitat is deemed to be Locally Important (Lower Value)

Plate 8-20: Recolonising bare ground (ED3)

Stone walls and other stonework (BL1)

This habitat was comprised of walls at the entrances of residential dwellings and bridges. In general, the biodiversity of walls varies. Some walls have no crevices or flora and offer little to wildlife and are Locally Important (Lower Value), whilst others contain crevices for resting fauna and are inhabited by flora and are deemed slightly higher value but overall the habitat type is classified as Locally Important (Lower Value).

Plate 8-21: Stone walls and other stonework (BL1) - Lower value

Plate 8-22: Stone walls and other stonework (BL1) - Higher value

Amenity grassland (improved) (GA2)

Lawns within residential lands adjacent to the road were typically comprised of species such as Annual-meadow Grass (*Poa annua)*, and Perennial Rye Grass*,* as well as Daisy and Dandelion (*Taraxacum officinale)*. Self-heal (*Prunella vulgaris*) was also present within a few managed verges. This habitat contains few species and is therefore assessed as being Locally Important (Lower Value).

Plate 8-23: Amenity grassland (improved) (GA2)

Conifer plantation (WD4)

The grid connection route north of the main wind farm site runs through a conifer plantation comprised primarily of Sitka Spruce. A small section of this habitat was also located along the on-road section of the proposed grid connection route. The densely planted monoculture offers little biodiversity and provided little ecological value. Less dense areas can provide foraging habitat for Red Squirrel. The habitat is considered to be Locally important (Higher Value).

Plate 8-24: Conifer plantation (WD4)

Scrub (WS1)

Scrub habitat found along the grid connection route and was typically dominated by Brambles and Gorse, as well as Willow (*Salix sp*.). Willow dominated scrub was also found adjacent to water course crossings. This habitat provides nesting habitat for birds and foraging habitat for wildlife and is therefore deemed to be Locally Important (Higher Value).

Plate 8-25: Scrub (WS1)

Dry meadows and grassy verges (GS2)

This habitat was common along road verges, within one large field consisting and also adjacent to farm tracks in the off-road southern section of the proposed grid connection route. Yorkshire fog, Knapweed (*Centaurea nigra*), Creeping Thistle, Hogweed (*Heracleum sphondylium*), Nettle (*Urtica dioca*), Dock (*Rumex sp*.), False Oat-grass (*Arrhenatherum elatius*), Cow Parsley (*Anthriscus sylvestris*) and Dandelion were common during the survey. This habitat is likely to provide foraging habitat for birds and butterflies and is therefore deemed to be Locally Important (Higher Value).

Plate 8-26: Grassy verges (GS2)

Spoil and bare ground (ED2)

In the southern section of the grid connection route there was a farm track running from a farmyard up through the associated fields. The track was compacted and held limited value to wildlife and is deemed to be Locally important (Lower Value).

Plate 8-27: Spoil and bare ground (ED2)

Watercourse Crossings

Eroding/upland rivers (FW1)

WCC7: Rossacurra (EPA segment code: 12_1967) a 1st order stream flows west-east within agricultural lands, just north of the main wind farm site. It flows across an existing track which shows sign that it has been regularly trafficked by cattle and farm machinery. This habitat was not in optimum condition. Its use as an access track has increased sedimentation and the natural flow and structure of the stream has been removed. Whilst the stream was highly modified and limited in width, it provides a source of water of wildlife and provides connectivity with larger tributaries and habitats and is therefore deemed to be Locally important (Lower Value).

Plate 8-28: Eroding/upland river (FW1)

Plate 8-29: Eroding/upland river (FW1)

Depositing/lowland rivers (FW2)

WCC 1. This shallow and slow flowing stream flows under a road via a culvert. Whilst small and shallow this stream has downstream connectivity with larger tributaries and habitats. It is therefore deemed to be Locally important (Higher Value).

WCC 2. This stream was similar to WCC1 above. This stream has downstream connectivity with larger tributaries and habitats. It is therefore deemed to be Locally important (Higher Value).

WCC 3. This river was 3 – 4 m wide and shallow, ca. 20 cm deep and passes under a large stone bridge. The river runs adjacent to improved grassland (GA1) which was grazed by sheep. This stream has downstream connectivity with larger tributaries and habitats. It is therefore deemed to be Locally important (Higher Value).

WCC 4: Stone bridge spanning crossing of a shallow and slow-moving waterbody. This stream provides connectivity within the landscape and foraging habitat for fauna and is deemed to be Locally important (Higher Value).

WCC 5: Densely vegetated bank making it difficult to survey. The crossing was comprised of a stone bridge spanning over very slow flowing stream which was approximately 50 cm wide and 10 cm deep.

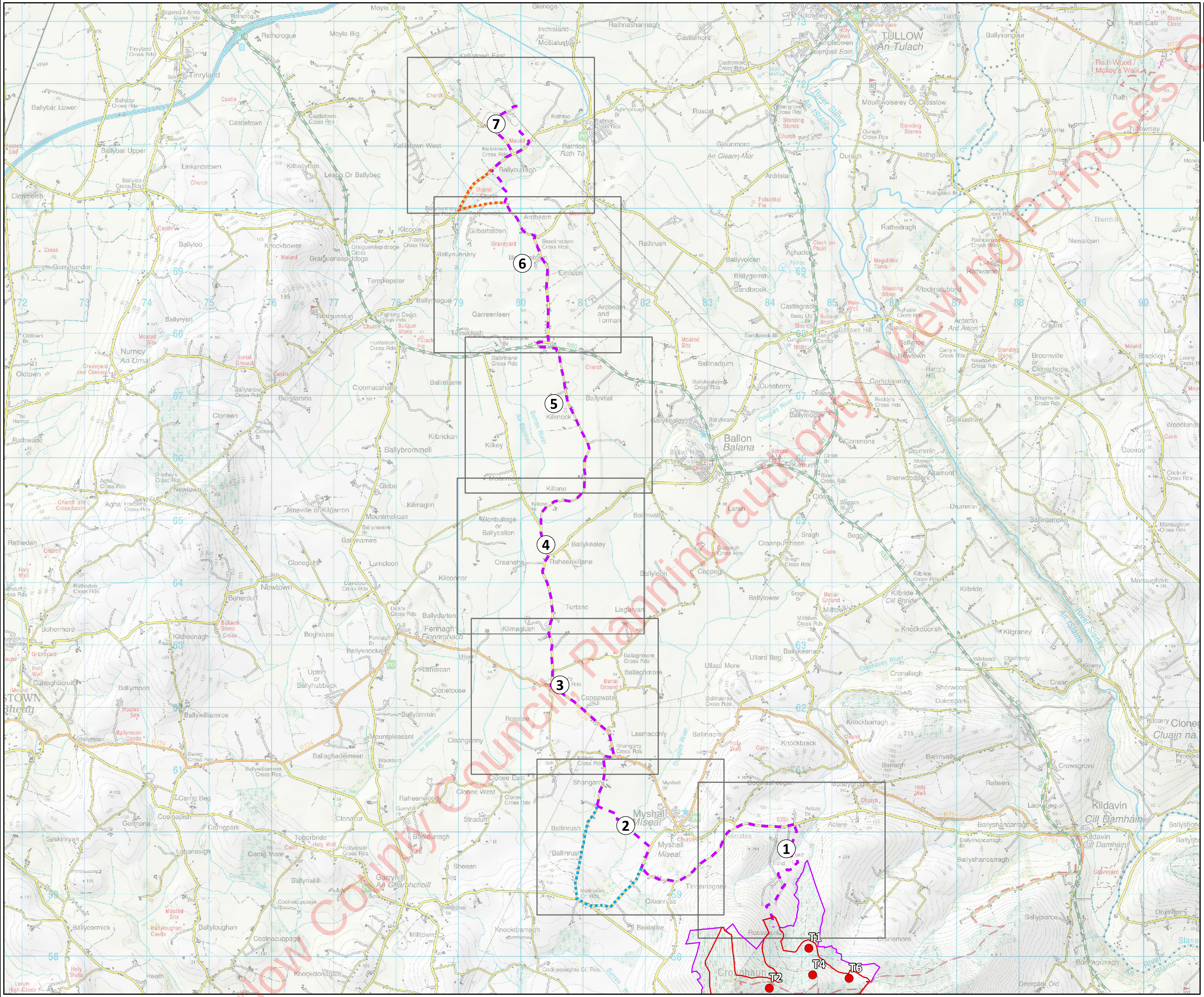
This stream provides connectivity within the landscape as well as foraging and resting habitat for fauna and is deemed to be Locally important (Higher Value).

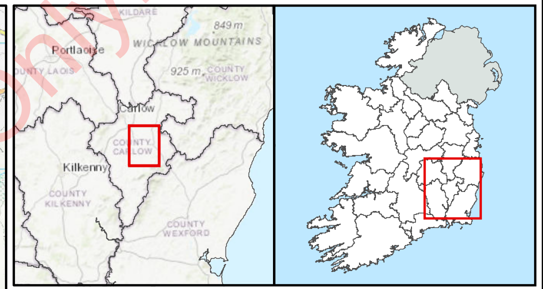
WCC 6: This stream was 10cm deep, 1.5m wide, very slow moving and crossed via a Stone bridge spanning. Lots of algae were present within the stream, indicating high nutrient level inputs. Although this stream was shallow and possibly polluted it provides connectivity within the landscape as well as foraging and resting habitat for fauna and is deemed to be Locally important (Higher Value).

WCC8: The crossing was 5 m in width, 20-40 cm deep, moderate flow flanked by treeline (WL2) comprised of several 15m tall Ash, Alder and Oak. The bank itself was low and heavily vegetated, unsuitable for breeding kingfisher. Some feeding habitat for kingfisher though, with lots of overhanging branches. Whilst no signs of Otter were recorded this stream offered potentially suitable feeding habitat for the species. Himalayan Balsam a High Risk invasive species was observed in the vicinity of this watercourse crossing. This river provides foraging habitat for fauna and is deemed to be Locally important (Higher Value).

WCC9: Burren 14 crossing was slightly larger than the other watercourse crossings, containing pondweeds and some Water Crowfoot (*Ranunculus sp*). Aquatic surveys of this watercourse confirm that the waterbody does not correspond to Annex I habitat 'watercourses of plain montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation' (3260); see Section 8.3.9. Himalayan Balsam a High Risk invasive species was observed in the vicinity of this watercourse crossing. Due to the semi-natural state, limited size and importance of these waterbodies to local wildlife and their connectivity to other habitats they are considered to be Locally Important (Higher Value).

Plate 8-30: Depositing/lowland rivers (FW2); Burren 14 crossing





- Proposed Turbine Layout
- Proposed Development Boundary
- Study Area
- Proposed Grid Connection Route
- Grid Connection Route Variant 1
- Grid Connection Route Variant 2

Kilometers
0 1 2 4

TITLE:	Habitats along Grid Connection Route Overview
PROJECT:	Croaghaun Wind Farm
FIGURE NO:	8.9.1
CLIENT:	Coillte
SCALE: 1:60000	REVISION: 0
DATE: 09/12/2020	PAGE SIZE: A3

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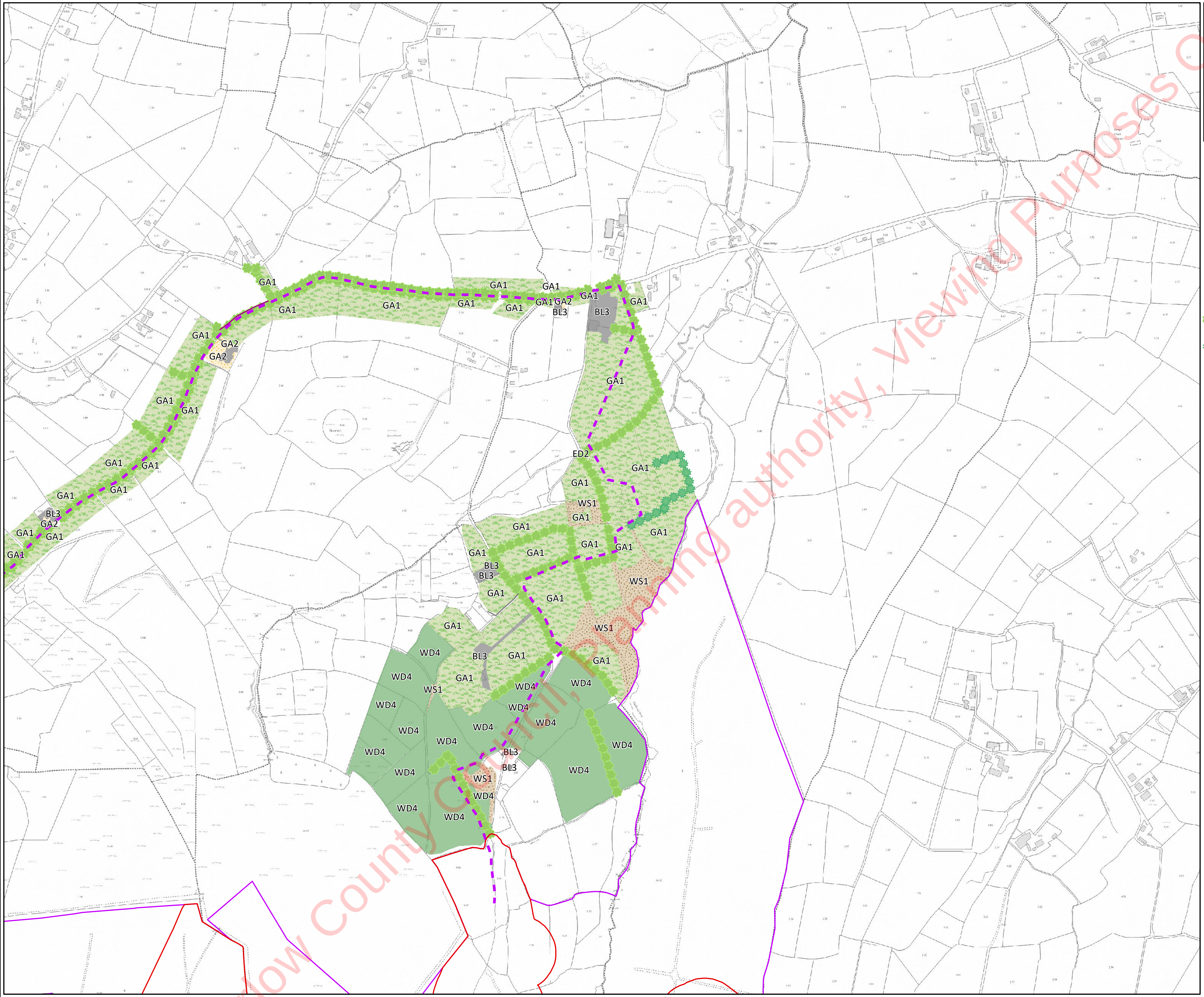

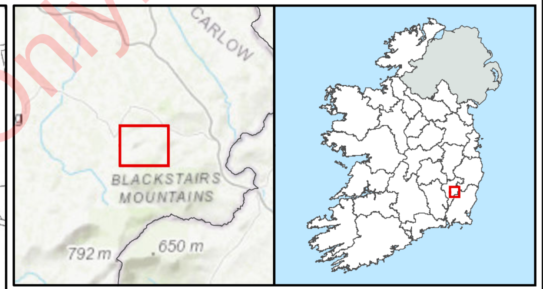

- Proposed Development Boundary
- Study Area
- Proposed Grid Connection Route

Habitat Classification

- BL1 / GS2, Buildings and artificial surfaces / Dry meadows and grassy verges
- BL3, Buildings and artificial surfaces
- WL1, Hedgerows
- WL2, Treelines
- BL3, Buildings and artificial surfaces
- GA2, Amenity grassland
- WS1, Scrub
- GA1, Improved agricultural grassland
- WD4, Conifer plantation

TITLE: Habitats along Grid Connection Route Submap 1			
PROJECT: Croaghaun Wind Farm			
FIGURE NO:	8.9.2		
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SCALE:	1:10000	**REVISION:**	0
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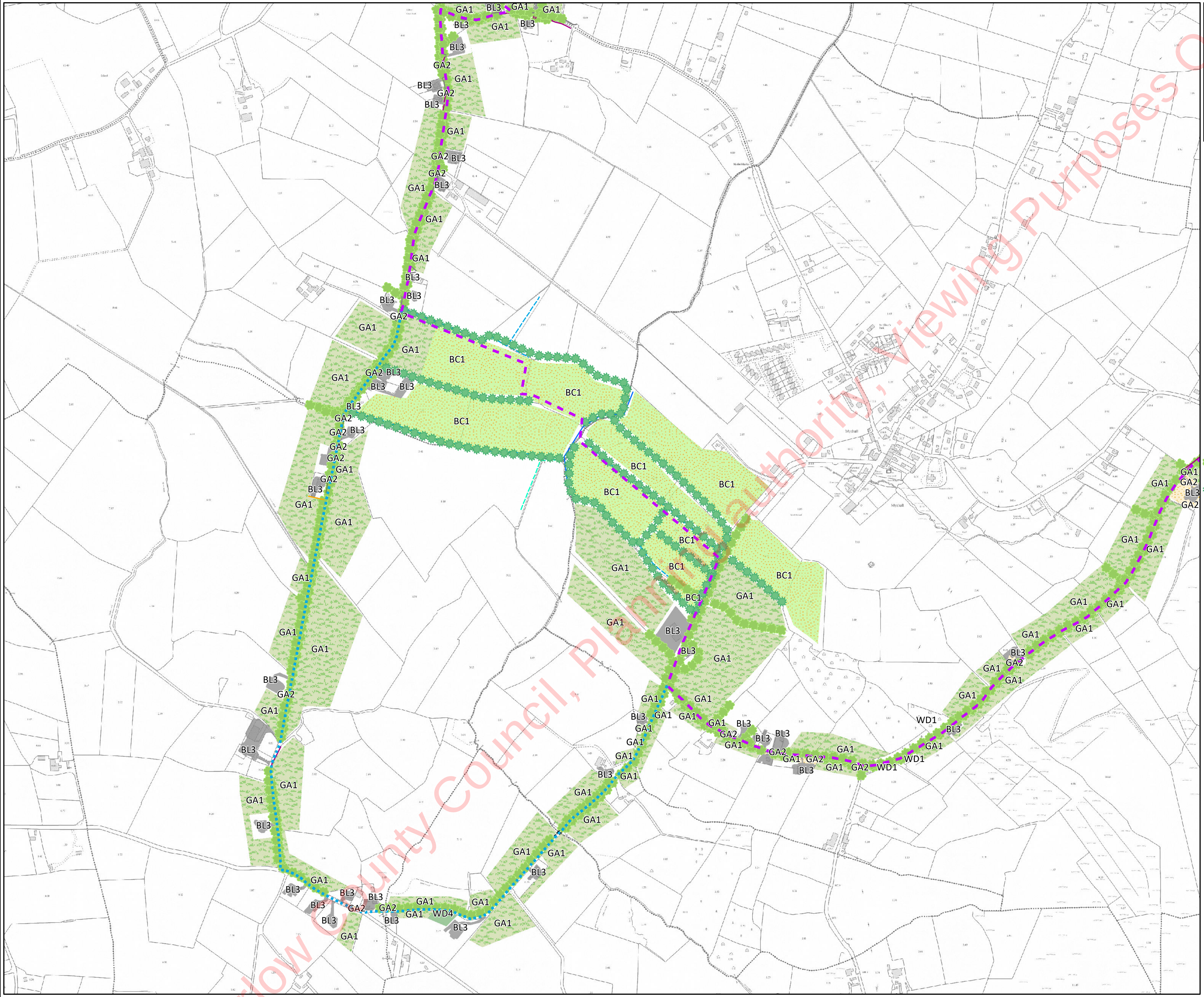

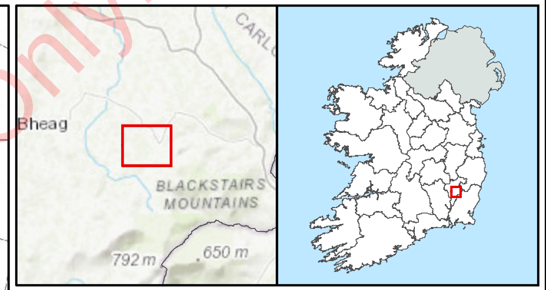

- Proposed Grid Connection Route
- Grid Connection Route Variant 1

Habitat Classification

- BL1 / GS2, Buildings and artificial surfaces / Dry meadows and grassy verges
- BL1 / WL1, Stone walls and other stonework / Hedgerows
- BL1, Stone walls and other stonework
- BL3, Buildings and artificial surfaces
- FW1, Eroding/upland rivers
- FW2, Depositing/lowland rivers
- FW4, Drainage ditches
- WL1 / BL3, Hedgerows / Buildings and artificial surfaces
- WL1, Hedgerows
- WL2, Treelines
- BL3, Buildings and artificial surfaces
- GA2, Amenity grassland
- BC1, Arable
- GA1, Improved agricultural grassland
- WD4, Conifer plantation

TITLE:	Habitats along Grid Connection Route Submap 2
PROJECT:	Croaghaun Wind Farm
FIGURE NO:	8.9.3
CLIENT:	Coillte
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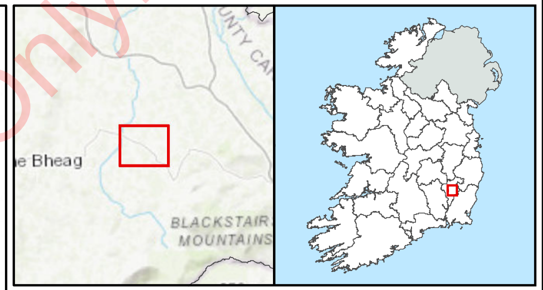

Proposed Grid Connection Route

Habitat Classification

- BL1 / GS2, Buildings and artificial surfaces / Dry meadows and grassy verges
- BL1, Stone walls and other stonework
- BL3, Buildings and artificial surfaces
- WL1, Hedgerows
- WL2, Treelines
- BL3, Buildings and artificial surfaces
- GA2, Amenity grassland
- BC1, Arable crops
- GS2, Dry meadows and grassy verges
- GA1, Improved agricultural grassland

TITLE:	Habitats along Grid Connection Route Submap 3
PROJECT:	Croaghaun Wind Farm
FIGURE NO:	8.9.4
CLIENT:	Coillte
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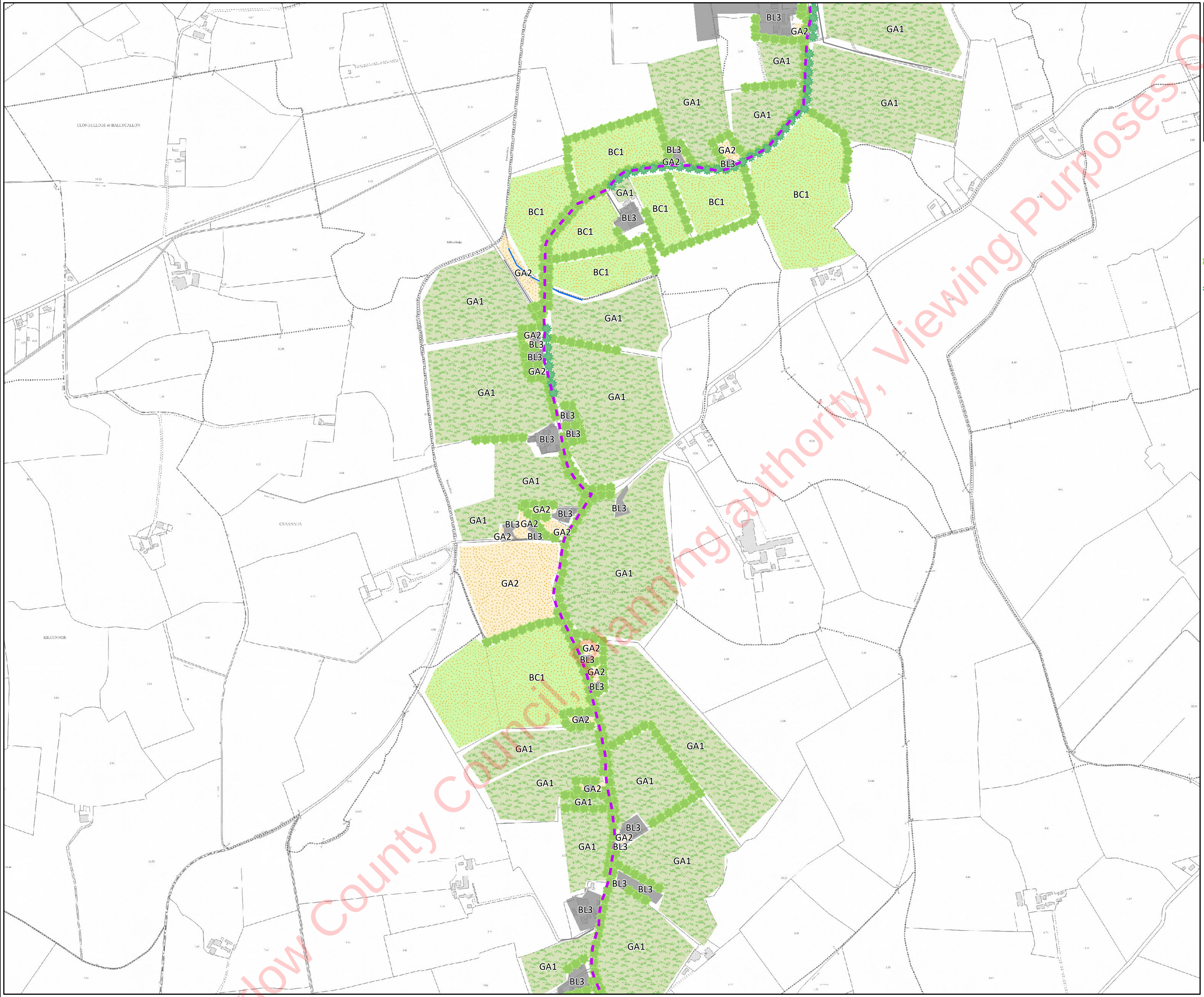

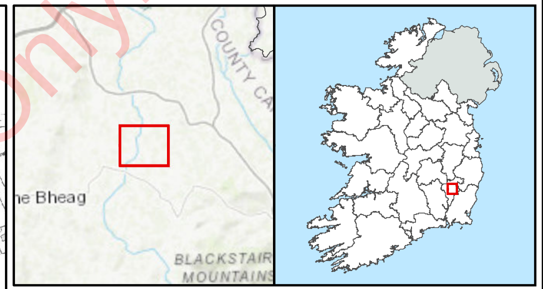

- Proposed Grid Connection Route

Habitat Classification

- BL3, Buildings and artificial surfaces
- FW2, Depositing/lowland rivers
- WL1, Hedgerows
- WL2, Treelines
- BL3, Buildings and artificial surfaces
- GA2, Amenity grassland
- BC1, Arable crops
- GA1, Improved agricultural grassland

TITLE:	Habitats along Grid Connection Route Submap 4		
PROJECT:	Croaghaun Wind Farm		
FIGURE NO:	8.9.5		
CLIENT:	Coillte		
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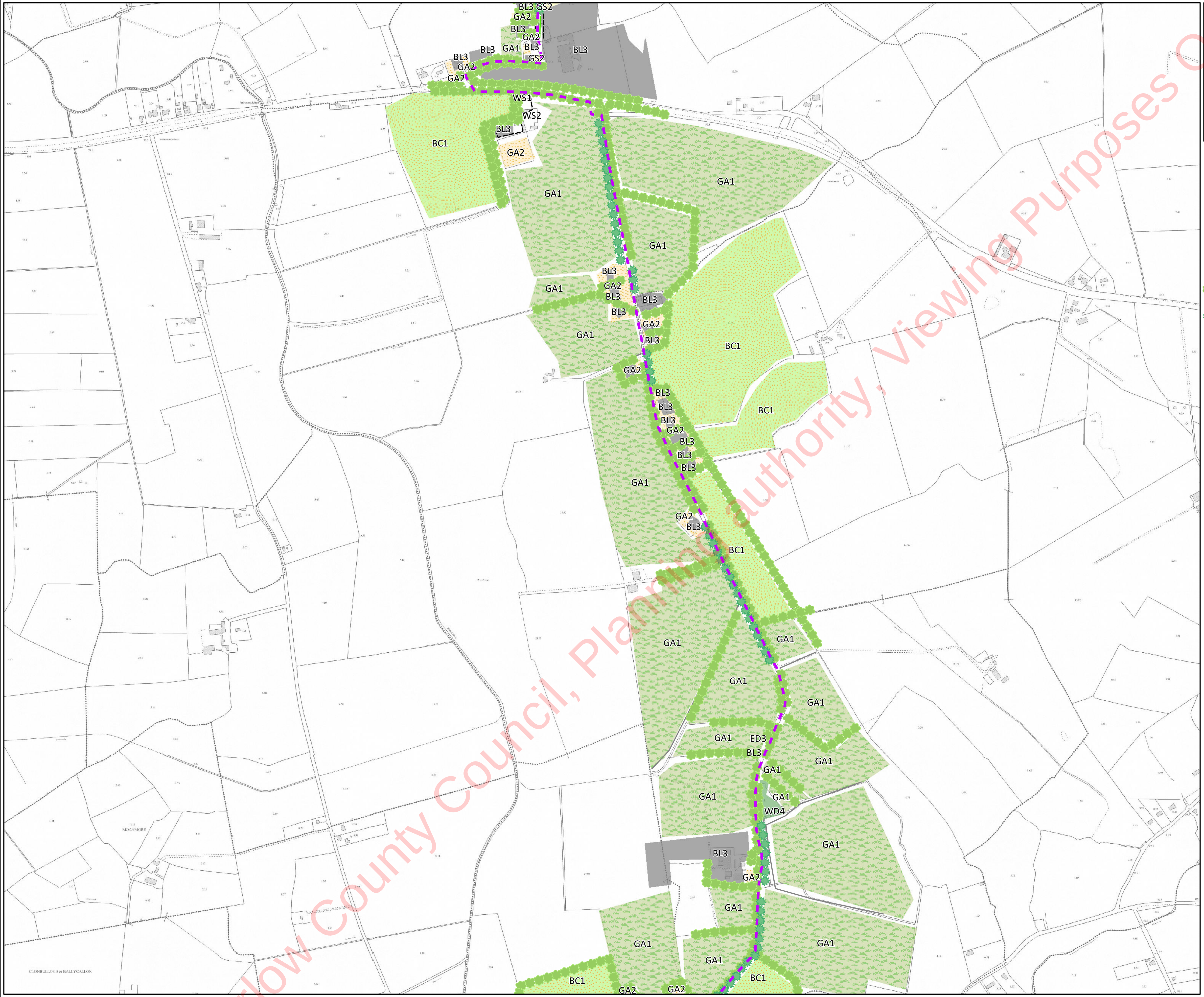

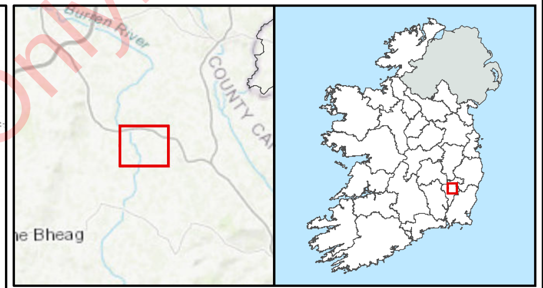

- - - Proposed Grid Connection Route

Habitat Classification

- BL1, Stone walls and other stonework
- BL3, Buildings and artificial surfaces
- GA1, Improved agricultural grassland
- WL1, Hedgerows
- WL2, Treelines
- BL3, Buildings and artificial surfaces
- GA2, Amenity grassland
- BC1, Arable
- WS1, Scrub
- GS2, Dry meadows and grassy verges
- GA1, Improved agricultural grassland
- WD4, Conifer plantation

TITLE:	Habitats along Grid Connection Route Submap 5		
PROJECT:	Croaghaun Wind Farm		
FIGURE NO:	8.9.6		
CLIENT:	Coillte		
SCALE:	1:10000	**REVISION:**	0
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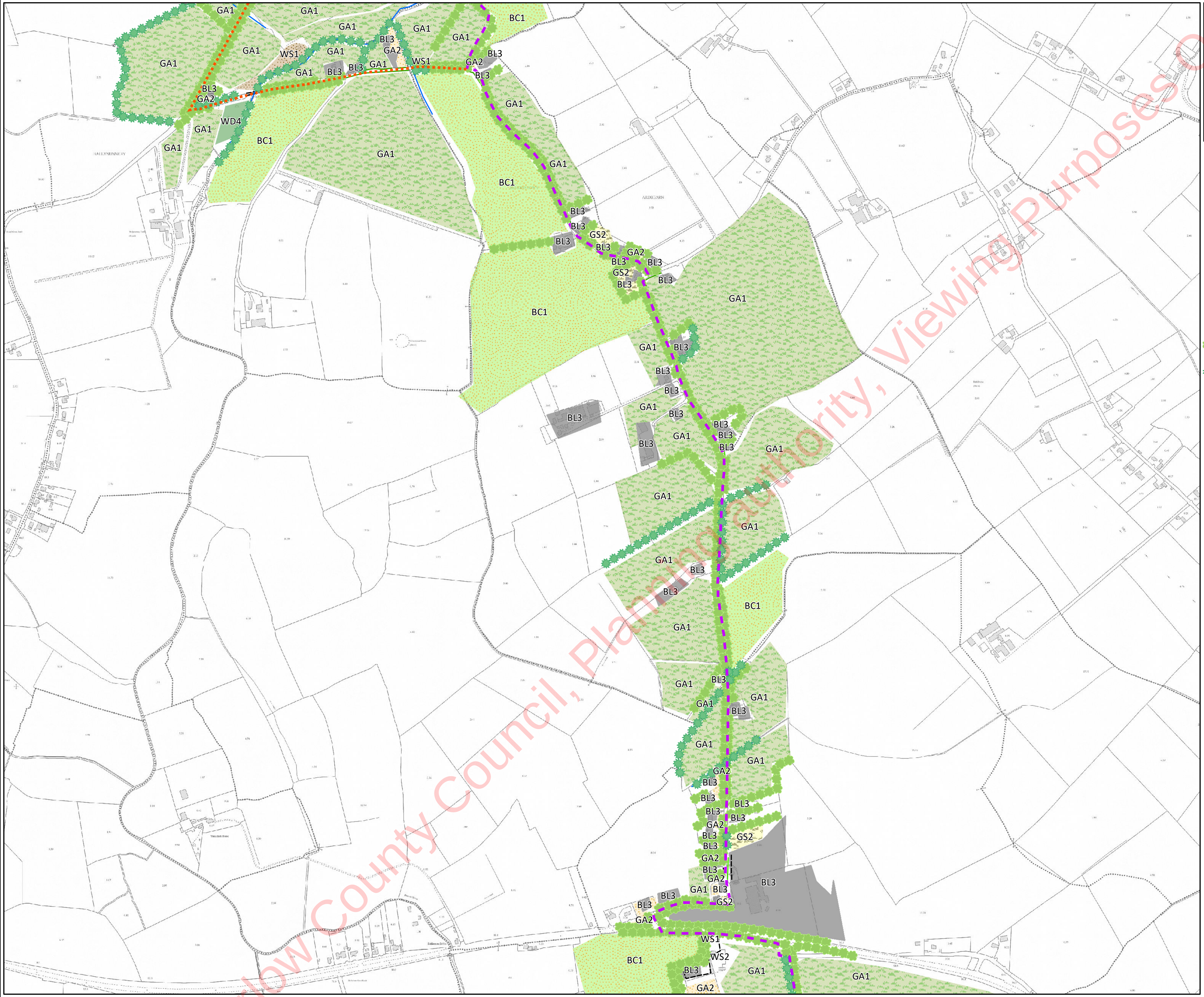

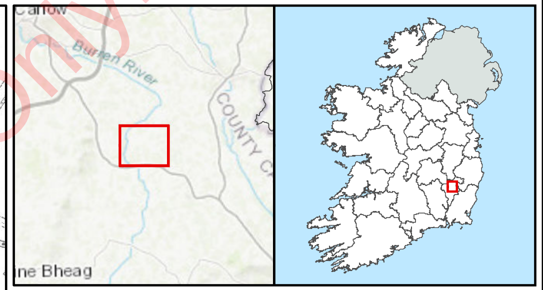

- Proposed Grid Connection Route
- Grid Connection Route Variant 2

Habitat Classification

- BL1, Stone walls and other stonework
- FW2, Depositing/lowland rivers
- GA1, Improved agricultural grassland
- GA2, Amenity grassland
- WL1, Hedgerows
- WL2, Treelines
- BL3, Buildings and artificial surfaces
- GA2, Amenity grassland
- BC1, Arable
- WS1, Scrub
- GS2, Dry meadows and grassy verges
- GA1, Improved agricultural grassland
- WD4, Conifer plantation

TITLE:	Habitats along Grid Connection Route Submap 6		
PROJECT:	Croaghaun Wind Farm		
FIGURE NO:	8.9.7		
CLIENT:	Coillte		
SCALE:	1:10000	**REVISION:**	0
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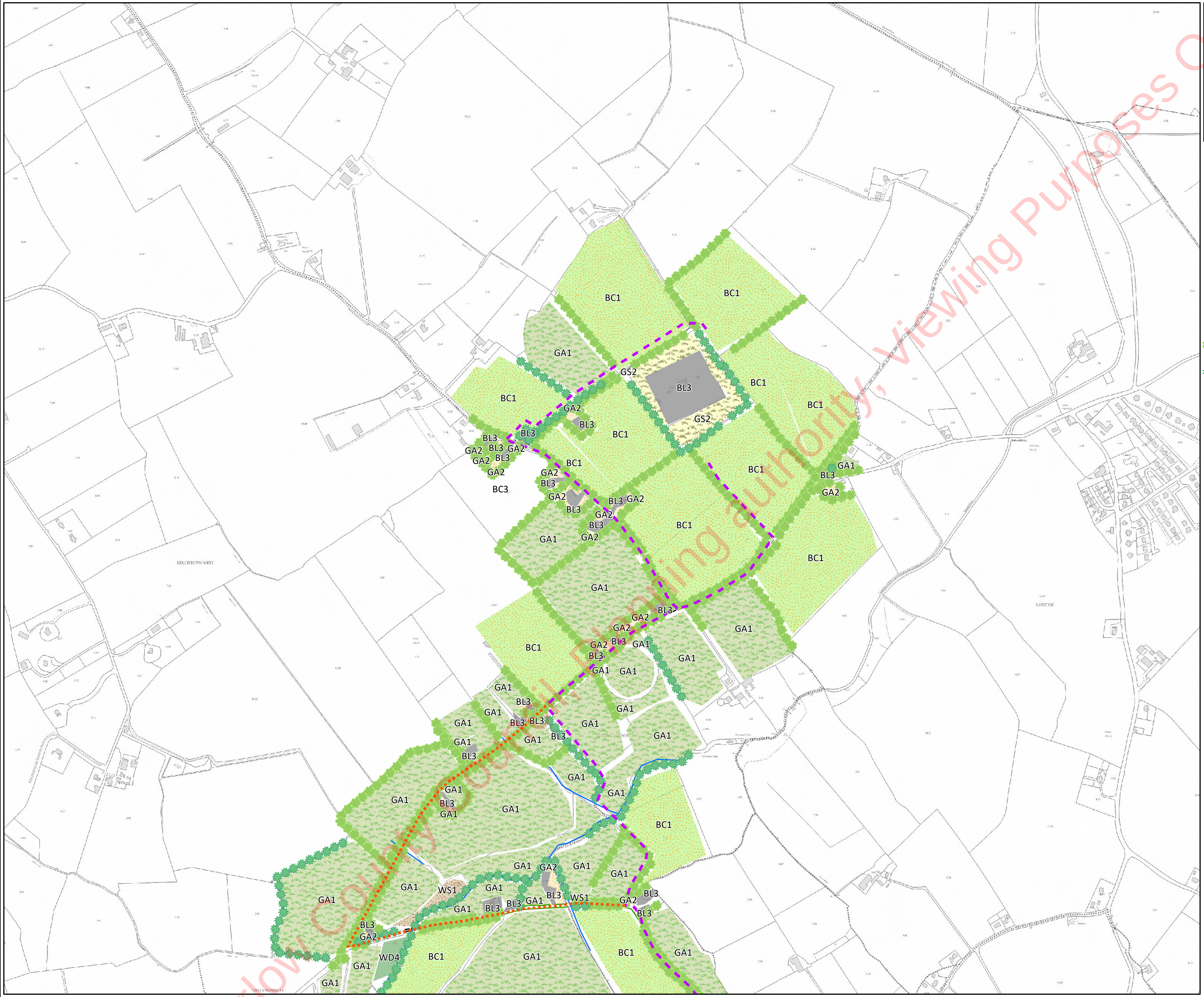

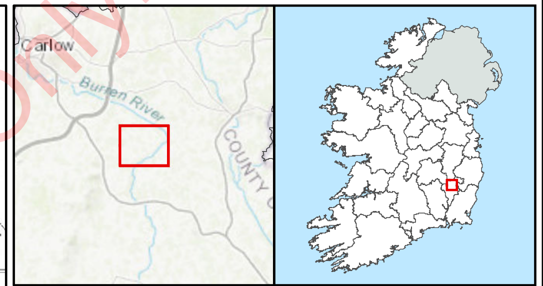

- - - Proposed Grid Connection Route

····· Grid Connection Route Variant 2

Habitat Classification

- BL1, Stone walls and other stonework
- BL3, Buildings and artificial surfaces
- FW2, Depositing/lowland rivers
- GA2, Amenity grassland
- WL1, Hedgerows
- WL2, Treelines
- BL3, Buildings and artificial surfaces
- GA2, Amenity grassland
- BC1, Arable
- WS1, Scrub
- GS2, Dry meadows and grassy verges
- GA1, Improved agricultural grassland
- WD4, Conifer plantation

TITLE:	Habitats along Grid Connection Route Submap 7		
PROJECT:	Croaghaun Wind Farm		
FIGURE NO:	8.9.8		
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8.3.5.3 Turbine Delivery Route (TDR)

A walkover of the TDR was undertaken of the locations of additional works between 10th – 11th July 2019. Additional works are required in 11 locations (identified by turbine delivery work numbers). No flora listed on the FPO or as threatened on the Irish Red list were recorded during site walkovers.

Turbine delivery work location no. 16. M11 Roundabout

Dry meadows and grassy verges (GS2) and buildings and artificial surfaces (BL3) were very common in this area. Amenity grassland (GA2) was also present with some immature woodland (WS2) consisting of mainly Mountain Ash (*Sorbus aucuparia*), Hawthorn and Oak (*Quercus* sp.). Buildings and artificial surfaces (BL3) and amenity grassland (GA2) habitats were modified and manmade habitats which offer little to local wildlife and are deemed to be Locally Important (Lower Value). Dry meadows and grassy verges (GS2) and immature woodland (WS2) are of value to local wildlife but limited in species and are deemed to be Locally Important (Lower Value).

Plate 8-31: Turbine delivery work location no. 16. Bunclody, view from the south

Turbine delivery location work no. 18. N30/N11 Roundabout

The habitat at the site consisted of amenity grassland (GA2), dry meadows and grassy verges (GS2), scrub (WS1), and buildings and artificial surfaces (BL3). A pool categorised as other artificial lakes and pond (FL8) habitat was located nearby and contained no vegetation. These habitats were very modified and deemed to be Locally Important (Lower Value).

Plate 8-32: Turbine delivery work location no. 18. N80 roundabout

Plate 8-33: Turbine delivery work location no. 18. N80 roundabout; pool (FL8)

Turbine delivery work location no. 26. N80 Left Bend Bunclody

The Habitat type at this location was dominated by buildings and artificial surfaces (BL3) with a small amount of flower beds and borders (BC4) located nearby. Both habitats were modified, man-made and offered little to wildlife and so are deemed to be Locally Important (Lower Value).

Plate 8-34: Turbine delivery work location no. 26. Bunclody

Turbine delivery work location no. 29. N80/L2026 Junction (Bunclody)

Habitats present included buildings and artificial surfaces (BL3), flower beds and borders (BC4), hedgerows (WL1) and treelines (WL2). Some amenity grassland (GA2) was noted within nearby gardens. A Large Monkey Puzzle (*Araucaria Araucana*) tree was also present. Buildings and artificial surfaces (BL3), flower beds and borders (BC4) and amenity grassland (GA2) are highly modified and manmade habitats and are Locally Important (Lower Value). Hedgerows (WL1) and treelines (WL2) provide foraging and nesting habitats for birds and commuting routes for bats are considered to be Locally Important (Higher Value). The Monkey Puzzle tree whilst large is a non-native species and is likely to provide very little to local wildlife in terms of foraging or nesting habitat.

Plate 8-35: Turbine delivery work location no. 29. Bunclody, view south

Turbine delivery work location no. 30 L2026 West of Bunclody

Hedgerows (WL1), (mixed) broadleaved woodland (WD1), buildings and artificial surfaces (BL3), stone walls and other stonework (BL1), flower beds and borders (BC4) and ornamental/non-native shrubs (WS3) were present in the immediate vicinity.

The (mixed) broadleaved woodland (WD1) habitat was comprised of mature trees (taller than 20m) and was dominated by Ash, Beech, Birch (*Betula sp*.) and Sycamore (an invasive species) with Sitka Spruce and Yew (*Taxus baccata*) occasional/rare. Holly (*Ilex aquifolium*) bushes were occasional further away from the road. The understorey of the woodland contained Cherry Laurel and Traveller's-joy which are invasive species (see Section 8.3.6.4). The woodland floor was species poor and dominated by Ivy (*Hedera helix*) and Bramble. A single mature 25m tall Oak was present near the road and contained no Ivy or services. The habitat contains limited species diversity and invasive species. However, the woodland habitat is likely to provide foraging and nesting habitat for birds and commuting/foraging habitat for bats and is therefore deemed to be Locally Important (Higher Value).

Hedgerows (WL1) were common and likely to provide foraging and nesting habitat for birds and commuting habitat for bats and was deemed to be Locally Important (Higher Value). Stone walls and other stonework (BL1) were vegetated and deemed to be Locally Important (Higher Value). All other habitats were highly modified and man-made and are considered to be Locally Important (Lower Value).

Plate 8-36: Turbine delivery work location no. 30. Bunclody facing south

Turbine delivery work location no. 31 L2026 West of Bunclody

Stone walls and other stonework (BL1) / hedgerow (WL2) / treeline (WL2) mosaic, buildings and artificial surfaces (BL3) and (mixed) broadleaved woodland (WD1) were present in the immediate vicinity. Within the stone walls and other stonework (BL1) / hedgerow (WL2) / treeline (WL2) mosaic, vegetation was comprised of Hawthorn, Beech and the invasive Cherry Laurel. The (mixed) broadleaved woodland (WD1) habitat is similar to that of turbine delivery work location no. 30.

Stone walls and other stonework (BL1) / hedgerow (WL2) / treeline (WL2) mosaic and (mixed) broadleaved woodland (WD1) is likely to provide foraging and nesting habitat for birds and commuting habitat for bats and is deemed to be Locally Important (Higher Value). Buildings and artificial surfaces (BL3) is highly modified, man-made and is evaluated as being Locally Important (Lower Value).

Turbine delivery work location no. 43 L2026 Kilbranish

Eroding/upland river (FW1), hedgerow (WL1) / treeline (WL2) mosaic, dry meadows and grassy verges (GS2) Stone walls and other stonework (BL1) and buildings and artificial surfaces (BL3) were present in the immediate vicinity.

The road and bridge were classified as buildings and artificial surfaces (BL3). The bridge was considered to offer medium potential as a bat roost. The bridge is evaluated as being Locally Important (Higher Value).

Eroding/upland river (FW1) was comprised of a fast flowing, first order stream running under an existing bridge. The almost vertical vegetated, tall stone wall banks (BL1) of the stream indicated a degree of modification of the waterbody in the past. Eroding/upland river (FW1) and stone walls and other stonework (BL1) are deemed Locally Important (Higher Value).

Hedgerow (WL1) / treeline (WL2) mosaic provides foraging and nesting habitat for birds and commuting habitat for bats and is deemed to be Locally Important (Higher Value).

Dry meadows and grassy verges (GS2) whilst modified provide foraging habitat for local birds and invertebrates and is deemed Locally Important (Higher Value).

Plate 8-37: Turbine delivery work location no. 43 L2026 Kilbranish.

Turbine delivery work location no. 44 L2026 Kilbranish

Hedgerow (WL1) / treeline (WL2), dry meadows and grassy verges (GS2) and buildings and artificial surfaces (BL3) habitats were recorded in the immediate vicinity of the turbine delivery work location. Buildings and artificial surfaces (BL3) included the road which is a modified man-made habitat and deemed Locally Important (Lower Value).

Hedgerow (WL1) / treeline (WL2) were dominated by Blackthorn, Elder, Hawthorn, with Holly, Bramble, and bracken abundant. This habitat is of importance to local birds and bats and therefore deemed Locally Important (Higher Value).

The dry meadows and grassy verges (GS2) habitat was noted as being a modified habitat with Yorkshire Fog, Knapweed, Creeping Thistle, Hogweed, Nettle, Dock, and Dandelion present. This habitat type was deemed to be Locally Important (Higher Value).

Turbine delivery work location no. 45 L2026 Kilbranish

Stone walls and other stonework (BL1), amenity grassland (GA2), hedgerow (WL1) and buildings and artificial surfaces (BL3) habitats were in the immediate vicinity.

The road was classified as buildings and artificial surfaces (BL3) which is a modified man-made habitat and deemed Locally Important (Lower Value). Amenity grassland (GA2) was limited in diversity offering little to local wildlife and is deemed Locally Important (Lower Value).

Stone walls and other stonework (BL1) was partially vegetated providing diversity for flora and fauna and is deemed Locally Important (Higher Value). Hedgerows (WL1) provide commuting roots for bats as well foraging and nesting habitat for birds and is deemed Locally Important (Higher Value).

Turbine delivery work location nos. 48/49 L2026 West of Kilbranish and Proposed Site Entrance Left Bend

Buildings and artificial surfaces (BL3), dry meadows and grassy verges (GS2) and scrub (WS1) were in the vicinity of this turbine delivery work location. The road classified as buildings and artificial surfaces (BL3) is a modified man-made habitat and deemed Locally Important (Lower Value). Dry meadows and grassy verges whilst modified habitats provide foraging habitat for local fauna and are deemed Locally Important (Higher Value). Scrub (WS1) provides nesting, foraging and resting habitat for birds and is deemed Locally Important (Higher Value).

Turbine delivery work location no. 52 existing carpark adjacent to (but not within) the Blackstairs Mountains SAC/pNHA (site code 000770)

The area consists of an existing car park to the south of a local road with conifer plantation (WD4) immediately to the south and east. The proposed turning area to the north of the local road is located within existing conifer plantation (WD4) and an improved agricultural grassland (GA1). The road and car park are classified as buildings and artificial surfaces (BL3). No works are required within the SAC or peatland habitats. A raised soil berm extends around the carpark separating the area of works from the SAC/pNHA. The existing park cark is located on a raised bank approximately 1m above the SAC/pNHA at this point. All three habitats are modified man-made habitat and offer little to local flora and fauna and are therefore deemed Locally Important (Lower Value).

8.3.6 Terrestrial Mammals

8.3.6.1 Desktop Study Rare and Protected Mammals

The protected mammal species listed in Table 8-28, below have been recorded within the 10 km grid square (S85) in which the main wind farm site is located, and 1km grid squares overlapping the grid connection. Both NBDC records (dated 10th September 2020) and NPWS records obtained by request (20th August 2020) were consulted as part of the desktop study. Nine protected mammal species have been recorded within the 10km grid square for the main wind farm site, namely Badger (*Meles meles*), Pygmy Shrew (*Sorex minutus*), Red Squirrel (*Sciurus vulgaris*), Otter (*Lutra lutra*), Irish Hare (*Lepus timidus subsp. hibernicus*), Irish Stoat (*Mustela erminea subsp. hibernica*), Pine Marten (*Martes martes*), Hedgehog (*Erinaceus europaeus*) and Wood Mouse (*Apodemus sylvaticus*). Six of the nine species have recorded within 1km grid squares which overlap the main wind farm site, namely, Badger, Irish Hare, Pygmy Shrew, Red Squirrel, Pine Marten and Wood Mouse. A number of 100m records were also present for these species, many of which were live sightings.

Five of the nine species have been recorded along the 1km grid squares which overlap the grid connection, namely Badger, Irish Hare, Otter, Irish Stoat and Hedgehog. A number of 100m records were also present for these species, many of which were of live sightings.

8.3.6.2 Desktop Study Invasive Mammal Species

Table 8-29 lists the invasive mammal species recorded within the 10km grid square (S85) overlapping the main wind farm site and 1km grid squares overlapping the grid connection. Both NPWS records obtained by request (20th August 2020) and NBDC records (dated 10th September 2020) were consulted as part of the desktop study. There are 7 species of invasive mammal recorded within the 10km grid square (S85) overlapping the main wind farm site and three of the species also overlap the 1km grid squares of the grid connection. The 7 invasive mammal species are: American Mink (*Mustela vison*), Brown Rat (*Rattus norvegicus*), Eastern Grey Squirrel (*Sciurus carolinensis*), European Rabbit (*Oryctolagus cuniculus*), Feral Goat (*Capra hircus*), House Mouse (*Mus musculus*) and Sika Deer (*Cervus nippon*).

The three species within the area of the grid connection are American Mink, Eastern Grey Squirrel and European Rabbit. Records of these species in the greater area are relatively recent having occurred within the last ten years.

Of the 7 species, only Brown Rat and Sika Deer were recorded within the main wind farm site (1km and 100m records).

Of the two species Sika Deer was the most frequently recorded; recorded within four areas of the main wind farm site with the most recent records dating from 2017. Of the three species in the general area of the grid connection, Rabbit was the most frequently recorded, the most recent record from 2018.

Table 8-28: Historical Records and Protected Mammals within 10km of the main wind farm site and 1km of Grid Connection

Species	1km (Grid Cable Route)	Grid Squares covering Wind Farm site	Year of Last Record	Survey/Dataset	Protection	NBDC and NPWS records within the study area
Eurasian Badger *Meles*	S8459, S8165, S8166, S8068, S7969, S7970, S8070	S85, S8459, S8356	2016	Badger and Habitat Survey of Ireland Badger Setts of Ireland Database	Wildlife Acts	One 2005 low resolution record (1km) overlaps with the most northern section of the main wind farm site. Several 100m resolution (2016) records located within forestry and farmed grassland to the south of the main wind farm site (type not specified). The closest of these records is ca. 213m south of the main wind farm site. Several 100m resolution records (the most recent 1999) located ca. 90m from the off-road northern section of the grid connection in Ballycurragh. The record in question was located within an adjacent field to that of the grid connection.
Irish Hare *Lepus timidus subsp. hibernicus*	S8070	S85, S8356, S8357	2017	Badger and Habitat Survey of Ireland Atlas of Mammals in Ireland 2010-2015 Mammals of Ireland 2016-2025	Annex V Habitats Directive Wildlife Acts	A single 100m resolution record located within conifer plantation within the west of the main wind farm site; a live sighting. A number of other 100m records of live sightings around the main wind farm site, in conifer plantation, mixed broadleaved woodland and arable land; most recent records from 2017. A 100m resolution record located ca. 70m in the same field as the proposed off-road section of grid connection in Rathtoe; (2013) in tilled land.
Eurasian Pygmy Shrew *Sorex minutus*	None	S85, S8356	2017	Mammals of Ireland 2016-2025	Wildlife Acts	There were no high resolution (100m) records of this species within the main wind farm site. A 100m resolution record (2017) located in Corrabut Gap, ca. 360 south of the main wind farm site within forestry (sighting of live animal).

Species	1km (Grid Cable Route)	Grid Squares covering Wind Farm site	Year of Last Record	Survey/Dataset	Protection	NBDC and NPWS records within the study area
Eurasian Red Squirrel *Sciurus vulgaris*	None	S85, S8356, S8357, S8257	2017	Atlas of Mammals in Ireland 2010-2015 Mammals of Ireland 2016-2025	Wildlife Acts	Four 100m resolution records of live sighting from 2013 in conifer forestry in Corrabut Gap within the main wind farm site. A further five 100m resolution records (partially located within the site) of life sightings in 2015, habitat not detailed. A single 100m resolution record (on part of western boundary) from 2013 of a dead animal (not road kill) in mixed conifer forestry. The most recent 100m record (2017) is located ca. 360m to the south of the main wind farm site.
European Otter *Lutra lutra*	S8460, S8070, S8071	S85	1991	Otter Survey of Ireland 1982 Badger and Habitats Survey of Ireland	Annex II and IV Habitats Directive, Wildlife Acts	Otter has not been recorded within the main wind farm site. No higher resolution (100m) records were located within the path of the grid connection. A single 100m resolution historic record (1982) located at Douglas River at Myshall, ca. 700m from the off-road section of the grid connection crossing; record of two spraints. Several 100m resolution records located along the River Burren at Rathtoe, ca. 1.2km from the watercourse crossing of the off-road northern section of the grid connection. The most recent record is from 2018 and was of a live sighting.
Irish Stoat *Mustela erminea subsp. hibernica*	S8259	S85	2012	Atlas of Mammals in Ireland 2010-2015	Wildlife Acts	There were no records available of Irish Stoat within the main wind farm site. A single 100m resolution record located in the general area of the grid connection along the L20261 local road (south of Myshall). The record was taken in 2012 and is of a live sighting in semi-natural grassland.
Pine Marten *Martes martes*	None	S85, S8356, S8257, S8258	2017	Atlas of Mammals in Ireland 2010-2015 Mammals of Ireland 2016-2025	Annex V Habitats Directive, Wildlife Acts	Four 100m resolution records (2013) within the northwest of the main wind farm site (Rossacurra) of live sightings. A further three 100m records (2015) overlapping with the southwestern boundary (Corrabut) of live sightings. There is a more recent 100m record (2017) of a live sighting located ca. 400m south of the main wind farm site (Corrabut).

Species	1km (Grid Cable Route)	Grid Squares covering Wind Farm site	Year of Last Record	Survey/Dataset	Protection	NBDC and NPWS records within the study area
West European Hedgehog *Erinaceus europaeus*	S8071	S85	2016	Mammals of Ireland 2016-2025	Wildlife Acts	The closest 100m resolution records to the grid connection were both located ca 580m away. The first (2015) located along the N80 at the crossing of the Burren River and the second (2016) along the L3046 at Rathtoe Bridge. Both records were roadkill.
Wood Mouse *Apodemus sylvaticus*	None	S85, S8356, S8357, S8257, S8258	2017	Atlas of Mammals in Ireland 2010-2015 Mammals of Ireland 2016-2025	Not Protected	Four 100m resolutions records (2014) within the northwest of the main wind farm site (Rossacurra) of live sightings. A further combined thirty-one 100m resolutions records in 2015 of live sightings located within the west and southwest of the main wind farm site (Corrabut Gap).

Table 8-29: Historic Records of Invasive Mammal Species within 10km of the Proposed Development

Species	Grid Square	Survey	Conservation Status/Impact	Records within the study area
American Mink *Mustela vison*	S85, S8070, S8071	Badger and Habitats Survey of Ireland Otter survey of Ireland 1982 - Vincent Wildlife Trust	High Impact Schedule III	No records of this species are present within the main wind farm site. A low resolution (1000m) record is present in the northern off-road section (Rathtoe) of the grid connection and is from 1991. The closest 100m resolution record is a historic record (1982) of a spraint and is located at Rathtoe Bridge ca. 465m from the grid connection.
Brown Rat *Rattus norvegicus*	S85	Mammals of Ireland 2016-2025	High Impact Schedule III	A single 100m resolution record located within the most north-western corner (Rossacurra) of the main wind farm site, of a live sighting in 2014. No other records are present within the main wind farm site or grid connection.

Species	Grid Square	Survey	Conservation Status/Impact	Records within the study area
Eastern Grey Squirrel *Sciurus carolinensis*	S85, S8063, S8259	Atlas of Mammals in Ireland 2010-2015 Mammals of Ireland 2016-2025	High Impact EU Regulation No. 1143/2014 Schedule III	There are no records of the species within the main wind farm site. A 100m resolution record is located at Turtane (R2022) within the general area of the grid connection. The record dates from 2016 and is a live sighting of three individuals.
European Rabbit *Oryctolagus cuniculus*	S85, S8070	Atlas of Mammals in Ireland 2010-2015 Northern Ireland Mammal Database Badger and Habitats Survey of Ireland Hare Survey of Ireland 2006 and 2007 Mammals of Ireland 2016-2025	Medium Risk	There are no records of the species within the main wind farm site. The closest 100m resolution record is located ca. 685m from the off-road section of the grid connection (northern section). There are several records at this location, the most recent record is from 2018 of a live animal.
Feral Goat *Capra hircus*	S85	Atlas of Mammals in Ireland 2010-2015	Medium Risk	No records of this species exist within the main wind farm site or along the grid connection. The closest record is a 1km record at Black Rock Mountain located ca. 3km to the south of the grid connection. The 2012 record was of a dead individual found in heath (not road kill).
House Mouse *Mus musculus*	S85	Atlas of Mammals in Ireland 2010-2015	High Risk	There are no records of this species within the main wind farm site or grid connection. The closest record to the main wind farm site is a 100m resolution located ca. 2.4km west of the site at Ballypierce (2012) and was of a live sighting of the species within a flower bed/border.
Sika Deer *Cervus nippon*	S85	Atlas of Mammals in Ireland 2010-2015 Mammals of Ireland 2016-2025 Badger and Habitats Survey of Ireland	High Risk Schedule III Wildlife Acts	There are several 100m resolution records located within four separate areas of the main wind farm site (Rossacurra, Croaghaun, Corrabut Gap and Kilbrannish North), the most recent record was made in 2017 at Corrabut Gap and was of a live sighting. There are no records of the species along the grid connection.

