STATKRAFT

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED DERNACART WIND FARM, COUNTY LAOIS

VOLUME 2 – MAIN EIAR

CHAPTER 12 – BIODIVERSITY

DECEMBER 2019

Statkraft

FEHILY TIMONEY
30 YEARS

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12 BIODIVERSITY

12.1 Introduction

The ecological appraisal for the project was carried out by Fehily Timoney & Company (FT) between July and November 2019. A series of ecological surveys were carried out at the site of the turbines and onsite substation and the route of the underground cable connecting the onsite substation to the national grid at the proposed Bracklone Sub-station east of Portarlington in Co. Laois. Including habitat and botanical surveys, bird surveys, and mammal (including bats) surveys. Ecofact Environmental Consultants Ltd. carried out an evaluation of the impact of the proposed development on aquatic habitats, aquatic ecological communities, and individual aquatic species. Bird surveys covering the study area were carried out during summer 2018, winter 2018/19 and summer 2019 by Natural Power Consultants. Bat surveys covering the study area were also carried out over the 2018 and 2019 activity season by Natural Power Consultants. An inspection of Kilnahown Bridge (along proposed cable route) was carried out by Caroline Shiel (licensed bat specialist) in September 2019.

The potential impact to ecology for the replant lands is considered in Appendix 4.3. Based on the results of these various 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:

- Undertake a desktop review of available ecological data for both the receiving environment and greater area, including a review of designated sites within 15 km of the project;
- Undertake ecological field surveys of the receiving environment including, where required, the proposed Dernacart Wind Farm Development, turbine delivery routes and grid connection routes;
- Identify flora and fauna present within the footprint of all elements of the project;
- 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 Dernacart Wind Farm Development, turbine delivery route and grid connection route;
- Consider measures to mitigate the potential negative impact(s) of the project on the ecology of the receiving environment.

12.1.1 Study Area

The proposed Dernacart Wind Farm study area is located within the townlands of Dernacart, Forest Upper, and Forest Lower County Laois. The proposed cable route will travel through the townlands of Forest Lower, Coolnavarnoge/Coolaghy, Kilbride, Dologh, Ballymorris, Cooltederry and Bracklone County Laois, and Barranaghs, Garryhinch, and Annamoe Co. Offaly. The planning boundary is a smaller area within the study area site which surrounds the wind farm infrastructure.

Please Note:

Study Area refers to the areas corresponding to landowner boundaries throughout which ecological surveys that were undertaken

Wind Farm Site or **Proposed Development Site** refers to the planning boundary for the proposed Dernacart Wind Farm

See Figure 12-1

As set out in the Turbine Delivery Route Assessment presented in Appendix 10.2; there will be mainly minor works required along the Turbine Delivery Route. Works will mainly include additions of hardcore, removal of signs, poles and street furniture and removal or trimming of hedges/vegetation. The study area is relatively flat, with elevations between 70- 80m above OD.

The study area drains to a number of small tributaries of the River Barrow, which flows in a south easterly direction to the south-west of the site, before turning east and then north east to flow towards Portarlington. All of these streams are canalised to some degree, running along field boundaries, cutover bog edges, and forestry plantation blocks, and the lack of steep slopes results in low flow rates. In addition, the streams are heavily vegetated, particularly in the southern parts of the site.

The stream network draining the study area is as follows: Dernacart Stream flows in a north-westerly direction along the northern boundary of the study area, before joining the Garrymore 14, which joins the Barrow c. 1.1 km downstream of the study area. There is no overlap between Dernacart stream and site infrastructure or the planning boundary. The Forest Upper stream has been canalised along its upper reaches, where it runs north-south along the western edge of Garryinch Bog (outside wind farm site). The watercourse then enters the planning boundary, passing under an existing access track and flowing southwest to join the Barrow, c. 1.2 km downstream of this crossing point. A tributary flowing within the study area joins the main channel before it exits the site. Part of this tributary lies within the wind farm site and felling buffer around turbine T3.

The White Hill (E) Stream is mapped as rising in coniferous forestry plantation within the study area, flowing south-west and then south-east towards the Barrow after leaving the study area. The channel was not observed to carry any water along its upper reaches but did contain water in its lower reaches. A tributary channel running along a southern section of the site boundary joins the stream before it enters the Barrow, and the main channel then flows along the southern tip of the study area boundary before entering the Barrow c. 435m downstream of this area. There is no overlap between the wind farm site and this watercourse.

The White Hill (W) Stream is mapped as rising in birch woodland within the study area, however this section of the channel did not contain water during the site visit. From here, the stream flows south and then east between and around conifer blocks, entering the wind farm site and proposed felling area around turbine T8. The stream then continues east before turning south to flow along the eastern study area boundary, where it is joined by and un-named tributary. The stream then leaves the study area, flowing south-east before entering the Barrow c. 2.4 km downstream of the planning boundary (wind farm site).

The Cottoner's Brook stream runs north-south along the eastern boundary of the wind farm site, before turning south-east towards the Barrow, which it enters c. 2 km downstream of the site after being joined by a number of tributaries including the Forest Lower and Barranaghs streams. The stream runs adjacent to a section of proposed access track for c. 215m, and adjacent to the proposed grid connection route for c. 195m; both of these sections run along an existing forestry track.

The River Barrow continues south as the main arterial river, joining the River Nore in New Ross and the River Suir in Waterford where it flows out into Waterford Harbour.

The Dernacart Wind Farm site, including the cable route, is located between the towns and villages of Mountmellick, Rosenallis, and Portarlington in Co. Laois, and Clonygowan, Geashill and Killeigh in Co. Offaly, as shown in Figure 1-1 in Chapter 1. The cable route runs west from Dernacart to connect to the proposed substation located at Bracklone in the eastern suburbs of Portarlington. The TDR and cable route will cross streams along the route and the exact location of these crossings, is detailed in Chapter 14, Sections 14.3.6 and 14.3.7.

The Geological Survey of Ireland (GSI) website (www.gsi.ie) provides information on subsoils and the underlying aquifer for the site. The soil on the proposed Dernacart Wind Farm site is mainly peat, with areas of Fine loamy drift with limestones and River alluvium fringing the site to the west and south.

The aquifer varies from low to high vulnerability, as shown in Figure 13-7 in Chapter 13 Land, Soils & Geology, being mostly 'Moderate' at the locations of the proposed infrastructure.

As discussed above, the in-stream distance via hydrological links between the proposed Dernacart Wind Farm and the River Barrow is 1.2km.

The proposed grid connection route also crosses the Barrow (via the existing Kilnahown Bridge), which is part of the River Barrow and River Nore Special Area of Conservation (SAC) (Site Code 002162). This environmentally designated area is discussed further in the Natura Impact Statement (see Appendix 12.1). The River Barrow is classified as a nutrient sensitive river.

There are no other sites which are designated for environmental protection within 15km downstream which would be categorised as sensitive receptors with hydrological links to the proposed development site. The landscape of the study area is rural in nature, but also within 1 km of the town of Mountmellick, Co. Laois. The wind farm development land is currently used for commercial coniferous forestry and farming of agricultural land. The grid connection route is located along existing public roads and tracks. The land use classifications for the study area as defined by the 2018 CORINE landcover dataset, are [231] Pastures, [312] Coniferous forest, [211] Non-irrigated arable land and [412] Peat bogs.

Dernacart Wind Farm development is situated within two WFD sub-catchments (Barrow SC_10 and Barrow SC_30). The wind farm portion of the development drains to the following waterbodies:

- Barrow_030
- Barrow_040
- Barrow_050
- Cottoner's Brook_010

The grid connection route traverses the following additional waterbodies:

- Barrow_060
- Clonygowan_010

12.1.2 Grid Cable Route

The proposed cable route will travel through the townlands of Forest Lower, Coolnavarnoge/Coolaghy, Kilbride, Dologh, Ballymorris, Cooltederry and Bracklone County Laois, and Barranaghs, Garryhinch, and Annamoe Co. Offaly.

The proposed cable route from the wind farm to the proposed grid connection is shown on Figure 4-2 The grid connection is proposed to connect to the proposed [gas-insulated, housed] future proposed Bracklone Sub-station and crosses 8 watercourses. The 8th crossing (Kilnahown Bridge over the Barrow) is spanned by a large Bridge. Of the remaining 7 crossings, 3 are culverted with concrete pipes, while the remainder are spanned by small bridges/stone culverts. There are no repairs or replacements required to structures where cabling is required along the route to the future proposed Bracklone Sub-station.

12.1.3 Turbine Delivery Route

Turbine deliveries are likely to be from Dublin Port to the M6, where the turbine components will travel to Junction 5. At Junction 5 of the M6, the turbine component deliveries will exit the motorway and travel along the N52 traveling through the Ardan, Cappincur, Cloncollig and Clonminch roundabouts. At the Clonminch roundabout, the deliveries will travel along the N80 through Killeigh to the site entrance at Dernacart. This final TDR will be determined in consultation with the local authority.

At Node 7, oversail of adjacent lands will be required and these lands are contained within the red line planning boundary. These adjacent lands at Node 7 are required for the turbine delivery truck to turn onto the local road where the site entrance is located. These lands are contained within the red line planning boundary.

A number of watercourse crossings were identified from mapping along the turbine delivery route from the M6, down along the N52 to Tullamore and on to the R420, through Geashill as follows:

- Structure carrying the N52 over a tributary of the River Brosna in Co. Westmeath
- Structure carrying the N52 over a tributary of the River Brosna at the boundary of Co. Westmeath and Co. Offaly

- Structure carrying the N52 over a tributary of the River Brosna at Ballybought in Co. Offaly
- Structure carrying the N52 over a tributary of the Silver River to the south of Durrow Abbey in Co. Offaly
- Gormagh Bridge carrying the N52 over the Silver River to the south of Durrow Abbey in Co. Offaly
- Structure carrying the N52 over a tributary of the Tullamore River at Puttaghan in Co. Offaly
- Bridge carrying the N52 over the Grand Canal at Bogtown in Co. Offaly
- Bridge carrying the N52 over the Tullamore River in Co. Offaly
- Bridge carrying the N80 over the Killeigh Stream at the western edge of Killeigh Village in Co. Offaly
- Structure carrying the N80 over the Cappanlug River Approaching the proposed site entrance in Co. Laois
- Structure carrying the N80 over the Garrymore 14 River Approaching the proposed site entrance in Co. Laois
- Structure carrying the N80 over an un-named tributary of the Dernacart South River Approaching the proposed site entrance in Co. Laois

No modifications to existing stream crossings were identified to be required in the Delivery Route Selection and Assessment Report (TDR Report) at these stream crossings. Modifications along the TDR in other sections involve the removal of street furniture and removal of some vegetation in addition to construction of temporary tracks through grassed roundabout islands.

Works at Nodes 1-4 require tracks through grassed roundabout islands (GA2) and street furniture removal. Node 5 requires an area of load bearing at the edge of Clonminch Roundabout and street furniture removal. Hedge trimming to reduce the level of the southern hedgerow to 1m above road level is required at Node 6 at Moneyquid along the N80. The turning area near the site entrance (Node 7) requires scrub clearance and placement of load bearing surface on agricultural grassland.

12.1.4 Replant Land

As compensation for felling as part of the proposed Dernacart Wind Farm development, 23.99ha of replant lands will be provided at Carrigthomas, Macroom, Co. Cork. These lands have previously received technical approval for afforestation.

Replanting will be undertaken using best practice in accordance with the Forestry and Water Quality Guidelines and the Forestry and Archaeological Guidelines.

The replanting impact assessment which considers potential impacts on ecology and designated sites is included in Appendix 4.4.

12.2 Methodology

12.2.1 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 (July 2017) '*Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)*' (2003), reference was also made to the draft (2015) guidelines and '*Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment*' (DoECLG, 2013).

Additional guidance available from the EU such as '*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 all published by the Chartered Institute of Ecology and Environmental Management (CIEEM).

The Heritage Council publication '*Best Practice Guidance for Habitat Survey & 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)*. '*Recommended Bird Survey Methods to inform Impact Assessment of Onshore Wind farms (2014)*','*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 Laois County Council (LCC) such as the '*Laois County Development Plan: 2014-2020*', the '*Biodiversity Action Strategy for Laois'* (June 2005) and '*County Laois The State of the Wild 2007'* 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* (2nd 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 (2nd Edition)* (Carlin, 2012);
- *Guidelines for the Treatment of Bats during the Construction of National Road Schemes* (NRA, 2006b);
- *Bat survey – specific requirements for wind farm proposals* (NIA, 2011);
- *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).

12.2.2 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.

It will be necessary to get written permission from Inland Fisheries Ireland to proceed with the works in any areas where disturbance to the spawning and nursery areas of both salmonids and lampreys will occur as a result of the proposed development. Salmon, all lamprey species and their habitats are further protected under the EU Habitats Directive, 1992.

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.

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.

12.2.3 Consultation

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

- NPWS
- The Development Application Unit (DAU)
- IFI
- Birdwatch Ireland
- Bat Conservation Ireland
- The EPA
- An Taisce
- Irish Peatland Conservation Council
- Irish Raptor Study Group
- Irish Red Grouse Association
- Irish Wildlife Trust

Responses

DAU/NPWS

The following statement was issued on 22nd November 2019 by the DAU: "The Department is not in a position to make specific Nature Conservation comment on this particular referral at this time. No inference should be drawn from this that the Department is satisfied or otherwise with the proposed activity. The Department may submit observations/recommendations at a later stage in the process".

IFI

A consultation response letter from Inland Fisheries Ireland (IFI), dated 18th of July 2019 was received. The letter outlined specific concerns relating to water quality, fisheries and protected aquatic species, and also detailed surveys, assessments and mitigation measures required. These measures have been including in the mitigation measure for the proposed project in section 12.6.

The letter is included in Appendix 1 of the Accompanying Aquatic report included in Appendix 12.6 of this document, and also in Appendix 5.2.

Birdwatch Ireland

Outlined a number of concerns and requested that an NIS examining potential impacts to nearby European sites be produced and also that an EIAR assessing potential impacts to the local environment including flora and fauna be completed. Particular comments were made in relation to the requirement to assess potential impacts to Annex I raptors and annex IV bird species, as well as red and amber-listed species in the area.

It was noted that bird species known to be sensitive to wind energy developments occur in the area and that collision risk modelling (CRM) should be carried out using data obtained during flight activity surveys in order to assess potential risks to these species. The response also asked that cognisance be paid to the water framework directive (WFD) as relevant to the proposed site, and to the flora protection order (FPO) (2015).

The consultation response letter dated 12th July 2019 is included in Appendix 5.2.

Other Consultees

No responses were forthcoming from the remainder of consultees in relation to Biodiversity.

12.2.4 Desktop study

12.2.4.1 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)[1] and Special Protection Areas for birds (SPAs) were identified as part of this ecological assessment using the Map Viewer at www.npws.ie. These designated sites are described in Section 12.2.4.1. A separate Natura Impact Statement (NIS) was prepared to evaluate the potential impact to European sites as a result of the proposed development.

12.2.4.2 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 29th July 2019).

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;
- National Parks and Wildlife Service (NPWS);
- National Biodiversity Data Centre (NBDC)
- The Ireland Red List No. 10: Vascular Plants (Wyse *et al.*, 2016);
- Teagasc Soil area maps;
- Bat Conservation Ireland (BCI); records obtained by request from Bat Conservation Ireland on 20th September 2019.
- Geological Survey Ireland (GSI) area maps;

[1] 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.

- Environmental Protection Agency (EPA) water quality data;
- Inland Fisheries Ireland; and
- South Eastern River Basin District (SERBD) datasets (Water Framework Directive).

12.2.5 Field study

12.2.5.1 Habitats

The habitats within the study area encompassing the proposed development and along the footprint of the proposed grid connection route were identified and classified, according to *'A Guide to Habitats in Ireland'* (Fossitt, 2000), during walkover and quadrat surveys of the wind farm development site carried out between 16th July – 15th August 2019. 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 & 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 12-9 below).

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 the cutover bog and bog woodland 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 quadrat was recorded.
- Each quadrat was 2 m x 2 m in size.
- The diversity and abundance/cover of the vegetation present was noted at each quadrat. Cover was recorded using the DOMIN scale.
- Unknown species were collected using specimen bags that were clearly labelled with the date, quadrat code and site name.
- Digital photographs were taken of each monitoring stop to record the vegetation.

12.2.5.2 Mammals

A targeted mammal survey was carried out within the study area in November 2019 as there are records of badger, red squirrel, pygmy shrew, Irish hare, Irish stoat, pine marten, hedgehog and otter in the greater study area.

Surveys were undertaken within a 150m buffer of turbines/felling areas within the site and within a 50m buffer from access roads. These areas were walked by experienced ecologists and searched for potential signs of mammals. As well as direct observations of mammal features such as tracks, trails, fur, droppings and shelter (setts, dreys and holts) were also recorded using GPS. Mammal observations or signs recorded during other ecological surveys conducted at the site between 2012 and 2017 were also noted.

Mammal surveys were carried out in accordance with *Ecological surveying techniques for protected flora and fauna during the planning of National Road Schemes – Version 2* (NRA 2008).

The banks of watercourses were surveyed to a distance of 150m both upstream and downstream of stream crossing points and areas where infrastructure/felling areas abut watercourses within the wind farm site to check for otter breeding sites or resting places. In addition, watercourse crossings on the proposed cable route and Grid Connection route were surveyed for evidence of otter and suitable holt habitat. Otter surveys also followed the methodology outlined in *Ecological surveying techniques for protected flora and fauna during the planning of National Road Schemes – Version 2* (NRA 2008).

Trail cameras were deployed within the study area during habitat/general ecology surveys between 16th July – 15th August 2019, and during the targeted mammal survey between 12th- 13th November 2019 (see Figure 12-1 for trail camera locations).

The conservation status of mammals within Ireland and Europe is assessed using one or more of the following documents; Wildlife Acts (1976 - 2010), the Red List of Terrestrial Mammals (Marnell *et al*., 2009) and NPWS (2013a and 2019b) *The Status of EU Protected Habitats and Species in Ireland*.

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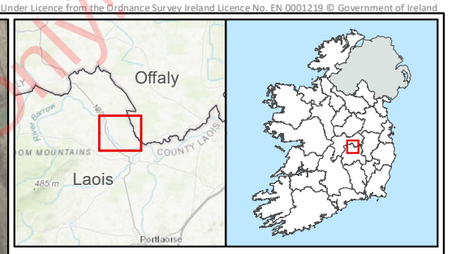

- Trail Cameras
- Proposed Turbines
- Proposed Planning Boundary
- Study Area Boundary
- Proposed Cable Route
- Proposed Turbine Hardstanding Areas
- Proposed Substation
- Proposed Temporary Compound

Proposed Access Tracks

- Existing Track to be Upgraded
- New Track

N W E S

0 0.25 0.5 1 Kilometers

TITLE:	Trail Camera Locations		
PROJECT:	Dernacart Wind Farm		
FIGURE NO:	12.1		
CLIENT:	Statkraft		
SCALE:	1:15000	**REVISION:**	0
DATE:	30/01/2020	**PAGE SIZE:**	A3

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12.2.5.3 Bats

Two years of bat surveys have been completed by Natural Power Consultants within the study area during the years 2018 and 2019. The surveys encompassed habitat and preliminary roost assessments, emergence surveys, activity surveys (transects) and static detector surveys. The methodologies for surveys undertaken within the wind farm study area described here are extracted from the 2018 and 2019 bat reports produced by Natural Power (Appendices 12.2 and 12.3).

It should be noted that due to proposed wind farm layout changes and the introduction of new guidance regarding static detector requirements for onshore wind farm developments (SNH, 2019), the locations of static detectors and methodology for static detector surveys changed between 2018 and 2019. Static detector surveys in 2018 followed the recommended guidance *Bats and Onshore Wind Turbines – Interim Guidance* (2nd Edition) (Carlin, 2012) which was current at the time these surveys were carried out. The 2018 bat report is included in Appendix 12.2; the 2019 bat report is included in Appendix 12.3.

FT ecologists carried out an assessment of bat roosting potential of bridge/culvert structures along the proposed cable route in August 2019. An inspection of Kilnahown Bridge which spans the River Barrow and is within the proposed grid connection cable corridor was undertaken by Caroline Shiel, licensed bat specialist in September 2019.

Proposed Grid Route

FT ecologists carried out an assessment of structures spanning watercourses along the proposed cable route on 14th August 2019 to investigate their potential to host roosting bats. Potential roosting features such as cracks and crevices, gaps in stonework and thick growths of mature ivy were searched for.

A thorough inspection (daytime torch survey) of Kilnahown Bridge was carried out by Caroline Shiel (licensed bat specialist) on 28th September 2019. Weather conditions were not suitable for a bat detector survey.

All accessible/visible masonry was searched for potential roosting features such as cracks and crevices, 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).

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 on the 12th July 2018. 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 2018 Bat Survey Report included in Appendix 12.2.

Preliminary Roost Assessment

A preliminary roost assessment was undertaken on 12th July 2018 to establish the presence of potential bat roosts within 200m of the developable area. All potential roost structures and trees identified were examined in more detail to assess their potential to support roosting bats (in accordance with Collins, 2016 as detailed in the accompanying 2018 Bat Survey Report).

A detailed internal and external inspection of all structures 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 categorized using definitions in Collins (2016).

Trees were inspected from ground-level during daylight for signs of potential bat roost features including rot holes, cracks and splits, trunk cavities and dense ivy growth. Survey methods followed the guidelines and techniques recommended in Andrew (2013) and Collins (2016).

Binoculars were used as required to obtain a better view of potential roost features. Trees were assessed as having either 'high', 'medium', 'low' or 'negligible' potential to support roosting bats and categorized using definitions in Collins (2016). Any potential roost sites identified during the preliminary roost assessment were subject to further survey work, as detailed below.

Dusk Emergence Survey

A dusk emergence survey was undertaken on 11th September 2018 of a potential roost site within the study area (c. 600m south of T3). Equipped with a Peersonic full spectrum bat detector, the surveyor was situated at a strategic point outside the building. The survey was conducted in suitable weather conditions: dry, 20°C and light wind. All bats seen and heard between 19:38 and 21:08 (sunset 19:53) were recorded. Species identification was made in the field. Other information recorded includes time of bat contact, location and behaviour.

Transect Surveys

Two transect routes were surveyed alternatively once per month between May and September 2018 (inclusive) in accordance with the best practice guidelines (Collins, 2016). As such a total of 5 activity surveys were completed during the activity season. The transects covered the proposed turbine areas as of 2018 and encompassed all the main habitats present within the site including coniferous plantation, coniferous plantation edge, improved grassland, edge of cutover bog and edge of broadleaved woodland. 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 and bats were recorded in real time by a minimum of two surveyors. Surveyors were equipped with a Peersonic full spectrum bat detector and Batbox Duet detector. Surveyors stopped regularly in areas of particularly suitable bat foraging and commuting habitat. Species identification was made in the field. Other information recorded included time of bat contact, location and behaviour.

The details of the 2018 activity survey are included below in Table 12-1. SeeFigure 12-2 for transect routes.

Hibernation Roost Survey

A hibernation roost survey was conducted at two buildings (B1 and B2 as detailed in the accompanying 2019 bat report) considered to have low potential to support hibernating bats. On the 15th January 2019, a detailed inspection of B1 and B2 was carried out from ground-level. All cracks, crevices and voids were closely and systematically inspected for hibernating bats and field signs, including bat droppings and oil staining.

Automated static bat activity surveys are recommended for all structures with a moderate to high potential to support hibernating bats for a minimum of two weeks per month from December to February (inclusive) (Collins, 2016). As B1 and B2 were both considered to have low potential to support hibernating bats it was determined that a single survey of two weeks using static bat detectors (SM2BAT detectors) was adequate to detect winter bat activity. This survey was conducted between 30th January and 15th February 2019.

Table 12-1: Bat Activity Survey Details 2018

Date	Sunset	Start/Finish	Total Survey Time	Weather Conditions
31/05/2018	21.43	21.15-23.15	02.00	16°C, dry, F1, 2/8
26/06/2018	22.00	21.30-23.15	01.45	24°C, dry, F0, 0/8
24/07/2018	21.35	21.05-23.30	02.25	18°C, dry, F2, 4/8
21/08/2018	20.46	20.30-22.45	02.15	20°C, dry, F1, 3/8
25/09/2018	19.32	19.15-21.00	01.45	16°C, dry, F2, 4/8

Static Detector Surveys (2018)

Anabat Express bat detectors (automated static recording detectors) were deployed at 6 locations within the site, for a minimum of 10 nights each per month between June and September 2018 (inclusive) following methods described in Collins (2016). Locations covered the proposed turbine layout and encompassed a variety of habitat features within the site including coniferous plantation, coniferous plantation edge, open grassland, edge of cutover bog and edge of broadleaved woodland, (refer to Figure 12-12-2). Detectors were programmed to commence recording from at least 60 minutes before sunset until at least 60 minutes after sunrise. Survey details are provided in Table 12-2 and Table 12-3 below.

Table 12-2: Location and total deployment time for static detectors in 2018

Location	Irish Grid Ref.	Habitat	Total Recording Time (hhh.mm)
1	N 44364 09575	Deciduous tree-line within improved grassland	363.45
2	N 44318 10552	Edge of conifer plantation bordering improved grassland	368.18
3	N 43652 11338	Edge of cutover bog bordering a drainage ditch and 50m from the edge of coniferous plantation	408.57
4	N 44150 11403	Edge of cutover bog, next to scrub	408.57
5	N 45370 11494	Within conifer plantation	268.3
6	N 43786 10589	Edge of conifer plantation facing a tree-lined lane	137.3

Table 12-3: Static detector deployment summary (2018 survey)

Month	Location	Dates	Total No. Nights	Total time (hhh.mm)
June	1, 2 & 3 4 5	26th June – 6th July 2018 26th – 5th July 2018* 26th – 28th July 2018*	46	421.08
July	1, 3 & 5 2 & 3	11th June–19th July 2018* 11th June – 21st July 2018	49	471.17
August	1, 2, 3 & 4 5	30th July–9th August 2018 30th July–7th August 2018*	53	561.27
September	1, 2, 3, 5 & 6	10th September – 17th September	40	608.15

** recorded less than 10 nights*

Static Detector Surveys (2019)

Static bat activity surveys were undertaken in accordance with SNH (2019) guidelines. A total of eight full spectrum SM4BAT detectors were deployed as close as possible to the eight proposed turbine locations (shown on figure Figure 12-3). The detectors were deployed for a total of ten consecutive nights during the summer season (June – mid-August) and autumn season (mid-August – October). The detectors were programmed to commence recording 30 mins before sunset until 30 minutes after sunrise.

Details of the surveys including detector locations, surrounding habitats and deployment dates are given in Table 12-4 and Table 12-5 below. Weather data is provided in Table 1-1, Appendix A of the accompanying Bat Survey Report included in Appendix 12.3.

Table 12-4: Location and corresponding habitats of static detectors in 2019

Location	Turbine	Irish Grid Ref.	Habitat
1	1	N 43167 12257	Within coniferous plantation
2	2	N 43284 11617	Sparse hedgerow bordering improved grassland
3	3	N 43511 11414	Along edge of vegetated drain. Microphone facing towards cut-over bog
4	4	N 44278 11276	Within coniferous plantation
5	5	N 44801 11241	Within coniferous plantation
6	6	N 45356 11453	Within coniferous plantation
7	7	N 44477 10854	Edge of conifer plantation, microphone angled towards adjacent pastoral field
8	8	N 44159 10376	Near edge of conifer plantation

Table 12-5: Detector deployment summary 2019

Season	Dates	Total nights per detector	Average no. of hours (recorded) per detector (hhh.mm)	Total recording time (hhh.mm)
Summer	6th-15th August 2019	10	97.50	774.36
Autumn	11th-22nd September 2019	12	134.43	1,077.37

Bat Survey Analysis (2018)

All recordings during static and transect surveys were made in full spectrum, retaining all amplitude and harmonic information from the original bat call for subsequent analysis. Recordings were analysed using bat call analysis software (Analook, Titley Scientific). All files were split to a maximum duration of 15 seconds and were reviewed manually, using established call parameters, to identify individual bat species. However, accurate identification to species level within the genus Myotis from echolocation alone is imprecise, therefore, all records were identified as '*Myotis* sp.'. In addition, calls with peak frequencies between 50 – 52 kHz were not identified to species level and were recorded as '*Pipistrellus* sp.'

A bat pass was defined as a sequence of bat pulses captured on a 15 second Anabat sound file. One sound file was counted as one bat record. Different species within the same 15 second sound file were counted as different bat records.

An individual bat can pass a particular feature on several occasions while foraging. It is therefore not possible to estimate the number of individual bats. In accordance with best practice guidance (Collins, 2016) an activity index is used; calculated from bat records per hour or per night which allows analysis of bat activity to estimate abundance and/or activity. The calculation is as follows:

BAI (Bat Activity Index) = Total number of bat records / number of hours of recording.

This calculation cannot be used to compare different sites but is a means of identifying the most active bat areas within habitats in one site boundary to identify where activity is concentrated.

Bat Survey Analysis (2019)

All recordings were made in full spectrum, retaining all amplitude and harmonic information from the original bat call for subsequent analysis. Bat calls were analysed using Kaleidoscope Pro Software. All files were split to a maximum duration of 15 seconds and automatically identified to species level, or genus level as appropriate, using auto-ID bat classifiers. The species identification of a randomly generated 10% sample of the files were manually checked for quality assurance.

The data was then entered into the Ecobat analysis tool and a report was generated. Ecobat is an online tool which makes assessments of bat activity levels by comparing data entered by the user with a national reference dataset, allowing objective quantification of bat activity levels.