8.3.6.3 Terrestrial Mammals Survey Results

A total of 12 terrestrial (non-volant) mammals were identified within the study area during surveys. See Table 8-30 below for more information. Figure 8-10 shows the location of mammal field signs, image captures and direct observations of live mammals (Badger setts are omitted as this is sensitive information which is not released into the public domain according to good practice). This data was obtained during the mammal survey walkover and from trail cameras located in the main wind farm site as well as records gathered during other ecological surveys. Eight of these species are considered to be of 'Least Concern', namely Badger, Rabbit (non-native), Irish Hare, Hedgehog, , Otter, Pygmy Shrew, Red Fox and Wood Mouse. The other four species are introduced and not provided a conservation status, namely, Bank Vole, Brown Rat, Feral Goat and Sika Deer. As discussed in section 8.3.6.2, Rabbit, Brown Rat, Feral Goat and Sika Deer are all invasive species. Bank Vole records were not found during the desk study of the area and this species is also a Medium Risk invasive species. 8.3.6.2

Other mammal species previously recorded in the area (see section 8.3.6.1) of the study area but not observed during surveys may also occur; Irish Stoat, Pine Martin and Red Squirrel. The treelines, as well as the edge of the woodland and scrub habitats, and adjacent field edges are suitable for Irish Stoat; utilising habitat edges to hunt. Species are subject to seasonal fluctuations in population as the availability of food changes throughout the year (Couzens *et al* 2017).

Table 8-30: Mammal Species recorded on the study area and their conservation status (Marnell et al., 2019)

Name	Conservation Status
Badger *Meles meles*	Least Concern
Bank Vole *Myodes glareolus*	Introduced
Brown Rat *Rattus norvegicus*	Introduced
Eurasian Rabbit *Oryctolagus cuniculus*	Least Concern
Feral Goat *Capra hircus*	Introduced
Hedgehog *Erinaceus europaeus*	Least Concern
Irish Hare *Lepus timidus subsp. hibernicus*	Least Concern
Otter *Lutra lutra*	Least Concern
Pygmy Shrew *Sorex minutus*	Least Concern
Red Fox *Vulpes vulpes*	Least Concern
Sika Deer *Cervus nippon*	Introduced
Wood Mouse *Apodemus sylvaticus*	Least Concern

Badger

Badger activity was scattered sparsely across the main wind farm site, however setts were only found in the drier grounds of the lowlands. As such it would appear that Badger in the area use the lowlands for foraging and shelter and use the uplands to forage only. All setts found near the works were disused, except for a single potentially active sett. See Table 8-31 for more information.

Table 8-31: Badger Setts within Study Area

Sett ID	Location	Proximity in relation to infrastructure	Details
1	Within the main wind farm site	Within the footprint of the wind farm	Single entrance, outlier/subsidiary sett (active)
2	Within the main wind farm site	Within the footprint turbine felling buffers	Single entrance, outlier/subsidiary sett (disused)
3	Within the main wind farm site	Within the footprint of the wind farm	Three entrances, subsidiary sett (disused)
4	Within the main wind farm site	Within the footprint turbine felling buffers	Single entrance, outlier/subsidiary sett (disused)

Red Fox

Red Fox scats were found throughout the main wind farm site, however burrowing activity was only found in lower drier ground in the southern section of site. Trail camera 3 captured three photographs of Red Fox in 21 days and it could not be ruled out that the Fox had not entered the burrow. Two confirmed Fox dens were noted within the main wind farm site and one unconfirmed den.

Rabbit

Eurasian Rabbit were seen within the main wind farm site well outside the footprint of the works on the lowland pastures. The only Rabbit burrows that were found near the works were disused and had been for a while. During the grid connection walkover Rabbit was sighted within barley stubble (BC1) and a couple of burrows were observed close by in hedgerow.

Irish Hare

During mammal surveys of the study area Irish Hare was seen within the plantation, high upon the eastern slope of Croaghaun mountain. During the habitat walkovers of the main wind farm site Irish Hare was observed crossing a forestry track; moving from improved grassland (GA1) to recently-felled conifer woodland (WD4).

Wood Mouse

Within the main wind farm site Wood Mouse was detected on trail camera 1 under the cover of dense gorse and bramble scrub and is likely to exist throughout the site where suitable habitats and conditions for each individual species exist. In general, good cover and the availability of food is a prerequisite. The scrub, treelines and drier woodland habitats are suitable for this species.

Brown Rat

Within the main wind farm site Brown Rat was detected on trail camera 1 under the cover of dense gorse and bramble scrub and is likely to exist throughout the study area (the main wind farm site, grid connection and TDR) where suitable habitats and conditions for each individual species exist. Good cover and the availability of food is a prerequisite. The scrub, treelines and drier woodland habitats are suitable for this species.

Bank Vole

Bank Vole was detected on trail camera 1 under the cover of dense gorse and bramble scrub and is likely to exist throughout the study area (the main wind farm site, grid connection and TDR) where suitable habitats and conditions for each individual species exist. Good cover and the availability of food is a prerequisite. The scrub, treelines and drier woodland habitats are suitable for this species.

Pygmy Shrew

Within the main wind farm site Pygmy Shrew was detected on trail camera 1 under the cover of dense gorse and bramble scrub and is likely to exist throughout the study area (the main wind farm site, grid connection and TDR) where suitable habitats and conditions for each individual species exist. In general, good cover and the availability of food is a prerequisite. The scrub, treelines and drier woodland habitats are suitable for this species.

Feral Goat and Sika Deer

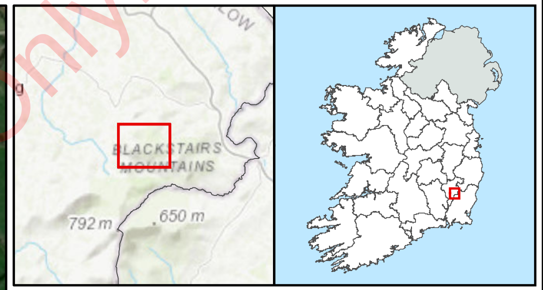
During mammal surveys of the study area Feral Goat and Sika Deer were recorded within the main wind farm site. A herd of four Feral Goats were seen high up on the western slope of Croaghaun mountain. Deer were mainly associated with higher ground where droppings and footprints were very common, and pits dug by rutting Deer were found.

Hedgehog

Hedgehog scatt was observed within a field (GA1) during the grid connection walkover survey only. Species are subject to seasonal fluctuations in population as the availability of food changes throughout the year (Couzins *et al* 2017). The treelines, as well as the edge of the woodland and scrub habitats, and adjacent field edges of the study area (the main wind farm site, grid connection and TDR) are suitable for Hedgehog; utilising the cover of habitat edges for concealment and the adjacent open areas to forage. (Couzins *et al* 2017).

Otter

Otters signs were recorded during aquatic surveys at aquatic survey sites: A4 (River Clody), A5 (River Slaney), B3 (Burren River), B6 (Burren River), C2 (Douglas River), D4 (Clashavey River) and E3 (Kildavin Stream). No otters were recorded in the main wind farm itself. Site B6 intersects the grid cable route (WCC2) and site C2 is downstream of WCC9 along the grid cable route.



- Proposed Turbine Layout
- Proposed Development Boundary
- Existing 80m Met Mast
- Proposed Permanent 100m Met Mast
- Proposed Grid Connection Route
- Proposed Croaghaun Loop
- Proposed Existing Road Upgrade
- Proposed New Road
- Proposed Turbine Hardstanding
- Proposed Borrow Pit
- Proposed Temporary Compound
- Proposed Substation Compound

Mammal Signs

- Badger latrine
- Badger latrine and snuffleholes
- Badger snuffle holes
- Brown rat
- Deer rut pit
- Feral goat
- Fox
- Fox field sign
- Irish Hare
- Mammal burrow
- Rabbit field sign
- Sika deer
- Wood mouse, brown rat, bank vole and pygmy Shrew

TITLE: Mammal Signs and Sightings			
PROJECT: Croaghaun Wind Farm			
FIGURE NO:	8.10		
CLIENT:	Coillte		
SCALE:	1:10000	**REVISION:**	0
DATE:	09/12/2020	**PAGE SIZE:**	A3

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8.3.7 Bats

There are four species recorded within 10km (S85) of the study area held by the NPWS (obtained by request) and NBDC (dated 10th September 2020): Daubenton's Bat (*Myotis daubentonii*), Lesser Noctule / Leisler's Bat (*Nyctalus leisleri*), Pipistrelle (*Pipistrellus sensu lato*[7]) and Soprano Pipistrelle (*Pipistrellus pygmaeus*). None of the four species have been recorded (1km and 100m records) within the main wind farm site. See Table 8-32 for more information.

Table 8-32: Historical Records of Bat Species in Close Proximity to the Study Area (NPWS and NBDC)

Species	Survey	Conservation Status	Closest record to the study area
Daubenton's Bat *Myotis daubentonii*	National Bat Database of Ireland	EU Habitats Directive Annex IV Wildlife Acts	No records for this species are located within the main wind farm site. The closest records are comprised of three 100m resolution records located to the east of the main wind farm site in two areas; Bunclody and Kildavin. The closest record is located ca. 4.2km east of the main wind farm site and dates from 2005 and was part of a road survey.
Lesser Noctule / Leisler's Bat *Nyctalus leisleri*	National Bat Database of Ireland BATLAS 2010	EU Habitats Directive Annex IV Wildlife Acts	No records for this species are located within the main wind farm site. The closest record is comprised of a single 100m resolution record (2008) located in Myshall (northwest), ca. 1.5km from the main wind farm site. Other 100m records are located in Bunclody (east) and Clonegal (northeast), with the closest record located ca. 4.2km away.
Pipistrelle *Pipistrellus sensu lato*	National Bat Database of Ireland BATLAS 2010	EU Habitats Directive Annex IV Wildlife Acts	No records for this species are located within the main wind farm site. The closest record is a 100m resolution record (2008) is located ca. 480m west of the main wind farm site along a local road (L3034). Other 100m records are located in in two areas; Bunclody and Kildavin, a minimum of ca. 4.2km west of the main wind farm site.
Soprano Pipistrelle *Pipistrellus pygmaeus*	National Bat Database of Ireland	EU Habitats Directive Annex IV Wildlife Acts	No records for this species are located within the main wind farm site. The closest record are two 100m resolution records located in two areas; Bunclody and Kildavin to the west of the main wind farm site. The record at Bunclody (2005) is located ca. 4.km away whilst the Kildavin record (2008) is located 4.5km away.

[7] May be an aggregate of more than one Pipistrelle species.

A review of existing bat roost records within 30km of the study area (dataset obtained from Bat Conservation Ireland on 23rd September 2020) reveals that 7 of the 9 Irish bat species have been recorded within 30km radius. These species are comprised of Brown Long-eared Bat (*Plecotus auratus*), Common Pipistrelle (*Pipistrellus pipistrellus*), Daubenton's Bat (*Myotis daubentonii*), Leisler's Bat / Lesser Noctule (*Nyctalus leisleri*), Natterer's Bat (*Myotis nattereri*), Soprano Pipistrelle (*Pipistrellus pygmaeus*) and Whiskered Bat (*Myotis mystacinus*). See Table 8-33 for more information.

Table 8-33: Roost records within a 30km radius of the study area (BCI, 25/09/2020)

Name	Known Roost within 30km of the proposed wind farm	Source
Brown Long-eared bat *Plecotus auritus*	21	Bat Conservation Ireland
Common Pipistrelle *Pipistrellus pipistrellus*	13	Bat Conservation Ireland
Daubenton's Bat *Myotis daubentonii*	10	Bat Conservation Ireland
Leisler's Bat / Lesser Noctule *Nyctalus leisleri*	7	Bat Conservation Ireland
Natterer's Bat *Myotis natterreri*	5	Bat Conservation Ireland
Soprano Pipistrelle *Pipistrellus pygmaeus*	20	Bat Conservation Ireland
Whiskered Bat *Myotis mystacinus*	6	Bat Conservation Ireland

8.3.7.1 Bat Landscapes

The bat landscape association model (Lundy *et al,* 2011) suggests that the main wind farm site is part of a landscape that is of low to moderate suitability for Daubenton's (*Myotis daubentonii*), Whiskered Bat (*Myotis mystacinus*), Brown Long-eared (*Plecotus auritus*), Common Pipistrelle (*Pipistrellus pipistrellus*), Soprano Pipistrelle (*Pipistrellus pygmaeus*), Leisler's (*Nyctalus leisleri*), Natterer's (*Myotis nattereri*). The main wind farm site and its environs are of low suitability for Lesser Horseshoe Bat and Nathusius' Pipistrelle.

8.3.7.2 Bat Activity/Transect Survey 2019

The results of the four no. bat activity surveys carried within the main wind farm site in 2019 are presented below. They are also outlined in Bat Report (see Appendix 8.4). Please note that the GPS file for the activity survey on 26/09/2019 failed due to a technical fault and therefore no map is available for this survey.

Survey Visit 1 (28/06/2019)

Dusk survey conditions were as follows:

- Sunset: 21:54
- Cloud cover: 2/8
- Wind: Beaufort F1
- Rain: Dry
- Temperature at sunset: 19°C

Table 8-34: Analysis BatLogger Data - Survey 1 Results 28/06/2019

Species	No. of Recordings	% Total Recordings
Common pipistrelle	31	60%
Leisler's bat	13	25%
Nathusius' pipistrelle	5	10%
Soprano pipistrelle	3	6%
Total	**52**	

Survey Visit 2 (31/07/2019)

Dusk survey conditions were as follows:

- Sunset: 21:21
- Cloud cover: 4/8
- Wind: Beaufort F1
- Rain: Dry
- Temperature at sunset: 19°C

Table 8-35: Analysis BatLogger Data - Survey 1 Results 31/07/2019

Species	No. of Recordings	% Total Recordings
Common pipistrelle	107	71%
Soprano pipistrelle	20	13%
Leisler's bat	18	12%
Brown long-eared	2	1%
Daubenton's bat	1	1%
Whiskered bat	3	2%
Total	**151**	

Survey Visit 3 (15/08/2019)

Dusk survey conditions were as follows:

- Sunset: 20:53
- Cloud cover: 4/8
- Wind: Beaufort F1
- Rain: Dry
- Temperature at sunset: 16°C

Table 8-36: Analysis BatLogger Data - Survey 2 Results 15/08/2019

Species	No. of Recordings	% Total Recordings
Common pipistrelle	116	81%
Soprano pipistrelle	25	17%
Leisler's bat	1	1%
Brown long-eared	1	1%
Total	**143**	

Survey Visit 4 (26/09/2019)

Dusk survey conditions were as follows:

- Sunset: 20:24
- Cloud cover: 6/8
- Wind: Beaufort F2
- Rain: Dry
- Temperature at sunset: 11°C

Table 8-37: Analysis BatLogger Data - Survey 3 Results 26/09/2019

Species	No. of Recordings	% Total Recordings
Common pipistrelle	79	77%
Soprano pipistrelle	17	17%
Leisler's bat	5	5%
Daubenton's bat	1	1%
Whiskered bat	1	1%
Total	**103**	

Table 8-38: Total number of bat passes recorded during transect surveys within the study area during 2019

Species	June	July	August	September	Total
Common Pipistrelle	31	107	116	79	333
Leisler's Bat	13	18	1	5	37
Nathusius' Pipistrelle	5	0	0		5
Soprano Pipistrelle	3	20	25	17	65
Brown Long-eared Bat	0	2	1	0	3
Daubenton's Bat	0	1	0	1	2
Whiskered Bat	0	3	0	1	4
Total	52	151	143	103	449

8.3.7.3 Roost Surveys (2019) – Preliminary Ecological Appraisal

The main wind farm site is comprised predominantly of conifer plantation and open upland vegetation, with small parcels of pasture in lower lying areas of the sites. There are also access tracks throughout those areas of conifer plantation. Watercourses are limited to small 1st order streams that are generally open or run adjacent to forest blocks. The existing drainage system is based on surface water being collected in drainage ditches located along the forest access tracks. Water from drains is discharged overland downslope of the access tracks. The hedgerows/ treelines bounding pasture do provide some connectivity to the wider landscape. In accordance with the criteria outlined in Table 8-4 the commuting and foraging habitats over most of the site is of moderate suitability for bats, with the dense areas of conifer plantation offering low suitability.

8.3.7.4 Roost Surveys (2019) – Inspection of Trees

The cover of broadleaved trees at the main wind farm site is limited to immature trees within the relatively sparse hedgerows in low-lying areas of pasture at the southern end of the site. A survey was carried out of all trees within a 200m radius of each turbine location. These were all conifer trees, most of which were in dense stands. None of these were identified as having roosting potential for bats. The survey areas are indicated in Figure 4.8 of the Bat Report Appendix 8.4.

8.3.7.5 Roost Surveys (2020) - Structures

The study area encompasses a larger area to the planning boundary. For bat surveys, the survey encompassed a 300m buffer of an earlier site boundary, which is greater than the recommended 200m (BCT, 2016). No relevant underground features (natural or man-made) were identified during the desk study, and no other underground sites were recorded on-site.

A total of nine above-ground man-made structures were identified within the 300m buffer (including discrete clusters of buildings) (see Figure 4-8 and 4-9 of the Bat Report Appendix 8.4). Ground truthing of these above-ground features was carried out and did not identify any features likely to host a significant winter bat roost (i.e. a roost which may attract bats from numerous colonies from a large catchment). Table 8-39 presents results of this investigation.

No features with likelihood of being a significant bat hibernaculum were located within the site boundary (red line, Figure 4-9 of the Bat Report Appendix 8.4).

Residences and agricultural buildings with potential for use by hibernating bats were located within the 300m buffer area. It was generally not possible to estimate the potential suitability of these buildings for use by hibernating bats without closer investigation.

Structures with potential for non-hibernation bat roosting are present within the study area, and some of these have potential to be used to by maternity colonies. Proposed further surveys in relation to these sites are provided below.

Table 8-39: Notes from ground truthing of identified features of interest

ID*	Comment	Potential	Distance to nearest turbine (km)
0	New build. Negligible potential for significant winter bat roosting.	Negligible	1.18km to T1
1	Traditional two-story farm-house. Occupied and in good condition. Slate roof. Low potential for significant winter bat roosting. Small, proximal outbuildings not visible from public road.	Low	1.47km to T3
2	Large, metal clad outbuildings which have negligible potential for winter roosting bats.	Negligible	1.53km to T3
3	Traditional two-story farmhouse, possibly unoccupied. Plastered walls and slate roof, generally in poor condition. Traditional and modern agricultural buildings present also.	Medium	1.91km to T3
4	"Hill Cottage". Occupied and in good condition. Slate roof. No obvious gaps/lifting tiles. Low potential for significant winter bat roosting.	Low	1.44km to T4
5	Single story residence. Occupied and in good condition. Slate roof. Low potential for winter roosting bats.	Low	1.46km to T3
6	Newly build residence, occupied. Negligible potential for significant winter bat roosting.	Negligible	1.79km to T3
7	Farm buildings (modern and traditional) visible from public road. Buildings are in use. Unknown if a residence is present.	Medium	1.84km to T3
8	Single story residence, occupied, Low potential for significant winter bat roosting. Traditional stone building to rear, in poor condition,	Low	1.28km to T1
9	Agricultural shed. Negligible potential for significant winter bat roosting.	Negligible	0.87km to T1

8.3.7.6 Roost Surveys (2019) – Watercourse Crossings

A potential roost inspection was carried out on all watercrossing features within the main wind farm site, the grid connection and the TDR. These are shown in section 4-5 of the Bat Report Appendix 8.4. Of the 20 features identified, 2 had medium potential, 2 had medium-high roosting potential, and 1 had low potential. The fifteen remaining were assessed as being of negligible potential. The results of the survey are outlined in Table 8-40.

Table 8-40: Bat roosting potential of watercrossing features

Map ID	Feature ID *GCR: Grid connection route; WF: Wind Farm*	X	Y	Notes	Potential
1	GCR - WCC3	679106.23	670049.96	3-arched stone bridge over small river, good number of holes, relatively dry for the most part, access under the bridge was impeded due to deep water.	Medium-high
2	GCR - WCC4	679529.51	670126.11	Pre-cast concrete, well-sealed.	Negligible
3	GCR - WCC6	680437.80	662507.73	Small aperture/calibre stone arch with some holes, however it may be liable to inundation during flood events.	Low
4	GCR - WCC7	681594.32	659057.55	Stone-arched bridge, well-sealed, joints all pointed in the recent past	Negligible
5	GCR - WCC8	682104.92	660852.71	Stone-arched bridge, well-sealed	Negligible
6	GCR - WCC9	679800.83	670511.25	No structure present.	Negligible
7	WF- HF1	684134.40	657002.30	Drainage pipe with no potential for bats.	Negligible
8	WF- HF2	684966.20	657245.00	Drainage pipe with no potential for bats.	Negligible
9	WF- HF3	684364.60	657798.00	Drainage pipe with no potential for bats.	Negligible
10	WF- HF4	684318.80	657803.70	Drainage pipe with no potential for bats.	Negligible
11	WF- HF5	684309.10	658018.90	Drainage pipe with no potential for bats.	Negligible
12	WF- HF6	684049.30	658136.50	Drainage pipe with no potential for bats.	Negligible

Map ID	Feature ID *GCR: Grid connection route; WF: Wind Farm*	X	Y	Notes	Potential
13	Barkers Bridge (TDR)	690514.49	656829.63	Double-arched bridge. Arches 10m apart; one arch is 2.1m wide, the other is 2.3m wide and with overall heights of 1.4m and 1.9m respectively. Lots of suitable holes where mortar has come loose, however, the bridge is damp in places.	Medium-high
14	Clashahilligh Bridge (TDR)	687312.18	655579.1	Single-span stone arch. 3.1m wide at bed level with an overall height of 3.35m, some suitable open holes on the arch barrel, and also some cracks on the south facing spandrel, generally quite dry.	Medium
15	Scratoes Bridge (TDR)	685757.76	656132.22	The northern half of the bridge is stone with medium potential due to the presence of small holes. The southern half of the bridge is pre-cast concrete and is well-sealed with no potential for bats.	Medium
16	Kilbranish Bridge (TDR)	684096.75	656878.82	Single-span bridge of 2.15m constructed reinforced concrete slab bearing on reinforced concrete buttresses.	Negligible
17	Bridge (TDR)	683566.04	656842.75	Small aperture/calibre bridge sitting low within its surrounds, bridge infilling with sediment and likely to become inundated during floods	Negligible
18	GCR - WCC2	679095.99	670297.35	Small aperture/calibre bridge	Negligible
19	WF - HF7	684014.7	658251.3	Drainage pipe with no potential for bats.	Negligible
20	WF - HF8	683968.8	658331.4	Drainage pipe with no potential for bats.	Negligible

8.3.7.7 Static Detector Surveys (2019)

The results of the static detector surveys deployed over three rounds are shown below.

Eight species of bats were recorded with a total of 40,523 recordings over the 53 nights of surveys. The most commonly recorded species was common pipistrelle, followed by soprano pipistrelle, and Leisler's.

Much lower levels of activity of Brown Long-eared Bat, Daubenton's Bat, Nathusius' Pipistrelle, Natterer's Bat, and Whiskered Bat were detected. Brown Long-eared Bat is present on-site, but this species is very quiet and sometimes hunts without echolocating, so it may be under-recorded by the static detectors.

Table 8-41: Results from 2019 Static Detector Recordings

Common Name	Species	No. of recordings	% Total Recordings
Brown Long-eared Bat	*Plecotus auritus*	316	0.78%
Common Pipistrelle	*Pipistrellus*	30832	76.09%
Daubenton's Bat	*Myotis daubentonii*	397	0.98%
Leisler's Bat	*Nyctalus leisleri*	3203	7.90%
Nathusius' Pipistrelle	*Pipistrellus nathusii*	384	0.95%
Natterer's Bat	*Myotis nattereri*	48	0.12%
Soprano Pipistrelle	*Pipistrellus pygmaeus*	4958	12.24%
Whiskered Bat	*Myotis mystacinus*	385	0.95%
Total		**40523**	

Brown Long-eared Bat

The total number of recordings for brown long-eared bat at Croaghaun was 316 no. recordings; 0.78% of total recordings. These were recorded over 53 no. nights which gives an average of 5.96 no. recordings per night.

Common Pipistrelle

The total number of recordings for common pipistrelle at Croaghaun was 30832no. recordings; 76.09% of total recordings. These were recorded over 53 no. nights which gives an average of 581.74no. recordings per night.

Daubenton's Bat

The total number of recordings for Daubenton's bat at Croaghaun was 397no. recordings; 0.98% of total recordings. These were recorded over 53 no. nights which gives an average of 7.49no. recordings per night.

Leisler's Bat

The total number of recordings for Leisler's bat at Croaghaun was 3203no. recordings; 7.90%of total recordings. These were recorded over 53 no. nights which gives an average of 60.43no. recordings per night.

Nathusius' Bat

The total number of recordings for Nathusius' Bat at Croaghaun was 384no. recordings; 0.95% of total recordings. These were recorded over 53 no. nights which gives an average of 7.25 no. recordings per night.

Natterer's Bat

The total number of recordings for Natterer's bat at Croaghaun was 48 no. recordings; 0.12% of total recordings. These were recorded over 53 no. nights which gives an average of 0.91no. recordings per night.

Soprano Pipistrelle

The total number of recordings of soprano pipistrelle recorded at Croaghaun was 4958 no. recordings; 12.24% of total recordings. These were recorded over 53 no. nights. This gives an average of 93.55 no. recordings per night.

Whiskered Bat

The total number of recordings for whiskered bat at Croaghaun was 385 no. recordings; 0.95% of total recordings. These were recorded over 53 no. nights which gives an average of 7.26 no. recordings per night.

8.3.7.8 Ecobat analysis

The static data, as per tables listed in Appendices, was uploaded and analysed using the Ecobat tool. This analysis was undertaken for each survey period separately. Where groups of detectors were deployed for different dates within a survey period, those that were deployed for the same dates were analysed together (details are provided for each survey period below). The reference range datasets were stratified to include:

- Only records from within 30 days of the survey date.
- Only records from within 100 km^2 of the survey location.
- Records using any make of bat detector.

The Ecobat tool provides are series of summary tables to enable analysis of the bat activity level at each static location.

These are presented below, and categorisation of activity level is based on the following table:

Table 8-42: Percentile Score and Categorised Level of Bat Activity (SNH, 2019)

Percentile	Bat Activity
81 to 100	High
61 to 80	Moderate to High
41 to 60	Moderate
21 to 40	Low to Moderate
0 to 20	Low

Table 8-43: ID used for detector locations

Turbine No .	Bat Box Location No.
N/A	C2
N/A	C3
T1	C9

Turbine No .	Bat Box Location No.
T2	C5
T3	C4
T4	C7
T5	C6
T6	C8
T7	C11

Table 8-44: Ecobat Analysis combined summer/autumn 2019 data per species/per turbine

Turbine ID	Bat Detector ID	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity
N/A	C2	*Myotis daubentonii*	0	0	0	0	15	0	Low
N/A	C2	*Myotis mystacinus*	0	0	0	0	15	0	Low
N/A	C2	*Myotis nattereri*	0	0	0	0	15	0	Low
N/A	C2	*Nyctalus leisleri*	0	2	4	2	7	32	Low to Moderate
N/A	C2	*Pipistrellus nathusii*	0	0	0	0	15	0	Low
N/A	C2	*Pipistrellus pipistrellus*	0	0	1	1	13	0	Low
N/A	C2	*Pipistrellus pygmaeus*	0	0	0	0	15	0	Low
N/A	C2	*Plecotus auritus*	0	0	0	0	15	0	Low
N/A	C3	*Myotis daubentonii*	0	0	0	0	15	0	Low
N/A	C3	*Myotis mystacinus*	0	0	0	0	15	0	Low
N/A	C3	*Myotis nattereri*	0	0	0	0	15	0	Low
N/A	C3	*Nyctalus leisleri*	0	1	2	0	12	0	Low
N/A	C3	*Pipistrellus nathusii*	0	0	2	1	12	0	Low
N/A	C3	*Pipistrellus pipistrellus*	0	0	4	1	10	15	Low

Turbine ID	Bat Detector ID	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity
N/A	C3	*Pipistrellus pygmaeus*	0	0	0	0	15	0	Low
N/A	C3	*Plecotus auritus*	0	0	0	0	15	0	Low
T3	C4	*Myotis daubentonii*	0	0	1	2	12	0	Low
T3	C4	*Myotis mystacinus*	0	0	0	1	14	0	Low
T3	C4	*Myotis nattereri*	0	0	0	0	15	0	Low
T3	C4	*Nyctalus leisleri*	0	1	6	2	6	32	Low to Moderate
T3	C4	*Pipistrellus nathusii*	0	0	0	1	14	0	Low
T3	C4	*Pipistrellus pipistrellus*	0	2	3	0	10	0	Low
T3	C4	*Pipistrellus pygmaeus*	0	0	0	0	15	0	Low
T3	C4	*Plecotus auritus*	0	0	0	0	15	0	Low
T2	C5	*Myotis daubentonii*	1	0	4	2	8	15	Low
T2	C5	*Myotis mystacinus*	0	3	4	3	5	32	Low to Moderate
T2	C5	*Myotis nattereri*	0	0	1	0	14	0	Low
T2	C5	*Nyctalus leisleri*	0	0	3	2	10	15	Low
T2	C5	*Pipistrellus nathusii*	0	0	0	0	15	0	Low

Turbine ID	Bat Detector ID	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity
T2	C5	*Pipistrellus pipistrellus*	4	6	2	1	2	66	Moderate to High
T2	C5	*Pipistrellus pygmaeus*	0	0	0	0	15	0	Low
T2	C5	*Plecotus auritus*	0	0	0	0	15	0	Low
T5	C6	*Myotis daubentonii*	0	0	1	0	14	0	Low
T5	C6	*Myotis mystacinus*	0	0	3	1	11	0	Low
T5	C6	*Myotis nattereri*	0	0	0	1	14	0	Low
T5	C6	*Nyctalus leisleri*	0	0	3	4	8	15	Low
T5	C6	*Pipistrellus nathusii*	0	0	0	0	15	0	Low
T5	C6	*Pipistrellus pipistrellus*	11	2	2	0	0	88	High
T5	C6	*Pipistrellus pygmaeus*	0	1	1	2	11	0	Low
T5	C6	*Plecotus auritus*	0	0	2	1	12	0	Low
T4	C7	*Myotis daubentonii*	0	1	2	1	11	0	Low
T4	C7	*Myotis mystacinus*	1	1	4	1	8	15	Low
T4	C7	*Myotis nattereri*	0	0	0	0	15	0	Low
T4	C7	*Nyctalus leisleri*	0	1	1	0	13	0	Low

Turbine ID	Bat Detector ID	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity
T4	C7	*Pipistrellus nathusii*	0	0	0	0	15	0	Low
T4	C7	*Pipistrellus pipistrellus*	9	1	0	0	5	94	High
T4	C7	*Pipistrellus pygmaeus*	0	0	2	0	13	0	Low
T4	C7	*Plecotus auritus*	0	0	0	0	15	0	Low
T6	C8	*Myotis daubentonii*	0	1	1	1	12	0	Low
T6	C8	*Myotis mystacinus*	0	0	0	1	14	0	Low
T6	C8	*Myotis nattereri*	0	0	0	0	15	0	Low
T6	C8	*Nyctalus leisleri*	0	2	4	1	8	15	Low
T6	C8	*Pipistrellus nathusii*	0	3	1	3	8	15	Low
T6	C8	*Pipistrellus pipistrellus*	9	5	1	0	0	87	High
T6	C8	*Pipistrellus pygmaeus*	0	0	1	0	14	0	Low
T6	C8	*Plecotus auritus*	0	0	1	2	12	15	Low
T1	C9	*Myotis daubentonii*	0	0	0	1	14	0	Low
T1	C9	*Myotis mystacinus*	0	0	0	0	15	0	Low
T1	C9	*Myotis nattereri*	0	0	0	0	15	0	Low

Turbine ID	Bat Detector ID	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity
T1	C9	*Nyctalus leisleri*	0	0	2	3	10	15	Low
T1	C9	*Pipistrellus nathusii*	0	0	1	0	14	0	Low
T1	C9	*Pipistrellus pipistrellus*	0	4	4	1	6	41	Moderate
T1	C9	*Pipistrellus pygmaeus*	0	0	0	0	15	0	Low
T1	C9	*Plecotus auritus*	0	0	0	2	13	0	Low
T7	C11	*Myotis daubentonii*	0	0	0	0	15	0	Low
T7	C11	*Myotis mystacinus*	0	0	0	0	15	0	Low
T7	C11	*Myotis nattereri*	0	0	0	0	15	0	Low
T7	C11	*Nyctalus leisleri*	0	0	5	2	8	15	Low
T7	C11	*Pipistrellus nathusii*	0	0	0	0	15	0	Low
T7	C11	*Pipistrellus pipistrellus*	0	0	3	2	10	15	Low
T7	C11	*Pipistrellus pygmaeus*	0	0	2	1	12	0	Low
T7	C11	*Plecotus auritus*	0	0	0	0	15	0	Low

Table 8-45 provides a summary of the bat assessment. It outlines whether a bat species identified for the desktop study was subsequently recorded within the main wind farm site and grid route during the bat surveys that took place in 2019 and 2020.

Table 8-45: Bat Survey Summary Results

Bat Species	Desktop Study (NBDC and NPWS)	2019 Activity Surveys	2019 Static Detector Surveys	2019/2020 Roost Surveys
Brown long-eared bat	X	✓	✓	X
Common pipistrelle	✓	✓	✓	X
Daubenton's bat	✓	✓	✓	X
Leisler's bat	✓	✓	✓	X
Nathusius' bat	X	X	✓	X
Natterer's bat	X	X	✓	X
Soprano pipistrelle	✓	✓	✓	X
Whiskered bat	X	✓	✓	X

8.3.8 Avifauna

8.3.8.1 Desk Study

A desktop study was undertaken to locate any records of rare or protected avian species that have previously been recorded for the study site and the surrounding area. Examination of NPWS and NBDC records indicates that there is a total of 54 species of ecological importance recorded historically in the 10 km grid square (S85) which overlaps the study area and are listed in Table 8-46, below. These species are comprised of 17 that are on the current Birds of Conservation Concern in Ireland (BoCCI) red list (Colhoun and Cummins, 2013) and 30 are on the BoCCI amber list (Colhoun and Cummins, 2013). Seven of the species are Annex I species of the EU Birds Directive (EC, 2009). Five are species which are not rare (Red or Amber listed) or protected under Annex I (Habitats Directive) but have been included as they are indicator/keystone species and/or may be sensitive to wind farm development; namely Common Buzzard (*Buteo buteo*), Eurasian Sparrowhawk (*Accipiter nisus*), Long-eared Owl (*Asio otus*), White-throated Dipper (*Cinclus cinclus*) and Heron (*Ardea cinerea*). Please note that Peregrine Falcon was not included in the grid square data (S85) but included as additional information from NPWS who advised that they hold a record of a Peregrine falcon nest 5-10km from the centre of the main wind farm site and this nest was recorded as occupied in the 2017 National Peregrine Survey.

Three of the avian species are historic records dating from 1972 for rare/protected species, namely Corn Crake (*Crex crex*), Hen Harrier (*Circus cyaneus*) and Ring Ouzel (*Turdus torquatus*). No invasive avian species were recorded within the overlapping grid square (S85).

Table 8-46: Rare and Protected species of avifauna recorded historically within the 10km squares (S85) in which the subject site is located[8]

Species	Year of last record	BoCCI status	Annex I status
Barn Swallow *Hirundo rustica*	23/05/2015	Amber	No
Black-headed Gull *Larus ridibundus*	23/05/2015	Red	No
Common Buzzard *Buteo buteo*	27/08/2017	Green	No
Common Goldeneye *Bucephala clangula*	31/12/2011	Red	No
Common Kestrel *Falco tinnunculus*	12/07/2015	Amber	No
Common Kingfisher *Alcedo atthis*	**31/12/2011**	**Amber**	**Yes**
Common Linnet *Carduelis cannabina*	23/05/2015	Amber	No
Common Pochard *Aythya ferina*	31/12/2011	Red	No
Common Sandpiper *Actitis hypoleucos*	31/12/2011	Amber	No
Common Snipe *Gallinago gallinago*	18/06/2017	Amber	No
Common Starling *Sturnus vulgaris*	23/05/2015	Amber	No
Common Swift *Apus apus*	23/05/2015	Amber	No
Corn Crake *Crex crex*	**31/07/1972**	**Red**	**Yes**
Eurasian Curlew *Numenius arquata*	31/12/2011	Red	No
Eurasian Sparrowhawk *Accipiter nisus*	09/06/2013	Green	No
Eurasian Teal *Anas crecca*	31/12/2011	Amber	No
Eurasian Wigeon *Anas penelope*	31/12/2011	Red	No
Eurasian Woodcock *Scolopax rusticola*	31/12/2011	Red	No
European Greenfinch *Carduelis chloris*	23/05/2015	Amber	No
European Robin *Erithacus rubecula*	12/07/2015	Amber	No
Goosander *Mergus merganser*	31/12/2011	Amber	No
Great Black-backed Gull *Larus marinus*	23/05/2015	Amber	No
Great Cormorant *Phalacrocorax carbo*	31/12/2011	Amber	No
Great Crested Grebe *Podiceps cristatus*	31/12/2011	Amber	No
Great Spotted Woodpecker *Dendrocopos major*	23/05/2015	Amber	No
Grey Heron *Ardea cinerea*	23/05/2015	Green	No
Grey Wagtail *Motacilla cinerea*	31/12/2011	Red	No
Hen Harrier *Circus cyaneus*	**31/07/1972**	**Amber**	**Yes**
Herring Gull *Larus argentatus*	31/12/2011	Red	No

[8] Colours correspond to BoCCI conservation status and Annex I species are shown in bold.

Species	Year of last record	BoCCI status	Annex I status
House Martin *Delichon urbicum*	02/10/2016	Amber	No
House Sparrow *Passer domesticus*	26/05/2013	Amber	No
Lesser Black-backed *Gull Larus fuscus*	23/05/2015	Amber	No
Little Egret *Egretta garzetta*	**31/12/2011**	**Green**	**Yes**
Little Grebe *Tachybaptus ruficollis*	31/12/2011	Amber	No
Long-eared Owl *Asio otus*	31/12/2011	Green	No
Meadow Pipit *Anthus pratensis*	23/05/2015	Red	No
Mute Swan *Cygnus olor*	23/05/2015	Amber	No
Northern Lapwing *Vanellus vanellus*	31/12/2011	Red	No
Northern Shoveler *Anas clypeata*	31/12/2011	Red	No
Northern Wheatear *Oenanthe oenanthe*	31/12/2011	Amber	No
Peregrine Falcon *Falco peregrine*	**2017**	**Green**	**Yes**
Red Grouse *Lagopus lagopus*	31/12/2011	Red	No
Ring Ouzel *Turdus torquatus*	31/07/1972	Red	No
Sand Martin *Riparia riparia*	23/05/2015	Amber	No
Short-eared Owl *Asio flammeus*	**31/12/2011**	**Amber**	**Yes**
Sky Lark *Alauda arvensis*	23/03/2016	Amber	No
Spotted Flycatcher *Muscicapa striata*	29/05/2014	Amber	No
Stock Pigeon *Columba oenas*	23/05/2015	Amber	No
Stonechat *Saxicola torquata*	23/05/2015	Amber	No
Tufted Duck *Aythya fuligula*	31/12/2011	Red	No
Whinchat *Saxicola rubetra*	31/12/2011	Red	No
White-throated Dipper *Cinclus cinclus*	31/12/2011	Green	No
Whooper Swan *Cygnus cygnus*	**31/12/2011**	**Amber**	**Yes**
Yellowhammer *Emberiza citrinella*	23/05/2015	Red	No

8.3.8.2 Target Species Observations (Flight Activity Surveys)

As per the SNH (2017) the site for the purposes for the flight activity surveys (Vantage Point surveys) is defined not by the planning boundary of the study are for the main wind farm site but by a 500m radius circle (buffer) around the proposed wind turbines locations. The proposed turbine locations form the centre point of each of these 500m radius buffers. This study area is called the '**flight activity survey area**' and is unique to this survey type. Any target species passing with this 500m buffer from proposed turbine locations (flight activity survey area) is considered within the main wind farm site under the SNH (2017) guidance.

8.3.8.3 Merlin

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

Merlin (*Falco columbarius*) is an Amber listed raptor species which is also Annex I listed. There was a single sighting during Winter 2017/2018 VP surveys. On the 28th March 2018 an immature bird flew past the VP1 heading in a north easterly direction away from the main wind farm site. The flight path was within the flight activity survey area.

There was just one sighting of Merlin during the winter 2019/2020 VP surveys. An adult male was observed in an area southeast of VP2 on the 28th October 2019. The bird flew in from the southwest, hunting over moorland before moving in a north-easterly direction and out of sight. There were no further sightings of Merlin for the remainder of the season.

Vantage Point Surveys Summer Season 2018, 2019

There were two separate sightings of Merlin both occurring in April 2019 at VP6. On the 17th April 2019 an adult male and female were both observed flying into and out of forestry to the south of VP6. They were constantly calling to each other and at times perching on a post located between a field and area of clear fell. Copulation was eventually witnessed on a field post. On the 20th April 2019 an adult male bird emerged from the same area of forestry to the south of VP6 and circled the area. It later perched on a post to the southwest of VP6 for 7 minutes. Calling between two Merlin was also heard from within the forest. There were no further sightings of Merlin for the remainder of the season.

2017/2018 Winter Walkover Survey

During the winter walkover survey there was no evidence Merlin.

Breeding Wader/Raptor Walkover Surveys, Summer 2018, 2019

On 17th April 2019 a Merlin pair seen copulating at VP6 strongly suggested that the birds were breeding in the area. However, there were no signs of the pair for the rest of the season and it was surmised that they had been migrating at the time of observation in April.

8.3.8.4 Buzzard

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

Buzzard were recorded on several occasions throughout the flight activity survey area during the 2017/2018 winter season. A total of 6 flight-lines of Buzzard were recorded over the survey period. The majority of flights occurred within the flight activity survey area. Two flights occurred within the flight activity survey area. The majority of sightings were of single birds. Buzzards were heard calling to the south-west of VP1 in second rotation forest and rough grassland. On the following day a Buzzard was heard calling, possibly to the south-east of VP2 in forestry however dense fog prevented an observation being made. On the 30th March 2018 three Buzzards were observed flying together over heather moorland, second rotation forestry and rough grassland north of VP4 moving in a south- easterly direction before flying out of view to the east. On the following day three Buzzards were observed circling to the west of VP3. They then flew north while continuing to circle before heading off in a northerly direction over heather moorland and second rotation forestry.

Buzzard were recorded regularly throughout the flight activity survey area during the 2018/2019 season, every month with the exception of January and February. A total of 14 flight-lines of Buzzard were recorded over the winter survey period. Flights occurred both within the main wind farm site and the flight activity survey area.

The majority of sightings were of single birds although groups of 2 and 3 birds flying together were also observed. In late October a Buzzard was seen soaring over improved grassland during VP2. At the end of November two Buzzards were observed to the north-east of VP6 circling over 2nd rotation forestry. Later on, the same day a single bird was seen further to the northeast circling and hunting over forestry and improved grassland before heading east. In mid- December a Buzzard was observed on the ground to the south-west of VP2. After being mobbed by hooded crows it flew off east before heading west. The following day a Buzzard was briefly observed flying west over forestry to the north-east of VP6.

In the last two weeks of March 2019 multiple sightings of Buzzards were recorded. On the 20/03/19 three Buzzards were observed soaring together to the south-east of VP2 before drifting north-west. One individual was seen later during the VP in the same area (possibly one of the same birds as earlier); however, this bird drifted north-east. Two Buzzards (likely pair) were seen east of VP3 on the same day. A single bird was also seen to the north of VP4. On the following day a Buzzard was observed during VP2 circling and hunting over grassland and heather moorland. During VP1 a female was observed to the north-east of the VP. This bird was joined by a male and second female. Display behaviour was observed between the first male and the first female. The second female was considered to be an immature bird, likely last season's fledgling. A Buzzard was also recorded during VP4 on the 22nd March 2019. On the 31st March 2019 a Buzzard was observed on a fencepost at the start of VP5 before it moved off eastwards. Later on, the same day a Buzzard was observed flying over 2nd rotation forestry during VP6. This individual flew in an easterly direction over improved grassland.

Buzzard was the most frequently observed target species during the 2019/2020 winter VP surveys and were recorded regularly from all VP locations during every month. Approximately 50% of sightings involved two or more birds flying and/or circling together. There were fewer flights in the earlier survey months and more activity reported into the spring with thirteen flights occurring in February, and eleven occurring in March. On the 28th October 2019 two individuals were seen hunting, hovering and hanging in the wind over forestry and moorland in an area directly east of VP1. On the 9th December 2019, an individual landed in a conifer tree to the northeast of VP2 and remained perched there for 24 minutes. A Buzzard was heard calling from VP1 during the survey on the 16th 2019 December but the exact location of the bird could not be ascertained. On a number of occasions over a period of approximately six minutes on the 16th December 2019, two individuals were observed flying and circling over moorland and grassland in an area south-southeast of VP2. One bird perched in a stand of Gorse before the other swooped down to it and they both flew west.

There were seven separate observations of Buzzard in January 2020. On the 27th January an adult was seen in an area to the east of VP1 hunting and circling over forestry before being mobbed by a Sparrowhawk. The Buzzard was joined briefly by three other Buzzards as it slowly flew south circling over fields and eventually drifting southeast while the other three Buzzards flew east. There was an increase in Buzzard activity at the flight activity survey area in February and March 2020. On the 24th February three adults were observed flying over an area of grassland, heath and forestry southeast of VP3 moving west. Three adults were also reported circling, flying and diving at each other over grassland southwest of VP5 on the 26th February. A pair of adults was seen flying over forestry to the east of VP6 on the 18th March, and approximately one hour later four adult Buzzard were observed flying from east to west over an area of forestry and clear-fell located to the north of VP6. On the 24th March, a male and female pair was seen flying over grassland and forestry northwest of VP5. They slowly weaved their way from east to west displaying and hunting as they went.

Vantage Point Surveys Summer Season 2018, 2019

Buzzard was recorded regularly and at all VP locations throughout the flight activity survey area during the 2018 summer season. A total of 18 flight-lines of Buzzard were recorded over the survey period, the majority of which were located within the flight activity survey area. A total of three flight paths occurred within the main wind farm site. The majority of sightings were of 1-2 birds hunting and circling.

There was one instance when 4 birds, comprising two adults and two juveniles, were recorded together at the one time in late September. Display behaviour was observed from VP6.

Buzzard were recorded regularly at all VP locations during the 2019 summer season during all months except July. A total of 23 flight-lines for Buzzard were recorded, nearly half of which occurred in August. There was a bird observed perched southeast of VP2 for 10 minutes without any flight. The majority of sightings in April and May were of 2 birds flying and/or circling together. There was one instance of probable display behaviour observed between two birds during April in forestry to the north of VP5. All flights after May occurred over either grassland or moorland, or both, and were only higher than 50 metres on three occasions – once at more than 200 metres, another at 70 metres, and another at 90 metres.

During August 2019, Buzzard were observed on 11 separate occasions - 10 times from VP2 and once from VP6. Around VP2 there was a notable increase of Buzzard activity, particularly to the south, and on the 26th August 2019 alone there were seven flights recorded at VP2 where Buzzards were seen flying, perching, circling, and hunting. Two days later on the 28th August 2019, a Buzzard was observed diving and pursuing a Kestrel at VP2.

Breeding Wader/Raptor Walkover Surveys, Summer 2018, 2019

During 2018 surveys a total of three pairs of Buzzard were estimated to be holding territory within a 2km radius of the main wind farm site. These pairs likely bred within the study area. Approximate locations of these territories can be seen in Appendix 8.2. Buzzard was not recorded nesting within the main wind farm site. Display behaviour by Buzzards was recorded from VP6.

During the 2019 surveys Buzzard observations were frequent, particularly at VP2, most sightings related to birds using the area solely to hunt. An area around T1, T2 and T3 to the far west of the main wind farm site provided the only possible evidence for Buzzards holding territory in the area. Possible display behaviour by two Buzzards was reported here in April along with multiple sightings in the following months suggesting breeding may have occurred.

8.3.8.5 Peregrine Falcon

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

There were three sightings of Peregrine during the 2017-2018 winter season. All flights occurred within the flight activity area. Two of the flights occurred within the main wind farm site. On the 21st September 2017 an adult female was observed being mobbed by Ravens north of VP5 over a stand of Scots Pine. This bird drifted east towards the flight activity survey area over both young and mature forestry. On the 31st October 2017 during VP4 an adult male was recorded heading west through the flight activity survey area towards Mount Leinster. On the 28th November 2017, a Peregrine was observed to the northwest of VP4 flying in a southerly direction through the flight activity survey area.

There were three sightings in total of Peregrine in flight during the 2018/2019 winter bird surveys. Two of these occurred within the flight activity survey area.

On 30th November 2018 a Peregrine was recorded during VP5. This bird was seen on multiple occasions during the VP over the same general area of improved grassland being mobbed by ravens. On the 17th December 2018 a Peregrine was seen briefly soaring above thicket during VP6 before moving out of view. On the 21st March 2019 a Peregrine was seen circling and soaring to the south-east of VP1 before it drifted south.

There were four instances of Peregrine during the winter 2019/2020 VP surveys. From VP4 on the 23rd October 2019, a female was observed gliding over fields northwest of VP1 before being mobbed by a Hen Harrier and then leaving the area. On the 29th January 2020 an individual was seen north of VP5 being mobbed by a Raven.

The Peregrine then began mobbing the Raven by repeatedly diving and rising back up to a height of 30 metres before flying south towards VP5.

Vantage Point Surveys Summer Season 2018, 2019

During the 2019 summer season there were two instances where Peregrine was observed. The first at VP6 on 29th July 2019 when a female was observed circling over grassland whilst being mobbed by 15 Swallows (*Hirundo rustica*). The Peregrine then flew at speed, gaining height over forestry and agricultural land southeast of VP6 before soaring south at a height of more than 100 metres. On 28th August 2019 at VP2 a juvenile female was seen moving southwest chasing a Kestrel over heathland.

Breeding Wader/Raptor Walkover Surveys, Summer 2018, 2019

No evidence of breeding Peregrine was observed during walkover surveys, this however is not surprising as no suitable breeding habitat exist on site.

8.3.8.6 Kestrel

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

Kestrel was observed on a regular basis throughout the flight activity survey area over the 2017-18 winter season. In total 20 observations of Kestrels were made. The majority of observations pertained to single birds either hunting or flying although two birds were recorded together on several occasions and on one date three individuals comprising two immature and one adult bird were observed. The majority of flights were recorded within the flight activity survey area. Four of the flights occurred within the main wind farm site.

Kestrels were observed on multiple occasions during the 2018/2019 winter survey period, occurring in every survey month except October and November. In total, 8 observations of Kestrels in flight were made during VP surveys carried out on-site. The majority of Kestrel sightings were made from VP2 although this species was also recorded from VP1 and VP5. The majority of flights were recorded within the flight activity survey area. Only one flight path was recorded within the main wind farm site. All observations pertained to single birds either hunting or commuting.

Kestrel were recorded regularly throughout the flight activity survey area over the winter 2019/2020 period with records from every month and from every VP, with the exception of VP3. In all, 28 observations of Kestrels were made with a peak in activity during November and December 2019. Almost all observations involved a single bird hunting and/or flying, and only one flight reached heights of more than 180 metres. There were many instances of lone Kestrels, both males and females, flying and hunting over moorland, bog, forestry and/or grassland. A female was seen flying over moorland in area northeast of VP1 on the 29th November 2019 while, simultaneously, another female was observed close by on the ground on the same moorland.

All of the eight Kestrel flights that occurred in December involved a lone bird moving over the landscape hovering and hunting by dropping low and then gaining altitude again. On the 16th December a single bird alighted on a conifer tree to the northeast of VP1, remained there for two minutes, and then flew to another tree for two minutes before finally flying off to the south-southwest.

On the 27th January 2020 two adult Kestrels were seen hunting over heathland to the southeast of VP2 while then also mobbing a Buzzard for several minutes. One of the pair was seen again ten minutes later hunting in the same area. Two flights in February, one from VP2 and one from VP5, involved a single bird flying and hunting over moorland and grassland. On the 24th March an adult female was observed hunting over grassland and forestry to the northeast of VP6 where she caught a shrew, perched on a fence post and then flew southeast.

On the 25th March 2020 a single adult Kestrel was seen flying south of VP2 where it was mobbed by Hooded Crows (*Corvus cornix*) and then turned east reaching heights of more than 180 metres.

Vantage Point Surveys Summer Season 2018, 2019

Kestrel was observed on a regular basis throughout the main wind farm site over the 2018 summer period. In total 32 observations of Kestrels in flight were made, the majority of which were located within the flight activity survey area. A total of six flight paths occurred within the main wind farm site. The vast majority of observations pertained to single birds either hunting or flying although two birds were recorded together on several occasions. In mid-August a family party comprising two adults and two juveniles was recorded during VP5 hunting together over farmland, scrub and forestry.

Kestrel was the most frequently observed raptor species throughout the site over the 2019 summer period. In all, 32 observations of Kestrels in flight were made and of these, 13 were at VP1 and 7 were at VP4. The majority of them were located inside the flight activity survey area and six occurred within the main wind farm site. Two observations were made of birds not in flight – one bird perched for 5 minutes at VP1 in April, and another perched for 2 minutes at VP2 in August. The vast majority of observations pertained to single birds hunting, flying or perching, and only one flight reached heights of more than 50 metres. A juvenile was seen alone on four separate occasions – twice in July 2019 at VP6 and VP1, and twice in August 2019 at VP2 and VP3.

Two birds, a female and possibly a juvenile, were recorded together on 22nd July 2019 flying and hovering over areas south and southeast of VP2, while on 26th September 2019 two females were seen hovering and flying near VP5. On 26th July 2019, 3 birds, at least 2 being juveniles, were seen flying and hunting over heath before perching to eat prey, and on 28th August 2019 4 birds, including at least 1 juvenile, were observed hovering in an area to the southeast of VP2. Kestrel were recorded during every month except September, with a marked increase in reported sightings during August 2019 with 15 separate observations.

During the summer 2019 summer period most Kestrel sightings occurred over forest, moorland and/or grassland. Individuals were recorded at all VP’s on at least two occasions.

Breeding Wader/Raptor Walkover Surveys, Summer 2018, 2019

During the 2018 season Kestrel were considered likely to breed in suitable areas surrounding the flight activity survey area such as farmland located south of VP1 and VP5, and woodland located in the north-western corner of the main wind farm site.

During the 2019 season Kestrel was the most frequently observed raptor and were considered likely to breed in suitable spots surrounding the flight activity survey area such as farmland located south of both VP1 and VP5, and woodland located to the northeast of the main wind farm site.

VP1 had a large amount of Kestrel activity, and it is believed birds nested in an area of forestry southeast of VP1 with juveniles being seen in the area in July. An area east of VP4, northeast of VP3 also likely contained a Kestrel nest due to increased activity and sightings of juveniles, suggesting that at least one pair had successfully bred in this area. Figures in Appendix 8.2 indicate the approximate locations of the Kestrel nests.

8.3.8.7 Sparrowhawk

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

Sparrowhawk were observed on several occasions throughout the flight activity survey area over the 2017-2018 winter VP survey period. A total of 11 observations of Sparrowhawks in flight were made. The majority of flights were recorded within the flight activity survey area. There were no flights recorded within the main wind farm site.

Sparrowhawk were recorded twice in-flight over the course of the 2018/2019 winter VP surveys. Both observations were recorded from VP4, one occurring in late January 2019, and one in late March 2019. One flight was recorded within the site boundary; the other was recorded within the flight activity survey area.

During the 2019/2020 winter survey period Sparrowhawk was observed from all VP's apart from VP2 and in all months apart from November. A total of twelve in-flight observations of Sparrowhawk were recorded. All records involved sightings of single birds that were mainly seen over forestry and/or grassland. A male bird was seen flying from the forestry plantation immediately east of VP3 on the 11th December 2019 before disappearing into another conifer stand to the northeast of VP3. Sparrowhawk were observed three times in January 2020 and three times in February 2020. On the 27th January an adult was seen east of VP1 mobbing a Buzzard and then flying north over forestry. An adult female was observed south of VP2 flying north over a pond and grassland on the 25th February and was then seen briefly over an hour later in approximately the same area. On the 25th March an adult was recorded south-southeast of VP2 flying at heights of more than 180 metres being mobbed by a Buzzard.

Vantage Point Surveys Summer Season 2018, 2019

Sparrowhawk was observed on a regular basis from the majority of VP locations during the 2018 summer survey period. A total of 10 in flight observations of Sparrowhawks were made, all of which occurred within the flight activity survey area. A total of three flight paths were recorded within the main wind farm site boundary. All records comprised sightings of single birds.

During the 2019 summer season, Sparrowhawk was observed at VP's 4 and 6 during April and September, and once at VP1 in June. A total of 7 in-flight observations of Sparrowhawks were recorded. All records involved sightings of single birds that were mainly seen over forestry or clear fell with the highest flight being 30 metres. The single sighting in June occurred on the 27th as an adult bird pursued a passerine in area northeast of VP1. Sparrowhawk was noted in flight 4 times at VP4, once on 26th 2019 April and again three times late in September 2019.

Breeding Wader/Raptor Walkover Surveys, Summer 2018, 2019

During the 2018 season one pair of Sparrowhawk are believed to have bred within the south-western corner of the main wind farm site. This pair originally commenced nest-building just outside the main wind farm site boundary close to the car-park at Kilbrannish. Due to felling operations this pair is believed to have subsequently moved northwards into the main wind farm site to breed (refer to Figures in Appendix 8.2).

During the 2019 season possible Sparrowhawk breeding was noted in the area east of VP4 as there was a report of a bird hunting there in April 2019, while in September 2019 there were multiple sightings in the same area. In 2018 a pair originally commenced nest-building just outside the main wind farm site close to the car-park at Kilbrannish. Due to felling operations this pair is believed to have subsequently moved northwards into the main wind farm site to breed.

8.3.8.8 Goshawk

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

There was a single sighting of a Goshawk during the winter 2017-2018 winter VP surveys. This observation occurred to the south-east of the main wind farm site but within the larger flight activity survey area, on the 24th October 2017 at VP1. A female Goshawk was observed chasing an adult male Kestrel into a spruce plantation, emerging a few minutes later. The Goshawk sat on a low tree for approximately two minutes before flying off eastwards out of sight.

She was lost from view near the wood for a time before reappearing and again sitting on a tree. While the female was perched a second bird could be heard calling from the plantation to the west. The observer did not get a visual on this second Goshawk, it was only heard calling.

Vantage Point Surveys Summer Season 2018, 2019

Goshawk was not recorded during summer VP surveys.

Breeding Wader/Raptor Walkover Surveys, Summer 2018, 2019

No evidence of breeding Goshawk was observed during walkover surveys.

8.3.8.9 Golden Plover

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

There was one record of Golden Plover during the 2017-18 winter VP surveys. On the 31st March 2018 a flock of twenty-two Golden Plover was observed to the south-west of VP5 flying over heather moorland and second rotation forestry towards the flight activity survey area. This flock headed in a north-easterly direction over the site.

There was one observation of Golden Plover during the 2019/2020 winter VP surveys. On the 25th March 2020 a group of seven adults were seen flying in from the north heading southwards past VP2 and through the flight activity survey area gaining height before eventually turning east.

Vantage Point Surveys Summer Season 2018, 2019

Golden Plover were nor observed during summer VP surveys.

2017/2018 Winter Walkover Survey

During the winter walkover survey conducted within the study area here was no evidence Golden Plover.

Red Grouse and Golden Plover Walkover Surveys 2019/2020

The three walkover surveys carried out in February 2020 did not find evidence of Golden Plover.

Breeding Wader/Raptor Walkover Surveys, Summer 2018, 2019

No evidence of breeding Golden Plover was observed during walkover surveys.

8.3.8.10 Black-headed Gull

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

During the 2017-18 winter VP survey period there were sporadic records of Black-headed Gull. On two dates in late January 2018 Black-headed Gulls were observed to the south of VP2. They landed in improved grassland where they were observed feeding with Lesser Black-backed Gulls. They occasionally moved around these fields to forage. There were no records of Black-headed Gulls in-flight within the main wind farm site.

Black-headed Gull was recorded on one occasion in late January during the 2018/2019 winter survey period. A total of 37 birds were observed feeding from VP1. No flight paths were recorded.

There were three observations of Black-headed Gull reported during the winter 2019/20 VP surveys and all were seen in areas south VP2. Two individuals were observed throughout the three hour survey in a field with other species on the 16th December 2019.

A group of ninety birds was seen flying west at heights of up to fifty metres on the 27th January 2020. Similarly, on the 25th February 2020 a flock of 100 individuals was observed feeding on the ground in a field for twenty minutes before they rose up and began flying west, gaining height and eventually reaching a height of more than 180 metres.

Vantage Point Surveys Summer Season 2018, 2019

Black-headed Gull was not observed during summer VP surveys.

Breeding Wader/Raptor Walkover Surveys, Summer 2018, 2019

No evidence of breeding Black-headed Gull was found during walkover surveys.

8.3.8.11 Herring Gull

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

During the 2017/2018 winter survey period Herring Gull was recorded in very low numbers during surveys at VP2 in November and December 2017. One individual was observed in early November while two were recorded in mid-December.

During the 2018/2019 winter survey season there was one sighting of Herring Gull. Three birds were observed during VP6 in mid-December 2018.

Herring Gull was observed on one occasion in during the winter of 2019/20. On the 27th January 2020 a pair of adults was seen flying west over an area of forestry and fields located northeast of VP1.

Vantage Point Surveys Summer Season 2018, 2019

There were two Herring Gull sightings in the flight activity survey area in the summer of 2019. Firstly, one was seen at VP3 flying northwest over heath on 24th May 2019, and was likely to be a bird displaying a 3rd summer plumage although the observer could not be certain. Secondly, an adult was seen on 25th June at VP2 circling over improved grassland. In both cases the bird was alone.

Breeding Wader/Raptor Walkover Surveys, Summer 2018, 2019

No evidence of breeding Herring Gull was found during walkover surveys which is to be expected as the species breeds in coastal colonies.

8.3.8.12 Hen Harrier

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

Hen Harrier (*Circus cyaneus*) was only observed during the 2019/2020 winter VP surveys. There were four sightings of Hen Harrier and all occurred at the end of October 2019. On the 23rd October, a female was observed east of VP4 moving northeast, gliding and diving over fields and moorland before eventually mobbing a peregrine. The remaining three hen harrier sightings occurred from VP1 on the 28th October 2019. The first two observations took place three minutes apart from each other and involved the same adult male in an area east of VP1. Each time the bird hunted by quartering low to the ground over heather moorland before flying away to the northwest. The third observation on the 28th October 2019 also concerned an adult male that flew and hunted from west to east over clear-fell and forestry in an area northeast of VP1.

Vantage Point Surveys Summer Season 2018, 2019

During the 2018 summer survey period there was a single sighting of Hen Harrier. This occurred on 25th April 2018 when an adult female was observed emerging from second rotation forestry and clearfell located to the north-west of VP4 (within the eastern section of the flight activity survey area). This individual travelled south-east through the flight activity survey area past VP4 and out of sight.

Breeding Wader/Raptor Walkover Surveys, Summer 2018, 2019

No evidence of breeding Hen Harrier was found during walkover surveys

Habitat Site Walkover

During the habitat walkover survey undertaken between 18th – 19th June 2019, Hen Harrier was observed in flight outside the southern boundary of the main wind farm site.

8.3.8.13 Red Kite

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

Red Kite was not observed during winter season VP surveys.

Vantage Point Surveys Summer Season 2018, 2019

During the 2018 summer survey period there was a single sighting of a Red Kite in flight at the flight activity survey area. This sighting occurred on the 25th July 2018 when a Red Kite was observed hunting over marginal farmland and forestry as it travelled southwards to the east of VP1 within the flight activity survey area.

During the 2019 summer survey period there were four sightings of Red Kite in the flight activity survey area. The first occurred on the 20th May 2020 when a bird was observed flying over heather moorland and forestry as it travelled south-eastwards, passing close by VP3 within the flight activity survey area. Three further sightings were reported from VP2 on 26th August 2019. A bird was seen flying over heath and grassland in an area to the southeast of VP2. Shortly after a bird was seen hunting over heath, rising and then dropping to catch prey. Finally, 10 minutes later a bird was seen flying west and out of sight at a height of 40 metres.

Breeding Wader/Raptor Walkover Surveys, Summer 2018, 2019

No evidence of breeding Red Kite was found during walkover surveys, which would be expected as breeds along the east coast of Ireland.

8.3.8.14 Curlew

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

Curlew was not observed during winter season VP surveys.

Vantage Point Surveys Summer Season 2018, 2019

There was a single record of Curlew throughout the summer 2018 bird surveys. On the 27th July 2018 a Curlew was heard calling as it flew by close to VP2 (within the flight activity survey area). No actual flight path was observed; however, an approximate flight path was estimated given the close proximity to the surveyor as it flew by. Given the timing of this single record it is considered that this sighting likely comprised an individual moving south through the area from summer breeding grounds elsewhere, possibly the Midlands.

Breeding Wader/Raptor Walkover Surveys, Summer 2018, 2019

With regards to breeding waders, no evidence was found during the walkover surveys carried out within the flight activity survey area. Curlew was the only species of wader recorded within the survey area over the course of the 2018 summer period (single record of a Curlew recorded during a VP survey - see above). The survey area in general is not considered to contain suitable breeding habitat for this species and the were no records of the species during the 2019 surveys.

8.3.8.15 Woodcock

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

During the 2019/2020 winter VP survey period there was one incidental sighting of a single Woodcock when it was flushed from a stream/drain beside a track southwest of VP4 as the surveyor passed by on the 26th February 2020 before the survey began. There were no observations in 2017/2018 or 2018/2019.

Vantage Point Surveys Summer Season 2018, 2019

There were three observations of Woodcock during the summer 2019 VP surveys with all three occurring from VP5 in June after 22.00. On 20th June 2019 an adult male was seen flying over forestry from north to south. On the 24th June 2019 there were two sightings of Woodcock flying over forestry. Firstly, at 22.12, a roding adult male flew south in area to east of VP5. Three minutes later an adult male was also observed roding and flying northwest of VP5.

Breeding Wader/Raptor Walkover Surveys, Summer 2018, 2019

During the 2019 walkover survey a Woodcock was heard calling and was observed briefly flying around near VP2 at approximately 1am on the 27th June 2018 (see map in Figures in Appendix 8.2 for Woodcock location).

Breeding Woodcock and Nightjar Survey Summer 2019

The nocturnal survey provided evidence of Woodcock breeding activity. An adult male was seen roding in the main roadside carpark near T3 at 22.40 on the 26th June 2019. Later, at 23.00, two Woodcock were observed flying over a clear-felled area near the mast at T5.

8.3.8.16 Lapwing

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

Lapwing were not observed during winter season VP surveys.

Vantage Point Surveys Summer Season 2018, 2019, 2020

Lapwing were not observed during summer season VP surveys.

Breeding Wader/Raptor Walkover Surveys, Summer 2018, 2019

With regards to breeding waders, no evidence was found during the walkover survey carried out onsite.

8.3.8.17 Whooper Swan

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

Whooper Swan was not observed during winter season VP surveys.

Vantage Point Surveys Summer Season 2018, 2019,

Whooper Swan was not observed during summer season VP surveys.

Breeding Wader/Raptor Walkover Surveys, Summer 2018, 2019

Whooper Swan was not observed during summer walkover surveys.

8.3.8.18 Red Grouse

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

Red Grouse was not observed during winter season VP surveys.

Vantage Point Surveys Summer Season 2018, 2019, 2020

Red Grouse was not observed during summer season VP surveys.

Winter Walkover Survey 2017/2018

During the winter walkover survey conducted within the study area there was no evidence Red Grouse.

Red Grouse Survey 2018/2019

No Red Grouse were observed or heard responding to the tape-lure played during the Red Grouse survey carried out on the 22nd February 2019 (see Figures in Appendix 8.2 for Red Grouse transect survey areas). Habitat condition in the north-western corner of the survey area was found to be very poor with very little heather remaining due to burning in the previous year (cause potentially anthropogenic). This was in contrast to the survey area located east of the site where good quality habitat with dense heather cover was recorded.

Red Grouse and Golden Plover Walkover Surveys 2019/2020

The three walkover surveys carried out in February 2020 did not find evidence of Red Grouse.

Breeding Wader/Raptor Walkover Surveys, Summer 2018, 2019

There was no evidence of this species found during summer walkover surveys.

Habitat Site Walkover

A female and juvenile were observed during the habitat walkover survey undertaken 18th – 19th June 2019 within dry heath habitat within the eastern corner of proposed wind farm site. According to the Red Grouse Survey 2018/2019, this area of heath is good quality habitat for the species.

8.3.8.19 Nightjar

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

Nightjar was not observed during winter season VP surveys.

Vantage Point Surveys Summer Season 2018, 2019

Nightjar was not observed during summer season VP surveys.

Breeding Wader/Raptor Walkover Surveys, Summer 2018, 2019

There was no evidence of Nightjar during summer walkovers.

Breeding Woodcock and Nightjar Survey Summer 2019

A nocturnal transect survey carried out on-site on the 26th June 2019 between 22.40 and 01.50 found no indication for the presence of Nightjar.

8.3.8.20 Cormorant

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

There was a single observation of Cormorant during the 2019/2020 winter VP surveys. One individual flew east over VP6, gliding at a height of approximately 50 metres before turning northwards.

Vantage Point Surveys Summer Season 2018, 2019

There were no observations of Cormorant during summer season VP surveys.

Breeding Wader/Raptor Walkover Surveys, Summer 2019, 2019

There were no observations of Cormorant during summer walkover surveys.

8.3.8.21 Heron

There were no observation of Heron during VP surveys or summer walkover surveys.

8.3.8.22 Common Gull

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

During the 2017/2018 winter survey period Common Gull was observed infrequently between November and December 2017, with the number of sightings increasing in January and March 2018. Common Gulls were recorded from VP1, VP3, VP5 and VP6. Monthly peak counts ranged between 6 birds, observed in November and a flock of 140 birds recorded in late January 2018 during VP3. The majority of observations pertained to birds feeding in agricultural grassland and moving between fields. Flights were recorded within the flight activity survey area; however, no flights were recorded within the main wind farm site boundary.

During the 2018/2019 winter survey period Common Gull was observed on several occasions during the months of December, January and February. Common Gull were regularly recorded feeding in agricultural grassland to the south of VP2 and east of VP6. Flights were recorded from VP2 in mid-December 2018 (11 birds) and VP6 in mid-February 2019 (2 birds). Both flights were recorded within the flight activity survey area. There were observations of Common Gull in-flight within the site boundary.

During the 2019/2020 winter VP survey period Common Gull was observed twice in December 2019 and twice in February 2020. On 16th December 2019, a group of at least 15 adults, with some juveniles present also, was seen in fields south of VP2 where they spent the entire three-hour survey time either on the ground feeding or flying to nearby fields to settle down and begin feeding again. Six Common Gulls were observed feeding on the 25th February 2019 also in a field south of VP2, with a large group of Black-headed Gulls until they left and flew west. Also, on the 25th February 2019 a group of 28 individuals flew from east to west over fields and clear-fell north of VP5.

Vantage Point Surveys Summer Season 2018, 2019

There were no observations of Common Gull during summer season VP surveys.

Breeding Wader/Raptor Walkover Surveys, Summer 2019, 2019

There was no evidence of this species found during summer walkover surveys, this is not unexpected as the species breeds along the coast and edges of lakes which are not present within the main wind farm site.

8.3.8.23 Great Black-backed Gull

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

A single Great Black-backed Gull was recorded from VP3 in mid-December 2017.

Over the course of the 2018/2019 winter VP surveys Great Black-backed Gull was recorded on one date in mid-December. Both observations occurred during VP2 and pertained to sightings of single birds in flight. Both flights were recorded within the flight activity survey area.

Vantage Point Surveys Summer Season 2018, 2019

There was a single sighting of Great Black-backed Gull over the course of the summer 2018 VP surveys. Two individuals were observed in late July circling over farmland and forestry during VP2 (within the flight activity survey area).

There were three sightings of a Great Black-backed Gull in flight during summer 2019. All three were from late August, over grassland and/or moorland, and from VP2. Two separate flights were recorded on the 26th of August 2019, both of an adult flying/circling in an area to the southwest of VP2 at a height of 50 metres. The third record, from the 28th August 2020, reported an individual flying in a southerly direction east of VP2.

Breeding Wader/Raptor Walkover Surveys, Summer 2018, 2019

There was no evidence of this species found during summer walkover surveys, this is not unexpected as the species breeds within coastal colonies and inland lakes.

8.3.8.24 Lesser Black-backed Gull

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

During the 2017-18 Winter VP survey period Lesser Black-backed Gull was recorded regularly throughout the months of November, December and January with some sightings in March also. The highest number of overall monthly sightings occurred in December 2017 which also corresponds to the single peak count of birds observed (flock of 131 bird's observed on ground during VP2 in December). The majority of observations pertained to birds feeding in agricultural grassland and moving between fields.

Lesser Black-backed Gull was regularly recorded throughout the 2018/2019 winter VP surveys. Lesser Black-backed Gulls were recorded in every month and from all VPs except VP1. Birds were occasionally observed feeding in fields to the south and south-west of VP2. The highest number of birds was recorded in November (275 birds), with observed numbers then decreasing from that point. A total of 28 flight paths were recorded.

Lesser Black-backed Gull flights were recorded on 15 separate occasions during the 2019/2020 winter VP surveys. Almost all observations occurred over either agricultural land and/or thicket/pole stage forestry. On 28th October 2019, an adult and an immature bird were seen separately but in the same area of fields southwest of VP2. On several occasions from December onwards, flocks were observed circling and flying over fields. The largest group consisted of 29 individuals of mixed ages and was seen on the 10th December 2019 moving past the southwest side of VP6. There were two records of Lesser Black-backed Gull during March 2020, and on both occasions the birds flew at heights of more than 180 metres. On the 18th March 2020, an adult and sub-adult were seen south of VP5 flying north-northwest, and on 25th March 2020, two individuals flew in from the north over an area west of VP2.

Vantage Point Surveys Summer Season 2018, 2019

Lesser Black-backed Gull was recorded infrequently during the summer 2018 VP surveys. Two birds were observed in late April 2018 flying south past VP5 over farmland and moorland within the flight activity survey area. A total of four individuals were also observed from VP6 at the end of August 2018 (two birds flew east over VP and joined two others feeding in freshly fertilised fields due east of the VP (within the flight activity survey area).

Lesser Black-backed Gull flights were recorded on 8 separate occasions during the summer 2019 VP surveys. All observations occurred over either agricultural land or heather moorland, and half took place in June 2019. Two sightings in June 2019 involved groups of adults with several juveniles – on 25th June 2019 nine birds were present, and on 27th June 2019 there were 26 individuals recorded. Both sightings reported birds both flying and on the ground within fields southwest of VP2 that had recently been cut for silage. Two flight observations occurred at VP5 on 21st August 2019, both over grassland. Firstly, one adult flew at a height of 100 metres from north of VP5 travelling in a south-westerly direction. It then joined a flock of 15 Lesser Black-backed Gulls which arrived at an area south of VP5 before turning north northwest at heights of 70-100 metres.

Breeding Wader/Raptor Walkover Surveys, Summer 2018, 2019

There was no evidence of this species found during summer walkover surveys, this is not unexpected as the species breeds within coastal colonies and inland lakes.

8.3.8.25 Snipe

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

Snipe was recorded incidentally on one occasion during the 2017-18 winter VP surveys. One Snipe was flushed while a surveyor was en-route to VP5 in late October 2017. There were no further observations during VP surveys.

During the 2018/2019 winter season Snipe was infrequently recorded during VPs in the months of October, December and February. A total of three flight paths were recorded. All flights occurred within the flight activity survey area. Nine birds were seen flying together around VP3 in late October 2018. Single birds were also recorded in-flight during VP3 and VP1 in mid- December 2018 and mid-February 2019.

There was one sighting of Snipe during the 2019/2020 winter VP surveys. On the 24th October 2019 an individual was flushed from an area of clear-felled forestry immediately north of VP4. The bird flew away in a north-northwest direction, rising to a height of 20 metres, calling as it flew.

Vantage Point Surveys Summer Season 2018, 2019

Snipe were not observed during summer season VP surveys.

2017/2018 Winter Walkover Survey

Four Snipe were flushed from heather moorland in the north-western corner of the flight activity survey area on the 24th January 2018.

Red Grouse and Golden Plover Walkover Surveys 2019/2020

Three walkover surveys carried out in February 2020 during which groups of snipe were observed, the largest consisting of 20 individuals.

Red Grouse Survey 2018/2019

During the Red Grouse survey carried out on the 22nd February 2019 Snipe were flushed in the location of walked transects.

Breeding Wader/Raptor Walkover Surveys, Summer 2018, 2019

Some areas encompassed by the breeding walkover survey were considered to comprise potentially suitable breeding habitat for Snipe. However, no observations of Snipe or evidence of breeding Snipe was recorded during the 2018 summer period.

Transect surveys conducted throughout the summer of 2019 covered areas that were considered to contain potentially suitable breeding habitat for Snipe. However, no observations of Snipe or evidence of breeding Snipe was recorded.

8.3.8.26 Mallard

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

Mallard was not observed during winter season VP surveys.

Vantage Point Surveys Summer Season 2018, 2019

There was a single sighting of Mallard over the course of the summer 2018 VP surveys. A male was observed flying north through the flight activity survey area over heather moorland and agricultural land during VP4 at the end of May. This was the only observation for this species as there were no observations during the summer 2019 surveys.

Breeding Wader/Raptor Walkover Surveys, Summer 2019, 2019

There was no evidence of this species found during summer walkover surveys.

8.3.8.27 Long-eared Owl

Vantage Point Surveys Winter Season 2017/2018, 2018/2019, 2019/2020

Long-eared Owl was not observed during winter season VP surveys.

Vantage Point Surveys Summer Season 2018, 2019

During the 2019 summer survey period there was one record of Long-eared Owl in the plantation east of VP5 on 24th June 2019. The surveyor heard juvenile owls calling/begging for two minutes in area of forestry to the southeast of VP5 but was unable to determine the exact number of individuals present.

Breeding Wader/Raptor Walkover Surveys, Summer 2019, 2019

There was no evidence of this species found during summer walkover surveys.

Breeding Woodcock and Nightjar Survey Summer 2019

The nocturnal survey provided evidence of breeding Long-eared Owls. Young owls were heard calling/begging for food not only during the night-time survey but also during a VP survey. Both records were from a similar area; refer to Figure in Appendix 8.2 for nest location.

8.3.8.28 White Throated Dipper

White Throated Dipper were not observed during the three years of targeted avifauna surveys this species was not observed within the wind farm study area.

Whilst undertaking a bat roost survey of watercourse crossing at Scratoes Bridge along the grid connection route, evidence of White Throated Dipper was observed was recorded. four birds nests on the ledge of either side of the span rests on the buttresses.

8.3.8.29 Hinterland Surveys

During hinterland surveys conducted outside the flight activity survey area no particular areas were found to be utilised by waders and other over-wintering species. However, fields located approximately 4.7km north-west of the hinterland survey area, in proximity to the village of Fenagh and the Burren River, were found on occasion to have large numbers of waders such as Curlew and sometimes Lapwing. See Table 8-47 for species recorded at Kildavin Quarry.

Table 8-47: Species recorded at Kildavin Quarry during hinterland survey on 24/01/18

Species	BoCCI Status	Count
Yellow-legged Gull *Larus michahellis*	Green	4
Iceland Gull *Larus glaucoides*	Green	2
Glaucous Gull *Larus hyperboreus*	Green	1
Lesser Black-backed Gull *Larus fuscus*	Amber	800
Great Black-backed *Gull Larus marinus*	Amber	35
Herring Gull Larus argentatus	Red	180
Black-headed Gull *Larus ridibundus*	Red	70

Species	BoCCI Status	Count
Goosander *Mergus merganser*	Amber	5
Great-crested Grebe *Podiceps cristatus*	Amber	2
Little Grebe *Anas platyrhychos*	Amber	7
Moorhen *Gallinula chloropus*	Green	5
Mallard *Anas platyrhynchos*	Green	28
Teal *Anas crecca*	Amber	8
Tufted Duck *Aythya fuligula*	Red	4

* Yellow-legged gull, Iceland Gull, Glaucous Gull, are not regularly occurring species in Ireland.

8.3.8.30 Transect/Point Counts Winter 2017/2018, 2018/2019, 2019/2020 and Summer 2018, 2019

Transect and Point Count Surveys for all species were recorded during monthly surveys of the proposed wind farm site over three winters and three summers. This survey captured the baseline of avian species using the site as well as their abundance and includes seasonal visitors of the winter (i.e. Fieldfare, Redwing, Snow Bunting,) and summer months i.e. Blackcap, Chiffchaff, Cuckoo, House Martin, Spotted Flycatcher, Stonechat, Swallow, Swift, Whitethroat, Willow Warbler). Over the survey period a total of 57 bird species were recorded. Of the 57 species, two are Annex I listed (Merlin, Peregrine Falcon), three are Red listed (Black-headed Gull, Meadow Pipit and Woodcock) and 20 are Amber listed (Common Gull, Goldcrest, Goshawk, Black-backed Gull, Great-spotted Woodpecker, Greenfinch, House Martin, Kestrel, Lesser Black-backed Gull, Linnet, Merlin, Mistle Thrush, Robin, Skylark, Spotted Flycatcher, Sparrowhawk, Starling, Stonechat, Swallow, Swift). The recorded information is provided in Table 8-48

8.3.8.31 Non-target Species recorded during Winter (2017/2018, 2018/2019, 2019/2020) and Summer VP surveys (2018, 2019)

During the three years of monthly VP surveys, of non-target species of conservation concern were also recorded. A total of 18 species were recorded and comprised of no Annex I species, two Red-listed species (Grey Wagtail and Meadow Pipit) and the other 16 species are Amber-Listed species. The recorded information is provided in Table 8-49.

Table 8-48: Results of Transect/Point Count Surveys undertaken over Winter 2017/2018, 2018/2019, 2019/2020 and Summer 2018, 2019

Species	BoCCI status	Annex I Status	Winter 2017/2018		Winter 2018/2019		Winter 2019/2020		Summer 2018		Summer 2019	
			Total Count	Mean Count	Total Count	Mean Count	Total Count	Mean Count	Total Count	Mean Count	Total Count	Mean Count
Blackbird *Turdus merula*	Green	No	15	2	18	3	6	1.5	19	3.2	11	1.8
Black-headed Gull *Larus ridibundus*	Red	No	115	38	0	0	0	0	0	0	0	0
Blackcap *Sylvia atricapilla*	Green	No	0	0	0	0	0	0	6	1.5	7	1.4
Blue Tit *Cyanistes caeruleus*	Green	No	7	1.8	7	2.3	1	1	6	2	2	1
Bullfinch *Pyrrhula pyrrhula*	Green	No	28	4.7	10	2	8	2	15	3	7	1.8
Buzzard *Buteo buteo*	Green	No	3	1	4	1.3	6	2	6	1.2	6	1.5
Chaffinch *Fringilla coelebs*	Green	No	47	6.7	36	6	17	4.3	43	7.2	17	3.4
Chiffchaff *Phyllosopus collybita*	Green	No	0	0	0	0	1	1	11	2.2	5	1.7
Coal Tit *Periparus ater*	Green	No	39	5.6	30	5	17	3.4	48	8	22	3.7
Common Gull *Larus canus*	Amber	No	40	40	52	52	0	0	0	0	0	0
Crossbill *Loxia curvirostra*	Green	No	43	6.1	52	8.7	12	2.4	27	5.4	7	1.4
Cuckoo *Cuculus canorus*	Green	No	0	0	0	0	0	0	1	1	1	1
Dunnock *Prunella modularis*	Green	No	14	2	6	1.2	6	1.2	8	1.3	4	1.3
Fieldfare *Turdus pilaris*	Green	No	50	16.7	75	37.5	32	16	0	0	0	0
Goldcrest *Regulus regulus*	Amber	No	53	7.6	23	4.6	15	3	38	6.3	19	3.2
Goldfinch *Carduelis carduelis*	Green	No	10	5	2	1	2	2	13	4.3	6	2
Goshawk *Accipiter gentilis*	Amber	No	0	0	0	0	0	0	1	1	0	0
Great Black-backed Gull *Larus marinus*	Amber	No	0	0	0	0	0	0	1	1	0	0
Great-spotted Woodpecker *Dendrocopus major*	Amber	No	1	1	0	0	0	0	2	1	0	0
Great Tit *Parus major*	Green	No	4	1.3	7	1.8	0	0	6	1.5	1	1
Greenfinch *Carduelis chloris*	Amber	No	0	0	2	2	20	20	0	0	0	0

Species	BoCCI status	Annex I Status	Winter 2017/2018		Winter 2018/2019		Winter 2019/2020		Summer 2018		Summer 2019	
			Total Count	Mean Count	Total Count	Mean Count	Total Count	Mean Count	Total Count	Mean Count	Total Count	Mean Count
Hooded Crow *Corvus cornix*	Green	No	51	7.3	20	3.3	19	3.8	16	4	9	1.5
House Martin *Delichon urbicum*	Amber	No	0	0	0	0	0	0	3	3	0	0
Jackdaw *Corvus monedula*	Green	No	24	4.8	8	2	6	6	8	2.7	0	0
Jay *Garrulus glandarius*	Green	No	7	1.4	4	1.3	5	1.7	7	1.4	8	1.6
Kestrel *Falco tinnunculus*	Amber	No	5	1	2	2	1	1	1	1	4	2
Lesser Black-backed Gull *Larus fuscus*	Amber	No	84	16.8	0	0	0	0	15	7.5	2	2
Linnet *Carduelis cannabina*	Amber	No	20	10	0	0	1	1	1	1	1	1
Long-tailed Tit *Aegithalos caudatus*	Green	No	12	6	4	2	0	0	3	3	9	4.5
Magpie *Pica pica*	Green	No	25	3.6	12	2	0	0	14	2.3	3	1
Meadow *Pipit Anthus pratensis*	Red	No	11	2.2	2	1	23	11.5	53	10.6	25	4.2
Merlin *Falco columbarius*	**Amber**	**Yes**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**
Mistle Thrush *Turdus viscivorus*	Amber	No	2	1	11	2.2	1	1	16	4	4	1.3
Peregrine Falcon *Falco peregrinus*	Green	**Yes**	**0**	**0**	**1**	**1**	0	0	**1**	**1**	**1**	**1**
Pheasant *Phasianus colchicus*	Green	No	5	1	3	3	0	0	4	1	4	2
Pied Wagtail *Motacilla alba*	Green	No	2	1	1	1	0	0	2	2	3	1
Raven *Corvus corax*	Green	No	63	9	25	5	13	2.6	33	5.5	9	3
Redpoll *Carduelis cabaret*	Green	No	41	6.8	11	2.8	11	3.7	21	3.5	5	1.3
Redwing *Turdus iliacus*	Green	No	12	6	0	0	0	0	0	0	0	0
Robin *Erithacus rubecula*	Amber	No	34	5.7	16	2.7	12	2.4	24	4	18	3
Rook *Corvus frugilegus*	Green	No	156	22.3	76	19	22	22	407	81.4	76	38
Siskin Carduelis spinus	Green	No	9	1.8	14	2.8	4	2	9	2.3	8	1.6
Skylark *Alauda arvensis*	Amber	No	3	1	0	0	0	0	1	1	0	0
Snow Bunting *Plectrophenax nivalis*	Green	No	1	1	1	1	0	0	0	0	0	0
Song Thrush *Turdus philomelos*	Green	No	7	1	8	2	1	1	6	1.2	2	1

Species	BoCCI status	Annex I Status	Winter 2017/2018		Winter 2018/2019		Winter 2019/2020		Summer 2018		Summer 2019	
			Total Count	Mean Count	Total Count	Mean Count	Total Count	Mean Count	Total Count	Mean Count	Total Count	Mean Count
Spotted Flycatcher *Musciapa striata*	Amber	No	0	0	0	0	0	0	0	0	3	1
Sparrowhawk *Accipter nisus*	Amber	No	3	1	0	0	0	0	1	1	0	0
Starling *Sturnus vulgaris*	Amber	No	550	137.5	2	2	207	103.5	9	9	0	0
Stonechat *Saxicola torquata*	Amber	No	0	0	0	0	3	1.5	2	2	0	0
Swallow *Hirundo rustica*	Amber	No	0	0	0	0	0	0	9	1.8	17	3.4
Swift *Apus apus*	Amber	No	0	0	0	0	0	0	0	0	2	1
Treecreeper *Certhia familiaris*	Green	No	0	0	0	0	0	0	0	0	1	1
Whitethroat *Sylvia communis*	Green	No	0	0	0	0	0	0	2	2	3	1.5
Willow Warbler *Phylloscopus trochilus*	Green	No	0	0	0	0	0	0	23	3.8	14	2.8
Woodpigeon *Columba palumbus*	Green	No	181	25.9	38	9.5	6	3	20	3.3	16	2.67
Woodcock *Scolopax rusticola*	Red	No					1	1				
Wren *Troglodytes troglodytes*	Green	No	24	3.4	16	2.7	9	1.8	14	2.3	17	2.83

Table 8-49: Non-Target Species recorded during Winter and Summer VP surveys

Species	BoCCI status	Annex I Status	Winter 2017/2018	Winter 2018/2019	Winter 2019/2020	Summer 2018	Summer 2019
Grey Wagtail *Motacilla cinerea*	Red	n/a	Recorded	Recorded	n/a	n/a	n/a
Meadow Pipit *Anthus pratensis*	Red	n/a	Recorded	Recorded	Recorded	Recorded	Recorded
Goldcrest *Regulus regulus*	Amber	n/a	Recorded	Recorded	Recorded	Recorded	Recorded
Great-spotted Woodpecker *Dendrocopus major*	Amber	n/a	Recorded	n/a	Recorded	n/a	Recorded
Greenfinch *Carduelis chloris*	Amber	n/a	Recorded	n/a	n/a	Recorded	n/a
House Martin *Delichon urbicum*	Amber	n/a	Recorded	n/a	n/a	Recorded	Recorded

Species	BoCCI status	Annex I Status	Winter 2017/2018	Winter 2018/2019	Winter 2019/2020	Summer 2018	Summer 2019
Linnet *Carduelis cannabina*	Amber	n/a	Recorded	Recorded	Recorded	Recorded	Recorded
Mistle Thrush *Turdus viscivorus*	Amber	n/a	Recorded	Recorded	Recorded	Recorded	Recorded
Robin *Erithacus rubecula*	Amber	n/a	Recorded	Recorded	Recorded	Recorded	Recorded
Sand Martin *Riparia riparia*	Amber	n/a	n/a	n/a	n/a	n/a	Recorded
Skylark *Alauda arvensis*	Amber	n/a	Recorded	Recorded	Recorded	Recorded	Recorded
Spotted Flycatcher *Musciapa striata*	Amber	n/a	Recorded	n/a	n/a	n/a	Recorded
Starling *Sturnus vulgaris*	Amber	n/a	Recorded	Recorded	Recorded	Recorded	n/a
Stock Dove *Columba oenas*	Amber	n/a	Recorded	n/a	n/a	n/a	Recorded
Stonechat *Saxicola torquata*	Amber	n/a	Recorded	Recorded	Recorded	Recorded	Recorded
Swallow *Hirundo rustica*	Amber	n/a	Recorded	n/a	n/a	Recorded	Recorded
Swift *Apus apus*	Amber	n/a	n/a	n/a	n/a	Recorded	Recorded
Wheatear *Oenanthe oenanthe*	Amber	n/a	Recorded	Recorded	n/a	n/a	n/a

8.3.9 Aquatic Ecology

A sensitive species data request was submitted (30th March 2020) to the National Parks and Wildlife Service for the 10km grid squares in the footprint of the main wind farm site, the TDR and grid connection (i.e. S85, S86, S95, S96) and was received on the 31st March 2020. Records for a number of rare or protected species were available although most did not overlap directly with the survey area.

Both River Lamprey (*Lampetra fluviatilis*) and Sea Lamprey (*Petromyzon marinus*) are known from the River Slaney main channel (King and Linnane, 2004), although spawning site records for Sea Lamprey were mostly located below Clohamon Weir. The nearest distance by water to a known Sea Lamprey spawning site from the main wind farm site was approx. 9.9km via the Kilbrannish North Stream and River Clody (i.e. a site 0.4km downstream of the Slaney Bridge; see Figure 8-3). A number of records for River Lamprey were available for the River Slaney channel, mostly in the vicinity of Altamount House and Gardens near Ballon (Figure 8-3). The nearest by-water distance for a River Lamprey spawning site from main wind farm site infrastructure was approx. 13.3km downstream of watercourse crossing GCR-WCC9, via the Douglas River.

Records for Freshwater Pearl Mussel (*Margaritifera margaritifera*) were available for the River Slaney channel in areas with hydrological connectivity to the proposed development site. The closest distance by water from wind farm infrastructure to a known Pearl Mussel site on the River Slaney was approx. 8.5km, via the Rossacurra Stream and Clashavey River (i.e. watercourse crossing GCR-WCC7). A known River Slaney Pearl Mussel population was also located approx. 13.2km downstream of watercourse crossing GCR-WCC9, via the Douglas River. There were no additional Freshwater Pearl Mussel sites identified during the Pearl Mussel survey carried out as part of this aquatic report in the vicinity of the main wind farm site and grid connection (See the Aquatic Report, Appendix 8.3 for more information).

Contemporary existing records for White-clawed Crayfish were available for several locations on the middle and lower reaches of the Burren River, a tributary of the River Barrow. These were at Ullard Bridge, Ballintrane Bridge, Rathtoe Bridge, Staplestown Bridge and Hanover Bridge (NBDC data). The nearest (indirect) hydrological distance from the proposed development site to a known White-clawed Crayfish site on the Burren River (Ullard Bridge) was approx. 10.1km, via the Burren River. There are two watercourse crossings on the Burren River. There were no other existing records for White-clawed Crayfish in or adjoining the study area following a desktop review and sensitive species data request. There were no contemporary or historical Crayfish records available for the wider River Slaney catchment.

Otter (*Lutra lutra*) records were widespread throughout the study area within grid squares S85, S86, S95 and S96, with >30 records available (sensitive species data request). With regards to watercourses in the vicinity of the proposed wind farm development, otter records were available for the River Slaney, Kildavin Stream and River Clody. However, it should be noted that only five records were contemporary (i.e. >2004), with most records from 1981. A total of n=32 contemporary records (i.e. ≥2004) for otter were available from the NBDC, demonstrating a wide distribution within the wider survey area

Records for two rare aquatic plant species were available for the Slaney River Valley SAC site, namely Short-leaved Water-starwort (*Callitriche truncata*), a very rare, small aquatic herb found nowhere else in Ireland, and Opposite-leaved Pondweed (*Groenlandia densa*), a species that is legally protected under the Flora Protection Order (NPWS, 2015). However, these species were not present or adjoining within the study area (i.e. present in tidal reaches of the River Slaney, downstream of Enniscorthy).

An examination of the NPWS and NBDC 10km grid square (S85) overlapping the main wind farm site and 1km grid squares overlapping the grid connection was undertaken for invasive aquatic species. No invasive fauna were recorded within the general area of the proposed development.

However, the invasive aquatic plant species Canadian Waterweed (*Elodea canadensis*), was recorded within the Slaney River (3.6km east of the main wind farm site) and River Burren (2.4km upstream of the closest grid connection crossing).

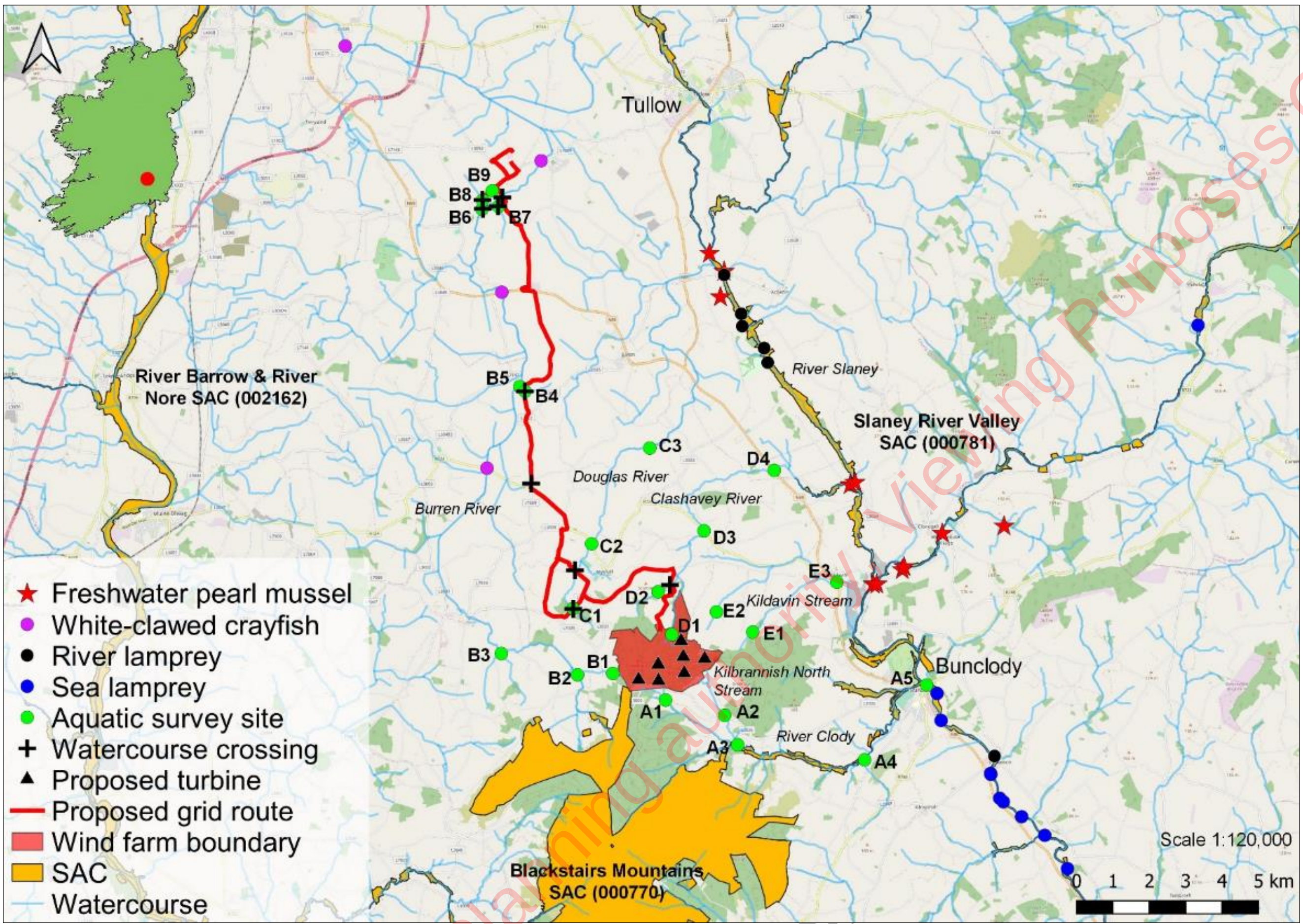

Plate 8-38: Distribution of selected protected aquatic species in the vicinity of the survey area

8.3.9.1 Overall Aquatic Ecology Value

The aquatic ecology of sites A1, B1, B4, B8, B9, B10 and E2 were evaluated as being of **Local Importance (lower value)** due to the absence of floating river vegetation, failure to achieve good status Q4 water (with exception of site A1) and limited fisheries value.

The majority of sites (62% of total) surveyed in the footprint of the proposed Croaghaun wind farm and associated Underground Grid Connection route crossings were evaluated as being of **Local Importance (higher value)** in terms of their aquatic ecology. These included sites A2, B2, B3, B5, B6, B7, C1, C2, C3, D1, D2, D3, D4, E1 and E3 (refer to Table 8-50 below).

The aquatic flora communities present among six sites namely: A5, B3, B5, B6, C3 and D4 shared links with Annex I habitat 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation' (3260) (i.e. 'floating river vegetation'). The floating river vegetation community recorded at sites B3 and B5 on the Burren River were considered to be a particularly good representation of this Annex I habitat given the presence of two or more indicator macrophyte species in addition to aquatic bryophytes.

Furthermore, sites A2, B2, B3, B5, B6, B7, C1, C2, C3, D1, D2, D3, D4, E1 and E3 were considered of higher value due to the presence of Brown Trout, although some sites also supported Atlantic Salmon (B5, B6, D4), European Eel (B3, C2, C3, D1, D2, D4, E3) and *Lampetra* sp. (B6, C1, C2, C3, D4, E3).

Sites A3 and A4 on the River Clody, as well as site A5 on the River Slaney, were evaluated as **International Importance** given their location within the Slaney River Valley SAC. Site A5 supported *Lampetra* sp. ammocoetes and both sites A4 and A5 supported Atlantic Salmon that are listed as qualifying interests for the Slaney River Valley SAC.

8.3.9.2 Fish surveys in the Study Area

Seven species of fish were observed in total, namely: Lamprey sp, Atlantic Salmon, European Eel, Brown Trout, Minnow, Stone Roach, Three-spined Stickleback. For more information see Table 8-50 and the Aquatic Report, Appendix 8.3.

Sites A1, B1, B4, B8, B9, B10 and E2 had limited fisheries value.

Sites A2, B2, B3, B5, B6, B7, C1, C2, C3, D1, D2, D3, D4, E1 and E3 were considered of higher value due to the presence of Brown Trout, although some sites also supported Atlantic Salmon (B5, B6, D4), European Eel (B3, C2, C3, D1, D2, D4, E3) and *Lampetra* sp. (B6, C1, C2, C3, D4, E3). For more information see Table 8-50.

8.3.9.3 Freshwater Pearl Mussel

No Freshwater Pearl Mussel were recorded within the study area during the aquatic surveys. However, historical records (sensitive species data request) for Freshwater Pearl Mussel are known downstream of the proposed development site. The nearest distance by water from the proposed development site to a known Freshwater Pearl Mussel site on the River Slaney was approx. 8.5km, via the Rossacurra Stream and Clashavey River (i.e. watercourse crossing GCR-WCC7). A known River Slaney Freshwater Pearl Mussel population was also located approx. 13.2km downstream of watercourse crossing GCR-WCC9, via the Douglas River. See Plate 8-37 for more information.

8.3.9.4 White-clawed Crayfish

No White-clawed Crayfish were recorded within the study area during the aquatic surveys.

8.3.9.5 Biological water quality

Sites B1, B4, B8, B9 and E2 failed to achieve good status Q4 water. The other 19 sites surveyed sites achieved good status Q4. At the time of surveying site B1 was dry and therefore surveying of water quality could not be undertaken. For more information see Table 8-50.

For three sites results indicate a reduction from previous 2019 EPA results:

- Site A4 received a result of Q4 (good status), however previous EPA monitoring of the site revealed Q4-5 (high status) water quality status in 2019.
- Site C2 received a result of Q3 (poor status), however previous EPA monitoring of the site resulted in a water quality of Q3-4 (2019).

- Site C3 received a result of Q3 (poor status) deviating from previous EPA monitoring of the site (Q4, 2019).

For two sites results indicate an improvement in 2019 EPA monitoring results:

- Site D4 obtained a result of Q4 (good status) an improvement on previous EPA monitoring of the river; Q3-4, moderate status.
- Site E1 received the status of Q4 (good status), an improvement on previous EPA monitoring of the river; Q3-4, 2019, approx. 0.5km downstream at Clashavey Bridge)

8.3.9.6 Annex I Habitat

The aquatic flora communities present among these sites i.e. A5, B3, B5, B6, C3 and D4 shared links with Annex I habitat '*Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation*' (3260) (i.e. 'floating river vegetation'). The floating river vegetation community recorded at sites B3 and B5 on the Burren River were considered to be a particularly good representation of this Annex I habitat given the presence of two or more indicator macrophyte species in addition to aquatic bryophytes.

8.3.9.7 Non-native invasive species

No invasive aquatic species were recorded during aquatic surveys. Himalayan Balsam was recorded in the area of surveys, see Section 8.3.4.1 for more information.

Table 8-50: Fisheries Surveys Results

Site	Waterbody	Fisheries potential	Fish Present	Freshwater Pearl Mussel (FPM)	Capable of supporting FPM	White-clawed Crayfish (WC)	Capable of supporting WC	Q Sample	Ecological Value
A1	Unnamed Kilbrannish South Stream tributary	• No fish recorded (not of fisheries value). Water quality of Q4 (good status) but no other aquatic features of higher than local importance	None	Absent	No	Absent	No	Q4 (good status)	**Local importance (lower value)**
A2	Kilbrannish North Stream	• Salmonid spawning and nursery habitat were both considered moderate with some locally good holding habitat present for smaller Salmonids • Not suitable for Lamprey ammocoetes • European Eel habitat was considered sub-optimal for resident fish although the stream may have acted as a migratory pathway for the species	Brown Trout	Absent	No	Absent	No	Q4 (good status)	**Local importance (higher value)**
A3	River Clody	Both adult and juvenile Trout were present • Good Salmonid habitat overall, with good holding in deeper pools and moderate nursery habitat • Moderate value to European Eel • No suitable Lamprey habitat	Brown Trout and European Eel,	Absent	No	Absent	No	Q4 (good status)	**International importance** given the location of the site within the Slaney River Valley SAC.

Site	Waterbody	Fisheries potential	Fish Present	Freshwater Pearl Mussel (FPM)	Capable of supporting FPM	White-clawed Crayfish (WC)	Capable of supporting WC	Q Sample	Ecological Value
A4	River Clody (Barnahask Bridge)	• Both juvenile and adult Trout were captured along with a moderate number of Salmon parr. • Good Salmonid habitat overall, with good spawning substrata (particularly for Atlantic Salmon) and good nursery areas • Some good spawning habitat present immediately upstream of small fish passable weir downstream of the bridge. • Excellent holding habitat for adult Salmonids. • Lamprey ammocoete habitat was absent given the high-energy nature of the site although some localised spawning was present for *Lampetra* sp. – no Lamprey were recorded	Brown Trout and Atlantic Salmon	Absent	No	Absent	Some suitability	Q4 (good status) Previous EPA monitoring of the site revealed Q4-5 (high status) water quality status in 2019	**International importance** given the location of the site within the Slaney River Valley SAC.
A5	River Slaney (Slaney Bridge	• Excellent Salmonid habitat, with some excellent quality spawning, nursery and holding habitat present downstream of the bridge • A low number of *Lampetra* sp. Ammocoetes were also recorded in association with small sand-silt pockets found at the downstream end of *Ranunculus* vegetation	Six fish species; Minnow, Brown Trout, Atlantic Salmon, *Lampetra* sp), European	Absent	No	Absent	Some suitability	Q4 (good status)	**International importance** given the location of the site within the Slaney River Valley SAC.

Site	Waterbody	Fisheries potential	Fish Present	Freshwater Pearl Mussel (FPM)	Capable of supporting FPM	White-clawed Crayfish (WC)	Capable of supporting WC	Q Sample	Ecological Value
		• Spawning for both Sea Lamprey and *Lampetra* sp. Was considered good, locally, although nursery habitat was limited (but good where present) • European Eel habitat was good overall given the presence of deeper pool habitat near the bridge and deeper glide habitat upstream • Stone Loach were present in low numbers in cobble-dominated areas	Eel, Stone Loach						
B1	Raheenleigh Stream	None	None	Absent	No	Absent	No	No water present at the time of survey.	**Local importance (lower value)**
B2	Burren River	• Brown Trout present in small numbers, although both juveniles and adults were captured indicating successful recruitment locally. Spawning habitat was present but was localised. • Site was more suited to Atlantic Salmon, though none were recorded. • No potential for Lamprey given	Brown Trout	Absent (Considered absent from the Burren)	No	Absent	Some suitability	Q4 (good status)	**Local importance (higher value)**

Site	Waterbody	Fisheries potential	Fish Present	Freshwater Pearl Mussel (FPM)	Capable of supporting FPM	White-clawed Crayfish (WC)	Capable of supporting WC	Q Sample	Ecological Value
B3	Burren River	• Excellent Salmonid nursery and also offered excellent quality spawning and holding habitat • No Atlantic Salmon present, locally the species struggles to pass natural barriers downstream of this point • European Eel refuge habitat was good whilst foraging opportunities were evidently high • Excellent Lamprey spawning habitat, no ammocoetes were recorded.	Three fish species were recorded; Brown Trout, European Eel,	Absent (Considered absent from the Burren)	Low suitability.	Absent	Some suitability	Q4 (good status)	**Local importance (higher value)**
B4	Ballykeally Stream	• Some potential for Three-spined Stickleback • Unsuitable for resident Salmonids	None	None	No	Absent	No	Q3 (poor status)	**Local importance (lower value)**
B5	Burren River	• Good Salmonid nursery and also offered good spawning and holding habitat locally • European Eel habitat was good overall, (none recorded)	Five fish species recorded; Atlantic Salmon, Brown Trout, Minnow, Stone Loach, Three-	Absent (Considered absent from the Burren)	No	Absent	Some good suitability	Q3-4 (moderate status)	**Local importance (higher value)**

Site	Waterbody	Fisheries potential	Fish Present	Freshwater Pearl Mussel (FPM)	Capable of supporting FPM	White-clawed Crayfish (WC)	Capable of supporting WC	Q Sample	Ecological Value
			spined Stickleback						
B6	Burren River	• Excellent Salmonid nursery with good to excellent unbedded spawning substrata locally in addition to excellent quality deeper holding pools for adult fish downstream of the bridge • The bridge apron was bedded and offered poor European Eel potential although deeper pools downstream, in addition to undercut banks and tree roots, provided ample refugia (none recorded) • Lamprey habitat was good overall although both suitable spawning (finer gravels) and ammocoete habitat were localised	Five fish species recorded; Atlantic Salmon, Brown Trout, *Lampetra* sp. and stone loach, Minnow	Absent (Considered absent from the Burren)	Some physical suitability but absent	Absent	Some good suitability	Q3-4 (moderate status)	**Local importance (higher value)**
B7	Garreenleen Stream	• Good Brown Trout nursery with some locally good holding for smaller year classes of fish. Spawning habitat, whilst present, was localised and limited given moderate. The stream likely becomes semi-dry during low-flow periods and this was considered to negatively impact the Salmonid population	Brown Trout	Absent	No	Absent	Some suitability	Q3 (poor status)	**Local importance (higher value)**

Site	Waterbody	Fisheries potential	Fish Present	Freshwater Pearl Mussel (FPM)	Capable of supporting FPM	White-clawed Crayfish (WC)	Capable of supporting WC	Q Sample	Ecological Value
		• Some localised Lamprey spawning habitat was present (species absent)							
B8	Bendinstown Stream	• Of no value to Salmonids and none were recorded • European Eel may use the channel as a migratory pathway or during periods of high flow in the downstream-connecting Burren River but was not of value to resident Eel	Three-spined Stickleback	Absent	No	Absent	No	Q3 (poor status)	**Local importance (lower value)**
B9	Ardbearn 14 Stream	None	None	Absent	No	Absent	No	Q3 (poor status)	**Local importance (lower value)**
C1	upper Douglas River	• Moderate quality Salmonid nursery and offered some localised good spawning habitat, although the site's overall value was compromised by the paucity of pool habitat • Lack of optimal habitat for Lamprey with dome good spawning habitat present but was highly localised • Not considered optimal for European Eel	Two Species; Brown Trout and *Lampetra* sp	No	No	Absent	No	Q4 (good status)	**Local importance (higher value)**
C2	Douglas River, Myshall Bridge	• Good Salmonid nursery For Brown Trout	Five fish species; *Lampetra*	Absent	No	Absent	Suitable	Q3 (poor status). Previous	**Local importance (higher value)**

Site	Waterbody	Fisheries potential	Fish Present	Freshwater Pearl Mussel (FPM)	Capable of supporting FPM	White-clawed Crayfish (WC)	Capable of supporting WC	Q Sample	Ecological Value
		• Salmonid spawning habitat was also of good quality • Lamprey habitat was good with Some good spawning habitat was also present. • Some good European Eel habitat under the bridge structure	sp, Brown Trout, European eel, Three-spined Stickleback and Stone Loach					EPA monitoring of the site resulted in a water quality of Q3-4 (2019)	
C3	Douglas River, Sragh Bridge	• Some good Salmonid nursery and spawning habitat • Lamprey ammocoetes habitat was good overall • European Eel habitat was moderate overall	Five fish species; Brown Trout, Minnow, *Lampetra* sp., Stone Loach, European Eel	Absent	No	Absent	Some good habitat suitability	Q3 (poor status) deviating from previous EPA monitoring of the site (Q4, 2019)	**Local importance (higher value)**
D1	Clashavey River, Rosscurra	• Salmonid spawning opportunities were moderate overall. Holding habitat for adults was poor habitat for adults was poor • Low potential for European Eel which likely used the channel for migration purposes (single yellow Eel captured). • No suitable larval Lamprey habitat present although some localised spawning habitat was present	Two fish species; Brown Trout and European Eel	Absent	No	Absent	No	Q3 (poor status)	**Local importance (higher value)**

Site	Waterbody	Fisheries potential	Fish Present	Freshwater Pearl Mussel (FPM)	Capable of supporting FPM	White-clawed Crayfish (WC)	Capable of supporting WC	Q Sample	Ecological Value
D2	Rosscurra stream, Rosscurra	• Low value Brown Trout nursery. Salmonid spawning opportunities were moderate. Holding habitat for adults was poor. The absence of a culvert and flow of the stream over (rather than under) a local access track significantly compromised Salmonid passage. • Low potential for European Eel which likely used the channel for migration purposes • No suitable larval Lamprey habitat	Two fish species; Brown Trout and European Eel	Absent	No	Absent	No	Q4 (good status)	**Local importance (higher value)**
D3	Clashavey River, R724 bridge, Moneygrogh	• Good Salmonid habitat with frequent excellent holding habitat (deeper pools) and good nursery habitat. Spawning opportunities moderate • Larval Lamprey habitat was absent • European Eel habitat was considered sub-optimal	Brown Trout	Absent	No	Absent	No	Q4 (good status)	**Local importance (higher value)**
D4	Clashavey river, Whitemill bridge	• Salmonid spawning and nursery habitat were both good, particularly for Atlantic Salmon and larger Trout. Upstream of the road some excellent quality deep holding habitat was present for adult Salmonids	Five fish species; Brown Trout, *Lampetra* sp, Atlantic Salmon,	Absent	low physical habitat suitability	Absent	low physical habitat suitability	Q4 (good status) an improvement on previous EPA monitoring	**Local importance (higher value)**

Site	Waterbody	Fisheries potential	Fish Present	Freshwater Pearl Mussel (FPM)	Capable of supporting FPM	White-clawed Crayfish (WC)	Capable of supporting WC	Q Sample	Ecological Value
		• Lamprey nursery optimal habitat was sparse. Spawning habitat present and good, locally near the bridge • Some good European Eel habitat.	European Eel and Stone Loach					of the river (Q3-4, moderate status	
E1	Upper Kildavin Stream, Cranemore	• Low value Brown Trout (moderate) nursery. Salmonid spawning opportunities were moderate. Holding habitat for adults was poor • Some low potential for European Eel which likely used the channel for migration purposes • Unsuitable for larval Lamprey	Brown Trout	Absent	No	Absent	No	Q4 (good status), an improvement on previous EPA monitoring of the river (Q3-4, 2019, approx. 0.5km downstream at Clashavey Bridge)	**Local importance (higher value)**
E2	Old Deerpark stream, Cranemore	• Little to no fisheries value. • Little value to resident European Eel although the species may use the channel as a migratory pathway	None	Absent	No	No	Absent	Q2-3 (poor status, moderately polluted)	**Local importance (lower value)**
E3	Kildavin stream, Kildavin	• Excellent Salmonid habitat with a combination of good spawning, good nursery and excellent holding habitat.	Four fish species; *Lampetra* sp., Brown Trout,	Absent	No species absent	No	Some suitability	Q4 (good status)	**Local importance (higher value)**

Site	Waterbody	Fisheries potential	Fish Present	Freshwater Pearl Mussel (FPM)	Capable of supporting FPM	White-clawed Crayfish (WC)	Capable of supporting WC	Q Sample	Ecological Value
		• Atlantic Salmon were, however, absent, despite some good suitability. Holding and nursery habitat was particularly good upstream • Good European Eel habitat was present throughout • Good quality Lamprey spawning and nursery habitat	European Eel, Stone Loach						

8.3.10 Other species

A desk study covering other fauna (amphibians, reptiles and terrestrial invertebrates) was carried out using NPWS and NBDC 10km grid square (S85) overlapping the study area. Common Frog (*Rana temporaria*) and Common Lizard (*Zootoca vivipara*) were recorded within the 10km grid square overlapping the study area. A further study of the NBDC webviewer indicated that neither species are recorded within the main wind farm site. Several 100m records for Frog and Lizard are scattered around the main wind farm site, with the closest record for both species dating from 2018 is located 1km away to the southeast of the main wind farm site at Raheenleigh.

8.3.10.1 Common Frog

Common Frog was not observed during ecological surveys of the study area, however the drains within the study area offer potential breeding habitat for Frogs.

8.3.10.2 Smooth Newt

Smooth Newt was not observed during surveys during ecological surveys of the study area, however the drains within the study area offer some potential breeding habitat for Smooth Newt.

8.3.11 Habitat Evaluation

8.3.11.1 Habitat Evaluation Summary

Table 8-51 and Table 8-52 below outline the ecological resources in the form of habitat types found within the study area. Key receptors as per NRA guidance (NRA, 2009a), for which impact assessment is to be carried out, are also indicated.

The habitats within the proposed wind farm site are predominantly conifer plantation (WD4) and buildings and artificial surfaces (BL3). These habitats are species poor in terms of flora, have been modified and are subject to disturbance.

Habitats along the proposed grid connection route are predominantly buildings and artificial surfaces (BL3), with adjacent dry meadows and grassy verges (GS2), with hedgerows (WL1), hedgerows (WL1) / treeline mosaic (WL2) and treelines (WL2) bounding fields of arable crops (BC1) and improved agricultural grassland (GA1). In terms of flora, the road itself if very limited as are the agricultural fields, with arable crops providing important foraging habitat for avifauna. The dry meadows and grassy verges (GS2) and linear road and field boundaries contain more species diversity. Grassy verges (GS2), provide foraging habitat for birds and butterflies whilst the linear boundaries provide foraging habitat for local fauna, nesting habitat for birds and commuting habitat for species like bat. However, these habitats have been modified and are subject to disturbance.

The habitats along the turbine delivery work locations of the TDR are predominantly buildings and artificial surfaces (BL3), with adjacent Dry meadows and grassy verges (GS2) hedgerows (WL1). Buildings and artificial surfaces (BL3) is mainly comprised of road which is species poor in terms of flora, whilst grass verges and hedgerows are more diverse. However, these habitats have been modified and are subject to disturbance.

Habitats evaluated as Local Importance (Higher Value) and above which are within the development footprint or zone of influence of proposed infrastructure are classified as key receptors, while habitats outside the development footprint or zone of influence or those within the development footprint evaluated as Local Importance (Lower Value) are not classified as key receptors.

Table 8-51: Summary of Habitat Evaluations, Habitats by Area and Key Receptors

Fossitt Habitat Classification (Code)	Evaluation	Key Receptor
Conifer plantation (WD4)	Locally Important (Higher Value)	Yes
Buildings and artificial surfaces (BL3)	Locally Important (Lower Value)	No
Spoil and bare ground (ED2) / Recolonising bare ground (ED2) mosaic	Locally Important (Lower Value)	No
Scrub (WS1)	Locally Important (Higher Value)	Yes
Dry meadows and grassy verges (GS2)	Locally Important (Higher Value)	Yes
Improved agricultural grassland (GA1)	Locally Important (Lower Value)	No
Dry Siliceous Heath (HH1)	County Importance	Yes
Recently-felled woodland (WS5)	Locally Important (Lower Value)	No
Arable crops (BC1)	Locally Important (Higher Value)	Yes
Recolonising bare ground (ED3)	Locally Important (Higher Value)	Yes
Stone walls and other stonework (BL1)	Locally Important (Higher Value)	Yes
Amenity grassland (improved) (GA2)	Locally Important (Lower Value)	No
Spoil and bare ground (ED2)	Locally Important (Lower Value)	No
Immature woodland (WS2)	Locally Important (Higher Value)	Yes
Flower beds and borders (BC4)	Locally Important (Lower Value)	No
(mixed) broadleaved woodland (WD1)	Locally Important (Higher Value)	Yes
Other artificial lakes and pond (FL8)	Locally Important (Higher Value)	Yes

Table 8-52: Summary of Habitat Evaluations, Linear Habitats and Key Receptors

Fossitt Habitat Classification (Code)	NRA Evaluation	Key Ecological Receptor
Hedgerows (WL1)	Locally Important (Higher Value)	Yes
Hedgerows (WL1) / treeline mosaic (WL2)	Locally Important (Higher Value)	Yes
Treelines (WL2)	Locally Important (Higher Value)	Yes
Stone walls and other stonework (BL1)	Locally Important (Higher Value)	Yes
Eroding/upland rivers (FW1)	Locally Important (Higher Value)	Yes
Depositing/lowland rivers (FW2)	Locally Important (Higher Value)	Yes

8.3.12 Fauna (Excluding Avifauna) Evaluation

The basis of impact assessment should be a determination of which ecological resources within the zone of influence of the proposed development and are of sufficient value to be material in decision making and therefore, included in the assessment (NRA, 2009a and CIEEM, 2019). Table 8-53, below, outlines the key receptors selected for assessment and the rationale for same; taken from NRA guidance (NRA, 2009a).