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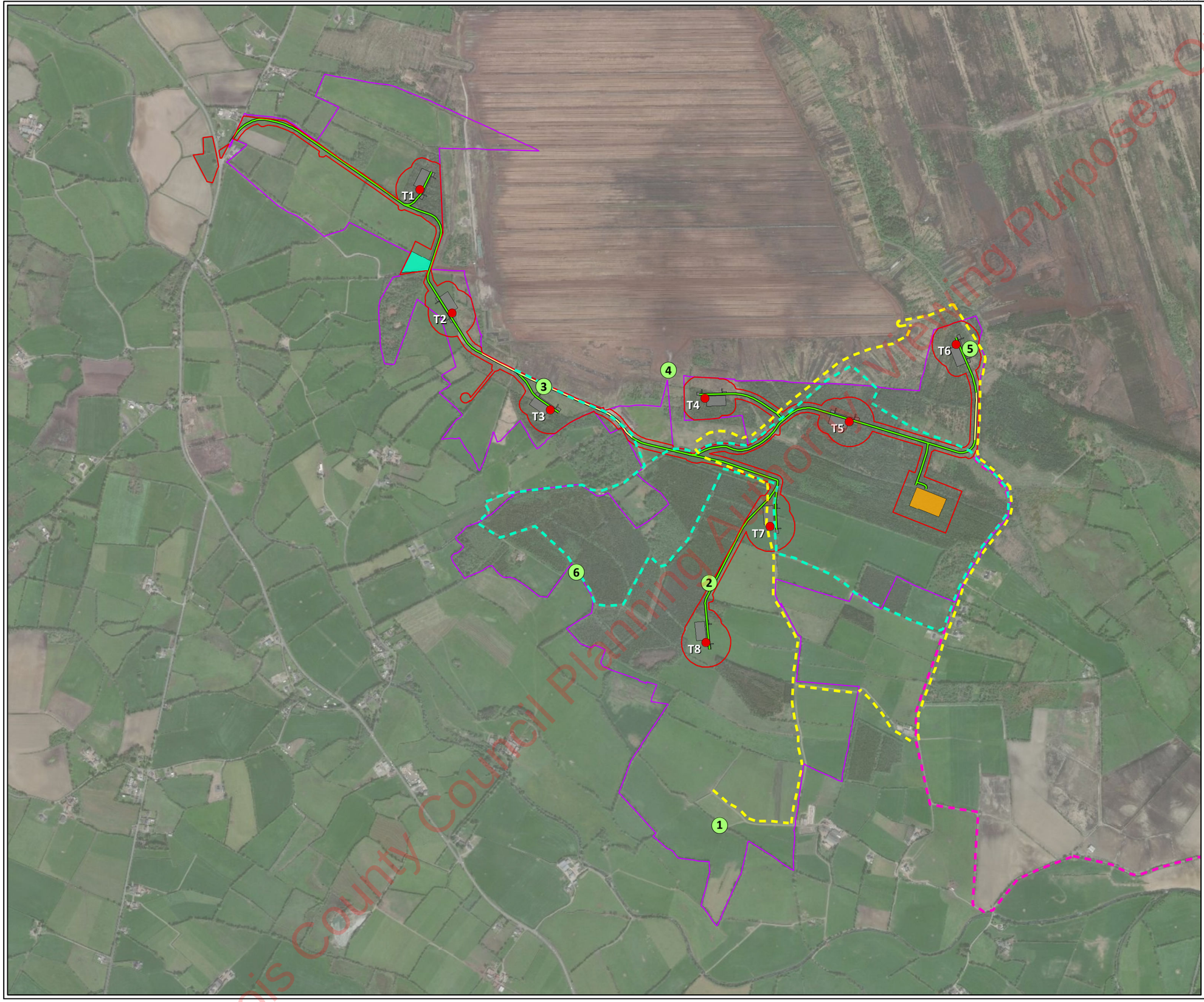

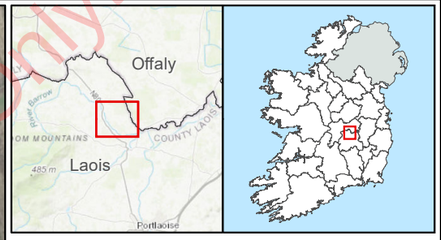

- Static Detector Locations
- Proposed Turbines
- Proposed Planning Boundary
- Study Area Boundary
- Proposed Cable Route
- Proposed Turbine Hardstanding Areas
- Proposed Substation
- Proposed Temporary Compound

Bat Survey Transects

- Transect 1
- Transect 2

Proposed Access Tracks

- Existing Track to be Upgraded
- New Track

N W E S

0 0.25 0.5 1 Kilometers

TITLE:	Bat Survey Transects and Static Detector Locations 2018		
PROJECT:	Dernacart Wind Farm		
FIGURE NO:	12.2		
CLIENT:	Statkraft		
SCALE:	1:15000	**REVISION:**	0
DATE:	30/01/2020	**PAGE SIZE:**	A3

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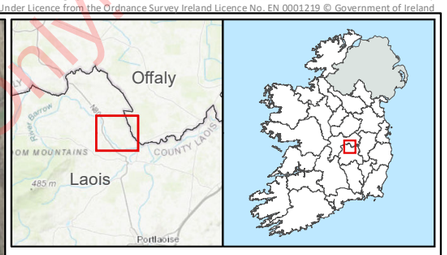

- Static Detector Locations
- Proposed Turbines
- Proposed Planning Boundary
- Study Area Boundary
- Proposed Cable Route
- Proposed Turbine Hardstanding Areas
- Proposed Substation
- Proposed Temporary Compound

Proposed Access Tracks

- Existing Track to be Upgraded
- New Track

N W E S

0 0.25 0.5 1 Kilometers

TITLE: Static Detector Locations 2019			
PROJECT: Dernacart Wind Farm			
FIGURE NO:	12.3		
CLIENT:	Statkraft		
SCALE:	1:15000	**REVISION:**	0
DATE:	30/01/2020	**PAGE SIZE:**	A3

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12.2.5.4 Avifauna

Target Species

The following criteria has been utilised to select target species for the current study. Scottish Natural Heritage (SNH) guidance (SNH, 2014 & 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 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, 2014 & 2017). Target species identified during avifauna surveys can be found in Table 12-7 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 on 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.

The primary target species for these surveys were; all raptors and owls, (excepting buzzard), and all wild goose, swan and duck species, (excepting Canada goose, mallard, and all wader species).

Overview of methods current surveys

All surveys were developed as per Scottish Natural Heritage (SNH) guidance (SNH, 2014 & 2017). Winter season surveys were carried out from October 2018 to March 2019 inclusive. The main components were a winter wader census walkover survey, Hen Harrier winter roost checks and a flight activity survey. Breeding season surveys were carried out from April 2018 to September 2018 and again from April 2019 to September 2019. The main components were a moorland breeding bird survey (an adapted Brown & Shephard survey as detailed in Gilbert *et al.,* 1998), a Countryside Bird Survey (CBS) and breeding wader surveys following established guidance (Bibby *et al*., 2000). A total of 36 hours per VP was undertaken for each of the three separate seasons of flight activity surveys. All surveys were carried out by competent field ornithologists.

Flight Activity Surveys

Flight activity surveys, based on observations of flight activity at pre-defined height bands (selected to match predicted rotor envelopes) were collated and used to establish a number of key metrics such as (Band *et al*., 2007):

1. The time each target species spends flying over a defined survey area
2. The relative use of different parts of the survey area by each target species
3. The proportion of flying time each target species spends at turbine rotor height.

The study area for this survey was the 500 m buffer around the proposed turbines located at the townlands of Barranaghs, Dernacart, Forest Upper, Forest Lower and Garrymore. Also included were the following townlands outside of the 500 m buffer: Avoley, Graigue, Nyra, Townparks, Garryhinch, Magheranskeagh, Clonyhurk, Cooltycanon, Clonaghadoo, Laught or Commons, Meelick, Cappaneary and Cappabeg. Vantage point locations are based on observations from walkover/reconnaissance surveys, viewshed analysis (using GIS) and collated information on known feeding and roosting sites from both desktop review and consultation. The number and location of vantage points was selected in order to achieve visibility of the entire study area and important features for birds in close proximity to the site (e.g. lakes, wetlands); see Figures in Appendix A of the accompanying Ornithology report included in Appendix 12.4 of this report.

In line with recommended best practice (SNH, 2014; SNH, 2017 and Band *et al*., 2007), viewshed analysis was undertaken using ARCMAP 10.3, to calculate a theoretical zone of visibility from each vantage point. Visibility was calculated from each vantage point along an invisible layer suspended at the predicted lowermost height passed through by the rotor blade tips, using an observer height of 1.5m. We note the following from SNH (2014 & 2017) guidance in respect of priority areas for viewshed analysis (emphasis added):

"Where the key purpose is to estimate the risk of collision with turbines, it is the visibility of the airspace to be occupied by the turbine rotors (the collision risk volume) that is of prime importance. Therefore, it is recommended that visibility be calculated using the least visible part of this airspace, i.e. an imaginary layer suspended at the lowermost height passed through by the rotor blade tips (typically about 20-30m above ground level). Predicting visibility at this level is a simple task using GIS. Being able to view all or most of the site to ground level can be helpful in gauging overall bird activity and usage of the site but is not as important as being able to view the collision risk volume."

The site study area boundary is calculated based on 500m buffers circled around the location of each turbine. Flight paths of target species within these 500m buffers were considered to be within the site for the purposes of the Collision Risk Model as per SNH (2014) Guidance.

Vantage point effort following SNH guidance was carried out over the winter of 2018/19 and the summer of 2018 and 2019 at these locations.

The proposed Dernacart Wind Farm was surveyed from a total of six VP survey locations from April to November 2018 in order to provide coverage of the wind farm turbine area. An additional VP was added in December 2018 due to alterations in the proposed turbine layout. Thirty-six hours of vantage point effort was carried out at each vantage point within each survey period. Each vantage point overlooks different parts of the proposed site and surrounding area:

- VP1. Overlooks the majority of the south of the site and townlands of Graigue, Nyra, Forest Upper, Forest Lower, Barranaghs and Cooltycanon.
- VP2. Overlooks the majority of the south of the site and townlands of Forest Upper, Forest Lower, Barranaghs, Cooltycanon, Garrymore and Graigue.
- VP3. Overlooks majority of site and townlands of Dernacart, Forest Upper, Garrymore, Forest Lower, Barranaghs, Townparks and Graigue.
- VP4. Overlooks the southwest of the site and townlands of Avoley, Graigue, Nyra, Forest Upper, Forest Lower and Barranaghs.
- VP5. Overlooks the centre of the site and townlands of Graigue, Forest Upper, Garrymore, Cooltycanon, Clonyhurk, Barranaghs and Forest Lower.

- VP6. Overlooks southeast of the site and townlands of Forest Upper, Forest Lower, Barranaghs, Garryhinch, Magheranaskeagh and Clonyhurk.
- VP7. Overlooks a small part of the north of the site and townlands of Dernacart, Cappaneary, Cappabeg, Laught or Commons, Clonaghdoo, Garrymore and Forest Upper.

Vantage point locations can be found in Table 12-6 below and are mapped in the Figures included in Appendix A of the accompanying bird report included in Appendix 12.4 of this report.

Table 12-6: Vantage Point Locations

VP Number	VP Location (ITM Grid Coordinates)
1	643664, 711651
2	643903, 711226
3	643628, 710551
4	644337, 709846
5	644882, 710674
6	645023, 711574
7	642744, 711950

Following SNH guidance (SNH, 2014 & 2017), the timing of watches was varied to encompass diurnal, crepuscular and nocturnal activity of target species. A portion of watches were conducted from before sunrise continuing for three hours after (total duration 180 minutes) and before sunset until as long as visibility allowed after (total duration 180 minutes).

With regard to the equipment utilised for vantage point surveys, binoculars and telescopes were the primary equipment used to scan for target species. Dictaphones were utilised to dictate bird heights whilst tracking flight events. Flight heights were estimated visually within the target height bands (0-20m, 20-40m, 40-140m, >140m) as allowed for in published guidance (SNH 2014 & 2017). Flight height estimation using a clinometer or rangefinder is accepted as one means of determining flight height, however this is often not practicable (equipment may be clumsy, and birds may be lost from view whilst trying to focus additional equipment on a target species rapidly moving out of sight). It should be noted that in practice many flocks of swans would not fly close enough to a surveyor for a rangefinder to be used, resulting in most flights heights being estimated in any case. As is often the case, an experienced observer was able to record accurate observations at a higher frequency resulting in a larger dataset for analysis.

The survey schedules for the flight activity surveys are presented in Appendix A of the accompanying ornithology report included in Appendix 12.4 of this document. The viewshed analysis figure is presented in Appendix A of the accompanying bird report included in Appendix 12.4 of this report.

Breeding bird surveys

A moorland breeding bird survey was undertaken across areas of peatland habitat within the proposed development and 500 m beyond the study area boundary. These surveys followed the adapted Brown & Shephard survey method which is appropriate for waders and other species of moorland passerines which are of conservation concern as detailed in Gilbert *et al.,* (1998).

An adapted Common Bird Census (CBC) methodology was used for farmland areas of the study area.

A total of four site visits were undertaken between mid-April and early-July 2018 and mid-April and early-July 2019. On completion of the surveys, the records were examined to estimate the location of breeding territories using the territory analysis method outlined in Bibby *et al.,* (2000).

SNH guidance on recommended bird survey methods to inform impact assessment of onshore wind farms states:

"Surveys of farmland passerines especially on more intensive arable habitat are generally not required" (SNH 2014).

While it is generally considered that passerine species are not significantly impacted by wind farms (SNH, 2014) and the variation in numbers between years is not expected to differ significantly, countryside bird surveys were carried out over two summers for the proposed Dernacart Wind Farm.

Breeding Waders

A separate breeding wader survey, targeting woodcock, was undertaken following the methodology described in Gilbert *et al*., (1998). The survey comprised three visits in total per breeding season i.e. between early April and late June 2018, and early April and late June 2019. Secondary species for the breeding wader surveys were common sandpiper, curlew, lapwing, redshank, ringed plover and snipe. The surveys spanned dusk to target the activity of woodcock.

Walkover surveys were undertaken within study area and a 500 m buffer beyond the study area boundary. A total of two transects were undertaken within the survey area, as the large size of the proposed site meant the survey area could not be surveyed within a single evening. In areas of coniferous forest, where access could not be gained, the surveyor stopped in suitable locations and scanned from a distance. All waders, observed or heard were recorded as accurately as possible, using standard British Trust for Ornithology (BTO) notification (one/two letter identity and activity codes), on an appropriately scaled field map for the site.

Monthly wader census

Walkover surveys were undertaken across areas of open habitat within the wind farm site and a 500 m buffer beyond the site boundary. The surveys followed appropriate methods for waders as detailed in Gilbert *et al.,* (1998). A total of six survey visits were undertaken at regular intervals (monthly) between October 2018 and March 2019 (inclusive).

Birds were located by walking, listening and scanning by eye and with binoculars. All waders encountered were recorded on survey maps using BTO notation, with care taken to minimise the risk of double counting individuals.

Table 12-7: Target Species and Associated Suitable Breeding Habitat

Target Species/Groups	Suitable Breeding Habitat
All raptors and owls, with the exception of buzzard	Trees, Buildings, Cliffs/Quarries
All wild goose, swan and duck species, with the exception of Canada goose and mallard	Wetlands, Lake/Lowland River Fringes
All wader species	Various habitats- Listed below
Lapwing	Lowland wet grassland, arable farmland, cutover bog with pools and wet grassland
Snipe	Wet pastures, marsh, bogs (intact and cutover) and fens
Redshank	Bog
Curlew	Bog
Common Sandpiper	Streams/rivers in bog

Target Species/Groups	Suitable Breeding Habitat
Woodcock	Woodland, bog woodland
Ringed Plover	Cutover bog, milled peat with exposed gravel

Hen harrier winter roost checks

Due to anecdotal evidence from a local birdwatcher that a hen harrier was observed on several occasions on the cutaway bog immediately north-east of the proposed wind farm site, hen harrier roost checks were undertaken in this area. Fixed-point watches were undertaken at dusk to target potential roosting hen harriers. The survey comprised three visits undertaken at regular intervals (monthly) between October and December (see Appendix B of the accompanying bird report included in Appendix 12.4 of this report). All raptor observations were recorded on field maps.

12.2.5.5 Aquatic Ecology

Surveys to inform the aquatic ecology assessment were completed during September 2019. The surveys included aquatic habitat assessments, fish/lamprey surveys (electrical fishing), kick sampling and species-specific surveys for Freshwater Peal Mussels and White-clawed crayfish. Figure 12-5 gives the location of the proposed Dernacart wind farm with respect to the River Barrow and River Nore SAC and watercourses in the Barrow catchment.

12.2.5.6 Selection of watercourses for appraisal

All watercourses / water bodies which could be affected directly (i.e. within the site) or indirectly (i.e. drain areas close to the site) were considered as part of the current appraisal.

A total of 11 sites were selected for detailed assessment. The sites selected for assessment are given in Table 12-8 and the location of these sites are shown in Appendix B of the accompanying bird report included in Appendix 12.4 of this report.

The surveys completed at each site were at a level required to make an evaluation of biological water quality, fisheries value, aquatic habitat value, and presence of rare/protected/notable aquatic species at each site. Generally, watercourses were observed from public roads and this allowed such watercourses to be adequately evaluated for the purpose of the current appraisal.

The surveys completed at each site were at a level required to make an evaluation of biological water quality, fisheries value, aquatic habitat value, and presence of rare / protected / notable aquatic species at each site. Surveying was carried out in September 2019.

Table 12-8: Location of the aquatic ecology sites assessed for the proposed Dernacart Wind Farm site

Site No.	Catchment	Sub-Catchment	Water-course Name	Water-course Order	Segment Code	EPA Code
1	Barrow	Barrow_SC_30 Barrw_SC_20	Barrow	5	14_10477	14B01
2	Barrow	Barrow_SC_30	Clonygowan	3	14_1770	14C51
3	Barrow	Barrow_SC_30	Cottoners Brook	2	14_1840	14C15

Site No.	Catchment	Sub-Catchment	Water-course Name	Water-course Order	Segment Code	EPA Code
4	Barrow	Barrow_SC_30	Cottoners Brook	3	14_1031	14C15
5	Barrow	Barrow_SC_010	Barrow	4	14_1043	14B01
6	Barrow	Barrow_SC_010	White Hill (E) Stream	1	14_1748	14W01
7	Barrow	Barrow_SC_010	White Hill (E) Stream	2	14_322	14W01
8	Barrow	Barrow_SC_010	Forest_Upper	1	14_1592	14F07
9	Barrow	Barrow_SC_010	Forest_Upper	2	14_1057	14F07
10	Barrow	Barrow_SC_010	Barrow	4	14_1053	14B01
11	Barrow	Barrow_SC_010	White Hill (W) Stream	2	14_1124	14W02

12.2.5.7 Aquatic Surveys

Aquatic surveys were carried out at all of the survey sites in September 2019. The majority of the watercourses were categorised as watercourses of insignificant aquatic ecological importance. Each site was assessed for potential lamprey, salmon and white-clawed crayfish habitat.

Electrofishing

An electrical fishing survey was undertaken at the 11 sites during September 2019. This was completed under authorisation from the Department of Communication, Energy and Natural Resources under Section 14 of the Fisheries Act (1980). Sites were surveyed following the methodology outlined in the CFB (2008) guidance "*Methods for the Water Framework Directive - Electric fishing in wadable reaches*". A portable electrical fishing unit (Smith Root-LR 24 backpack) was used during the assessments. Fishing was carried out continuously for 5 minutes at each of the sites. Captured fish were collected into a container of river water using dip nets. On completion of the survey fish were then anaesthetised using a solution of 2-phenoxyethanol, identified, and measured to the nearest mm using a measuring board. Subsequent to this the fish were allowed to recover in a container of river water and were the released alive and spread evenly over the sampling area. No mortalities were recorded. Strict biosecurity measures were followed during all fieldwork (IFI, 2010).

Lamprey Surveys

Juvenile lamprey surveys generally followed the methodology for ammocoete surveys given in the manual 'Monitoring the River, Brook and Sea Lamprey, *Lampetra fluviatilis*, *L. planeri* and *Petromyzon marinus* by Harvey & Cowx (2003). Electrical fishing for juvenile lampreys was carried out at three 1m^2 habitat patches where available. A total of 3 x 1 m^2 enclosures were fished at each site where suitable habitat was present and where conditions allowed. It is noted that most of the sites did not have optimal juvenile lamprey habitats. Dip and sweep netting was also undertaken at each site. This was undertaken due to the difficulty in surveying most of the river channels due to heavy vegetation growths.

Aquatic Macroinvertebrate Surveys

Qualitative sampling of benthic (or bottom dwelling) macroinvertebrates was undertaken at all survey sites using kick-sampling (Toner *et al.,* 2005). This procedure involved the use of a 'D' shaped hand net (mesh size 0.5 mm; 350 mm diameter) which was submerged on the riverbed with its mouth directed upstream.

The substrate upstream of the net was then kicked for one minute in order to dislodge invertebrates, which were subsequently caught in the net. Where possible, this procedure was undertaken at three points along/across the watercourse.

Stone washings and vegetation sweeps were also undertaken to ensure a representative sample of the fauna present at each site was collected. Macroinvertebrates were identified onsite with some specimens fixed in alcohol. The relative abundance of macroinvertebrates was recorded on-site at each site. The Q-rating biotic index were used to rate the biological status of the study sites. It is noted that 7 of the sites assessed were too small (or dry) so a Q rating could not be assigned. An estimated Quality Status is assigned where possible.

White-clawed Crayfish and Mussel Surveys

Specific sweep netting assessments were completed for White-clawed crayfish. Also, electrical fishing work was completed which would also have captured crayfish. Mussels were surveyed using visual assessments using a bathyscope at each site.

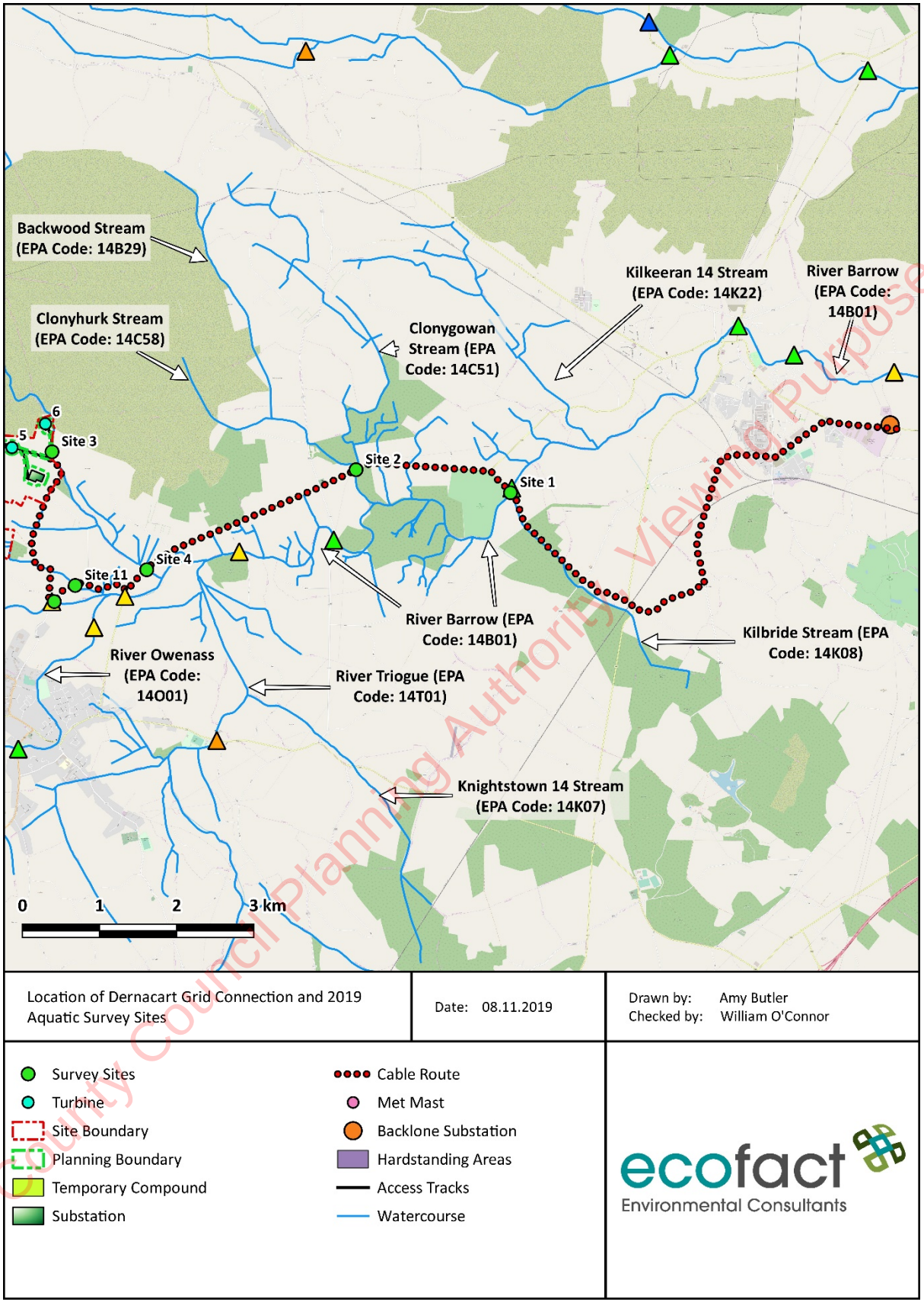

Figure 12-4: Wind farm, grid connection route, river network and aquatic ecology survey sites

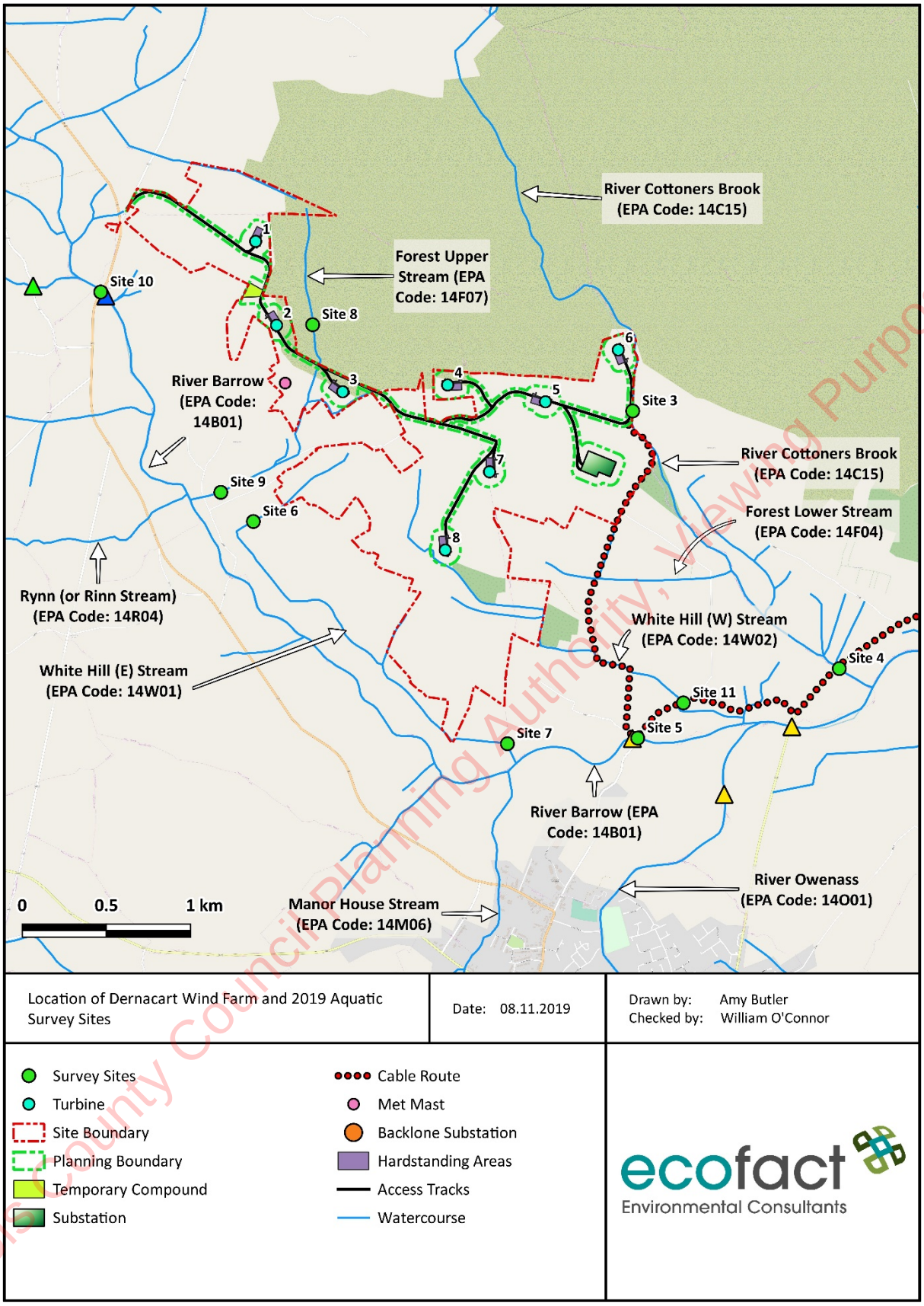

Figure 12-5: Wind farm, grid connection route, river network and aquatic ecology survey sites

12.2.6 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 12-9.

Table 12-9: 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 & Natural Heritage, 1972). Biosphere Reserve (UNESCO Man & 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. 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.

Resource Evaluation	Defining Criteria
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.

12.2.7 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 12-9, 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 & 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 12-10 illustrates the combined receptor evaluation criteria used to assign sensitivity levels to key receptors.

Table 12-10: 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; 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	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	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;

Sensitivity of key receptor	Percival 2007 criteria	NRA Resource Evaluation	NRA Criteria	Combined Criteria
	in the UK BAP subject to special conservation measures		quality or extent at a national level.	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.

12.2.8 Aquatic Receptor Evaluation

Ecological features are assessed on a scale ranging from international-national-county-local (see Table 12-9). 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.

12.2.9 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 proposed windfarm on the identified key ecological receptors.
Table 12-11 to Table 12-16 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 12-11: 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 12-12: 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.
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 12-13: 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 12-14: 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 12-15: 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 12-16: 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 12-17: Confidence levels of predictions of impacts as outlined in 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 (Environmental Protection Agency) 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 12-18 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.

Table 12-18: 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*

Magnitude	Description
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*
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 12-19.

Table 12-19: 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

12.3 Description of the Existing Environment

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

12.3.1 Overview of watercourses in the study area

The proposed development is located in Hydrometric Area 14 - the River Barrow catchment. The River Barrow main channel rises in Glenbarrow in the Slieve Bloom Mountains in Co. Laois and flows in a north-easterly direction until it meets its first tributary, the Glenlahan River. It then continues and turns to flow in a south-easterly direction at Ballyclare Beg. Its total channel length is approximately 192 km, to where it flows into the Atlantic at Waterford Harbour. Together with its tributaries, it drains a catchment of approximately 3,067 km^2. The River Barrow together with the River Nore is designated as a Special Area of Conservation (SAC) (SAC Code 002162).

The proposed development has the potential to impact the Barrow River catchment, as the River runs to the southwest and south of wind farm site (c. 90m from site boundary and c. 900m from site infrastructure at its closest point) and runs roughly parallel to and then intersects the proposed grid connection route. A number of minor tributaries of the Barrow flow through the wind farm site, and also intersect the proposed grid connection route.

The proposed grid connection would involve the crossing of a number of minor watercourses (forest lower stream, 3 unnamed streams, Cottoner's Brook, Clonygowan and Rathmore 14 watercourses), in addition to the Barrow via Kilnahown Bridge. After this, the cable route runs parallel to the Kilbride stream for c. 1.2 km before joining the Barrow at Kilnahown Bridge.

The typology of watercourses draining the proposed wind farm development site is largely dictated by gradient and watercourse management. All watercourses in the study area, including those affected by the grid connection are slow-flowing low gradient hydromorphologically impacted waterbodies with little physical character.

The River Barrow rises in the Old Red Sandstone of the Slieve Bloom Mountains before passing through a band of Carboniferous shales and sandstones. The upper reaches of the Barrow also run through limestone. The middle reaches and many of the eastern tributaries, sourced in the Blackstairs Mountains, run through Leinster Granite. The southern end, similar to the Nore River, runs over intrusive rocks poor in silica. Waterford Harbour, the mouth of the River Barrow, is a deep valley excavated by glacial floodwaters when the sea level was lower than today. The coast shelves quite rapidly along much of the shore.

Most of the land use in the Barrow Catchment consists of agricultural activities, mostly intensive in nature and principally grazing and silage production. Arable crops are also grown, and slurry is spread over much of the area. There is a threat to the water quality due to the spreading of slurry and fertiliser which can affect the salmonid river and populations of the E.U. Habitats Directive Annex II animal species present in the Barrow Catchment. A lot of the woodlands in the area along the rivers belong to old estates and include many non-native species. Little active woodland management takes place. The main tourist attraction of the area is fishing along stretches of the main rivers and their tributaries and there are a few Angler associations, some of which have a number of beats. Fishing stands and styles have been erected in places. There is net fishing in the estuary and a mussel bed as well. Both leisure and commercial fishing takes place on the rivers in the Barrow Catchment.

The main threats to the Barrow Catchment involve high inputs of nutrients into the river system from agricultural run-off and several sewage plants, over-grazing in the woodland areas, and invasion by non-native species, for example Cherry Laurel (*Prunus laurocerasus*) and Rhododendron (*Rhododendron ponticum*). Therefore, the water quality of the river remains vulnerable. Good quality water is necessary to maintain the populations of the Annex II species present. The improvement of the quality of the water depends on controlling fertilisation of the grasslands and sewage being properly treated before discharge. Flash floods can occur due to drainage activities which can damage the Annex II species present. Dredging within the lower reaches of the system poses a threat to migrating fish species such as Lamprey and Shad.

12.3.2 Description of watercourses in the study area

Figure 12-4 and Figure 12-5 show the principal watercourses in the study area. These water features correspond with rivers and streams shown on the EPA map viewer.

The Dernacart Stream flows in a north-westerly direction along the northern boundary of the site, before joining the Garrymore 14, which joins the Barrow c. 1.1 km downstream of the site. There is no overlap with site infrastructure and no areas where infrastructure is proposed drain towards the Dernacart Stream. The Forest Upper stream has been re-routed and canalised along its upper reaches, where it runs north-south along the western edge of Garryinch Bog (outside wind farm site). The watercourse then enters the site, passing under an existing access track and flowing southwest to join the Barrow, c. 825m downstream of the site boundary (1.2 km downstream of crossing point). A tributary flowing within the site joins the main channel before it exits the site. This tributary lies within the outer part of the 90m felling buffer

The White Hill (E) Stream is mapped as rising in coniferous forestry plantation within the site, flowing south-west and then south-east towards the Barrow after leaving the site. The channel was not observed to carry any water along its upper reaches but did contain water in its lower reaches. A tributary channel running along a southern section of the site boundary joins the stream before it enters the Barrow, and the main channel then flows along the southern tip of the site boundary before entering the Barrow c. 435m downstream of this area. No proposed infrastructure overlaps this watercourse.