Table 8-53: Evaluation of Fauna

Common name	Conservation Status	NRA Evaluation	Rationale	Key Ecological Receptor
Badger	Wildlife Act (Amendment) 2000	County Importance	Recent 100m NBDC records located in the main wind farm site and grid connection route. Field signs observed during mammal survey.	Yes
Irish Hare	EU Habitats Directive Annex V, Wildlife Act (Amendment) 2000	National Importance	Recent 100m NBDC records located in the main wind farm site and grid connection route. This species was observed within the main wind farm site during the habitat walkover undertaken between 18th – 19th June 2019 to the south east of the site within dry meadow grassy verge (GS2) surrounded by conifer plantation (WD4). Observed during mammal survey	Yes
Pygmy Shrew	Wildlife Act (Amendment) 2000	National Importance	Recent 100m NBDC records located in the main wind farm site. Captured on trail camera during site surveys	Yes
Red Squirrel	Wildlife Act (Amendment) 2000	National Importance	Recent 100m NBDC records located in the main wind farm site. Not observed during any survey but may still use the main wind farm site.	Yes
Otter	EU Habitats Directive Annex II and Annex IV; Wildlife Act (Amendment) 2000	National Importance	Recent 100m NBDC records located along the proposed grid connection site. A single otter spraints was recorded at Barnahask Bridge on the River Clody Species is consider to be present within the Slaney and Barrow River Catchments	Yes
Irish Stoat	Wildlife Act (Amendment) 2000	National Importance	Recent 100m NBDC records located in along the grid connection route. Not observed during any survey but may still use the main wind farm site.	Yes

Common name	Conservation Status	NRA Evaluation	Rationale	Key Ecological Receptor
Pine Marten	EU Habitats Directive Annex V, Wildlife Act (Amendment) 2000	National Importance	Recent 100m NBDC records located in the main wind farm site. Not observed during any survey but may still use the proposed wind farm site.	Yes
Hedgehog	Wildlife Act (Amendment) 2000	National Importance	Recent 100m NBDC records located along the proposed grid connection site.	Yes
Wood Mouse	None	Local Importance (lower Value)	Recent 100m NBDC records located in the main wind farm site. Observed on trail camera within the main wind farm site during mammal surveys.	No
American Mink	Invasive non-native species	Not of conservation importance	Records in the greater area and potentially along the grid connection.	No
Brown Rat	Invasive non-native species	Not of conservation importance	Recent 100m NBDC records located in the main wind farm site. Observed on trail camera during mammal surveys within the main wind farm site.	No
Grey Squirrel	Invasive non-native species	Not of conservation importance	Records near the grid connection no observation within the main wind farm site.	No
Bank Vole	Invasive non-native species	Not of conservation importance	Observed on trail camera during mammal surveys within the main wind farm site.	No
Rabbit	Invasive non-native species	Not of conservation importance	Records in the greater area. Observed during mammal surveys within the main wind farm site.	No
Feral Goat	Invasive non-native species	Not of conservation importance	Observed during mammal surveys within the main wind farm site.	No
Sika Deer	Invasive non-native species	Not of conservation importance	Observed during mammal surveys within the main wind farm site.	No
House Mouse	Invasive non-native species	Not of conservation importance	There are no records of this species within the main wind farm site or grid connection.	No
Sika Deer	Invasive non-native species	Local Importance (lower Value)	Recent 100m NBDC records located in the proposed development site	No
Fox	None	Local Importance (lower Value)	Fox dens observed during mammal surveys within the main wind farm site.	No

Common name	Conservation Status	NRA Evaluation	Rationale	Key Ecological Receptor
Bats	EU Habitats Directive Annex IV; Wildlife Act (Amendment) 2000	National Importance	Recent records of bat roosts and activity within 10km of the main wind farm site, grid connection and TDR.	Yes
Common Frog	EU Habitats Directive Annex V, Wildlife Act (Amendment) 2000	National Importance	Common Frog was not observed during ecological surveys of the study area, however the drains within the study area offer potential breeding habitat for frogs.	Yes
Smooth Newt	Wildlife Act (Amendment) 2000	National Importance	Smooth Newt was not observed during surveys during ecological surveys of the study area, however the drains within the study area offer some potential breeding habitat for Smooth Newt.	Yes

8.3.13 Avifauna Evaluation

The basis of impact assessment should be a determination of which ecological resources within the zone of influence of the proposed development are of sufficient value to be material in decision making and therefore, included in the assessment (NRA, 2009a and CIEEM 2019. Table 8-54, over, outlines the key receptors selected for assessment and the rationale for same based on NRA guidance (NRA, 2009a); the overall importance or sensitivity evaluation for each key receptor, taken from guidance such as Percival 2007 is also illustrated.

Table 8-54: Avifauna Key Receptor Evaluations

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Blackbird	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Blackcap	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Black-headed Gull	Red Listed	National Importance	Recorded during vantage point surveys. No breeding or roosting recorded within the study area or hinterland.	Yes	High

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Blue Tit	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Bullfinch	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Buzzard	Green Listed	Local Importance (Higher Value)	Buzzard were recorded holding territory to the far west of the main wind farm site with display behaviour visible and further sightings suggesting breeding nearby. However, no record of them nesting within the main wind farm site.	Yes	Low
Chaffinch	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Chiffchaff	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Coal Tit	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Common Gull	Amber Listed	County Importance	Common gull was observed during winter VP surveys with numbers ranging from low (2) to medium (140) levels.	Yes	Medium
Crossbill	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Cuckoo	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Cormorant	Amber listed	County Importance	A single observation was made during the 2019/2020 winter VP surveys. One individual flew east over VP6.	Yes	Medium

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Curlew	Red Listed	National Importance	As single record was made during VP surveys and this occurred during the summer 2018 VP season. Ii was concluded to be a single bird flying south from summer breeding grounds elsewhere. During summer breeding walkover surveys it was surmised that there was no suitable breeding habitat on site for Curlew and other waders. During the 2018 hinterland surveys large numbers of Curlew were observed in fields located 4.5km northwest of the main wind farm site.	Yes	High
Dunnock	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Fieldfare	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Glaucous Gull	Green Listed	Local Importance (Higher Value)	Not observed within the flight activity study area. This species was observed during a 2018 hinterland survey within a field located near Fenagh village ca. 4.5km northwest of the main wind farm site.	No	Low
Goldcrest	Amber Listed	County Importance	Recorded during transect/count surveys	Yes	Medium
Golden Plover	Annex I Red Listed	International Importance	Recorded infrequently during vantage point surveys. No breeding recorded within the study area or hinterland.	Yes	Very High
Goldfinch	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Goosander	Amber Listed	County Importance	Not observed within the flight activity study area. This species was observed during a 2018 hinterland survey within a field located near Fenagh village ca. 4.5km northwest of the main wind farm site.	No	Medium

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Goshawk	Amber Listed	County Importance	There was a single sighting of Goshawk during the 2017/2018 winter VP surveys; a female was observed hunting south-east of the boundary over conifer plantation and a second bird was heard calling from conifer plantation to the west but never seen. A single Goshawk was also observed during the summer 2018 transect/point count survey.	Yes	Medium
Great Black-backed Gull	Amber Listed	County Importance	Great Black-backed Gull was observed during winter and summer VP surveys were observed a few times during each VP season in low numbers.	Yes	Medium
Great Crested Grebe	Amber Listed	County Importance	Not observed within the flight activity study area. This species was observed during a 2018 hinterland survey within a field located near Fenagh village ca. 4.5km northwest of the main wind farm site.	No	Medium
Great Spotted Woodpecker	Amber Listed	County Importance	Recorded during transect/count surveys	Yes	Medium
Great Tit	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Greenfinch	Amber Listed	County Importance	Recorded during transect/count surveys	Yes	Medium
Grey Wagtail	Red Listed	National Importance	Species not observed over 3 years of surveys.	No	n/a
Hen Harrier	Annex I Amber Listed	International Importance	During surveys Hen Harrier was observed once during summer 2018 VP surveys. An adult female was observed emerging from second rotation forestry and clearfell located to the north-west of VP4 (within the flight activity survey area). This individual travelled south-east through the site past VP4 and out of sight. There were four sightings of the species in October 2019 during	Yes	Very High

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
			winter VP surveys. Both males and females of the species were observed hunting over heather moorland.		
Herring Gull	Red Listed	National Importance	Few sightings of Herring Gull were observed during winter VP surveys and their numbers were low. Two Herring Gull sightings were observed during 2019 summer VP surveys of single birds; observed flying northwest over heath and circling improved grassland at VP2.	Yes	High
Hooded Crow	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
House Martin	Amber Listed	County Importance	Recorded during transect/count surveys	Yes	Medium
Iceland Gull	Green Listed	Local Importance (Higher Value)	Not observed within the flight activity study area. This species was observed during a 2018 hinterland survey within a field located near Fenagh village ca. 4.5km northwest of the main wind farm site.	No	Low
Jackdaw	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Jay	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Kestrel	Amber Listed	County Importance	Kestrel observed on a regular basis during summer and winter VP surveys. It was surmised that Kestrel bred in the wooded northwest corner of the main wind farm site. and in surrounding farmland.	Yes	Medium
Kingfisher	Annex I Amber Listed	International Importance	Not recorded on within the main wind farm site or surrounding area. No appropriate available habitat on site but potentially available along the grid connection route water course crossings. Included as a precaution.	Yes	Very High

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Lesser Black-backed Gull	Amber Listed	County Importance	Lesser Black-backed Gull were observed during winter and summer VP surveys. Flight paths were recorded within the flight activity survey area.	Yes	Medium
Linnet	Amber Listed	County Importance	Recorded during transect/count surveys	Yes	Medium
Little Grebe	Amber Listed	County Importance	Not observed within the flight activity study area. This species was observed during a 2018 hinterland survey within a field located near Fenagh village ca. 4.5km northwest of the main wind farm site.	No	Medium
Long-eared Owl	Green Listed	Local Importance (Higher Value)	During the 2019 summer VP survey period one record of Long-eared Owl was made; comprised juvenile owls calling/begging in an area of forestry southeast of VP5. During the breeding Woodcock and Nightjar survey in 2019, young owls were again heard calling/begging; providing evidence of breeding.	Yes	Low
Long-tailed Tit	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Magpie	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Mallard	Green Listed	Local Importance (Low Value)	A single sighting of Mallard was made during the course of the 2018 summer VP surveys; a male was observed flying north through the flight activity survey area over heather moorland and agricultural land during VP4. This species was observed during a 2018 hinterland survey within a field located near Fenagh village.	No	Negligible
Meadow Pipit	Red Listed	National Importance	Recorded during transect/count surveys, including the breeding season.	Yes	High

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Merlin	Annex I Amber Listed	International Importance	Few sighting of Merlin during summer and winter VPs in low numbers. A pair observed copulating but were not observed after during summer breeding walkovers and it is surmised that they migrated.	Yes	Very High
Mistle Thrush	Amber Listed	County Importance	Recorded during transect/count surveys	Yes	Medium
Moorhen	Green Listed	Local Importance (Low Value)	This species was observed during a 2018 hinterland survey within a field located near Fenagh village ca. 4.5km northwest of main wind farm site.	No	Negligible
Lapwing	Red Listed	National Importance	Not observed within the flight activity study area. During the summer breeding walkover it was found that the site does not contain suitable breeding habitat for waders. During the 2018 hinterland surveys large numbers of Lapwing were observed in fields located 4.5km northwest of the site.	No	High
Peregrine Falcon	Annex I Green Listed	International Importance	Low number of Peregrine sightings during winter and summer VP surveys. No evidence of them breeding during surveys including summer breeding survey walkovers.	Yes	Very High
Pheasant	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Pied Wagtail	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Raven	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Red Grouse	Red Listed	National Importance	Red Grouse is a target species and was not observed during avifauna site surveys undertaken over three years which included a Red Grouse survey in 2019.	Yes	High

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
			A female and juvenile were observed during the habitat walkover survey undertaken 18th – 19th June 2019 within dry heath habitat within the eastern corner of main wind farm site. Dry heath habitat is located within the north-western and eastern part of the site. Avifauna walkover surveys determined the habitat condition in the north-western corner to be very poor with very little heather remaining due to burning in the previous year. This was in contrast to the heath habitat located to the east of the site which was good quality habitat with dense heather cover.		
Red Kite	Amber Listed	County Importance	During summer VP surveys Red Kite was observed once in the flight study area on 2018 and three times in 2019 within the flight activity study area.	Yes	Medium
Redpoll	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Redwing	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Robin	Amber Listed	County Importance	Recorded during transect/count surveys, including the breeding season.	Yes	Medium
Rook	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Sand Martin	Amber Listed	County Importance	Recorded during transect/count surveys	Yes	Medium
Siskin	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Skylark	Amber Listed	County Importance	Recorded during transect/count surveys	Yes	Medium

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Snipe	Amber Listed	County Importance	During winter VP surveys snipe were recorded in infrequently and in low numbers (1-9). During the summer breeding surveys it was considered that potentially suitable breeding habitat was located on site however, no evidence of snipe or observations of them were recorded.	Yes	Medium
Snow Bunting	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Song Thrush	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Sparrowhawk	Amber Listed	County Importance	Sparrowhawk were observed on several occasions during 2017/2018 and 2019/2020 winter VP surveys and to a lesser extent during winter 2018/2019 winter VP surveys. Sparrowhawk was again observed on several occasions during summer VP surveys with all observations of a single bird with few sightlines over the site. The 2018 summer breeding walkover surveys indicates that a pair of Sparrowhawk bred within the southwest corner of the main wind farm site.	Yes	Medium
Spotted Flycatcher	Amber Listed	County Importance	Recorded during transect/count surveys	Yes	Medium
Starling	Amber Listed	County Importance	Recorded during transect/count surveys, including the breeding season.	Yes	Medium
Stock Dove	Amber Listed	County Importance	Recorded during VPs as non target species	Yes	Medium
Stonechat	Amber Listed	County Importance	Recorded during transect/count surveys	Yes	Medium
Swallow	Amber Listed	County Importance	Recorded during transect/count surveys	Yes	Medium
Swift	Amber Listed	County Importance	Recorded during transect/count surveys	Yes	Medium

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Teal	Amber Listed	County Importance	Not observed within the flight activity study area. This species was observed during a 2018 hinterland survey within a field located near Fenagh village ca. 4.5km northwest of the main wind farm site.	No	Medium
Treecreeper	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Tufted Duck	Red Listed	National Importance	Not observed within the flight activity study area. This species was observed during a 2018 hinterland survey within a field located near Fenagh village ca. 4.5km northwest of the main wind farm site.	No	High
Wheatear	Amber Listed	County Importance	Recorded during VPs as non target species	Yes	Medium
Whitethroat	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
White throated Dipper	Green Listed	Local Importance (Higher Value)	Recorded during bat roost survey of grid connection route watercourse crossing.	Yes	Low
Willow Warbler	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Woodcock	Red Listed	National Importance	Recorded during summer (moderate numbers) and winter (low numbers) vantage point surveys. Recorded breeding on site in low numbers.	Yes	High
Woodpigeon	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Wren	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Yellow-legged Gull	Green Listed	Local Importance (Higher Value)	Not observed within the flight activity study area. This species was observed during a 2018 hinterland survey within a field located near Fenagh village ca. 4.5km northwest of the main wind farm site.	No	Negligible

The following Very High to Medium sensitivity species were recorded within the 10km grid square encompassing the study site (S85) within the last 10 years (2009-2019) only and were not recorded within the study area over three years of dedicated field surveys. Consequently, they are not listed as key receptors. These species are:

- Little Egret, Short-eared Owl, Whooper Swan (Very High sensitivity)
- Goldeneye, Northern Shoveler, Pochard, Red Grouse, Whinchat, Wigeon, Yellowhammer (High sensitivity)
- House Sparrow, Mute Swan, Northern Wheatear, Sandpiper (Medium sensitivity)

Heron a Low sensitivity species was recorded within the 10km grid square encompassing the study site (within the last 10 years) and was included as a secondary target species due to its potential sensitivity to a wind farm development. The species was not observed during the three years of surveys and is therefore not listed as a key receptor.

Corncrake[9] (Very High sensitivity species) and Ring Ouzel (High sensitivity species) are historic records (1972) within the 10km grid square (encompassing the study area) and were not observed during three years of surveys and consequently are not listed as key receptors.

Specific Nightjar surveys (Very High sensitivity species) were undertaken. The species was not recorded within the 10km grid square (in which the site is located) and was not observed over three years of surveys and therefore is not included as a key receptor.

8.3.14 Aquatic Ecology Evaluation

The basis of impact assessment should be a determination of which ecological resources within the zone of influence of the proposed development and are of sufficient value to be material in decision making and therefore, included in the assessment (NRA, 2009a and CIEEM, 2019). Table 8-55, below, outlines the key receptors selected for assessment and the rationale for same; taken from NRA guidance (NRA, 2009a). All streams have been considered key receptors due to the downstream connectivity to high value watercourses.

[9] Corncrake are no longer located in the area; populations concentrated in west Connacht and Donegal (NPWS, 2019).

Table 8-55: Aquatic Key Receptor Evaluations

Site	Waterbody name	EPA code	Evaluation of aquatic importance	Summary of features of conservation value	Key Receptor
A1	Kilbrannish South Stream	12K81	Local importance (lower value)	No fish recorded (not of fisheries value). Water quality of Q4 (good status) but no other aquatic features of higher than local importance	Yes
A2	Kilbrannish North Stream	12K82	Local importance (higher value)	Brown Trout population, Q4 (good status) water quality)	Yes
A3	River Clody	12C03	**International importance** (within SAC)	Brown Trout and European Eel populations, Q4 (good status) water quality and situated within Slaney River Valley SAC	Yes
A4	River Clody	12C03	**International importance** (within SAC)	Brown Trout and Atlantic Salmon populations, Q4 (good status water quality) and situated within Slaney River Valley SAC	Yes
A5	River Slaney	12S02	**International importance** (within SAC)	Atlantic Salmon, Lamprey, Brown Trout and European Eel populations, floating river vegetation, Q4 (good status water quality) and situated in Slaney River Valley SAC	Yes
B1	Raheenleigh Stream	14R22	Local importance (lower value)	No high value ecological attributes. Dry at time of survey and situated in upland conifer plantation	Yes
B2	Burren River	14B05	Local importance (higher value)	Brown Trout populations and Q4 (good status) water quality	Yes
B3	Burren River	14B05	Local importance (higher value)	Brown Trout populations, floating river vegetation and Q4 (good status) water quality	Yes
B4	Ballykeally Stream	14B55	Local importance (lower value)	No fish recorded (not of fisheries value). Water quality of Q4 (good status) but no other attributes to elevate ecological evaluation	Yes
B5	Burren River	14B05	Local importance (higher value)	Brown Trout and Atlantic Salmon populations, Q4 (good status) water quality and floating river vegetation	Yes

Site	Waterbody name	EPA code	Evaluation of aquatic importance	Summary of features of conservation value	Key Receptor
B6	Burren River	14B05	Local importance (higher value)	Brown Trout, Lamprey and Atlantic Salmon populations, Q4 (good status) water quality and floating river vegetation	Yes
B7	Garreenleen Stream	14G24	Local importance (higher value)	Brown Trout population present and spawning tributary of the Burren River	Yes
B8	Bendinstown Stream	14B70	Local importance (lower value)	No fisheries value and Q3 (poor status) water quality recorded	Yes
B9	Ardbearn 14 Stream	14A21	Local importance (lower value)	No fisheries value and Q3 (poor status) water quality recorded	Yes
C1	Douglas River	12D03	Local importance (higher value)	Brown Tout and *Lampetra* sp. populations present and Q4 (good status) water quality recorded	Yes
C2	Douglas River	12D03	Local importance (higher value)	*Lampetra* sp., Brown Trout and European Eel populations recorded	Yes
C3	Douglas River	12D03	Local importance (higher value)	Brown Trout, *Lampetra* sp. and European Eel populations recorded. Floating river vegetation present	Yes
D1	Clashavey River	12C10	Local importance (higher value)	Brown Trout and European Eel populations recorded	Yes
D2	Rossacurra Stream	12R37	Local importance (higher value)	Brown Trout and European Eel populations present. Good status (Q4) water quality recorded	Yes
D3	Clashavey River	12C10	Local importance (higher value)	Brown Trout populations present and Q4 (good status) water quality recorded	Yes
D4	Clashavey River	12C10	Local importance (higher value)	Brown Trout, Atlantic Salmon, *Lampetra* sp. and European Eel populations present. Floating river vegetation and Q4 (good status) water quality also recorded	Yes
E1	Kildavin Stream	12K04	Local importance (higher value)	Brown Trout, Atlantic Salmon and *Lampetra* sp. present. Q4 (good status) water quality was also recorded.	Yes

Site	Waterbody name	EPA code	Evaluation of aquatic importance	Summary of features of conservation value	Key Receptor
E2	Old Deerpark Stream	12O08	Local importance (lower value)	Not of fisheries value and Q2-3 (poor status) water quality recorded	Yes
E3	Kildavin Stream	12K04	Local importance (higher value)	Brown Trout and *Lampetra* sp. populations recorded. Good status (Q4) water quality also recorded	Yes

8.4 Do Nothing Scenario

If the proposed development does not proceed, the 'do nothing' scenario is that the existing environment and key receptors identified in Section 8.3 are likely to remain as described previously. This assumes the continuation of existing forestry operations at the main wind farm site. Although key ecological receptors can fluctuate in abundance and may be found in different locations during different stages of said forestry operations (e.g. post-felling, conifer plantation habitats can be replaced by scrub habitats, which may cause animals that use conifer habitats to move to different locations in the forestry), overall, the habitats and species found at the project will likely remain as they are currently.

8.5 Potential Impacts on Ecology

The potential impacts of the project are addressed below in terms of potential impacts arising in both the construction, operational and decommissioning phases.

8.5.1 Construction Phase

8.5.1.1 European sites

There are no designated European sites within the proposed main wind farm site and grid connection, therefore no direct impacts are predicted during construction for these elements of the project. The TDR passes through the Slaney River Valley SAC (000781) for a short section along the L2026 local road directly west of Bunclody. The Blackstairs Mountains SAC (site code 000770) is located adjacent to the proposed turning area at turbine delivery work location no. 52, however no works are required within the SAC or peatland habitats.

European sites hydrologically linked to the proposed development site have the potential to be indirectly impacted due to hydrological changes and impacts such as increased siltation, nutrient release and/or contaminated run-off through drainage channels and watercourses.

Hydrological impacts are more likely to occur during the construction phase but could also occur during the operational phase e.g., run-off from hard-standing areas.

A Natura Impact Statement (NIS) has been prepared for the proposed development and has been submitted with the planning application. The NIS (Appendix 8.1) addresses potential effects on European Sites resulting from the proposed development.

The Stage One Appropriate Assessment Screening report concluded that, in the absence of mitigation measures (which have not been considered at this screening stage), likely significant effects on the qualifying interests of the Slaney River Valley SAC, Blackstairs Mountains SAC, Lower River Shannon SAC and River Barrow and River Nore SAC cannot be excluded on the basis of objective scientific information.

A Stage 2 Appropriate Assessment (Natura Impact Statement) of the potential impact on the Slaney River Valley SAC, Blackstairs Mountains SAC, Lower River Shannon SAC and River Barrow and River Nore SAC was therefore required. The Natura Impact statement concluded that, in the light of the conclusions of the assessment which it shall conduct on the implications for the European sites concerned, the competent authority is enabled to ascertain that the proposed project will not adversely affect the integrity of any of the European sites concerned.

8.5.1.2 Natural Heritage Areas or Proposed Natural Heritage Areas

Two pNHAs within the 10km of the study area lie within the boundary of a European site which have been considered as part of the Natura Impact Statement:

- Blackstairs Mountain SAC/pNHA (000770)
- Slaney River Valley SAC/pNHA (000781)

These two SACs/pNHAs are outside the footprint of the main wind farm site and therefore, no direct impacts are predicted.

The grid connection route does not traverse any designated nature conservation site. These two SACs/pNHAs previously described are outside the footprint of the cable route and, therefore, no direct impacts are predicted.

Along the TDR, additional works are required at turbine delivery work location no. 30, located within the Slaney River Valley pNHA (000781) and is considered further under the potential impact section below. Minor oversail of the northern verge through the right bend will be required only at turbine delivery work location no. 31. No trimming, vegetation clearance, felling or excavation works are required at the location and no works are required within the Slaney River Valley pNHA.

The AA Screening concluded that in the hypothetical scenario of a large release of suspended solids or silt into onsite watercourses during construction, it was not possible to exclude whether the project, alone or in combination with other activities would have significant indirect effects on the Slaney River Valley SAC/pNHA.

These indirect effects, via water quality, could occur on the key species for which the pNHA has been designated. In the event of siltation or pollution of watercourses resulting from uncontrolled run-off from the Croaghaun Wind Farm development, the River Slaney and its tributaries could be indirectly damaged by changes to turbidity and water quality. There is also potential for indirect effects to designated fish and aquatic species including, *inter alia*, white-clawed crayfish and salmon, due to water quality changes which could cause a fish kill.

Changes in water quality could in turn reduce prey availability of breeding otter in the Slaney River Valley SAC/pNHA and reduce breeding sites for aquatic species.

Whilst it has been acknowledged that there could be potential for the main wind farm site, turbine delivery route and grid connection to have significant effects on the Slaney River Valley SAC/pNHA, with the implementation of the detailed mitigation measures identified in the NIS, it is concluded beyond reasonable scientific doubt that the integrity of the Slaney River Valley SAC/pNHA will not be adversely affected.

The NIS report has assessed the potential effects on the integrity of the Slaney River Valley SAC/pNHA in light of the sites' conservation objectives and mitigation measures have been developed to prevent such potential effects occurring.

In the light of the conclusions of the assessment which it shall conduct on the implications for the Slaney River Valley SAC/pNHA, the competent authority is enabled to ascertain that the proposed project will not adversely affect the integrity of any of the Slaney River Valley SAC/pNHA.

The Blackstairs Mountain SAC/pNHA is located immediately adjacent to main wind farm site, however no element of the main wind farm site infrastructure is located within the same catchment. No hydrogeological effects (specifically, the drying out of peat) are possible due to the relative location of main wind farm infrastructure (the closest part of the SAC is separated from wind farm infrastructure by a ridge and located c. 350m north-east) and the shallow peat depths and soil types onsite (ranging from 0.1 – 0.3m; firm clay or firm peaty topsoil).

The only element of the project with any potential connection to Blackstairs Mountains pNHA is the TDR turning area (turbine delivery work location no. 52) located immediately adjacent to the pNHA and is considered further under the potential impact section below.

The AA Screening concluded that in the hypothetical scenario of a release of suspended sediment, polluted runoff and/or spread of non-native invasive species from the construction of the car park extension there could be significant indirect effects to the SAC/pNHA via existing forestry drainage onsite which drains to the south and east. Changes in water quality could indirectly affect the QI habitats for which the SAC/pNHA is designated. Therefore it was not possible to exclude whether the project, alone or in combination with other activities would have significant indirect effects on the Blackstairs Mountain SAC/pNHA.

Whilst it has been acknowledged that there could be potential for the turbine delivery route to have significant effects on the Blackstairs Mountain SAC/pNHA, with the implementation of the detailed mitigation measures identified in the NIS, it is concluded beyond reasonable scientific doubt that the integrity of the Blackstairs Mountain SAC/pNHA will not be adversely affected.

The NIS report has assessed the potential effects on the integrity of the Blackstairs Mountain SAC/pNHA in light of the sites' conservation objectives and mitigation measures have been developed to prevent such potential effects occurring.

In the light of the conclusions of the assessment which it shall conduct on the implications for the Blackstairs Mountain SAC/pNHA, the competent authority is enabled to ascertain that the proposed project will not adversely affect the integrity of any of the Blackstairs Mountain SAC/pNHA.

Within 10km of the main wind farm site there are a further three pNHAs:

- Bunclody Slate Quarries pNHA (000750)
- Ballymoon Esker pNHA (000797)
- John's Hill pNHA (000808)

Within 10km of the grid connection there are a further five pNHAs:

- Bunclody Slate Quarries pNHA (000750)
- Ballymoon Esker pNHA (000797)

- John's Hill pNHA (000808)
- Ardristan Fen pNHA (000788)
- Cloghristick Wood pNHA (000806)

The western section of Cloghristick Wood pNHA (000806) lies within the River Barrow and River Nore SAC (002162) which has been considered as part of the Natura Impact Statement (conclusions shown in section 8.5.2.1). However over half of the pNHA is outside of the SAC, therefore the non-Annex I woodland habitat of the pNHA will be assessed here.

Additional localised works will be undertaken at several locations along the TDR. Within 10km of TDR there are five pNHAs:

- John's Hill pNHA (000808)
- Bunclody Slate Quarries pNHA (000750)
- Ballynabarney Wood pNHA (000746)
- Clone Fox Covert pNHA (000755)
- Killoughrum Forest pNHA (000765)

Potential Direct Impacts

The main wind farm site is not within the boundaries of any designated nature conservation site. All pNHAs previously described are outside the footprint of the main wind farm site and therefore, no direct impacts are predicted.

The grid connection route does not traverse any designated nature conservation site. All pNHAs previously described are outside the footprint of the cable route and, therefore, no direct impacts are predicted.

Along the TDR, additional works are required at turbine delivery work location no. 30 which is located within Slaney River Valley pNHA (000781).

At turbine delivery work location no. 30, it is proposed to repair the existing road surface, lower the existing stone wall to 0.5m (height) and remove street furniture and trim overhanging vegetation. Road verge habitats within this turbine delivery work location are comprised of (mixed) broadleaved woodland (WD1), stone walls and other stonework (BL1) and hedgerows (WL1), which are all deemed to be Locally Important (Higher Value) and low-sensitivity habitats. The removal of stone walls and other stonework (BL1) will be limited in length, resulting in a *Permanent Reversible Slight Impact*. Trimming of (mixed) broadleaved woodland (WD1) and hedgerow (WL1) vegetation will also be limited in length. The trimming of hedgerow (WL1) is a common practice and is deemed to have a *Temporary Imperceptible Reversible Effect*. The trimming of (mixed) broadleaved woodland (WD1) will result in a *Temporary Imperceptible Reversible Impact*.

The invasive Cherry Laurel, Himalayan honeysuckle and Traveller's Joy are all located within the woodland understorey and canopy (outside the immediate area of trimming) and the natural regeneration of the area of failed trees could be impeded by invasive species. The woodland is Local Value (Higher Value), the worst-case scenario of invasive species preventing the regeneration of trees could result in *Permanent Slight Reversible Impact*.

Potential Indirect Impacts

The Main Wind Farm Site

The main wind farm site is situated within five sub-basins as defined by the WFD. These waterbodies are as follows:

- Clashavey_River_010 – IE_SE_12C00500
- Kildavin_Stream_010_010 – IE_SE_12K040800
- Clody_010 – IE_SW_12C030080
- Burren_020 – IE_SE_14B050110
- Douglas (Ballon)_010 – IE_SE_12D030200

The Burren_020 sub basin forms part of the Barrow Catchment (catchment id: 14), whilst the other four sub basins form part of the Slaney and Wexford Harbour catchment (catchment id: 12). No turbines will be constructed in the Burren_020 sub-basin.

A first order stream (no EPA name, which feeds into the Clody EPA code: 12C03) is located along the southern boundary of John's Hill pNHA (000808). This national site is designated for Bog Orchid and corresponding bog habitat. While the pNHA is within the same sub-catchment area, it is located hydrologically up gradient of the main wind farm site. Additionally, due to the distance (ca. 3.4km direct-line) and an absence of a direct hydrological link, no impacts will occur to John's Hill pNHA (000808) during construction works.

Bunclody Slate Quarries pNHA (000750), is dissected by the Glaslacken 12 (EPA code: 12G50) which feeds into the Clody River. The national site is designated for heath habitat as well as Bird's-foot, Small Cudweed, Pale Dog Violet. While the pNHA is within the same sub-catchment area it is located hydrologically up gradient of the main wind farm site. Additionally, due to distance (ca. 5.2km direct-line) and the absence of a direct hydrological link, no impacts will occur to Bunclody Slate Quarries pNHA (000750) during construction works.

Ballymoon Esker pNHA (000797) is bisected by a tributary of the River Barrow (Lower Clorusk, EPA code: 14C31). The national site is designated for esker and calcareous grassland, as well as Green-winged Orchid, Basil Thyme and Bee Orchid. The pNHA is within the same sub-catchment area but again, it is located hydrologically up gradient of the main wind farm site. Due to distance (ca. 9.1km direct-line) and the absence of a direct hydrological link, no impacts will occur to Ballymoon Esker pNHA (000797) during construction works.

Grid Connection

Two grid connection route variants have been assessed in addition to the primary route which makes use of private agricultural lands at two separate locations to both minimise the overall length of the route and reduce the number of watercourse crossings required for the project. In both cases, where the primary route leaves the public road and passes through private lands, an alternative route variant has been assessed which involves the cable route following the public road corridor. Two separate cable route options for entering the proposed substation at Kellistown substation (see Section 3.5.9.2 in Chapter 3) have also been assessed. For the purposes of assessing worst case, the maximum possible route length and number of watercourse crossings based on the route permutations available have been used for quantities and material calculations. Should the proposed primary route be constructed, the total number of watercourse crossings shall amount to 5no. (2no. in the public road corridor and 3no. in private lands). The maximum possible number of watercourse crossings required is 7no. and would involve the inclusion of both route variants in the final grid connection.

In this scenario, 6 no. watercourse crossings will be located in the public road corridor and 1 no. will be on private lands. To avoid instream and bankside works, the installation of the underground cable at stream crossings will be achieved by horizontal directional drilling (HDD) or installation within existing bridge deck. HDD will be employed at up to 8 no. locations to cross watercourses existing watercourses and the N80 road along the grid connection route as part of the development. Cable ducts will be installed in the bridge deck at GCR-WCC6. Table 8-1 summarises watercourse crossing locations along the grid connection route and the proposed method for crossing at each location. In terms of the grid connection, drainage from the route is to the Rossacura stream and Douglas (Ballon) Stream which are tributaries of the Slaney, and to the Bendinstown stream, Gareenleen stream, Kilmaglush stream, Ballykealey stream and Burren river, which are tributaries of the Barrow.

The closest pNHA to the grid connection is Ardistan Fen pNHA, located ca. 2.2km away (direct distance). The national site is also the closest site to a watercourse crossing; located ca. 2.7km (direct distance) from WCC8 (Variant 2). None of the national sites are designated for aquatic habitats or species. Due to distance, the nature of cable route installation and the absence of a direct hydrological link there will be no impacts to Ardistan Fen pNHA from the installation of the grid connection.

Cloghristick Wood pNHA (000806) is designated for woodland and located ca. 8.8km away (direct distance). Due to distance and the absence of a direct hydrological link there will be no impacts to Cloghristick Wood pNHA from the grid connection installation.

Turbine Delivery Route (TDR)

Additional works along the TDR will mainly be comprised of the trimming of vegetation and removal of street furniture. Invasive species have been recorded along turbine delivery work locations nos. 30, 31 (areas assessed above in Direct Impacts) and turbine delivery work location no. 29.

Turbine delivery work location no. 18 is located at the N30/N11 roundabout. Additional works will include providing a load bearing surface through the centre of the roundabout island and temporary removal of street furniture. The closest pNHA's to turbine delivery work location no. 18 are Ballynabarney Wood pNHA ca. 3.2 km (direct distance), Clone Fox Covert pNHA ca. 2.6 km (direct distance) and Killoughrum Forest pNHA ca. 7.4 km (direct distance). Due to distance, the nature of works (within existing transport infrastructure) at turbine delivery work location no. 18 and the absence of a direct hydrological link there will be no impacts to the pNHA's from the turbine delivery route works.

Turbine delivery work location no. 29 is located in Bunclody and the invasive species are comprised of Cherry Laurel and Wall Cotoneaster. Additional works will include the trimming and removal of vegetation which may or may not result in invasive species being trimmed/removed. This turbine delivery work location is not adjacent to a national site, or a waterbody which could transfer either species, and so no impact will occur to any national site. However, it is prudent to include invasive species management measures to restrict the spread of invasive species to other turbine delivery work locations along the TDR.

At turbine delivery work location no. 43, the construction of a temporary bridge crossing at Kilbranish is proposed to accommodate turbine delivery. The watercourse at the turbine delivery work location is a first order stream (Deerpark_New, EPA code_12D25), which is a tributary of the Slaney River. Works will include the removal of adjacent vegetation (including a section of hedgerow), the placement of the temporary bridge, laying of an aggregate surface and placement of concrete supports. Following delivery of turbines, the bridge shall be removed and disassembled, the temporary aggregate track hard standing areas shall be removed and fully reinstated and the concrete bridge supports shall be left in situ. During the construction and the subsequent removal of the bridge suspended solids could potentially enter the stream.

Both John's Hill pNHA (000808) and Bunclody Slate Quarries pNHA (000750) are within the greater Slaney River catchment, located ca. 1.6km and 2.7km away (direct distance) respectively. However, due to the absence of a direct hydrological link as well as distance there will be no effect on either national site from works at turbine delivery work location no. 43.

The existing car park hardstanding area at turbine delivery work location no. 52 is adjacent to the Blackstairs Mountains pNHA. The car park is surfaced and surrounded by a vegetated soil berm. This car park has previously been used to carry out a similar turning manoeuvre for wind turbines associated with the existing Greenoge Wind Farm.

The proposed works at turbine delivery work location no. 52 involves extending the hardstanding area of the existing car park to the south to facilitate the wheel over run of the turbine delivery vehicles. The extension shall be temporary and will be removed following the completion of the works.

The existing car park as well as the proposed extension are located within a large stand of conifer plantation. The proposed extension is located 7.5m from the pNHA in existing drained land for forestry. The location is on raised ground above the pNHA surrounded by existing drainage for forestry with no further excavation required. There is a possible hydrological link between the extension and the SAC via the existing forestry drainage onsite which drains to the south and east. While it is unlikely that the resulting runoff will have a significant effect on the pNHA it is prudent to include measures to mitigate this.

Due to the presence of invasive species along the TDR there is the potential for the spread of species to turbine delivery work location no. 52 if works were to progress in a sequential manner (i.e. from turbine delivery work locations to turbine delivery work locations), it is prudent to include invasive species management measures to restrict the spread of invasive species to other turbine delivery work locations along the TDR.

8.5.1.3 Habitats and Flora

Potential Direct Impacts

Table 8.56 below summarises the habitat loss which will result from the proposed development. Table 8-57 summarises habitat loss for linear habitats.

Table 8-56: Habitat loss (habitat areas) within the main wind farm site

Habitat	Selected as key ecological receptor	Area in Hectares within the Ecology Study Area (ha)	Percentage of total Ecology Study Area (%)	Area of habitat to be lost (ha)	Percentage loss of each habitat type (%)
Conifer Plantation (WD4)	Yes	298.19	71.01	20.16	6.76
Degraded Dry Siliceous Heath (HH1)	Yes	33.56	7.99	0.67	2.00
Dry Meadows and Grassy Verges (GS2)	Yes	10.23	2.44	0.18	1.76
Improved Agricultural Grassland (GA1)	No	31.91	7.60	0.65	2.04

Habitat	Selected as key ecological receptor	Area in Hectares within the Ecology Study Area (ha)	Percentage of total Ecology Study Area (%)	Area of habitat to be lost (ha)	Percentage loss of each habitat type (%)
Recently-felled Woodland (WS5)	No	43.36	10.33	4.28	9.87
Scrub (WS1)	Yes	2.7	0.64	0.24	8.89
Total		**419.95**	**100**	**26.18**	**N/A**

Table 8-57: Habitat loss (linear habitats) as a result of the main wind farm site

Habitat	Selected as key ecological receptor	Total length within wind farm study area (m)	Length of habitat to be lost (m)	Percentage of total linear habitat loss (%)
Hedgerows (WL1)	Yes	1,976.23	26.45	1.34

The construction of access roads, temporary compound, on-site substation, foundations and hard standings as well as the excavation of cable trenches will result in a degree of habitat damage and loss. The habitat loss will be the total area covered by the access tracks (new sections and upgrading of existing tracks), plus the footprint associated with each of the seven proposed turbines (foundations, hard standings, and associated felling buffers) and all other wind farm infrastructure.

The most abundant habitat type within the study area is conifer plantation (WD4) which on its own accounts for 71.01% (298.19 Ha) of the study area. This is followed by the strongly-linked habitat type, recently-felled conifer plantation (WS5), which accounts on its own for 10.33% (43.36 Ha) of the study area. The two stages of this habitat type combined accounts for 81.34% of the study area.

Another highly modified habitat type, improved agricultural grassland (GA1), accounts for an additional 7.60% (31.91 Ha) of the study area. Due to its artificial character and intensive management, GA1 is of low value in ecological terms and as such, is not considered a key ecological receptor. Consequently, it is not considered further. Degraded dry siliceous heath (HH1) makes up 7.99% (33.56 Ha) of the study area. This is followed by dry meadows and grassy verges 2.44% (10.23 Ha) and scrub 0.64% (2.7 Ha).

The footprint of the proposed development including felling buffers, will be approximately 26.18 Ha or 6.23 % of the total study area. A total of 20.16 Ha or 6.76 % of conifer plantation within the study area shall be lost due to the felling of trees. An additional total of 4.28 Ha or 9.87% recently-felled conifer plantation (WS5) shall be lost due to the wind farm. The combined habitat loss percentage for both these habitat types is 93.35% of the overall habitat loss. These felled areas shall be maintained as treeless areas for the life of the wind farm, but they shall form other semi-natural habitats as vegetation recolonises these areas. It is important to note that the majority of felling is made up of conifer plantation, a highly artificial habitat of recent origin and limited biodiversity value, managed primarily as a silvicultural crop for the production of timber. When these two conifer habitats are combined with another highly modified habitat type namely improved agricultural grassland (Habitat loss 0.65 Ha or 2.04 %), they account for 25.09 Ha or 95.84 % of the total habitat loss.

Approximately 7.99% of the study area is classified as Degraded Dry Siliceous Heath (HH1). Whilst the habitat on site is dry heath, relevé results confirms that it does not correspond with Annex I habitat 'European dry heaths (4030)', as the habitat contains limited floral diversity with an immature moss ground layer with lichen completely absent from the ground layer. Also, Bracken (both areas) and Bramble (Area B only) is invading the habitat.

The proposed development shall result in the loss of approximately 0.67 Ha (2.00 % of the total habitat type) at turbine 6. Degraded dry heath accounts for 2.56 % of the total habitat loss. The felling of conifer plantation within the main wind farm site that will remain unplanted for the lifetime of the wind farm will increase the amount of degraded dry heath within the site. The bare sections of shallow peat will recolonise with heathland species over time. While this habitat type will not be of Annex I quality, it will offer habitat of a similar quality to the existing dry heath habitat within the site.

Considering the potential for clear felled sections of peat to develop into semi-natural heath, but also the small area impacted, and isolation and small size of the stands, this will result in a *Permanent Moderate Irreversible Impact*.

Dry meadows and grassy verges (GS2) is present along existing internal roads within the main wind farm site representing a total area of 10.23 Ha (2.44%). The total area of habitat loss for this habitat type is 0.18 Ha or 1.76 % of the total habitat type. This accounts for 0.69 % of the total habitat loss associated with the main wind farm site. This habitat has formed through the recolonisation of bare ground or disturbed ground due to the construction of internal forestry roads and ongoing forestry practices. Therefore, it is considered highly likely that a similar pattern of recolonisation would occur following construction of the proposed wind farm and any resultant habitat loss would be short-term (1-7 years) in nature. The loss of this habitat would result in a *Short-term Imperceptible Reversible Impact*.

Small sections of scrub (WS1) are present throughout the study area, representing a total area of 2.7Ha (0.64%). The total area of habitat loss for this habitat type is 0.24 Ha or 8.89 % of the total habitat type. This accounts for 0.92 % of the total habitat loss associated with the main wind farm site. Scrub habitats would follow a similar recolonisation pattern to grassy verges (GS2) and therefore, it is considered highly likely that a similar pattern of recolonisation would occur following construction of the proposed wind farm and any resultant habitat loss would be short-term (1-7 years) in nature. The loss of this habitat would result in a *Short-term Imperceptible Reversible Impact*.

Limited sections of hedgerows will be lost within the footprint of proposed wind farm. The magnitude of habitat loss is *Imperceptible* (26.5m of hedgerow, accounting for 1.34 % of this habitat type within the study area). The loss of this habitat would result in a *Long-term Imperceptible Irreversible Impact*.

The proposed grid connection runs through predominantly manmade or modified surfaces including access tracks, local and regional roads. There are five main off-road sections of the grid connection route; one in the area of Kellistown Substation (northern section of grid connection), one between Rathoe Road and crossing the River Burren (northern section of grid connection), one at the Kilnock junction (northern section of grid connection), one to the west of Myshall village (middle section of grid connection) and the other within and leaving the northern end of the main wind farm site (southern end of grid connection route). Habitats along the proposed grid connection route are predominantly buildings and artificial surfaces (BL3), with adjacent dry meadows and grassy verges (GS2), with hedgerows (WL1), hedgerows (WL1) / treeline mosaic (WL2) and treelines (WL2) bounding fields of arable crops (BC1) and improved agricultural grassland (GA1). In terms of flora, the road itself is very species-poor, as are the agricultural fields, with arable crops providing important foraging habitat for avifauna. The dry meadows and grassy verges (GS2) and linear road and field boundaries contain a greater species diversity.

Grassy verges (GS2), provide foraging habitat for birds and butterflies whilst the linear boundaries provide foraging habitat for local fauna, nesting habitat for birds and commuting habitat for mammalian species like bats. However, these habitats have been modified and are subject to disturbance.

The off-road sections were dominated by improved agricultural grassland (GA1) with hedgerows (WL1) and treelines (WL2) associated with farmland. The southern section also contained conifer plantation (WD4), treelines (WL2) and a farm track categorised as spoil and bare ground (ED2). The section of the grid connection route located within the main wind farm site travels through conifer plantation (WD4). To avoid instream and bankside works, the installation of the underground cable at stream crossings will be achieved by horizontal directional drilling or installation within the existing bridge deck. The avoidance of instream works for stream crossing shall ensure that there is no direct habitat loss to watercourses as a result of the grid connection. The predicted impact to habitats due to the construction of the grid connection is considered to be *Short-term Imperceptible Reversible Impact*.

Habitat loss associated with the TDR is detailed in Section 8.1.4 and is limited to the removal of existing street furniture, the laying of temporary hardcore along road verges and the trimming of vegetation. The habitats along the turbine delivery work locations of the TDR are predominantly buildings and artificial surfaces (BL3), with adjacent dry meadows and grassy verges (GS2) and hedgerows (WL1). Buildings and artificial surfaces (BL3) were mainly comprised of road, which were species poor in terms of flora, whilst grass verges and hedgerows were more diverse. However, these habitats have been modified and are subject to disturbance. These habitats are artificial, modified and/or intensively managed resulting in an overall *Temporary Imperceptible Reversible Impact* to habitats affected by the TDR.

Turbine delivery work location no. 30 – Woodland within Slaney River Valley pNHA (000781)

The proposed works at turbine delivery work location no. 30 are confined to the preparation of local load bearing surface along the existing road verge, localised vegetation trimming, the lowering of an existing stone wall to 0.5m and the removal of street furniture. This section of the TDR is located at the entrance to two residential properties along the northern side of Baker's road on the western edge of Bunclody.

The habitats within the foorprint of this works are a stone wall, a garden and a severely trimmed hedgerow along with the entrances to these properties. The removal of stone walls and other stonework (BL1) will be limited in length, resulting in a *Permanent Reversible Slight Impact*. Trimming of hedgerow (WL1) will also be limited in length. The trimming of hedgerow (WL1) is a common practice and is deemed to have a *Temporary Imperceptible Reversible Effect*.

The understorey of the woodland contained Cherry Laurel and Traveller's-joy, which are invasive species (see Section 8.3.4). Work in close proximity to these invasive species could result in their spread to other turbine delivery work locations along the TDR. Therefore, it is prudent to include invasive species management measures to restrict the spread of invasive species.

Turbine delivery work location no.43 – Crossing of Kilbranish North River at Kilbranish

It is proposed to cross the Kilbranish North River at this location using the existing road bridge for standard construction vehicles.

Also proposed for oversized vehicles for turbine delivery purposes is a temporary bridge crossing which is assessed as part of the EIAR and is located directly south of the existing bridge structure at the location shown in Plate 8-38 and Plate 8-39.

The temporary bridge will be a clear-span structure. The bridge will be of adequate length and will be designed to ensure that no in-stream works will be required and that the existing stream banks are not disturbed during construction. Sufficient free-board will be allowed for in the proposed bridge design to allow for 1 in 100-year fluvial flood conditions. In order that flood flows will not be obstructed, the stream crossings will be sized to convey a 1 in 100-year flood flow.

The temporary bridge will comprise of a modular steel structure that shall be assembled and erected on site by a crane. A temporary stone access track and hard standing will be constructed to facilitate the installation of the crossing as well as laying of aggregate load bearing surface to public road verges. The works will include the removal of hedgerows and trees within the footprint of the works, construction of concrete bridge supports which will be built from both the field and public road and lifting of the assembled bridge structure into place. The bridge components will be delivered to site on standard HGV's. A cross section of the proposed steel bridge is shown in Plate 8-40.

Following completion of turbine component deliveries, the bridge shall be removed and disassembled. The temporary aggregate track hard standing areas shall be removed and fully reinstated. Concrete bridge supports shall be left in situ.

Eroding/upland river (FW1), hedgerow (WL1) / treeline (WL2) mosaic, dry meadows and grassy verges (GS2), stone walls and other stonework (BL1) and buildings and artificial surfaces (BL3) were present in the immediate vicinity. The use of a clear span bridge shall avoid instream works and direct impacts to the river. The predicted impact to hedgerow (WL1) / treeline (WL2) mosaic and dry meadows and grassy verges (GS2) habitats at turbine delivery work location no.43 due to the construction of the grid connection is considered to be *Temporary Slight Reversible Impact*.

There will be no direct impact on eroding/upland river (FW1) habitats at turbine delivery work location no.43 due to the construction of the grid connection.

Plate 8-39: Turbine delivery work location no. 43 – Temporary Bridge Crossing Location

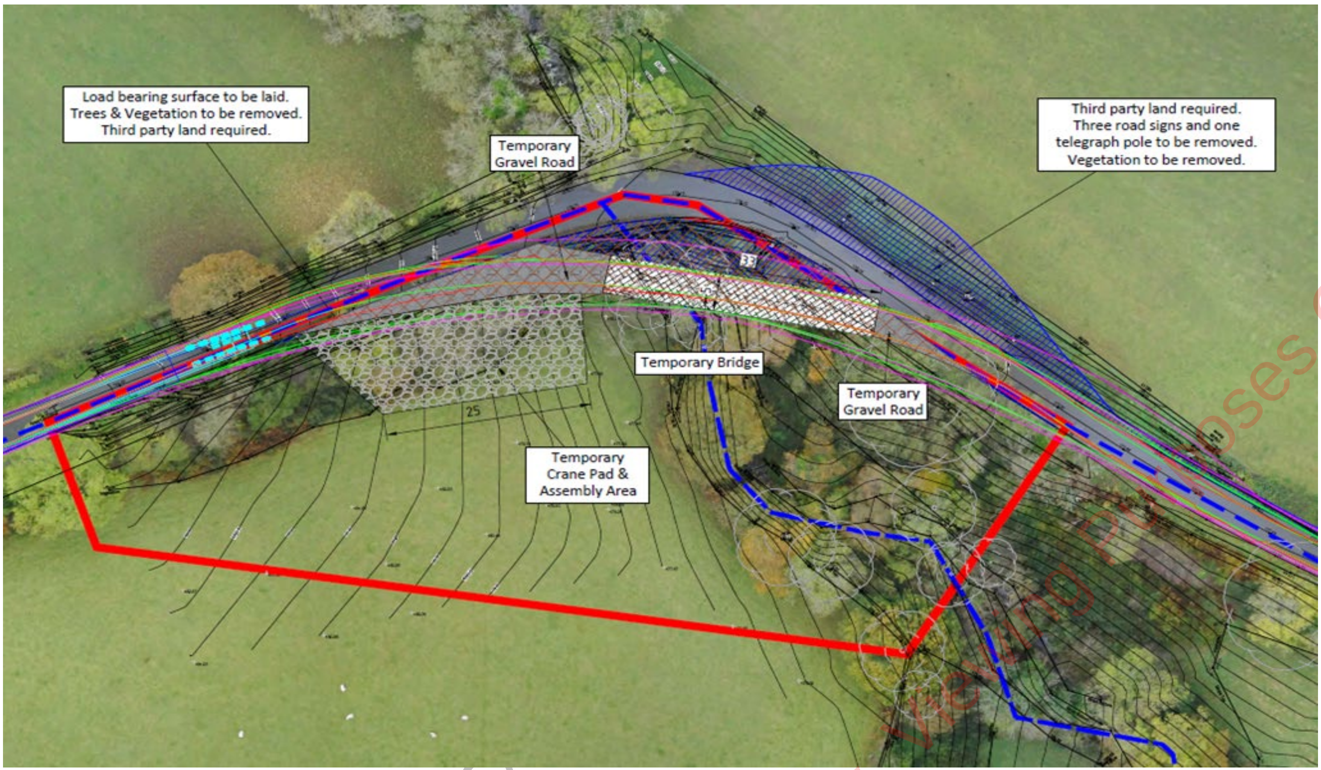

Plate 8-40: Temporary Bridge Location and General Arrangement

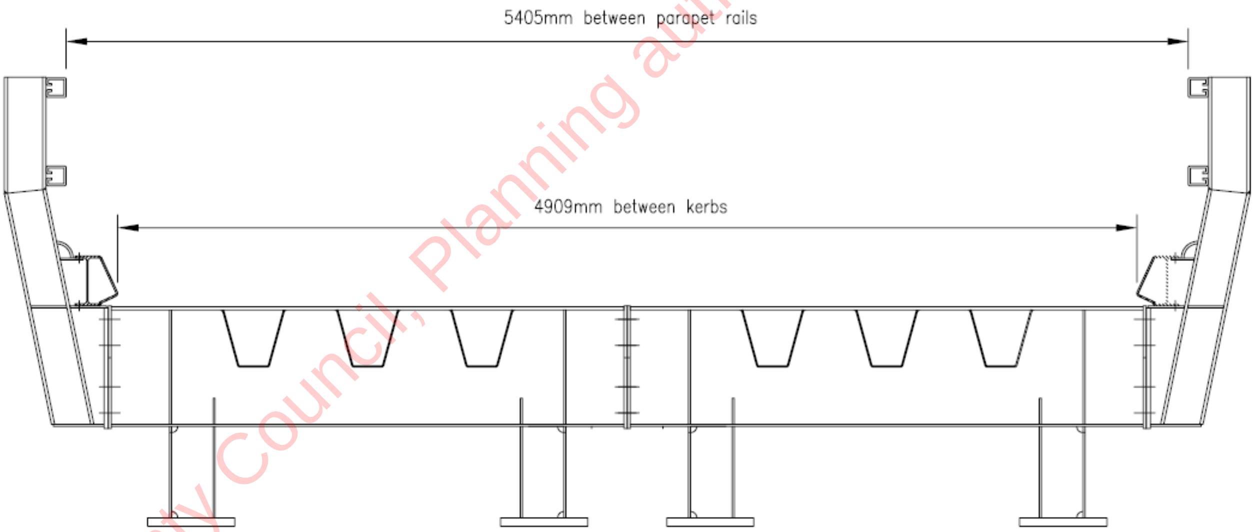

Plate 8-41: Temporary Bridge Cross Section

Turbine delivery work location no. 52 Existing carpark adjacent to (but not within) the Blackstairs Mountains pNHA (site code 000770)

The area consists of an existing car park to the south of a local road with conifer plantation (WD4) immediately to the south and east. The proposed turning area to the north of the local road is located within existing conifer plantation (WD4) and an improved agricultural grassland (GA1). The road and car park are classified as buildings and artificial surfaces (BL3). All three habitat types within the footprint of the POI are modified man-made habitats and offer little to local flora and fauna and are therefore deemed Locally Important (Lower Value).

The proposed works involves the extension of the existing car park hard standing to facilitate vehicle turning. Load bearing surface to existing field along with the removal of trees and vegetation. No works are required within the pNHA or peatland habitats. A raised soil berm extends around the carpark separating the area of works from the pNHA. The existing park cark is located on a raised bank approximately 1m above the pNHA at this point. The proposed works will not extend into the Blackstairs Mountains pNHA and therefore there will be no direct effects (habitat loss) to the pNHA.

Potential Indirect Impacts

Indirect impacts on habitats and flora include the spread of invasive species which could be distributed during construction works. During the site walkovers two invasive species were observed within the main wind farm site. One stand of *Rhododendron ponticum,* a High Impact invasive species was observed within the western area of the site. A single area of Spanish bluebell (*Hyacinthoides hispanica),* a Low Risk invasive species was observed adjacent to an existing access track. Both *Rhododendron ponticum* and Spanish bluebell are Third Schedule listed species.

Nine invasive species were recorded along the grid connection (see Table 8-26). These species are comprised of two High Risk species, two Medium Risk species, two Low Risk Species and three species whose invasiveness has not yet been determined. Of these nine species Himalayan Balsam (*Impatiens grandulifera*), a High Risk species[10] is also a Third Schedule listed species. See Table 8-26 for list of recorded invasive species. Himalayan Balsam was also observed in the vicinity of watercourse crossings GCR WCC 8 (northern off-road section of the route) and GCR WCC9 (southern off -road section). Cherry Laurel was observed at the crossing of the N80.

Five invasive species were recorded at three locations in Bunclody. Of these five invasive species one is classified as High Risk and four Medium Risk.

Construction works within the main wind farm site, grid connection and TDR could affect the existing environment by facilitating the spread of these species. It is considered that prior to mitigation a *Long-term Significant Reversible Impact* could arise.

[10] Kelly, J., O'Flynn, C., and Maguire, C. 2013. Risk analysis and prioritisation for invasive and non-native species in Ireland and Northern Ireland. A report prepared for the Northern Ireland Environment Agency and National Parks and Wildlife Service as part of Invasive Species Ireland.

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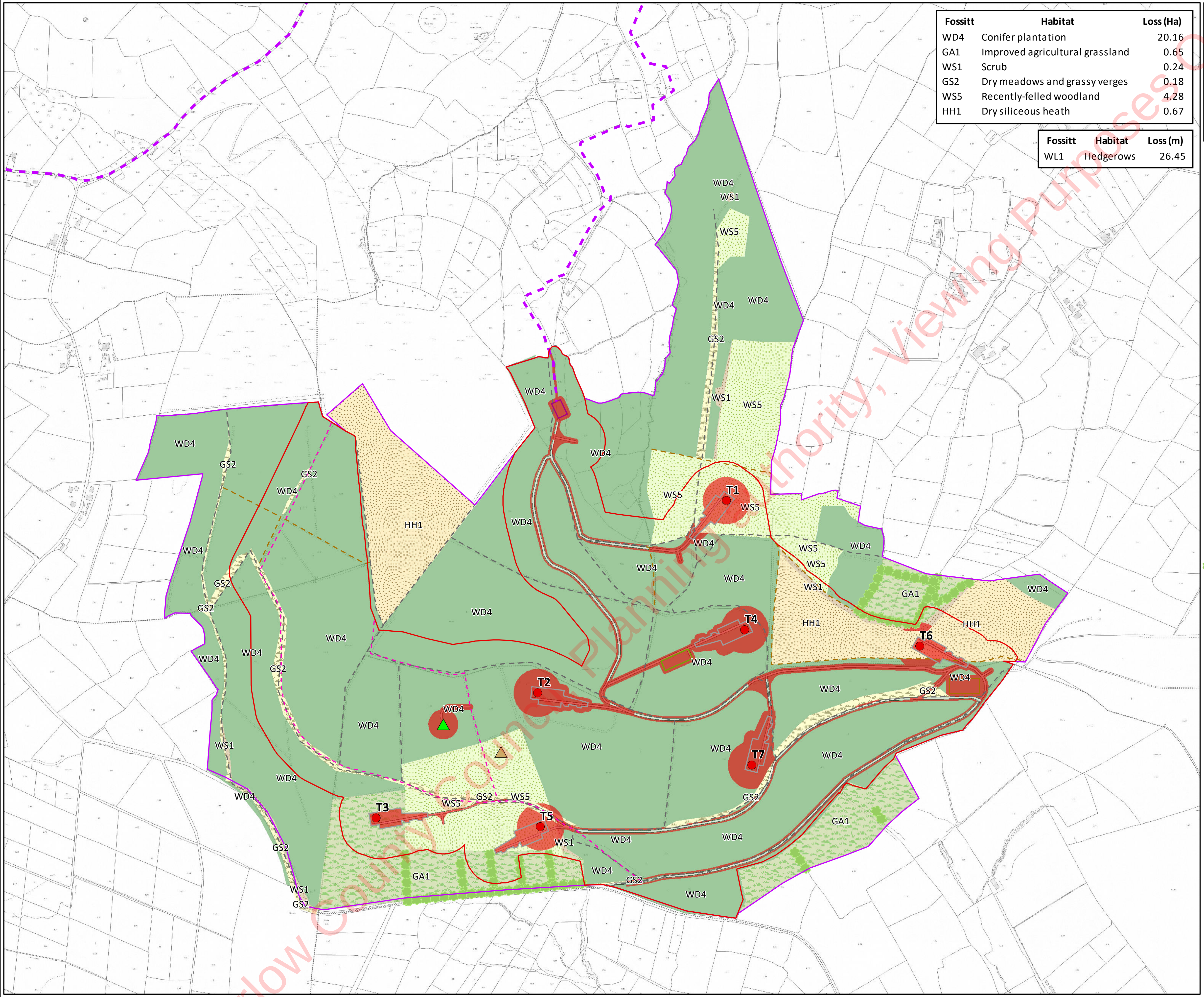
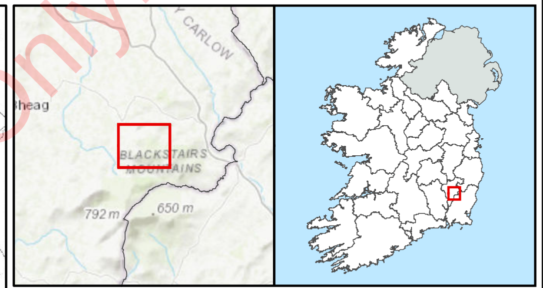


Fossitt	Habitat	Loss (Ha)
WD4	Conifer plantation	20.16
GA1	Improved agricultural grassland	0.65
WS1	Scrub	0.24
GS2	Dry meadows and grassy verges	0.18
WS5	Recently-felled woodland	4.28
HH1	Dry siliceous heath	0.67

Fossitt	Habitat	Loss (m)
WL1	Hedgerows	26.45



- Proposed Turbine Layout
- Proposed Development Boundary
- Study Area Boundary
- Existing 80m Met Mast
- Proposed Permanent 100m Met Mast
- Proposed Grid Connection Route
- Proposed Internal Access Tracks
- Proposed Croaghaun Loop
- Proposed Turbine Hardstanding
- Proposed Borrow Pit
- Proposed Temporary Compound
- Proposed Substation Compound
- Habitat Loss

Habitat Classification

- BL1, Buildings and artificial surfaces
- ED3, Spoil and bare ground
- WL1, Hedgerows
- HH1, Dry siliceous heath
- WS1, Scrub
- GS2, Dry meadows and grassy verges
- GA1, Improved agricultural grassland
- WD4, Conifer plantation
- WS5, Recently-felled woodland

TITLE: Habitat Loss

PROJECT: Croaghaun Wind Farm

FIGURE NO:	8.11		
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SCALE:	1:12500	**REVISION:**	0
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8.5.1.4 Mammals (excluding Bats)

Potential Direct Impacts

The construction of new tracks, turbine hardstanding areas, substation in addition to felling buffers will lead to a permanent loss of approximately 26.18 Ha or 6.23 % of habitats within the study area, most of which is conifer plantation and recently-felled conifer plantation (93.35 %). In addition, the felling and maintenance of buffer zones surrounding turbines located in conifer plantation will result in habitat alteration (from conifers to scrub, grassland and heath type habitats). Both habitats are widespread in the general area and this small-scale loss of habitat will not result in a significant negative impact on the distribution of local protected mammal fauna including Pygmy Shrew, Irish Hare, Irish Stoat, and Hedgehog.

Any unmitigated impacts to these species will be a *Short-term Imperceptible Reversible Impact*.

No impact is envisaged as a result of habitat loss along the TDR or grid connection route as the habitats are highly modified and of low value ecologically.

Badger

A total of four Badger setts were noted within the study area (subsidiary/outlier setts). One potential active sett and three inactive setts were recorded. Two setts (1 and 3) are within the footprint of the development while the two remaining setts (2 and 4) are within the felling areas. All four of these setts could potentially be directly impacted by felling and construction works.

If construction and/or felling were to be carried out in close proximity to an active sett particularly during the breeding season (December to June), this could result in a *Long-term Significant Reversible Impact* (without mitigation).

Red Squirrel

While the species was not recorded during ecological surveys within the study area, the existence of recent records within the study area indicates that the species is likely to utilise the conifer plantation within the main wind farm site. The total loss of conifer plantation from the area is 20.16 Ha or 6.76 % of the total habitat type within the study area. There is however ample conifer plantation in the study area and the greater surroundings. Conifer plantations are harvested and replanted as trees reach maturity and therefore the availability of this habitat is subject to transition as a resource for Red Squirrel under normal circumstances. As Red Squirrel are present in the area, a precautionary approach is required, and it is assumed that they may occur in any area of woodland where clear-felling is proposed.

There is therefore the possibility that Red Squirrel breeding or resting sites may be disturbed during any clear-felling operations. It is considered that prior to mitigation a *Short-term Significant Reversible Impact* to Red Squirrel could arise.

Otter

No holts were recorded during surveys at or within 150m up or down-stream of the proposed stream crossing or other parts of the proposed development site in close proximity to watercourses (only otter signs were recorded).

Therefore, there shall be *no direct impact* to Otter during construction.

Pine Marten

While the species was not recorded during ecological surveys within the study area, the existence of recent records within the study area indicates that the species is likely to utilise the conifer plantation within the main wind farm site. As Pine Marten are present in the general area, a precautionary approach is required, and it is assumed that they may occur in any area of woodland where clear-felling is proposed. However, no dens were found during the mammal survey within the footprint of the proposed development or the greater study area.

Dens are normally used only during the breeding season. Pine Marten use refuge sites outside these periods which are less visible and more casual. Therefore, it is considered that the permanent loss of conifer plantation is unlikely to impact negatively on the local Pine Marten population. There is however still the possibility that Pine Marten breeding or resting sites may be disturbed during any clear-felling operations. It is considered that prior to mitigation a *Short-term Significant Reversible Impact* to Pine Marten could arise.

Potential Indirect Impacts

The construction phase of the development may result in temporary disturbance to fauna, however as this will be temporary in duration, and given the habitats present in the wider environment, affected mammals will be able to move to other locations in the wider area until the disturbance has ceased. There is the potential for disturbance to Badgers setts within and in close proximity to construction works. As such, the potential exists for a *Short-term Significant Reversible Impact* to Badger prior to mitigation.

Prior to mitigation, there is potential for indirect impacts to Otter through the transport of pollutants and/or contaminants which could negatively affect the aquatic animals such as Salmonids on which Otter depend. These impacts could occur as the result of felling and/or construction activities. As such, any impacts on Otter prior to mitigation are predicted to be *Short-term Significant* and *Reversible*.

8.5.1.5 Bats

The main wind farm site is comprised predominantly of conifer plantation and open upland vegetation, with small parcels of pasture in lower lying areas of the sites. Watercourses are limited to small 1st order streams that are generally open or run adjacent to forest blocks. These hedgerows/treelines bounding pasture do provide some connectivity to the wider landscape. The commuting and foraging habitats over most of the site is of moderate suitability for bats, with the dense areas of conifer plantation offering low suitability. Two medium potential roosting structures were recorded within the 300m buffer of the study area (note the study area is larger than the main wind farm site). One was a series of Farm buildings (modern and traditional) 1.83 km north west of the closest turbine (T2) and the second a traditional two-story farmhouse 1.92km north west closest turbine (T2). No bat confirmed roosts were recorded within the study area. The distance of this roost from the closest element of proposed infrastructure (T3, c. 600m north) and intervening buffer provided by woodland plantations mean that no direct or indirect impacts to these roosts will occur during construction. The lack of suitable trees and structures within the main wind farm site means that no direct or indirect impacts to roosts will occur during construction.

Foraging or commuting bats may suffer disturbance impacts during the construction phase of the development through increased noise and lighting on the site.

However, mitigation measures such as restrictions on night-time working and use of appropriate lighting will minimise or avoid these impacts.

The construction of new tracks, turbine hardstanding areas, substation and felling buffers will lead to a permanent loss approximately 26.18 Ha or 6.23 % of habitats making up the study area. The vast majority of this is conifer habitat or improved agricultural grassland (25.09 Ha or 95.84 %). The wooded habitats within the study area were found not to contain any potential bat roost trees, while trees with potential to host roosting bats (associated primarily with hedgerows) contained no obvious bat roosting features. Wooded habitats and hedgerows are widespread in the general area and this small-scale loss of habitat will not result in a negative impact on the distribution of the local bat population.

The use of directional drilling where the proposed cable route crosses watercourses avoids potential impacts to bats which could use bridge structures to roost in (features 1 and 13 as shown in Table 8-40). The exception to this is the stone-arched bridge at crossing point GCR-WCC6 where the grid connection ducts are to be laid in flat profile within concrete bridge beam in the road deck. The bridge was deemed to have *Negligible* potential as a bat roost as it was found to be well-sealed and all joints had been pointed in the recent past.

The TDR will involve offsite widening of existing road carriageways to allow unimpeded haulage of the large turbine sections. Some minimal trimming of sections of hedgerows is required to facilitate the passage of turbine components. These hedgerows are already subject to intensive trimming and are less than 2m in height and are located along an existing roads. As such there is no potential for impacts to bats arising from this aspect of the proposed development.

No upgrading works are required to existing bridges and culverts which may be in use by bats and will not require strengthening to cope with increased loads during turbine delivery or works to facilitate cable placement.

New onsite haul roads will also need to be constructed resulting in the loss of vegetation which may be in use as flight path features by bats; this will be partly offset by the creation of new foraging/commuting corridors resulting from felling of access road corridors within coniferous forestry blocks. Onsite human construction activity may also cause disturbance to these animals. The foreseen potential impacts are as follows:

Potential Direct Impacts

- Loss of commuting and foraging habitats which may reduce the amount of area available for feeding;
- The reduction in habitat may inhibit bats from crossing the landscape or result in bats using more energy by having to make longer journeys between roosts/feeding areas; and
- Loss of roosts in trees which may displace some populations and/or impact breeding success.

Potential Indirect Impacts

- Disturbance due to increased human activity as bats are very intolerant of changes to their environment; and
- Loss of insect prey species due to tree trimming which may reduce the amount of available food for bats.

As no roosts were recorded within the site the impact to bats during the construction phase will be a *Long-term Slight to Moderate Impact* and will require mitigation measures.

8.5.1.6 Avifauna

The effects of infrastructure such as wind farms on birds are highly variable and depend on a wide range of factors including the specification of the development, the topography of the surrounding land, the habitat affected and the numbers and species of birds present (Drewitt, A., and Langston, R., 2006). Developments such as wind farms in general have many effects on birds, including potential direct habitat loss and fragmentation, displacement due to disturbance, death and injury due to collisions and disruption of local or migratory movements, with a consequent increase in energy expenditure (Drewitt, A., and Langston, R., 2008). However, the principle concerns in terms of adverse effects on birds are (1) disturbance displacement, (2) collision, (3) habitat loss/change and (4) barriers to movement (Langston, R., 2010). Of these, only two are applicable during construction: 1) disturbance and / or displacement and 2) habitat loss/alteration. Habitat loss is the primary potential direct impact during constructions and although disturbance and / or displacement could be viewed as effective habitat loss, it is essentially indirect (SNH, 2017) and therefore covered under Indirect Impacts.

With regard to impacts on bird species, it is considered that the main potential source of impacts on avian fauna is the construction of the wind farm, particularly the construction of turbines and the associated road network.

The potential likely significant impact of wind turbines on birds may be considered as:

- Possible loss or deterioration of habitats; and
- Disturbance or displacement of birds.

Consideration of the survey data against Table 8-54 indicates that 5 'Very High' sensitivity species has been recorded within the project study area (wind farm and grid connection) site:

- Golden Plover (Annex I, Red Listed)
- Hen Harrier (Annex I, Amber Listed)
- Kingfisher (Annex I, Amber Listed)
- Merlin (Annex I, Amber Listed)
- Peregrine Falcon (Annex I, Green Listed)

Consideration of the survey data against Table 8-54 indicates that 6 'High' sensitivity species have been recorded within the project study area (main wind farm site and grid connection).

- Black-headed Gull (Red Listed)
- Curlew (Red Listed)
- Herring Gull (Red Listed)
- Meadow Pipit (Red Listed)
- Red Grouse (Red Listed)
- Woodcock (Red Listed)

'Medium' sensitivity species are also considered in this assessment.

The 25 most relevant species recorded within the project study area (main wind farm site and grid connection) are:

- Common Gull (Amber Listed)
- Cormorant (Amber listed)
- Goldcrest (Amber Listed)
- Goshawk (Amber Listed)
- Great Black-backed Gull (Amber Listed)
- Great Spotted Woodpecker (Amber Listed)
- Greenfinch (Amber Listed)
- House Martin (Amber Listed)
- Kestrel (Amber Listed)
- Lesser Black-backed Gull (Amber Listed)
- Linnet (Amber Listed)
- Mistle Thrush (Amber Listed)
- Red Kite (Amber Listed)
- Robin (Amber Listed)
- Sand Martin (Amber Listed)
- Skylark (Amber Listed)
- Snipe (Amber Listed)
- Sparrowhawk (Amber Listed)
- Spotted Flycatcher (Amber Listed)
- Starling (Amber Listed)
- Stock Dove (Amber Listed)
- Stonechat (Amber Listed)
- Swallow (Amber Listed)
- Swift (Amber Listed)
- Wheatear (Amber Listed)

Three ‘Low’ sensitivity species are considered in this assessment:

- Buzzard (Green Listed)
- Long-eared Owl (Green Listed)
- White-throated Dipper (Green Listed)

It is noted that the construction of the proposed grid connection will progress in a sequential manner along the grid connection route from Croaghaun in the direction of the proposed Kellistown substation and, therefore, the works in any one location will be of a temporary duration only. Because the works will progress relatively quickly along a linear corridor, any fugitive noise will be highly localised, temporary and are not expected to be of sufficient magnitude to create any disturbance or displacement impacts outside of areas contiguous or adjacent to the corridor. These adjacent habitats, as described in section 8.3.4.1 above, are widespread in the surrounding area therefore any resident species can easily move in response to any temporary disturbance.

8.5.1.6.1 Habitat Loss or Alteration

Habitat loss can be direct through land take of breeding or foraging habitats for key species or indirect such as effective habitat loss through avoidance or disturbance due to the above factors. For direct impacts during construction land take of potential breeding or foraging habitat is the primary impact. This may constitute land stripping or vegetation removal affecting ground nesting birds, hedgerow removal or trimming if this takes place during the breeding season and loss of nesting or roosting sites such as trees. Some species (for example Sand Martin) may also be affected through material extraction requirements for construction purposes.

Impacts on avifauna are to be assessed following guidance in Percival (2007). As outlined previously, key avian receptors have been assigned an evaluation of importance (or sensitivity) for assessment. Following this the significance of potential impacts are rated as a product of both the magnitude of the predicted effect and the importance value (sensitivity) of the key receptor affected, based on the probability of the likely impact occurring.

The construction of the wind farm tracks, turbine foundations and hardstandings, the substation compound, temporary site compound and excavation of the on-site borrow pit will result in some habitat damage and loss. Permanent felling of forestry will also be required around the turbines and along the new access roads (and at the bends of the existing forestry roads). The habitat loss will be the total area covered by the roads plus the footprint of each of the seven proposed turbines. Felling shall not be required at all seven turbines. Habitat that will be lost will be dominated by conifer plantation (same age class) with areas of agricultural grassland and degraded dry heath. Part of the main road network is already in existence, so most of the habitat loss is associated with the turbines and spur roads.

During additional works along several areas of the TDR there will be trimming of hedgerows, treelines and foliage of woodland that overhang the TDR (in two locations) which will result in a temporary loss of foliage within these habitats.

For the purpose of the consideration of the potential impacts to birds, species have been grouped into four categories namely passerines and pigeons/doves, birds of prey, Red Grouse and waders/waterfowl with kingfisher considered separately. A passerine is any bird of the order Passeriformes, which includes more than half of all bird species. A notable feature of passerines is the arrangement of their toes (three pointing forward and one back) which facilitates perching. The group are sometimes known as perching birds or, less accurately, as songbirds. Pigeon/dove belong to the order Columbidae comprised of birds with stout bodies, short necks and slender bills which primarily feed on seed, fruits and plants. Bird of prey are raptors that actively hunt other bird species. Gamebirds are birds that can be legally hunted, and terrestrial species often include pheasants and grouse, of which Red Grouse is an example. Waders are shorebirds with the majority of species eating small invertebrates picked out of mud or exposed soil. Waterfowl are swimming gamebird and are comprised of duck, geese and swan.

<u>Passerines and Stock Dove</u>

The loss of habitat due to the construction of the project has the potential to affect passerines and Stock Dove. Habitat loss is inevitable in the development of any wind farm, especially when the development of turbine foundations and hard stands, access roads and other associated construction is considered. This can result in reduced feeding and nesting opportunities for birds. However, direct habitat loss by the development of wind farms tends to be relatively small (Drewitt and Langston 2006).

The main wind farm site is a predominantly closed habitat of conifer woodland with some open habitats present in areas around the boundary of the site. Conifer woodland is suboptimal habitat for most passerine species.

The proposed development will result in the loss of 20.16 Ha (6.76 %) conifer plantation, 4.28 Ha (9.87%) recently felled conifer plantation, 0.65 Ha (2.04 %) improved grassland habitat, 0.24 Ha (8.89 %), 0.24 Ha (8.89 %) scrub and 0.67 Ha (2.00 %) heath. Additional works along the TDR will result in the trimming of branches of trees along the corridor of the route.

Goldcrest is a species which will nest in conifer woodland, habitat which is common in the area of the development. The resultant loss for Goldcrest is deemed to be *Permanent Imperceptible Impact* and *Reversible*.

Barn Swallow, Swift, House Martin and Sand Martin are aerial species which forage over open habitats. There will be the loss of improved grassland and dry heath. Loss of these habitats for these species is considered *Temporary Imperceptible Impact* and *Reversible*. As clear-felled areas become revegetated, they will provide more foraging habitat for these species.

The limited open habitats within the site such as heath, scrub, hedgerow and grasslands provide foraging and nesting habitat for Meadow Pipit, Linnet, Skylark and Stonechat. The loss of improved grassland and dry heath on these species will be *Permanent Slight Impact* and *Reversible*. Also, as clear-felled habitat is revegetated it will provide further foraging habitat for these species.

Most of the conifer plantation dominated site provides limited foraging and nesting habitat for Starling, Greenfinch, Robin, Wheatear, Mistle Thrush, Spotted Flycatcher, and Stock Dove. The loss of improved grassland, scrub, grassy verges and dry heath on these species is deemed to be *Permanent Slight Effect* and *Reversible*. As clear-felled conifer habitat revegetates it will provide some foraging habitat for these species.

Great Spotted Woodpecker is a species which typically nests in oak woodlands, with some coniferous woodland nearby. Conifer plantation is common within the area of the development. There will be the loss of 20.16 Ha (6.76% of total habitat) conifer plantation. The resultant loss for Greater Spotted Woodpecker is deemed to be *Permanent Imperceptible Impact* and *Reversible*

Hedgerow and treeline and woodland edge provide foraging and nesting habitat to species such as Starling, Greenfinch, Robin, Wheatear, Mistle Thrush, Spotted Flycatcher, Great Spotted Woodpecker. Hedgerow and woodland habitat is common along the TDR and cutting back of vegetation will be limited. There is therefore potential for a *Temporary Slight Impact* which is *Reversible*.

It is therefore, not expected that the wind farm development will cause a reduction in the baseline population of passerines as the area of nesting/foraging habitat lost will be *Imperceptible to Slight*. It is considered that the proposed impact of habitat loss will be a *Permanent Imperceptible to Slight Impact* which is *Reversible.* However, the trimming of vegetation along with the removal of scrub or felling of trees (the latter two associated within the main wind farm site) during the nesting season for birds could result in a *Localised Temporary Significant Reversible Impact* to nesting birds.

<u>Birds of Prey, Red Grouse and Waders/Waterfowl and Kingfisher – Other Target Species</u>

Table 8-58 below displays the direct impact character during construction as well as the significance of impacts without the implementation of mitigation.

Table 8-58: Impact of habitat loss to other target species

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Black-headed Gull (High)	Black-headed Gull was observed during winter VP surveys. There were observations of flocks of birds foraging within improved grassland immediately adjacent to the proposed wind farm's south-eastern boundary (up to 100 individuals). Walkover surveys indicate that the site does not contain breeding habitat for gulls. Habitat surveys also indicate that there is limited foraging habitat within the main wind farm site for gulls in the form of improved grassland. There will be loss of 0.65 Ha (2.04% of total habitat) of improved grassland, a habitat common in the general area.	Magnitude effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Not Significant impact*** (Criteria: EPA, 2017)
Buzzard (Low)	This species was observed during three years of summer and winter VP surveys and summer breeding walkover surveys with some flights recorded within the site boundary. During summer VP surveys and the breeding walkover, Buzzard were observed displaying to the south of the site but no nesting has been found within the site. It was surmised that Buzzard is likely to have had a territory within a northern (2018) and western (2019) sections of conifer plantation within the site. There will be the permanent loss of 20.16 Ha (6.76% of total habitat) of conifer plantation, which is widespread in the area.	Magnitude effects is assessed as **Medium** (5-20% habitat lost), species sensitivity is **Low**, overall effect significance is **Very Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Not Significant impact*** (Criteria: EPA, 2017)
Common Gull (Medium)	This species was observed during winter VP surveys; with a maximum flock of 140 birds. The majority of observations were of the bird foraging within improved grassland outside of the site. Few flight paths were recorded over the site. Walkover surveys indicate that the site does not contain breeding habitat for gulls. Habitat surveys also indicate that there is limited foraging habitat for gull within the proposed wind farm site. There will be the loss of 0.65 Ha (2.04% of total habitat) of improved grassland, a habitat common in the general area.	Magnitude effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***long-term Not Significant impact*** (Criteria: EPA, 2017)

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Cormorant (Medium)	There was a single bird recorded during winter VP surveys, likely commuting over the site. The species was not recorded breeding on site. There is no suitable aquatic foraging habitat for this species on site, so there will be no impact on Cormorant from habitat loss.	Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Medium**, overall effect significance is **Very Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Imperceptible impact*** (Criteria: EPA, 2017)
Curlew (High)	During three years of surveys Curlew was observed once; heard calling within to the east of the site during foggy conditions and likely to be an individual moving south through the area from summer breeding grounds. Walkover surveys indicate that the site does not contain breeding wader habitat. Habitat surveys also indicate that there is limited foraging habitat for waders within the proposed wind farm site. Of the habitats present, dry siliceous heath is probably most likely to be used by Curlew. There will be the loss of 0.67 Ha (2% of total habitat).	Magnitude effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Imperceptible impact*** (Criteria: EPA, 2017)
Golden Plover (Very High)	During three years of surveys Golden Plover were recorded twice (during 2017/2018 winter and 2019/2020 winter VP surveys); a flock of 22 bird flew southwest over the site in a north-easterly direction and a flock of 7 birds flew through the flight activity area. This species breeds in peatlands and acidic grassland in northwest Ireland (outside the range of the site). Walkover surveys concluded that the site does not contain breeding habitat for waders. The site contains limited habitat of value for foraging Golden Plover. Of the habitats present, dry siliceous heath is probably most likely to be used by Golden Plover. There will be the loss of 0.67 Ha (2% of total habitat).	Magnitude effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **Very High**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Permanent Not Significant impact*** (Criteria: EPA, 2017)
Goshawk (Medium)	There was a single sighting of a Goshawk in flight during the winter 2017-2018 winter VP surveys and a second bird could be heard calling from the plantation to the west of the site. No flight lines recorded over the site. No evidence of breeding Goshawk was observed during breeding walkover surveys. Of the habitats present, conifer plantation is likely to be most important for this species. There will be the permanent loss of 20.16 Ha (6.76% of total habitat) of conifer plantation, which is widespread in the area.	Magnitude effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Permanent Not Significant impact*** (Criteria: EPA, 2017)

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Great Black-backed Gull (Medium)	This species was observed in low numbers (1-2) during summer and winter VP surveys; mostly from VP2. Walkover surveys indicate that the site does not contain breeding habitat for gulls. Habitat surveys also indicate that there is limited foraging habitat within the proposed wind farm site for gull. There will be loss of 0.65 Ha (2.04% of total habitat) of improved grassland, a habitat common in the general area.	Magnitude effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Not Significant impact*** (Criteria: EPA, 2017)
Hen Harrier (Very High)	There was a single sighting of Hen Harrier during the 2018 summer VP period. An adult female was observed emerging from second rotation forestry and clear-felled forestry located within the east of the site and flew south east through the site and out of sight. There were also four sightings of Hen Harrier in October 2019 near VP4 and VP1. Birds were recorded hunting over heather moorland. No birds were recorded breeding on site and there were only infrequent observations of the species during the 2.5 years of bird surveys within the larger flight activity study area. While there will be the permanent loss of 20.16 Ha (6.76 % of total habitat) conifer woodland and 0.67 Ha (2% of total habitat) dry heath habitat, the conifer plantation onsite is predominantly enclosed canopy forestry unsuitable for breeding. Surveys have confirmed that the species is not utilising the site with any regularity with one sighting over two summers of breeding season surveys.	Magnitude effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **Very High**, overall effect significance is **Medium** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Slight Impact*** (Criteria: EPA, 2017)
Herring Gull (High)	During summer and winter VP surveys this species was recorded a few times and comprised of a few individuals; flying over the site or near improved grassland outside of the site. Walkover surveys indicate that the site does not contain breeding habitat for gulls. Habitat surveys also indicate that there is limited foraging habitat within the proposed wind farm site for gull. There will be loss of 0.65 Ha (2.04% of total habitat) of improved grassland, a habitat common in the general area.	Magnitude effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival, 2003). It is considered ***near certain*** that the proposed impact of habitat loss will be a ***long-term Not Significant impact*** (Criteria: EPA, 2017)

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Kestrel (Medium)	Kestrel was recorded on a regular basis during summer and winter VP surveys; with winter surveys recording lone individuals and summer surveys recording adults with juveniles. Many flight paths were recorded over the proposed wind farm site and were of birds commuting or hunting. Summer breeding surveys (2018) indicated suitable breeding habitat within the north-western corner of the site with nesting recorded within the northeast (2019) of the proposed development site in the area of conifer plantation/recently felled forestry. Conifer plantation, dry heath, dry meadows and grassy verges, improved agricultural grassland, recently-felled woodland and scrub all provide potential breeding and foraging habitats. There will be the permanent loss of 25.53 Ha (6.58% of all habitat) of breeding and foraging habitat for Kestrel; habitat which is also present in the general area.	Magnitude effects is assessed as **Medium** (5-20% habitat lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Permanent Not Significant impact*** (Criteria: EPA, 2017)
Kingfisher (Very High)	Kingfisher was not recorded within the proposed development site or during any surveys within the study area. This species has been included as a precautionary measure as it may nest along the watercourse crossings of the proposed grid cable route. There will be no direct loss of habitat.	Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Very High**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Permanent Imperceptible impact*** (Criteria: EPA, 2017)
Lesser Black-backed Gull (Medium)	This species was recorded regularly through the winter VP period (max 275 birds) and infrequently throughout the summer VP period (max 26). Observations were mainly associated with feeding in improved agricultural fields and moving between fields to the south and south west of the site with some flight lines located over the proposed wind farm site itself. Walkover surveys indicate that the site does not contain breeding habitat for gulls. Habitat surveys also indicate that there is limited foraging habitat for gull within the proposed wind farm site. There will be loss of 0.65 Ha (2.04% of total habitat) of improved grassland, a habitat common in the general area.	Magnitude effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Not Significant impact*** (Criteria: EPA, 2017)

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Long-eared Owl (Low)	During summer 2019 VP surveys a juvenile owls were heard calling from forestry outside of the site close to VP5. During the 2019 breeding walkover juveniles were again heard calling in the same location outside of the site. Of the habitats present, conifer plantation is likely to be most important for this species. There will be the permanent loss of 20.16 Ha (6.76% of total habitat) of conifer plantation, which is widespread in the area.	Magnitude effects is assessed as **Medium** (5-20% habitat lost), species sensitivity is **Low**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Not Significant impact*** (Criteria: EPA, 2017)
Merlin (Very High)	Merlin were observed once during winter VP surveys (2017/2018) and once during Summer VP (2019) surveys to the east of the site and close to the proposed wind farms southern boundary (max of 2 birds). A flight path was recording within site during the winter VP survey. During summer breeding surveys (2019) a pair of Merlin were observed copulating to the south of the site but were not seen for the rest of the summer season and it was surmised that they had migrated. Given the low and infrequent number of observations the habitats within the site were not deemed to be of high value for the species.	Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Very High**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be ***Long-term Slight impact*** (Criteria: EPA, 2017)
Peregrine Falcon (Very High)	Individual birds were seen a few times each year of the winter VP surveys and during summer 2019 VP surveys. Most records involved a peregrine being mobbed by other birds whilst it flew/hunted over grassland or forestry; the majority of flight paths were located over the site. Habitat surveys indicate that the habitat required for breeding peregrine is not present on site.	Magnitude effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **Very High**, overall effect significance is **Medium** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Slight - Moderate impact*** (Criteria: EPA, 2017)
Red Grouse (High)	Habitat walkover surveys (2019) recorded a female and juvenile observed in heath habitat located within the proposed development site's eastern corner. There will be the permanent loss of 0.67 Ha (2% of total habitat) foraging habitat within the site; habitat which is present within the general area.	Magnitude effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Not Significant impact*** (Criteria: EPA, 2017)

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Red Kite (Medium)	Red Kite was observed (individuals) during summer VP surveys hunting over marginal farmland and forestry. The majority of flight paths were located to the east of the site with one located over the site. This species breeds along the east coast of Ireland. Dry heath and grassland are likely to be the most important foraging habitats for this species on site. There will be the permanent loss of 1.32 Ha (2.02% total habitat) foraging habitat within the site; habitat which is present within the general area.	Magnitude effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Not Significant impact*** (Criteria: EPA, 2017)
Snipe (Medium)	Snipe was observed on site during winter VP surveys; incidental record en-route to VP 5 (2017) and three flight paths 2018/2019; max of 9 birds with flight paths located over the site. During the 2017/2018 winter walkover the species was flushed within heath habitat in the north-western corner of the site and in 2018/2019 Red Grouse Surveys the species was flushed in the location of walked transects. One sighting was made of a single bird in winter of 2019/2020 near an area of clear-fell forestry. Summer breeding walkovers were undertaken of areas considered suitable for the species, but they were not observed.	Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Medium**, overall effect significance is **Very Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Imperceptible impact*** (Criteria: EPA, 2017)
Sparrowhawk (Medium)	This species was observed on several occasions during winter VP surveys and regularly during summer VP surveys with the majority of flight paths recorded over/within the proposed wind farm site; max of 2 birds. During breeding bird walkover surveys (2018), a pair were believed to have bred close to the car park at Kilbrannish, due to felling they moved northwards into the site to breed (middle of southern boundary). In 2019, it is possible that they bred east of VP4. Conifer plantation is likely to be the most important foraging and breeding habitat on site. There will be the permanent loss of 20.16 Ha (6.76% of total habitat) potential breeding and foraging habitat within the site; habitat which is present within the general area.	Magnitude effects is assessed as **Medium** (5-20% habitat lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Not Significant impact*** (Criteria: EPA, 2017)
Woodcock (High)	Three woodcock observations were made in 2019 summer VP surveys; all occurring along the site's southern boundary (one over forestry and the others over improved grassland) with two of the observations of a male roding. During the 2019 summer breeding walkover the species was observed calling and flying within the site. The breeding woodcock and nightjar summer 2019 survey observed roding and flying within the site.	Magnitude effects is assessed as **Medium** (5-20% habitat lost), species sensitivity is **High**, overall effect significance is **High** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Moderate impact*** (Criteria: EPA, 2017)

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
	Conifer plantation, scrub and dry heath are likely to be the most important habitats for this species on site. There will be the permanent loss of 21.07 Ha (6.3% of total habitat) potential breeding and foraging habitat within the site; habitat which is present within the general area.	

8.5.1.6.2 Disturbance and Displacement

High levels of activity and disturbance during construction may cause birds to vacate territories close to works, especially for species vulnerable to disturbance. The displacement of birds from areas within and surrounding developments can effectively amount to habitat loss (Drewitt, A. L. and Langston, R. H., 2006). If a habitat is therefore avoided as a result of the disturbance, then effective habitat loss can occur. Examples of causes of disturbance during construction which may lead to displacement are vehicle and personnel movements, vibration and noise impacts from the construction process and visual intrusion (Drewitt, A. L. and Langston, R. H., 2006).

Additional impacts may occur during the construction process due to road works along turbine delivery routes, the laying of cabling, the placement of underground cabling, re-working structures such as bridges along turbine delivery routes, and excavation of materials.

Studies both during construction (Pearce-Higgins *et al.*, 2012) and during operational impacts of wind farms (Pearce-Higgins *et al.*, 2009) have shown that certain species (e.g. large wading species) can be affected particularly as a result of construction impacts (in that the affected species fail to recover to pre-construction densities).

Indirect effects may occur on species linked to aquatic habitats through pollution events, sediment laden runoff and dust deposition.

Indirect Construction Impacts on Avifauna are shown in Table 8-59 below.

Table 8-59: Indirect Construction Impacts on Avifauna

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
Black-headed Gull (High)	Possible indirect impact to commuting/foraging birds within the area, particularly within improved agricultural grasslands. A max total of 100 individuals was recorded (in winter only).	Probability of temporary to short-term impacts. Sensitivity: **High**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
Buzzard (Low)	Flight paths were recorded within the site every year over the three years of VP surveys. It was surmised that the species held territories within northern (2018) and western (2019) sections of conifer plantation within the site. The recorded territories are within areas of the site where there will be no development. Possible noise/visual intrusion disturbance to foraging birds within the site.	Probability of temporary to short-term impacts. Sensitivity: **Low**. Magnitude assessed as **Medium**. Overall significance assessed as **Very Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Common Gull (Medium)	This species was observed during winter VP surveys; max flock of 140 birds. The majority of observations were of the bird foraging within improved grassland outside of the site. A few flight paths were recorded over the site. Habitat surveys also indicate that there is limited foraging habitat within the proposed wind farm site for gull.	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Cormorant (Medium)	This species was recorded once commuting near VP6 in the winter of 2019/2020. There are no suitable aquatic foraging habitats present within the site, precluding any possible noise/visual intrusion disturbance to this species.	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Negligible**. Overall significance assessed as **Very Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Curlew (High)	During three years of surveys Curlew was observed once outside the site (foggy weather) and was likely to have been an individual moving south through the area from summer breeding grounds. Site does not contain breeding habitat for waders. The site contains limited foraging habitat for this species.	Probability of temporary to short-term impacts. Sensitivity: **High**. Magnitude assessed as **Negligible**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Not Significant Impact*** (Criteria: EPA, 2017).
Goldcrest (Medium)	Recorded during transect counts within the site (max count of 53). Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct breeding habitat loss is the main effect via felling of conifer plantation.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
Golden Plover (Very High)	During three years of surveys Golden Plover were recorded once during 2017/2018 winter VP surveys; a flock of 22 bird flew southwest over the site in a north-easterly direction. A flock of 7 birds was also recorded in winter 2018/2019 flying past VP2. The site contains limited foraging habitat for this species. This species breeds in northwest Ireland. Literature suggests differences in densities pre- and post-construction of wind farms not significant (Pearce-Higgins et al., 2012), implying low levels of permanent displacement.	Probability of temporary to short-term disturbance to winter birds. Sensitivity: **Very High**. Magnitude assessed as **Low**. Overall significance assessed as **Medium**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Goshawk (Medium)	There was a single sighting of a Goshawk in flight during the winter 2017-2018 winter VP surveys and a second bird could be heard calling from the plantation to the west of the site. No flight paths recorded over the site. No evidence of breeding Goshawk was observed during breeding walkover surveys. Possibility of noise/visual intrusion disturbance to hunting birds.	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Great Black-backed Gull (Medium)	This species was observed in low numbers (1-2) during summer and winter VP surveys; mostly from VP2. Habitat surveys also indicate that there is limited foraging habitat within the proposed wind farm site for gull.	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Great Spotted Woodpecker (Medium)	This species was observed during transect surveys (max count of 2). Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. This species could be affected by removal of conifer plantation. Possibly disturbed by noise.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term imperceptible Impact*** (Criteria: EPA, 2017).
Greenfinch (Medium)	Recorded during transect surveys (max count of 20). Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term imperceptible Impact*** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
Hen Harrier (Very High)	There was a single sighting of Hen Harrier during the 2018 summer VP period. An adult female was observed emerging from second rotation forestry and clear fell located within the east of the site and flew south east through the site and out of site. Four sightings of this species were also made in the winter of 2019/2020 and were of birds hunting, generally outside of the site. There is no indication the species breeds on site. There will be felling activities and the permanent loss of conifer plantation which is common in the area. Permanent reduction in potential breeding habitat (second rotation conifer plantation and new pre-thicket habitat) for this species and disturbance during felling and construction works for species hunting within site and species breeding/hunting nearby the site.	Probability of temporary to short-term impacts. Sensitivity: **Very High**. Magnitude assessed as **Negligible**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Herring Gull (High)	During summer and winter VP surveys this species was recorded a few times and comprised of individuals; flying over the site or improved grassland outside of the site. Habitat surveys also indicate that there is limited foraging habitat within the proposed wind farm site for gull.	Probability of temporary to short-term impacts. Sensitivity: **High**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
House Martin (Medium)	Recorded in transect surveys (max count 3). Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Imperceptible Impact*** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
Kestrel (Medium)	Kestrel was recorded on a regular basis during summer and winter VP surveys; with winter surveys recording lone individuals and summer surveys recording adults with juveniles. Many flight paths were recorded over the proposed wind farm site and were of birds commuting or hunting. Summer breeding surveys (2018) indicated suitable breeding habitat within the north-western corner of the site with nesting recorded within the northeast (2019) of the proposed development site in the area of conifer plantation/recently felled forestry. Development and felling will not occur within the north-western section of the site. Possible noise/visual intrusion disturbance to foraging/breeding birds within the site.	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Medium**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Moderate Impact*** (Criteria: EPA, 2017).
Kingfisher (Very High)	The site does not contain any waterbodies. Any nesting birds located nearby to cable route watercourse crossings may be disturbed during installation works. None were recorded during surveys.	Probability of temporary to short-term impacts. Sensitivity: **Very High**. Magnitude assessed as **Low**. Overall significance assessed as **Medium**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Lesser Black-backed Gull (Medium)	This species was recorded regularly through the winter VP period (max 275 birds) and infrequently throughout the summer VP period (max 26). Observations were mainly associated with feeding in improved agricultural fields and moving between fields to the south and south west of the site with some flight paths located over the proposed wind farm site itself. Habitat surveys also indicate that there is limited foraging habitat within the proposed wind farm site for gull.	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Linnet (Medium)	Recorded during transect surveys (max count 20). Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands and scrub.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
Long-eared Owl (Low)	During summer 2019 VP surveys a juvenile owl was heard calling from forestry outside of the site close to VP5. During the 2019 breeding walkover, juveniles were again heard calling in the same location outside of the site. This species may be disturbed whilst breeding/resting nearby during the summer months. As this species is largely nocturnal it will not be disturbed whilst hunting, as works will be limited to daylight.	Probability of temporary to short-term impacts. Sensitivity: **Low**. Magnitude assessed as **Low**. Overall significance assessed as **Very Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Meadow Pipit (High)	Recorded during transect surveys (max count 53). Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands and heath.	Probability of temporary to short-term impacts. Sensitivity: **High**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Imperceptible Impact*** (Criteria: EPA, 2017).
Merlin (Very High)	Merlin were observed twice during winter VP surveys (2017/2018 and 2019/2020) and twice during Summer VP (2019) surveys to the east of the site and close to the proposed wind farms southern boundary (max of 2 birds). A flight path was recording within site during the winter VP survey. During summer breeding surveys (2019) a pair of Merlin were observed copulating to the south of the site but were not seen for the rest of the summer season and it was surmised that they had migrated. Hunting Merlin may be disturbed by felling and construction activities.	Probability of temporary to short-term impacts. Sensitivity: **Very High**. Magnitude assessed as **Low**. Overall significance assessed as **Medium**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Mistle Thrush (Medium)	Recorded during transect surveys (max count 16). Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Peregrine Falcon (Very High)	Individual birds were seen a few times each year of the winter VP surveys and during summer 2019 VP surveys. Most records involved a peregrine being mobbed by other birds whilst it flew/hunted over grassland or forestry; the majority of flight paths were located over the site. The site does not provide suitable breeding habitat for this species. Disturbance unlikely, as the species adapts to disturbance-prone urban habitats easily and also recorded in low densities.	Probability of temporary to short-term impacts. Sensitivity: **Very High**. Magnitude assessed as **Low**. Overall significance assessed as **Medium**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
Red Grouse (High)	Habitat walkover surveys (2019) recorded a female and juvenile observed in heath habitat located within the proposed development site's eastern corner. Breeding walkover surveys did indicate that the heath habitat that they were observed in was good breeding habitat for them. There will be works within this area. The heath habitat is connected to heath habitat outside of site. Species foraging within the site may be disturbed whilst the species foraging/nesting nearby the site may be disturbed by noise during construction and felling activities.	Probability of temporary to short-term impacts. Sensitivity: **High**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Red Kite (Medium)	Red Kite was observed (individuals) during summer VP surveys hunting over marginal farmland and forestry. The majority of flight paths were located to the east of the site with one located over the site. Possible noise/visual intrusion disturbance to hunting birds within on nearby the site.	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Robin (Medium)	Recorded during transect surveys (max count 34). Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands and scrub.	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Sand Martin (Medium)	Recorded as a non-target species during VP surveys. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands.	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Skylark (Medium)	Recorded during transect surveys (max count 3). Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands and heath.	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
		Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Snipe (Medium)	Snipe was observed on site during winter VP surveys; incidental record en-route to VP 5 (2017) and three flight paths 2018/2019; max of 9 birds with one flight path located over the site. During the 2017/2018 winter walkover the species was flushed within heath habitat in the north-western corner of the site and in 2018/2019 Red Grouse Surveys the species was flushed in the location of walked transects. One snipe was recorded in winter of 2019 as well, flushed from an area of clear-felled forestry. Summer breeding walkovers were undertaken of areas considered suitable for the species but they were not observed. During felling/construction activities, this species may be disturbed whilst resting/foraging within the site or nesting nearby.	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Spotted Flycatcher (Medium)	Recorded during transect surveys (max count 3). Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands.	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Sparrowhawk (Medium)	This species was observed on several occasions during winter VP surveys and regularly during summer VP surveys with the majority of flight paths recorded over/within the proposed wind farm site; max of 2 birds. During breeding bird walkover surveys (2018), a pair were believed to have bred close to the car park at Kilbrannish, due to felling they moved northwards into the site to breed (middle of southern boundary). In 2019, it is possible that they bred east of VP4. Possible noise/visual intrusion disturbance to hunting/breeding birds within the site.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Medium**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Moderate Impact*** (Criteria: EPA, 2017).
Starling (Medium)	Recorded during transect surveys (max count 55). Studies on the impact of wind farms during both construction (Pearce-Higgins *et al.*, 2012) and operation (Pearce-Higgins *et al.*, 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term imperceptible Impact*** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
Stock Dove (Medium)	Recorded as a non-target species during VP surveys. Studies on the impact of wind farms during both construction (Pearce-Higgins *et al.*, 2012) and operation (Pearce-Higgins *et al.*, 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term imperceptible Impact*** (Criteria: EPA, 2017).
Stonechat (Medium)	Recorded during transect surveys (max count 3). Studies on the impact of wind farms during both construction (Pearce-Higgins *et al.*, 2012) and operation (Pearce-Higgins *et al.*, 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands, scrub and heath.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term imperceptible Impact*** (Criteria: EPA, 2017).
Swallow (Medium)	Recorded during transect surveys (max count 17). Studies on the impact of wind farms during both construction (Pearce-Higgins *et al.*, 2012) and operation (Pearce-Higgins *et al.*, 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term imperceptible Impact*** (Criteria: EPA, 2017).
Swift (Medium)	Recorded during transect surveys (max count 2). Studies on the impact of wind farms during both construction (Pearce-Higgins *et al.*, 2012) and operation (Pearce-Higgins *et al.*, 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term imperceptible Impact*** (Criteria: EPA, 2017).
Wheatear (Medium)	Recorded as non-target species during VP surveys. Studies on the impact of wind farms during both construction (Pearce-Higgins *et al.*, 2012) and operation (Pearce-Higgins *et al.*, 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands and heath.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term imperceptible Impact*** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
White-throated Dipper (Low)	No birds or suitable habitat were recorded within the main site. Four nests were recorded at Scratoes Bridge along the GCR. Studies on the impact of wind farms during both construction (Pearce-Higgins *et al.*, 2012) and operation (Pearce-Higgins *et al.*, 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction near bridges along the GCR.	Probability of temporary to short-term impacts. Sensitivity: **Low;** magnitude **Low**. Overall impact is **Very Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term imperceptible Impact*** (Criteria: EPA, 2017).
Woodcock (High)	One observation of Woodcock was made in the winter of 2019/2020, which was flushed from a stream near a track SW of VP4. Three woodcock observations were made in 2019 summer VP surveys; all occurring along the site's southern boundary (one over forestry and the others over improved grassland) with two of the observations of a male roding. During the 2019 summer breeding walkover the species was observed calling and flying within the site. The breeding woodcock and nightjar summer 2019 survey observed roding and flying within the site. There is potential indirect impact to breeding territories within the site and wider area.	Probability of temporary to short-term impacts. Sensitivity: **High**. Magnitude assessed as **Medium**. Overall significance assessed as **High**. (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance and/or habitat loss will be a ***Short-term Moderate Impact*** (Criteria: EPA, 2017).

8.5.1.7 Aquatic Ecology

The principle impacts from the proposed development on the aquatic environment are expected to occur during the construction phase. Primarily, these risks relate to water pollution and or contamination via siltation, hydrocarbons, concrete and or tree felling. The Construction Environmental Management Plan (CEMP), which details the construction methodology, has been developed to eliminate the requirement for in-stream works (e.g. trenchless piping horizontal directional drilling -HDD) and or to minimise the risk of potential contamination and water pollution. Potential impacts relating specifically to hydrology are dealt with in Chapter 10 – Hydrology and Water Quality. The potential impacts relating to specific construction-phase activities on the aquatic environment are discussed in detail below.

Tree Felling

Tree felling will be required at five of the 7 no. proposed turbine locations (i.e. T1, T2, T4, T5 and T7; see Figure 5.1 in Appendix 8.3). A total of 24.4 Ha of conifer plantation WD4 and Recently-felled Woodland WS5 shall be lost due to the felling of trees to facilitate development of the proposed wind farm infrastructure (e.g. access tracks and turbine base construction). Whilst the Croaghaun wind farm catchment is not be considered an acid-sensitive area, there are risks associated with sediment and nutrient run-off in surface waters following tree felling activities, including vehicle tracking and extraction methods. The risks to receiving watercourses is considered highest where downstream hydrological connectivity exists. Of these felling areas, potential indirect hydrological connectivity was identified on the Clashavey River in the vicinity of turbine T1 and T4, and on an unnamed Kilbrannish South Stream tributary, in the vicinity of turbineT5 (See Figures 5.1, 5.2 in Appendix 8.3).

Potential indirect hydrological connectivity with an unnamed tributary of the Kilbrannish North Stream was also identified given the proximity and up-slope location of turbine T7 relative to this watercourse. These watercourses were located ≤0.41km from the respective turbine locations and tree felling areas (see Table 8-60). The upper reaches of an unnamed Kilbrannish South Stream tributary was semi-dry (seasonal) and not of value for fisheries. However, fisheries value improved in the downstream-connecting River Clody (salmonids, otter etc.). The Clashavey River was found to support Salmonid populations in addition to European Eel has good statuses for water quality.

Atlantic Salmon and *Lampetra* sp. (Lamprey) were recorded on the lower Clashavey River (site D4). Both of these species are listed as qualifying interests for the Slaney River Valley SAC (000781), which is located c.8.7kmand 2.4km downstream in these two aforementioned watercourses, respectively.

Therefore, the tree felling process could result in impacts to these watercourses through water quality deterioration via sediment release and nutrient run-off, which may cause impacts to Salmonid and Lamprey spawning habitat (siltation of gravels) as well as general fisheries habitat. The felling of mature conifers may result in periodic and localised changes to the pH of receiving watercourses ('acid pulses'), which may impact aquatic invertebrate communities and the sensitive developmental stages of Salmonids (Finn, 2007). However, the risk is reduced considerably given that the development is not situated in an acid-sensitive catchment. Tree felling could also lead to an increase in sedimentation and nutrient enrichment of surface waters should brash remain in the riparian buffer zones.

Whilst not recorded in the Clashavey River, Kilbrannish South Stream and Kilbrannish North Stream (or unnamed tributary), Freshwater Pearl Mussel are known in the main River Slaney channel, downstream of the Clashavey River confluence (see Appendix 8.3). The nearest distance by water from the proposed tree felling areas to a known Pearl Mussel site on the River Slaney was approx. 10.9km, via the Clashavey River (tree felling located approx. 0.29km from watercourse). There was no hydrological connectivity between tree felling areas and a second Slaney Pearl Mussel population via the Douglas River (however, see below impacts from grid connection installation). Records at these locations, as well as other records on the Slaney upstream of Bunclody, are from the 1987-1990 period. This Annex II and Slaney River Valley SAC qualifying interest species is particularly sensitive to the effects of siltation (suffocation) and nutrient enrichment (habitat deterioration) and could be impacted by unmitigated tree felling activities in the vicinity of turbine T1 (i.e. downstream hydrological connectivity to historical population). Records for Pearl Mussel do not exist in the River Clody and none were recorded during the Pearl Mussel survey (see Appendix B of the Aquatic Report, Appendix 8.3).

The trafficking of heavy machinery required for tree felling could lead to pollution of nearby receiving watercourses due to spillage of fuels and hydrocarbons. Haul roads passing close to watercourses could allow the migration of silt-laden run-off into adjacent watercourses via surface water pathways (see impacts during turbine delivery below). There is also a risk that machinery associated with tree felling could act as a vector for introducing or dispersing non-native invasive species, which may spread along nearby watercourses.

Potential hydrological impacts as a result of tree felling or felling activities are considered in Chapter 10 – Hydrology and Water Quality. Potential tree felling impacts on aquatic ecology, in the absence of mitigation, are assessed as being *Significant Negative, Short-Term* and at the *Local Scale*. Mitigation is required to avoid potential impacts.

While the risk of impacting highly-sensitive Freshwater Pearl Mussel is low given the downstream hydrological distances and indirect connectivity (10.9km nearest downstream distance), potential impacts are considered *Very Significant Negative, Permanent* and at the *National Scale*, in the absence of mitigation.

Turbine Base and Met Mast Construction

The construction of turbine bases (hard-standing areas) will include construction activity, tree felling, large-scale earthworks, drainage and pouring of concrete. Therefore, the risk of water quality impacts to adjacent watercourses via siltation, nutrient run-off and pollution exists. All seven proposed turbine locations are located ≤0.68km from the nearest watercourse, as outlined above. However, given the location of turbines T1, T3 and T5, the greatest threat to water quality exists on the receiving Clashavey River and an unnamed Kilbrannish South Stream tributary, as well as larger downstream-connecting watercourses and Slaney River Valley SAC (000781) (see Table 8-60).

There is a lower risk of impacts from the proposed construction of a permanent 100m met mast approx. 0.37km north-east of turbine T3 (Figure 10.5.2, Chapter 10 – Hydrology and Water Quality) due to greater hydrological separation.

Wet concrete poured for turbine bases and met mast construction could lead to contamination of receiving waters via surface water run-off. Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative impacts on water quality and aquatic biota, including Slaney River Valley SAC qualifying interest Atlantic Salmon, *Lampetra* sp. and, in the case of the Clashavey River pathway, Freshwater Pearl Mussel. Similarly, soil excavation works required to facilitate turbine base construction may liberate nutrients and increase the sediment load of surface water run-off, potentially impacting water quality and aquatic sensitivities in adjacent watercourses. Inappropriate management of the excavated material (e.g. inadequate silt fences on drainage channels alongside roads) could lead to loss of suspended solids to surface waters.

Heavy machinery may also lead to pollution of nearby receiving watercourses due to spillage of fuels and hydrocarbons. Haul roads passing close to watercourses could allow the migration of silt-laden run-off into adjacent watercourses via surface water pathways (e.g. wheel rutting; see impacts during turbine delivery below). There is also a risk that machinery could act as a vector for introducing or dispersing non-native invasive species, which may spread along nearby watercourses.

Potential hydrological impacts as a result of turbine and met mast construction are considered in Chapter 10 – Hydrology and Water Quality. Increases in surface water run-off volumes due to the construction phase, including hard-standing areas, are outlined in Chapter 10 – Hydrology and Water Quality (section 10.4) and are not predicted to be significant.

Given the up-slope proximity of turbines T1 and T4 to the Clashavey River, the up-slope proximity of turbine T5 to an unnamed Kilbrannish South Stream tributary and the up-slope proximity of turbine T7 to an unnamed Kilbrannish North Stream tributary, the potential impacts to aquatic ecology resulting from turbine construction are considered *Significant Negative, Short-Term* and in the *Local Context*, in the absence of mitigation.

Turbine Delivery Route (TDR)

In addition to turbine construction, the delivery of turbines and associated materials has the potential to impact water quality of watercourses crossed during transport.

The proposed turbine delivery route will cross 14 no. watercourses, as outlined in section 10.3.8 of Chapter 10 – Hydrology and Water Quality. The turbine delivery route will follow the existing road and forestry track network. However, no modifications were identified as being required at these stream crossings, except for crossings over the Kilbrannish North Stream at the local road L2026 (turbine delivery work location no.43).

Therefore, potential impacts to aquatic ecology are only likely at the single identified stream crossing point (i.e. turbine delivery work location no. 43).

Modifications along the delivery route will involve the temporary removal of street furniture and removal of some vegetation in addition to the temporary local widening at bends using hardcore material (i.e. turbine delivery work location nos. 29 and 30 adjacent to the River Clody in Bunclody, ≥75m from watercourse). Such works may result in silt-laden run-off or contaminated water (e.g. hydrocarbons) entering the River Clody, located within the Slaney River Valley SAC (000781), which may cause impacts to qualifying interest and non-qualifying interest aquatic receptors and habitats – these include Atlantic Salmon, Lamprey species, European Eel and floating river vegetation.

Sediment carried on the wheels of vehicles leaving the wind farm site could be carried onto the public road network and enter receiving watercourses (through road drainage), causing water quality impacts to aquatic ecology.

Although no road network modifications were identified as being required at these watercourse crossings, the installation of a temporary modular steel bridge crossing over the Kilbrannish North Stream immediately south of the local road L2026 (i.e. aquatic survey site A2); turbine delivery work location no. 43 on Plate 8-38) will be used to alleviate loading stresses and accommodate oversized vehicles for turbine delivery (all other machinery and vehicles will use the existing bridge). This temporary crossing will also include a temporary stone access track and a hard standing will be constructed to facilitate the installation of the crossing, as well as laying of aggregate load bearing surface to public road verges. The works will include the removal of hedgerows and trees within the footprint of the works, construction of concrete bridge supports which will be built from both the field and public road and lifting of the assembled bridge structure (turbine delivery work location no.43 on Figure 5.2 in Appendix 8.3). Following completion of turbine component deliveries, the bridge shall be removed and disassembled. The temporary aggregate track hard standing areas shall be removed and fully reinstated. Concrete bridge supports shall be left in situ. Temporary crossing works are described in further detail in Chapter 13 – Traffic and Transport.

Whilst the crossing of any watercourses poses risk to aquatic ecology, predominantly via potential water quality impacts, the temporary bridge will be of adequate length (to span the watercourse) and will be designed to ensure that no in-stream works will be required and that the existing stream banks are not disturbed during construction This will substantially reduce the potential for impacts to aquatic receptors through sources such as increased siltation and nutrient escapement via surface water run-off. However, other potential impacts affecting aquatic ecology during the temporary bridge construction could occur as a result of accidental spillage of cement or hydrocarbons stored on site or silt-laden run-off resulting from vegetation removal, impacting upon water quality. Aquatic surveys at this road crossing on the Kilbrannish North Stream recorded Brown Trout as well as Q4 good status water quality. The proposed temporary crossing is located approx. 0.9km upstream of the Slaney River Valley SAC (000781) boundary.

Turbine delivery (and turbine construction) will also require the upgrade of the existing track network within the wind farm boundary, in addition to the construction of new access tracks leading to all 7 no. turbine locations and the proposed new met mast (see Figure 8-3 and Figure 10.5.2, Chapter 10 – Hydrology and Water Quality). Those tracks with close proximity to receiving watercourses (i.e. ≤250m direct distance) are summarised in Table 5.1 Appendix 8.3. A small number of very minor watercourse crossings are proposed to facilitate access track upgrade and or construction works (see Chapter 10). These minor watercourses have connectivity to the Clashavey River downstream. The upgrade of existing tracks in the vicinity of minor watercourses crossings have potential to impact the water quality of adjacent watercourses via sediment or nutrient-laden run-off. There is also a risk that machinery associated with vegetation clearance could act as a vector for introducing or dispersing non-native invasive species, which may spread along nearby watercourses.

The aquatic ecological receptors considered at risk from water quality impacts in the Clashavey River, Kilbrannish South and the Kilbrannish North Stream are outlined above in tree felling impacts.

Potential impacts to the hydrology of adjacent watercourses due to track upgrade/construction works are considered in Chapter 10 – Hydrology and Water Quality.

Both the road modifications and temporary bridge crossing of the Kilbrannish North Stream (clear-span modular steel bridge) at turbine delivery work location no. 43 are considered likely to cause impacts to aquatic ecology which are *Significant Negative, Short-Term* and in the *Local Context*, in the absence of mitigation.

Given the particularly close up-slope proximity of access track works to the headwaters of the Clashavey River (0m), Aclare River (Clashavey tributary; 60m) and Kilbrannish North Stream (i25m) (Figure 5.1 Appendix 8.3**,** Table 8-60), potential impacts to aquatic ecology resulting from access track works are considered *moderate negative, short-term and in the local context*, in the absence of mitigation.

Site Drainage

The construction phase may result in significant changes/alterations to the existing drainage network within the main wind farm site, which may increase sediment and nutrient loads to receiving watercourses within or adjoining the site. No alterations to existing drainage are proposed or expected outside of the main wind farm site boundary (e.g. along the grid connection). As outlined in Chapter 10 – Hydrology and Water Quality, the drainage system for the existing tracks and roads will largely be retained. Most of the existing tracks were approximately 4m wide. It is proposed to widen approximately 5.26 km of existing roads by approximately 1m, with some additional widening at bends. Inappropriate management of the carrying out of these modifications could result in blockages of existing roadside drainage, which may both increase the risk of water contamination to adjacent watercourses via siltation, spillages etc., as well as cause alterations in the existing hydrology of the wider site.

As outlined above, the primary concerns regarding impacts to aquatic ecological receptors due to works within the main wind farm site lie with the Clashavey River and tributary (Aclare River), unnamed tributary of the Kilbrannish South Stream and Kilbrannish North Stream (plus unnamed tributary), given their proximity to the existing access track network and proposed infrastructure construction.

Increases in surface water run-off volumes due to the construction phase are outlined in Chapter 10 – Hydrology and Water Quality (section 10.4) and the effects of the increase in run-off is predicted to have an imperceptible impact on receiving waters.

Therefore, potential impacts to aquatic ecology resulting from site drainage works/alterations are considered *Non-Significant Negative, Short-Term* and in the *Local Context*, in the absence of mitigation.

Borrow Pit Excavation

A borrow pit is proposed within the wind farm boundary as part of the construction phase (see Figure 8-3 and Figure 10.5.2, Chapter 10 – Hydrology and Water Quality). The nearest watercourse to the proposed borrow pit is the Clashavey River, located approx. 0.18km to the north (direct distance, up-slope). It should be noted that there will be poor hydrological connectivity between the borrow pit and the Clashavey River (i.e. indirect). However, the excavation of the borrow pit may result in silt-laden run-off entering receiving watercourses via the roadside drainage network.

A lack of or an inadequate silt-attenuation system for the borrow pit may result in down-slope silt and nutrient escapement to surface waters. The Clashavey River supports Atlantic salmon, brown trout, *Lampetra* sp., otter and has downstream connectivity with the Slaney River SAC. (see Figure 8-3).

Potential impacts to aquatic ecology resulting from borrow pit construction are considered *Significant Negative, Short-Term and in the Local Context*, in the absence of mitigation.

Grid Connection Installation

The grid connection route is presented in see Figure 8-3. It is proposed to cross watercourses at up to 9 no. locations on the Bendinstown Stream, Burren River (2 no. crossings), Garreenleen Stream, Ballykeally Stream, Kilmaglush Stream, Douglas River (2 no. crossings) and Rossacurra Stream. These are outlined in Table 8-1. Potential impacts to these sites as a result of watercourse crossing methodologies are summarised in Table 8-61**.**

To prevent direct impacts to watercourses and avoid instream works, it is proposed to cross watercourses via trenchless horizontal directional drilling (HDD) under the existing river/stream bed. The only exceptions to HDD is the crossing of the Douglas River at Bealaw Bridge (aquatic survey site C1; GCR-WCC6) via laying ducts within the concrete bridge beam in the road deck. The Douglas River (Slaney catchment) at the grid connection crossing point was evaluated as being of local importance (higher value) in terms of aquatic ecology given the presence of Brown Trout, *Lampetra* sp. and good status water quality (Site C1, see Table 8-50.

The nearest distance by water from wind farm infrastructure to a known (historical) Pearl Mussel site on the River Slaney was approx. 8.5km, via the Rossacurra Stream and Clashavey River (i.e. watercourse crossing GCR-WCC7). A second Slaney population with downstream connectivity to wind farm infrastructure was located approx. 13.2km downstream of watercourse crossing GCR-WCC9, via the Douglas River.