The White Hill (W) Stream is mapped as rising in birch woodland within the site, however this section of the channel did not contain water during the site visit. From here, the stream flows south and then east between and around conifer blocks, and then turns south to flow along the eastern site boundary, where it is joined by and un-named tributary. The stream then leaves the site, flowing south-east before entering the Barrow c. 1.5km downstream.

The Cottoner's Brook stream runs north-south along the eastern boundary of the wind farm site, before turning south-east towards the Barrow, which it enters c. 2 km downstream of the site after being joined by a number of tributaries including the Forest Lower and Barranaghs streams. The stream runs adjacent to a section of proposed access track for c. 215m, and adjacent to the proposed grid connection route for c. 195m; both of these sections run along an existing forestry track.

The EPA carry out biological monitoring at various locations in the vicinity of the proposed development site as part of their monitoring programme; the nearest monitoring point upstream along the Barrow is Ballyclare Bridge, c. 5 km upstream of the wind farm site; this site was rated as Q4 corresponding to WFD 'Good Status' in 2017. The Rosenalis Stream monitoring point, immediately upstream of the wind farm site was rated as Q4 (Good Status) in 2003. The Twomile Bridge monitoring point, upstream of wind farm infrastructure, was rated as Q4-5 (High-quality Status) in 2018. The monitoring point at Bay Bridge, downstream of roughly half the wind farm site, was rated as Q4 (Good Status) in 1989; this station has not been sampled since. The Barranaghs Bridge station (downstream of part of wind farm site) was classified as Q3-4 (Moderate Status) in 2018, while the 'Bridge SE of Hammerlane' station (1st monitoring station downstream of entire wind farm site) was classified as Q3-4 (Moderate Status) in 1989.

Further downstream, water quality increases again, with Q4 (Good Status) in recorded at Portnahinch Bridge in 2011, and Q4 also recorded at Kilnahown Bridge (point where cable route crosses the Barrow) in 2018. The next station downstream of this crossing point is Portarlington Upper Bridge; this station was classified as Q4 in 2000.

Therefore, it is known that the watercourses surrounding the proposed development site boundary are of Moderate-Good Status according to the EPA, with water quality in the Barrow declining after it flows past the proposed wind farm site and increasing again as it flows eastward to Portarlington. Reduced water quality (Q3-4) in the River Owenass which flows through Mountmellick and enters the Barrow upstream of the two Q3-4 stations detailed above (Barranaghs Bridge and 'Bridge SE of Hammerlane') is a potential cause of this reduction. The older Q values may not be representative of current conditions.

12.3.3 Designated Nature Conservation Sites

12.3.3.1 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 Dernacart 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) were initially designated under Directive 79/409/EEC, The Directive on the Conservation of Wild Birds ('The Birds Directive') and are now protected as European (Natura 2000) Sites under the EU 'Habitats Directive'. There is one SPA within 15km of the study area.

12.3.3.2 Sites of National Importance

Sites of National Importance in the Republic of 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. One NHA and four pNHAs are present within 10 km of the proposed wind farm, while a further three pNHAs are present within 10 km of the proposed grid connection route.

Figure 12-6 and Figure 12-7 show the location of the designated sites in relation to the proposed turbine locations. There are no designated sites within 2km of the proposed wind farm development site. The closest designated site to the wind farm is Raheen Lough pNHA, which is located 6.6km from the closest element of infrastructure.

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 project on European Sites (cSACs and SPAs); and accompanies this planning application.

Table 12-20: Summary of European Sites within 15 km of the Project

Designated Site	Site Code	Features of Interest	Distance to closest turbine (km)	Distance to Cable Route (km)
River Barrow and River Nore SAC	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]	0.7	0.0

Designated Site	Site Code	Features of Interest	Distance to closest turbine (km)	Distance to Cable Route (km)
		• 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] • *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]		
Slieve Bloom Mountains SPA	004160	• Hen Harrier (*Circus cyaneus*) [A082]	4.7	6.4
Mountmellick SAC	002141	• *Vertigo moulinsiana* (Desmoulin's Whorl Snail) [1016]	4.8	1.8
Slieve Bloom Mountains SAC	000412	• Northern Atlantic wet heaths with *Erica tetralix* [4010] • Blanket bogs (* if active bog) [7130] • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) [91E0]	8.2	9.3
Charleville Wood SAC	000571	• Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0] • *Vertigo moulinsiana* (Desmoulin's Whorl Snail) [1016]	14.5	16.7

Table 12-21: Summary of Proposed Natural Heritage Areas and Natural Heritage Areas within 10 km of the Project

Designated Site	Site Code	Features of Interest	Distance to closest element of infrastructure (km)	Distance to Cable Route (km)
Raheen Lough pNHA	000917	• Wildfowl and waders • Marsh	6.6	7.0
Clonreher Bog NHA	002357	• Peatlands [4]	7.0	6.3
Ridge of Portlaoise pNHA	000876	• Eskers • Native Woodland • Species-rich Calcareous Grassland • Nettle-leaved Bellflower *Campanula trachelium* • Blue Fleabane *Erigeron acris*	8.0	6.5
Slieve Bloom Mountains pNHA	004160	• Northern Atlantic wet heaths with *Erica tetralix* [4010] • Blanket bogs (* if active bog) [7130] • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) [91E0]	8.2	9.3
Emo Court pNHA	000865	• Semi-natural woodland • Freshwater Lake	9.7	1.9
Great Heath of Portlaoise pNHA	000881	• Lowland acidic grassland • Bog Lough • Fen	11.5	6.9
Derries Wood pNHA	000416	• Fen • Lake • Rare Dipterans • Pine Marten • Ducks	12.1	4.4
Grand Canal pNHA	002104	• Calcareous grassland • Otter	15.6	5.3

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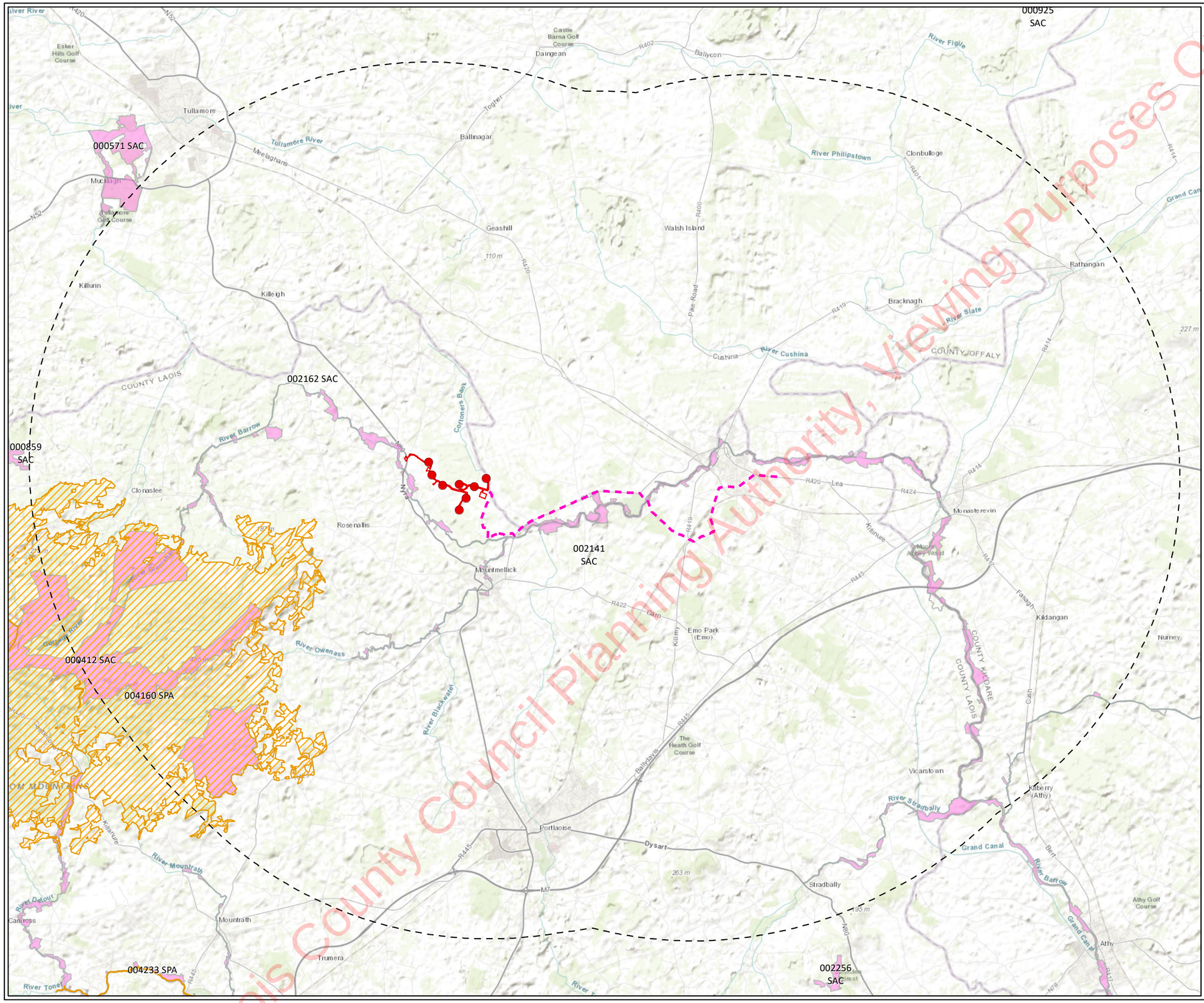

TITLE: European Sites within 15km of the Proposed Development

PROJECT: Dernacart Wind Farm

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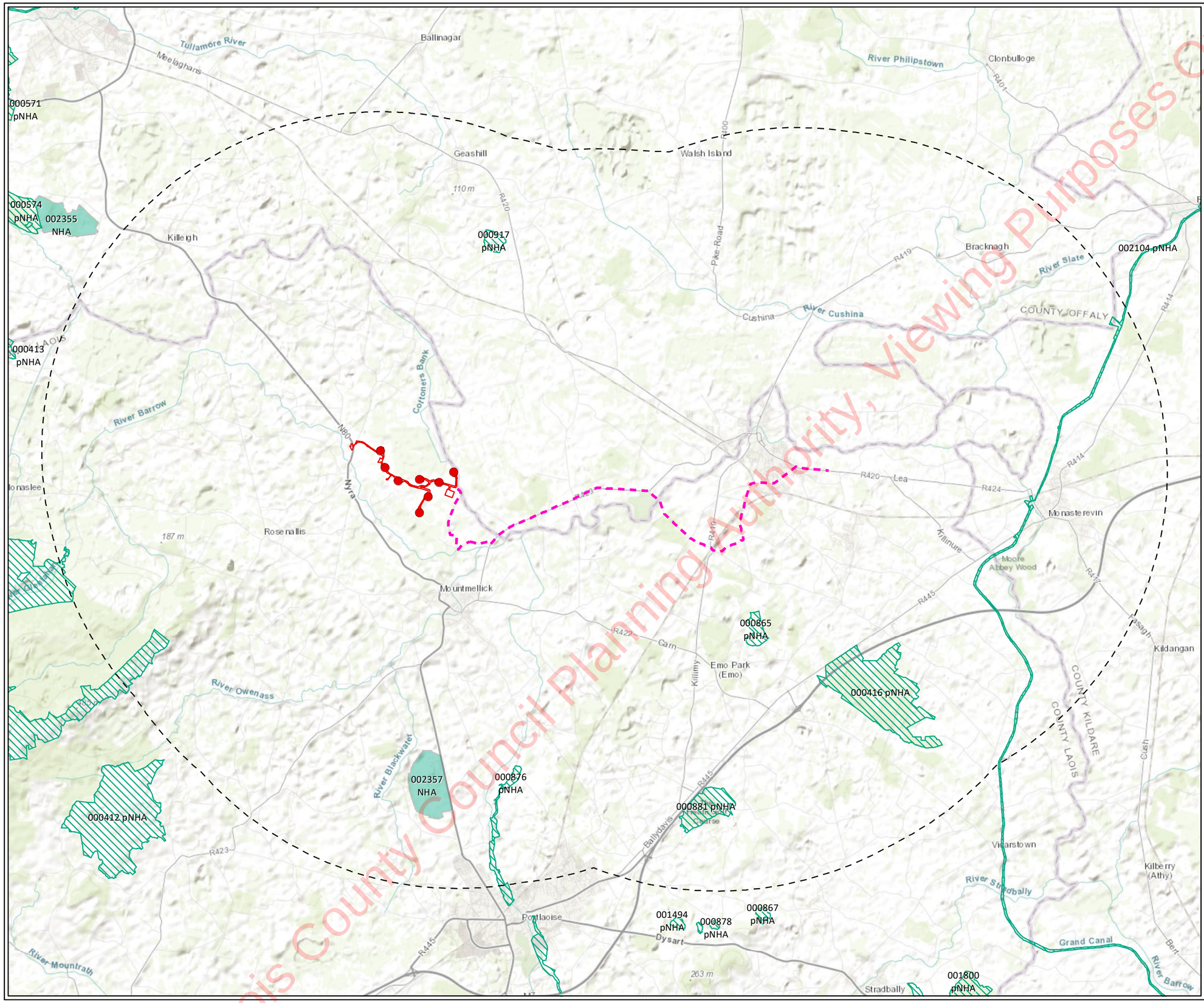

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PROJECT:	Dernacart Wind Farm		
FIGURE NO:	12.7		
CLIENT:	Statkraft		
SCALE:	1:110000	**REVISION:**	0
DATE:	30/01/2020	**PAGE SIZE:**	A3

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12.3.3.3 Other Designated Sites

Nature Reserves, Ramsar Sites

The Slieve Bloom Mountains Nature reserve (established in 1985) occupies the same site as The Slieve Bloom Mountains SAC & pNHA (7.9 km east). At over 2,300 hectares, it is Ireland's largest state-owned Nature Reserve. In addition, the Slieve Bloom Mountains Nature Reserve is designated a Ramsar Wetland Site and a Council of Europe Biogenetic Reserve.

The are no other nature reserves within 10km of the proposed development. The closest sites are Raheenmore Bog (c. 19 km north), Pollardstoen Fen (c. 20 km east), and Timahoe Esker (16.5 km south) of the proposed Dernacart wind farm site/grid route.

Ramsar Sites & Other Designations

The Slieve Bloom Mountains, Raheenmore Bog and Pollardstown Fen Nature Reserves are also designated as Ramsar Wetland Sites; The Slieve Bloom Mountains is also designated as a Council of Europe Biogenetic Reserve.

12.3.4 Rare or protected Flora

Detailed botanical surveys (quadrat recording) carried out as described above in 12.2.5.1 above were undertaken in semi-natural/potentially higher value habitats within the study area. No rare or protected species were recorded during these surveys or the extensive surveys carried out throughout the study area.

The wind farm study area lies within Ordnance Survey National Grid 10km Squares N40 and N41. These 10km grid squares were searched for records of plant species through the National Biodiversity Data Centre (NBDC) website on 10th December 2019. 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). 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; this encompassed grid squares N30, N31, N40, N41, N50, N51, N60 & N61. 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 12-22 presents details of the rare and protected plant species found within the 10km squares N30, N31, N40, N41, N50, N51, N60 & N61. Information on habitats was completed using; Webb's '*An Irish Flora*', 8th edition, 2012., F. Rose '*The Wild Flower Key*', Revised edition, 1981, and The British Bryological society's '*Mosses and Liverworts of Britain and Ireland a field guide*', first edition, 2010.

All but one of the records are historical (pre-1970), and only 2 are within the 10km grid squares overlapping the wind farm site.

While broadly suitable habitat for some of these species (Lesser Centaury, Yellow Bird's-nest, Large White-moss and Red-neck Forklet-moss) is present in certain areas of proposed wind farm site, they were not recorded during surveys.

Table 12-22: Historical Records of protected flora within the 10km Grid Squares (N30, N31, N40, N41, N50, N51, N60 & N61) 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 Dernacart
Corncockle *Agrostemma githago*	N61	Rathangan, E. of Rathangan	Historical record 1898	NPWS Rare/Threatened Plants Database, Herbarium and Literature Database 19/02/2013	Waiting List (2016) (evaluated as Extinct in 1988 Red Data Book)	Arable land; nationally rare in Ireland (Rose, 2006)	Not recorded; no suitable habitat present
Lesser Centaury *Centaurium pulchellum*	N50	Emo	Historical records 1896	NPWS Rare/Threatened Plants Database, Herbarium and Literature Database 19/02/2013	FPO (2015) Near Threatened (2016)	Bare, often damp open ground on calcareous and acid soils; very rare (Rose, 2006)	Not recorded; suitable habitat potentially present
Yellow Bird's-nest *Hypopitys monotropa* (formerly *Monotropa hypopitys*)	N60	Marquis of Drogheda Estate	Historical record 1898	NPWS Rare/Threatened Plants Database	Near Threatened (2016)	Woods (especially beech or pine), dune hollows; very rare (Rose, 2006)	Not recorded; suitable habitat potentially present
Marsh Saxifrage *Saxifraga hirculus*	N51	Bog of Allen	Historical record 1866	NPWS Rare/Threatened Plants Database	FPO (2015) Near Threatened (2016)	Bog flushes in Counties Mayo and Antrim (Webb, 2012), North and West Ireland on mountain bogs (Rose, 2006)	Not recorded; no suitable habitat present, and site is outside known range of species

Species	Grid Square	Location of Record	Year of Last Record	Survey/Dataset	Conservation Status	Habitat	Result of surveys for Dernacart
Shepherd's-needle *Scandix pecten-veneris*	N30	Tullamore	Historical records 1898, 1900	NPWS Rare/Threatened Plants Database	Regionally Extinct (2016)	Formerly common weed in cornfields; now rare. Arable land, especially on calcareous soils (Rose, 2006)	Not recorded; no suitable habitat present
Large White-moss *Leucobryum glaucum*	N40	Clonsoghey (south of Mountmellick) (1 km resolution); Cloneyhurk (north-west of study area) (100m resolution)	2009	Bryophytes of Ireland	Protected Species: EU Habitats Directive Annex IV Least Concern (2012)	Broad range of habitats from wet heath to valley mires, raised bogs, and fens. Most commonly found in acidic woodland and mires. (Atherton *et al*., 2010)	Not recorded; suitable habitat potentially present
Red-neck Forklet-moss *Dicranella cerviculata*	N40	Mountmellick area (10 km resolution)	Historical record 1915	Bryophytes of Ireland	Near Threatened (2012)	Fresh peat cuttings, damp acidic gravel & sand, edges of peaty tracks & pools (Atherton *et al*., 2010)	Not recorded; suitable habitat potentially present

12.3.5 Invasive Non-native Flora

The invasive species listed in Table 12-23 have been recorded within the 10 km grid squares (grid square N40, N41) overlapping the proposed wind farm site, and 1km grid squares overlapping the proposed grid route. The closest record (1 km resolution) of Canadian waterweed (a legally restricted species) to the wind farm site is c. 390m to the southwest, associated with the River Barrow, while another 1 km resolution record is located in the vicinity of Kilnahown Bridge which spans the Barrow. The proposed grid connection traverses Kilnahown Bridge.

None of these species were recorded within the study area; however, giant hogweed *Heracleum mantegzzianum* was recorded in the central northern part of the study area, in two linear growths (22 & 85m in length) bordering a block of conifer plantation. These areas are over 350m from the nearest infrastructure (new access track) and 250m from the wind farm site boundary at their closest point. Giant hogweed is listed on Schedule III under Regulations 49 & 50 of the EC (Birds & Natural Habitats) Regulations 2011, which makes it an offence to cause the spread of plant species listed on the Schedule.

Table 12-23: Invasive Species within 2km and 10km of Site (Source: NBDC)

Common Name	*Scientific Name*	1km (Grid Cable Route)	2km	10km	Invasive Impact	Legal Status	Recorded in study area
Sycamore	*Acer pseudoplatanus*	N4609, N4910, N5110	-	N40, N41	Medium Impact	None	Yes
Canadian Waterweed	*Elodea canadensis*	N5110	N41F	N40, N41	High Impact	Schedule III Listed	No
Japanese Knotweed	*Fallopia japonica*	-	-	N40	High Impact	Schedule III Listed	No
Cherry Laurel	*Prunus laurocerasus*	-	-	N40	High Impact	None	No
Japanese Honeysuckle	*Lonicera japonica*	-	-	N40	Medium Impact	None	No
Old man's beard	*Clematis vitalba*	-	-	N40	Medium Impact	None	No

12.3.6 Description of Existing Habitats

12.3.6.1 Proposed wind farm development site

The habitat survey was carried out between 16th July and 15th August 2019 and incorporated a walkover survey of the wind farm site, along with intensive surveying of higher value habitat areas using quadrats.

The wind farm site encompasses a mixture of habitat types, with Improved Agricultural Grassland (GA1) and Conifer Plantation (WD4) dominating. Pockets of Mixed Broadleaved woodland (WD1) are also present, as are areas of (degraded) Raised Bog (PB4), often interspersed with other habitat types such as Bog Woodland (WN7), Scrub (WS1) and Wet Grassland (GS4). The habitats present within the proposed site boundary are mapped in Figure 12-12-8.

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

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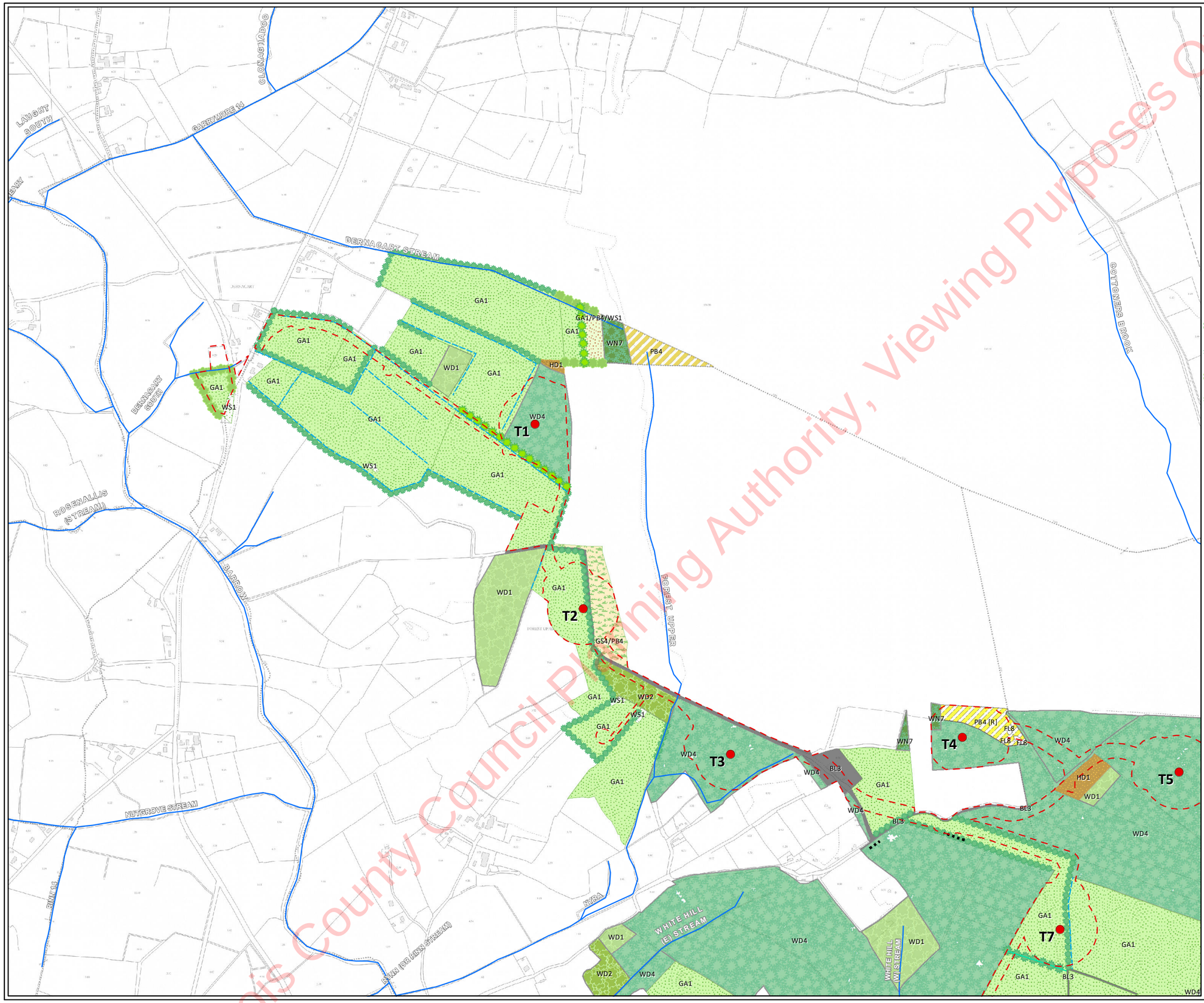

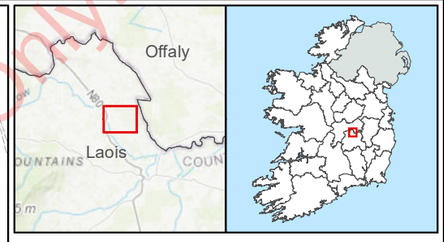

- Proposed Turbines
- Proposed Planning Boundary

Invasive Species

- Giant Hogweed

Habitat

- FW2, Depositing/lowland rivers
- FW4, Drainage ditches
- FW4/WL1/WL2, Drainage ditches / Hedgerows / Treelines
- FW4/WL2, Drainage ditches / Treelines
- WL1, Hedgerows
- WL1/WL2, Hedgerows / Treelines
- WL2, Treelines
- BL3, Buildings and artificial surfaces
- GA1, Improved agricultural grassland
- GA1/PB4/WS1, Improved agricultural grassland / Cutover bog / Scrub
- GS4/PB4, Wet grassland / Cutover
- HD1, Dense bracken
- PB4 [R], [Recolonising] Cutover
- PB4, Cutover
- WD1, (Mixed) broadleaved woodland
- WD2, Mixed broadleaved/conifer woodland
- WD4, Conifer plantation
- WN7, Bog woodland
- WS1, Scrub

TITLE:	Habitats Submap 1/3		
PROJECT:	Dernacart Wind Farm		
FIGURE NO:	12.8.1		
CLIENT:	Statkraft		
SCALE:	1:10000	**REVISION:**	0
DATE:	30/01/2020	**PAGE SIZE:**	A3

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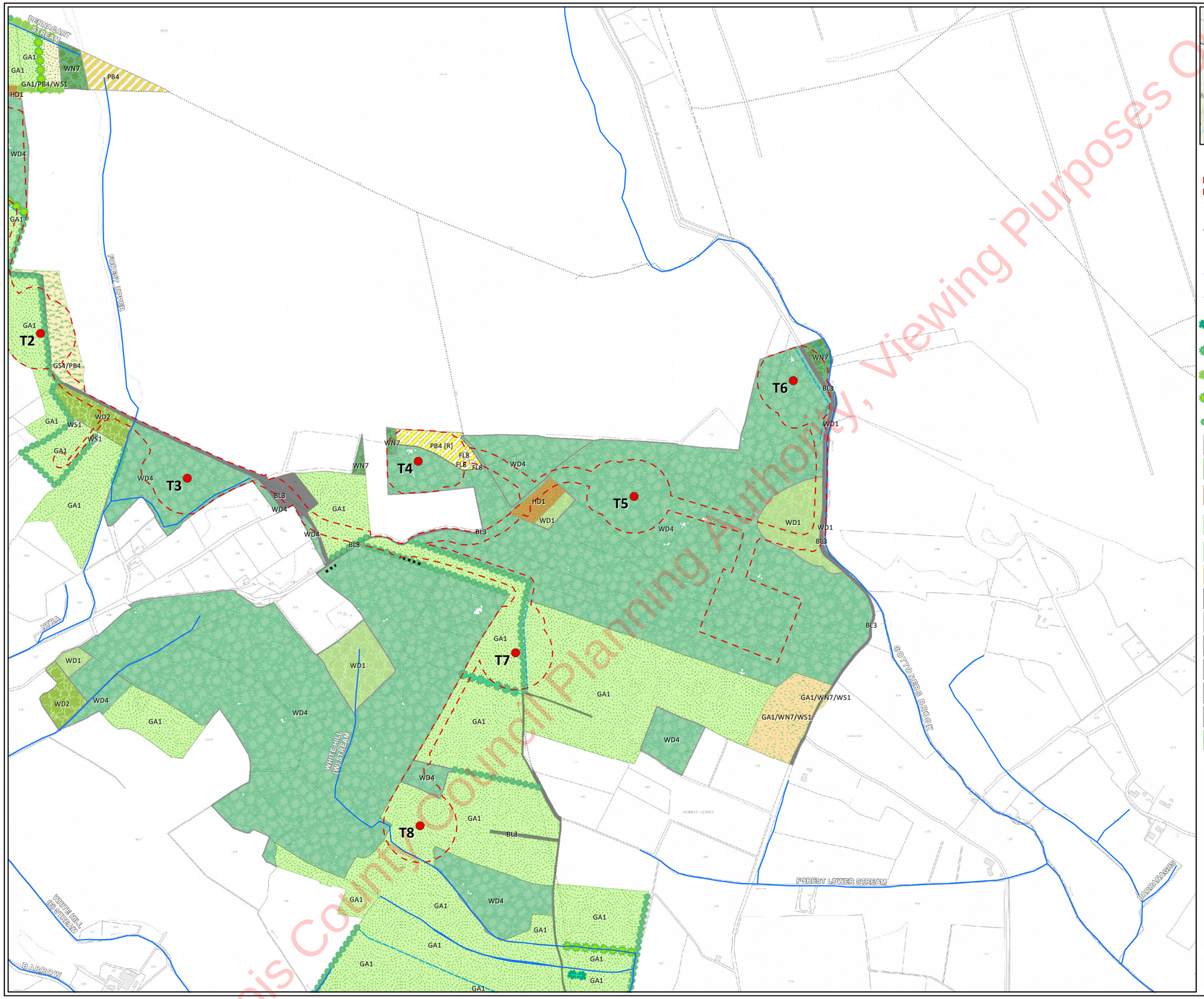

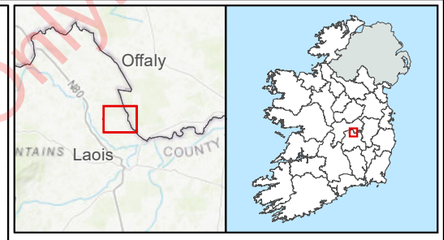

- Proposed Turbines
- Proposed Planning Boundary

Invasive Species

- Giant Hogweed

Habitat

- FW2, Depositing/lowland rivers
- FW4, Drainage ditches
- FW4/WL1/WL2, Drainage ditches / Hedgerows / Treelines
- FW4/WL2, Drainage ditches / Treelines
- WL1, Hedgerows
- WL1/WL2, Hedgerows / Treelines
- WL2, Treelines
- BL3, Buildings and artificial surfaces
- GA1, Improved agricultural grassland
- GA1/PB4/WS1, Improved agricultural grassland / Cutover bog / Scrub
- GA1/WN7/WS1, Improved agricultural grassland / Bog woodland / Scrub
- GS4/PB4, Wet grassland / Cutover
- HD1, Dense bracken
- PB4 [R], [Recolonising] Cutover
- PB4, Cutover
- WD1, (Mixed) broadleaved woodland
- WD2, Mixed broadleaved/conifer woodland
- WD4, Conifer plantation
- WN7, Bog woodland
- WS1, Scrub

TITLE:	Habitats Submap 2/3		
PROJECT:	Dernacart Wind Farm		
FIGURE NO:	12.8.2		
CLIENT:	Statkraft		
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DATE:	30/01/2020	**PAGE SIZE:**	A3