Bridge deck trenching over the Douglas River (GCR-WCC6) may cause impacts to the downstream River Slaney pearl mussel populations in terms of suspended solid release and general water quality contamination via hydrocarbons and construction materials. Watercourses crossed by HDD are at risk of suspended solid releases and general water quality impacts to aquatic biota and habitats resulting from hydrocarbon and or fuel spillages from machinery. Of particular concern is the possibility of frac-out . This is a potential concern at the (8 no.) HDD sites, particularly in the case of more sensitive aquatic/fisheries habitats recorded on the Burren River and Douglas River (e.g. Salmonids, Lamprey species, floating river vegetation, European Eel etc.). Given that Freshwater Pearl Mussel are located on the main River Slaney channel downstream of the Douglas and Clashavey River confluences, there is a risk of impact to this Annex II species within the downstream Slaney River Valley SAC (000781) through an increase in suspended solids and water quality deterioration.

There is also a risk that machinery required for trenching, drilling and or cable laying could act as a vector for introducing or dispersing non-native invasive species, including Crayfish plague (*Aphanomyces astaci*). This would be of concern at watercourse crossings over the Burren River and tributaries (i.e. GCR-WCC1, GCR-WCC2, GCR-WCC3, GCR-WCC4, GCR-WCC5 and GCR-WCC8) given the presence of White-clawed Crayfish populations downstream in the Burren catchment.

The duration and significance of the specific impacts on hydrology and water quality associated with grid cable route installation and HDD are provided in Chapter 10 – Hydrology and Water Quality.

In light of the above, potential impacts to aquatic ecology resulting from grid cable route installation and horizontal directional drilling (HDD) are considered *Significant Negative, Short-Term* and in the *Local Context*, in the absence of mitigation.

However, with regards to White-clawed Crayfish, the introduction of Crayfish plague would likely result in a *Long-Term to Permanent Significant Impact In Context Of The Barrow Catchment*, given the demonstrated lack of recovery following infections in Irish populations to date.

While the risk of impacting highly-sensitive Freshwater Pearl Mussel is low given the downstream hydrological distances to known Pearl Mussel populations (≥8km downstream distance), potential impacts are considered *Very Significant Negative, Permanent* and at the *National Scale*, in the absence of mitigation.

Table 8-60: Summary of hydrological distances of watercourses from proposed turbine locations and access tracks

Infrastructure	Distance to nearest watercourse (direction)	Watercourse	Major downstream connecting watercourse(s) (hydrological distance)	Upgrade/new access track
Turbines				
T1	290m (south-west)	Clashavey River	River Slaney (10.9km downstream)	n/a
T2	625m (north-east)	Clashavey River	River Slaney (10.9km downstream)	n/a
T3	270m (south)	Kilbrannish South Stream	River Clody (3.2km downstream)	n/a
T4	430m (north-west)	Clashavey River	River Slaney (10.9km downstream)	n/a
T5	260m (south-east)	Unnamed stream	Kilbrannish South Stream (0.3km downstream)	n/a
T6	305m (south)	Kilbrannish North Stream	River Clody (2.4km downstream)	n/a
T7	415m (south-east)	Unnamed stream	Kilbrannish North Stream (0.3km downstream)	n/a
Access tracks (≤250m to watercourses)				
Track to T1	60m (west)	Aclare Stream	Clashavey River (0.23km downstream)	Track upgrade
Track to T1	20m (north)	Clashavey River	River Slaney (10.9km downstream)	New track
Track to T3	250m (south)	Kilbrannish South Stream	River Clody (3.2km downstream)	New track
Track to T5	230m (south-east)	Unnamed stream	Kilbrannish South Stream (0.3km downstream)	New track
Track to T6	105m (south)	Unnamed stream	Kilbrannish North Stream (0.3km downstream)	Track upgrade
Track to T6	25m (south)	Kilbrannish North Stream	River Clody (2.4km downstream)	Track upgrade

Table 8-61: Summary of construction phase impacts to aquatic ecological receptors at watercourse crossings (grid connection)

Feature ID (hydrology chapter)	Aquatic ecology survey site	Major downstream watercourse(s) (km)	Crossing methodology	Aquatic ecological receptor	Ecological threats	Potential impact significance
GCR-WCC1	B8 (Bendinstown Stream)	Burren River (0.2km)	HDD in public road corridor	No habitats or species of high conservation value recorded within Bendinstown Stream. However, downstream-connecting Burren River supports Atlantic Salmon, European Eel, *Lampetra* sp., Otter, floating river vegetation and Q4 good status water quality. White-clawed Crayfish populations downstream.	Sedimentation of spawning substrata; mortality of fish eggs and invertebrates (reduction of biological water quality); mortality as result of water pollution (i.e. hydrocarbon spillage); spread of invasive plants by machinery; Crayfish plague and other aquatic invasive species; impacts to otter prey resources and habitat	*All aquatic habitats and species excluding White-clawed Crayfish:* **Significant negative, short-term and at the local scale** *White-clawed Crayfish:* **long-term to permanent significant impact in context of the Barrow catchment (Crayfish plague)**
GCR-WCC2	B6 (Burren River)	n/a	HDD in public road corridor	Burren River at site B6 supports Atlantic Salmon, European Eel, *Lampetra* sp., Otter, floating river vegetation and Q4 good status water quality. White-clawed Crayfish populations downstream.	Sedimentation of spawning substrata and floating river vegetation; mortality of fish eggs and invertebrates (reduction of biological water quality); mortality as result of water pollution (i.e. hydrocarbon spillage, frac-out etc.); Crayfish plague and other	*All aquatic habitats and species excluding White-clawed Crayfish:* **Significant negative, short-term and at the local scale** *White-clawed Crayfish:* **long-term**

Feature ID (hydrology chapter)	Aquatic ecology survey site	Major downstream watercourse(s) (km)	Crossing methodology	Aquatic ecological receptor	Ecological threats	Potential impact significance
					aquatic invasive species; impacts to otter prey resources and habitats	**to permanent significant impact in context of the Barrow catchment**
GCR-WCC3	B7 (Garreenleen Stream)	Burren River (0.13km)	HDD in public road corridor	Garreenleen Stream is a valuable Brown Trout nursery. The downstream-connecting Burren River supports Atlantic Salmon, European Eel, *Lampetra* sp., Otter, floating river vegetation and Q4 good status water quality. White-clawed Crayfish populations downstream.	Sedimentation of spawning substrata and floating river vegetation; mortality of fish eggs and invertebrates (reduction of biological water quality); mortality as result of water pollution (i.e. hydrocarbon spillage, frac-out etc.); Crayfish plague and other aquatic invasive species; impacts to otter resources and habitat	*All aquatic habitats and species excluding White-clawed Crayfish:* **Significant negative, short-term and at the local scale** *White-clawed Crayfish:* **long-term to permanent significant impact in context of the Barrow catchment (Crayfish plague)**
GCR-WCC4	B4 (Ballykeally Stream)	Burren River (0.17km)	HDD in public road corridor	No habitats or species of high conservation value recorded within Ballykealy Stream. However, downstream-connecting Burren River supports Atlantic Salmon, European Eel, *Lampetra* sp., Otter, floating river vegetation and Q4 good status water quality. White-clawed Crayfish populations downstream.	Sedimentation of spawning substrata and floating river vegetation; mortality of fish eggs and invertebrates (reduction of biological water quality); mortality as result of water pollution (i.e. hydrocarbon spillage,	*All aquatic habitats and species excluding White-clawed Crayfish:* **Significant negative, short-term at the local scale**

Feature ID (hydrology chapter)	Aquatic ecology survey site	Major downstream watercourse(s) (km)	Crossing methodology	Aquatic ecological receptor	Ecological threats	Potential impact significance
					frac-out etc.); Crayfish plague and other aquatic invasive species; impacts to otter prey resources and habitats	*White-clawed Crayfish:* **long-term to permanent significant impact in context of the Barrow catchment (Crayfish plague)**
GCR-WCC5	B10 (Kilmaglush Stream)	Burren River	HDD in public road corridor	Some moderate Lampetra sp. habitat present at crossing. No other species or habitats of high conservation value recorded within Kilmaglush Stream. However, downstream-connecting Burren River supports Atlantic Salmon, European Eel, *Lampetra* sp., Otter, floating river vegetation and Q4 good status water quality. White-clawed Crayfish populations downstream.	Sedimentation of spawning substrata and floating river vegetation; mortality of fish eggs and invertebrates (reduction of biological water quality); mortality as result of water pollution (i.e. hydrocarbon spillage, frac-out etc.); Crayfish plague and other aquatic invasive species	*All aquatic habitats and species excluding White-clawed Crayfish:* **Significant negative, short-term and at the local scale** *White-clawed Crayfish:* **long-term to permanent significant impact in context of the Barrow catchment**
GCR-WCC6	C1 (Douglas River)	River Slaney (14.2km)	Ducts laid in flat profile within concrete bridge beam in road deck	Douglas River at site C1 supported Brown Trout, *Lampetra* sp. and Q4 good status water quality. The downstream-connecting River Slaney SAC (14.1km downstream) supports Atlantic Salmon, Freshwater Pearl Mussel, Lamprey species, floating river vegetation,	Sedimentation of spawning substrata and floating river vegetation; siltation impacts to Freshwater Pearl Mussel; mortality of fish eggs and invertebrates (reduction of biological	*All aquatic habitats and species:* **Short-term, not significant negative at the local scale**

Feature ID (hydrology chapter)	Aquatic ecology survey site	Major downstream watercourse(s) (km)	Crossing methodology	Aquatic ecological receptor	Ecological threats	Potential impact significance
				Otter, European Eel and Q4 good status water quality.	water quality); mortality as result of water pollution (i.e. hydrocarbon spillage); spread of invasive plants by machinery;	
GCR-WCC7	n/a - 0.37km downstream from D2 (Rossacurra Stream)	River Slaney (via Clashavey River) (8.4km)	HDD in private field	The Rossacurra Stream upstream of GCR-WCC7 supported Brown Trout, European Eel and Q4 good status water quality. The downstream-connecting Clashavey River supports Atlantic Salmon, *Lampetra* sp. and Q4 good status water quality. The Slaney River Valley SAC is c. 6.8km downstream of the crossing.	Sedimentation of spawning substrata and floating river vegetation; siltation impacts to Freshwater Pearl Mussel; mortality of fish eggs and invertebrates (reduction of biological water quality); mortality as result of water pollution (i.e. hydrocarbon spillage, frac-out etc.); spread of invasive plants by machinery;	*All aquatic habitats and species:* **Short-term, significant negative at the local scale** ***Freshwater pearl mussel:*** Very significant negative, permanent and at the national scale
GCR-WCC8	n/a - 0.6km downstream from B6 (Burren River)	n/a	HDD in private field	Burren River upstream of GCR-WCC8 supports Atlantic Salmon, European Eel, *Lampetra* sp., Otter, floating river vegetation and Q4 good status water quality. White-clawed Crayfish populations downstream.	Sedimentation of spawning substrata and floating river vegetation; siltation impacts to Freshwater Pearl Mussel; mortality of fish eggs and invertebrates (reduction of biological water quality); mortality as result of water	*All aquatic habitats and species excluding Pearl Mussel:* **Significant negative, short-term and at the local scale**

Feature ID (hydrology chapter)	Aquatic ecology survey site	Major downstream watercourse(s) (km)	Crossing methodology	Aquatic ecological receptor	Ecological threats	Potential impact significance
					pollution (i.e. hydrocarbon spillage, frac-out etc.); Crayfish plague and other aquatic invasive species	*White-clawed Crayfish:* **long-term to permanent significant impact in context of the Barrow catchment**
GCR-WCC9	n/a – 1.27km downstream from C1 (Douglas River)	River Slaney (12.9km)	HDD in private field	Downstream of the HDD crossing, the Douglas River supported Brown Trout, *Lampetra* sp., European Eel, kingfisher and Q3 or Q4 water quality. The downstream-connecting River Slaney SAC (12.8km downstream) supports Atlantic Salmon, Freshwater Pearl Mussel, Lamprey species, floating river vegetation, Otter, European Eel and Q4 good status water quality.	Sedimentation of spawning substrata and floating river vegetation; siltation impacts to Freshwater Pearl Mussel; mortality of fish eggs and invertebrates (reduction of biological water quality); mortality as result of water pollution (i.e. hydrocarbon spillage, frac-out etc.); spread of invasive plants by machinery	*All aquatic habitats and species;* **Short-term, significant negative at the local scale** *Freshwater pearl mussel:* **Very significant negative, permanent and at the national scale**

Table 8-62: Summary of construction phase impacts to aquatic ecological receptors (wind farm infrastructure excluding the grid connection).

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impact	Potential impact significance
Tree felling	Clashavey River (0.0km); Kilbrannish South Stream (0.27km); unnamed Kilbrannish South Stream tributary (0.26km)	Salmonids, European Eel, Lamprey species, Freshwater Pearl Mussel, floating river vegetation	Sedimentation of spawning substrata; mortality of aquatic invertebrates, Freshwater Pearl Mussel and fish eggs; eutrophication and impacts to floating river vegetation communities, Freshwater Pearl Mussel, fish and invertebrates	*All aquatic habitats and species excluding Pearl Mussel:* **Significant Negative, Short-term and at the local scale** *Freshwater Pearl Mussel:* **Very Significant Negative, Permanent and at the national scale**
Turbine base and met mast construction	Clashavey River (0.29km); Kilbrannish South Stream (0.27km); unnamed Kilbrannish South Stream tributary (0.26km); Kilbrannish North Stream (0.3km); unnamed Kilbrannish North Stream tributary (0.41km); **met mast:** Kilbrannish South Stream (0.56km)	Salmonids, European Eel, Lamprey species, Freshwater Pearl Mussel, floating river vegetation	Release of suspended solids, alkaline fines, hydrocarbons etc.	*All aquatic habitats and species excluding Pearl Mussel:* **Significant Negative, Short-term and at the local scale** *Freshwater Pearl Mussel:* **Very Significant Negative, Permanent and at the national scale**
Turbine delivery route	Kilbrannish North Stream (0km, at turbine delivery work location no. 43bridge crossing); River Clody (>0.075km, at turbine delivery work location nos. 29 and 30)	Salmonids, European Eel, Lamprey species, floating river vegetation	Sedimentation of spawning substrata; mortality of aquatic invertebrates, Freshwater Pearl Mussel and fish eggs; construction compounds (e.g. concrete) and hydrocarbon spillage causing habitat degradation and/or mortality of aquatic species	**Significant Negative, Short-term and at the local scale**

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impact	Potential impact significance
Site drainage	Clashavey River (0.0km); Aclare Stream (0.06km); (Kilbrannish South Stream (0.25km); unnamed Kilbrannish South Stream tributary (0.23km); Kilbrannish North Stream (0.025km); unnamed Kilbrannish North Stream tributary (0.105km)	Salmonids, European Eel, Lamprey species, floating river vegetation	Increase in flow rates (surface water run-off); impacts to migratory slow-swimming fish species (e.g. European Eel); changes to rates of erosion and deposition; impacts to floating river vegetation habitat; impacts to fish spawning substrata	**Significant Negative, Short-term and at the local scale**
Borrow pit construction	Clashavey River (0.18km)	Salmonids, European Eel, Lamprey species, floating river vegetation	Sedimentation of spawning substrata; mortality of aquatic invertebrates and fish eggs; eutrophication and impacts to floating river vegetation communities, fish and invertebrates; hydrocarbon spillage and mortality of downstream aquatic species	**Significant Negative, Short-term and at the local scale**

8.5.1.8 Other Species

Additional species such as Common Frog and Smooth Newt may be directly affected through habitat loss which may occur during construction though this is considered unlikely to be significant due to the presence of similar habitats not impacted by the proposed development. Some insect habitat will be directly lost through land take of hedgerows.

Common Frog and Smooth Newt may also be indirectly affected through sediment or pollution run off into waterbodies. It is considered possible that any unmitigated impacts on water quality could be *Significant*. Interference with actively used amphibian breeding habitat during breeding periods could result in a *Short-term Significant Reversible Impact.*

8.5.2 Operational Impacts

The operational phase will have lower potential for impacts on the local ecology than the construction phase. The main potential operational impacts of the project will arise from the rotation of the blades of the wind turbines and, to a lesser extent, from vehicular movement in relation to wind turbine maintenance along access roads. The rotation of the blades may result in displacement of local wildlife due to the avoidance by birds of the area around the turbines. In addition, the rotating blades present a potential collision hazard to local bird and bat species. The rotation of the blades of the turbines may also result in increased noise levels which may also cause disturbance to local wildlife. There are no expected operational direct and indirect impacts on habitats; hence they are not discussed further.

8.5.2.1 European sites

A Natura Impact Statement (NIS) has been prepared for the proposed development. The NIS addresses potential impacts on European sites resulting from the proposed development. The Stage One Appropriate Assessment Screening report concluded that, in the absence of mitigation measures (which have not been considered at this screening stage), likely significant effects on the qualifying interests of the Slaney River Valley SAC, Blackstairs Mountains SAC, Lower River Shannon SAC and River Barrow and River Nore SAC cannot be excluded on the basis of objective scientific information. A Stage 2 Appropriate Assessment (Natura Impact Statement) of the potential impact on the Slaney River Valley SAC, Blackstairs Mountains SAC, Lower River Shannon SAC and River Barrow and River Nore SAC was therefore required. The Natura Impact statement concluded that, in the light of the conclusions of the assessment which it shall conduct on the implications for the European sites concerned, the competent authority is enabled to ascertain that the proposed project will not adversely affect the integrity of any of the European sites concerned.

8.5.2.2 Natural Heritage Areas or Proposed Natural Heritage Areas

Operational wind farms are not considered to have the potential to significantly impact the aquatic environment. The main risk to watercourses is when oils and lubricants are used on the site. The risk of substances leaked from the turbines has been eliminated by the inclusion of internal oil bunds within the design of turbines. If pollutants leak from maintenance areas in significant quantities or were disposed of inappropriately, there is the potential for water pollution. However, the likelihood of this occurring is very low, and the potential significance of this impact can be mitigated through proper management. Spills of any oil or fuels from site vehicles onto the access roads may find their way to the local stream network. However, this is unlikely to be a significant impact considering the low numbers of vehicles involved and the high-quality standards that are implemented on a well-managed site.

As discussed in section 8.5.1.1 an NIS has been undertaken to identify any potential impacts to European sites (SACs and SPAs) as a result of the proposed development.

Five pNHAs are present within 10 km of the main wind farm site (two overlap with European sites which are assessed in the NIS). Where European sites overlap with nationally designated sites, the conclusions from the NIS for said sites is presented below.

In the NIS, the main potential effects during the operation of the proposed main wind farm are on the water quality of the Slaney River Valley SAC/pNHA.

These indirect effects, via water quality, could occur on the key species for which the pNHA has been designated. In the event of siltation or pollution of watercourses resulting from uncontrolled run-off from the main wind farm site, turbine delivery route and grid connection, the River Slaney and its tributaries could be indirectly damaged by changes to turbidity and water quality. There is also potential for indirect effects to designated fish and aquatic species including, inter alia, white-clawed crayfish and salmon, due to water quality changes which could cause a fish kill.

Changes in water quality could in turn reduce prey availability of breeding otter in the Slaney River Valley SAC/pNHA and reduce breeding sites for aquatic species.

Whilst it has been acknowledged that there could be potential for the main wind farm site, turbine delivery route and grid connection to have significant effects on the Slaney River Valley SAC, with the implementation of the detailed mitigation measures identified in the NIS, it is concluded beyond reasonable scientific doubt that the integrity of the Slaney River Valley SAC/pNHA will not be adversely affected.

The NIS report has assessed the potential effects on the integrity of the Slaney River Valley SAC/pNHA in light of the sites' conservation objectives and mitigation measures have been developed to prevent such potential effects occurring.

In the light of the conclusions of the assessment which it shall conduct on the implications for the Slaney River Valley SAC/pNHA, the competent authority is enabled to ascertain that the proposed project will not adversely affect the integrity of any of the Slaney River Valley SAC/pNHA.

The Blackstairs Mountain SAC/pNHA is located immediately adjacent to main wind farm site, however no element of the main wind farm site infrastructure is located within the same catchment. No hydrogeological effects (specifically, the drying out of peat) are possible due to the relative location of main wind farm infrastructure (the closest part of the SAC is separated from wind farm infrastructure by a ridge and located c. 350m north-east) and the shallow peat depths and soil types onsite (ranging from 0.1 – 0.3m; firm clay or firm peaty topsoil). The only element of the project with any potential connection to Blackstairs Mountains SAC is the TDR turning area (turbine delivery work location no. 52) located immediately adjacent to the SAC/pNHA. However no further works will be required to this turning area during the operational phase. No operational phase impacts are predicted for the Blackstairs Mountain SAC/pNHA.

The remaining three sites are located outside European sites namely: Bunclody Slate Quarries pNHA (000750), Ballymoon Esker pNHA (000797) and John's Hill pNHA (000808). Two additional pNHAs are present within 10 km of the proposed grid connection route. There is no direct hydrological link between the proposed wind farm site and grid connection route and any of the pNHAs. The closest national site is located ca. 1.5km (John's Hill pNHA 000808) from the main wind farm site and ca. 2.2km (Ardistan Fen 000788) from the grid connection route. Along the TDR, additional works are required at turbine delivery work location no. 30 which are located within Slaney River Valley pNHA (000781). At turbine delivery work location no. 43 the construction of a temporary bridge crossing at Kilbranish is proposed as a potential option to accommodate turbine delivery.

The watercourse at the turbine delivery work location is a first order stream (Deerpark_New, EPA code_12D25) which is a tributary of the Slaney River Both John's Hill pNHA (000808) and Bunclody Slate Quarries pNHA (000750) are within the greater Slaney River catchment, located ca. 1.6km and 2.7km away (direct distance) respectively.

As further excavation works shall not be required during the operational phase of the proposed wind farm, grid connection or TDR, only occasional maintenance works will be required (these shall be minimal without the need for large scale construction) and the use of hydrocarbons within the main wind farm site, offsite substation, grid connection and TDR shall be minimal and the resultant risk to water quality shall be significantly less. No further impacts are envisaged to Bunclody Slate Quarries pNHA (000750), Ballymoon Esker pNHA (000797), John's Hill pNHA (000808), Ardristan Fen pNHA (000788), Cloghristick Wood pNHA (000806), Ballynabarney Wood pNHA (000746), Clone Fox Covert pNHA (000755) or Killoughrum Forest pNHA (000765) during the operational phase of the proposed wind farm; therefore, no impacts to these sites are envisaged during the operational phase.

8.5.2.3 Mammals (excluding bats)

The level of human activity associated with the maintenance of the operational windfarm will be infrequent and minimal given that it will be monitored remotely. The proposed wind farm is also located within a commercial forestry and agricultural area, so there is already disturbance caused by human and machinery activity associated with forestry and agricultural management. As a result, any negative impact to terrestrial fauna during the operational phase of the windfarm is deemed to be a *Long-term Imperceptible Reversible Impact*.

8.5.2.4 Bats

According to SNH, 2019 the operational phase of wind farms can affect bats in the following ways:

- Collision mortality, barotrauma and other injuries (although it is important to consider these in the context of other forms of anthropogenic mortality)

According to the SNH, 2019 to ensure that bats are protected by minimising the risk of collision, an assessment of Effect at a site requires an appraisal of:

- The level of activity of all bat species recorded at the site assessed both spatially and temporally.
- The risk of turbine-related mortality for all bat species recorded at the site during bat activity surveys.
- The effect on the species' population status if predicted effects are not mitigated.

Eight species of bat were recorded during the 2019/2020 bat surveys at Croaghaun Wind Farm site. The table below provides an ecological valuation of each bat species and the collision risk factor in relation to wind farms. Four of the bat species recorded is considered to be High risk.

Table 8-63: Ecological evaluation of the bat species recorded during the bat survey (CIEEM Guidelines, 2019) and "Bat Risk" in relation to Wind Turbines (SNH, 2019)

Geographical Scale of Importance	Species	Bat Risk
International	Leisler's Bat	High
Regional	Brown Long-eared Bat Natterer's Bat Nathusius' Pipistrelle	Low Low High
County		
Local	Soprano Pipistrelle Common Pipistrelle Whiskered Bat Daubenton's Bat	High High Low Low
Negligible		

Using the SNH guidelines outlined in Table 8-69, the following risk assessment for the individual turbines in relation to each bat species recorded was completed using the following values:

- Project Size = Medium (7 turbines, but other wind energy development within 10km)
- Habitat Risk = Moderate

Therefore a value of 3 is applied to this proposed development site and this is multiplied by the Ecobat value for the four most common bat species recorded which are also High Risk species (i.e. Leisler's Bat, Nathusius' Pipistrelle, Common Pipistrelle and Soprano Pipistrelle) for two separate value categories. The overall value of the site is based on the summary tables for these four species yielded from Ecobat analysis (Table 4-8 to Table 4-11 of Bat Report, Appendix 8.4).

- Highest Ecobat activity category recorded;
- Most frequent activity category (i.e. median value).

Overall assessment value (i.e. Turbine Risk value) is then compared to the ranges below:

- Low (green) 0-4
- Medium (amber) 5-12
- High (red) 15-25.

Table 8-64: Risk matrix

Site Risk	Ecobat activity category (or equivalent justified categorisation): Nil (0)	Low (1)	Low – Moderate (2)	Moderate (3)	Moderate – High (4)	High (5)
Lowest (1)	0	1	2	3	4	5
Low (2)	0	2	4	6	8	10
Medium (3)	0	3	6	9	12	15
High (4)	0	4	8	12	15	18
Highest (5)	0	5	10	15	20	25

Due to the low levels of nightly bat activity at each of the static locations, the majority have a potential Low Risk factor in relation to Leisler's bat (n = 6 locations), with a lesser number is of Moderate Risk (n=3 locations). A greater number is of Moderate Risk in relation to Ecobat median values (n = 7 turbines). This is presented in Table 8-65.

Table 8-65: Risk assessment for each proposed turbine location – Leisler's bat

Turbine Number	Static detector ID	Site risk value	Ecobat activity category	Turbine risk (site risk x Ecobat activity category)	Ecobat median category	Turbine risk (site risk x Ecobat median category)
N/A*	**2**	3	1	**3**	3	**9**
N/A*	**3**	3	3	**9**	4	**12**
T3	**4**	3	3	**9**	3	**9**
T2	**5**	3	1	**3**	3	**9**
T5	**6**	3	1	**3**	3	**9**
T4	**7**	3	0	**0**	1	**3**
T6	**8**	3	0	**0**	1	**3**
T1	**9**	3	3	**9**	3	**9**
T7	**11**	3	1	**3**	4	**12**

*** Two additional detectors within the study area but not at turbine locations.**

Due to the low levels of nightly bat activity at each of the static locations, the have a potential Low Risk factor in relation to common pipistrelle bat (n = 9 locations), with a lesser number is of High Risk in relation to Ecobat median values (n = 6 locations). This is presented in Table 8-66.

Table 8-66: Risk assessment for each proposed turbine location – Common pipistrelle

Turbine Number	Static detector ID	Site risk value	Ecobat activity category	Turbine risk (site risk x Ecobat activity category)	Ecobat median category	Turbine risk (site risk x Ecobat median category)
N/A*	**2**	3	1	3	1	3
N/A*	**3**	3	1	3	1	3
T3	**4**	3	1	3	3	9
T2	**5**	3	1	3	5	15
T5	**6**	3	1	3	5	15
T4	**7**	3	1	3	5	15
T6	**8**	3	1	3	5	15
T1	**9**	3	1	3	4	12
T7	**11**	3	1	3	5	15

Due to the low levels of nightly bat activity at each of the static locations, the majority have a potential Low Risk factor in relation to soprano pipistrelle bat (n = 9 locations), with a lesser number is of High Risk in relation to Ecobat median values (n = 1 locations). This is presented in Table 8-67.

Table 8-67: Risk assessment for each proposed turbine location – Soprano pipistrelle

Turbine Number	Static detector ID	Site risk value	Ecobat activity category	Turbine risk (site risk x Ecobat activity category)	Ecobat median category	Turbine risk (site risk x Ecobat median category)
N/A*	**2**	3	0	0	1	3
N/A*	**3**	3	1	3	1	3
T3	**4**	3	1	3	2	6
T2	**5**	3	3	9	2	6
T5	**6**	3	1	3	4	12
T4	**7**	3	0	0	2	6
T6	**8**	3	1	3	5	15
T1	**9**	3	0	0	2	6
T7	**11**	3	1	3	3	9

Due to the low levels of nightly bat activity at each of the static locations, the majority have a potential Low Risk factor in relation to Nathusius' pipistrelle bat (n = 9 locations), while the same number are Low Risk in relation to Ecobat median values (n = 9 locations). This is presented in Table 8-68.

Table 8-68: Risk assessment for each proposed turbine location – Nathusius' pipistrelle

Turbine Number	Static detector ID	Site risk value	Ecobat activity category	Turbine risk (site risk x Ecobat activity category)	Ecobat median category	Turbine risk (site risk x Ecobat median category)
N/A*	**2**	3	0	0	1	3
N/A*	**3**	3	0	0	1	3
T3	**4**	3	0	0	1	3
T2	**5**	3	0	0	1	3
T5	**6**	3	0	0	1	3
T4	**7**	3	0	0	1	3
T6	**8**	3	0	0	1	3
T1	**9**	3	0	0	1	3
T7	**11**	3	1	3	1	3

Table 8-69: Stage 1 - Initial site risk assessment (SNH, 2019)

Site Risk Level (1-5)*	Project Size			
Habitat Risk		Small	Medium	Large
	Low	1	2	3
	Moderate	2	3	4
	High	3	4	5

Key: Green (1-2) - low/lowest site risk; Amber (3) - medium site risk; Red (4-5) - high/highest site risk.

* Some sites could conceivably be assessed as being of no (0) risk to bats. This assessment is only likely to be valid in more extreme environments, such as above the known altitudinal range of bats, or outside the known geographical distribution of any resident British species.

Habitat Risk	Description
Low	Small number of potential roost features, of low quality. Low quality foraging habitat that could be used by small numbers of foraging bats. Isolated site not connected to the wider landscape by prominent linear features.
Moderate	Buildings, trees or other structures with moderate-high potential as roost sites on or near the site. Habitat could be used extensively by foraging bats. Site is connected to the wider landscape by linear features such as scrub, tree lines and streams.
High	Numerous suitable buildings, trees (particularly mature ancient woodland) or other structures with moderate-high potential as roost sites on or near the site, and/or confirmed roosts present close to or on the site. Extensive and diverse habitat mosaic of high quality for foraging bats. Site is connected to the wider landscape by a network of strong linear features such as rivers, blocks of woodland and mature hedgerows. At/near edge of range and/or on an important flyway. Close to key roost and/or swarming site.

Project Size	Description
Small	Small scale development (≤10 turbines). No other wind energy developments within 10km. Comprising turbines <50m in height.
Medium	Larger developments (between 10 and 40 turbines). May have some other wind developments within 5km. Comprising turbines 50-100m in height.
Large	Largest developments (>40 turbines) with other wind energy developments within 5km. Comprising turbines >100m in height.

For this ecological assessment, the habitats adjacent to the proposed development may be considered in terms of extent, diversity, naturalness, rarity, fragility, typicality, recorded history, position, potential value and intrinsic appeal (Regini, 2000). The potential of these habitats for bat fauna is considered in this framework also. Table 8-70 provide a summary of bat survey data and assessments.

Table 8-70: Summary of bat survey data and assessments.

Turbine No.	Bat Box ID.	Risk Assessment Leisler's bat		Risk Assessment Common pipistrelle		Risk Assessment Soprano pipistrelle		Risk Assessment Nathusius' pipistrelle		Clarifying comment	Bat Habitat within 200m	Bat Habitat along wind farm access tracks	Bat encounters wind farm access tracks in vicinity of Turbine location	If no mitigation is applied, what is the potential impact level?
		Ecobat Activity	Ecobat Median	Ecobat Activity	Ecobat Median	Ecobat Activity	Ecobat Median	Ecobat Activity	Ecobat Median	Is location of Static at Turbine location Yes/No				Taking into consideration the clarifying comment.
T1	9	9	9	3	12	0	6	0	3	Yes	Yes	Yes	Yes	Low
T2	5	3	9	3	15	9	6	0	3	No	Yes	Yes	Yes	Moderate
T3	4	9	9	3	9	3	6	0	3	Yes	Yes	Yes	Yes	Moderate
T4	7	0	3	3	15	0	6	0	3	Yes	Yes	Yes	Yes	Moderate-High
T5	6	3	9	3	15	3	12	0	3	Yes	Yes	Yes	Yes	Moderate-High
T6	8	0	3	3	15	3	15	0	3	Yes	Yes	Yes	Yes	Moderate-High
T7	11	3	12	3	15	3	9	3	3	Yes	Yes	Yes	Yes	Moderate-High
N/A	2	3	9	3	3	0	3	0	3	Yes	Yes	Yes	Yes	Moderate
N/A	3	9	12	3	3	3	3	0	3	No	Yes	Yes	Yes	Moderate-High

Bat mortality due to collisions with wind turbines is well known and studies have further shown that bats may be killed without physically contacting turbine blades. The death of bats due to the presence of the operating turbines may reduce local bat populations especially if a turbine is sited near a roost. The planned turbine development is also to be sited within an area which is over-flown by Leisler's bat and whose hedgerow, treeline and forest edge habitats are currently in use by seven other bat species. Although, as yet, there are no published results of a study of bat mortality from Irish wind turbines, considering recent research from mainland Europe and North America, there is an increasing amount of detailed published evidence that wind turbines cause bat fatalities. However, many of these overseas turbine/bat mortality studies are at wind farms, with significantly large numbers of turbines, sited along known bat migration routes where many hundreds or even thousands of bats commute seasonally resulting in numerous deaths and injuries.

There is currently no evidence that mortality of bats on the same scale occurs in Ireland. Also, although it is known that Nathusius' pipistrelle migrates from Scandinavia to Scotland and to the north of Ireland and back again (Russ *et al.,* 2001), apart from this species, there is currently no evidence that internal or external migration routes of other bat species exist elsewhere in Ireland as no research has been undertaken. It has been suggested that lights for civil aviation above the nacelle may also attract bats but a 2014 study by Bennett and Hale disproved this hypothesis. Nevertheless, risks to bats from wind turbines have to be acknowledged and there is the potential for some bat mortality to occur during the operation of the proposed development. Therefore, mitigation measures are recommended to reduce the likelihood of such fatalities.

Keyhole felling in woodland plantations for wind turbines (usually carried out to reduce turbulence) creates new edge habitat, which is favoured by certain bat species (particularly pipistrelles) for hunting. If these new woodland edges are too close to turbine blades, there is an increased risk of collision for bats hunting in these areas. Felling of forestry/woodland is required around T2, T4, and T7, while felling of hedgerows and sections of forestry/woodland not immediately adjacent to turbine locations is required at T4, T5 and T6.

In the absence of mitigation, two of the seven turbine locations (T1, T3) are assessed as having a potential moderate impact to three high risk species recorded within the wind farm (Leisler's bat, common pipistrelle, and soprano pipistrelle). As such, any impacts on bats prior to mitigation (particularly felling buffers) are predicted to be *Long-term Significant Impact on a Local Level* and *Reversible*.

The cable within the grid connection route will be laid underground and will only be accessed for intermittent maintenance works.. As the grid connection is underground, the only locations where bat roosts might be impacted by maintenance works are at water courses. Directional drilling will be used for bridge structures that are potential bat roosts (features 1 and 13 as shown in Table 8-40), so maintenance works will be either side of these structures and will have no impact on bats. Crossing point GCR-WCC6 will not use HDD, but the bridge was deemed to have *Negligible* potential as a bat roost as it was found to be well-sealed and all joints had been pointed in the recent past. Therefore, there is predicted to be no impact to bats as a result of maintenance works to the grid connection.

The foreseen potential effects during operation are as follows:

Potential Direct Impacts

- Death through collision with turbine blades as bats are known to have difficulty in detecting the moving blades with their echolocation due to the movement and the angle of the blade surfaces
- Death through barotrauma as bats may be killed by the change of atmospheric pressure resulting from the turning blades which can cause their lungs to haemorrhage.

Potential Indirect Impacts

- No indirect effects envisaged due to the implementation of mitigation measures and absence of roosts or potential roosts within the proposed development footprint.

8.5.2.5 Avifauna

Collision risk

Studies on operational impacts of wind farms (Pearce-Higgins *et al*., 2009) have shown that certain species do exhibit levels of turbine avoidance during operational phases which may be extrapolated to reductions in breeding bird densities; however, this may not be as significant as previously thought, certainly in comparison to impacts during construction (Pearce-Higgins *et al*., 2012). It seems that there is little evidence for consistent post-construction population declines in any species, suggesting for the first time that wind farm construction can have greater impacts on birds than wind farm operation; this is supported in the literature (Devereux *et al*., 2008). A recent study on the effects of wind turbines on the distribution of wintering farmland birds (Devereux *et al*., 2008) did not find any consistent patterns of turbine avoidance across the species groups studied (corvids, seed-eaters, gamebirds and skylark).

The primary cause of direct impact on birds during the operational phase of a development is Collision Risk. Collision risk behavioural observations of birds in relation to operational wind farms provide the basis of studies on collision risk. Fixed point observations of flight behaviour, flight lines into, through and out of the area and information about the birds' use of the area help to inform the environmental evaluation of the proposed wind farm development. Bird mortality may result from potential bird collision with turbine structures or turbine blades.

Not all bird species are equally susceptible to collision, and some species suffer proportionately high levels of collision mortality (Drewitt and Langston, 2008). Morphology, physical flight characteristics and differences in vision are all influencing factors. Martin and Shaw, 2010, suggest that it is the characteristics of the section of a birds visual field that projects forward and hence 'looks' that are the key factors.

In some species the vertical extent of the forward binocular vision is reduced and therefore the bird is rendered blind if, whilst in the process of flying it undertakes behaviour such as the detection of conspecifics, remote food sources etc. (Martin, 2011 and Martin and Shaw, 2010).

Other species have reduced fovea, are emmetropic (default focus is distant) or may contain blind spots in their field of vision (as an evolutionary trait) which may cause susceptibility to collision. Flight height or the flight heights which birds habitually use along either migration or local flight paths is also an influencing factor. Relative size and high wing loading (or low manoeuvrability) are influencing factors as larger birds with poor manoeuvrability are generally perceived as at greater risk of collision with structures (see Brown *et al.,* 1992, quoted in Drewitt and Langston, 2006). Various species therefore exhibit different morphological and behavioural attributes which may contribute to collision risk.

Recent studies show that modern, larger multi-MW turbines show comparable fatality estimates with older generation models and expected increases in fatalities due to increases in rotor surface are not as expected, possibly due to increased altitude, increased distance between turbines and slower rotation speeds (Krijgsveld *et al*., 2009). Appraisal of collision risk for the proposed development is based on a predicted rotor envelope of 40-178m (see Chapter 3 Description of Development, Section 4.6 of this EIAR).

Relatively little is known about collision as a threat to birds. One problem is that most studies rely on the number of corpses found, but this can be extremely unreliable, since it is known that corpses are quickly removed by predators. At a wind farm site in Co. Tipperary in 2011, it was found that 72% of bird corpses left out were removed after five days. At this site in Co. Tipperary in 2012, scavengers were present at a bird corpse within forty-five minutes of it being placed in the vicinity of a turbine (J. Kearney principal ecologist FT, per. comm. 2020).

Collision Risk Model Analysis

The Collision Risk Model Report (See Appendix 8.7) presents the results of collision risk modelling for the proposed Croaghaun Wind Farm, Co. Carlow. This modelling used data from vantage point surveys carried out in the winter of 2017/18, winter 2018/19, winter 2019/20 and the summers of 2018 and 2019. The modelling was carried out using the Scottish Natural Heritage Collision Risk Model (Scottish Natural Heritage, 2000; Band *et al*., 2007 and Band, 2012). The bird occupancy method (Scottish Natural Heritage, 2000) was used to calculate the number of bird transits through the rotors, and the spreadsheet accompanying the Scottish Natural Heritage report was used to calculate collision probabilities for birds transiting through the rotors.

The following raptor and waterfowl and wader species were recorded in the vantage point surveys: Merlin, Buzzard, Peregrine Falcon, Kestrel, Sparrowhawk, Goshawk, Golden Plover, Black-headed Gull, Herring Gull, Hen Harrier, Red Kite, Curlew, Woodcock, Common Gull, Great Black-backed Gull, Lesser Black Backed Gull, Snipe, Cormorant, and Long-eared Owl.

Thirteen species were selected for collision risk modelling: Buzzard, Peregrine Falcon, Kestrel, Sparrowhawk, Golden Plover, Black-headed Gull, Hen Harrier, Red Kite, Common Gull, Great Black-backed Gull, Lesser Black Backed Gull, Cormorant and Snipe. These species have been selected because they were recorded within the 500 m buffers and at rotor swept heights, and are of conservation concern: i.e., they are red or amber-listed in Birds of Conservation Concern Ireland 2014-2019 (Colhoun and Cummins, 2013), and/or are listed on Annex I of the Birds Directive (2009/147/EC) or greens-listed and sensitive to wind farm developments (i.e. Long-eared Owl. For all the other species recorded but not included for collision risk modelling, the effective collision risk can be assumed to be zero.

<u>Passerines</u>

Collision by resident passerines is not considered likely to be a significant issue as their breeding activity is generally well below the height of rotor blades and the proposed impact of collision risk will be a *Long-term Imperceptible Reversible Impact*.

<u>Non-Passerines</u>

Potential collision risk to non-passerine target species is outlined in Table 8-71 below over.

Table 8-71: Potential collision risk to non-passerine target species

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Black-headed Gull (High)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were 87 fatalities across 46 European wind farms (Hoetker *et al*., 2006).	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **high**,

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
	However, the published avoidance rate is 98% (SNH 2010), suggesting black-headed gulls exhibit high levels of micro-avoidance at wind farms. Predicted number of collisions is 0.72 per year.	overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (40 - 178 m), published best scientific knowledge and frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Buzzard (Low)	Twenty-seven Buzzard fatalities have been recorded within the European Context, with 27 recorded in a review of 46 wind farms up to 2004 (Hoetker *et al.,* 2006). However, this number is low in relation to the estimated European population of up to one million pairs (Gensbol, 2008) and best available knowledge suggests mortality due to wind farms is not sufficient to cause significant population declines of this green-listed species. Predicted number of collisions is 0.20 per year.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **low**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (40 - 178 m), published best scientific knowledge and moderate frequency of occurrence at the site. The significance considered **near certain** that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Common Gull (Medium)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were 14 fatalities across 46 European wind farms (Hoetker *et al.*, 2006). However, the published avoidance rate is 98% (SNH 2010), suggesting common gulls exhibit high levels of micro-avoidance at wind farms. Predicted number of collisions is 0.22 per year	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **medium**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (40 - 178 m), published best scientific knowledge and frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Cormorant (Medium)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were two fatalities across 46 European wind farms (Hoetker et al., 2006). However, the published avoidance rate is 98% (SNH 2010), suggesting cormorant exhibit high levels of micro-avoidance at wind farms. Predicted number of collisions is <0.01 per year.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **medium**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (40 - 178 m), published best scientific

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
		knowledge and moderate frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Curlew (High)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were zero fatalities across 46 European wind farms (Hoetker et al., 2006). However, the published avoidance rate is 98% (SNH 2010), suggesting curlew exhibit high levels of micro-avoidance at wind farms. This species was recorded as a call only (no flight lines were recorded), precluding a quantitative estimate of collision risk.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **high**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (40 - 178 m), published best scientific knowledge and frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Golden Plover (Very High)	Golden Plover have been recorded in low numbers as collision fatalities at wind farms (Hoetker *et al.*, 2006; Grunkorn 2011). The published avoidance rate by SNH for collision risk modelling for this species is 98% (SNH 2010), indicating a high micro-avoidance rate regarding collision with turbines. In further support of a high micro-avoidance rate, a study in the Netherlands of three operational wind farms where golden plovers were both diurnally and nocturnally active found no fatalities (*Krijgsveld et al.,* 2009). Golden plovers were not recorded breeding within the 500 m turbine envelope during the survey period which reduces magnitude. Predicted number of collisions is <0.01 per year. It must be noted that the winter population of golden plover would be larger than the summer breeding population due to the arrival of migrants from Europe and Iceland.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **very high**, overall effect significance is **low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (40-178 m), published best scientific knowledge and moderate frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Goshawk (Medium)	A published review of the number of bird fatalities owing to collision with wind turbines showed there was a single fatality across 46 European wind farms (Hoetker et al., 2006). However, the published avoidance rate is 98% (SNH 2010), suggesting goshawks exhibit high levels of micro-avoidance at wind farms.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **medium**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (40 - 178 m), published best scientific

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
	This species was not recorded within the 500 m turbine buffers, so the effective collision risk for this species is zero.	knowledge and frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Great Black-backed Gull (Medium)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were zero fatalities across 46 European wind farms (Hoetker *et al.*, 2006). However, the published avoidance rate is 98% (SNH 2010), suggesting great black-backed gulls exhibit high levels of micro-avoidance at wind farms. Predicted number of collisions is 0.01 per year.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **medium**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (40 - 178 m), published best scientific knowledge and frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Hen Harrier (Very High)	No hen harriers were observed breeding on site, so potential collision risk significantly reduced due to the absence of breeding as territorial display known as 'skydancing', which often occurs at heights within the predicted rotor envelope. Documented as occasionally soaring or arriving at winter roosts 'at height' (Watson, 1977), however no documented roosts were recorded within 10 km of the site. Predicted number of collisions is <0.01 per year. Literature suggests flying at low heights is a 'ubiquitous trait' supported by a number of studies (Whitfield and Madders, 2006). The species has a high, published avoidance rate 99%) (SNH, 2017) in relation to wind turbines. Due to the lack of observations of the species within rotor-swept heights, the collision risk for this species can be assumed to be effectively zero.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **high**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (40 - 178 m), published best scientific knowledge and low frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Herring Gull (High)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were 189 fatalities across 46 European wind farms (Hoetker *et al.*, 2006). However, the published avoidance rate is 98% (SNH 2010), suggesting herring gulls exhibit high levels of micro-avoidance at wind farms. No flight heights were recorded for this species, precluding a quantitative impact of collision risk.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **high**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (40 - 178 m), published best scientific knowledge and frequency of occurrence at the site.

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
		The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Kestrel (Medium)	Twenty-nine fatalities were recorded across 46 wind farms in a published review of the effects of turbine collision on birds in the European Context (Hoetker et al., 2006). The published avoidance rate is 95% (SNH, 2010). Predicted number of collisions is 0.11 per year.	**Collision:** Magnitude effects is assessed as **negligible** (5-10% population lost), species sensitivity is **medium**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (40 - 178 m), published best scientific knowledge and moderate frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Lesser Black-backed Gull (Medium)	A published review of 46 European wind farms (Hoetker *et al.*, 2006) found 45 fatalities across wind farms. However, the published avoidance rate (SNH, 2010) is 98%, suggesting birds exhibit a high level of micro-avoidance. Predicted number of collisions is 0.19 per year	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **medium,** overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (40 – 178 m), published best scientific knowledge and moderate frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Long-eared Owl (Low)	A published review of 46 European wind farms (Hoetker *et al*., 2006) found zero fatalities across wind farms. However, the published avoidance rate (SNH, 2010) is 98%, suggesting birds exhibit a high level of micro-avoidance. This species was not recorded within the 500 m turbine buffers, so the effective collision risk for this species is zero.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **low**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (40 - 178 m), published best scientific knowledge and moderate frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Merlin (Very High)	Merlin mainly take prey from a perch, on the ground or low in flight (Gensbol 2008).	**Collision:**

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
	Wintering birds have been shown to employ low flight attacks for over 64% of total hunts (Dickson 1996). Occasionally birds fly upwards during a pursuit flight, but this only represents 10.8% of total hunts (Dickson 1996), possibly due to increased energy expenditure. Flight patterns during the breeding season are likely to be similar with documented hunting and commuting flight often 1-2 m in height (McElheron 2005). This species was not recorded within the 500 m turbine buffers at rotor swept heights, so the effective collision risk for this species is zero.	Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **very high**, overall effect significance is **low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (40 - 178 m), published best scientific knowledge and moderate frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Peregrine Falcon (Very High)	Evidence of collision fatality is low, with only two birds recorded in published reviews of wind farm fatalities (Hoetker et al., 2006). The SNH recommended avoidance rate for collision-risk modelling is 98% (SNH, 2010), suggesting high micro-avoidance capabilities. Predicted number of collisions is 0.02 per year.	**Collision:** Magnitude effects is assessed is **negligible** (<1% population lost), species sensitivity is **high**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (40 - 178 m), published best scientific knowledge and moderate frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Red Kite (Medium)	A published review of 46 European wind farms (Hoetker *et al*., 2006) found ze43 fatalities across wind farms. However, the published avoidance rate (SNH, 2010) is 99%, suggesting birds exhibit a high level of micro-avoidance. Predicted number of collisions is <0.01 per year.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **medium,** overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (29.5-144.5 m), published best scientific knowledge and moderate frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Snipe (Medium)	A published review of 46 European wind farms (Hoetker et al., 2006) found 45 fatalities across wind farms. However, the published avoidance rate (SNH, 2010) is 98%, suggesting birds exhibit a high level of micro-avoidance. Predicted number of collisions is 0.01 per year.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **medium,** overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (29.5-144.5 m), published best

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
		scientific knowledge and moderate frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Sparrowhawk (Medium)	Sparrowhawks are a resident species of the wind farm study area, although no breeding has been recorded within the site. Published fatality rates are low, with two fatalities from a review of 46 wind farms across Europe (Hoetker *et al*., 2006). Predicted number of collisions is 0.11 per year.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **medium**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (40 - 178 m), published best scientific knowledge and moderate frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Woodcock (High)	A published review of 46 European wind farms (Hoetker *et al*., 2006) found one fatality across wind farms. However, the published avoidance rate (SNH, 2010) is 98%, suggesting birds exhibit a high level of micro-avoidance. This species was not recorded within the 500 m turbine buffers at rotor swept heights, so the effective collision risk for this species is zero.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **high**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (40 - 178 m), published best scientific knowledge and frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).

Displacement and disturbance

There is evidence that the rotor blades of wind turbines during operation can displace or exclude some species, which effectively results in habitat loss for these birds. Habitat loss can be direct through land take of breeding or foraging habitats for key species or indirect such as effective habitat loss through avoidance or disturbance due to factors such as perceived collision risk. Birds may therefore avoid areas proximal to turbines until habituation takes place. There are examples in the literature of habituation in species such as geese and swans (see Fijn *et al*., 2012 and Madsen and Boertmann, 2008).

Available evidence suggests that breeding passerines are not adversely affected by the presence of wind turbines. For example, a German study found no effect on numbers or spatial distribution of skylarks within 1km of turbines (Langston and Pullan, 2004).

Whitfield and Madders (2006), suggest that most studies do not detect any significant displacement of raptor species by wind turbines although there are occasional notable exceptions.

Displacement of birds by the presence of turbines is not considered to be a significant effect on the species assemblage given the limited amount of habitat available onsite and the availability of habitat in the greater area.

Barrier Effect

One of the potential operational impacts of wind farms is avoidance where the wind farm may act as a barrier to movements (Masden *et al*., 2009). The effect of birds altering their migration flyways or local flight paths to avoid any infrastructure is a form of displacement (Drewitt and Langston, 2006). The primary impact of barrier effect is increased energy expenditure when birds have to fly further to circumvent an obstacle.

Effects can be highly variable and range from slight 'checks' in-flight direction, height or speed, through to larger diversions around objects. Studies have shown that birds on migration may show avoidance of wind farms (Masden, 2009) but the observed distances involved were trivial in regard to total migration distances, and hence energy expenditure.

In relation to nocturnal flight activity recent studies utilising radar on both offshore and coastal wind farms in Europe have recorded macro-avoidance rates in wildfowl at least as high, or higher at night than during the day, implying that diurnal avoidance rates are comparable to those in periods of lower visibility (Desholm, and Kahlert, 2005). In the same study migrating flocks at night were recorded increasing their distance from individual turbines once inside the wind farm and also travelling in the corridors between turbines (Desholm, and Kahlert, 2005).

Potential disturbance and barrier effects due to the operation of the proposed wind farm are outlined in Table 8-72 below.

Table 8-72: Disturbance and Barrier effect on target species

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Black-headed Gull (High)	**Disturbance:** Of a literature review, carried out by Percival (2003), all studies which indicated gull species being significantly affected or being a species found to have collided, were identified at wind farms on costal habitats. It is uncertain that disturbance may impact gull species in-land. **Barrier Effect:** Species such as gulls will be more at risk from collision impacts as a result of their flight behaviour, but less sensitive to disturbance and displacement effects (Humphreys *et al.,* 2015). For gull species such as Lesser Black-Backed, Herring and Greater Black-Backed Gull, some studies indicate evidence for attraction, whereas others for displacement, with the remainder indicating no significant response (Cook *et al*., 2014; Humphreys *et al.,* 2015).	**Disturbance:** Magnitude of effects is assessed as **Low**; Species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude ***Not Significant*** due to published habituation to wind farms; overall significance considered ***Long-term Not Significant Impact*** (Criteria: EPA 2017). **Barrier Effect:** Magnitude effects is assessed as **Negligible** (<1 % habitat lost), species sensitivity is **High**, overall effect significance is **Very Low** (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as ***Imperceptible***; magnitude of daily barrier effect assessed as ***Imperceptible***; overall significance considered an ***Imperceptible Long-term Impact*** (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Buzzard (Low)	**Disturbance:** In a review of the published impacts of wind farms on Buzzard populations (Hoetker et al., 2006), it was found that overall, impacts on Buzzard populations post-construction, across both winter and breeding seasons was not significant and that Buzzards do show habituation to the presence of wind farms (Hoetker *et al.,* 2006). **Barrier Effect:** Barrier effects on either migration or regular flights of Buzzard has been shown at two out of six studies to date (2004) in a European context (Hoetker *et al.,* 2006). The overall barrier effect was not shown to be significant.	**Disturbance:** Magnitude of effects is assessed as **Medium** (5-20% of habitat/population lost), species sensitivity is **Low**, overall effect significance is **Very Low** (Criteria: Percival 2003). Magnitude ***Imperceptible*** due to published habituation to wind farms; overall significance considered an ***Imperceptible Long-term Impact*** (Criteria: EPA 2017). **Barrier Effect:** Magnitude effects is assessed as **Medium** (5-20% of habitat/population lost), species sensitivity is **Low**, overall effect significance is **Very Low** (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as ***Imperceptible***; magnitude of daily barrier effect assessed as ***Imperceptible***; overall significance considered an ***Imperceptible Long-term Impact*** (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Common Gull (Medium)	**Disturbance:** Of a literature review, carried out by Percival (2003), all studies which indicated gull species being significantly affected or being a species found to have collided, were identified at wind farms on costal habitats. It is uncertain that disturbance may impact gull species in-land. **Barrier Effect:** Species such as gulls will be more at risk from collision impacts as a result of their flight behaviour, but less sensitive to disturbance and displacement effects (Humphreys et al., 2015). For gull species such as Lesser Black-Backed, Herring and Greater Black-Backed Gull, some studies indicate evidence for attraction, whereas others for displacement, with the remainder indicating no significant response (Cook *et al.,* 2014; Humphreys *et al*., 2015).	**Disturbance:** Magnitude of effects is assessed as **Low**; Species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude ***Not Significant*** due to published habituation to wind farms; overall significance considered ***Long-term Not Significant Impact*** (Criteria: EPA 2017). **Barrier Effect:** Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Medium**, overall effect significance is **Very Low** (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as ***Imperceptible***; magnitude of daily barrier effect assessed as ***Imperceptible***; overall significance considered an ***Imperceptible Long-term Impact*** (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Cormorant (Medium)	**Disturbance:** In a review of the published impacts of wind farms on birds (Hoetker et al., 2006), there was no information available on Cormorant populations post-construction. Single bird observed flying over site suggests any impacts will be low. **Barrier Effect:** Barrier effects on either migration or regular flights of Cormorant has been shown for 2/6 studies to date (2004) in a European context (Hoetker *et al.,* 2006), with the overall effect significance being non-significant. Single bird observed flying over site suggests any impacts will be low.	Magnitude of effects is assessed as **Low**; Species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude ***Not Significant*** due to published habituation to wind farms; overall significance considered ***Long-term Not Significant Impact*** (Criteria: EPA 2017). **Barrier Effect:** Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Medium**, overall effect significance is **Very Low** (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as ***Imperceptible***; magnitude of daily barrier effect assessed as ***Imperceptible***; overall significance considered an ***Imperceptible Long-term Impact*** (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Curlew (High)	**Disturbance:** Only one observation of the species during surveys and no breeding recorded within the study area. Studies on the operational effects of wind farms have found Curlews can exhibit avoidance of up to 800 m in respect of turbines (Pearce-Higgins *et al.,* 2009). However, results of studies vary with some studies finding little or no evidence of disturbance (Reichenbach, 2011), suggesting impacts may vary from site to site dependant on factors such as habitat. **Barrier Effect:** Foraging during the breeding season has been recorded up to 1.5 km from nest sites; however, as curlew are not breeding within the site and only on observation of curlew was observed passing through the study area, no significant daily impediment is expected. Barrier effects on migrating birds or birds undertaking larger scale movements is extremely unlikely to be significant given the minimum distances between individual turbines.	**Disturbance:** Magnitude of effects **Negligible**, species sensitivity is **High**, overall effect significance is **Very Low** (Criteria: Percival 2003). Magnitude ***Imperceptible*** due to low level of sightings within the site; overall significance considered an ***Imperceptible Long-term Impact*** (Criteria: EPA 2017). **Barrier Effect:** Magnitude of effects is assessed as **Negligible** (< 1% population/ habitat lost), species sensitivity is **High**, overall effect significance is **Very Low** (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as ***Imperceptible***; magnitude of daily barrier effect assessed as ***Imperceptible*** as literature suggests low published avoidance rates of wind farms; overall significance considered an ***Imperceptible Long-term Impact*** (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Golden Plover (Very High)	**Disturbance:** Possible disturbance during winter months from feeding or roosting locations; feeding is mainly nocturnal and ample displacement habitat is available during daylight hours. Two observations of the species (22 birds) over study area. Literature suggests differences in densities pre- and post-construction of wind farms is not significant (Pearce-Higgins *et al.,* 2012); displacement is not significant but may occur up to 175 m (Hoetker *et al.,* 2006). **Barrier Effect:** Low published avoidance rates of wind farms (Krijgsveld *et al.,* 2009) and changes in densities within wind farms post construction (Pearce-Higgins *et al*., 2012), suggests wind farms do not act as significant barriers to golden plover.	**Disturbance:** Magnitude of effects is assessed as **Negligible**; species sensitivity is **Very High**. Overall impact is **Low** (Criteria: Percival 2003). Magnitude ***Not Significant***; overall significance considered Long-term, ***Not Significant Impact*** (Criteria: EPA 2017). **Barrier Effect:** Magnitude effects is assessed as **Negligible** (<1 % habitat lost), species sensitivity is **Very High**, overall effect significance is **Low** (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as ***Imperceptible***; magnitude of daily barrier effect assessed as ***Imperceptible*** as literature suggests low published avoidance rates of wind farms; overall significance considered an ***Imperceptible Long-term Impact*** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Goshawk (Medium)	**Disturbance:** Only a single sighting and no breeding or roosting takes place within the subject site; noise disturbance/visual intrusion unlikely to deter wintering birds from foraging as evidence suggests birds may continue to utilise wind farms post construction (Robinson *et al.,* 2012). **Barrier Effect:** Barrier effect has been recorded in Europe (Hoetker *et al.,* 2006) though this may relate mainly to large scale migration, which is unlikely at the subject site. Only a single record of two birds during winter indicating wind farms may not be significant barriers. Large scale migration of this species doesn't occur at the subject site.	**Disturbance:** Magnitude effects is assessed as **Negligible** (< 1% population/ habitat lost), species sensitivity is **Low**, overall effect significance is **Low** (Criteria: Percival, 2003). Magnitude ***Imperceptible*** due to lack of sightings within the site; overall significance considered an ***imperceptible long term impact*** (Criteria: EPA, 2002). **Barrier Effect:** Magnitude effects is assessed as **Negligible** (< 1% population/ habitat lost), species sensitivity is **Medium** overall effect significance is **Very Low** (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as ***Imperceptible***; overall significance considered an ***imperceptible long term impact*** (Criteria: EPA, 2002).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Great Black-backed Gull (Medium)	**Disturbance:** Of a literature review, carried out by Percival (2003), all studies which indicated gull species being significantly affected or being a species found to have collided, were identified at wind farms on costal habitats. It is uncertain that disturbance may impact gull species in-land. **Barrier Effect:** Species such as gulls will be more at risk from collision impacts as a result of their flight behaviour, but less sensitive to disturbance and displacement effects (Humphreys *et al.,* 2015). For gull species such as Lesser Black-Backed, Herring and Greater Black-Backed Gull, some studies indicate evidence for attraction, whereas others for displacement, with the remainder indicating no significant response (Cook et al., 2014; Humphreys *et al.,* 2015).	**Disturbance:** Magnitude of effects is assessed as **Low**; Species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude ***Not Significant*** due to published habituation to wind farms; overall significance considered ***Long-term Not Significant Impact*** (Criteria: EPA 2017). **Barrier Effect:** Magnitude effects is assessed as **Negligible** (<1 % habitat lost), species sensitivity is **Medium**, overall effect significance is **Very Low** (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as ***Imperceptible***; magnitude of daily barrier effect assessed as ***Imperceptible***; overall significance considered an ***Imperceptible Long-term Impact*** (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Hen Harrier (Very High)	**Disturbance:** No breeding or roosting takes place within the subject site; adult female observed once in the summer within the study area. Noise disturbance/visual intrusion unlikely to deter foraging as evidence suggests birds may continue to utilise wind farms post construction (Robinson *et al.,* 2012). **Barrier Effect:** Although barrier effect has been documented in at least one study in the European context; recent evidence suggests that birds continue to use wind farms post construction (Whitfield and Madders, 2006) (Robinson *et al.,* 2012) indicating wind farms may not be significant barriers. Large scale migration of this species observed once during the summer within subject site.	**Disturbance:** Magnitude effects is assessed as **Low** (< 1% population/ habitat lost), species sensitivity is **Very High**, overall effect significance is **Medium** (Criteria: Percival, 2003). Magnitude ***Low*** due toa single summer sightings within the site; overall significance considered an ***Long-term not significant impact*** (Criteria: EPA, 2002). **Barrier Effect:** Magnitude effects is assessed as **Negligible** (< 1% population/ habitat lost), species sensitivity is **Very High**, overall effect significance is **Low** (Criteria: Percival, 2003). Magnitude to birds in terms of energy expenditure assessed as ***Not Significant***; magnitude of daily barrier effect assessed as ***Not Significant***; overall significance considered ***Long-term not significant impact*** (Criteria: EPA, 2002).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Herring Gull (High)	**Disturbance:** Of a literature review, carried out by Percival (2003), all studies which indicated gull species being significantly affected or being a species found to have collided, were identified at wind farms on coastal habitats. It is uncertain that disturbance may impact gull species in-land. **Barrier Effect:** Species such as gulls will be more at risk from collision impacts as a result of their flight behaviour, but less sensitive to disturbance and displacement effects (Humphreys *et al.,* 2015). For gull species such as Lesser Black-Backed, Herring and Greater Black-Backed Gull, some studies indicate evidence for attraction, whereas others for displacement, with the remainder indicating no significant response (Cook *et al*., 2014; Humphreys *et al*., 2015).	**Disturbance:** Magnitude of effects is assessed as **Low** (1-5% habitat/population lost), species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude ***Not Significant*** due to published habituation to wind farms; overall significance considered ***Long-term Not Significant Impact*** (Criteria: EPA 2017). **Barrier Effect:** Magnitude of effects is assessed as **Low** (1-5% population/habitat lost), species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as ***Imperceptible***; magnitude of daily barrier effect assessed as ***Imperceptible***; overall significance considered an ***Imperceptible Long-term Impact*** (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Kestrel (Medium)	**Disturbance:** Disturbance (in terms of minimal distance to wind farm) has been recorded in 14 studies on wind farms in Europe; however, the maximum distance recorded was 150 m (Hoetker *et al.,* 2006). This is unlikely to be significant. Habituation to wind farms has been recorded in Kestrel (Hoetker *et al.,* 2006). **Barrier Effect:** Barrier effects have been shown to a degree in either migrating Kestrel or regular flight paths within the European context (3 of 5 studies; Hoetker *et al.,* 2006).	**Disturbance:** Magnitude of effects is assessed as **Medium**; species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude ***Not Significant*** due to published habituation to wind farms; overall significance considered ***Long-term Not Significant Impact*** (Criteria: EPA 2017). **Barrier Effect:** Magnitude of effects is assessed as **Medium** (5-20% of habitat/population lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude in terms of energy expenditure assessed as ***Imperceptible***; magnitude of daily barrier effect assessed as ***Imperceptible*** as literature suggests low published avoidance rates of wind farms with habituation; overall significance considered a ***Slight Long-term Impact*** but with habituation an ***Imperceptible Long-term Impact*** (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Kingfisher (Very High)	**Disturbance:** In a review of the published impacts of wind farms on birds (Hoetker et al., 2006), there was no information available on Kingfisher populations post-construction. The species was not recorded on-site, so any effects are likely to be negligible. **Barrier Effect:** Barrier effects on either migration or regular flights of Kingfisher has not been shown to date (2004) in a European context (Hoetker *et al.,* 2006). The species was not recorded on-site, so any effects are likely to be negligible.	Magnitude of effects is assessed as **Negligible**; Species sensitivity is **Very High**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude ***Not Significant*** due to species being not recorded on site; overall significance considered ***Long-term Not Significant Impact*** (Criteria: EPA 2017). **Barrier Effect:** Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Very High**, overall effect significance is **Low** (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as ***Imperceptible***; magnitude of daily barrier effect assessed as ***Imperceptible***; overall significance considered an ***Imperceptible Long-term Impact*** (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Lesser Black-backed Gull (Medium)	**Disturbance:** Of a literature review, carried out by Percival (2003), all studies which indicated gull species being significantly affected or being a species found to have collided, were identified at wind farms on costal habitats. It is uncertain that disturbance may impact gull species in-land. **Barrier Effect:** Species such as gulls will be more at risk from collision impacts as a result of their flight behaviour, but less sensitive to disturbance and displacement effects (Humphreys *et al.,* 2015). For gull species such as Lesser Black-Backed, Herring and Greater Black-Backed Gull, some studies indicate evidence for attraction, whereas others for displacement, with the remainder indicating no significant response (Cook *et al*., 2014; Humphreys *et al*., 2015).	**Disturbance:** Magnitude of effects is assessed as **Low** (1-5% habitat/population lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude ***Not Significant*** due to published habituation to wind farms; overall significance considered ***Long-term Not Significant Impact*** (Criteria: EPA 2017). **Barrier Effect:** Magnitude of effects is assessed as **Low** (1-5% population/habitat lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as ***Imperceptible***; magnitude of daily barrier effect assessed as ***Imperceptible***; overall significance considered an ***Imperceptible Long-term Impact*** (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Long-eared Owl (Low)	**Disturbance:** This species has bred not far outside the site's southern boundary; a local road is located between the site boundary and possible nesting site. Long-eared Owl can have urban associations which indicates tolerance to disturbance; noise disturbance from turbines are unlikely to deter nesting birds and foraging birds. **Barrier Effect**: Given the low population levels within both the immediate area and the wider regional context (Balmer *et al*., 2016) avoidance of the proposed wind farm is unlikely to induce significant energetic expenditure on either daily patterns of birds or birds undertaking larger movements such as post fledging dispersal of juveniles.	**Disturbance:** Magnitude effects is assessed as **Low** (1-5% population/ habitat lost), species sensitivity is **Low**, overall effect significance is **Very Low** (Criteria: Percival, 2003). Magnitude ***Not Significant*** ; overall significance considered an imperceptible ***Long-term Not Significant Impact*** (Criteria: EPA, 2002). **Barrier Effect:** Magnitude effects is assessed as **Low** (1-5% population/ habitat lost), species sensitivity is **Low**, overall effect significance is **Very Low** (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as ***Imperceptible***; magnitude of daily barrier effect assessed as ***Not Significant***; overall significance considered ***Long-term Not Significant Impact*** (Criteria: EPA, 2002).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Merlin (Very High)	**Disturbance:** Possible disturbance to wintering birds due to operational maintenance etc. A pair were observed copulating but not seen after and are likely to have migrated. No roosting was noted within the site. **Barrier Effect:** Barrier effect has been recorded in Europe (Hoetker *et al.,* 2006) though this may relate mainly to large scale migration, which is unlikely at the subject site. Numbers recorded on site were low in summer and winter.	**Disturbance:** Magnitude of effects is assessed as **Low** (1-5% population/habitat lost); species sensitivity is **Very High**. Overall impact is **Medium** (Criteria: Percival 2003). Magnitude ***Slight***; overall significance considered a ***Slight***, ***Long-term Impact*** (Criteria: EPA 2017). **Barrier Effect:** Magnitude of effects is assessed as **Low** (1-5% population/habitat lost); species sensitivity is **Very High**. Overall impact is **Medium** (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as ***Imperceptible***; magnitude of daily barrier effect assessed as ***Slight****;* overall significance considered a ***Slight, Long-term Impact*** (Criteria: EPA, 2017)

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Peregrine Falcon (Very High)	**Disturbance:** Possible disturbance to foraging birds through noise, visual intrusion. No displacement from breeding sites due to none being recorded within the proposed site boundary (SNH 2012). **Barrier Effect:** Recorded infrequent flight activity suggests high proportion of flight activity below rotor height; the wind farm is unlikely to act as a significant barrier to a species such as Peregrine.	**Disturbance:** Magnitude of effects is assessed as **Negligible**; species sensitivity is **Very High**. Overall impact is **Low** (Criteria: Percival 2003). Magnitude ***Not Significant*** due to low level of sightings within the site; overall significance considered ***Long-term Not Significant Impact*** (Criteria: EPA 2017). **Barrier Effect:** Magnitude of effects is assessed as **Low** (1-5% population/habitat lost); species sensitivity is **Very High**. Overall impact is **Low** (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as ***Imperceptible***; magnitude of daily barrier effect assessed as ***Imperceptible***; overall significance considered an ***imperceptible, long-term impact*** (Criteria: EPA, 2017)

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Red Grouse (High)	**Disturbance:** In a review of the published impacts of wind farms on birds (Hoetker et al., 2006), there was no information available on Red Grouse populations post-construction. The species was recorded on-site in low numbers, so any effects are likely to be low. **Barrier Effect:** Barrier effects on either migration or regular flights of Red Grouse has not been shown to date (2004) in a European context (Hoetker *et al.,* 2006). The species was recorded on-site in low numbers, so any effects are likely to be low.	Magnitude of effects is assessed as **Low**; Species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude ***Not Significant*** due to low numbers recorded on site; overall significance considered ***Long-term Not Significant Impact*** (Criteria: EPA 2017). **Barrier Effect:** Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as ***Imperceptible***; magnitude of daily barrier effect assessed as ***Imperceptible***; overall significance considered an ***Long-term Imperceptible Impact*** (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Red Kite (Medium)	**Disturbance:** Disturbance (in terms of increased distance to wind farm) of habituation of Red Kite has been recorded in 1 study of wind farms in Europe. Avoidance deemed not significant in an assessment of seven studies where no negative effect on density occurred in 3 of 4 studies (Hoetker *et al.*, 2006). **Barrier Effect:** Red Kite gave been shown to be sensitive to barrier effects; with 3 of 3 studies showing effect on migrating birds and breeding birds (Hoetker *et al*., 2006). Red Kite was observed infrequently during summer surveys within the study area hunting; with a single flightpath located within the site. No signs of breeding.	**Disturbance:** Magnitude effects is assessed as **Negligible** (< 1% population/ habitat lost), species sensitivity is **Medium**, overall effect significance is **Very Low** (Criteria: Percival, 2003). Magnitude ***Not Significant*** due to limited sightings within the site; overall significance considered an ***Long-term Not Significant Impact*** (Criteria: EPA, 2002). **Barrier Effect:** Magnitude effects is assessed as **Negligible** (< 1% population/ habitat lost), species sensitivity is **Medium**, overall effect significance is **Very Low** (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as ***Moderate***; magnitude of daily barrier effect assessed as ***Imperceptible***; overall significance considered a ***Long-term Not Significant Impact*** (Criteria: EPA, 2002).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Snipe (Medium)	**Disturbance:** Possible disturbance during winter months from feeding or roosting locations; feeding is mainly in heath areas and grassy verge where invertebrates are present. Numbers recorded on site are low in relation to National Threshold (1-9 birds). Literature suggests differences in densities pre- and post-construction of wind farms has a significant impact upon Snipe within the area (Pearce-Higgins *et al.*, 2012). **Barrier Effect:** Recorded infrequent flight activity suggests low proportion of flight activity below rotor height; the wind farm is unlikely to act as a significant barrier to a species such as Snipe.	**Disturbance:** Magnitude of effects is assessed as **Negligible** (<1% population/habitat lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival 2003). The proposed impact of disturbance will be a ***Long-term Slight Impact*** (Criteria: EPA 2017). **Barrier Effect:** Magnitude of effects is assessed as **Low** (<1% population/habitat lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as ***Imperceptible***; magnitude of daily barrier effect assessed as ***Imperceptible*** as literature suggests low published avoidance rates of wind farms; overall significance considered an ***Imperceptible Long-term Impact*** (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Sparrowhawk (Medium)	**Disturbance:** In a review of the published impacts of wind farms on Sparrowhawk populations (Hoetker *et al.,* 2006), it was found that overall, impacts on Sparrowhawk populations post-construction, across both winter and breeding season was not significant. Sparrowhawk do show habituation to the presence of wind farms (Hoetker *et al*., 2006). The species was also observed to be breeding on the outer edge of the site. **Barrier Effect:** Sparrowhawk is considered to be less sensitive or less willing to change their original migration direction when approaching wind farms (Hoetker et al., 2006). The species also avoided wind farms less often and their local populations were less influenced by wind farms. The overall barrier effect was not shown to be significant.	**Disturbance:** Magnitude of effects is assessed as **Medium**, species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude ***Not Significant*** due to published habituation to wind farms; overall significance considered ***Long-term Not Significant Impact*** (Criteria: EPA 2017). **Barrier Effect:** Magnitude effects is assessed as **Low** (1-5% habitat/population lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as ***Imperceptible***; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered an ***Imperceptible Long-term Impact*** (Criteria: EPA 2017).
Stock Dove (Medium)	**Disturbance:** In a review of the published impacts of wind farms on birds (Hoetker et al., 2006), there was no information available on Stock Dove populations post-construction. The species was recorded in low numbers on-site, so any effects are likely to be low. **Barrier Effect:** Barrier effects on either migration or regular flights of Pigeons (as a combined group including Stock Dove) as a group has been shown for 6/9 studies to date (2004) in a European context (Hoetker *et al.,* 2006). The overall effect was non-significant. The species was not recorded on-site, so any effects are likely to be low.	Magnitude of effects is assessed as **Low**; Species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude ***Not Significant*** due to low numbers recorded on site; overall significance considered ***Long-term Not Significant Impact*** (Criteria: EPA 2017). **Barrier Effect:** Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Medium**, overall effect significance is **Very Low** (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as ***Imperceptible***; magnitude of daily barrier effect assessed as ***Imperceptible***; overall significance considered an ***Imperceptible Long-term Impact*** (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Woodcock (High)	**Disturbance:** As a nocturnal species, it is unlikely to be affected by noise/visual intrusion. **Barrier Effect:** Home ranges are small with birds recorded flying up to 1 km from nests sites to forage (Hoodless and Hirons 2007). No published evidence of barrier effect to migrating birds (Hoetker *et al.,* 2006).	**Disturbance:** Magnitude of effects is assessed as **Low**, species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude ***Not Significant***; overall significance considered ***Long-term Not Significant Impact*** (Criteria: EPA, 2017). **Barrier Effect:** Magnitude effects is assessed as **Low** (Guide: 1-5% habitat lost), species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as ***Imperceptible***; magnitude of daily barrier effect assessed as ***Imperceptible*** as literature suggests low published avoidance rates of wind farms; overall significance considered an ***Imperceptible Long-term Impact*** (Criteria: EPA, 2017).

8.5.2.6 Aquatic Ecology

Operational wind farms are not normally considered to have the potential to significantly impact on the aquatic environment. The main risk to watercourses is via water quality impacts, when oils and lubricants are used on the site (e.g. infrastructure maintenance). If such substances leaked from the turbines or maintenance areas or were disposed of inappropriately, there is a risk of water contamination and subsequent impacts to aquatic ecology. However, the likelihood of this occurring is very low, and the potential significance of this impact can be mitigated through effective mitigation and appropriate management. Spills of any oil or fuels from site vehicles onto access tracks may leach to adjacent watercourses. However, this is unlikely to be a significant impact considering the low volumes of vehicular traffic involved in typical wind farm operations and the high standards that are implemented on a well-managed site.

Due to the natural 'grassing-over' the drainage swales and revegetation of other exposed surfaces, and the non-intrusive nature of site operations, there is a negligible risk of sediment release to the watercourses during the operational stage.

Upgrading of the site track/road network within the wind farm boundary, as well as the provision of the Croaghaun Loop public amenity walk, will increase public access to the site. Maintenance or upgrading of the site access network could allow increased public access to the site. This could potentially result in illegal dumping of domestic refuse which could impact adjacent watercourses by causing a deterioration in water quality, alterations to local hydrological regimes or direct habitat interreference.

Similarly, the risk of silt-laden run-off resulting from excavations required for underground cable maintenance may impact water quality and aquatic habitats but can, again, be effectively mitigated against through the measures outlined in Chapter 10 and the CEMP (Appendix 3.1) that are proposed for maintaining the grid connection cable..

There is a potential risk of some hydrocarbons polluting the watercourses following run-off from the impermeable trafficked areas associated with the wind farm layout. During the operational stage, small quantities of oil will be used in cooling the transformers associated with the facility. There is, therefore, a potential for small oil spills which may enter surface waters and cause impacts to aquatic ecology.

The overall estimated increase in the peak run-off due to the wind farm development is 0.077 m^3/s (or 0.0 %) for a 1-in-100 years storm event (Chapter 10, section 10.4.2). Therefore, the slight predicted increase in surface water run-off during the lifetime of the wind farm development is not anticipated to impact slow-swimming fish species, such as European Eel or *Lampetra* sp., in receiving watercourses and is considered negligible. Potential operational phase impacts on aquatic ecology are considered *slight short-term Impact* and in the *Local Context*, in the absence of mitigation.

8.5.2.7 *Other Species*

During the operation of the wind farm no effects to other species are anticipated.

8.5.3 Potential Effects during the Decommissioning of the Project

Decommissioning activities of Croaghaun Wind Farm Project will take place in a similar fashion to the construction phase. Potential impacts will be similar to the construction phase but on a reduced scale. Potential Impacts during decommissioning on the following are addressed below:

- Designated Nature Conservation Sites
- Habitats and Flora
- Mammals (excluding Bats)
- Bats
- Avifauna
- Aquatic Ecology and Fisheries
- Other Species.

8.5.3.1 *European sites*

A Natura Impact Statement (NIS) has been prepared for the proposed development. The NIS addresses potential impacts on European sites resulting from the proposed development. The Stage One Appropriate Assessment Screening report concluded that, in the absence of mitigation measures (which have not been considered at this screening stage), likely significant effects on the qualifying interests of the Slaney River Valley SAC, Blackstairs Mountains SAC, Lower River Shannon SAC and River Barrow and River Nore SAC cannot be excluded on the basis of objective scientific information. A Stage 2 Appropriate Assessment (Natura Impact Statement) of the potential impact on the Slaney River Valley SAC, Blackstairs Mountains SAC, Lower River Shannon SAC and River Barrow and River Nore SAC was therefore required.

The Natura Impact statement concluded that in the light of the conclusions of the assessment which it shall conduct on the implications for the European sites concerned, the competent authority is enabled to ascertain that the proposed project will not adversely affect the integrity of any of the European sites concerned.

8.5.3.2 Natural Heritage Areas or Proposed Natural Heritage Areas

Turbine delivery work location no. 30 is located within Slaney River Valley pNHA (000781) located outside of its associated SAC boundary. During the preparation of the TDR for the removal of turbines, vegetation will be trimmed at turbine delivery work location no. 30 and will not include the removal of walls or treatment of the widened surface (turbine delivery work location no. 30). As the habitats are of Local Importance (Higher Value) with low sensitivity and limited length of works this will result in the *Temporary Imperceptible Reversible Impact* on Slaney River Valley pNHA (000781).

It is highly likely that at turbine delivery work location no. 43 there will be the construction and removal of a temporary bridge crossing at Kilbranish. Works will be less than that required for the construction phase but suspended solids could still be released into the first order stream (Deerpark_New, EPA code_12D25) which is a tributary of the Slaney River. Due to the absence of a direct hydrological link between the turbine delivery work location and any national site as well as distance (John's Hill pNHA 000808 is the closest located ca. 1.6km away) there will be no indirect impacts on any national site.

In the NIS, the main potential effects during the decommissioning phase of the main wind farm site, turbine delivery route and grid connection are on the water quality of the Slaney River Valley SAC/pNHA and Blackstairs Mountain SAC/pNHA.

These indirect effects, via water quality, could occur on the key species for which the pNHA has been designated. In the event of siltation or pollution of watercourses resulting from uncontrolled run-off from main wind farm site, turbine delivery route and grid connection, the River Slaney and its tributaries could be indirectly damaged by changes to turbidity and water quality. There is also potential for indirect effects to designated fish and aquatic species including, inter alia, white-clawed crayfish and salmon, due to water quality changes which could cause a fish kill.

Changes in water quality could in turn reduce prey availability of breeding otter in the Slaney River Valley SAC/pNHA and reduce breeding sites for aquatic species.

Whilst it has been acknowledged that there could be potential for the main wind farm site, turbine delivery route and grid connection to have significant effects on the Slaney River Valley SAC/pNHA, with the implementation of the detailed mitigation measures identified in the NIS, it is concluded beyond reasonable scientific doubt that the integrity of the Slaney River Valley SAC/pNHA will not be adversely affected.

The NIS has assessed the potential effects on the integrity of the Slaney River Valley SAC/pNHA in light of the sites' conservation objectives and mitigation measures have been developed to prevent such potential effects occurring.

In the light of the conclusions of the assessment which it shall conduct on the implications for the Slaney River Valley SAC/pNHA, the competent authority is enabled to ascertain that the proposed project will not adversely affect the integrity of any of the Slaney River Valley SAC/pNHA.

The only element of the project with any potential connection to Blackstairs Mountains pNHA is the TDR turning area (turbine delivery work location no. 52) located immediately adjacent to the pNHA and is considered further under the potential impact section below.

Whilst it has been acknowledged that there could be potential for the turbine delivery route to have significant effects on the Blackstairs Mountain SAC/pNHA, with the implementation of the detailed mitigation measures identified in the NIS, it is concluded beyond reasonable scientific doubt that the integrity of the Blackstairs Mountain SAC/pNHA will not be adversely affected.

The NIS report has assessed the potential effects on the integrity of the Blackstairs Mountain SAC/pNHA in light of the sites' conservation objectives and mitigation measures have been developed to prevent such potential effects occurring.

In the light of the conclusions of the assessment which it shall conduct on the implications for the Blackstairs Mountain SAC/pNHA, the competent authority is enabled to ascertain that the proposed project will not adversely affect the integrity of any of the Blackstairs Mountain SAC/pNHA.

8.5.3.3 Habitats and Flora

The decommissioning of the wind farm may result in some temporary loss of habitat, primarily to hedgerows at access points which may require partial removal to facilitate the removal of turbine parts. The impact of this vegetation clearance would result in a *Short-term Imperceptible Reversible Impact*.

8.5.3.4 Mammals (excluding Bats)

Vehicular traffic during decommissioning along access roads may result in fatalities; however, this is not expected to be significant due to the mainly diurnal requirement for access and speed restrictions which will be in place. It is considered unlikely that direct impacts on Badger during the decommissioning process will be significant; as setts are unlikely to have become established in locations to be affected.

The potential exists for indirect impacts via both visual and noise disturbance, in particular decommissioning works overlapping with periods of activity by Badger. Badgers may also be excluded from foraging areas due to screening/fencing erected during works. Indirect impacts are considered unlikely to be significant due to works primarily taking place in daylight hours and the short duration of works.

<u>Otter</u>

It is considered extremely unlikely that direct impacts on otter during the decommissioning process will be significant. Otters may be indirectly impacted through decommissioning works which disturb occupied breeding or resting sites. This is considered unlikely due to roads and stream/river crossings already being in place.

Sediment and/or contaminated run-off entering streams and waterways could reduce water quality within areas where prey items occur, an increase in sediment could also lead to the smothering of spawning grounds if present thereby inducing longer term effects on prey availability; however, this should be minimal during the decommissioning process. It is considered that indirect impacts on otter are unlikely.

8.5.3.5 Bats

The possible direct effects on bats during the decommissioning phase of the wind farm are greatly reduced compared with the construction phase of the project; works will be limited to turbine removal, resulting in potential disturbance only.

As such, potential effects due to decommissioning will be limited to:

- disturbance due to increased human activity.
- Trimming of vegetation to accommodate turbine removal.

8.5.3.6 Avifauna

Potential Direct Impacts

The following matrix outlines the assessment of direct impacts on key avifauna receptors during decommissioning, based on the criteria previously outlined.

Note: the criteria utilised in the current assessment to define duration were as follows, from published guidance (EPA, 2017):

- Momentary: seconds to minutes
- Brief: less than a day
- Temporary: up to 1 year
- Short-term: from 1-7 years;
- Medium-term: 7-15 years;
- Long-term: 15-60 years; and
- Permanent: over 60 years.

It is likely that the time period for decommissioning of the project would be ca. 6 months.

<u>Passerines and Pigeon/Dove</u>

Decommissioning during the breeding season may result in some minimal disturbance to breeding passerine species due to increased human activity and noise. Tree trimming shall not however be carried out during the bird breeding season. There will be no further habitat loss during the decommissioning phase and the resultant impact to passerine species is a *Temporary Imperceptible Reversible Impact.*

<u>Birds of Prey</u>

Surveys conducted as part of the proposed development indicate that Kestrel and Sparrowhawk are breeding within the study area. Tree trimming will not be carried out during the bird breeding season. Buzzard and Long-eared Owl are breeding nearby the site and Merlin, Peregrine, Hen Harrier, Red Kite and Goshawk have been recorded within the proposed wind farm development site on an infrequent basis and are not breeding or roosting within the site. There shall be no further habitat loss during the decommissioning phase. Decommissioning during the breeding or wintering season shall result in some minimal disturbance to breeding Kestrel, Sparrowhawk, Long-eared Owl and Buzzard species due to increased human activity and noise. The resultant impact to birds of prey is a *Temporary Imperceptible Reversible Impact.*

<u>Waders and waterfowl</u>

A number of gulls species and Snipe were noted as being present within and immediately adjacent to the wind farm with Woodcock likely to be breeding within the wind farm site. The increase in human activity and noise may result in a minimal temporary disturbance to these species.

Golden plover and Curlew were observed once within the study area (flight paths) and did not land, no effect is anticipated for these species.

Again, as there will be no further habitat loss during the decommissioning phase, and tree trimming will not be carried out during the bird breeding season. The resultant impact to waders and waterfowl is a *Temporary Imperceptible Reversible Impact.*

Red Grouse

Red Grouse was observed within heath habitat to the northwest corner of the wind farm. The increase in human activity and noise may result in a minimal temporary disturbance to this species.

Again, as there will be no further habitat loss during the decommissioning phase, and tree trimming will not be carried out during the bird breeding season. The resultant impact to Red Grouse would be a *Temporary Imperceptible Reversible Impact.*

Kingfisher

This species was not observed within the proposed wind farm site and there are no suitable habitat for the species on site. Underground cables along the cable route will stay in place. The resultant impact to Kingfishers would be a *Temporary Imperceptible Reversible Impact.*

Potential Indirect Impacts

The decommissioning phase of the proposed wind farm site poses similar risks of potential effects vis-á-vis the construction phase. However, it should be noted that the magnitude of the effect of decommissioning is normally reduced as all infrastructure is already in situ.

8.5.3.7 Aquatic Ecology

The decommissioning phase of the proposed wind farm site poses similar risks of potential effects vis-á-vis the construction phase. However, it should be noted that the magnitude of the effect of decommissioning is normally reduced as all infrastructure is already in situ. With suitable planning and provision of adequate mitigation, potential negative effects on the receiving aquatic environment during decommissioning can be minimised.

The decommissioning phase is described in Chapter 3 of this EIAR and these works will be subject to a decommissioning plan, to be agreed with Carlow County Council.

It is proposed that turbine foundations and hard-standing areas are left in place and covered with local topsoil and allowed to revegetate. Removal of this infrastructure would result in considerable disruption to the local environment in terms of an increased possibility of sedimentation and potential impacts to surface waters. It is considered that leaving the turbine foundations hard-standing areas in-situ will cause less environmental damage than removing them during decommissioning.

Grid connection cables will be left in the ground, therefore no potential impacts during decommissioning stage are likely to occur.

Potential decommissioning phase impacts on aquatic ecology are considered *Slight Negative, Short-term* and in the *Local Context*, in the absence of mitigation.

8.5.3.8 Other Species

Impacts to other species will be similar to the construction phase but greatly reduced.

8.5.4 Potential Cumulative Impacts on Biodiversity

The EC (2001) guidelines on the provision of Article 6 of the Habitats' Directive state that the phrase 'in combination with other plans or projects' in Article 3(3) of the Habitats Directive refers to the cumulative impacts due to plans or projects 'that are currently under consideration together with the effects of any existing or proposed projects or plans.'

According to the Scottish Natural Heritage, 'the cumulative effect of a set of developments is the combined effect of all the developments, taken together' (SNH, 2005).

A cumulative impact arises from incremental changes caused by other past, present or reasonably foreseeable actions together with the proposed wind farm development.

The surrounding environment is dominated by conifer plantation and agricultural land. The main damaging operations and threats to the greater regions ecological resources are afforestation, industrialised agriculture and overgrazing. Afforestation i.e. the planting of conifer crops and agriculture have all impacted the habitats within the study area.

The site is dominated by conifer plantation (with agricultural grasslands along parts of the site boundary) with the added impact of the construction of forestry access roads, to plant, manage and harvest the plantation. The habitats formerly within the footprint of the plantation have been altered dramatically as a result of afforestation, with only fragmented sections of heath, and dry meadow and grassy verge and scrub located along the margins of some access tracks. Improved monoculture grassland where present is only broken up by hedgerows. Forestry and agriculture creates habitat uniformity, negatively impacts river catchments, and alters nesting and feeding habitats for animals. Forestry and farming are the most extensive, but other threats and potentially damaging operations to valuable habitats include land drainage and reclamation, fertilisation and dumping.

In-combination impacts may occur should indirect impacts such as a decline in water quality be sufficiently significant to cumulatively add to existing pressures on key species and habitats which form the qualifying interests of European sites. To inform the current appraisal, planning searches were carried out on the relevant planning authority webpages. The lands at Crag, Co. Limerick and Sroove, Co. Sligo form part of the overall project and relate to replant lands and these have been assessed in detail in Appendix 3-3 and Appendix 3-4 of Volume 3 of the EIAR but are considered cumulatively with other elements of the wind farm project in this section.

8.5.4.1 Replant Lands

As it is proposed to fell approximately 24.4ha of coniferous forestry for the proposed development[11], potential replanting sites lands of have been identified provided at Crag Co. Limerick and Sroove, Co. Sligo. The total area identified for replanting is 34.8ha. The Sroove site has been granted technical approval and planted.

[11] Replacement replanting of forestry in Ireland is subject to licence in compliance with the Forestry Act 2014 as amended. The consent for such replanting is covered by statutory instrument S.I. No. 191/2017 - Forestry Regulations 2017 as amended. This legislation provides for development of afforestation and forest road construction project's compliance with the Environmental Impact Assessment Directive insofar as it applies to forestry development.

A technical approval application for the Crag site has been submitted by the applicant to forest service. If these replant lands become unavailable, other similarly approved lands will be used for replanting should the proposed project receive planning permission. Site surveys were undertaken on September and October 2020. These lands have previously received technical approval for afforestation.

The replanting impact assessment which considers potential impacts on ecology and designated sites is included in for each site in Appendix 3-3 and Appendix 3-4 of Volume 3 of the EIAR.

Crag Co. Limerick Replant Lands

A potential forestry replacement area has been identified at Crag, Co. Limerick. The total replacement area for afforestation at this site is 9.19 hectares and is comprised of two plots.

This proposed replanting site falls within the townland of Crag just inside the Co. Limerick border with the Kerry County border forming the southern boundary. The proposed replanting site is approximately 800m west of the village of Mountcollins and 7km southeast of the town of Abbeyfeale. The proposed replanting site is accessed off the Crag road which cuts through the site in a north-south direction. The proposed replanting site is not located within any site designated for nature conservation. However, a number of rare and protected flora and fauna have been recorded from the hectad in which the proposed replanting is located.

Furthermore, there is hydrological connectivity from within the proposed replanting site via the unnamed watercourse which flows to the River Feale and thus to the Lower River Shannon SAC, which is located adjacent to the southern boundary of the proposed replanting site. The proposed replanting site is also located within a catchment listed as having other extant populations of Freshwater Pearl Mussel.

The proposed replanting site is primarily located within improved and wet grassland. The improved and wet agricultural grassland habitat have been assessed as of low ecological value. In addition, habitats identified as of local importance (higher value) such as Oak-ask-hazel woodland (WN1) have been avoided. Consequently, no potential for significant effects on the Key Ecological Receptors at the site have been identified. No EU Habitats Directive Annex I listed habitats were identified within the site. No protected faunal species were recorded within the proposed replanting site, although the site is likely to be used by regularly occurring common and widespread species that are common in a local and national context.

Impacts on nationally designated sites including NHAs (i.e. Lough Gay Bog NHA) and pNHAs (i.e. Dooneen Wood pNHA) were considered. No pathways for impact were identified on pNHAs or NHAs within the zone of influence (ZOI), and therefore no potential for significant effect on such Nationally designated sites.

The potential for in-combination impacts to result in significant cumulative effects when considered in-combination with other plans and projects was assessed. The proposed replanting will not result in any significant residual effects on any ecological receptors or Designated Sites. Therefore, there is no potential for the proposed development to contribute to any potential for cumulative impacts in this regard when considered in-combination with other plans and projects. Similarly, the proposed replanting will not result in significant effects in relation to water quality, given implementation of standard best practice and layout of the site.

Taking the above information into consideration and having regard to the precautionary principle, the proposed afforestation project will not result any significant impacts at any geographic scale and will not have any significant impacts on the ecology of the wider area.

Provided that the proposed replanting is constructed and operated in accordance with the design, best practice and mitigation that is described within the replant land assessment, significant impacts on ecology are not anticipated at any geographic scale. For the report see Appendix 3-3 of Volume 3 of the EIAR.

Sroove, Co. Sligo Replant Lands

A potential forestry replacement area has been identified at Sroove in Co. Sligo. The total replacement area for afforestation at this site is 9.19 hectares.

This proposed replanting site is in the townland of Sroove, Co. Sligo. The replacement site is located approximately 4.34km southeast of the village of Gorteen and 3km west of Lough Gara. This proposed replanting site comprises four plots which will be planted with Sitka Spruce and additional broad leaf, Lodgepole Pine, Common Alder and Rowan trees under Technical Approval Reference CN76694. The proposed replanting site is accessible via a private lane off the L4102 which connects to the R293 approximately 3km to the west of the site. The Technical Approval area for afforestation measures 9.19 hectares in total. Existing Coillte forestry can be found immediately to the north and west and south. The Lough Gara pNHA boundary is located 2.93km to the east and the Lough Gara SAC is located 3.9km to the south.

The site is primarily located within wet grassland that has previously been drained in advance of planting. The wet grassland habitat has been assessed being as of low ecological value. Consequently, no potential for significant impacts on the Key Ecological Receptors identified in this report has been identified. No EU Habitats Directive Annex I listed habitats were identified within the site.

No protected faunal species were records within the site, although the site is likely to be used by regularly occurring common and widespread species that are common in a local and National context.

No Natural Heritage Areas (NHA) or proposed Natural Heritage Areas (pNHAs) were identified within the Zone of Likely Impact. All forestry activities will be undertaken in accordance with industry guidance and best practice. No potential for significant impacts were identified based on the nature and scale of the works and separation in distance from the designated site.

The proposed replanting has Technical Approval from the Forest Service and will be undertaken accordingly. This approval is conditional to all associated works being undertaken in accordance with Forest Service requirements. The impacts associated with this afforestation have been classified overall as a neutral impact. As such, when considered in-combination with the other land uses in the area, and considering that the forestry guidelines are designed to minimise and prevent impacts to habitats that are outside the site, cumulative impacts on sensitive ecological receptors are not anticipated.

Taking the above information into consideration and having regard to the precautionary principle, the proposed replanting will not result any significant impacts at any geographic scale and will not have any significant impacts on the ecology of the wider area.

Provided that the proposed replanting is constructed and operated in accordance with the design, best practice and mitigation that is described within this application, significant impacts on ecology are not anticipated at any geographic scale.

8.5.4.2 Developments

Existing or Proposed Wind farms and Turbines

A number of operational or planned wind farms exist within 20km of the main wind farm site , these are detailed and discussed below. Projects along the grid connection and TDR were also considered. Note that planning searches for proposed wind farms were also conducted (see Appendix 1.2).

There are 13 operational wind farms and 1 permitted wind farm within 20 km of the proposed development. The following existing and permitted wind farms within 20 km of the proposed development were examined for potential cumulative effects on Biodiversity with the proposed development.

Table 8-73: Existing and permitted wind farms within 20 km of the proposed development

Wind Farm Name	Number of Turbines	Distance and Direction from Proposed Development Site	Status
Greenogue Wind Farm	5	0.50km East of site	Existing
Ballon Turbine	1	6.79km Northwest of site	Existing
Monaughrim Turbine	1	7.87km Northeast of site	Permitted
Gibbet Hill Wind Farm	4	9.16km East of site	Existing
Ballindaggin Wind Farm	6	9.48km Southeast of site	Existing
Castledockrell Wind Farm	11	10.33km Southeast of site	Existing
Carranroe Wind Farm	1	10.62km Southeast of site	Existing
Knockalour Wind Farm	6	11.16km East of site	Existing
Ballaman Wind Farm	2	14.06km East of site	Existing
Ballycadden Wind Farm	9	14.20km East of site	Existing
Ballynancoran Wind Farm	2	14.75km East of site	Existing
Cronelea Wind Farm	9	17.35km Northeast of site	Existing
Shillelagh Wind Farm	1	18.44km Northeast of site	Existing
Tullow Mushroom Growers Turbine	1	19.87km Northeast of site	Existing

The construction phase of Croaghaun Wind Farm has the greatest potential to contribute suspended solids/pollutants to nearby watercourses due to excavation works and general construction works. All of these developments within 20km of the proposed wind farm site are already operational and so significant in combination effects to shared watercourses are not likely to occur. This is also the case for habitats, flora and less mobile species of fauna. The potential for cumulative impacts to birds and bats is considered further below.

The single Monaughrim turbine is located between Kildavin and Clonegal and drains into the same catchment as the proposed wind farm site (Slaney and Wexford Harbour catchment) and separate sub catchment (Slaney_SC_060). Due to the direct distance between the two developments (ca. 6.5m) and the limited nature of the Monaughrim development (single turbine), if the construction phases of the developments were to overlap a significant cumulative effect to water quality is unlikely to occur.

As the extension of duration granted to this project expires in 2021, there is no chance that the construction phases of the developments will overlap. Also, the proposed cable route for the Monaughrim development is unknown. Therefore, the Monaughrim development is unlikely to contribute towards a significant cumulative effect to water quality.

Factories and other Businesses:

The Slaney Foods beef processing plant was considered due to its proximity (c. 8 km southeast/10 km downstream of proposed development). The plant is noted as a potential source of negative effects on water in the Slaney River Valley SAC Site Synopsis (NPWS, 2015; the factory discharges wastewater to the Slaney).

Examination of recent EPA reports and licencing documentation (SV13885 - EPA 2018; SV16367 – EPA 2019) indicates the factory's wastewater treatment plant is performing effectively, with sampling of discharges showing parameters are well within ELVs (Emission Limit Values). As such, the potential for this facility to contribute to cumulative impacts is currently negligible.

The Ballon Meats processing plant is located c. 370m from the proposed grid connection. This facility includes a wastewater treatment plant and constructed wetland. The closest watercourse is the Ballaghmore Distributary stream (tributary of the Slaney – 7.2 km downstream), located c. 165m from the constructed wetland. The facility is licenced by the EPA (P0846-01). Recent inspections found effluent to be within ELVs (SV15198 – EPA, 2018) but that onsite testing equipment used for daily effluent checks was not checked and calibrated as required (SV17147 – EPA, 2019).

It was however noted that testing for compliance monitoring was carried out professionally by an external laboratory. Considering the above, potential for this facility to contribute to cumulative impacts is currently negligible.

FLI Precast Concrete is located along the proposed grid connection. This facility is located c. 600 m from the Burren River but is not licensed for industrial emissions and no hydrological pathways were identified. As such this activity does not have potential to result in cumulative impacts.

Other industrial activities include: an animal feed factory adjacent to the Slaney (Hogg Enterprises) (licence surrendered due to licensable activity falling below licensing capacity thresholds); a fish farm adjacent to the Burren River downstream of proposed amenity trail/upstream of grid connection (covered by section 4 discharge licence – RPS02) and a composting facility (covered by emissions licence IEL W0284) located c. 140 m from the Tinnaclash 14 stream (tributary of the Burren). Due to the nature of these activities and/or licensing controls, no cumulative impacts are likely to occur.

An application for a 30-room accommodation complex in Carrickduff, Bunclody Co. Carlow (within the grounds of Bunclody Golf Club) has been submitted and is currently being assessed. A stage 2 NIS which included mitigation measures include to reduce / avoid significant effects was completed for this project. The proposed accommodation development is immediately adjacent to the Slaney River Valley SAC. Due to the mitigation measures specified in the accompanying NIS, there is not considered to be the potential for cumulative impacts.

Housing Developments

There are no large housing developments in close proximity to the proposed Croaghaun Wind Farm. A 6-unit housing development is permitted adjacent to the River Burren in Carlow town. A stage 2 NIS was completed for this project. A 9-unit housing development is permitted in the townland of Carrickduff, Bunclody Co. Carlow.

An 18-unit housing development is permitted in the townland of Tullowbeg on the outskirts of Tullow, Co. Carlow (c. 5 km from proposed grid connection at Kellistown substation).

An application for a 78-unit residential development made up of apartments in Carlow town is currently the subject of a further information request. The proposed development site is adjacent to the River Barrow. A stage 2 NIS was completed for this project.

There is potential for cumulative effects to occur in combination with the construction stages of housing developments where mitigation measures have not been specified. Operational stage effects are not predicted as housing developments in the wider area are all located within built-up urban areas and will be served by existing wastewater/sewage treatments plants.

Renewable Energy Developments

There are no solar farm applications located in close proximity to the proposed wind farm site. Within 10km of the proposed development the following solar energy projects have been identified:

1. Friarstown, Co. Carlow (Ref 1946; permitted) (4.5 km from Kellistown Substation) (NIS submitted)
2. Friarstown, Co. Carlow (Ref 16325; permitted) (4.5 km from Kellistown Substation) (AA Screening Submitted)
3. Bennekerry, Co. Carlow (Ref 2044; further information) (5.2 km from Kellistown Substation) (AA Screening Submitted)
4. Ardbearn/Rathtoe, Co. Carlow (Ref 20143; refused/appealed) (adjacent to proposed grid connection) (NIS submitted).

A 100MW battery storage facility (Ref 1823) is proposed to be located adjacent to Kellistown Substation, which is where the grid connection route will connect the proposed Croaghaun wind farm to the grid. Extension works to the existing substation may be undertaken for the battery storage facility and we have assumed that this is the case as part of this cumulative impact assessment. There is a ca. 530m distance between the Kellistown substation and the nearest watercourse (Glenogue 14, EPA code: 14G27; Barrow Catchment) with a number of farmed fields and hedgerow/treeline field boundaries which will act as buffers. If the construction works of the two projects were to overlap, due to buffers and the distance between the site and the nearest watercourse no sediment input will occur and there will be no effect to water quality.

In terms of acting cumulatively with the proposed development, the most relevant projects are those that may be constructed at the same time as the proposed Croaghaun Wind Farm project and are within the same catchment, as this increases the likelihood of impacts acting cumulatively. Solar farms have no moving parts and installation of panels creates minimal disturbance to the ground. No cumulative effects are envisaged in this regard. All four solar farms are located within the same catchment as the proposed grid connection route; over half of the cable route crossings are of the Barrow Catchment. The conclusion of the AA screening for Ardbearn/Rathtoe solar farm was that there was the potential for negative effects on the Slaney River Valley SAC and River Barrow and River Nore SAC via a reduction in water quality due to pollutants/sediment entering the River Burren during the construction stage. However, in the NIS, the conclusion was with the mitigation measures proposed, there will not be significant impacts on water quality of nearby watercourses and the named SACs. For the Friarstown solar farm, the conclusion of the AA screening for was that there was the potential for negative effects on the River Barrow and River Nore SAC via a reduction in water quality due to pollutants/sediment entering the River Ardnahue during the construction stage.

However, in the NIS, the conclusion was with the mitigation measures proposed, there will not be significant impacts on water quality of nearby watercourses and the named SAC. No significant impacts on water quality were predicted for the other project with AA screenings (Bennekerry). While it is difficult to quantify the level of impact with certainty, in-combination effects are considered likely. These would include the increased release of sediments and nutrients to receiving watercourses. In the absence of mitigation, potential indirect cumulative impacts to the River Slaney and River Burren could occur and a *Short-term Significant Reversible Cumulative Impact* is considered likely.

There is potential for cumulative effects to occur in conjunction with associated grid connections due to the nature of underground cable installation works. The grid connection route of the Terra II solar farm will utilise part of the grid connection of the proposed Croaghaun wind farm (the last 2.5 km of the grid connection near Kellistown substation). The excavated trenches for the solar farm will be slightly bigger to incorporate the wind farm and solar farm cables, so could result in a loss of more habitats lying adjacent to the grid connection. However, none of the habitats adjacent to the grid route (except for the River Burren watercourse) are classed as being of high value and are common in the wider landscape, which is agricultural.

Similarly, no bat roost trees or high value mammal habitat will be lost due to the installation of the grid connection. The NIS for the solar farm shows that HDD will be used to cross watercourses and no instream works are proposed unless the stream is dry, precluding impacts on water quality. Therefore, the cumulative impact as a result of the two grid connection cable installations is not predicted to be significant.

The proposed grid connection route for the Croaghaun Wind Farm will eventually connect to existing ESB substation at Kellistown, County Carlow. Given that the grid connection crosses tributaries of the Slaney and Barrow rivers, there is potential for cumulative effects on aquatic ecology in the absence of mitigation.

8.5.4.3 Forestry

Forestry is one of the main land uses within the main wind farm site and the greater area. Conifer plantation is the most dominant habitat within the proposed site boundary. The impacts associated with forestry on the local environment are habitat loss, habitat alteration and potential reduction in water quality.

Historically, it can be assumed that the forestry in the area has resulted in a loss of native grasslands, heath habitats and potential fen habitat. This would have reduced the habitat available for certain fauna and flora species. While forestry may have resulted in a reduction in water quality very locally, particularly within waterways which are directly encroached by conifer trees, the water quality in the majority of the streams within the study area is at least Q4, indicating a high-water quality value.

However, it is noted that there will be no commercial forestry felling within the main wind farm site during the construction period which will reduce the potential for cumulative effects during the construction phase. Outside the main wind farm site all commercial activities will continue to occur during the construction activities of the wind farm. While it is difficult to quantify the level of impact with certainty, in-combination effects are considered likely. These would include the increased release of sediments and nutrients to receiving watercourses. In the absence of mitigation potential indirect cumulative impacts to the Slaney River could occur and *Short-term Moderate Reversible Cumulative Impact* is considered likely.

8.5.4.4 Farming

Intensive grassland management is noted close to (but not within) parts of the main wind farm site, grid connection and along the TDR).

The diversity of flora within the habitats has been reduced dramatically by drainage, reseeding, fertilisation and intensive grazing by cattle. The main potential impact would be an increase in nutrient levels of local watercourses. There is potential for the proposed wind farm to contribute to a cumulative impact on water quality in drains within the site and local watercourses further downstream of the site, through the potential for sediments and other pollutants entering the watercourses as a result of felling, construction activities in addition to ongoing farming operations. The risk of such impacts would, for example, greatly increase if such works were taking place during the winter months or times of very high rainfall. Due to the already degraded state of the watercourses draining the proposed development site, significant direct impacts to these are *unlikely*. Potential indirect cumulative impacts to the Slaney River could occur. These could be *Short-term Moderate Reversible Cumulative Impact* prior to mitigation.

8.5.4.5 Cumulative Impacts during construction on key receptors

Potential Cumulative Impacts during construction on key receptors identified are addressed below:

- Designated Nature Conservation Sites
- Habitats and Flora
- Mammals (excluding Bats)
- Bats
- Avifauna
- Aquatic Ecology and Fisheries
- Other Species.

Designated Nature Conservation Sites

The main wind farm site is not within the boundaries of any designated nature conservation site. The grid connection route does not traverse any designated nature conservation site. Therefore, there will be no direct impacts to designated nature conservation sites for the main wind farm site or the grid connection. The potential spread of invasive species recorded along the TDR could result in cumulative impacts with other projects along the route. This is particularly pertinent to turbine delivery work locations in within or in close proximity to designated sites. Turbine delivery work location no. 30 is located within Slaney River Valley pNHA (outside the SAC boundary). Cumulative effects from other developments cannot be ruled out. A housing development for 8 no. detached dwellings received planning permission not far from the location of additional works and is located within the national site. The NIS report (Carlow Co. Council planning ref: 15246) noted that the existing habitat within the site is Locally Important and was being used as a garden, was highly modified and had been cleared prior to surveys. Cumulatively there is likely to be a *Permanent Significant Reversible Cumulative Impact* without mitigation.

No direct impacts are predicted to any other Nature Conservation sites during construction of the proposed wind farm project and no additive effects due to in combination direct impacts with other existing sources of direct impact are predicted.

An accompanying Natura Impact Statement (NIS) has been prepared for the proposed development and accompanies this EIAR. The NIS addresses potential impacts on European sites resulting from the proposed development. Where European sites overlap with nationally designated sites, the conclusions from the NIS for said European sites is show here.

The two relevant SACs are:

- Blackstairs Mountain SAC/pNHA (000770)
- Slaney River Valley SAC/pNHA (000781)

The conclusion from the NIS stated that given that the grid connection crosses tributaries of the Slaney River and the main wind farm site is located within the catchment area of the River Slaney, there is potential for cumulative impacts on the Slaney River Valley SACs in the absence of mitigation.

The conclusion from the NIS stated that where construction of turbine delivery work location no. 52 occurred in parallel with forestry activities (offsite), there is the potential for significant cumulative effects on local watercourses which in turn may affect the integrity of the Blackstairs Mountains SAC in the absence of mitigation.

Habitats and Flora

Potential direct impacts during construction have been identified as land take during construction of the wind farm (including turbine hardstands, compound, substation, sections of new access roads and internal cabling), which will lead to some permanent loss of habitat. Other existing or planned sources of land take in the vicinity of the proposed wind farm may result in cumulative impacts. Land take from built development in the area is not sufficient to result in an in combination significant effect and the footprint of development is predominantly located within highly modified habitats (95.84 % of the total habitat loss).

The potential spread of invasive species recorded along the TDR, within the main wind farm site and the grid connection could result in cumulative impacts with other projects. Cumulatively there is likely to be a *Permanent Moderate Reversible Cumulative Impact* without mitigation.

Mammals (excluding Bats)

Mammal breeding or resting sites may be cumulatively impacted by other developments which either remove potential breeding sites and foraging habitats (e.g. road construction) or farming and forestry activities which may for example remove Badger setts, Pine Marten breeding sites, Red Squirrel dreys, etc.

Planning permission and felling licences are provided with environmental control and best practice. Prior to the implementation of mitigation cumulative effects are likely to be *Short-term Moderate Cumulative Impact* which are potentially *Reversible*.

Bats

Potential cumulative impacts on bats during the construction phase would be as follows:

- Displacement of populations
- Abandonment of young
- Mortality.

At the closest wind farm Greenoge wind farm (0.50 km east of Proposed Development Site) a one day ecological walkover was carried out for the second extension application (2011). No bat survey was carried out.

Bat surveys conducted as part of the planning application for the operational Ballon Meats Turbine in 2013 (6.79 km northwest of site) recorded a single pass of Soprano Pipistrelle. A potential tree roost was identified but no emergence activity was recorded.

At Gibbet Hill Wind Farm (9.16 km east of site) in August 2008 a habitat assessment was carried out for bats. There were no PRFs (Potential Roosting Features) recorded. Low-moderate commuting/foraging habitat was noted in the form of hedgerows.

For Knocknalour Wind Farm (11.16km east of site) a habitat assessment was carried out for bats. No PRFs were recorded, just commuting/foraging habitat in form of hedgerows.

No bat surveys were undertaken at Monaughrim Turbine (7.87 km northeast of site).

Although the assessment of bat activity levels at these sites is not strictly objective as the Ecobat analysis tool was not used as standard practice when these applications were submitted, when the patterns of activity, species composition, nature of the sites and ecological connectivity are considered cumulatively, in addition to the fact that there is a significant distance to many of these wind farms, the proposed wind farm would result in a *Long-Term Imperceptible Cumulative Impact*.

Avifauna

At the closest wind farm Greenoge wind farm (0.50 km east of Proposed Development Site) a one-day ecological walkover was carried out for the 2nd extension application (2011). Bird species recorded included Raven, Stonechat and Swallow.

Ecological surveys conducted as part of the planning application for the operational Ballon Meats Turbine in 2013 (6.79 km northwest of site) recorded no target bird species within the site. However, the only survey undertaken was an ecological walkover survey.

For Gibbet Hill Wind Farm (9.16 km east of site) an ecological walkover survey was carried out in August 2008 and no target bird species were recorded within the site. The same survey methodology was employed at Monaughrim Turbine (7.87 km northeast of site) and Ballydaggin Wind Farm (9.48 km southeast of site) with the same results.

For Knocknalour Wind Farm (11.16km east of site) two rounds of bird transects were completed in both winter and breeding seasons. The only species of note recorded was Snipe during the winter survey.

Direct impacts on avifauna during construction are primarily land take related, mainly due to the loss of nesting habitats to key species. Other sources of land take as outlined above do have the potential to cumulatively impact on nesting or resident farmland or woodland species (the typical landscape characters) in addition to specialist species such as Woodcock (potentially affected by forestry operations). Species such as Robin may be affected cumulatively by further loss of hedgerows due to farming practices etc. Even though in-combination land take is unlikely to result in range loss of any species which frequent the subject site, mitigation may be required to neutralise the effect of the proposed wind farm.

Disturbance or effective habitat loss indirectly is more difficult to quantify; especially as most species of birds may habituate to disturbance over time.

Based on the evidence available in addition to the fact that there is a significant distance to many of these wind farms, the lack of migration paths during survey, along with the results of hinterland surveys undertaken for the proposed development, any cumulative impacts to birds during the construction phase would be a *Long-Term Imperceptible Cumulative Impact*.

Aquatic Ecology

Commercial forestry activities and agricultural practices will continue to occur during the construction activities of the wind farm. While it is difficult to quantify the level of impact with certainty, in-combination effects are considered likely. These would include the increased release of sediments and nutrients to receiving watercourses. In the absence of mitigation, a *Significant Negative, Short-term Cumulative Impact* is considered likely.

Other Species

Frog and Smooth Newt may forage and rest within the site and may be affected by land take; however, given the amount of displacement and alternative habitats available, the overall in combination effect is assessed as a *Short-term Slight Cumulative Impact* which is ***Reversible.***

8.5.4.6 Cumulative Impacts during operation on key receptors

Potential Cumulative Impacts during operation on the following are addressed below:

- Designated Nature Conservation Sites
- Habitats and Flora
- Mammals (excluding Bats)
- Bats
- Avifauna
- Aquatic Ecology and Fisheries
- Other Species

Designated Nature Conservation Sites

As no direct or indirect effects are predicted on Nature Conservation sites during the operation of the proposed wind farm then no additive effects due to in combination direct impacts with other existing sources of direct impact are predicted.

An accompanying Natura Impact Statement (NIS) has been prepared for the proposed development and accompanies this EIAR. The NIS addresses potential impacts on European sites resulting from the proposed development.

Where European sites overlap with nationally designated sites, the conclusions from the NIS for said European sites is show here. The two relevant SACs/pNHAs are:

- Blackstairs Mountain SAC/pNHA (000770)
- Slaney River Valley SAC/pNHA (000781)

The conclusion from the NIS stated that given that the grid connection crosses tributaries of the Slaney river, there is potential for cumulative effects on the Slaney River Valley SAC/pNHA in the absence of mitigation.

Habitats and Flora

No direct impacts on habitats and flora are predicted during the operational phase of the development. Indirect impacts predicted during operation are considered under Aquatic Ecology.

Mammals (excluding Bats)

Mammal breeding or resting sites may be cumulatively impacted by other developments which either remove potential breeding sites (e.g. road construction) or farming or forestry activities which may for example remove Badger setts, Pine Marten or Red Squirrel breeding sites etc. However, given that no landtake is predicted for the operational phase, no cumulative effect is predicted.

Bats

Potential Cumulative impacts on Bats during operation would be as follows:

- Mortality
- Reduction of local populations.

At the closest wind farm Greenoge wind farm (0.50 km east of Proposed Development Site) a one day ecological walkover was carried out for the second extension application (2011). No bat survey was carried out.

Bat surveys conducted as part of the planning application for the operational Ballon Meats Turbine in 2013 (6.79 km northwest of site) recorded a single pass of Soprano Pipistrelle. A potential tree roost was identified but no emergence activity was recorded.

At Gibbet Hill Wind Farm (9.16 km east of site) in August 2008 a habitat assessment was carried out for bats. There were no PRFs (Potential Roosting Features) recorded. Low-moderate commuting/foraging habitat was noted in the form of hedgerows.

For Knocknalour Wind Farm (11.16km east of site) a habitat assessment was carried out for bats. No PRFs were recorded, just commuting/foraging habitat in form of hedgerows.

No bat surveys were undertaken at Monaughrim Turbine (7.87 km northeast of site).

Although the assessment of bat activity levels at these sites is not strictly objective as the Ecobat analysis tool was not used as standard practice when these applications were submitted, when the patterns of activity, species composition, nature of the sites and ecological connectivity are considered cumulatively, in addition to the fact that there is a significant distance to many of these wind farms, any cumulative impacts to bats during the operational phase would be a *Long-Term Imperceptible Cumulative Impact*.

Avifauna

Direct impacts on avifauna during operation which may be cumulatively added to by other existing pressures or proposed developments include collision related mortality, ongoing disturbance/displacement and barrier effect.

Table 8-73 details the wind farm development within 20 km of the proposed Craoghaun Wind Farm development. A total of 13 operational wind farms and 1 permitted wind farm. Flight height or the flight heights which birds habitually use along either migration or local flight paths is an influencing factor in determining whether the proposed development will combine with additional wind farms to produce additive, synergistic or antagonistic effects. These effects include: increased Barrier Effect (potentially obstructing migratory flightpaths), increased collision risk (through combined mortality in susceptible species) and increased disturbance to birds utilising foraging grounds whilst on migration.

At the closest wind farm Greenoge wind farm (0.50 km east of Proposed Development Site) a one-day ecological walkover was carried out for the 2nd extension application (2011). Bird species recorded included Raven, Stonechat and Swallow.

Ecological surveys conducted as part of the planning application for the operational Ballon Meats Turbine in 2013 (6.79 km northwest of site) recorded no target bird species within the site. However, the only survey undertaken was an ecological walkover survey.

For Gibbet Hill Wind Farm (9.16 km east of site) an ecological walkover survey was carried out in August 2008 and no target bird species were recorded within the site. The same survey methodology was employed at Monaughrim Turbine (7.87 km northeast of site) and Ballydaggin Wind Farm (9.48 km southeast of site) with the same results.

For Knocknalour Wind Farm (11.16km east of site) two rounds of bird transects were completed in both winter and breeding seasons. The only species of note recorded was Snipe during the winter survey.

Considering the distances of these wind farm sites in relation to the Croaghaun study area, the cumulative collision risk on any avian receptors is considered *negligible*. Furthermore, studies have found that local wintering birds will habituate to the presence of turbines and therefore avoid collision (Langston & Pullan, 2003). Cumulative collision mortality combined with other wind farm developments is predicted to be a *Long-Term Imperceptible Cumulative Impact*.

Based on the evidence available in addition to the fact that there is a significant distance to many of these wind farms, the lack of migration paths during survey, along with the results of hinterland surveys undertaken for the proposed development, any cumulative impacts to birds during the operational phase would be a *Long-Term Imperceptible Cumulative Impact*.

Aquatic Ecology

Operational wind farms are not normally considered to have the potential to significantly impact on the aquatic environment. The main risk to watercourses is via water quality impacts, when oils and lubricants are used on the site (e.g. infrastructure maintenance). If such substances leaked from the turbines or maintenance areas or were disposed of inappropriately, there is a risk of water contamination and subsequent impacts to aquatic ecology. However, the likelihood of this occurring is very low is unlikely to be a significant impact considering the low volumes of vehicular traffic involved in typical wind farm operations and the high standards that are implemented on a well-managed site.

Due to the natural 'grassing-over' the drainage swales and revegetation of other exposed surfaces, and the non-intrusive nature of site operations, there is a negligible risk of sediment release to the watercourses during the operational stage. Potential cumulative operational phase impacts on aquatic ecology are considered *Short-term Slight Cumulative Reversible Impacts* and in the *Local Context*, in the absence of mitigation

Other Species

Frog and Smooth Newt may forage and rest within the site and may be affected by land take however given the large amount of displacement and alternative habitats available the overall in combination effect is assessed as this would result in a *Short-term Imperceptible Cumulative Reversible Impacts.*

8.5.4.7 Cumulative Impacts during decommissioning on key receptors

The potential cumulative effects during decommissioning are considered to be the same as those described for the construction phase of the proposed development.

8.6 Mitigation Measures for Ecology

Mitigation measures are described below which will avoid, reduce and where possible, offset likely significant impacts arising in relation to ecology from the construction, operation and decommissioning of the site. These mitigation measures shall be implemented in full.