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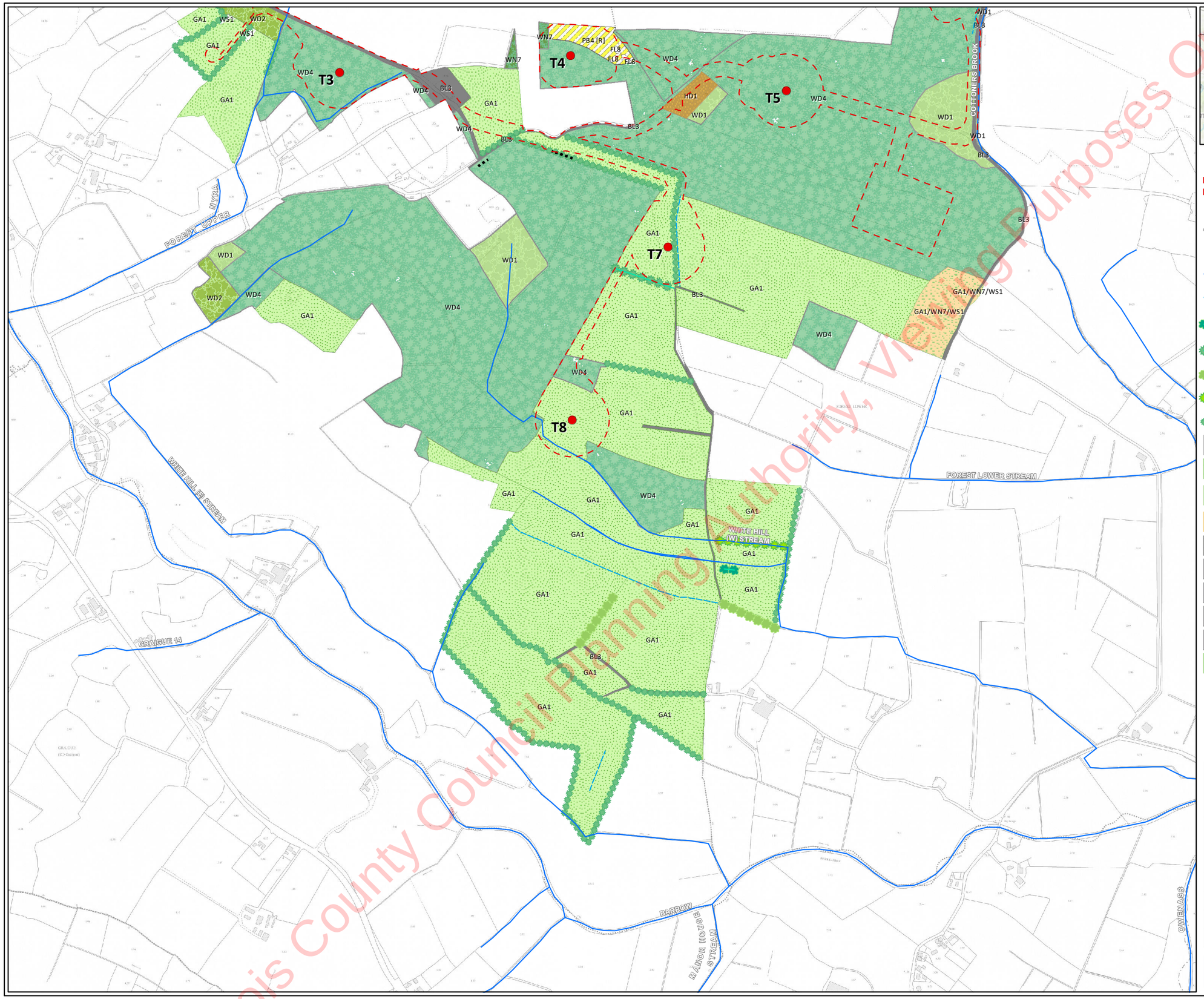

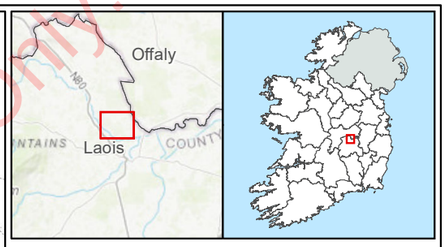

- Proposed Turbines
- Proposed Planning Boundary

Invasive

- Giant Hogweed

Habitat

- FW2, Depositing/lowland
- FW4, Drainage
- FW4/WL1/WL2, Drainage ditches / Hedgerows
- FW4/WL2, Drainage ditches /
- WL1, Hedgerows
- WL1/WL2, Hedgerows /
- WL2, Treelines
- BL3, Buildings and artificial
- GA1, Improved agricultural
- GA1/WN7/WS1, Improved agricultural
- HD1, Dense bracken
- PB4 [R], [Recolonising] Cutover
- WD1, (Mixed) broadleaved
- WD2, Mixed broadleaved/conifer
- WD4, Conifer
- WN7, Bog woodland
- WS1, Scrub

TITLE:	Habitats Submap 3/3		
PROJECT:	Dernacart Wind Farm		
FIGURE NO:	12.8.3		
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DATE:	30/01/2020	**PAGE SIZE:**	A3

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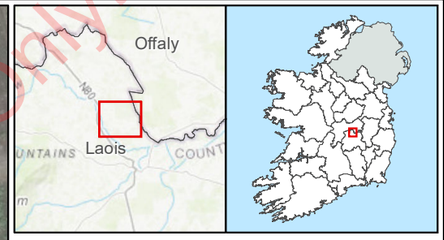

- Proposed Turbines
- Proposed Planning Boundary
- Study Area Boundary
- Proposed Cable Route
- Proposed Turbine Hardstanding Areas
- Proposed Substation
- Proposed Temporary Compound

Proposed Access Tracks

- Existing Track to be Upgraded
- New Track

Mammal Signs

- Badger Snuffle Holes
- Deer droppings
- Deer prints
- Deer trail
- Fox droppings
- Pine Marten
- Pine Marten Scat
- Red Squirrel
- Wallow Hole (Deer)

TITLE:	Mammal Signs		
PROJECT:	Dernacart Wind Farm		
FIGURE NO:	12.9		
CLIENT:	Statkraft		
SCALE:	1:10000	**REVISION:**	0
DATE:	30/01/2020	**PAGE SIZE:**	A3

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Improved Agricultural Grassland (GA1)

This is the most common habitat within the site; it is currently in use, being grazed and/or cut for silage. The species present in the intensively managed areas include red clover *Trifolium pratense*, white clover *Trifolium repens*, creeping buttercup *Ranunculus repens*, meadow buttercup *Ranunculus acris*, docks *Rumex* sp., ribwort plantain *Plantago lanceolata*, Yorkshire fog *Holcus lanatus* and perennial ryegrass *Lolium perenne*.

A number of species less commonly associated with this habitat type including heath spotted orchid *Dactylorhiza maculata*, bush vetch *Vicia sepium* and slender St. John' wort *Hypericum pulchrum* were recorded around the perimeter of agricultural fields.

This habitat is an intensively managed monoculture with low species diversity and therefore is considered from a botanical and ecological perspective to be *Locally Important (Lower Value)*; the presence of orchids and slender St. John' wort around the fringes at some locations increase the value of these areas to *Locally Important (Higher Value)*.

Plate 1: Improved Agricultural Grassland

Conifer Plantation (WD4)

A large portion of the site comprises conifer plantation, dominated by non-native species such as sitka spruce *Picea sitchensis*, lodgepole pine *Pinus contorta* and larches *Larix* spp. The majority of the conifer plantations within the site are fringed by narrow bands of broadleaved trees such as ash *Fraxinus excelsior*, birch *Betula* sp. and alder *Alnus glutinosa*, which were planted along with the conifer crops.

Conifer plantation characterised by even-aged stands of non-native conifers which are maintained for commercial timber production are generally of low diversity and therefore as a habitat type of low value. This habitat is *Locally Important (Higher Value)*.

Despite their lower inherent value as a habitat type, conifer plantations can form a resource for species like red squirrel, pine martin and woodcock.

Plate 2: Conifer Plantation

Mixed Broadleaved Woodland (WD1)

This habitat type is found in six locations within the site, represented by broadleaved forestry plantations. Three of these are mature birch plantations. The birch woodlands are bordered by a combination of ash, alder and holly *Ilex aquifolium*. There is an ash plantation in the northeast of the site, an alder plantation in the east of the site and a sycamore *Acer pseudoplatanus* plantation in the north of the site. The understory of these recently established woodlands contains bramble *Rubus fruticosus* Agg., bracken *Pteridium aquilinum*, ivy *Hedera helix*, nettle *Urtica dioica* and Yorkshire fog.

Due to their semi-natural state and importance of woodland to local wildlife these areas of habitat are *Locally Important (Higher Value)*.

Plate 3: Mixed Broadleaved Woodland

Mixed Broadleaved/Conifer Woodland (WD2)

This habitat is present in the west of the site. It comprises stands of alder, ash, hawthorn *Crataegus monogyna*, scots pine *Pinus sylvestris* and Norway spruce *Picea abies*. The understory comprises bramble and herb Robert *Geranium robertianum*, interspersed with smaller areas of bracken.

Due to the semi-natural state and importance of woodland to local wildlife the habitat is *Locally Important (Higher Value)*.

Plate 4: Mixed Broadleaved/Conifer Woodland

Buildings and Artificial Surfaces (BL3)

This comprises a storage shed, trailers and small yard used for turf harvesting operations in the centre of site. No features with potential for bird nesting or roosting areas for bats are present.

Due to the absence of any features of value to nesting birds or roosting bats, these man-made structures are of low ecological value and are of *Negligible* value.

Plate 5: Buildings and Artificial Surfaces

Dense Bracken (HD1)

The habitat type consisted almost exclusively of dense stands of bracken *Pteridium aquilinum*. This habitat is present in three areas in the northwest and northeast of the site.

As the habitat is dominated almost exclusively by dense bracken it is *Locally Important (Lower Value)*.

Plate 6: Dense Bracken

Bog Woodland (WN7)

Bog woodland composed of birch woodland which is reclonising cutover bog and fringing areas is present within the study area. As such while corresponding to Bog Woodland (WN7) under the Fossit habitat classification system, these woodlands are not the Annex I habitat *Bog Woodland*.

Bog woodland is present in four locations within the site. Birch is the dominant tree, with willow (*Salix* Sp.), scots pine, bramble, tamarisk moss *thuidium tamariscinum*, Ling *Calluna vulgaris*, nettle, willowherb *Epilobium* sp., field bindweed *Convolvulus arvensis*, hart's-tongue fern *Asplenium scolopendrium*, herb robert and silverweed *Potentilla anserina* all present on occasion.

Detailed data on species composition, structural and environmental characteristics were obtained through recording of quadrats (see Appendix 12.5). No *Sphagnum* is present, reflective of the dried-out nature of the peat in these areas.

As such, while the dominance of birch in the canopy and peatland setting places these areas within the category of bog woodland under the Fossitt (2000) classification system, these areas do not correspond to the Annex I priority habitat type '*bog woodland (91D0)', which refers to woodland of intact raised bog only. Examples of this habitat are very rare in Ireland.

These woodlands originated in the colonisation of cutover bog by birch following the obliteration of raised bog habitats caused by commercial peat harvesting; as such they represent the early successional stages of woodlands which could develop into mature woodlands highly natural in character.

Due to the semi-natural state and importance of woodland to local wildlife, and the fact these woodlands represent the early successional stages of a severely disturbed landscape developing new habitats through natural processes, the habitat is *Locally Important (Higher Value)*.

Plate 7: Bog Woodland

Improved Agricultural Grassland/Bog Woodland/ Scrub (GA1/WN7/WS1) Mosaic

This habitat mosaic is located in the east of the site. The mosaic is heavily dominated by scrub with smaller areas of grassland and woodland. Species present include Yorkshire fog, gorse *Ulex* Sp., nettle, bracken, bramble, willow, hawthorn, birch, silverweed, perennial ryegrass, ivy, bindweed, rosebay willowherb *Chamerion angustifolium* and white clover. Quadrats were undertaken at this habitat as part of the Annex I assessment (see Appendix 12.5). The species composition and cover present does not correspond to any Annex I habitats. No mosses were present, and as above, the woodland portion of the habitat does not meet the criteria set out for Annex I bog woodland.

This habitat is *Locally Important (Higher Value)*.

Plate 8: Improved Agricultural Grassland/Bog Woodland/Scrub Mosaic

Cutover Bog (PB4)

This habitat is present in a small area in the northeast of the site. There is no vegetation present. The original mass of peat has been removed through mechanical peat exaction.

Due to this recent and severe disturbance, this habitat is *Locally Important (Lower Value)*.

Plate 9: Cutover Bog

(Recolonising) Cutover Bog (PB4)

This habitat is located in the northeast of the site (partly within proposed road/hardstanding footprint) and is dominated by cotton-grass *Eriophorum* Sp.and ling. Purple moor-grass *Molinia caerulea*, immature willow and birch, gorse, crossed leaved heath *Erica tetralix* and tormentil *Potentilla erecta* are common throughout the habitat. Soft rush *Juncus effusus*, Sharp flowered rush *Juncus acutiflorus*, devils bit scabious *Succisa pratensis* and bramble are present on occasion. Devil's bit scaboius was not abundant and vegetation was more open and sparse than the wet grassland/heath type vegetation usually associated with high densities of this plant species.

There is a low abundance of sphagnum moss within this habitat area with *Spaghnum magellanicum* being the only species noted during the quadrat surveys. *Dicranum scoparium* was common at the northern end of this habitat area. There are areas of bare cutover bog adjacent to the east of this habitat. Given the species composition and cover recorded during the quadrat surveys (see Appendix 12.5), it can be concluded that the habitat onsite does not correspond to any Annex I habitats.

This habitat is *Locally Important (Higher Value)*.

Plate 10: (Recolonising) Cutover Bog

Improved Agricultural Grassland/(Recolonising) Cutover Bog/Scrub (GA1/PB4/WS1) Mosaic

This habitat mosaic is located in the northwest of the site, where an area of cutover bog formerly managed as agricultural grassland has been allowed to be colonised naturally. Species present include purple moor-grass, bramble, bracken, Yorkshire fog, tormentil, heather, meadowsweet *Filipendula ulmaria*, neat feather-moss *Pseudoscleropodium purum* and gorse. Bush vetch, ribwort plantain and birch were recorded on occasion.

Given the species composition and cover recorded during the quadrats undertaken for the Annex I habitat assessment (see Appendix 12.5) it can be concluded that the habitat onsite does not correspond to any Annex I habitats.

This habitat is *Locally Important (Higher Value)*.

Plate 11: Improved Agricultural Grassland/(Recolonising) Cutover Bog/Scrub Mosaic

Wet Grassland / Recolonising Cutover Bog (GS4/PB4)

This habitat mosaic, dominated by meadowsweet, is located in the north of the site. Ling, soft rush, silverweed, bracken, marsh thistle *Cirsium palustre*, knapweed *Centaurea nigra*, immature birch and tormentil are common throughout the habitat. Docks, ragwort *Jacobaea vulgaris*, Yorkshire fog, ribwort plantain, white clover, creeping buttercup, and bush vetch were present on occasion. No sphagnum species were recorded in this area.

Given the species composition and cover recorded during the quadrats undertaken for the Annex I habitat assessment (see Appendix 12.5), it can be concluded that the habitat onsite does not correspond to any Annex I habitats.

This habitat is *Locally Important (Higher Value)*.

Plate 12: Wet Grassland/Recolonising Cutover Bog

Scrub (WS1)

Scrub is found in a limited number of areas throughout the site, including the road verge along the N80 where a turning area for turbine deliveries is required. The remainder is along the edges / in the corners of agricultural fields in the north west of the site. The dominant species present are nettle, bramble and gorse.

This habitat is *Locally Important (Higher Value)*.

Plate 13: Scrub

Hedgerows (WL1)

The hedgerows present throughout the site are of varying condition. Dominant species include hawthorn, and willows (*Salix* spp.), with bramble occupying the understory.

This habitat is *Locally Important (Higher Value)*.

Plate 14: Hedgerows

Treelines (WL2)

Ash and hawthorn are the dominant species in the treelines throughout the site. Willow and birch occur frequently, with holly and sycamore present on occasion.

This habitat is *Locally Important (Higher Value)*.

Plate 15: Treelines

Hedgerows (WL1) / Treelines (WL2) Mosaic

Ash is the dominant species making up treelines within this mosaic. Birch and sycamore are also present on occasion. Bramble and hawthorn are the main hedgerow species. Willow, meadowsweet, marsh thistle, Yorkshire fog, cow parsley *Anthriscus sylvestris*, bush vetch, rosebay willowherb and lesser stitchwort *Stellaria graminea* are also present within the understory of the hedgerow.

This habitat is *Locally Important (Higher Value)*.

Plate 16: Hedgerow/Treeline Mosaic

Other artificial lakes and ponds FL8

Four large man-made ponds were noted within the area of recolonising cutover bog in the north east of the site. These ponds were bordered by cotton-grass, purple moor-grass and soft rush. Vegetation within these ponds was minimal, with algae and bull-rush *Typha latifolia* present on occasion.

This habitat is *Locally Important (Higher Value)*.

Plate 17: Other artificial lakes and ponds

Depositing/Lowland Rivers (FW2)

This habitat is represented within the site by the forest upper river, white hill streams, Dernacart stream and the Cottoners brook which flow through and around the site. The upper reaches of the white hill stream and Dernacart stream within the site are more similar to agricultural drains. They are relatively dry and bordered by hedgerows/treelines. The Cottoner's Brook where it borders the wind farm site is a tiny polluted stream with no fish present; it does not provide any potential habitat for fish. The site was heavily silted and there had been illegal rubbish dumping. Even during higher water levels this stream could not provide habitat for salmonids. This habitat is detailed further in the Aquatic Ecology section (12.3.11).

The River Barrow is downstream of the wind farm site and is also crossed by the proposed grid connection route at Kilnahown Bridge. The quality of the Barrow is higher than the small streams running through and around the wind farm site, with Salmonids and Lamprey recorded.

No freshwater pearl mussel (which are known not to be present along this stretch) or white-clawed crayfish were present. Q values ranging from Q 3-4 Moderate to Q4 Good were assigned based on macroinvertebrate sampling, with background activities including industrialised agriculture and peat extraction contributing to reductions in water quality.

This habitat is automatically classified as *Locally Important (Higher Value)*.

However, most of the streams that could potentially be affected by construction of the wind farm are very small 1st order streams which do not support significant aquatic ecosystems.

Plate 18: Depositing/Lowland Rivers

Drainage Ditches (FW4)

Drainage ditches are present within the site along agricultural field boundaries, particularly in the north-western section of the study area. The majority of ditches exhibited limited flow during the summer but contained more water during the winter months. Vegetation present includes watercress *Nasturtium officinale*, great willow herb *Epilobium hirsutum*, soft rush, thistle, Yorkshire fog, and timothy grass *Phleum pratense*. A small number of drainage ditches are present in agricultural fields within the site.

This habitat is *Locally Important (Higher Value)*.

Plate 19: Drainage Ditches

7.3.5.2. Habitats along the proposed grid cable route

The cable will follow the route along a local road on the eastern boundary of the site, before joining the R423. The grid connection is then proposed to be laid in the R423 to Portarlington Golf Club. At Portarlington Golf Club, the grid route follows a local road to Kilbride. At Kilbride the grid route will follow local roads to the R420 and connect to the proposed Bracklone substation.

Total length of the grid route between substations is c. 16.2 km. The length of the cable route within the wind farm site is c. 1 km. The grid cable route will travel along existing tracks and roads for approximately 16 km. This habitat type is classified as Buildings and Artificial Surfaces (BL3). Adjacent habitats to this section of the proposed route included Hedgerows (WL1) and Treelines (WL2) with Improved Agricultural Grassland (GA1) the most dominant habitat in the greater area.

Roads (BL3) with Grassy Verges (GS2) and Hedgerows (WL1)

Grassy verges and hedgerows border the local and regional roads along which the cable route proceeds. All of these roads are tarmacked except the first c. 1km which is comprised of stone, loose gravel and earth.

Grassy verges contain nettle, bracken, bramble, hedge bindweed, willow, rosebay willowherb, hogweed, meadowsweet, Yorkshire fog, ryegrass species, dock, clover, cow's parsley, hedge woundwort, common spotted orchid and poppy.

These hedgerows contain hawthorn, ash and willow *Salix* sp., with some blackthorn *Prunus spinosa* and bramble also present.

Grassy verges and hedgerows are *Locally Important (Higher Value)*, while roads are of *negligible* value.

Hedgerows (WL1) / Treelines (WL2)

This habitat mosaic is present along the cable route. Species present include hawthorn and ash, sycamore, bramble, hedge bindweed *Calystegia sepium* and willow *Salix* sp.

This habitat is *Locally Important (Higher Value)*.

Treelines (WL2)

The treelines flanking the proposed grid connection route are made up of ash, sycamore, hawthorn*)* and willow, with beech and alder present on occasion.

This habitat is *Locally Important (Higher Value)*.

Amenity Grassland (GA2)

In a number of locations along the length of the cable route, property owners have removed the grassy verges and, in some cases, established hedgerows and replaced them with mowed, species poor lawn and ornamental hedgerow such as privet *Ligustrum vulgare* and Leyland cypress *Cupressus* × *leylandii*.

This habitat is *Locally Important (Lower Value)*.

Buildings and Artificial Surfaces (BL3)

The end of the proposed grid connection route passes through the town of Portarlington prior to joining up with the proposed Bracklone substation. Residential and commercial premises in addition to paved footpaths border the grid route in Portarlington.

12.3.7 Rare or Protected Mammals

The protected mammal species listed in Table 12-24, below have been recorded within the 10 km grid squares (N40 and N41) in which the proposed wind farm site is located, and 1km grid squares overlapping the proposed cable route. Both NBDC records and NPWS records obtained by request were consulted as part of the desktop study. Nine protected mammal species have recorded within 10km of the proposed study area namely badger *Meles meles*, red squirrel *Sciurus vulgaris*, otter *Lutra lutra*, pygmy shrew *Sorex minutus*, hedgehog *Erinaceus europaeus*, fallow deer *Dama dama*, Irish hare *Lepus timidus*, Irish stoat *Mustela erminea Hibernica* and pine marten *Martes martes*. Four of the records (Badger, Red Squirrel, Irish Hare and Pine Marten) are within the last three years.

Table 12-24: Historical Records of Protected Mammals within 10 km of the Proposed Development

Grid Square(s)	Common Name	Scientific Name	Year of Last Record	Survey/Dataset	Protection	Records within the study area
N40, N41, N40P, N41F, N41G, N4609, N4911, N5010, N5410, N5511, N5611	Eurasian Badger	*Meles meles*	2017	National Biodiversity Data Centre (NBDC) - general, Mammals of Ireland 2016-2025, Irish National Badger Sett Database	Wildlife Acts	Numerous recent 100m resolution (2015) records (roadkill, scat, tracks, trail camera) from lands surrounding site; one low resolution (1km) record (2004) (type not specified) overlaps southern portion of site dominated by agricultural fields.
N41, N4910	Eurasian Pygmy Shrew	*Sorex minutus*	2011	Atlas of Mammals in Ireland 2010-2015	Wildlife Acts	No records within the site. Closest record is in Garryhinch 4.3km east of site near River Barrow on 23/04/2011 (N498106).
N40, N41, N4911, N5010, N5110, N5209, N5410	Eurasian Red Squirrel	*Sciurus vulgaris*	2017	Mammals of Ireland 2016-2025, The Irish Squirrel Survey 2007, Atlas of Mammals in Ireland 2010-2015	Wildlife Acts	One recent 100m resolution record (type not specified) (2012) overlaps conifer plantation/grassland in north of site.
N40, N41, N41F, N41G, N1910, N5010	European Otter	*Lutra lutra*	2015	NBDC records (general), Mammals of Ireland 2016-2025, Atlas of Mammals in Ireland 2010-2015, Otter Survey of Ireland 1982	EU Habitats Directive Annex II & Annex IV Wildlife Acts	One recent 100m resolution record (06/03/2015) of spraint associated with bog drain abutting site boundary; 3 further similar records between 100-300m of northern site boundary. One recent 100m resolution record (25/03/2015) of slide/track into Barrow c. 400m southwest of site.

Grid Square(s)	Common Name	Scientific Name	Year of Last Record	Survey/Dataset	Protection	Records within the study area
N40, N41, N41G, N4810, N4910, N4911, N5010	Fallow Deer	*Dama dama*	2015	C, Atlas of Mammals in Ireland 2010-2015	Wildlife Acts (*note- although fallow deer are protected, they are also considered a high-impact invasive species*)	One recent 100m resolution trail camera record (2015) overlapping north-eastern corner of site. Numerous recent (2015) records of tracks associated with edges of cutover bog to north of site.
N40, N41, N41F, N41G, N5010	Irish Hare	*Lepus timidus*	2017	Mammals of Ireland 2016-2025, Atlas of Mammals in Ireland 2010-2015	EU Habitats Directive Annex V, Wildlife Acts	One recent 100m resolution live sighting record (09/07/2011) overlapping conifer plantation in mid-western section of site. Other more recent live sightings (2017) are recorded in areas fringing cutover bog to the north of the site.
N40, N41	Irish Stoat	*Mustela erminea hibernica*	2013	Atlas of Mammals in Ireland 2010-2015	Wildlife Acts	No records in site; closest records (scat & roadkill) dating from 2010 & 2013 are 3.2 km north and 2.7 km south respectively.
N40, N41, N40P, N5010, N5110	Pine Marten	*Martes martes*	2017	NBDC Records (general), Mammals of Ireland 2016-2025, Atlas of Mammals in Ireland 2010-2015	EU Habitats Directive Annex V, Wildlife Acts	One recent 100m resolution record (type not specified) (2012) overlaps conifer plantation/grassland in north of site. A live sighting (2017) and trail camera image (2015) are recorded in areas fringing the cutover bog to the north of the site.

Grid Square(s)	Common Name	Scientific Name	Year of Last Record	Survey/Dataset	Protection	Records within the study area
N40, N41, N41F, N5110	West European Hedgehog	*Erinaceus europaeus*	2016	Mammals of Ireland 2016-2025	Wildlife Acts	There are no records of hedgehogs within the site. The closest record (2013) is of an animal killed on the road, c. 760m southeast of the site boundary.

There are eight species of invasive mammal recorded within the 10 km grid squares (N40, N41) overlapping the proposed wind farm site and 1 km grid squares overlapping the grid connection route. Both NBDC records and NPWS records obtained by request were consulted as part of the desktop study. These records are of American mink *Mustela vison*, grey squirrel *Sciurus carolinensis* bank vole *Myodes glareolus* brown rat *Rattus norvegicus,* European rabbit *Oryctolagus cuniculus,* fallow deer *Dama dama* house mouse *Mus musculus* greater white-toothed shrew *Crocidura russula*. Records of these species within the greater area are relatively recent having occurred within the last ten years. The most frequently recorded and widely distributed species is fallow deer, which has been recorded in an area bordering the proposed wind farm site, and in a number of 1km grid squares along the proposed grid connection route.

Table 12-25: Historic Records of Invasive Mammal Species within 10 km of the Proposed Development

Grid Square	Common Name	Scientific Name	Year of Last Record	Survey	Conservation Status	Records within the study area
N40, N41, N5010	American Mink	*Mustela vison*	2015	Otter Survey of Ireland 1982, General Biodiversity Records from Ireland, Bord na Móna Commission Survey 2014-2015	Invasive species – High Impact; Schedule III (Reg. 49 & 50 EC Birds & Natural Habitats Regs, 2011)	There are no records of mink within the site. However, there are numerous records in the greater surroundings; closest (tracks) is 100m resolution record from 22/01/2015, at Garryhinch c. 2.8 km northwest of wind farm site.
N40	Bank Vole	*Myodes glareolus*	2011	Atlas of Mammals in Ireland 2010-2015	Invasive species – Medium Impact	There are no records of bank vole within the site. The closest record is a live sighting from 20/06/2012, in woodland c. 9.8 km southeast of wind farm site (100m resolution).
N40	Brown Rat	*Rattus norvegicus*	2013	Atlas of Mammals in Ireland 2010-2015	Invasive species – High Impact; Schedule III (Reg. 49 & 50 EC Birds & Natural Habitats Regs, 2011)	There are no records of brown rat within the site. The closest (high resolution) record is a live sighting from 02/10/2013, c. 5.5 km southeast of wind farm site (100m resolution).

Grid Square	Common Name	Scientific Name	Year of Last Record	Survey	Conservation Status	Records within the study area
N40, N41, N5010	European Rabbit	*Oryctolagus cuniculus*	2017	Atlas of Mammals in Ireland 2010-2015, Mammals of Ireland 2016-2025	Invasive species – Medium Impact	There are no records of rabbit within the site. The closest record is from 01/03/2007, c. 2.1 km southwest of wind farm site (100m resolution).
N40, N41, N41G, N41K, N4810, N4910, N4911, N5010	Fallow Deer	*Dama dama*	2015	Atlas of Mammals in Ireland 2010-2015, General Biodiversity Records from Ireland	Invasive species – High Impact; Schedule III (Reg. 49 & 50 EC Birds & Natural Habitats Regs, 2011); protected under Wildlife Acts	One recent 100m resolution trail camera record (2015) overlapping north-eastern corner of site. Numerous recent (2015) records of tracks associated with edges of cutover bog to north of site.
N40	House Mouse	*Mus musculus*	2011	Atlas of Mammals in Ireland 2010-2015	Invasive species – High Impact	There are no records of house mouse within the site. The closest record is a live sighting from 10/01/2018, at Geashill c. 8.8 km north of wind farm site (100m resolution).
N41, N4910, N5010, N5209	Eastern Grey Squirrel	*Sciurus carolinensis*	2010	Atlas of Mammals in Ireland 2010-2015	Invasive species – High Impact; Schedule III (Reg. 49 & 50 EC Birds & Natural Habitats Regs, 2011)	There are no records of grey squirrel within the site. The closest record is a live sighting from 22/05/2010, at Garryhinch Woods c. 4.3 km east of wind farm site (100m resolution).
N41	Greater White-toothed Shrew	*Crocidura russula*	2017	Mammals of Ireland 2016-2025	Invasive species – Medium Impact	There are no records of greater white-toothed shrew within the site. The closest record is a dead animal from 09/08/2017, in pasture c. 5.2 km northeast of wind farm site (100m resolution).

12.3.8 Terrestrial Mammals

Evidence of six mammal species was obtained within the study area (Table 12-26). Figure 12-9 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 dedicated mammal survey of the proposed development and also during other ecological surveys. Five of these species are considered to be of 'Least Concern' in Ireland (Marnell *et al.,* 2009). Red squirrel are evaluated as 'Near Threatened' in Ireland, due principally to the presence of the invasive grey squirrel *Sciurus carolinensis* which are having a significant negative impact on the native red squirrel population. Other common and widespread mammal species, such as pygmy shrew, Irish stoat and European hedgehog may also occur on site despite not being recorded during surveys.

Table 12-26: Mammal Species recorded on the site and their conservation status (Marnell *et al*., 2009 and NPWS, 2013a)

Common Name	Scientific name	Conservation Status
Fox	*Vulpes vulpes*	Least Concern*
Rabbit	*Oryctolagus cuniculus*	Least Concern*
Badger	*Meles meles*	Least Concern*
Pine Marten	*Martes martes*	Least Concern*
Fallow Deer	*Dama dama*	Least Concern*
Red Squirrel	*Sciurus vulgaris*	Near Threatened*

* Marnell *et al*., 2009 ** NPWS, 2013a

Badger

A total of nine badger setts and two potential setts were observed within the study area, none of which are directly within the proposed development footprint. These comprised ten single-entrance setts, and one two-entrance sett. One single entrance sett (sett 6) in conifer plantation near the access road between T7/T8 was active at the time of surveying (November 2019) with fresh spoil present outside. Four inactive setts (setts 7-11) are present in conifer plantation to the south of the active sett, near the access road, and within the proposed felling buffer around T8. Inactive setts are also present in the turbine/access track felling buffers around T1 and T3, and in conifer plantation outside the site boundary south of T5. The potential setts are located in conifer plantation near T7 and in a hedgerow near the site entrance (outside the site boundary.

As such, no main setts are present; those recorded are considered to be subsidiary or outlier setts. Table 12-27 details the setts present within the study area, including their status, and location relative to site boundary and proposed infrastructure.

Evidence of badger including snuffle holes, latrines and prints was also recorded during 2018/19 winter walkover bird surveys.

Table 12-27: Badger Setts within Study Area

Sett Number	Location	Distance from the development	Details
1	Outside planning boundary	131 m	Single entrance potential outlier sett (inactive).
2	In access track/turbine felling buffer	15 m	Single entrance outlier sett (inactive).

Sett Number	Location	Distance from the development	Details
3	In access track/turbine felling buffer	49 m	Single entrance outlier/subsidiary sett (inactive).
4	Outside planning boundary	114 m	Single entrance outlier/subsidiary sett (inactive).
5	Inside planning boundary	23 m	Single entrance potential outlier sett (inactive).
6	Inside planning boundary	16 m	Single entrance subsidiary sett (Active).
7	Outside planning boundary	22 m	Two entrance subsidiary sett (inactive).
8	Inside planning boundary	11 m	Single entrance outlier/subsidiary sett (inactive).
9	In Turbine felling buffer	43 m	Single entrance outlier/subsidiary sett (inactive).
10	In Turbine felling buffer	44 m	Single entrance outlier sett (inactive).
11	In Turbine felling buffer	48 m	Single entrance outlier/subsidiary sett (inactive).