8.6.1 Mitigation by Avoidance and design

The following measures are incorporated into the proposed wind farm design to reduce impacts on designated sites, flora and fauna through avoidance and design:

- The hard-standing area of the wind farm has been kept to the minimum necessary for the maximum turbine envelope proposed, including all site clearance works to minimise land take of habitats and flora.
- Site design and layout deliberately avoided direct impacts on designated sites. as recommended by statutory bodies as English Nature and the Royal Society for the Protection of Birds (Drewitt and Langston, 2006).
- All cabling for the project will be placed underground; this significantly reduces collision risk to birds over the lifetime of the wind farm and is in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt and Langston, 2006).
- The grid connection routes have been selected to minimise land take of potentially sensitive habitats by using a mixture of public roads and agricultural land. Off-road sections of the grid connection route have been located to avoid hedgerow/treeline removal where possible. Further mitigation measures for hedgerows/treelines that will be affected by the grid connection route are discussed further in Section 8.6.2.
- Care has been taken to ensure that sufficient buffers are in place between wind farm infrastructure and hydrological features such as rivers and streams.

No new stream crossings shall be required within the main wind farm site. Existing crossings in the form of pipe culverts are already in place and these existing crossing points have been utilised for the design of internal roads.

- Directional drilling is the proposed installation method where the grid connection crosses watercourses. At one potential crossing point (GCR-WCC6), it is proposed that ducts shall be laid in flat profile within the concrete bridge beam in the road deck. As such, in-stream works will not be required and the potential for contaminant or pollutant input will be greatly reduced as a result.
- For crossings where HDD has been identified as the preferred crossing method, open cut trenching methods shall be permitted in dry conditions where there is no-flow in the watercourse and there is no risk of in-stream works. In such instances, cable ducts will be laid under the stream bed which would then be fully reinstated to its pre-existing condition.
- The design of the grid connection was also carried out with cognisance to ecological features. Cables are to be placed underneath public roads where possible to avoid impact to roadside hedgerows. Further mitigation measures for hedgerows/treelines that will be affected by the grid connection route are discussed further in Section 8.6.2.
- The design of POI52 was carried out with cognisance to the adjacent Blackstairs mountain pNHA. No excavation shall be required for the proposed extension which shall consist of a hardstanding constructed using floated techniques. Firstly, a roll of geotextile will be laid on the existing surface, followed by a layer of granular fill on top.

  A surface layer of clause 804 stone will be placed on top to build up the level to match the existing car park. This will then be surfaced with hardcore. The extension shall be temporary and will be removed following the completion of the works.

8.6.2 Mitigation measures during the construction phase of the project

8.6.2.1 Introduction

Construction of this project is expected to cause temporary (disturbance) adverse impacts on local ecological receptors, as outlined in the impact appraisal above. The mitigation measures described below will reduce these impacts significantly.

8.6.2.2 Project Ecologist

A Project Ecologist/Ecological Clerk of Works (ECoW) with appropriate experience and expertise (in implementing ecological mitigation measure for wind farm developments) will be employed for the duration of the construction phase to ensure that all the mitigation measures outlined in relation to the environment are implemented. The Project Ecologist/ECoW will be awarded the authority to stop construction activity if there is potential for significant adverse ecological effects to occur.

8.6.2.3 Habitats and Flora

The area of the proposed works will be kept to the minimum necessary, including all site clearance works, to minimise disturbance to habitats and flora. In this case, the footprint of the proposed development has been kept to the minimum necessary, including the use of layout design methods including existing roads and stream crossings to minimise excavation works.

No disturbance to habitats or flora outside the proposed development area will occur. All works will be restricted to the immediate footprint of the development, which will be wholly within the development site boundary and kept separate from any key areas for biodiversity (see CEMP; Appendix 3.1). Machinery, and equipment will be stored within the site compound. Designated access points will be established within the site and all construction traffic will be restricted to these locations. Access to the site will be primarily via the existing local road L2026 Barker's Road. HGVs shall approach the site via this road from the East.

8.6.2.4 Trimming of Woodland of Local Importance (Higher Value) at Slaney River Valley pNHA (000781) located outside of its associated SAC

With regards to turbine delivery work location no. 30, the proposed works are confined to the preparation of local load bearing surface along the existing road verge, localised vegetation trimming, the lowering of an existing stone wall to 0.5m and removal of street furniture. The following will be implemented:

- Prior to works an invasive species survey will be undertaken in the area to reconfirm the findings of the EIAR.
- The invasive species plan and management plan (Appendix 8.5) will be adhered to for works at this area.

8.6.2.5 Management of the Spread of Non-native Invasive Species

According to Invasive Species Ireland (ISI) invasive non-native species are the second greatest threat (after habitat destruction) to worldwide biodiversity. Invasive species negatively impact Ireland's native species; changing habitats and ultimately threatening ecosystems which impacts on biodiversity as well as economics as they are costly to eradicate.

Halting the spread of non-native invasive species can be achieved via prevention, containment, treatment and eradication.

Prevention

<u>Main Wind Farm Site</u>

Rhododendron ponticum has been recorded within the main wind farm site growing within conifer plantation located close to heath habitat to the north west of the site (not adjacent to proposed infrastructure). Spanish Bluebell has been recorded in five locations, four adjacent to existing access track to the west of the main wind farm site (away from proposed infrastructure) and one record located adjacent to existing access track not far from the main entrance to the main wind farm site (southern boundary). Both species are listed in Schedule III under Regulations 49 and 50 of the EC (Birds and Natural Habitats) Regulations 2011, which makes it an offence to cause the spread of plant species listed on the Schedule.

As such based on the current extent of *Rhododendron ponticum* within the study area, there is no possibility of interaction with works. There is however the possibility of interaction with one area of Spanish Bluebell near the entrance to the wind farm with incoming machinery.

A pre-construction survey will be carried out to reconfirm the extent of *Rhododendron ponticum* and Spanish Bluebell to ensure that they have not spread to any areas in or near the proposed wind farm infrastructure. Mapping using GPS equipment will be carried out to document its location.

Grid Connection Route

Prior to trimming or vegetation removal along the grid connection an invasive species survey will be undertaken to reconfirm the findings of the EIAR.

Additional Works along the Turbine Delivery Route

Prior to trimming or vegetation removal at turbine delivery work locations, an invasive species survey will be undertaken to reconfirm the findings of the EIAR.

Containment, Treatment, Eradication

- Cordoning off the area – this shall include a buffer of 5m surrounding the area of infection to ensure that seeds are not transported to other sections of the site via vehicular traffic, equipment or PPE.
- No machinery or personnel shall be allowed within this restricted area. Similarly, there shall be no storage of materials within or adjacent to this restricted area.
- There shall be no vegetation clearance or trimming within the cordoned area (except where undertaken in accordance with the invasive species management plan) as this can lead to the species recolonising other areas via the wind, water if displaced into drains, or soil and vegetation attached to machinery, vehicles or personnel.
- No soil or vegetation shall be removed from this area unless it is securely contained and is transported under licence to a suitably licenced facility for treatment.
- Informing all site staff through toolbox talk as part of site inductions.
- Any new sightings of the species shall by relayed to construction staff and the developer via the project ecologist/ECoW. These areas shall follow the same protocol as described above.
- Reporting sighting(s) to the NPWS and NBDC and liaising with to the NPWS.

8.6.2.6 Mammals (excluding bats)

An ecologist will supervise areas where vegetation, scrub and hedgerow removal will occur prior to and during construction as appropriate (e.g., an ecologist may be required during some clearance works of areas where vegetation is too dense to check beforehand). This will ensure that any site-specific issues in relation to wildlife not currently present (e.g. Badger setts) on site will be reconfirmed prior to commencement of works so as to allow appropriate mitigation measures to be put in place.

In the event that an issue arises, the NPWS will be updated, consulted with and the relevant guidelines will be implemented as appropriate (e.g. '*NRA guidelines for the treatment of badgers prior to the construction of national road schemes*'; NRA, 2005).

Construction operations will take place predominantly during the hours of daylight to minimise disturbances to faunal species at night. Some works along the grid connection route and wind farm site may occur at night but the project ecologist/ECoW shall limit night-time works to sections of the route / site which avoid sensitive features (e.g. mature treelines).

Badgers

A pre-construction mammal survey will be undertaken within the footprint of the development in order to reconfirm the existing environment as described in the EIAR and, in the event that a Badger sett should be encountered at any point, then NPWS will be informed and NRA *Guidelines for the Treatment of Badgers Prior To the Construction of National Road Schemes* will be followed.

A number of Badger setts including an active sett were present within the site boundary area during surveys, and there are records of Badger in the local area. Badgers can move between setts regularly and may also excavate new setts within their territory. As such there is potential for the layout and status of the Badger setts onsite to change in the intervening period between planning and construction stages.

If planning permission is granted and a derogation/disturbance licence is required, the NPWS will be consulted with and a derogation/disturbance licence will be sought in order to implement mitigation measures prior to construction.

Setts within the footprint of proposed infrastructure would require (following evacuation if active) controlled destruction under ecological supervision, while setts within tree felling buffers and in close proximity to the development would require temporary hard-blocking and exclusion for the duration of construction works to ensure that Badgers potentially occupying these setts during construction works are not injured.

No hard-blocking or sett exclusions will be undertaken during the Badger breeding season (December-June inclusive).

Construction of an artificial sett will be undertaken in consultation with NPWS in the case that sufficient alternative setts are not available due to hard blocking of setts near the development footprint.

A report detailing evacuation procedures, sett excavation and destruction, and any other relevant issues will be submitted to the NPWS, in fulfilment of the wildlife licence conditions.

Vegetation clearance

There is the potential for setts to be discovered during vegetation clearance works. Care will need to be taken during this early stage of the development and a competent ecologist will be required on-site for these works. If setts are discovered all works within 30m of the sett shall cease including vegetation clearance. NPWS shall be contacted and a derogation/disturbance licence shall be sought. An activity survey shall be carried out to assess the potential for the sett to be used by Badgers.

Measures to prevent the injury of Badgers during proposed mitigation measures

In the event that a Badger is found injured during the proposed mitigation measures, it is important to realise that injured Badgers will be frightened and can be very dangerous. They are strong animals and are not used to being handled, so no attempt will be made to touch an injured Badger, as this could result in workers being bitten. NPWS shall be contacted along with ISPCA and potentially a vet specified by NPWS capable of treating the species.

Red Squirrel

Where possible, any required felling of trees in forestry areas will be limited to time periods outside which Red Squirrel may have young in dreys (peak period January to March).

If this is unavoidable then areas to be clear felled will be surveyed in advance by a suitable qualified ecologist to determine whether any occupied dreys are present. A license under the Wildlife Act will be sought as necessary.

Pine Marten

Where possible, felling of trees in forestry areas will be limited to time periods outside which Pine Martens may have young in dens (March and April). If this is unavoidable than areas to be clear felled will be surveyed in advance by a suitable qualified ecologist to determine whether any occupied Pine Marten dens are present. A necessary license under the Wildlife act will be applied for should any sites have to be disturbed.

Irish Hare, Pygmy Shrew and Hedgehog

These species are mobile and will disperse, however, hibernating Hedgehogs and the young of Irish Hare, Pygmy Shrew or Hedgehog are vulnerable during clearance of vegetation. An ecologist will check for the presence of hibernating hedgehog and or young mammals as appropriate, prior to vegetation clearance works prior to or during construction (as necessary).

Where habitat is too dense the ecologist will supervise vegetation removal and grassland trimming/maintenance during clearance works as appropriate.

- Outside of the bird breeding season (March 1st to August 31st inclusive) attention will be paid to the removal of vegetation, scrub and hedgerow with regards to leverets, October to March for hibernating Hedgehog and September to October for breeding Pygmy Shrew as is appropriate.
- Within the breeding bird season and outside of it, attention will be paid to the removal and/or maintenance of dense grassland for breeding hare (all year), pygmy shrew (April to October) and Hedgehog (April to July).

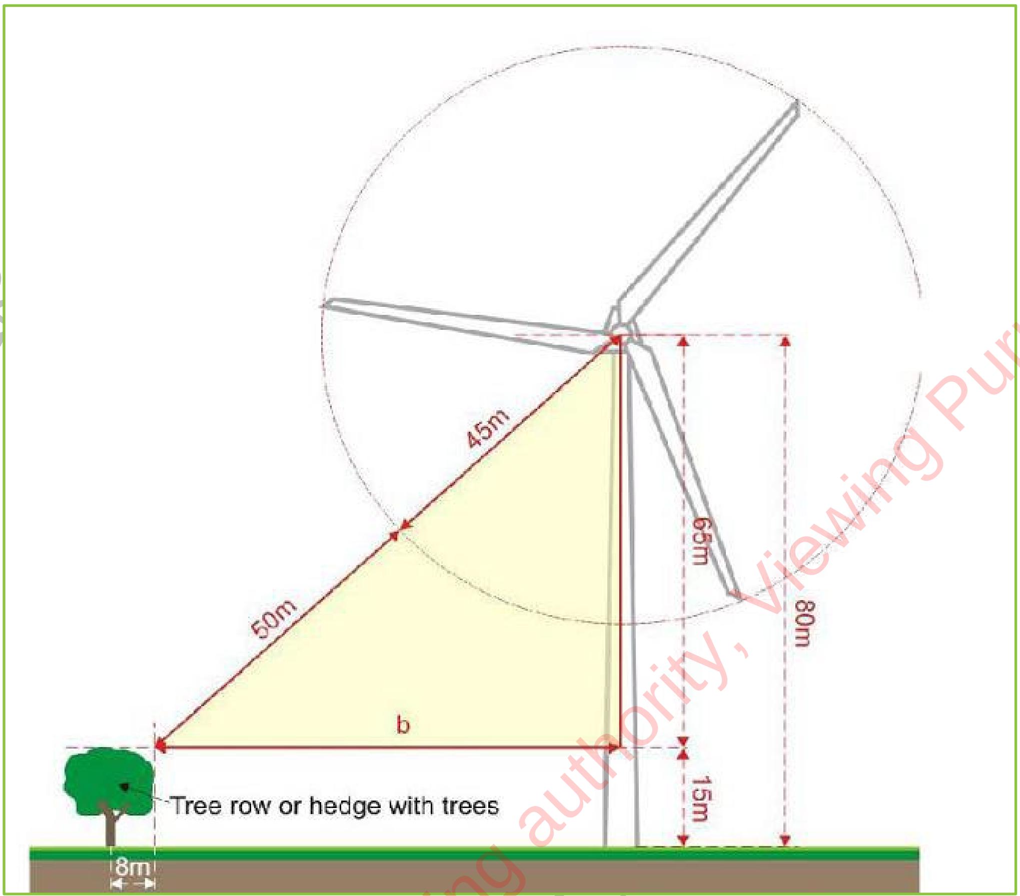
8.6.2.7 Bats

According to SNH (2019) guidance:

> *"The Eurobats guidance recommends a 200m buffer around woodland areas. There is, however, currently no scientific evidence to support this distance in the UK and it is recommended that a distance of 50m between turbine blade tip and nearest woodland (or other key habitat features such as wetlands etc.) is adequate mitigation in most, lower risk situations. Exceptionally, larger buffers may be appropriate, e.g. near major swarming and hibernation sites. The longevity of wind farms should also be taken into account and the maximum growth, or management, of woodland and other relevant habitat features considered in their planning.*

These distances were taken into account during the design phase of the proposed Croaghaun Wind Farm Development.

The following formula was used to calculate the required felling buffer for each turbine (taking into account the height of surrounding woodland/plantations at each turbine location):



$$b = \sqrt{(50 + bl)^2 - (hh - fh)^2}$$

where: b = the distance on the ground between the edge of the canopy and the turbine (m)
bl = blade length (m)
hh = hub height (m)
fh = feature height (m)

$$b = \sqrt{(50 + 69)^2 - (109 - fh)^2}$$

Note: fh for each turbine location is given in column 3 of Table 8-74 below

Note: 69m is the maximum proposed blade length, which may not be used. As such this assessment using this dimension represents the 'worst case scenario'. Therefore, felling buffers may decrease if a reduction in the turbine blade length alters the calculation.

Each of the proposed locations of the 7 turbines was surveyed and the bat activity findings recorded informed the application of the 50m blade tip buffer described above at all 7 proposed turbine locations. Surrounding habitats, height of surrounding trees and felling buffer calculated using the above equation are included in Table 8-74 below.

To minimize risk to bat populations, a buffer zone is recommended around any treeline, hedgerow, woodland feature, into which no part of the turbine should intrude. The buffers for each turbine are presented in Table 8-74.

Table 8-74: Assessment of potential turbine/bat conflict zones (based on maximum proposed turbine blade length 69m)

Turbine number	Habitats Requiring Felling	Surrounding Tree/Hedgerow Height (fh/m)	Felling Buffer Radius (m)
1	Recently felled conifer plantation*	20	79
2	Conifer plantation	20	79
3	Improved agricultural grassland	0	0
4	Conifer plantation	20	79
5	Recently felled conifer plantation, conifer plantation, scrub and hedgerow	20	79
6	Conifer plantation and dry heath and hedgerow	20	79
7	Conifer plantation	20	79

*Recently felled conifer plantation forms part of the cycle of conifer plantation. A 79m buffer has been provided to ensure that when this habitat is replanted a 79m buffer will be left unplanted

Existing trees / scrub will be cleared around all 7 turbines to provide a vegetation-free buffer zone around each turbine. The minimum distance has been taken into consideration for felling of conifer plantation around wind turbines. All buffers will be maintained throughout the lifetime of the wind farm.

The following mitigation measures for bats are proposed:

Supervision of vegetation clearance

An ecologist/ECoW will supervise areas where vegetation, scrub and hedgerow removal will occur prior to and during construction as appropriate (e.g., ecologist may be required during some clearance works of areas where vegetation is too dense to check beforehand). This will ensure that any site-specific issues in relation to wildlife not currently present (e.g., Bat roost locations) on site will be discovered prior to commencement of works to allow appropriate mitigation measures to be put in place. In the event that an issue arises, the NPWS will be informed and the relevant guidelines will be implemented as appropriate (e.g. NRA guidelines).

Retention of trees

Several species of bats roost in trees. Treelines and mature trees that are located immediately adjacent to the line of proposed haul roads will be avoided and retained intact. Overall impacts on these areas will be reduced through modified design and sensitivity during construction. Any trees and treelines along approach roads and planned site access tracks will be retained unless felling is unavoidable.

Retained trees should be protected from root damage by an exclusion zone of at least 7 metres or equivalent to canopy height. Such protected trees will be fenced off by adequate temporary fencing prior to other works commencing.

Compensation for loss of commuting routes

Linear features such as hedgerows and treelines serve as commuting corridors for bats (and other wildlife). The magnitude of habitat loss is Imperceptible. The total length of hedgerow to be removed is 26.5m (1.34 % of this habitat type within the study area) of a total of 1,976 m within the study area..

The hedgerow in question shall be reconnected will be reconnected with saplings to compensate for the loss of hedgerows currently used by bats. Native species of Irish provenance will be used as they support more insect life than non-native varieties. This will compensate for habitat loss and provide continuity in the landscape.

Habitat retention, replacement and landscaping

Habitat replacement and landscaping could compensate for or add to the wildlife value of the area and also provide areas of aesthetic as well as wildlife interest. In general, landscape design should aim to retain the quality of the landscape and ensure its protection within the landscaping programme. Existing hedgerows and semi-natural scrub or semi-natural grasslands within the study area outside of the footprint of the development will be retained and incorporated into the landscaping. Disturbed areas will be allowed to recolonise naturally.

Lighting restrictions

In general, artificial light creates a barrier to bats so lighting should be avoided where possible. Construction operations within the wind farm site will take place during the hours of daylight where possible to minimise disturbances to faunal species at night. Some works along the cable route and wind farm site may occur at night but the project ecologist/ECoW shall limit night-time works to sections of the route / site which avoid sensitive features (e.g. mature treelines). Where lighting is required, directional lighting (i.e. lighting which only shines on work areas and not nearby countryside) will be used to prevent overspill.

This can be achieved by the design of the luminaire and by using accessories such as hoods, cowls, louvers and shields to direct the light to the intended area only.

It is understood that flashing red aviation lights will be provided on perimeter turbines. These will not negatively impact bats (Bennett and Hale 2014).

Any Bridges requiring works at watercourse crossings which have potential as bat roosts

A pre-works survey (torch/endoscope inspection and/or emergence survey will be undertaken during the bat activity season (April-September inclusive) to reconfirm if the bridges (WCC3 along the GCR, and Barkers Bridge, Clashahilligh Bridge and Scratoes Bridge all along TDR) is in active use as a roost. If bats are present a derogation licence will be sought from NPWS to allow works to proceed in a manner which minimises disturbance and ensures no bats are harmed.

Pre-construction Surveys

If three years lapse from between planning-stage surveys in 2019 and installation of the wind turbines, it will be necessary to repeat one season of surveys during the activity period (EUROBATS, 2014). Future survey work will be completed according to best practice guidelines available (Hundt, 2012; Collins, 2016; SNH, 2019) and includes static detector, activity and roost inspection surveys.

8.6.2.8 Avifauna

Subject to other environmental concerns (e.g., run-off), the removal of vegetation and scrub as well as trimming of trees along the TDR will be undertaken outside of the bird breeding season (March 1st to August 31st inclusive). This will help protect nesting birds.

This in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt, A. L. and Langston, R. H., 2006).

Construction operations will take place during the hours of daylight to minimise disturbances to roosting birds, or active nocturnal bird species. This is in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt and Langston, 2006). Limited operations such as concrete pours, turbine erection and installation of the grid connection may require night-time operating hours; these works will be supervised by the project ecologist/ECoW.

Toolbox talks will be undertaken with construction staff on disturbance to key species during construction. This will help minimise disturbance. This is in line with best practice recommendations for mitigation measures with regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt and Langston, 2006).

Re-instated hedgerows will be planted with locally sourced native species. This will result in habitat enhancement for local species of conservation importance such as meadow pipit. This is in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt and Langston, 2006).

Kingfisher: Implement mitigation measures outlined in Chapter 10 - Hydrology and Water Quality of this EIAR, the CEMP and Aquatic Ecology Mitigation, section 8.6.2.10 below, to minimise and prevent the identified indirect impacts to water quality.

A re-confirmatory survey (March/April) will be conducted of the proposed turbine locations to assess any evidence of Buzzard, Kestrel, Long-eared Owl, Sparrowhawk and Woodcock activity or taking up new territories. Should any new nests be recorded, works at these locations will be restricted to outside the breeding season (April-July) or until chicks are deemed to have fledged (following monitoring).

8.6.2.9 Lights on Turbines

It appears that the lighting on top of wind turbines may affect the likelihood of bats colliding with turbines. Research on this topic, which is reviewed in Powelsland (2009), indicates that intermittent lighting is less likely to cause species to collide with turbines.

The use of “white lights” on the turbines will be avoided as these can attract night flying birds such as migrants, and insects, which in turn can attract bats. Certain turbines will be illuminated with medium intensity fixed red obstacle lights of 2000 candelas where required by the IAA Lighting will be fitted with baffles to ensure that the light is directed skywards and will not be discernible from the ground.

8.6.2.10 Aquatic Ecology - Water Quality Measures during the Construction Phase

Proposed Mitigation Measures for the Construction Stage of the project

Construction phase mitigation for site drainage will follow that outlined in section 10.7 of Chapter 10 – Hydrology and the mitigation measures outlined will be adhered to in conjunction with those outlined in this section.

Proposed Mitigation Measures for Tree Felling

Tree felling will be required at six of the 7 no. proposed turbine locations (i.e. T1, T2, T4, T5, T6 and T7; see Figure 8-11). It is estimated that 24.4 Ha in total of existing forestry lands (conifer plantation WD4, recently Recently-felled Woodland WS5) will be removed to facilitate development of the proposed wind farm infrastructure (e.g. access tracks and turbine base construction). Tree felling will be undertaken prior to the construction of site access tracks and hardstanding areas.

There is a requirement in the Forest Service Code of Practice and in the FSC Certification Standard for the installation of buffer zones adjacent to aquatic zone (Forestry Service, 2000a and b). However, no felling areas are present within c.250m of aquatic zones, with the exception of forestry drains. Therefore, the risk of impacts from felling on water-dependent species is reduced.

Tree felling will be the subject of a felling license from the Forest Service and to the conditions of such a license. A Limited Felling License will be in place prior to works commencing on site. To ensure a tree clearance method that reduces the potential for sediment and nutrient run-off, the construction methodology will follow the specifications set out in the following guidance documents:

- DAFM (2019). Standards for Felling and Reforestation;
- Forestry Service (2000a). Forest Service Forestry and Water Quality Guidelines;
- Forestry Service (2000b). Forest Harvesting and Environmental Guidelines;
- DAFM (2018). Draft Plan for Forestry and Freshwater Pearl Mussel in Ireland

Additional mitigation measures for the protection of aquatic ecology and receptors during felling activities will follow those outlined in Chapter 10 – Hydrology and Water Quality.

Given the sensitivity of aquatic ecological receptors downstream (notably Freshwater Pearl Mussel), it is proposed to undertake felling in the spring to facilitate the sowing of grass seeds post-harvest to aid sediment filtration and nutrient absorption, using native grass species *Holcus lanatus* and *Agrostis capillaris* (DAFM, 2018). Machine operations must not take place in the 48hour period before predicated heavy rainfall, during heavy rainfall or in the 48-hour period following heavy rainfall (DAFM, 2018).

Removal of branch lop-and-top and other debris (brash) from felling areas within 20m of forestry drains (i.e. up-slope of active pathways to larger downstream watercourses) will reduce nutrient seepage immediately post-felling and in the proceeding years after felling has occurred (DAFM, 2019).

Proposed Mitigation Measures Wind Farm Construction

Please refer to Chapter 10 – Hydrology (section 10.7.1) for detailed mitigation measures for site drainage and silt attenuation to prevent impacts to the water quality of downstream watercourses during the construction phase. These include measures to prevent run-off erosion from vulnerable areas and consequent sediment release into nearby watercourses to which the proposed development site discharges. The mitigation measures proposed will reduce potential direct and indirect impacts from the construction of the turbine foundations, access tracks (upgrade and construction), borrow pit, met mast and site compound.

Excavated subsoil material not required for in-site reinstatement will be removed to the designated material storage areas at the borrow pit location. The proposed borrow pit is located away from any watercourses (c.380m from Clashavey River headwaters but with limited, closer (180m hydrological connectivity via small drains on site), in the centre of the main wind farm site, between turbines T2 and T4. The risk of water quality impacts to receiving watercourses via siltation or nutrient release will be further reduced through siltation management at the borrow pit site as detailed in the CEMP.

All measures for the protection of water quality within the proposed development site, as detailed in the CEMP (Appendix 3.1), will also protect the aquatic ecology and fisheries value of downstream watercourses. The measures adopted within the CEMP (including recommendations from Inland Fisheries Ireland) will ensure effective protection of aquatic ecological interests downstream of the proposed development, particularly the habitats supporting sensitive aquatic species and with connectivity to the Slaney River Valley SAC (000781). These are summarised in
Table 8-62**.**

Proposed Mitigation Measures during Construction for the Turbine Delivery Route

Please refer to Chapter 10 – Hydrology (section 10.7.1.4) for detailed mitigation measures for turbine delivery to prevent impacts to the water quality of downstream watercourses during the construction phase.

The temporary bridge crossing over the Kilbrannish North Stream may be required for turbine delivery at turbine delivery work location no. 43. Furthermore, road widening is required at turbine delivery work location nos. 29 and 30, adjacent to the River Clody in Bunclody and an extension to the existing car park at turbine delivery work location no. 52 adjacent to the Blackstairs Mountains pNHA.

In addition to the mitigation measures outlined in Chapter 10 – Hydrology and Water Quality, a method statement for temporary bridge construction and road widening will be agreed with Inland Fisheries Ireland in advance of works commencement.

Proposed Mitigation Measures during Construction for the Grid Connection and temporary alterations for the Turbine Delivery Route

A summary of grid cable route watercourse crossings (9 no. in total) and potential impacts to aquatic receptors is provided in Table 8-61. For the purposes of assessing worst case, the maximum possible route length and number of watercourse crossings based on the route permutations available have been used.

Should the proposed primary route be constructed, the total number of watercourse crossings shall amount to 5 no. (2 no. in the public road corridor and 3 no. in private lands). The maximum possible number of watercourse crossings required is 7 no. and would involve the inclusion of both route variants in the final grid connection. In this scenario, 6 no. watercourse crossings will be located in the public road corridor and 1 no. will be on private lands.

Sections 10.7.1.1 and 10.7.1.2 of Chapter 10 – Hydrology refer to site-specific mitigation measures for bridge deck laying and horizontal directional drilling (HDD). Horizontal directional drilling is required at 8 no. locations (Table 8-1). These works will be subject to site-specific method statements agreed with Inland Fisheries Ireland in advance of construction commencement. There will be no works conducted between October and June (inclusive) to protect spawning salmonids and or lamprey species in the crossed watercourses. These works will be supervised by an Ecological Clerk of Works (ECoW), that will monitor water quality during construction. The management of excavated bankside material, trench water and water quality risks associated with hydraulic drilling fluid are addressed in the CEMP (Appendix 3.1) and Chapter 10 Hydrology and Water Section 10.7.1.2. Briefly, these include:

- A site-specific drilling design, risk assessment and method statement shall be prepared by the contractor prior to the works.
- If drilling fluids are required, a biodegradable fluid such as CLEARBORE shall be used rather than Bentonite.
- HDD operations to be limited to daytime hours and conditions when low levels of rainfall are forecast.
- The depth of the bore shall be at least 3m below the bed of the watercourse.
- Visual inspection to take place at all times along the bore path of the alignment.
- A field response plan to minimize loss of returns of drilling fluid and actions to restore returns shall be provided.
- Silt fences will be constructed around proposed work areas prior to commencement of works.
- No refuelling will take place within 50m of the watercourse or any sensitive habitats.
- Pre-construction verification surveys shall take place at drilling sites to confirm the presence of any sensitive species.
- A qualified biological monitor will be onsite for the duration of the drilling operation.

To reduce the risk of invasive species and pathogen introduction (e.g. Crayfish plague), all equipment will be thoroughly checked, cleaned and dried in accordance with best practice as specified in the CIRIA guidelines below. Furthermore, plant machinery which has worked within riparian corridors or come in to contact with water will be steam-cleaned and dried in advance of works commencement in the Slaney and Barrow catchments. Crayfish plague is known from the River Barrow catchment since 2017.

The potential introduction of Crayfish plague is of particular concern at watercourse crossings over the Burren River and tributaries (i.e. GCR-WCC1, GCR-WCC2, GCR-WCC3, GCR-WCC4, GCR-WCC5 and GCR-WCC8) given the presence of White-clawed Crayfish populations downstream in the Burren catchment.

Works within and adjacent to watercourses, as part of HDD and in the existing bridge deck, will adhere the guidelines set out in the best practice documents as listed below:

- CIRIA (2001). Control of water pollution from construction sites - Guidance for consultants and contractors (C532). Construction Industry Research and Information Association, London.

- CIRIA (2006). Control of Pollution from Linear Construction Project; Technical Guidance (C648). Construction Industry Research and Information Association, London.
- CIRIA (2015a). Manual on scour at bridges and other hydraulic structures, second edition (C742). Construction Industry Research and Information Association, London.
- CIRIA (2015b). Environmental Good Practice on Site (4th edition) (C741). Construction Industry Research and Information Association, London.
- CIRIA (2019). Culvert, screen and outfall manual (C786). Construction Industry Research and Information Association, London.
- DHPLG (2019). Draft Revised Wind Energy Development Guidelines. Department of Housing, Planning and Local Government. December 2019
- Enterprise Ireland (unknown). Best Practice Guide (BPGCS005) Oil storage guidelines.
- IFI (2016). Guidelines on Protection of Fisheries during Construction Works in and adjacent to waters. Inland Fisheries Ireland, Dublin.
- IFI (2019) Windfarm scoping document (draft). Inland Fisheries Ireland, Dublin.
- IWEA (2012). Best Practice Guidelines for the Irish Wind Energy Industry. Guidance prepared by Fehily Timoney and Company for the Irish Wind Energy Association.
- Kilfeather, P.K. (2007). Maintenance and protection of the Inland Fisheries resource during road construction and improvement works. Requirements of the Southern Regional Fisheries Board. Southern Regional Fisheries Board, Clonmel, Co. Tipperary
- Murphy, D.F. (2004). Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin.
- NRA (2008). Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. National Roads Authority.
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);
- SNH (2012). Assessing the cumulative impact of onshore wind energy developments. Scottish Natural Heritage, March 2012.
- SNH (2019b). Good Practice during Wind Farm Construction (4th edition). Scottish Natural Heritage.

8.6.2.11 Other Species

In the event that construction is required to proceed during the breeding seasons of common frog/smooth newt, translocation will be undertaken where active breeding drains are within the development footprint.

Protection of existing hydrological conditions where drains are adjacent to or within the zone of influence (i.e. could be impacted by drainage works elsewhere) are required. In the event that the hydrology of existing breeding areas within the zone of influence cannot be maintained, translocation to suitable receptor sites can be used.

Amphibian fencing will be erected to prevent re-entry to areas which have been evacuated and any areas which could be occupied by amphibians during the construction period.

8.6.3 Mitigation measures during operation

8.6.3.1 Designated Nature conservation sites

Implement mitigation measures outlined in section 8.6.3.5 and Chapter 10 - Hydrology and Water Quality of this EIAR, in addition to the NIS to minimise and prevent the identified indirect impacts on water quality as outlined previously.

8.6.3.2 Habitats and Flora

Implement mitigation measures outlined in section 8.6.3.5 and Chapter 10 - Hydrology and Water Quality of this EIAR, in addition to the NIS, to ensure that there will be no contamination of water bodies due to siltation or contaminated run-off during the operational phase.

Invasive species will continue to be treated within the project area according to the invasive species management plan for as long as they persist within the site.

8.6.3.3 Bats

Feathering of Blades

Turbines will operate in a manner which restricts the rotation of the blades as far as is practicably possible below the manufacturer's specified cut-in speed. This is usually achieved by feathering the blades during low wind speeds; the angle of the blades is rotated to present the slimmest profile possible towards the wind, ensuring they do not rotate or 'idle' when not generating power.

Turbine blades spinning in low wind can kill bats, however bats cannot be killed by feathered blades which are not spinning (Horn *et al*., 2008). The feathering of turbine blades combined with increased cut-in speeds have been shown to reduce bat fatalities from 30% to 90% (Arnett *et al*., 2008, 2011; Baerwald *et al*., 2009).

As such, the feathering of blades to prevent 'idling' during low wind speeds is proposed for all turbines.

Cut-in Speeds/Curtailment

Increasing the cut-in speed above that set by the manufacturer can reduce the potential for bat/turbine collisions. A study by Arnett *et al*., (2011) showed a 50% decrease in bat fatality can be achieved by increasing the cut-in speed by 1.5 m/s.

Species with elevated risk of collision (Leisler's bat, soprano and common pipistrelle) in particular would benefit from increasing the cut-in speed of turbines, as dictated on a case-by case basis depending on the activity levels recorded at each turbine.

Cut-in speeds should be increased during the bat activity season (April-October) or where temperatures are optimal for bat activity to 5.5 m/s from 30 minutes prior to sunset and to 30 minutes after sunrise at turbines where surveillance shows high bat activity levels for High and Medium-Risk species and/or if bat carcasses are recorded.

The duration required depends on the level of mitigation required for each individual turbine i.e. a full bat activity season or only spring and autumn (duration will be determined by the first year of surveillance).

Cut-in speeds restrictions will be operated according to specific weather conditions:

1. When the air temperature is greater than 7°C (as bat activity does not usually occur below this temperature).
2. Generally, bat activity peaks at low wind speeds (<5.5m/s). As such, it has been shown that curtailing the operations of wind turbines at low wind speeds can reduce bat mortality dramatically, particularly during late summer and the early autumn months.

Modern remotely-operated wind turbines allow cut-in speeds to be controlled centrally/automatically, facilitating an operation regime designed to minimise harmful impacts to bats.

No high-risk turbines were identified. However, five turbines fell within the range of the 'Moderate to High' risk category (T2, T4, T5, T6 and T7). The two remaining turbines (T1 and T3) fell within the 'Moderate' risk category. Due to the elevated levels of bat activity at T2, T4, T5, T6 and T7 increased cut-in speeds will be required at these locations. Intensive monitoring will be carried out during the operational phase of the proposed wind farm. These monitoring surveys will be carried out during years 1, 2, 3, 5, 10, 15 and 25 post construction.

If, following a given year's surveys, Common Pipistrelle bat activity increases above the baseline and remains consistently high at Moderate to High-risk and carcass searches indicate fatalities are occurring, increased cut-in speeds will continue to be implemented. Alternatively, if it is found that the results of bat activity surveys and fatality searches confirm that the level of bat activity at turbine locations is reduced (from baseline levels present in this EIAR) then a derogation will be sought from Carlow County Council (in consultation with NPWS) for the cessation in the requirement for these cut-in speeds / curtailment measures, or a reduction on the timing restrictions for these measures. In relation to the monitoring / fatality surveys, these may indicate a peak period of activity (i.e. a particular month or window during the bat activity season) where cut-in speeds / curtailment measures would be required only? rather than implementing them for the full season.

Bat activity levels at the moderate risk turbines (T1 and T3), operating without cut-in speed limits will also be monitored to determine if increased cut-in speeds are required at these turbine locations.

In addition to the above, the effectiveness of curtailment will be monitored in order to determine whether it is working effectively (i.e. the level of bat mortality is considered to be incidental), and whether the curtailment regime can be fine-tuned or ceased so that turbine down-time is minimised while ensuring the regime remains effective in preventing casualties (SNH, 2019).

Buffer zones

The vegetation-free buffer zones around the identified turbines will be managed and maintained during the operational life of the development.

Due to mitigation by design, turbines are proposed to be sited at a suitable separation distance from trees and trees or vegetation are to be removed to ensure a woodland-free buffer zone.

The immediate surroundings of individual turbines will be managed and maintained so that they do not attract insects (i.e. the concentration of insects in the wind turbine vicinity should be reduced as much as possible, but not such that insect abundancies affected elsewhere on the site). This should be achieved through physical management of habitats without the use of toxic substances.

The radius of each buffer zone as determined by the height of surrounding vegetation is listed below in Table 8-75 below. ***Note - these buffers are calculated based on the maximum proposed blade length*** and as such anticipate the worst-case scenario and provide a robust assessment and adequate mitigation. If the turbine blade length is reduced, felling buffers may decrease in accordance with the formula presented in section 8.6.1.7.

Table 8-75: Vegetation Free Buffer Zones for Bats (based on maximum proposed blade length of 69 m)

Turbine number	Felling Buffer Radius (m)
1	79
2	79
3	0
4	79
5	79
6	79
7	79

Monitoring of mitigation measures

The success of the implemented mitigation measures for bats on the project should be monitored during years 1, 2, 3, 5, 10, 15 and 25 post construction. A recommended schedule for monitoring is given in Table 8-76 below.

Bat fatality monitoring

Whilst no significant residual impacts on bats are predicted, the proposed development could provide an opportunity to gain baseline data on bat/turbine interaction and it is recommended that the scheme be monitored for bat fatalities during years 1, 2, 3, 5, 10, 15 and 25 post construction. A comprehensive onsite avian fatality monitoring programme is to be undertaken. This fatality monitoring programme will be extended and duplicated for bat fauna.

The primary components of the bird mortality programme are outlined below, and an assessment of bat mortality will essentially follow the same methodology.

a) Carcass removal trials to establish levels of predator removal of possible fatalities. This will be done following best recommended practice and with due cognisance of published effects such as predator swamping, whereby excessive placement of carcasses increases predator presence and consequently skews results. No turbines which are used for carcass removal trials will be used for subsequent fatality monitoring.

b) Turbine searches for fatalities will be undertaken following best practice in terms of search area (minimum radius hub height) and at intervals selected to effectively sample fatality rates as determined by carcass removal trials in (a) above.

c) A standardised approach with a possible control group and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches will be undertaken. This will provide a means of robustly estimating the post construction collision fatality impact (if any).

d) Recorded fatalities will be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

Table 8-76: Monitoring schedule proposed for bat mitigation measures

Mitigation measure	Monitoring required	Description	Duration
Newly planted hedgerows	Ensure viable growth of planting	Planted material shall be checked periodically over the growing season to remove dead material. Any dead material shall be replaced within the same season with viable stock according to age/height restrictions already specified in mitigation.	From time of planting to 1 year post construction
Bat boxes and tubes	Monitor bat use	Bat boxes and tubes to be placed at locations removed from wind farm as determined by project ecologist/ECoW. These shall be examined by a licensed bat specialist according to NPWS recommendations. Records will be submitted to *Bat Conservation Ireland* for inclusion in its bat distribution database. Re-site if necessary. Annual cleaning required if well used by bats or if used by birds. Replacement if damaged/lost.	From mounting to 3 years post construction.
Mortality study	Fatality monitoring	Corpse searches beneath turbines to assess the impact of operation on bats.	From initial operation conducted during years 1, 2, 3, 5, 10 and 15 post construction.

Table 8-77: Summary of Operational-phase Mitigation Measures for Bats

Moderate-High Level Bat Mitigation Applies to T2, T4, T5, T6 and T7	**Moderate Level Bat Mitigation** Applies to T1 and T3
Operate the wind turbines in a manner that reduces the movement of the blades below the cut-in speed (e.g. by feathering the blades).	Operate the wind turbines in a manner that reduces the movement of the blades below the cut-in speed (e.g. by feathering the blades).
Implement a monitoring programme during years 1, 2, 3, 5, 10, 15 and 25 post construction to ensure that bat activity is at a low level in vicinity of these turbines. Review monitoring results to determine if further bat mitigation measures are required.	Implement a monitoring programme during years 1, 2, 3, 5, 10, 15 and 25 post construction to ensure that bat activity is at a low level in vicinity of these turbines. Review monitoring results to determine if further bat mitigation measures are required.
Undertake a carcass search during years 1, 2, 3, 5, 10, 15 and 25 post construction of the wind farm to determine whether a higher cut-in speed of the blades is required. Implement cut-in speeds (coupled with carcass search results) where surveillance shows high bat activity levels for High-Risk species.f bat activity levels/monitoring results..	Undertake a carcass search during years 1, 2, 3, 5, 10, 15 and 25 post construction of the wind farm to determine whether a higher cut-in speed of the blades is required.

Moderate-High Level Bat Mitigation Applies to T2, T4, T5, T6 and T7	Moderate Level Bat Mitigation Applies to T1 and T3
Implement curtailment where surveillance shows high bat activity levels for High -Risk species (and carcasses are recorded). The curtailment will involve operating the selected wind turbine from 30 minutes prior sunset to 30 minutes after sunrise at a cut-in speed of 5.5 m/s during specified weather conditions and during the active bat season (April to October).	
Clear and maintain buffer zone free of woodland/trees within 50m of turbine blade tips.	Clear and maintain buffer zone free of woodland/trees within 50m of turbine blade tips.
Maintain immediate area around the wind turbines in a manner that does not attract insects.	Maintain immediate area around the wind turbines in a manner that does not attract insects.

8.6.3.4 Avifauna

A post construction monitoring programme is to be implemented at the subject site in order to confirm the efficacy of the mitigation measures; the results of this will be submitted annually to the competent authority and NPWS. Published guidance on assessing the impacts of wind farms on birds from English Nature and the Royal Society for the protection of birds recommends the implementation of an agreed post development monitoring programme as a best practice mitigation measure (Drewitt and Langston, 2006).

In addition, published recommendations on swans and wind farms (Rees, 2012) suggests that systematic post construction monitoring; adapted to quantify collision, barrier and displacement, be conducted over a period of sufficient duration to allow for annual variation or in combination effects. The following individual components are proposed.

1) Fatality Monitoring (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction)- A comprehensive fatality monitoring programme is to be undertaken following published best practice; the primary components are as follows:

    a. Initial carcass removal trials to establish levels of predator removal of possible fatalities. This is to be done following best recommended practice and with due cognisance to published effects such as predator swamping, whereby excessive placement of carcasses increases predator presence and consequently skews results (Shawn *et al*., 2010). No turbines which are used for carcass removal trials are to be used for subsequent fatality monitoring. Carcass removal trials shall be continued for the duration of fatality searches.

    b. Turbine searches for fatalities are to be undertaken following best practice (Fijn *et al*., 2012 and Grunkorn, 2011) in terms of search area (minimum radius hub height) and at intervals selected to effectively sample fatality rates based on carcass removal rates (e.g. 1 per month). To be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring to be agreed with NPWS.

    c. A standardised approach with a possible control group and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches will be undertaken. This will provide a means of robustly estimating the post construction collision fatality impact (if any).

    d. Recorded fatalities to be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

Reports will be submitted to the competent authority and NPWS following each round of surveys.

2) Flight Activity Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction) - A flight activity survey is to be undertaken during the summer and winter months to include both Vantage Point and hinterland surveys as Per SNH (2017) guidance:

    a. Record any barrier effect i.e. the degree of avoidance exhibited by species approaching or within the wind farm (Drewitt and Langston, 2006). Target species to be all raptors and owls, all wild goose and duck species, all swan species and all wader species.
    b. Record changes in flight heights of key receptors post construction.

Reports will be submitted to the competent authority and NPWS following each round of surveys. This survey is to be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring requirements will be agreed with NPWS.

3) Monthly Wildfowl Census (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A monthly wildfowl census, following the methods utilised for the baseline survey, is to be repeated on a monthly basis during the winter period.

This aims to:

    a. Assess displacement levels (if any) of wildfowl such as swans post construction
    b. Assess overall habitat usage changes within the vicinity of the Croaghaun Wind Farm Development post construction.

This survey is to be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring requirements will be agreed with NPWS. Reports will be submitted to the competent authority and NPWS following each round of surveys.

4) Breeding Bird Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A breeding bird survey (moorland breeding bird and Common Bird Census), following methods used in the baseline survey to be repeated yearly between early April to early July. This aims to:

    a. Assess any displacement effects such as those recorded on breeding birds. Overall density of breeding birds to be annually recorded.

5) Breeding Wader Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A breeding bird survey, following methods used in the baseline survey to be repeated yearly April-May-June.

Both of the above surveys are to be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring requirements will be agreed with NPWS.

8.6.3.5 Aquatic Ecology

The primary impact to aquatic ecology resulting from the operational phase of the proposed wind farm is an increase in surface water run-off from hard-standing areas, access tracks etc. Mitigation for the maintenance regime is outlined in section 10.7.2 of Chapter 10 – Hydrology and Water Quality.

The maintenance of the development will incorporate effective maintenance of the drainage system, including visual inspections in accordance with maintenance schedule in CIRIA C753. Therefore, it is not envisaged that maintenance will involve or accrue significant impacts on the hydrological regime of the area. Quarterly inspections of the erosion and sediment control measures on site (i.e. drains, swales, outfalls to field drains) will be undertaken for the first year following construction and annually thereafter to ensure operational efficiency.

During the operational phase, oils will be required for cooling the transformers giving rise to the potential for oil spills within the site. To mitigate this risk, transformers will be bunded to over 110% of the volume of oil within them.

8.6.4 Mitigation Measures during the Decommissioning of the project

The same mitigation measures will apply for the decommissioning phase as for the construction phase.

8.6.5 Vulnerability to Major Accidents or Disasters

The main possible accidents or disasters are considered to be the risk of turbine foundation failure, toppling and landslide. For biodiversity, the main possible impacts are considered to be the release of sediment and pollutants into watercourses, which could negatively impact upon aquatic habitats and species.

Turbines have been sited with consideration for existing ground conditions to minimise the risk of turbine foundation failure, toppling and landslide. Intrusive site investigations have been carried out to confirm ground conditions at turbine locations as well as slope stability analysis for turbines located on sloped ground. Other design mitigation measures employed for the siting of wind turbines include the following:

- Areas mapped by GSI as having a high susceptibility to landslides have been avoided;
- Turbine locations have been assessed by site investigation and visually by geotechnical engineers prior to confirmation of final siting;
- If turbines are located on sloped ground, particular care has been taken in design of road and hard standing alignments, cutting and filling and drainage;
- Peat probing has been carried out at turbine locations. Locating turbines in peat has been avoided where possible.

See Chapter 9 Lands, Soils and Geology for more information on the above.

The other potential major disaster/accident that could occur and has the potential to negatively impact biodiversity (e.g. through the loss of habitats and destruction of species) is fire.

As part of the Safety and Health Management Plan (section 5 in CEMP), all hazards (including fire) must be minimised throughout the design, construction, operation and decommissioning process.

While specific measures undertaken to reduce the risk of fire are not explicitly outlined in the CEMP, the Environmental Management Programme will incidentally reduce the risk of fire through other measures. For example, as part of the Noise and Vibration programme, exhaust emissions will be minimised via the regular maintenance of machinery. This will also reduce the risk of faults developing and thus, the start of fires.

All site personnel will receive environmental awareness information as part of their initial site briefing. The detail of the information should be tailored to the scope of their work on site.

An Emergency Response Plan for any fires is contained with CEMP (section 6.1). Briefly, the steps (relevant to containing the fire and thus, preventing damage to biodiversity) to be taken in response to fire include:

- Designate an Emergency Response Liaison
- Provide a map depicting tower locations with emergency meeting points to the local County Council Fire Department and HSE ambulance co-ordinators
- Raise an emergency alarm on site as soon as fire is detected
- Contact the nearest supervisor with radio equipment/mobile phone
- In case of major emergency, the local fire department (999) will be contacted.

An emergency response plan is contained in the CEMP in Appendix 3.1 and outlines how any major accident or disaster in relation to watercourses will be addressed.

8.7 Residual Ecological Impacts

8.7.1 European sites

The Natura Impact statement concluded that, on the basis of objective scientific information, the main wind farm site, turbine delivery route, grid connection and replant will not, either alone or in combination with other plans or projects, adversely affect any of the constitutive interests of the Slaney River Valley SAC, River Barrow and River Nore SAC, Blackstairs Mountains SAC and Lower River Shannon SAC (or any other European site), in light of the sites' conservation objectives.

8.7.2 Natural Heritage Areas or Proposed Natural Heritage Areas

The lowering of wall which is of Local Importance (Higher Value) during additional works at turbine delivery work location no. 30 of the TDR will be limited but permanent and will have a *Permanent, Negligible Effect* on Slaney River Valley pNHA (000781) that is *Reversible*

Two pNHAs within the 10km of the study area lie within the boundary of a European site which have been considered as part of the Natura Impact Statement:

- Blackstairs Mountain SAC/pNHA (000770)
- Slaney River Valley SAC/pNHA (000781).

Whilst it has been acknowledged that there could be potential for the main wind farm site, turbine delivery route and grid connection to have significant effects on the Slaney River Valley SAC/pNHA and Blackstairs Mountain SAC/pNHA, with the implementation of the detailed mitigation measures identified in the NIS, it is concluded beyond reasonable scientific doubt that the integrity of the Slaney River Valley SAC/pNHA and Blackstairs Mountain SAC/pNHA will not be adversely affected.

The NIS report has assessed the potential effects on the integrity of the Slaney River Valley SAC/pNHA and Blackstairs Mountain SAC/pNHA in light of the sites' conservation objectives and mitigation measures have been developed to prevent such potential effects occurring.

In the light of the conclusions of the assessment which it shall conduct on the implications for the Slaney River Valley SAC/pNHA and Blackstairs Mountain SAC/pNHA, the competent authority is enabled to ascertain that the proposed project will not adversely affect the integrity of any of the Slaney River Valley SAC/pNHA and Blackstairs Mountain SAC/pNHA.

No potential impacts were predicted for the Bunclody Slate Quarries pNHA, Ballymoon Esker pNHA (000797), John's Hill pNHA (000808), Ardristan Fen pNHA (000788) Cloghristick Wood pNHA (000806), Ballynabarney Wood pNHA (000746), Clone Fox Covert pNHA (000755) and Killoughrum Forest pNHA (000765).

8.7.3 Habitats and Flora

Construction of the wind farm will lead to some permanent loss of habitat. The habitat loss will be the total area covered by the roads plus the footprint of each of the proposed turbines and all other wind farm infrastructure and associated felling buffers.

For clarity, associated infrastructure includes a compound and a substation. Land take has also been calculated for land-take at junctions along the proposed turbine delivery route which shall be minimal.

Not all land take is permanent as modifications along the turbine delivery route will be reinstated and felling areas will become different habitats rather than being lost within the development footprint. Any hedgerows to be re-instated will utilise locally sourced native species which shall minimise residual impacts. Mitigation measures as outlined in the current chapter and Chapter 10 - Hydrology and Water Quality' as well as the use a of HDD and installation of cables within the concrete bridge beam in road deck at grid connection watercourse crossings shall ensure no significant loss of aquatic habitat.

The implementation of the invasive species management plan will avoid the spread of invasive species as a result of the proposed project and will have a benefit locally of reducing the extent of invasive plant species.

The proposed development shall result in the loss of approximately 0.67 Ha (2.00 % of the total habitat type) degraded dry heath at turbine 6. However, the felling of conifer plantation within the main wind farm site that will remain unplanted for the lifetime of the wind farm will increase the amount of degraded dry heath within the site. The bare sections of shallow peat will recolonise with heathland species over time. While this habitat type would not be Annex I quality it will offer habitat of a similar quality to the existing dry heath habitat within the site. Considering the potential for clear felled sections of peat to develop into semi-natural heath, but also the small area impacted and isolation and small size of the stands, this would result in a *Permanent Slight Irreversible Impact* and in the *local context*. With the application of the appropriate mitigation measures as outlined, it is considered that the impacts of the proposed development will be minimised for other habitats to an acceptable level, resulting in *no residual impacts*.

8.7.4 Mammals

Measures to protect Red Squirrel and Pine Marten include restricting felling operations to outside their breeding periods, and pre-felling surveys where this cannot be facilitated. Badgers will be protected through a suite of measures including pre-construction surveys, temporary hard-blocking of setts in felling areas and in close proximity to proposed infrastructure and the implementation of buffer zones as required. No actions to exclude Badgers from active setts will be undertaken during the breeding season (December - June inclusive).

Some permanent loss of areas of grassland, scrub and conifer plantation habitats which could be used by foraging and breeding mammals for shelter/breeding will occur. While scrub may develop in these areas, this will be periodically disturbed during the course of operation of the proposed wind farm due to the maintenance of tree-free turbulence/bat mitigation buffers around turbines. The implementation of mitigation measures will reduce residual impacts to *Long-term Imperceptible Negative Reversible Impacts in the local context*.

For Otters, by implementing the mitigation measures outlined in section 8.6.2.5 and accompanying Chapter 10, residual impacts are considered to be *Non-Significant, Short-Term and in the local context* (i.e. sub-catchment scale).

The habitats used by protected mammal species within the proposed development footprint and felling areas represent a small amount of the total available within the study area and are also present within the wider landscape.

8.7.5 Bats

Some of the planned turbines are to be located within or close to existing tree—dominated vegetation but providing a 50m vegetation-free buffer zone (50m from turbine blade tip to top of surrounding trees) around each turbine will reduce the risk of collision and/or barotrauma to foraging and/or commuting species such as pipistrelles. Post construction Bat fatality monitoring will also be undertaken at the subject site.

The adjudged worst-case scenario is that, during operation, the turbines may possibly cause injury or death to a few individual specimens of Leisler's bat as it is a high-flying species (10m to 70m+). However, the amount of time spent hunting at the upper height limit cannot be assessed accurately due to the maximum distance (60m to 80m) of detection of this species by ultrasound detectors (Rodrigues *et al.*, 2008) but most activity and time can be expected to occur in the mid-region of the species hunting altitude i.e. 40m.

The resulting impact of the proposed development on local bat populations, with implemented mitigation measures, is considered to be a *Slight to Imperceptible Residual Negative Reversible Residual Impact And In The Local Context* with the favourable conservation status (FCS) of bat species being unaffected and all species confirmed or expected on or near the study areas are predicted to persist.

8.7.6 Avifauna

To minimise effects on those species which the literature suggests can be negatively impacted, a re-confirmatory survey (March/April) will be conducted of the proposed turbine locations to assess any evidence of Buzzard, Kestrel, Long-eared Owl, Sparrowhawk and Woodcock activity or taking up new territories. Should any new nests be recorded, works at these locations will be restricted to outside the breeding season (April-July) or until chicks are deemed to have fledged (following monitoring).

A comprehensive monitoring program will also be implemented following construction of the proposed wind farm; this will monitor the degree of barrier effect, if any, on existing species as a result of the development, in addition to comprehensively monitoring any bird fatalities.

It is considered that with the implementation of mitigation, the proposed wind farm development will have a *Slight-Imperceptible Reversible Residual Impacts and in the local context* on birds.

8.7.7 Aquatic Ecology

The residual impacts on aquatic ecology resulting from Croaghaun wind farm development are summarised in Table 8-78.

The layout and design of the proposed Croaghaun wind farm has taken the aquatic ecology of the existing environment into consideration. Provided all mitigation measures are implemented in full, no significant residual impacts on the local aquatic ecology or Slaney River Valley SAC (000781) are expected from the development. Overall, the proposed Croaghaun wind farm development will have a *slight to significant negative, short-term impact* on sensitive aquatic receptors, namely fisheries, floating river vegetation and invertebrates.

However, this would be elevated to *very significant negative, permanent and at the national scale* should impacts to downstream Freshwater Pearl Mussel occur, in the absence of mitigation. With regards to White-clawed Crayfish, the introduction of Crayfish plague would result in a *long-term to permanent significant impact in context of the Barrow catchment*, in the absence of mitigation.

By implementing the mitigation measures outlined in Section 8.6, the CEMP and Chapter 10 – Hydrology and Water Quality, impacts to water-dependent species and habitats are considered to be *non-significant, short-term and in the local context* (i.e. sub-catchment scale).

Table 8-78: Residual Impacts for aquatic ecology

Activity	Nearest downstream connecting watercourse(s) (direct distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impact	Potential impact significance
Tree felling	Clashavey River (0.29km); Kilbrannish South Stream (0.27km); unnamed Kilbrannish South Stream tributary (0.26km); Kilbrannish North Stream (0.3km); unnamed Kilbrannish North Stream tributary (0.41km)	Salmonids, European Eel, Lamprey species, Freshwater Pearl Mussel, floating river vegetation	Sedimentation of spawning substrata; mortality of aquatic invertebrates, Freshwater Pearl Mussel and fish eggs; eutrophication and impacts to floating river vegetation communities, Freshwater Pearl Mussel, fish and invertebrates	*All aquatic habitats and species:* **Reversible, non-significant, short-term and in the local context**
Turbine base and met mast construction	Clashavey River (0.29km); Kilbrannish South Stream (0.27km); unnamed Kilbrannish South Stream tributary (0.26km); Kilbrannish North Stream (0.3km); unnamed Kilbrannish North Stream tributary (0.41km); **met mast:** Kilbrannish South Stream (0.56km)	Salmonids, European Eel, Lamprey species, Freshwater Pearl Mussel, floating river vegetation	Release of alkaline fines, hydrocarbons etc	*All aquatic habitats and species:* **Reversible, non-significant, short-term and in the local context**
Turbine delivery route	Kilbrannish North Stream (0km, at turbine delivery work location no. 43bridge crossing);	Salmonids, European Eel, Lamprey species, floating river vegetation	Sedimentation of spawning substrata; mortality of aquatic invertebrates, Freshwater Pearl Mussel and fish eggs; construction compounds (e.g. concrete) and hydrocarbon spillage causing habitat degradation and/or mortality of aquatic species	*All aquatic habitats and species:* **Reversible, non-significant, short-term and in the local context**

Activity	Nearest downstream connecting watercourse(s) (direct distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impact	Potential impact significance
	River Clody (>0.075km, at turbine delivery work location nos. 29 and 30)			
Site drainage	Clashavey River (0.02km); Aclare Stream (0.06km); (Kilbrannish South Stream (0.25km); unnamed Kilbrannish South Stream tributary (0.23km); Kilbrannish North Stream (0.025km); unnamed Kilbrannish North Stream tributary (0.105km)	Salmonids, European Eel, Lamprey species, floating river vegetation	Increase in flow rates (surface water run-off); impacts to migratory slow-swimming fish species (e.g. European Eel); changes to rates of erosion and deposition; impacts to floating river vegetation habitat; impacts to fish spawning substrata	*All aquatic habitats and species:* **Reversible, non-significant, short-term and in the local context**
Borrow pit construction	Clashavey River (0.18km)	Salmonids, European Eel, Lamprey species, floating river vegetation	Sedimentation of spawning substrata; mortality of aquatic invertebrates and fish eggs; eutrophication and impacts to floating river vegetation communities, fish and invertebrates; hydrocarbon spillage and mortality of downstream aquatic species	*All aquatic habitats and species:* **Reversible, non-significant, short-term and in the local context**
Grid route installation and HDD	Refer to **Table 5.3** for exact locations	Salmonids, European Eel, Lamprey species, floating river vegetation, otter, floating river vegetation, white clawed Crayfish, Freshwater Pearl Mussel	Sedimentation of spawning substrata and floating river vegetation; mortality of White-clawed Crayfish and aquatic invertebrates, Freshwater Pearl Mussel and fish eggs; construction material contamination and or hydrocarbon spillage causing mortality of downstream aquatic species	*All aquatic habitats and species:* **Reversible, non-significant, short-term and in the local context**

8.7.8 Other Species

Residual effects are assessed as Imperceptible Reversible Residual Impacts and in the local context.

8.7.9 Overall residual impact

With the implementation of the detailed mitigation measures (outlined in the Natura Impact Statement, Chapter 8 Biodiversity, Chapter 9 Lands, Soils and Geology, Chapter 10 Hydrology and Water Quality and the CEMP) there will be no significant residual impacts from the main wind farm site, turbine delivery route and grid connection on biodiversity.

8.8 Bibliography for Ecology

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