Pine Marten

A pine marten was recorded on a trail camera placed adjacent to conifer woodland in the central northern part of the study area between T3 and T4 during habitat/general ecology surveys carried out between 16th July – 15th August 2019. In addition, pine marten scat was recorded in conifer plantation near T1. The species is considered to be using the birch woodland, mixed broadleaved woodland and conifer plantation habitats within the study area. No dens went recorded during mammal surveys.

Red Squirrel

A live sighting of red squirrel was recorded during the mammal survey. This observation was of a red squirrel near an access track adjacent to conifer plantation, which ran up a tree to escape the surveyor. A live sighting of red squirrel was also made during 2018/19 winter walkover bird surveys. No dreys were observed during surveys, however these can be difficult to observe from the ground, particularly within the dense canopy of spruce plantations.

Desktop study results indicate the presence of both red and grey squirrel near the proposed cable route, while the live sightings confirm the presence of red squirrel within the study area. It is possible that both species are present within the study area.

Otter

There were no holts found during surveys and no holts were recorded within the study area 150m up and down-stream of the existing crossing EXC1 and of watercourses adjacent to existing tracks and within felling buffers.

No potential holt habitat was present at the Barrow cable route crossing point (Kilnahown Bridge) and no signs of otter were recorded here.

Fallow Deer

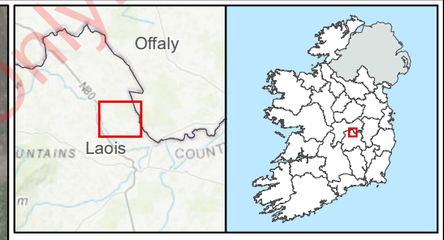
Fallow deer were observed within the site grazing in grassland adjacent to a large conifer plantation in the south of the site during surveys in July 2019. A group of 4 fallow deer were captured on trail camera images in August 2019 by a trail camera deployed adjacent to conifer plantation/improved agricultural grassland near T7.

A high number of signs, manly droppings and tracks indicate fallow deer regularly reside within the study area. The species is likely to be utilising the birch woodland and conifer plantation within the site for shelter while grazing in grassland habitats and margins.

Other Mammal Species

Records and signs of fox and rabbit were also noted during surveys and desk studies. While not observed during ecological surveys for the proposed development pygmy shrew, Irish stoat and hedgehog are also likely to be utilising habitats within the study area.

Path: R:\Map Production\2018\P1892\Workspace\EIAR\Chapter 12 - Biodiversity\P1892_Fig12-9_MammalSignsAndSightings_A3.mxd



- Proposed Turbines
- Proposed Planning Boundary
- Study Area Boundary
- Proposed Cable Route
- Proposed Turbine Hardstanding Areas
- Proposed Substation
- Proposed Temporary Compound

Proposed Access Tracks

- Existing Track to be Upgraded
- New Track

Mammal Signs

- Badger Snuffle Holes
- Deer droppings
- Deer prints
- Deer trail
- Fox droppings
- Pine Marten
- Pine Marten Scat
- Red Squirrel
- Wallow Hole (Deer)

TITLE:	Mammal Signs		
PROJECT:	Dernacart Wind Farm		
FIGURE NO:	12.9		
CLIENT:	Statkraft		
SCALE:	1:10000	**REVISION:**	0
DATE:	30/01/2020	**PAGE SIZE:**	A3

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12.3.9 Bats

There are records of five species within 10 km of the proposed development held by the NBDC: brown long-eared bat (*Plecotus auritus*), Daubenton's bat (*Myotis daubentonii*), Leisler's bat (*Nyctalus leisleri*), natterer's bat (*Myotis nattereri*) and soprano pipistrelle (*Pipistrellus pygmaeus*).

Only four of these species were recorded during bat activity transect surveys in 2018 and static detector surveys in 2019, while recordings of un-defined *Myotis* were also made during these surveys (Myotis can be difficult to identify to species level using echolocation calls due to overlap in the frequency bandwidth of the calls of different species).

Table 12-28: Historical Records of Bat Species in close proximity to the Proposed Development (NBDC)

Species	Survey	Conservation Status	Closest record to the site
Brown Long-eared Bat (*Plecotus auritus*)	Brown long-eared Roost Monitoring Scheme	EU Habitats Directive Annex IV, Wildlife Acts	Brown long eared bat recorded approximately 2.2 km east of wind farm site near on 15/06/2007.
Daubenton's Bat (*Myotis daubentonii*)	EIS surveys - Brian Keeley	EU Habitats Directive Annex IV, Wildlife Acts	Daubenton's Bat recorded approximately 400 m southwest (N423117) of wind farm site along River Barrow on 24/05/2007.
Leisler's Bat (*Nyctalus leisleri*)	BATLAS 2010	EU Habitats Directive Annex IV, Wildlife Acts	Leisler's Bat recorded approximately 4.6 km northeast (N483152) of wind farm site at Geashill on 25/04/2009.
Natterer's Bat (*Myotis nattereri*)	EIS surveys - Brian Keeley	EU Habitats Directive Annex IV, Wildlife Acts	Natterer's Bat recorded approximately 6.2 km southwest (N412037) of wind farm site at Clonygowan Bridge on 01/08/2007. Record indicates bridge roost.
Soprano Pipistrelle (*Pipistrellus pygmaeus*)	EIS surveys - Brian Keeley	EU Habitats Directive Annex IV, Wildlife Acts	Soprano Pipistrelle recorded approximately 1.8 km southeast (N450074) of wind farm site at Mountmellick on 04/10/2006.

A review of existing bat records within 30km of the study area (dataset obtained by request from Bat Conservation Ireland on 20th September 2019) reveals that, currently, roosts of seven of the nine known Irish species have been recorded within a 30km radius and roosts of six species within a radius of 10km. These include common *Pipistrellus pipistrellus,* soprano *P. pygmaeus* pipistrelles, Leisler's *Nyctalus leisleri*, brown long-eared *Plecotus auritus*, Daubenton's *Myotis daubentonii,* whiskered *M. mystacinus* and Natterer's *M. nattereri* bats as shown in Table 12-29 and Table 12-30 below.

The nearest known roost included in these records is a Daubenton's bat roost in Cappaghbeg (1km grid square N4211). This grid square (located c. 330m south of the proposed site entrance) overlaps the study area but does not overlap the proposed wind from site. A second Daubenton's bat roost is recorded in 1km grid square N4509 to the east of the study area.

The two remaining Irish species, Nathusius' pipistrelle and lesser horseshoe bat have not been recorded in the local area to date. Of these, the lesser horseshoe bat is not known to occur in Co. Laois as the species' distribution range is confined to the west of Ireland. Only two confirmed specimens of Brandt's bat have been recorded in Ireland (Kelleher, 2005; Mullen 2006).

Table 12-29 and Table 12-30 below give numbers of roosts for each bat species within a 30km and a 10km radius of the study area, respectively (records obtained by request from Bat Conservation Ireland on 20th September 2019).

Table 12-29: Roost records within a 30km radius of the study area

Common name	Scientific name	Known roosts	Source
Common pipistrelle	*Pipistrellus pipistrellus*	3 known	BCIreland
Soprano pipistrelle	*Pipistrellus pygmaeus*	3 known	BCIreland
Nathusius' pipistrelle	*Pipistrellus nathusii*	0 known	BCIreland
Leisler's bat	*Nyctalus leisleri*	3 known	BCIreland
Brown long-eared bat	*Plecotus auritus*	8 known	BCIreland
Daubenton's bat	*Myotis daubentonii*	3 known	BCIreland
Natterer's bat	*Myotis nattereri*	3 known	BCIreland
Whiskered bat	*Myotis mystacinus*	1 known	BCIreland
Lesser horseshoe bat	*Rhinolophus hipposideros*	0 known	BCIreland/NPWS

(Source: Bat Conservation Ireland)

Table 12-30: Roost records within a 10km radius of the study area

Common name	Scientific name	Known roosts	Source
Common pipistrelle	*Pipistrellus pipistrellus*	1 known	BCIreland
Soprano pipistrelle	*Pipistrellus pygmaeus*	1 known	BCIreland
Nathusius' pipistrelle	*Pipistrellus nathusii*	0 known	BCIreland
Leisler's bat	*Nyctalus leisleri*	1 known	BCIreland
Brown long-eared bat	*Plecotus auritus*	3 known	BCIreland
Daubenton's bat	*Myotis daubentonii*	2 known	BCIreland
Natterer's bat	*Myotis nattereri*	1 known	BCIreland
Whiskered bat	*Myotis mystacinus*	0 known	BCIreland
Lesser horseshoe bat	*Rhinolophus hipposideros*	0 known	BCIreland/NPWS

(Source: Bat Conservation Ireland)

In addition, consultation with the Biodiversity Ireland Bat Landscapes Map showed that the overall habitat suitability within the site for bat species present in Ireland is moderate, with indices of 21-28 for the northern part of the study area and 28 – 26 for the southern sections.

12.3.9.1 Foraging Habitat

The site comprises a mosaic of improved grassland with associated mature hedgerows and deciduous treelines, parcels of coniferous plantation and pockets of broadleaved woodland. A *c.*172ha area of cutover bog, which is presently subject to commercial peat harvesting, is situated immediately north of the site. There are a number of watercourses surrounding the site, including Cottoners Brook with abuts the eastern boundary and the River Barrow which lies just beyond the western site boundary.

The predominantly open nature of the improved grassland and cutover bog, and closed nature of the coniferous plantation and broadleaved woodland provides suboptimal bat habitat. However, continuous, high quality habitat that is well connected to the wider landscape and likely to be used regularly by foraging and commuting bats is present in the form of plantation edges, hedgerows, treelines and the watercourses that adjoin the site.

Overall, the proposed development was assessed as having moderate suitability for bats.

12.3.9.2 Preliminary Roost Assessment and Dusk Emergence Surveys (2018)

Four mature trees (Trees 1- 4) and three buildings ((a barn (Building 1), an abandoned house (Building 2) and derelict ivy clad house (Building 3)) were identified during habitat assessment surveys as possible bat roosts as detailed in the accompanying bat survey report (Appendix 12.2: Photos 1 – 8).

Tree 1 is a mature horse chestnut tree with no obvious roosting features recorded.

Trees 2, 3 and 4 are mature, multi-stemmed ash trees with light-moderate ivy coverage. No obvious bat roosting features were observed.

Building 1 is a barn composed of corrugated metal sheeting supported by a metal frame. Large sections of the barn are open. No evidence of bats was noted.

Building 2 is an abandoned single-storey house composed of stone with a corrugated metal roof. The house is derelict and the branches of an adjacent tree are now growing within the building. No evidence of bats was noted.

Building 3 is located approximately 600m from the nearest proposed turbine (T3). The building has two-storeys and is entirely covered in a thick layer of ivy. All windows panes and doors, and a large section of the roof are missing, providing potential access points. There are no enclosed attic spaces present due to an attic conversion. A couple of fresh bat droppings and several potential old bat droppings were observed adhered to the internal walls of the building. During a dusk emergence survey a single soprano pipistrelle was observed emerging from Building 3 at 20:25, 32 minutes after sunset. In addition, two soprano pipistrelles and a common pipistrelle were recorded commuting and foraging in the vicinity of the building.

The observation of only a single bat emerging from this building indicates it is a transitory roost.

In summary; one confirmed bat roost (building 3) and no additional potential bat roosts were recorded in 2018.

12.3.9.3 Transect Surveys (2018)

Overall, 5 dusk surveys were undertaken (one per month) between May and September 2018. In total, 76 bat passes were recorded during transect surveys (see Figure 3 in accompanying bat survey report in Appendix 12.2). A minimum of three bat species were recorded: common pipistrelle, soprano pipistrelle and Leisler's bat. The most commonly recorded species by bat activity index (BAI) was common pipistrelle (5.31 BAI), followed by soprano pipistrelle (1.87 BAI) and Leisler's bat (0.29 BAI).

Bat passes in May had a combined BAI of 5 but decreased in June to a BAI of 3.43. Activity increased in July to 9.66. In August, the highest number of bat registrations were recorded with a BAI of 10.67. Bat passes decreased in September to a BAI of 7.43

Table 12-31: Total number of bat passes recorded during transect surveys within the study area during 2018

Species	May	June	July	August	September	Total
Common pipistrelle	7	5	16	21	5	54
Soprano pipistrelle	2	0	6	3	8	19
Leisler's bat	1	1	1	0	0	3

12.3.9.4 Hibernation Roost Survey (2019)

No evidence of wintering bats was identified during careful inspection of buildings B1 and B2 as detailed in the accompanying 2019 bat report (see Appendix 12.3). No bat activity was recorded during the automated static detector survey conducted at during January and February 2019 at buildings B1 and B2.

12.3.9.5 Proposed Cable Route (2019)

The assessment found that Kilnahown Bridge was the only structure along the proposed grid connection route with potential to host roosting bats.

The subsequent daytime torch inspection in late September 2019 recorded 2 no. Daubenton's bats roosting in the stonework of the dry arch on the southern bank. Daubenton's bats are most frequently associated with water, which they fly over while hunting insects. They are commonly found roosting in bridges and a number of records of roosting Daubenton's bats including bridge roost records were noted in the area during the desktop study.

There are limited roosting spaces available in the bridge and the structure does not have the potential to support a maternity roost.

12.3.9.6 Static Detector Surveys (2018)

In total, 16,094 bat passes were recorded during 188 survey nights in 2018. A minimum of 4 bat species were recorded: common pipistrelle, soprano pipistrelle *Myotis* sp. and Leisler's bat. In addition, there were a number of contacts identified as *Pipistrellus* sp. which were either soprano or common pipistrelle but the mean frequently of the sonogram did not all for separation between these two species (see Table 12-32 below).

A total BAI of 8.92 was recorded within the site across all monitoring locations. The most commonly recorded by BAI was common pipistrelle (3.84 BAI), followed by soprano pipistrelle (3.69 BAI). The remaining contacts were Leisler's bat (0.74 BAI), *Pipistrellus* sp. (0.55 BAI) and *Myotis* sp. (0.11 BAI).

The highest level of activity was recorded at location 6, at the edge of coniferous plantation facing a treelined lane. The treelined lane represents a good commuting route and foraging area for bats.

Furthermore, this location is in proximity (300 m) from a confirmed soprano pipistrelle roost site. The BAI across all monitoring locations in June was 11.47 BAI which decreased to 5.25 BAI in July and 2.84 BAI in August. Bat activity peaked in September (20.51 BAI), refer to Graph 2 (Appendix 12.2).

It should be noted that due to layout changes and the introduction of new guidance regarding static detector requirements for onshore wind farm developments (SNH, 2019), the locations of static detectors in 2018 do not in all cases reflect the locations of proposed turbines. As such, during the 2018 survey static detectors were located near turbines T3 and T6, and in the general vicinity of T4, T7 and T8. No detectors were placed in the vicinity of T1, T2 and T5. The detectors placed at locations 1 and 6 are not near any currently proposed turbine locations (see Figure 12-2).

As such, while the 2018 static detector survey gives an indication of overall bat activity within the study area, and more specific data relevant to the areas where T3, T4, T6, T7 and T8 are located, it does not provide the data required for a comprehensive assessment of the finalised site layout.

Table 12-32: Total number of bat passes recorded during 2018 static detector surveys

Species	June	July	August	September	Total
Common pipistrelle	2362	1248	893	2419	6922
Soprano pipistrelle	1056	774	404	4422	6656

Species	June	July	August	September	Total
Pipistellus sp.	780	204	0	238	997
Leisler's bat	576	210	238	302	1326
Myotis sp.	56	34	61	42	193

12.3.9.7 Static Detector Surveys (2019)

In total, 20,363 bat passes were recorded during the summer and autumn season 2019 (Table 12-33). A minimum of four bat species were recorded: common pipistrelle, soprano pipistrelle, Leisler's bat and brown long-eared bat. In addition, there were a number of contacts identified to genus level only: *Pipistrellus* sp. and *Myotis* sp. The total number of bat passes recorded per detector during the summer and the autumn seasons individually is presented in Appendix B of the accompanying 2019 bat report included in Appendix 12.3 of this document.

A total Bat Activity Index (BAI) of 10.99 was recorded within the site. The most commonly recorded species by BAI was common pipistrelle (4.99 BAI), followed by soprano pipistrelle (3.58 BAI). The remaining contacts were *Pipistrellus* sp. (1.41 BAI), Leisler's bat (0.58 BAI), *Myotis* sp. (0.34 BAI) and brown long-eared bat (0.11 BAI). Common pipistrelle, soprano pipistrelle and Leisler's bat are high-risk species in terms of turbine collision risk.

The highest concentration of bat activity was at T7 (Graph 3.1 in of the accompanying 2019 bat report included in Appendix 12.3 of this document). This detector was located on the edge of conifer planation with the microphone of the detector facing the adjacent pastoral field. In contrast, the lowest levels of bat activity were recorded at T1 and T6, respectively (Graph 3.1 in Appendix 12.3 of this document). At these locations the detectors were located within coniferous plantation.

Overall, bat activity levels were higher during the summer season (17.33 BAI) compared to the autumn season (6.43 BAI) (Graph 3.2, Appendix 12.3).

Table 12-33: Total number of bat passes recorded per detector during the summer and autumn seasons 2019

Turbine number	Common pipistrelle	Soprano pipistrelle	*Pipistrellus* sp.	Leisler's bat	*Myotis* sp.	Brown long-eared bat	Total
T1	154	34	10	69	3	8	**278**
T2	2743	2036	174	174	121	35	**5283**
T3	234	190	42	79	28	8	**581**
T4	598	392	104	91	50	80	**1315**
T5	1732	148	34	163	26	15	**2118**
T6	109	30	6	141	5	19	**310**
T7	2810	3136	2104	255	81	12	**8398**
T8	854	661	135	97	315	18	**2080**
Total	**9234**	**6627**	**2609**	**1069**	**629**	**195**	**20363**

12.3.9.8 Analysis of bat passes vs. emergence times

Bat passes recorded during the 2019 static detector survey were plotted against species-specific emergence times. While bat passes for a number of species overlap their respective emergence times at a number of turbines, activity is in most cases at a consistent level. The two instances where spikes in activity occur during emergence periods are *Myotis* sp. at T2 and Leisler's bat at T6 (see Figures B.1.2 and B.1.6 in Appendix B of the accompanying 2019 bat report included in Appendix 12.3 of this document).

A Daubenton's bat *Myotis daubentonii* roost is known to be present in the 1km grid square south-west of T2, which could potentially explain this spike. No mature trees offering potential roosts for Leisler's bat are present in the vicinity of T6 however, making it unlikely this spike is indicative of a roost nearby.

12.3.9.9 Ecobat analysis

The Ecobat analysis of combined Summer/Autumn data is presented in this section. Individual analyses of these seasons are presented in Appendix B of the accompanying 2019 bat report included in Appendix 12.3 of this document.

The activity level for each species/genus during the combined summer/autumn seasons per turbine location are listed below in High activity levels as indicated by Ecobat analysis were recorded at turbines T2, T3, T4, T5, T7 and T8, with all of the higher activity accounted for by pipistrelles (Common & Soprano pipistrelle, *Pipistrellus* sp.). T1 had Moderate to High activity and T6 had Moderate activity, again with pipistrelles accounting for the highest activity levels at these locations.

For Leisler's bat, Low-moderate activity was recorded at T1, T3, T4, T6, and T8, and moderate activity at T2, T5 and T7. There was low activity at T1, T2, T3, T5, T6, T7 and T8, and moderate activity at T4 for Brown Long-eared bat. Activity for *Myotis* sp. was low at T1, T2, T3, and T6, and low-moderate at T4, T5, T7, and T8.

Activity levels are determined based on the median percentile as per Table 12-34 extracted from the guidance document *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* (SNH, 2019).

Table 12-34: 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

High activity levels as indicated by Ecobat analysis were recorded at turbines T2, T3, T4, T5, T7 and T8, with all of the higher activity accounted for by pipistrelles (Common & Soprano pipistrelle, *Pipistrellus* sp.). T1 had Moderate to High activity and T6 had Moderate activity, again with pipistrelles accounting for the highest activity levels at these locations.

For Leisler's bat, Low-moderate activity was recorded at T1, T3, T4, T6, and T8, and moderate activity at T2, T5 and T7. There was low activity at T1, T2, T3, T5, T6, T7 and T8, and moderate activity at T4 for Brown Long-eared bat. Activity for *Myotis* sp. was low at T1, T2, T3, and T6, and low-moderate at T4, T5, T7, and T8.

Table 12-35: Ecobat analysis of combined summer/autumn 2019 data per species/turbine

Detector ID	Species/Genus	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Percentile Median	Bat Activity Category
T1	Common pipistrelle	1	6	6	0	3	60	Moderate
T1	Soprano pipistrelle	0	0	2	4	7	19	Low
T1	*Pipistrellus* sp.	2	2	1	1	0	72	Moderate to High
T1	Leisler's bat	1	0	2	7	6	31	Low to Moderate
T1	*Myotis* sp.	0	0	0	0	2	10	Low
T1	Brown long-eared	0	0	0	0	6	4	Low
T2	Common pipistrelle	13	5	3	0	1	83	**High**
T2	Soprano pipistrelle	9	7	4	2	0	75	Moderate to High
T2	Pipistrellus sp.	17	1	1	0	0	90	**High**
T2	Leisler's bat	2	4	5	3	6	47	Moderate
T2	*Myotis* sp.	2	0	0	4	7	4	Low
T2	Brown long-eared	0	1	0	3	8	19	Low
T3	Common pipistrelle	3	6	4	2	1	69	Moderate to High
T3	Soprano pipistrelle	1	7	5	2	1	64	Moderate to High
T3	*Pipistrellus* sp.	6	3	0	0	1	82	**High**
T3	Leisler's bat	0	2	6	3	6	31	Low to Moderate
T3	*Myotis* sp.	0	0	0	5	7	19	Low
T3	Brown long-eared	0	0	0	1	5	4	Low
T4	Common pipistrelle	9	3	6	3	1	68	Moderate to High
T4	Soprano pipistrelle	4	9	2	5	2	65	Moderate to High
T4	Pipistrellus sp.	10	5	1	1	0	84	**High**
T4	Leisler's bat	0	2	6	4	8	35	Low to Moderate
T4	Myotis sp.	0	0	4	6	3	39	Low to Moderate
T4	Brown long-eared	0	5	2	3	4	44	Moderate
T5	Common pipistrelle	10	5	1	2	2	81	**High**

Detector ID	Species/Genus	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Percentile Median	Bat Activity Category
T5	Soprano pipistrelle	0	5	4	3	3	57	Moderate
T5	Pipistrellus sp.	10	0	0	0	0	92	**High**
T5	Leisler's bat	0	6	5	2	6	47	Moderate
T5	Myotis sp.	0	0	1	8	3	24	Low to Moderate
T5	Brown long-eared	0	0	0	1	7	19	Low
T6	Common pipistrelle	2	0	5	1	4	50	Moderate
T6	Soprano pipistrelle	0	0	2	3	9	4	Low
T6	Pipistrellus sp.	1	1	1	2	0	46	Moderate
T6	Leisler's bat	1	5	2	4	6	28	Low to Moderate
T6	Myotis sp.	0	0	0	0	4	3	Low
T6	Brown long-eared	0	0	0	3	7	19	Low
T7	Common pipistrelle	18	1	1	1	0	90	**High**
T7	Soprano pipistrelle	15	5	1	1	0	92	**High**
T7	Pipistrellus sp.	19	0	0	0	0	98	**High**
T7	Leisler's bat	3	2	5	4	4	49	Moderate
T7	Myotis sp.	0	1	6	4	5	33	Low to Moderate
T7	Brown long-eared	0	0	0	2	5	1	Low
T8	Common pipistrelle	13	2	0	0	1	87	**High**
T8	Soprano pipistrelle	9	4	3	1	0	81	**High**
T8	Pipistrellus sp.	14	1	0	0	0	92	**High**
T8	Leisler's bat	0	3	4	3	6	39	Low to Moderate
T8	Myotis sp.	1	0	1	3	5	25	Low to Moderate
T8	Brown long-eared	0	0	0	3	5	19	Low

12.3.9.10 Overview of bat surveys

Overall, common and soprano pipistrelles were the most common species recorded during surveys within the wind farm study area. Common pipistrelle accounted for the highest amount of activity recorded during all surveys but had markedly higher activity levels during 2018 activity surveys and 2019 passive detector surveys, while soprano and common pipistrelle activity during 2018 static detector surveys was comparable.

Approximately 14% of all Pipistrelle records from static detector surveys in 2019 did not allow for separation between either common or soprano pipistrelle (the peak frequency of calls fell within the overlap between the echolocation call ranges of common and soprano pipistrelle, requiring these calls to be identified as *Pippistrllus* sp.). while the same statistic for 2018 static detector surveys was c. 7%. *Myotis* sp. were also recorded during 2018 and 2019 static detector surveys, with no records assigned to species level. Brown long-eared bat was recorded for the first time within the study area during 2019 static detector surveys was the least frequently recorded genus/species with a total of 195 bat basses recorded.

During 2019 static detector surveys, turbine T3 had the lowest bat activity level, while T1 and T6 also had lower activity levels relative to other turbine locations, with the total number of bat passes over the combined summer/autumn period in totalling c. 300 at both locations. Turbines T4, T5 and T8 had c. 1,000-2,000 bat passes during this period while T2 had c. 5,000. Turbine T7 had the highest activity level with over 8,000 bat passes recorded, made up predominantly of pipistrelles. Leisler's bat were the next most numerous species in terms of activity levels at T7.

Table 12-36 summarises the peak activity levels recorded at each turbine location as evaluated by Ecobat, and also indicates which species/genus accounted for peak levels at each location.

As previously noted, pipistrelles account for the highest activity levels recorded. It should also be noted however that a bias exists towards under-representation of species which emit lower-intensity echolocation calls, including *Myotis* species and brown long-eared bat. This is not a cause for concern when assessing turbine strike risk however, since *Myotis* sp. and brown long-eared bat are classified as low-risk in terms of collision risk (detailed further in impacts and mitigation sections) (SNH, 2019).

Table 12-36:Summary of high-activity turbines and species (Ecobat analysis)

Turbine	T1	T2	T3	T4	T5	T6	T7	T8
Highest activity level recorded	Moderate to High	High	High	High	High	Moderate	High	High
Highest activity-level species/genus	*Pipistrellus* sp.	Common Pipistrelle, *Pipistrellus* sp.	*Pipistrellus* sp.	*Pipistrellus* sp.	Common Pipistrelle, *Pipistrellus* sp.	Common Pipistrelle, *Pipistrellus* sp.	Common & Soprano Pipistrelle, *Pipistrellus* sp.	Common & Soprano Pipistrelle, *Pipistrellus* sp.

Daubenton's bat was recorded roosting in Kilnahown bridge during a daytime torch survey. The bridge does not contain sufficient roosting spaces to support a maternity colony however. The desktop study indicated Daubenton's bats are present in the area; the species is most commonly associated with water and often found roosting in bridges. They may also occasionally hunt in terrestrial habitats such as woodland (Dietz & Kiefer, 2016) making it possible that they could occur within the wind farm study area (Daubenton's bat belongs to the genus *Myotis*, so may make up a portion of *Myotis* sp. recordings from the study area).

Both pipistrelle species recorded in the study area, all *Myotis* species and brown long-eared bat are listed as species of Least Concern in Ireland, while Leisler's bats are classed as Near Threatened (Marnell *et al.,* 2009). All bat species/genera recorded in the study area and are protected under the Wildlife Acts (1976–2000) and are listed on Annex II of the Habitats Directive.

A single soprano pipistrelle, likely to be a lone male inhabiting a transitional/night roost was recorded emerging from an ivy-covered derelict building with the study area but c. 600m from the closest element of infrastructure.

This building and another derelict building (derelict cottage c. 220m south west of T3) were inspected and surveyed using static detectors during winter 2018/19 and confirmed not to be in use as hibernation roosts.

12.3.10 Avifauna

12.3.10.1 Desktop 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 NBDC records indicates that fifty-seven rare or protected bird species have been recorded historically in the 10 km grid squares (N40 and N41) within which overlap the proposed wind site and are listed in Table 12-37, below. Of these, 20 are on the current Birds of Conservation Concern in Ireland (BoCCI) red list (Colhoun and Cummins, 2013) and 36 are on the BoCCI amber list (Colhoun and Cummins, 2013). Nine Annex I species of the EU Birds Directive (EC, 2009) have been recorded historically in the 10 km grid squares within which the wind farm site occurs. These are listed in Table 12-37, below. Only a single invasive species was recorded historically: Greylag Goose (*Anser anser*) in grid square N41 in 2001 (invasiveness not assessed by www.biodiversityireland.ie). Greylag Goose is subject to restrictions under regulations 49 and 50 of S.I. 477 (Ireland; EC, 2011).

Table 12-37: Species of Birds recorded historically within the 10 km squares (N40 and N41) in which the subject site is located, from desktop review[2]

Grid square	Scientific name	Common name	Year of last record	*BoCCI status	**Annex I status
N40, N41	*Tyto alba*	Barn Owl	02/03/2013, 31/07/1972	Red	No
N40, N41	*Hirundo rustica*	Barn Swallow	11/05/2013, 28/03/2016	Amber	No
N40	*Limosa limosa*	Black-tailed Godwit	31/12/2011	Amber	No
N41	*Fulica atra*	Common Coot	31/12/2011	Amber	No
N40, N41	*Falco tinnunculus*	Common Kestrel	01/07/2017, 31/12/2011	Amber	No
N40, N41	***Alcedo atthis***	**Common Kingfisher**	**31/12/2011, 31/12/2001**	**Amber**	**Yes**
N40, N41	*Carduelis cannabina*	Common Linnet	31/12/2011, 31/12/2011	Amber	No
N40, N41	*Aythya ferina*	Common Pochard	29/02/1984, 31/12/2011	Red	No
N41	*Tringa totanus*	Common Redshank	31/12/2001	Red	No
N41	*Actitis hypoleucos*	Common Sandpiper	31/12/2001	Amber	No
N40, N41	*Gallinago gallinago*	Common Snipe	31/12/2011, 31/12/2011	Amber	No
N40, N41	*Sturnus vulgaris*	Common Starling	11/05/2013, 31/12/2011	Amber	No
N40, N41	*Apus apus*	Common Swift	31/12/2011, 31/12/2011	Amber	No
N41	***Sterna hirundo***	**Common Tern**	**31/07/1991**	**Amber**	**Yes**
N40, N41	***Crex crex***	**Corn Crake**	**31/07/1972, 31/07/1972**	**Red**	**Yes**

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

Grid square	Scientific name	Common name	Year of last record	*BoCCI status	**Annex I status
N40, N41	***Calidris alpina***	**Dunlin**	**31/12/2011, 31/12/2001**	**Red**	**Yes**
N40, N41	*Numenius arquata*	Eurasian Curlew	31/12/2011, 18/05/2010	Red	No
N40, N41	*Accipiter nisus*	Eurasian Sparrowhawk	31/12/2011, 31/12/2011	Amber	No
N40, N41	*Anas crecca*	Eurasian Teal	31/12/2011, 31/12/2011	Amber	No
N41	*Passer montanus*	Eurasian Tree Sparrow	12/04/2017	Amber	No
N40, N41	*Anas penelope*	Eurasian Wigeon	29/02/1984, 31/12/2011	Red	No
N40, N41	*Scolopax rusticola*	Eurasian Woodcock	31/12/2011, 31/12/2011	Red	No
N40, N41	***Pluvialis apricaria***	**European Golden Plover**	**31/12/2011, 31/12/2011**	**Red**	**Yes**
N40, N41	*Carduelis chloris*	European Greenfinch	31/12/2011, 31/12/2011	Amber	No
N40, N41	*Erithacus rubecula*	European Robin	11/05/2013, 31/12/2011	Amber	No
N40	*Anas strepera*	Gadwall	31/12/2011	Amber	No
N40, N41	*Regulus regulus*	Goldcrest	31/12/2011, 31/12/2011	Amber	No
N40	*Phalacrocorax carbo*	Great Cormorant	29/02/1984	Amber	No
N41	*Podiceps cristatus*	Great Crested Grebe	31/12/2011	Amber	No
N40, N41	*Perdix perdix*	Grey Partridge	29/02/1984, 31/07/1972	Red	No
N40, N41	*Motacilla cinerea*	Grey Wagtail	31/12/2011, 31/12/2011	Red	No
N41	*Anser anser*	Greylag Goose	31/12/2001	Amber	No
N40, N41	***Circus cyaneus***	**Hen Harrier**	**31/12/2011, 31/12/2011**	**Amber**	**Yes**
N40	*Larus argentatus*	Herring Gull	29/02/1984	Red	No
N40, N41	*Delichon urbicum*	House Martin	11/05/2013, 31/12/2011	Amber	No
N40, N41	*Passer domesticus*	House Sparrow	31/12/2011, 31/12/2011	Amber	No
N40	*Lymnocryptes minimus*	Jack Snipe	29/02/1984	Amber	No
N40, N41	*Larus fuscus*	Lesser Black-backed Gull	29/02/1984, 31/12/2001	Amber	No
N40	***Egretta garzetta***	**Little Egret**	**31/12/2011**	**Green**	**Yes**
N41	*Tachybaptus ruficollis*	Little Grebe	31/12/2011	Amber	No
N40, N41	*Anthus pratensis*	Meadow Pipit	31/12/2011, 31/12/2011	Red	No

Grid square	Scientific name	Common name	Year of last record	*BoCCI status	**Annex I status
N40, N41	***Falco columbarius***	**Merlin**	**28/07/2016, 29/02/1984**	**Amber**	**Yes**
N40, N41	*Turdus viscivorus*	Mistle Thrush	31/12/2011, 31/12/2011	Amber	No
N40, N41	*Cygnus olor*	Mute Swan	31/12/2011, 31/12/2011	Amber	No
N40, N41	*Vanellus vanellus*	Northern Lapwing	31/12/2011, 31/12/2011	Red	No
N41	*Anas acuta*	Northern Pintail	31/12/2001	Red	No
N41	*Anas clypeata*	Northern Shoveler	31/12/2001	Red	No
N40	*Oenanthe oenanthe*	Northern Wheatear	31/07/1972	Amber	No
N40, N41	*Lagopus lagopus*	Red Grouse	29/02/1984, 31/07/1972	Red	No
N40, N41	*Riparia riparia*	Sand Martin	31/12/2011, 31/12/2011	Amber	No
N40, N41	*Alauda arvensis*	Sky Lark	31/12/2011, 31/12/2011	Amber	No
N40, N41	*Muscicapa striata*	Spotted Flycatcher	31/07/1991, 31/12/2011	Amber	No
N40, N41	*Columba oenas*	Stock Pigeon	31/07/1972, 31/12/2011	Amber	No
N41	*Aythya fuligula*	Tufted Duck	31/12/2011	Red	No
N41	*Saxicola rubetra*	Whinchat	31/07/1991	Red	No
N40, N41	***Cygnus cygnus***	**Whooper Swan**	**31/12/2011, 31/12/2011**	**Amber**	**Yes**
N40, N41	*Emberiza citrinella*	Yellowhammer	01/07/2017, 12/04/2017	Red	No

Target Species Observations (Flight Activity Surveys)

12.3.10.2 Grey Heron

This species was regularly observed with a total of fifty-one flights recorded during the VP surveys. Flight activity was widespread throughout the survey area, with numbers comparable during both breeding seasons (sixteen and seventeen) and the winter season (eighteen). A high proportion of flights were recorded within the proposed wind farm with individuals commuting across the site, generally in a northerly or southerly direction.

Grey heron was not recorded as breeding within the survey area, although birds were present on site during the monthly wader census with one in October 2018 and two in January 2019.

12.3.10.3 Lapwing

Lapwing were regularly recorded during the winter season of 2018/19 with a total fourteen flights (four-hundred-and-four individuals). The majority of the flights were observed within the northeast part of the survey area, with birds flying from Garryinch Bog (a large re-colonising cutover bog to the north and east of the proposed development site), which may have been used as a foraging/ roosting site. These flights generally headed in a south or south-west direction along the south-eastern edge of the proposed site with a large proportion near turbine T6.

There were fewer flights recorded within the array. Birds were less frequently recorded during the breeding seasons with only four flights (seventy-seven individuals) between August and September 2019. Groups of birds were generally recorded commuting in small to medium sized flocks (ranging from four to 76 individuals) along the edges of the proposed wind farm.

This species was not recorded as breeding within the survey area during the breeding bird surveys in 2018/19. However, a small number of birds were present on site between November and March, recorded during the wader census, with a peak count of five in December.

12.3.10.4 Golden Plover

This species was recorded during the winter season with eight flights (two-hundred-and-thirty-nine individuals) between October and November 2018 and a further four flights (fifty-four individuals) in August and September 2019. Most records were of birds (groups ranging from six to sixty-eight individuals) circling over Garryinch Bog and also where Garryinch Bog borders the north edge of the study area. There were very few flights recorded within the array. The activity levels recorded over Garryinch Bog is shown in Appendix A, Figures 4 and 5 in the accompanying bird report included in Appendix 12.4 of this document. and would suggest that birds were using the area for foraging and possibly as a roost site during the winter season.

This species was not recorded as breeding within the survey area.

12.3.10.5 Curlew

A total of sixteen flights (forty-eight individuals) were recorded during the VP surveys from July 2018 to March 2019 and then again from August to September 2019. This may suggest that most records were of post-breeding and wintering birds commuting over and around the site. During the winter season flights were observed heading in a south-westerly direction along the edge of the proposed wind farm west of near T8. Flights during the breeding season (August and September 2018) were more widespread and generally headed south or south-easterly direction from Garryinch Bog.

This species was not recorded as breeding within the survey area.

12.3.10.6 Woodcock

Woodcock was recorded once during the 2018/19 winter season. Between April and July 2019 eleven flights (12 individuals) were recorded, all within the hour before sunrise and after sunset. Most flights were observed along the northern edge of the array (T3, T5 and T6) where the southern edge of Garryinch Bog borders an area of mixed woodland and scrub. Flight activity is presented in Appendix A, Figure 6, where direction of flight is shown to be typically recorded along a west to east axis above the fringe habitat of mixed woodland and bog. Birds were also recorded along the south-western edge of the study area and near T8. Fewer flights were recorded within the array.

Additional flights were recorded during the survey targeting breeding woodcock in 2019. Between May and July, a total of twenty flights were recorded. Mapped flights clearly show that birds were flying along the southern border of Garryinch Bog and northern edge of the proposed wind farm between T6 and T1 (Appendix A, Figure 6). Analysis of these flights and behaviour suggests there are two breeding territories in the area.

12.3.10.7 Snipe

This species was recorded throughout the survey period with similar numbers of flights recorded during the two breeding seasons (four and five). The number of flights increased over the winter season (ten). Most flights recorded were of birds flushed from human activities within Garryinch Bog i.e. dog walkers, peat cutters and farming. Bird flights were generally recorded flying along a west to east axis along the border between Garryinch Bog and the northern edge of the proposed wind farm.

This species was also recorded as breeding within the survey area with a total of three and five territories in 2018 and 2019 respectively. During the monthly wader census snipe was regularly recorded between October 2018 and March 2019 with a peak count of five in December.

12.3.10.8 Jack Snipe

A single Jack Snipe was observed in the winter of 2018 on the 10th of December. An adult was flushed from the field about 5 m in front of VP 4, causing the bird to take flight near turbine T8. It is likely that this species uses the site for foraging in winter. This species was recorded flying over improved agricultural grassland (GA1) and conifer plantation (WD4) habitats.

This species was not recorded as breeding within the survey area.

12.3.10.9 Sparrowhawk

A total of fifty-three flights were observed within the survey area with most birds recorded during both breeding seasons (nineteen and twenty-four respectively) with only ten flights in the winter season. Much of the flight activity was of display and hunting/soaring behaviour, which was typically observed often above the wooded areas along the southwestern edge of the proposed wind farm, and in particular, around the turbine locations, T3 and T8. Flight activity is represented in Figures 4 and 5, Appendix A showing activity concentrated at the locations with few flights straying into the array.

This species was not confirmed as breeding within the survey area, however displaying birds were observed over suitable habitat along the western edge of the turbine array, so it is possible a breeding attempt occurred during the 2018/19 season.

12.3.10.10 Kestrel

A total of one-hundred-and-seventy-four flights (one-hundred-and-seventy-four individuals) was recorded, this being the most frequently observed species during the VP surveys (breeding season one-hundred-and-ten, winter season sixty-four). The majority of flights were of birds searching/ hunting, favouring the areas to the north of the proposed wind farm where it borders the western and southern parts Garryinch Bog. Flight activity is shown in Appendix A, Figures 4 and 5. Some flights did stray into the array, in particular around the proposed turbine locations T6, T4 and T8.

During the breeding bird surveys two and five breeding pairs were recorded within the survey area in 2018 and 2019 respectively. The high frequency of flights recorded would certainly be attributable to the number of breeding birds in the area.

12.3.10.11 Merlin

Merlin were recorded occasionally from October 2018 to March 2019 with fourteen flights (fourteen individuals) and just three flights between August and September 2019. Almost all records were of immature/ juvenile birds and flying along the northern edge of the proposed wind farm that borders Garryinch Bog heading generally in an easterly direction. Five flights were also recorded in the southeastern section of the study area. Most of the records were of juvenile/ immature birds and it is likely that these birds had dispersed from their natal sites, using the site for hunting.

This species was not recorded as breeding within the survey area.

12.3.10.12 Peregrine

This species was recorded on five occasions (five individuals), three during the winter season and two during the breeding season. All records were of juvenile/ immature birds with all flights widespread across the survey area, either heading south or south-easterly direction.

This species was not recorded as breeding within the survey area.

12.3.10.13 Black-headed Gull

Black-headed Gulls were recorded infrequently during the breeding season of 2018 only, with a total of four flightlines (eight individuals) recorded. The majority of flights were observed within the east of the site, with birds commuting east over Garryinch Bog (PB4 habitat) near turbine T6. Pairs of adult birds were recorded on the 30/04/2018 and 03/07/2018 and pairs of juveniles were recorded on 01/08/2018 and 23/07/2018. Given the low number of observations, it is unlikely that the birds were using the area for foraging.

This species was not recorded as breeding within the survey area.

12.3.10.14 Herring Gull

Herring Gulls were infrequently recorded during the summer of 2018 (one flightline and five individuals) and winter of 2018 (one flightline and three individuals) only. The birds recorded in the summer flight were adults commuting in association with Lesser Black-backed Gulls, heading south east from T7. Those recorded in the winter flight were immature birds, commuting east south east. It is unlikely that the birds recorded use the site for foraging, given the low numbers recorded and the fact that birds were only recorded commuting over the study area. This species was recorded flying over improved agricultural grassland (GA1) habitats.

This species was not recoded as breeding within the survey area.

12.3.10.15 Lesser Black-backed Gull

Lesser Black-backed Gulls were infrequently recorded at the study site. In 2018, there were seven flightlines of thirteen individuals, all recorded during the breeding season. Six of these flightlines were of adults and almost all were of pairs of birds commuting. In 2019, one flightline was recorded in the summer and one in the winter. The summer 2019 flightline was of a small group of four adult birds flying southeast and the winter 2019 flightline was of a single bird heading east. Flightlines took a variety of directions all over the study area but were focused mainly in the centre of the site around turbines T3, T4, T5 and T7. All observations were of birds commuting, making it unlikely that this species uses the site for foraging. Birds were recorded flying over improved agricultural grassland (GA1), conifer plantation (WD4) and cutover bog (PB4) habitats.

This species was not recorded as breeding within the survey area.

12.3.10.16 Breeding Wader Surveys 2018 and 2019

The dedicated breeding wader surveys recorded the target species, Woodcock, and one secondary species, Snipe. Both these species are likely breeding within the study area. The registrations detailed in Table 12-38 below and Appendix B, Figure 4 in the accompanying ornithology report included in Appendix 12.4 of this document are additional to those recorded during the breeding bird surveys. Woodcock is a red listed species (breeding) on the Birds of Conservation Concern in Ireland 2014 – 2019 review[3]. Snipe is an amber listed species (breeding and wintering).

Table 12-38: Results of breeding wader surveys at Dernacart 2018 and 2019

Species	Conservation status	2018 No. of registrations	2019 No. of registrations
Woodcock	Red	0	20
Snipe	Amber	10	26

[3] Colhoun, K. and Cummins, S. (2013). Birds of Conservation Concern in Ireland 2014 –2019. Irish Birds 9: 523—544

12.3.10.17 Monthly Wader Census 2018 and 2019

A total of three wader species were recorded within the survey area during 2018/ 2019 monthly wader census (Table 12-39). The wader species recorded were Heron, Lapwing and Snipe. The survey in December recorded the highest number of waders (10) with a peak count of five for Lapwing and Snipe.

Table 12-39: Monthly wader census results 2018/2019

Species	Conservation status	Oct	Nov	Dec	Jan	Feb	Mar
Heron	Green	1	0	0	2	0	0
Lapwing	Red	0	2	5	1	0	3
Snipe	Amber	2	4	5	3	1	2
Total		3	6	10	6	1	5
KEY: Red/ Amber: Birds of Conservation Concern in Ireland 2014 – 2019[4]							

12.3.10.18 Hen Harrier Winter Roost Checks

No hen harriers were recorded during the winter roost checks carried out between October-December 2018 in the cutover bog immediately north-east of the proposed wind farm site.

12.3.10.19 Barn Owl

No direct observations or signs of barn owl were recorded within the study area. If present, this species would have been detected through direct observations during bat activity and emergence surveys, or through signs such as pellets or whitewashing during bat roost inspections of buildings and mature trees.

12.3.10.20 General Wintering Birds

A total of 24 species were recorded on site during winter 2018/19 winter walkover surveys. Of these, three species (Curlew, Golden plover and Lapwing) are on the BoCCI Red List, six species (Kestrel, Linnet, Mistle thrush, Skylark, Starling and Swallow) are Amber listed. Thirteen of the remaining species recorded are Green listed, while one (Bluethroat) is not evaluated as it occurs only rarely as a passage migrant.

Two species listed on Annex I of the EU habitats directive (golden plover and little egret) are amongst the birds recorded during winter walkover surveys. A number of these species are also target species for activity surveys and as such are detailed above. Little egret was noted on one occasion during December 2018, with a group of seven individuals recorded within the study area. Golden plover observations are discussed in detail in 12.3.10.4 above.

Large flocks of linnet (up to 150) and swallow (200) were recorded within the study area during winter 2018/19 walkover surveys (swallow were recorded during early September).

Table 12-40: General wintering birds recorded during ornithological surveys over the course of the 2018-19 season

Common Name	Species Name	BoCCI status	Annex I Status
Bluethroat	*Luscinia svecica*	N/A	No
Buzzard	*Buteo buteo*	Green	No
Chaffinch	*Fringilla coelebs*	Green	No
Coal Tit	*Periparus ater*	Green	No
Curlew	*Numenius arquata*	Red	No
Golden Plover	*Pluvialis apricaria*	Red	Yes
Great Tit	*Parus major*	Green	No
Grey Heron	*Ardea cinerea*	Green	No
Hooded Crow	*Corvus corone cornix*	Green	No
Jackdaw	*Corvus monedula*	Green	No
Jay	*Garrulus glandarius*	Green	No
Kestrel	*Falco tinnunculus*	Amber	No
Lapwing	*Vanellus vanellus*	Red	No
Lesser Redpoll	*Carduelis flammea cabaret*	Green	No
Linnet	*Carduelis cannabina*	Amber	No
Little Egret	*Egretta garzetta*	Green	Yes
Long-tailed Tit	*Aegithalos caudatus*	Green	No
Mistle Thrush	*Turdus viscivorus*	Amber	No
Raven	*Corvus corax*	Green	No
Rook	*Corvus frugilegus*	Green	No
Skylark	*Alauda arvensis*	Amber	No
Starling	*Sturnus vulgaris*	Amber	No
Swallow	*Hirundo rustica*	Amber	No
Woodpigeon	*Columba palumbus*	Green	No
Total Species	**24**		

12.3.10.21 General Breeding Birds

Table 12-41 below details up to 196 and 408 breeding bird territories recorded in 2018 and 2019, respectively. A total of 43 species considered to be breeding within the survey area were recorded across both survey seasons. The majority of these are common and widespread species; the most abundant breeding species was blackbird with an estimated 31 territories in 2018 and 36 territories in 2019. Wren was the next most abundant species with an estimated 26 and 33 territories in 2018 and 2019, respectively. Of the total number of species, 12 (28%) are recognised as being of conservation importance in Ireland. There were no species listed as Annex 1 recorded breeding within the survey area. There were two Red-Listed species: Woodcock and Meadow Pipit. There were 10 Amber-Listed species: Snipe, Barn Swallow, House Martin, Starling, Mistle Thrush, Robin, Stonechat, House Sparrow, Greenfinch and Linnet. The remaining 31 species are Green-Listed and of low conservation concern.

Table 12-41: General breeding bird assemblage recorded during 2018 & 2019 Breeding Bird Surveys (Common Bird Census)

				No. of territories	
Common Name	**Species Name**	**BoCCI status**	**Annex I Status**	**2018**	**2019**
Barn Swallow	*Hirundo rustica*	Amber	No	3	6
Blackbird	*Turdus merula*	Green	No	31	36
Blackcap	*Sylvia atricapilla*	Green	No	0	10
Blue Tit	*Cyanistes caeruleus*	Green	No	25	32
Bullfinch	*Pyrrhula pyrrhula*	Green	No	0	6
Buzzard	*Buteo buteo*	Green	No	2	4
Chaffinch	*Fringilla coelebs*	Green	No	5	28
Chiffchaff	*Phylloscopus collybita*	Green	No	12	8
Coal Tit	*Periparus ater*	Green	No	8	6
Crossbill	*Loxia curvirostra*	Green	No	0	2
Cuckoo	*Cuculus canorus*	Green	No	12	21
Dunnock	*Prunella modularis*	Green	No	2	23
Goldfinch	*Carduelis carduelis*	Green	No	2	8
Great Tit	*Parus major*	Green	No	5	18
Greenfinch	*Carduelis chloris*	Amber	No	0	3
Hooded Crow	*Corvus cornix*	Green	No	3	5
House Martin	*Delichon urbica*	Amber	No	1	5
House Sparrow	*Passer domesticus*	Amber	No	0	1
Jackdaw	*Corvus monedula*	Green	No	4	6
Jay	*Garrulus glandarius*	Green	No	1	2
Kestrel	*Falco tinnunculus*	Amber	No	2	5
Lesser Redpoll	*Carduelis flammea cabaret*	Green	No	1	10
Linnet	*Carduelis cannabina*	Amber	No	0	7
Long-Tailed Tit	*Aegithalos caudatus*	Green	No	0	4s
Magpie	*Pica pica*	Green	No	3	4

				No. of territories	
Common Name	**Species Name**	**BoCCI status**	**Annex I Status**	**2018**	**2019**
Mallard	*Anas platyrhynchos*	Green	No	1	3
Meadow Pipit	*Anthus pratensis*	Red	No	4	4
Mistle Thrush	*Turdus viscivorus*	Amber	No	2	4
Pied Wagtail	*Motacilla alba yarrellii*	Green	No	2	2
Raven	*Corvus corax*	Green	No	1	4
Reed Bunting	*Emberiza schoeniclus*	Green	No	0	7
Robin	*Erithacus rubecula*	Amber	No	5	27
Rook	*Corvus frugilegus*	Green	No	2	9
Siskin	*Carduelis spinus*	Green	No	0	3
Snipe	*Gallinago gallinago*	Amber	No	3	5
Song Thrush	*Turdus philomelos*	Green	No	12	13
Starling	*Sturnus vulgaris*	Amber	No	1	5
Stonechat	*Saxicola rubicola*	Amber	No	0	3
Treecreeper	*Certhia familiaris*	Green	No	0	7
Willow Warbler	*Phylloscopus trochilus*	Green	No	12	15
Woodcock	*Scolopax rusticola*	Red	No	0	2
Woodpigeon	*Columba palumbus*	Green	No	3	2
Wren	*Troglodytes troglodytes*	Green	No	26	33
Total				**196**	**408**

12.3.11 Aquatic Ecology

All watercourses / water bodies which could be affected directly were considered as part of the Aquatic Ecology appraisal. A total of 11 sites were selected for detailed assessment (see Aquatic Report in Appendix 12.6); these encompassed the minor watercourses running through and around the proposed wind farm site, those crossing the proposed grid connection, and 3 sites on the River Barrow (Kilnahown bridge where the grid route intersects the Barrow, Bay Bridge downstream of just under half the proposed wind farm, and Twomile Bridge upstream of the proposed wind farm).

The minor channels draining the proposed wind farm site are of subject to pollution and alteration and as such are of low fisheries value and low ecological value in general.

12.3.11.1 Fish surveys in the Study Area

Inland Fisheries Ireland (IFI) carried out an electrofishing survey of the entire River Barrow Catchment as part of the National Research Survey Programme in 2015, including 35 sites on the main river channel and canal cuts and 118 sites across 21 sub-catchments.

In the survey Dace and Roach were found to be widely distributed throughout the main River Barrow channel being recorded at 91% and 80% of sites respectively. Atlantic salmon occurred at 57% of sites surveyed. The numbers of juvenile Atlantic salmon were generally low and that they seemed to be largely confined to fast-flowing, non-navigable areas downstream of weirs, as were Brown Trout which were only recorded at 46% of the main channel sites. Perch were widely distributed in the main channel, recorded at 74% of survey sites, but were poorly represented in the sub-catchments. Pike were also scarce in the sub-catchment watercourses. Although no Bream was recorded in the survey there were Roach x Bream hybrids found in the main channel indicating their presence. Minnow and Gudgeon were widely distributed. European Eel, Stone Loach, Flounder and Three-spined Sticklebacks were also recorded in the 2015 survey.

According to the IFI assessment of the fish stocks in the River Barrow Catchment, the fish status in the upper section of the main channel of the River Barrow itself, above Mountmellick were Good. This section of the River Barrow is the closest part of the main river channel to the proposed wind farm site, and Site 10 of the current assessment is located on this section of the River Barrow. However, the main wind farm site lies across upper sub-catchments of the Barrow rather than on the main River Barrow channel. The IFI survey identified a trend across the sub-catchments whereby the sub-catchments of the upper area of the Barrow Catchment tended to be assigned a fish status of moderate or less compared to better status in the downstream sub-catchments. The likely cause of the poorer fish stocks is mainly due to poor water quality, poor habitat, barriers impeding migratory fish passage and competition with invasive Dace.

In the entire survey of the catchment there were only 5 sites of the 153, that were assessed, i.e. 3% of the survey sites, that had a High fish stock status. More than 50% of the survey sites across the entire Barrow Catchment were recorded as having Moderate or lower fish status. It was also noted that there have been recurring problems in the Barrow Catchment relating to water quality in the past.

The natural character of the Barrow has been severely altered by Drainage schemes and works aimed at improving navigation. The numerous weirs along its course are a major impediment to all migratory fish, including salmon and trout. The modification of the main channel and its sub catchments has significantly reduced suitable salmonid habitat and in turn has created favourable conditions for coarse species, e.g. Dace and Roach.

The River Barrow is part of the River Barrow and River Nore SAC. The Barrow is a Special Area of Conservation (SAC) because it contains important protected habitats and species listed on Annex I / II of the E.U Habitats Directive. Atlantic Salmon, Twaite shad, Lamprey species (Brook, River & Sea) occur within the Barrow catchment (NPWS).

Brown trout were recorded in the River Barrow and in the Clonygowan stream during electrofishing surveys in 2019. Atlantic salmon were recorded at all three sites on the Barrow, while limited numbers of brook lamprey ammocetes were recorded at site 1 on the Barrow.

Atlantic Salmon and Brook Lamprey are present within the catchment area of the proposed wind farm.

Sea Lamprey and River Lamprey are migratory species and are unlikely to be present this far upstream of the Barrow catchment. This is due to the migratory barriers present along the Barrow navigation. The minor watercourses running through and around the proposed wind farm site do not contain any salmonid or lamprey habitat, and no fish were recorded in any of these streams in the vicinity of the proposed wind farm site (Minnow and Three-spined Stickleback were present in the Cottoner's Brook c. 2 km *downstream* of the wind farm site).

Suitable habitat for lamprey is present at sites 1, 5 and 10 on the Barrow; river/brook lamprey ammocetes were present in very low densities at site 1 at Kilnahown Bridge, but no lamprey were present at sites 5 and 10 further upstream.

The results of fish surveys carried out in 2019 are shown in Table 12-42 below.

Table 12-42: Fisheries Surveys Results

Site	Watercourse Name	Atlantic salmon	Brown Trout	Brook Lamprey	Minnow	Three-spined stickleback	Stone Loach	Dace	Roach
1	Barrow	***	***	*	**		**	*	
2	Clonygowan		*			*			
3	Cottoners Brook								
4	Cottoners Brook								
5	Barrow	***	**		***		*		**
6	White Hill (E) Stream								
7	White Hill (E) Stream								
8	Forest_Upper								
9	Forest_Upper								
10	Barrow	**	**		*	**	***	*	*
11	White Hill (W) Stream								

12.3.11.2 Distribution of Lamprey in Barrow catchment

In 2004 IFI conducted an extensive catchment wide survey of lamprey in the main stem and tributary channels. The survey was conducted in two phases:

- Phase I Spot-fishing surveys
- Phase II Qunatitative Fishing surveys

Locations suitable for quantitative surveys were investigated during Phase I undertaken between June and July, by spot fishing using electro fishing equipment. Phase II was carried out between August and October and a total of 75 sites were fished quantitatively. The survey showed that 52% of the quantitative sampling sites generated negative results with no lamprey recorded. A high proportion of negative sites were recorded in sub-catchments draining into the River Barrow between Monasterevin and Carlow. Many of the tributaries lack suitable lamprey habitat with deposits of fine substrate bed material absent.

The status of sea lamprey throughout the River Barrow is poor due to migration barriers such as weirs and lock gates associated with navigation. The Barrow's Sister Rivers, the Suir and Nore, have more favourable lamprey conditions and this is attributed to extensive gravelled areas of river bed in open flowing water.

12.3.11.3 Atlantic salmon

The Atlantic salmon (*Salmo salar*) is listed under Annexes II and V of the EU Habitats Directive and Appendix III of the Bern Convention. It an economically important species and salmon recreational and commercial fisheries occur throughout Ireland. Atlantic salmon are an anadromous species, meaning they are spawned in freshwater habitats and then migrate to the sea. Salmon habitats are usually fast flowing riffle and glide habitats with cobble or gravel substrates. The gravels at these sites must be clean and well oxygenated for successful hatching.

Crisp (2000) notes that salmon spawning site selection is governed by a complex of environmental factors including intra-gravel flow, gravel size, water depth as well as stream velocity and cover, which are all essential for successful spawning, egg survival and hatching. One of the most important factors for salmon egg survival is oxygen supply, which is dependent upon dissolved oxygen concentration and inter-gravel flow. High concentrations of suspended solids in the river are undesirable as they are likely to result in infilling of the gravel pores with fine material (Cowx and Fraser, 2003). Juvenile salmon require fast flowing clean water and the cover of instream rocks, plants and banks to thrive. Adult salmon require pool habitat to rest before in the interval between entering the river and reaching spawning grounds and the act of spawning. Salmon angling areas are usually located on main river channels or small rivers in deep glides of 1.5m depth or more.

Atlantic Salmon are present downstream of the proposed wind farm, as demonstrated by the results of current surveys.

12.3.11.4 Freshwater Pearl Mussel

The freshwater pearl mussel (*Margaritifera margaritifera* (L.)) is a large bivalve species found in oligotrophic, soft to neutral waters of rivers and, occasionally, in lakes. In Ireland, the species is concentrated along the western sea-board, but also occurs in the south and east where geology allows.

The biology and ecology of the species are particularly notable in that individuals can grow to very large sizes relative to other freshwater molluscs, building up thick calcareous valves, in rivers with relatively soft water and low levels of calcium. Their shell building is consequently very slow, and individuals in natural conditions live to over a hundred years of age.

Freshwater Pearl Mussel does not occur in the study area and is known to be absent from the main channel of the River Barrow.

The Overall Status of Freshwater Pearl Mussel in Ireland is Bad and deteriorating, unchanged since the 2013 Article 17 assessment (NPWS, 2019b).

12.3.11.5 White-clawed crayfish

The white-clawed crayfish is the only freshwater crayfish recorded in Ireland. Populations of the species in the rest of Europe have declined dramatically and Ireland is seen as a unique stronghold for this species in a European context (Reynolds 1998).

The white-clawed crayfish is protected under both European and Irish legislation. It is protected by the Wildlife Act, 1976 and has been classified as endangered in the IUCN Red List. It is also listed under Appendix III of the Bern Convention and Annexes II and V of the EU Habitats Directive (1992). The white-clawed crayfish is Ireland's only crayfish species. Ireland is understood to hold some of the best European stocks of this species, under least threat from external factors. Irish stocks are therefore of substantial conservation importance (Reynolds, 1998). Throughout its natural range across Western Europe, the distribution and abundance of white-clawed crayfish has been dramatically reduced in the last 150 years due to human disturbances such as overfishing, habitat destruction, pollution and the introduction of foreign crayfish species (Reynolds, 1998).

In Britain, the North American signal crayfish (*Pacifastacus leniusculus*) was introduced for aquaculture and subsequently escaped into the wild, where it has had a devastating effect on white-clawed crayfish populations. While this species has not been recorded in Ireland, there is a real threat that this alien crayfish species will reach this country. The crayfish plague, which was transmitted by introduced crayfish species and is caused by the fungus *Aphanomyces astaci*, has been found in Ireland since the late 1980s.

White-clawed crayfish are widespread in areas which are underlain by Carboniferous limestone, or its derivative - glacial drift (Reynolds, 1998). Demers *et al.* (2005) reported that white-clawed crayfish are still widespread in the rivers of the Irish midlands, where the geology is predominantly limestone. However, these authors also report that the distribution of white-clawed crayfish in rivers has been restricted since the mid-1980s. This was attributed in part to an outbreak of the crayfish plague. Recent data from the EPA suggests a decline in crayfish populations in the north midlands (Reynolds, 2006).

In 2017 large Crayfish mortality events occurred in the catchment between Graiguenamanagh in Kilkenny and upstream as far as Carlow. DNA tests from 4 different locations along this stretch confirmed the presence of Crayfish plague. According to catchments.ie the highly infectious disease has spread through the main Barrow channel and it is now widespread in the river. It was been recorded as far upstream in the main channel as Monasterevin in 2018. In May of this year (2019) an additional infected location has been identified in the River Slate at Rathangan.

White-clawed crayfish were not recorded during current surveys but have been recorded in 2006 at Barranagh's Bridge on the Barrow, downstream of the Forest Upper, White Hill East and White Hill West streams which drain the proposed wind farm site, and at Kilnahown Bridge (where the proposed grid connection intersects the Barrow) in 2009. The species was also recorded at Portnahinch Bridge on the Barrow in 2011 (downstream of proposed wind farm, south of proposed grid connection) (NBDC, 2019a).

The Overall Status of the species in Ireland is Bad with a deteriorating trend. This represents a decline since the last Article 17 reporting period and is mainly due to bad Future prospects for the species due to the presence of Crayfish Plague across six catchments (NPWS, 2019b).

12.3.11.6 Brook lamprey

The brook lamprey is the smallest of the three lampreys native to Ireland and it is the only one of the three species that is non-parasitic and spends all its life in freshwater (Maitland & Campbell 1992). Brook lamprey is listed in Annex II of the EU Habitats Directive (92:43: EEC) and in Appendix III of the Bern Convention. Brook lampreys are the most common and widespread of the three Irish lamprey species (Kurtz & Costello, 1999). Brook lampreys live for up to five years burrowed into silt deposits in rivers. They metamorphose into adults and spawn in the early spring in fast flowing streams with gravel substrates. Unlike the other two Irish lamprey species they are not parasitic as adults and undertake only localised migrations.

Although still common in Ireland they are under significant threat from drainage and navigation maintenance works and also from water quality deterioration. Brook lampreys are also doing less well across the rest of European Union. In this regard Irish populations of Brook lampreys are of International Importance in Ireland. Ireland has failed to protect lampreys with a close season for instream works during their spawning season, so they are vulnerable due to the lack of this type of protection. Responsibility for protecting lampreys in Ireland falls within the remit of Inland Fisheries Ireland, although there are not and never have been any fisheries for this species in Ireland.

A single river/brook lamprey ammocete (larva) was recorded at Kilnahown Bridge during current (September 2019) surveys. No lamprey were found at sites 5 and 10 on the Barrow, despite the presence of suitable habitat. The small watercourses draining the proposed wind farm site do not contain any potential lamprey habitat.

King (2006) recorded river/brook lamprey ammocetes (which are not distinguishable at larval stage) in the Barrow near the wind farm.

Brook lamprey populations in Ireland have been recently assessed as being 'favourable' by NPWS in the 2019 Article 17 Conservation Status Assessments (NPWS, 2019b).

12.3.11.7 River and Sea Lamprey

The River Lamprey *Lampetra fluviatilis* and Sea Lamprey *Petromyzon marinus* are larger in size than the brook lamprey and exhibit an anadromous life cycle. Both species are listed in Annex II and IV of the Habitats Directive (92:43: EEC), and also in Appendix III of the Bern Convention. Lampreys are poor swimmers and cannot jump or climb (Reinhardt *et al.,* 2009), so have significant difficulty getting past the main stem weirs on the River Barrow.

The Overall Status of River lamprey populations in Ireland is currently assessed as Favourable. The Overall Status of sea lamprey is assessed as Bad with a stable trend, unchanged since the last assessment (NPWS, 2019b).

Sea Lamprey and River Lamprey are considered not to be present in the catchment area of the proposed wind farm due to the series of migratory barriers along the Barrow navigation.

12.3.11.8 Biological water quality

Macroinvertebrate sampling was undertaken at the survey sites on the Barrow and minor watercourses draining the proposed wind farm site. The results were used to assign Q values where feasible; a number of the smaller streams were not suitable for assignment of Q values, and one site on the white Hill East stream was dry at the time of surveying.

The proposed wind farm cable route crosses the 5th order River Barrow (EPA Segment Code: 14_10477) at Site 1 located at Kilnahown Bridge. EPA monitoring is carried out at the site and the most recent water quality rating recorded was a Q value of 4, indicating 'Good' WFD water quality status. This site was rated Q4 based on 2019 macroinvertebrate survey results. However, there was siltation and some algal growth at this site

Site 5 is located at Bay Bridge (EPA Segment Code: 14_1043) where the L20972 crosses the 4th order River Barrow downstream of the proposed wind farm site. The last EPA water quality rating recorded for this site was Q4 in 1989, indicating WFD status of 'Good'. Following survey and assessment in 2019, Site 5 was rated as Q3-4 which is the equivalent to WFD status 'Moderate'. Considering the time elapsed since previous Q sampling and ongoing pressures associated with industrialised agriculture and peat harvesting, this drop in status is not remarkable.

Site 10 is located at Twomile Bridge on the 4th order River Barrow (EPA segment code: 14_1053) to the West (upstream) of the proposed wind farm site. In 2018 this site was rated Q4-5 by the EPA, corresponding to a 'High' WFD status. Site 10 was rated as Q3-4 which is the equivalent of WFD status 'Moderate' following the current assessment; considering the recent EPA assignment of Q4-5, this reduction in water quality is considerable, and could be indicative of a localised pollution event and/or extreme climatic conditions in the intervening period.

The 3rd order Clonygowan Stream (EPA Segment Code: 14_1770) is intersected by the proposed cable route where it is crossed by the R423 road. This area is approximately 550 m upstream from where the Clonygowan joins the main River Barrow channel and is the location of site 2. This river segment is not monitored by the EPA and has no assigned Q ratings on record. Site 2 was rated as Q3 which is the equivalent to WFD status 'Moderate'. This is a tiny stream and is not downstream of the proposed wind farm – it is affected only by the grid connection route.

Cottoner's Brook is a small, highly-modified and polluted stream running along the eastern boundary of the proposed wind farm site before intersecting the proposed cable route c. 250m upstream of its confluence with the Barrow. Site 3 is located along the eastern boundary of the proposed site; this segment is not monitored by the EPA and is not suitable for applying a Q-rating however it is assessed as having 'Bad' water quality status. There are no up-to-date EPA Q ratings available for site 4, and the site is not suitable for applying a Q-rating however it is assessed as having 'Poor' water quality status.

The White Hill (E) stream rises within the proposed wind farm site and then flows south-east towards the barrow. Site 6 is located on the 1st order segment to the south-west of the proposed wind farm site boundary; this site was dry when surveyed. Site 7 is located along the 2nd order segment near the Barrow confluence; No Q rating could be assigned to this site due to the low number of macroinvertebrates recorded, but it is rated as having "Poor" status. The White Hill (E) Stream is classified as 'at risk' by the WFD and has a WFD (2010-2015) status of Moderate.

The only water monitoring stations on this water course are located upstream of site 6 but there has been no recent monitoring and therefore there are no Q ratings available for this stream.

The White Hill (W) EPA segment code: 14_1124), south-east of the proposed Wind Farm site was surveyed at one location (Site 11). The WFD classify the White Hill (W) Stream as being 'at risk' and it has a WFD (2010-2015) status of Moderate. There has been no recent EPA water quality monitoring on the watercourse and there are no Q ratings available for the stream. No Q Rating could be assigned to Site 11; however, it is rated as having "Poor" status.

The Forest Upper Stream rises within the northernmost section of the proposed wind farm site, exits the site, enters the site again to intersects the proposed access track between T2 and T3, and then exits the site again to flow south-west before joining the Barrow. Site 8 is located on the 1st order segment (EPA Segment Code: 14_1592) in Garryinch Bog. No Q Rating could be assigned to Site 8; however, it is rated as having "Poor" status. Site 9 is located on the 2nd order segment (EPA Segment Code: 14_1057), downstream of the proposed wind farm site. No Q rating could be assigned to site 8 due to the low number of Macroinvertebrate families present, however it is rated as it is rated as having "Poor" status.

As indicated by the aquatic macroinvertebrate compositions at sites investigated during the current survey, biological water quality within the Barrow ranges from 'Moderate' (upstream and immediately south of the proposed wind farm site) to 'Good' (Kilnahown Bridge along the proposed cable route). Water quality within the smaller tributaries of the Barrow which drain the proposed wind farm site ranges from 'Bad'- 'Poor' (Q1-Q2), which is based on a general habitat quality assessment since sufficient numbers of Macroinvertebrate groups were not present.

12.3.11.9 Annex I Habitat

The Annex I habitat 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]' was not present at any of the survey sites.

12.3.11.10 Non-native invasive species

The medium-impact Jenkin's spire snail *Potamopyrgus jenkinsi* was recorded at Sites 1 and 5. No other non-native invasive species were noted at any of the survey sites.

12.3.12 Other species

A desk study covering other fauna (Amphibians, Reptiles and non-aquatic Invertebrates) was carried out using the NBDC website on 21/08/2019, in addition to consulting NPWS records of rare/protected species (obtained on 29/07/2019). No records of fauna from these groups were present in NBDC records for the 10 km grid squares (N40 & N41) overlapping the proposed wind farm.

The NPWS dataset contained recent (2005-2011) records of common frog *Rana temporaria* (N40 & N41) and Desmoulin's whorl snail *Vertigo moulinsiana* (N40). The most recent record of Desmoulin's whorl snail is from 2006 at Dangan's Bridge, Mountmellick, located c. 1.5 km south-east of the proposed grid connection. This record is associated with the Grand Canal and Mountmellick SAC, and as such there is no connectivity between this area and the proposed development.

In addition to these, Records of common frog, smooth newt *Lissotriton vulgaris*, and the endangered wall butterfly *Lasiommata megera* in areas abutting and within 1 km of the proposed grid connection route are held by the NBDC.

12.3.12.1 Common Frog

A single observation of common frog (*Rana temporaria*) was recorded within the study area. This was an adult frog observed in vegetation within the bog woodland to the north-east of T6 (observed during mammal survey). The drains and ponds within the study area offer potential breeding habitat for frogs.

12.3.12.2 Smooth Newt

Smooth newt were not recorded during surveys within the study area. However suitable habitat was recorded, notably the man-made ponds to the east of turbine T4. The species is likely to be present within the study area, particularly the drains and water filled depressions throughout the site. The three manmade ponds to the east of T4 offer potential breeding areas for the species.

12.3.12.3 Wall Butterfly

The wall brown butterfly prefers grasslands with short grass, with broken turf and stones, and is also found dunes and other coastal habitats, as well as disused quarries, derelict land, farm tracks, railway embankments and cuttings, gardens and field edges.

A number of common grasses including false Brome *Brachypodium sylvaticum*, Cock's-foot *Dactylis glomerata*, bents *Agrostis* spp., Wavy Hair-grass *Deschampsia flexuosa* and Yorkshire-fog *Holcus lanatus* are used as larval foodplants (Butterfly Conservation.org, 2019).

The record of this species dates from 2001 and is a 100m resolution record corresponding with the grid reference N479103. This 100m grid square overlaps the proposed grid connection (surfaced road), a dwelling house and associated garden, agricultural land, hedgerows and a clearing bordering forestry plantation. It is possible that the habitat present at this location have developed or been altered significantly since the time the record was made.

12.3.13 Habitat Evaluation

12.3.13.1 Habitat Evaluation Summary

The following summary table outlines the ecological resources in the form of habitat types found at the proposed development site. Key receptors as per NRA guidance (NRA, 2009a), for which impact assessment is to be carried out, are also indicated.

The habitats within the study area are predominantly conifer plantation, improved agricultural grassland, cutover/degraded raised bog, bog woodland (birch), existing roads and mixed broadleaved woodland. These habitats are species poor in terms of flora, and many have been modified or been subject to disturbance.

Hedgerows, treelines and hedgerow/treeline mosaics form the field boundaries of agricultural fields not bounded by conifer plantations.

The cable route travels along existing tracks and roads for approximately 16km. This habitat type is classified as Buildings and Artificial Surfaces (BL3). Adjacent habitats to this section of the proposed route included Hedgerows (WL1) and Treelines (WL2) with Improved Agricultural Grassland (GA1) the most dominant habitat in the greater area.

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 12-43: Summary of Habitat Evaluations, Habitats by Area and Key Receptors

Fossitt Habitat Classification (Code)	Area in Hectares within the Ecology Study Area (ha)	% of Total Ecology Study Area	Evaluation	Key Receptor
Improved Agricultural Grassland (GA1)	143.88	48.90 %	Local Importance (Lower Value)	No
Conifer Plantation (WD4)	120.12	40.82 %	Local Importance (Higher Value)	Yes
Mixed Broadleaved Woodland (WD1)	11.89	4.04 %	Local Importance (Higher Value)	Yes
Buildings and Artificial Surfaces (BL3)	4.15	1.41 %	Local Importance (Lower Value)	No
Improved Agricultural Grassland/Bog Woodland/ Scrub (GA1/WN7/WS1) Mosaic	2.97	1.01 %	Local Importance (Higher Value)	No
Mixed Broadleaved/Conifer Woodland (WD2)	2.7	0.92 %	Local Importance (Higher Value)	Yes
Wet Grassland / Recolonising Cutover Bog (GS4/PB4)	2.12	0.72 %	Local Importance (Higher Value)	Yes
Bog woodland (WN7)	1.65	0.56 %	Local Importance (Higher Value)	Yes
(Recolonising) Cutover Bog (PB4)	1.25	0.43 %	Local Importance (Higher Value)	Yes
Cutover Bog (PB4)	1.19	0.41 %	Local Importance (Lower Value)	No
Dense Bracken (HD1)	0.96	0.32 %	Local Importance (Lower Value)	No
Improved Agricultural Grassland/(Recolonising) Cutover Bog/Scrub (GA1/PB4/WS1) Mosaic	0.78	0.26 %	Local Importance (Higher Value)	No
Scrub (WS1)	0.49	0.17 %	Local Importance (Higher Value)	Yes
Other artificial lakes and ponds FL8	0.07	0.02 %	Local Importance (Higher Value)	Yes

Table 12-44: Summary of Habitat Evaluations, Linear Habitats and Key Receptors

Fossitt Code	Length (M) within the Ecology Study Area	Evaluation	Key Receptor
Hedgerows (WL1)	1,1121	Local Importance (Higher Value)	No
Treelines (WL2)	8,542	Local Importance (Higher Value)	Yes
Hedgerows (WL1)/ Treelines (WL2) Mosaic	723	Local Importance (Higher Value)	Yes
Drainage Ditches/ Treelines (FW4/WL2) mosaic	169	Local Importance (Higher Value)	Yes
Drainage Ditches/Treelines/Hedgerows (FW4/WL2/WL1) mosaic	28	Local Importance (Higher Value)	No
Depositing/Lowland Rivers (FW2)	532	Local Importance (Higher Value)	Yes
Drainage Ditches (FW4)	6,460	Local Importance (Higher Value)	Yes

12.3.14 Non-Avian Fauna 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 12-45, below, outlines the key receptors selected for assessment and the rationale for same; taken from NRA guidance (NRA, 2009a).

Table 12-45: Evaluation of Fauna

Common name	Conservation Status	NRA Evaluation	Rationale	Key Ecological Receptor
Otter	EU Habitats Directive Annex II; Protected Species: EU Habitats Directive Annex IV; Wildlife Act (Amendment) 2000	National Importance	Recent records in drainage network near site and in river Barrow to south	Yes
Bats	EU Habitats Directive Annex IV; Wildlife Act (Amendment) 2000	National Importance	Legal status and ecological sensitivity	Yes
Badger	Wildlife Act (Amendment) 2000	County Importance	Setts present within site boundary, evidence of badger activity recorded	Yes
Pygmy Shrew	Wildlife Act (Amendment) 2000	National Importance	Records in the greater area and potentially present within the site.	Yes
Red Squirrel	Wildlife Act (Amendment) 2000	National Importance	Live sighting in study area.	Yes

Common name	Conservation Status	NRA Evaluation	Rationale	Key Ecological Receptor
Fallow Deer	Wildlife Act (Amendment) 2000; Invasive non-native species	Local Importance (Higher Value)	Species observed within the site.	Yes
Irish Hare	EU Habitats Directive Annex V, Wildlife Act (Amendment) 2000	National Importance	Recent records within/near site	Yes
Irish Stoat	Wildlife Act (Amendment) 2000	National Importance	Records in the greater area and potentially present within the site.	Yes
Pine Marten	EU Habitats Directive Annex V, Wildlife Act (Amendment) 2000	National Importance	Scat and trail camera record in study area.	Yes
Hedgehog	Wildlife Act (Amendment) 2000	National Importance	Records in the greater area and potentially present within the site.	Yes
Grey Squirrel	Invasive non-native species	Not of conservation importance	Records in the greater area and potentially present within the site.	No
Wood Mouse	None	Local Importance (lower Value)	Recent records near site	No
Rabbit	Invasive non-native species	Local Importance (lower Value)	Rabbit recorded within the site. Widespread/resilient	No
Fox	None	Local Importance (lower Value)	Fox recorded within the site. Widespread/resilient	No
American Mink	Invasive non-native species	Not of conservation importance	Records in the greater area and potentially present within the site.	No
Bank Vole	Invasive non-native species	Not of conservation importance	Records in the greater area and potentially present within the site.	No
Brown Rat	Invasive non-native species	Not of conservation importance	Recent records within/near site	No
House Mouse	Invasive non-native species	Not of conservation importance	Records in the greater area but unlikely to be present within the site.	No
Greater White-toothed Shrew	Invasive non-native species	Not of conservation importance	Records in the greater area- could occur within or colonise site in future.	No
Common Frog	Wildlife Act (Amendment) 2000	National Importance	Recorded within the site, potentially suitable habitats present	Yes
Smooth Newt	Wildlife Act (Amendment) 2000	National Importance	potentially suitable habitats recorded within the site, records in wider	Yes

Common name	Conservation Status	NRA Evaluation	Rationale	Key Ecological Receptor
			area and potentially present within the site.	
Brook Lamprey	Annex II, Wildlife Act (Amendment) 2000	National Importance	Suitable habitat present and juveniles present in low numbers in the in the study area catchment (Barrow main channel)	Yes
River and Sea Lamprey	Annex II, Wildlife Act (Amendment) 2000	National Importance	Not considered likely to be within the study area	No
Atlantic Salmon	Annex II, Wildlife Act (Amendment) 2000	National Importance	Recorded within catchment area of the proposed project	Yes
Brown Trout	Wildlife Act (Amendment) 2000	National Importance	Recorded within catchment area of the proposed project	Yes
European Eel	Wildlife Act (Amendment) 2000	National Importance	Not recorded within catchment area of the proposed project	No
White-clawed Crayfish	Annex II & V, Wildlife Act (Amendment) 2000	National Importance	Species not recorded during survey but may occur within the catchment area in low densities (previously recorded at Kilnahown Bridge)	Yes
Freshwater Pearl Mussel	Annex II & IV, Wildlife Act (Amendment) 2000	National Importance	Species does not occur in the study area.	No
Wall Butterfly	Endangered	National Importance	Recorded within 1km grid square (N4710) overlapping proposed grid route. Unlikely to use the habitats along the road where the grid is to be located.	No

12.3.15 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 12-46, 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 12-46: Avifauna Key Receptor Evaluations

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Golden Plover	Red Listed, Annex I	International Importance	Species present in the study area during summer (moderate numbers) and winter (large numbers) vantage point surveys. No breeding birds recorded.	Yes	Very High
Black-Headed Gull	Red Listed	National Importance	Recorded during summer vantage point surveys in low numbers. No breeding or roosting recorded within the study area or hinterland.	Yes	High
Curlew	Red Listed	National Importance	Recorded during summer and winter vantage point surveys in moderate numbers. No breeding recorded within the study area or hinterland.	Yes	High
Herring Gull	Red Listed	National Importance	Recorded during the summer and winter in moderate numbers during vantage point surveys. No breeding or roosting recorded within the study area or hinterland.	Yes	High
Kingfisher	Amber Listed, Annex I	International Importance	Not recorded on site or in surrounding area. Unlikely to use habitats on site but included as precaution.	Yes	Very High
Lapwing	Red Listed	National Importance	Species recorded during summer and winter vantage point surveys in large numbers. No breeding birds recorded but low numbers detected during monthly winter wader census.	Yes	High
Meadow Pipit	Red Listed	National Importance	Recorded breeding during surveys.	Yes	High
Merlin	Amber Listed, Annex I	International Importance	Recorded during summer (low numbers) and winter (moderate numbers)	Yes	Very High

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
			vantage point surveys. No breeding or roosting recorded within the study area or hinterland during surveys.		
Peregrine	Green Listed, Annex I	International Importance	Species recorded during summer and winter vantage point surveys in low numbers. No breeding or roosting recorded within the study area or hinterland during surveys.	Yes	Very High
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
Barn Swallow	Amber Listed	County Importance	Recorded breeding during surveys. Site contains good feeding habitats.	Yes	Medium
Greenfinch	Amber Listed	County Importance	Recorded breeding during surveys.	Yes	Medium
House Martin	Amber Listed	County Importance	Recorded breeding during surveys.	Yes	Medium
House Sparrow	Amber Listed	County Importance	Recorded breeding during surveys.	Yes	Medium
Jack Snipe	Amber Listed	County Importance	Recorded during winter vantage point surveys in low numbers. Not recorded breeding on site.	Yes	Medium
Kestrel	Amber Listed	County Importance	Recorded during summer and winter vantage point surveys in moderate numbers. Recorded breeding on site.	Yes	Medium
Lesser Black-Backed Gull	Amber Listed	County Importance	Recorded during summer vantage point surveys in low numbers. No breeding or roosting recorded within the study area or hinterland.	Yes	Medium

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Linnet	Amber Listed	County Importance	Recorded breeding during surveys.	Yes	Medium
Mistle Thrush	Amber Listed	County Importance	Recorded breeding during surveys.	Yes	Medium
Robin	Amber Listed	County Importance	Recorded breeding during surveys.	Yes	Medium
Snipe	Amber Listed	County Importance	Recorded during summer and winter vantage point surveys in moderate numbers. Recorded breeding on site in low numbers.	Yes	Medium
Sparrowhawk	Amber Listed	County Importance	Recorded during summer and winter vantage point surveys in moderate numbers. Not recorded breeding on site, although conifer woodlands provide potentially suitable habitat.	Yes	Medium
Starling	Amber Listed	County Importance	Recorded breeding during surveys.	Yes	Medium
Stonechat	Amber Listed	County Importance	Recorded breeding during surveys.	Yes	Medium
Buzzard	Green Listed	Local Importance (Higher Value)	Recorded breeding during surveys.	Yes	Low
Grey Heron	Green Listed	Local Importance (High Value)	Recorded during summer and winter vantage point surveys in low numbers. Not recorded breeding on site.	Yes	Low
Blackbird	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Blackcap	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Blue Tit	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Bullfinch	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Chaffinch	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Chiffchaff	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Coal Tit	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Crossbill	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Cuckoo	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Dunnock	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Goldfinch	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Great Tit	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Hooded Crow	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Jackdaw	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Jay	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Lesser Redpoll	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Long-Tailed Tit	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Magpie	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Mallard	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Pied Wagtail	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Raven	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Reed Bunting	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Rook	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Siskin	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Song Thrush	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Treecreeper	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Willow Warbler	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Woodpigeon	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible
Wren	Green Listed	Local Importance (Low Value)	Recorded breeding during surveys.	No	Negligible

The following Very High to Medium sensitivity species were recorded within the 10 km grid squares encompassing the study site (N40 and N41) within the last 10 years (2009-2019) only and were not recorded within the study area over 1.5 years of dedicated field surveys. Consequently, they are not listed as key receptors. These species are:

- Dunlin (Very High sensitivity)
- Barn Owl, Grey Wagtail, Hen Harrier, Little Egret, Pochard, Tufted Duck, Whooper Swan, Wigeon and Yellowhammer (High sensitivity)
- Black-Tailed Godwit, Coot, Teal, Gadwall, Goldcrest, Mute Swan, Sand Martin, Skylark, Spotted Flycatcher, Stock Pigeon, Swift, Tree Sparrow (Medium sensitivity)

12.4 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 12.3 are likely to remain as described previously.

12.5 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.

12.5.1 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, including all site clearance works to minimise land take of habitats and flora.
- Larger turbines have also been utilised to minimise the total rotor envelope of the proposed development.
- Site design and layout deliberately avoided direct impacts on designated sites. The placement of turbines in deciduous woodland has been avoided. Internal road design has avoided hedgerow removal wherever possible. 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 and Langston, 2006).
- All cabling for the project is to 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 utilise public roads thereby minimising land take of potentially sensitive habitats.
- Care has been taken to ensure that sufficient buffers are in place between wind farm infrastructure and hydrological features such as rivers and streams. Only one stream crossing is required for internal access roads; an existing crossing (EXC1) in the form of a pipe culvert is already in place at this location. It is proposed to replace this with a pre-cast bottomless culvert in order to widen the crossing and allow a more natural stream bed hydromorphology.
- Directional drilling is the proposed installation method where the grid connection route crosses watercourses. As such, in-stream works will not be required and the potential for contaminant or pollutant input will be reduced.
- Any works in or around watercourses will adhere to best practice as per NRA guidance where possible.
- The design of the proposed cable route 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.

12.5.2 Construction Phase

12.5.2.1 European sites

There are no designated European sites within the proposed development area therefore no direct impacts are predicted during construction. 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 12.1) addresses potential effects on European Sites resulting from the proposed development.

12.5.2.2 Natural Heritage Areas or Proposed Natural Heritage Areas

One pNHA lies within the boundary of a European Site and therefore is considered as part of the Natura Impact Statement:

- Slieve Bloom Mountains pNHA/SPA (004160)

In addition, one NHA and three pNHAs are present within 10 km of the proposed wind farm, while a further three pNHAs are present within 10 km of the proposed grid connection route. The closest of these to the proposed wind farm is Raheen Lough pNHA (6.6 km north).

- Raheen Lough pNHA (000917)
- Clonreher Bog NHA (002357)
- Ridge of Portlaoise pNHA (000876)
- Emo Court pNHA (000865)
- Hawkswood Bog NHA (002355)
- Great Heath of Portlaoise pNHA (000881)
- Grand Canal pNHA (002104)

The turbine delivery route traverses the Royal Canal pNHA (002103) (travels under aqueduct intersecting M50), Liffey Valley pNHA (000128) (existing bridge) and Grand Canal pNHA (002104) (existing bridges near Kilbeggan and Tullamore). In all cases existing roads will be used and no modifications to these structures are required, precluding any impacts to these sites.

Potential Direct Impacts

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

Potential Indirect Impacts

There are no downstream hydrological links between the proposed development and any of the national sites within 10 km. Four waterbodies run through the proposed site- Cottoner's Brook, White Hill (W), White Hill (E), and Forest Upper streams all draining into the Barrow which flows in an eastward direction, away from nearby designated sites. Therefore, no impacts to Raheen Lough pNHA (000917), Clonreher Bog NHA (002357), Ridge of Portlaoise pNHA (000876), Emo Court pNHA (000865), Hawkswood Bog NHA (002355), Great Heath of Portlaoise pNHA (000881), Derries Wood pNHA (000416) or Grand Canal pNHA (002104) are envisaged during the construction phase of the project.

While Raheen Lough pNHA (000917) is not hydrologically linked to the proposed development, it is recognised as a wintering site for several wetland species including the Whooper Swan. No impacts to this site are predicted during the construction phase (potential for impacts is limited to the operational phase).

A Natura Impact Statement (NIS) has been prepared for the proposed development and has been submitted with the planning application. The NIS (Appendix 12.1) addresses potential effects on European Sites resulting from the proposed development.

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While Raheen Lough pNHA (000917) is not hydrologically linked to the proposed development, it is recognised as a wintering site for several wetland species including the Whooper Swan. No impacts to this site are predicted during the construction phase (potential for impacts is limited to the operational phase).

12.5.2.3 Habitats and Flora

Potential Direct Impacts

Table 12-47 over summarises the habitat loss which would result from the proposed development. Table 12-48 summarises Habitat loss for linear habitats.

Table 12-47: Habitat loss as a result of the proposed wind farm development

Habitat	Selected as key ecological receptor	Area in Hectares within the Ecology Study Area (ha)	% of Total Ecology Study Area	Area of habitat to be lost (ha)	Percentage of total habitat loss (%)
Buildings and Artificial Surfaces (BL3)	No	4.15	1.4 %	0	0 %
Improved Agricultural Grassland (GA1)	No	143.88	48.9%	3.64	2.5 %
Dense Bracken (HD1)	No	0.96	0.32 %	0.07	5.2 %
Cutover Bog (PB4)	No	1.19	0.41 %	0.0	0 %
(Recolonising) Cutover Bog (PB4)	Yes	1.25	0.43 %	0.21	16.7 %
Mixed Broadleaved/Conifer Woodland (WD2)	Yes	2.7	0.92 %	0.13	4.8 %
Bog woodland (WN7)	Yes	1.65	0.56 %	0.26	15.7 %
Mixed Broadleaved Woodland (WD1)	Yes	11.89	4.04 %	0.54	4.5 %
Conifer Plantation (WD4)	Yes	120.12	40.82%	17.32	14.6 %
Improved Agricultural Grassland/Bog Woodland/ Scrub (GA1/WN7/WS1) Mosaic	No	2.97	1.01 %	0.0	0 %
Improved Agricultural Grassland/(Recolonising) Cutover Bog/Scrub (GA1/PB4/WS1) Mosaic	No	0.78	0.26 %	0.0	0 %
Wet Grassland / Recolonising Cutover Bog (GS4/PB4)	Yes	2.12	0.72 %	0.09	4.3 %
Scrub (WS1)	No	0.49	0.17 %	0.0	0 %
Other artificial lakes and ponds FL8	Yes	0.07	0.02 %	0.01	14.6 %

Table 12-48: Habitat loss (linear habitats) as a result of the proposed wind farm development

Habitat	Selected as key ecological receptor	Total length within Dernacart Wind Farm study area (M)	Length of habitat to be lost (M)	Percentage of total linear habitat loss (%)
Hedgerows (WL1)	No	1,1121	0	0 %
Treelines (WL2)	Yes	8,542	498	5.8 %
Hedgerows (WL1)/ Treelines (WL2) Mosaic	Yes	723	252	34.8 %
Drainage Ditches/Treelines/Hedgerows (FW4/WL2/WL1) mosaic	No	28	0	0 %
Drainage Ditches / Treelines (FW4/WL2) mosaic	Yes	169	5	3.0%
Depositing/Lowland Rivers (FW2)	Yes	532	0	0 %
Drainage Ditches (FW4)	Yes	6,460	0	0 %

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 8 proposed turbines (foundations, hard standings, and associated felling buffers) and all other wind farm infrastructure.

The footprint of the proposed development including felling buffers will be approximately 22.4 Ha or 7.6 % of the total study area. A total of 18.2 Ha (17.32 ha of conifer plantation, 0.54 ha of mixed broadleaved woodland, 0.26 ha of bog woodland and 0.13 ha of mixed broadleaved/conifer plantation) or 13.5 % of the wooded habitats within the study area shall be lost due to the felling of trees. These felled areas shall be maintained as treeless areas for the life of the wind farm, but they shall form other semi-natural habitat 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.

The most abundant habitat type within the study area is Improved Agricultural Grassland (GA1) which on its own accounts for 49.17% (144.68 Ha) of the study area. This is followed closely by Conifer Plantation WD4 which accounts for 40.55% (119.32 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. As such it is not considered further.

(Recolonising) Cutover Bog is a relatively minor habitat type within the study area with a total area of 1.25 Ha (0.43 %). The total area of habitat loss for recolonising cutover bog (excluding mosaics) is 0.21 ha or 16.7 % of the total habitat type. Recolonising Cutover Bog accounts for 0.9% of the total habitat loss associated with the proposed development. Considering the small area impacted and transient nature of this habitat this would result in a ***short-term imperceptible impact***.

Mixed Broadleaved/Conifer Woodland is a relatively minor habitat type within the study area with a total area of 2.7 ha (0.92 %). The total area of habitat loss for this habitat type is 0.13 ha or 4.8% of the total habitat type. Mixed Broadleaved/Conifer Woodland accounts for 0.6% of the total habitat loss associated with the proposed development.

Considering the low ecological value and polluted state of this section of stream, any direct impacts to the Forest Upper stream be ***not significant***.

As such the primary concern is the conveyance of silt or contaminants towards the Barrow, 1.25km downstream. The low gradient and flow rate reduce the likelihood of contaminants or pollutants reaching the Barrow however. Prior to mitigation, a ***short-term slight impact*** is predicted.

For the grid connections, directional drilling within the road corridor under watercourses will be used to cross channels where bridges are in place. For culvert crossings, directional drilling, piped culvert crossings or flatbed formations over culverts will be used. As such, instream works will be avoided, and any impacts would be limited to surface runoff of sediment or contaminants towards watercourses. Prior to mitigation, a ***short-term slight impact*** is predicted.

Drainage ditches (FW4) within the proposed site will be crossed using pipe culverts. Disturbance will be minimised to the area where the culvert is being installed. Considering that none of the drains on site where observed to be ecologically sensitive, Prior to mitigation, a ***short-term imperceptible impact*** is predicted.

The proposed grid cable runs through manmade or modified surfaces including access tracks, local and regional roads and the town of Portarlington on the approach to the proposed Bracklone substation. The predicted impact to habitats due to the construction of the cable route is considered to be ***short-term imperceptible.***

Habitat loss associated with the TDR is detailed in Section 12.1.3 and is limited to construction of temporary tracks on Amenity Grassland (GA2) on roundabout islands, a section of low-quality intensively-managed Hedgerow (WL1), Scrub (WS1) and Improved Agricultural Grassland (GA1). These habitats are artificial, modified and/or intensively managed resulting in an overall ***temporary imperceptible impact*** to habitats affected by the TDR.

Potential Indirect Impacts

Indirect impacts on habitats and flora include the spread of invasive species which could be distributed during construction works. Giant hogweed was recorded within the study area, c. 350m from proposed access tracks and c. 250m from the proposed wind farm site at its closest point. This is a highly invasive plant species and is easily spread by human activities, and in addition poses a human health hazard in the form of Phytophotodermatis, a painful skin condition.

While interaction of proposed works with the giant hogweed in its current location will not occur, there is the possibility of it being spread to the proposed wind farm site by third party activities in the intervening period.

Therefore, while unlikely due to the current distance from infrastructure, the proposed development could affect the existing environment by facilitating the spread of this species. It is considered **unlikely but possible** that prior to mitigation a ***long-term significant impact*** could arise.

There is potential for the conveyance of silt or contaminants towards the Barrow via the Forest Upper, White Hill (W) and Cottoner's Brook watercourses, which are in close proximity to or intersecting proposed infrastructure in a number of locations. The low gradient and flow rates of these channels reduce the likelihood of contaminants or pollutants reaching the Barrow however. Prior to mitigation, a ***short-term slight impact*** is predicted.

Two invasive species were recorded on the site boundary of the proposed replant lands at Carrigmacthomas, Macroom Co. Cork; Montbretia *Crocosmia x crocosmiiflora* and Snowberry *Symphoricarpos albus.* These could potentially be spread in the absence of mitigation measures, resulting in ***Long-term moderate effects*** on habitats and designated sites.

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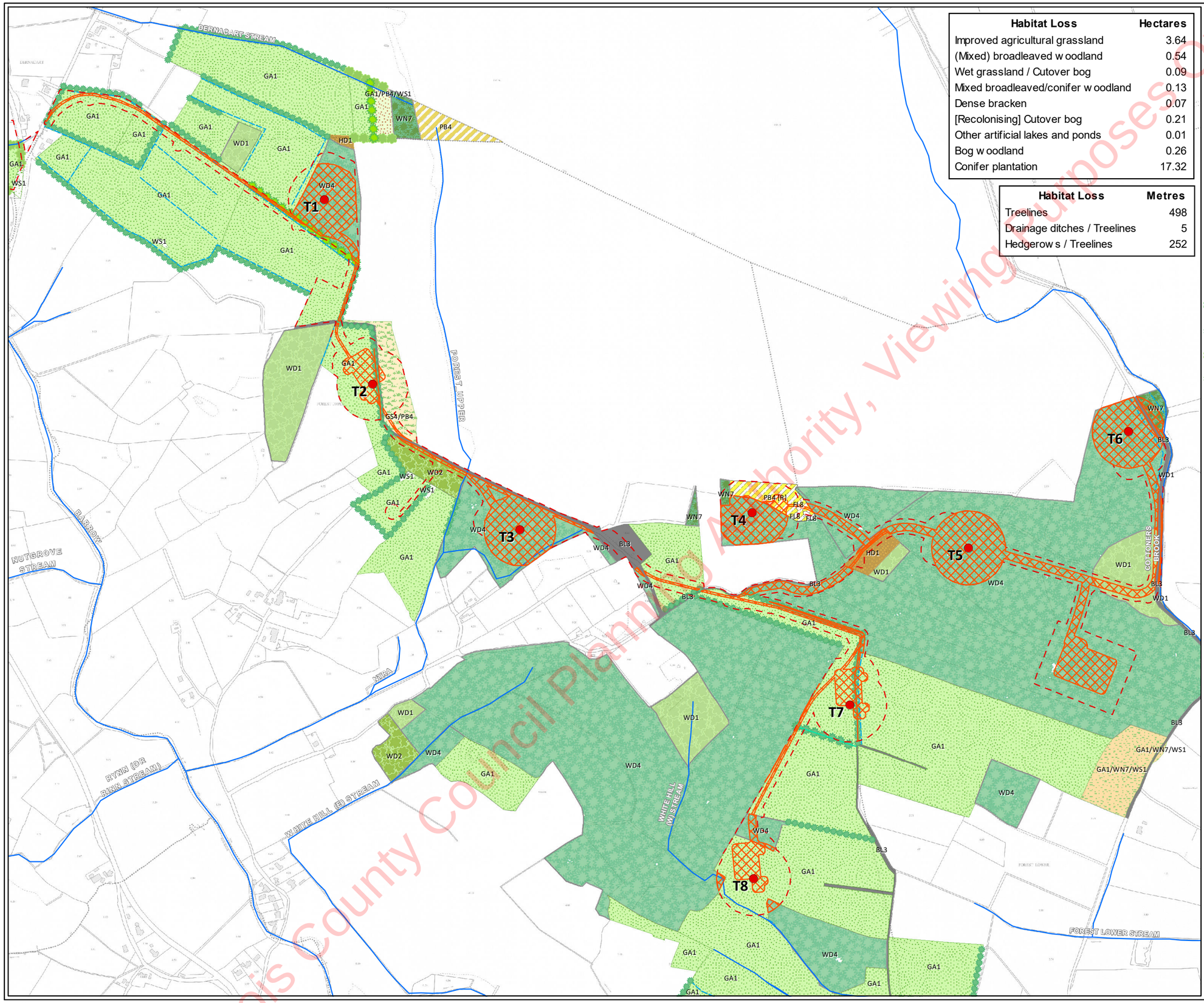
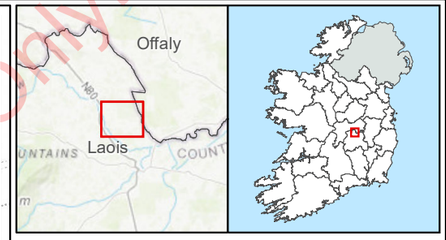


Habitat Loss	Hectares
Improved agricultural grassland	3.64
(Mixed) broadleaved w oodland	0.54
Wet grassland / Cutover bog	0.09
Mixed broadleaved/conifer w oodland	0.13
Dense bracken	0.07
[Recolonising] Cutover bog	0.21
Other artificial lakes and ponds	0.01
Bog w oodland	0.26
Conifer plantation	17.32

Habitat Loss	Metres
Treelines	498
Drainage ditches / Treelines	5
Hedgerow s / Treelines	252



- Proposed
- Habitat Loss
- Proposed Planning Boundary

Habitat Classification

- FW2, Depositing/lowland
- FW4, Drainage
- FW4/WL1/WL2, Drainage ditches / Hedgerows
- FW4/WL2, Drainage ditches /
- WL1,
- WL1/WL2, Hedgerows /
- WL2, Treelines
- BL3, Buildings and artificial surfaces
- GA1, Improved agricultural grassland
- GA1/PB4/WS1, Improved agricultural grassland
- GA1/WN7/WS1, Improved agricultural
- GS4/PB4, Wet grassland / Cutover bog
- HD1, Dense bracken
- PB4 [R], [Recolonising] Cutover bog
- PB4, Cutover bog
- WD1, (Mixed) broadleaved woodland
- WD2, Mixed broadleaved/conifer woodland
- WD4, Conifer plantation
- WN7, Bog woodland
- WS1, Scrub

TITLE: Habitat Loss			
PROJECT: Dernacart Wind Farm			
FIGURE NO:	12.10		
CLIENT:	Statkraft		
SCALE:	1:10000	**REVISION:**	0
DATE:	30/01/2020	**PAGE SIZE:**	A3

FEHILY TIMONEY
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www.fehilytimoney.ie

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0 0.25 0.5 1 Kilometers

12.5.2.4 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 22.4 ha or 7.6% of habitat within the study area, most of which is conifer plantation or improved agricultural grassland. In addition, the felling and maintenance of buffer zones surrounding turbines located in woodland will result in habitat alteration (from woodland to scrub-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, fallow deer, Irish hare, Irish stoat, and hedgehog.

It is considered ***near certain*** that any unmitigated impacts will be ***short-term imperceptible***.

No impact is envisaged as a result of habitat loss along the TDR or grid cable route as the habitats are highly modified and of low value ecologically.

Badger

A total of nine confirmed and two potential badger setts were noted within the study area (subsidiary/outlier setts). One potential inactive sett and one inactive sett are outside the site boundary and at a sufficient distance from infrastructure and felling areas to preclude any direct impacts. The remaining nine setts are within or in close proximity to access tracks, hard standings and/or felling areas, but are not directly within the proposed development footprint. All nine of these setts in close proximity to the proposed development 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), it is considered ***near certain*** a ***long-term significant impact*** would result (without mitigation).

Otter

No holts were recorded during surveys at or within 150m up or down-stream of the proposed stream crossing (upgrade of EXC1) or other parts of the proposed site in close proximity to watercourses. No potential holt habitat or otter signs were present along watercourses intersecting the proposed cable route.

Therefore, there shall be ***no direct impact*** to otter during construction.

Red Squirrel

The presence of red squirrel within the study area was confirmed by a live sighting to the south of the proposed access track between T3 and T7. The total loss of conifer plantation from the area is 17.43 ha or 14.6 % 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 ***possible*** that any unmitigated impacts on Red Squirrel may be a ***short-term significant impact*** (without mitigation).

Pine Marten

Pine marten are confirmed to be utilising the conifer plantation within the study area and are also likely to use the birch and mixed broadleaved woodland onsite. However, no dens were found during the mammal survey within the footprint of the proposed development.

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 ***possible*** that any unmitigated impacts on Pine Marten will be ***short term significant impacts*** (without mitigation).

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 in close proximity to construction works. It is considered ***possible*** that any unmitigated impacts on badger will be ***short term significant impact*** (without 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 and white-clawed crayfish on which otter depend. These impacts could occur as the result of felling and/or construction activities; however, considering the low gradient and flow rate of the streams draining the study area and lack of salmonid or white-clawed crayfish habitat near the proposed development, the magnitude of any such impacts would be low. As such, any impacts on otter prior to mitigation are predicted to be ***temporary slight***.

12.5.2.5 Bats

A confirmed bat roost was recorded within the study area. This is located in a derelict ivy-covered house in the west of the study area. The roost is surrounded by conifer plantation, conifer/broadleaved plantation, mixed broadleaved woodland and improved agricultural grassland. A single soprano pipistrelle was observed to emerge from the building, indicating it may be in use as a transitional or night roost, probably by a lone male. 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 the roost 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 and substation will lead to a permanent loss of 22.4 ha or 7.6% of habitats making up the study area, most of which is conifer habitat or improved agricultural grassland. 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.

The construction of the proposed development will involve offsite widening of existing road carriageways to allow unimpeded haulage of the large turbine sections. The trimming of one section of hedgerow along the N80 to 1m above road level is required to facilitate the passage of turbine components. This section of hedgerow is already subject to intensive trimming and is less than 2m in height and is located along a busy national road. 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:

12.5.2.6 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.

12.5.2.6.1 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 it is considered ***near certain*** that the impact to bats during the construction phase will be a ***long term slight to moderate impact*** and will require mitigation measures.

12.5.2.7 Avifauna

Potential Direct Impacts

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., & Langstone, 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., & Langstone, 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 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 12-46 indicates that one 'Very High' sensitivity species has been recorded within the project study area (wind farm and cable route) site:

- Golden Plover (Red-listed and Annex I)

Consideration of the survey data against Table 12-46 indicates that nine 'High' sensitivity species have been recorded within the project study area (wind farm and cable route) site.

- Black-Headed Gull (Red-listed)
- Curlew (Red-listed)
- Herring Gull (Red-listed)
- Kingfisher (Amber-listed and Annex I)
- Lapwing (Red-listed)
- Meadow Pipit (Red-listed)
- Merlin (Amber-listed and Annex I)
- Peregrine (Green-listed and Annex I)
- Woodcock (Red-listed)

'Medium' sensitivity species are considered in this assessment. The 14 most relevant species recorded within the project study area (wind farm and cable route) site are:

- Barn Swallow (Amber-listed)
- Greenfinch (Amber-listed)
- House Martin (Amber-listed)
- House Sparrow (Amber-listed)
- Jack Snipe (Amber-listed)
- Kestrel (Amber-listed)
- Lesser Black-Backed Gull (Amber-listed)
- Linnet (Amber-listed)
- Mistle Thrush (Amber-listed
- Robin (Amber-listed)
- Snipe (Amber-listed)
- Sparrowhawk (Amber-listed)
- Starling (Amber-listed)
- Stonechat (Amber-listed)

Two low sensitivity species are considered in this assessment:

- Buzzard (Green-listed)
- Grey Heron (Green-listed)

It is noted that the construction of the proposed grid connection will progress in a sequential manner along the proposed grid route from Dernacart in the direction of the proposed Bracklone 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 12.3.6 above, are widespread in the surrounding area therefore any resident species can easily move in response to any temporary disturbance.

12.5.2.8 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 eight proposed turbines. Felling shall not be required at all eight turbines. Habitat that will be lost will be dominated by conifer plantation of different age classes and agricultural grassland. Part of the main road network is already in existence, so most of the habitat loss is associated with the turbines and spur roads. There shall be no loss of valuable habitat for birds along the TDR.

For the purpose of the consideration of the potential impacts to birds, species have been grouped into four categories namely passerines, birds of prey and waders/waterfowl/swans 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. Bird of prey are raptors that actively hunt other bird species. Waders are shorebirds with the majority of species eating small invertebrates picked out of mud or exposed soil.

Passerines

The loss of habitat due to the construction of the project has the potential to affect passerines. 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 & Langston 2006).

Aerial species such as Barn Swallow and House Martin would not be expected to be affected by the proposed wind farm development, as open habitat within the footprint of the development is predominantly agricultural grassland and the area of land take is negligible in relation to alternative habitat available. Similarly, the loss of suitable habitat for starling is considered ***imperceptible***.

The proposed development shall result in the loss of 755m of treelines and hedgerow habitats (or 2.7% of linear habitats) and 18.4 Ha or 13.5 % of wooded habitats (17.43 ha of conifer plantation, 0.54 ha of mixed broadleaved woodland, 0.26 ha of bog woodland and 0.13 ha of mixed broadleaved/conifer plantation).

Of this 17.4 Ha (14.6 % of the total habitat type) is conifer plantation including mosaics which is of lower value to passerine species and common in the greater area. There shall be a reduction of potential nesting habitat for passerine species like Meadow Pipit, Greenfinch, House Sparrow, Linnet, Mistle Thrush, Robin, Starling and Stonechat. However, the resultant loss is considered *Negligible* as a percentage of these habitat types available within the study area due to the availability of similar habitat in the greater area. Also, as felling areas revegetation they shall provide suitable foraging habitat for these species.

It is therefore, not expected that the wind farm development will cause any reduction in the baseline population of passerines as the area of nesting/foraging habitat lost will be of *Negligible*. It is considered ***near certain*** that the proposed impact of habitat loss will be a ***long-term imperceptible impact***.

Table 12-49 below displays the direct impact character during construction as well as the significance of impacts without the implementation of mitigation.

Table 12-49: Impact of habitat loss to other target species

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Golden Plover (Very High)	A total of 54 individuals were recorded on site in summer 2019, while 239 individuals were recorded in the study area in winter 2018/19. No breeding was recorded on site or in the surrounding area. The proposed wind farm shall result in the loss 0.3 ha of reclonising cutover bog (including mosaics encompassing wet grassland). Area of land take negligible in relation to alternative displacement habitats available.	Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Very 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 slight impact*** (Criteria: EPA, 2017)
Black-Headed Gull (High)	A total of 8 individuals were recorded in the study area in summer only. No breeding was recorded on site. The proposed wind farm shall result in the loss of 3.64 ha of Improved Agricultural Grassland (2.5% of total of habitat type within study area). Area of land take negligible in relation to alternative displacement habitats available.	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 slight impact*** (Criteria: EPA, 2017)
Curlew (High)	A total of 48 individuals were recorded in the study area over the course of surveys (in both summer and winter). No breeding was recorded on site or in the surrounding area. The proposed wind farm shall result in the loss 0.3 ha of reclonising cutover bog (including mosaics encompassing wet grassland). Area of land take negligible in relation to alternative displacement habitats available.	Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **High**, overall effect significance is **Very Low** (Criteria: Percival, 2003). It is considered ***near certain*** that the proposed impact of habitat loss will be a ***long-term imperceptible impact*** (Criteria: EPA, 2017)
Herring Gull (High)	A total of 8 individuals were recorded on site were recorded in the study area during 2018 (in both summer and winter). No breeding was recorded on site. The proposed wind farm shall result in the loss of 3.64 ha of Improved Agricultural Grassland (2.5% of total of habitat type within study area). Area of land take negligible in relation to alternative displacement habitats available.	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 slight impact*** (Criteria: EPA, 2017)
Kingfisher (Very High)	No Kingfishers were recorded on site or in the surrounding area during surveys (identified in	Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Very High**,

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
	desktop search only). The proposed wind farm shall result in loss of a short section of drainage ditches but will not result in negative impacts to aquatic habitats. No direct loss of habitat is predicted.	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 imperceptible impact*** (Criteria: EPA, 2017)
Lapwing (High)	A total of 404 individuals were recorded in the study area during winter 2018/19, but no breeding was recorded on site or in the surrounding area. The proposed wind farm shall result in the loss 0.3 ha of reclonising cutover bog (including mosaics encompassing wet grassland). Area of land take negligible in relation to alternative displacement habitats available.	Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **High**, overall effect significance is **Very Low** (Criteria: Percival, 2003). It is considered ***near certain*** that the proposed impact of habitat loss will be a ***long-term imperceptible impact*** (Criteria: EPA, 2017)
Merlin (Very High)	A total of 14 individual flightlines were recorded during winter 2018/19, while a further 3 flightlines were recorded in summer 2019. Flightlines were concentrated predominantly along the northern site boundary north of T4, T5 and T6 along the southern portion of Garryinch Bog. No breeding was recorded on site or in the hinterland. The flightlines recorded potential commuting/foraging. Area of land take negligible in relation to alternative displacement habitats available.	Magnitude effects is assessed as **Low** (1-5 % habitat lost), species sensitivity is **Very High**, overall effect significance is **Medium** (Criteria: Percival, 2003). It is considered ***near certain*** that the proposed impact of habitat loss will be a ***long-term moderate impact*** (Criteria: EPA, 2017)
Peregrine (Very High)	This species was recorded on 5 occasions across winter and summer during surveys. No breeding or roosting was recorded on site or in the surrounding area. Area of land take negligible in relation to alternative displacement habitats available.	Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Very 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)
Woodcock (High)	A total of 11 flightlines (12 individuals) were recorded in the study area in the summer 2019 while only a single individual was recorded in winter 2018/19. Two breeding territories were recorded within the study area in 2019. Area of land take negligible in relation to alternative displacement habitats available.	Magnitude effects is assessed as **Low** (*Guide: 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 moderate impact*** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Jack Snipe (Medium)	A single observation was recorded in winter 2018/19. No breeding was recorded on site or in the surrounding area. The proposed wind farm shall result in the loss of 0.3 ha of reclonising cutover bog (including mosaics encompassing wet grassland). Area of land take negligible in relation to alternative displacement habitats available.	Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Medium**, overall effect significance is Very **Low** (Criteria: Percival, 2003). It is considered ***near certain*** that the proposed impact of habitat loss will be a ***long-term imperceptible impact*** (Criteria: EPA, 2017)
Kestrel (Medium)	A total of 174 individual flightlines were recorded across the both the winter (64) and summer (110) survey periods. Two breeding territories were recorded on site in 2018 and five in 2019. The proposed wind farm shall result in the loss 18.4 Ha or 13.5 % of wooded habitats within the study area. Area of land take negligible in relation to alternative displacement habitats available.	Magnitude effects is assessed as **Medium** (*5-20% of habitat lost*), species sensitivity is **Medium**, 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 slight - moderate impact*** (Criteria: EPA, 2017).
Lesser Black-Backed Gull (Medium)	A total of 13 individuals were recorded during summer 2018, while single flightlines were recorded in winter 2018/19 and summer 2019. No breeding was recorded on site. The proposed wind farm shall result in the loss of 3.64 ha of Improved Agricultural Grassland (2.5% of total of habitat type within study area). Area of land take negligible in relation to alternative displacement habitats available.	Magnitude effects is assessed as **Low** (1-5 % habitat lost), species sensitivity is **Medium**, 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 imperceptible impact*** (Criteria: EPA, 2017)
Snipe (Medium)	A total of 9 flights were recorded over the combined breeding seasons, while a total of 10 flights were recorded during winter 2018/19. Three and five breeding territories were recorded on site in 2018 and 2019, respectively. The proposed wind farm shall result in the loss of 0.3 ha of reclonising cutover bog (including mosaics encompassing wet grassland). Area of land take negligible in relation to alternative displacement habitats available.	Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Medium**, overall effect significance is Very **Low** (Criteria: Percival, 2003). It is considered ***near certain*** that the proposed impact of habitat loss will be a ***long-term imperceptible impact*** (Criteria: EPA, 2017)
Sparrowhawk (Medium)	A total of 53 flights were observed within the survey area with most during the combined breeding seasons. Only 10 flights were recorded in the winter season. . No breeding was recorded on site or in the surrounding area. The proposed wind farm shall result in	Magnitude effects is assessed as **Medium** (5-20% Habitat Lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival, 2003). It is considered ***near certain*** that the proposed impact of habitat loss

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
	the loss and 18.4 Ha or 13.5 % of wooded habitats. Area of land take negligible in relation to alternative displacement habitats available.	will be a ***long-term slight impact*** (Criteria: EPA, 2017)
Buzzard (Low)	Two and four breeding territories were recorded in the study area in 2018 and 2019, respectively. The proposed wind farm shall result in the loss and 18.4 Ha or 13.5 % of wooded habitats, and 4.3 % of semi-natural grassland habitats. Area of land take negligible in relation to alternative displacement habitats available.	Magnitude effects is assessed as **Medium** (5-20% Habitat Lost), species sensitivity is **Low**, overall effect significance is **Very Low** (Criteria: Percival, 2003). It is considered ***near certain*** that the proposed impact of habitat loss will be a ***long-term slight impact*** (Criteria: EPA, 2017)
Grey Heron (Low)	A total of 51 flightlines were recorded over the entire survey period, distributed evenly over summer and winter. No breeding was recorded on site or in the surrounding area. The proposed wind farm shall result in the loss XYZ but no XYZ. Area of land take negligible in relation to alternative displacement habitats available.	Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Low**, overall effect significance is **Very Low** (Criteria: Percival, 2003). It is considered ***near certain*** that the proposed impact of habitat loss will be a ***long-term imperceptible impact*** (Criteria: EPA, 2017)

12.5.2.8.1 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. & 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. & 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 12-50 over.

Table 12-50: Indirect Construction Impacts on Avifauna

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
Golden Plover (Very High)	Possible disturbance during winter months to feeding or roosting locations from daytime construction. Feeding is mainly nocturnal and ample displacement area is available for daylight hours. A total of 54 individuals were recorded on site in summer 2019, while 239 individuals were recorded in the study area in winter 2018/19. 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 some temporary to short-term disturbance to winter birds. Sensitivity: **Very High**; magnitude **Low** due to availability of displacement habitats. Overall impact **Medium**. (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance and/or habitat loss will be a ***Short-term Moderate Impact*** (Criteria: EPA, 2017).
Black-Headed Gull (High)	Possible indirect impact to commuting/foraging birds within the area, particularly within improved agricultural grasslands. A total of 8 individuals was recorded (in summer only).	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).
Curlew (High)	A total of 48 individuals were recorded on site over the course of surveys (in both summer and winter). No breeding was recorded on site. Studies show that high levels of activity and disturbance during construction are likely to cause birds to vacate territories close to turbine locations. Resultant consequences on breeding success may cause birds to seek other territories in subsequent years post-construction (Pearce-Higgins *et al.,* 2012), resulting in effective habitat loss.	Probability of temporary to short-term impacts. Sensitivity: **High**; magnitude **Low**. Overall impact is **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).
Herring Gull (High)	A total of 8 individuals were recorded over the course of summer 2018 and winter 2018/19. Possible indirect impact to commuting/foraging birds within the area, particularly within improved agricultural grasslands. Recorded on site in moderate numbers.	Probability of temporary to short-term impacts. Sensitivity: **High**; magnitude **Low**. Overall impact is **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).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
Kingfisher (Very High)	Possible indirect impact to commuting/foraging birds within the area, particularly within improved agricultural grasslands.	Probability of some temporary to short-term impacts. Sensitivity: **Very High**; magnitude **Negligible** due to availability of displacement habitats and sub-optimal condition. Overall impact **Low**. (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance and/or habitat loss will be a ***Short-term Imperceptible Impact*** (Criteria: EPA, 2017).
Lapwing (High)	A total of 404 individuals were recorded during winter 2018/19 (observations concentrated around Garryinch Bog to the north of the proposed site. Not recorded breeding on site. Literature suggests changes in densities during construction and differences in densities from pre- to post-construction are not significant (Pearce-Higgins *et al.*, 2012). Studies on disturbance to nesting lapwing found that increased disturbance did not reduce lapwing clutch survival (Fletcher *et al.*, 2005).	Probability of temporary to short-term impacts. Sensitivity: **High**; magnitude **Low** due to non-breeding population and ample displacement habitat available nearby. Overall impact is **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).
Meadow Pipit (High)	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: **High**; magnitude **Low**. Overall impact is **Low.** (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance and/or habitat loss will be a ***Short-term Imperceptible Impact*** (Criteria: EPA, 2017).
Merlin (Very High)	Possible noise/visual intrusion disturbance to foraging birds within the site. No breeding or roosting recorded on site.	Probability of temporary to short-term impacts. Sensitivity: **Very High**; magnitude **Low**. Overall impact is **Medium.** (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance and/or habitat loss will be a ***Short-term Moderate Impact*** (Criteria: EPA, 2017).
Peregrine (Very High)	Possible noise/visual intrusion disturbance to foraging birds within the site. No breeding or roosting recorded on site. Disturbance unlikely, as the species adapts to disturbance-	Probability of temporary to short-term impacts. Sensitivity: **Very High**; magnitude **Negligible**. Overall impact is **Low.** (Criteria: Percival, 2003).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
	prone urban habitats easily and also recorded in low densities.	It is considered ***Near Certain*** that disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Woodcock (High)	Possible indirect impact to breeding territories within the site and wider area. Two breeding territories recorded in 2019.	Probability of temporary to short-term impacts. Sensitivity: **High**; magnitude **Low**. Overall impact is **Low.** (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance and/or habitat loss will be a ***Short-term moderate Impact*** (Criteria: EPA, 2017).
Barn Swallow (Medium)	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). It is considered ***Near Certain*** that disturbance and/or habitat loss will be a ***Short-term imperceptible Impact*** (Criteria: EPA, 2017).
Greenfinch (Medium)	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 hedgerows.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **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)	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). It is considered ***Near Certain*** that disturbance and/or habitat loss will be a ***Short-term Imperceptible Impact*** (Criteria: EPA, 2017).
House Sparrow (Medium)	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 hedgerows.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low.** (Criteria: Percival, 2003). It is considered ***Near Certain*** that 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
Jack Snipe (Medium)	Possible disturbance to birds in winter months, however only one observation of this species was recorded in winter. Not recorded breeding on site. May experience similar declines in density during construction as Snipe (Pearce-Higgins *et al*., 2012), so impact magnitude listed as high as a precaution.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low** due to only single observation. Overall impact is **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).
Kestrel (Medium)	Disturbance to this species is unlikely as they typically occur in high densities in open countryside and farming landscapes. Recorded breeding on site with two and five territories in 2018 and 2019, respectively.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude magnitude assessed as **high** should a nest site be located closed to works. Overall impact is **Medium.** (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance and/or habitat loss will be a ***Short-term Moderate Impact*** (Criteria: EPA, 2017).
Lesser Black-Backed Gull (Medium)	Possible indirect impact to commuting/foraging birds within the area, particularly within improved agricultural grasslands.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Medium**; Overall impact is **Low.** (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance and/or habitat loss will be a ***Short-term Imperceptible Impact*** (Criteria: EPA, 2017).
Linnet (Medium)	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 hedgerows.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **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).
Mistle Thrush (Medium)	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 hedgerows.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **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).
Robin (Medium)	Studies on the impact of wind farms during both construction (Pearce-Higgins *et al*., 2012) and	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**.

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
	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 hedgerows.	Overall impact is **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).
Snipe (Medium)	Possible disturbance to breeding birds during construction. Literature suggests significant declines in densities during construction (Pearce-Higgin *et al.,* 2012), which may lead to the previously published density declines post-construction (Pearce-Higgins *et al.,* 2009).	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **High**. Overall impact is **Medium.** (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance and/or habitat loss will be a ***Short-term Moderate Impact*** (Criteria: EPA, 2017).
Sparrowhawk (Medium)	Disturbance to this species is unlikely as they typically occur in high densities in open countryside and farming landscapes. Not recorded breeding on site or in the surrounding area.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Medium**. Overall impact is **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).
Starling (Medium)	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 hedgerows.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low.** (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance and/or habitat loss will be a ***Short-term Imperceptible Impact*** (Criteria: EPA, 2017).
Stonechat (Medium)	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 hedgerows.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **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).
Buzzard (Low)	Disturbance to this species is unlikely as they typically occur in high densities in open countryside and farming landscapes. Two and four breeding territories identified in 2018 and 2019, respectively.	Probability of temporary to short-term impacts. Sensitivity: **Low**; magnitude assessed as **High** should a nest site be located close to works. Overall impact is **Low.** (Criteria: Percival, 2003).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
		It is considered ***Near Certain*** that disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Grey Heron (Low)	Disturbance to this species is unlikely as abundant displacement habitats available and occurs on site in low densities. Not recorded breeding on site or in the surrounding area.	Probability of temporary to short-term impacts. Sensitivity: **Low**; magnitude assessed as **Low** should a nest site be located close to works. Overall impact is **Very Low.** (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance and/or habitat loss will be a ***Short-term Imperceptible Impact*** (Criteria: EPA, 2017).

12.5.2.9 Aquatic species and habitats

12.5.2.9.1 Potential Direct Impacts

Engineering works in the vicinity of streams and at stream crossings can impact directly on physical habitat, for example the spawning or nursery areas of fish. Permanent loss of aquatic habitats can also occur where access roads are constructed over or in close proximity to streams/rivers. These activities can result in increased silt runoff (discussed below). Obstruction to upstream movement of fish, particularly salmon and trout, due to construction of culverts can also potentially occur. However, as the sole stream crossing where works are proposed (ECX1 along the access track between T2 and T3) is of no value in terms of fisheries or aquatic ecology, the potential for a direct impact is greatly reduced. The replacement of the existing pipe culvert at EXC1 with a bottomless box culvert is a non-invasive solution which will have a ***neutral*** or ***positive impact***.

'Improved' drainage of the site can potentially result in increased erosion of nearby streams and may result in lower water levels in dry weather, which will reduce the habitat available to fish and other aquatic life including macroinvertebrates and amphibians. Any operations which result in loss of sediment will also result in increased nutrients being released from the soil. This has the potential to cause eutrophication of streams thereby lowering the capacity of the streams to support fish and invertebrate fauna. The construction of the wind farm is not expected to significantly affect the drainage regime on the site, with direct impacts affecting watercourses and aquatic ecology minimised via the protection of water quality within the site. No new stream crossings are proposed; new drainage ditch crossings will be constructed using precast pipe culverts resulting in minimal disturbance.

An un-named tributary of the Forest Upper stream and a section of the White Hill (W) stream are within the proposed felling buffers surrounding T3 and T8, while the Cottoners Brook runs alongside the existing access track leading to T6 and also alongside a section of the proposed grid connection where it exits the wind farm site.

The use of directional drilling will eliminate the need to for in-stream works or works to bridge structures along the proposed grid connection route, and greatly reduce the potential for direct impacts to aquatic receptors.

Considering the low ecological value of the streams draining the site and proposed stream crossing methodologies, there is no potential for significant direct impacts to fisheries or aquatic ecosystems to occur due to wind farm construction. Potential for impacts on white-clawed crayfish, Atlantic Salmon and River/Brook Lamprey, while greatly reduced by the use of directional drilling as the proposed stream crossing methodology for cable route construction could still occur. The potential impact on these species is assessed as being ***short-term slight Negative*** in the absence of mitigation. However, with the implementation of proposed mitigation measures it is considered that this impact would be reduced to ***short-term Imperceptible Negative***.

12.5.2.9.2 Potential Indirect Impacts

The most likely potential impact during the construction phase of wind energy developments on receiving watercourses and aquatic habitats arises indirectly via impacts affecting water quality, such as accidental releases of silt laden runoff. Suspended solids can be carried to downstream areas and in even quite small quantities may have a serious effect on the spawning sites of salmonids (O'Connor & Andrew, 1998; Turnpenny & Williams, 1980; Shackle *et al.*, 1999). Suspended solids or sediment in a river is also a major concern and can have serious negative impacts on aquatic invertebrates and instream flora through reducing light penetration and habitat variety and altering the aquatic trophic system. Other potential impacts affecting aquatic ecology during the construction phase could also occur as a result of accidental spillage of cement or hydrocarbons stored on site impacting upon water quality. Waste from on-site toilets and wash facilities could also potentially impact on aquatic ecology.

The proposed wind farm development poses a potential risk to watercourses in terms of alteration of drainage regimes, silt run-off and pollution events originating from site works which gives rise to the potential for impacts affecting fish and fisheries, as well as aquatic invertebrate communities within the study area.

Any engineering works which cause runoff of sediments can also increase the levels of nutrients in receiving streams. This can result in the enrichment or eutrophication of the affected streams and catchment areas further downstream, and a possible change in macroinvertebrate compositions and overall water quality status.

Aquatic species listed on Annex II of the EU Habitats Directive (1992) within the study area catchment include white-clawed crayfish (historical records), Atlantic Salmon and River/Brook Lamprey (confirmed present). Potential impacts affecting these species could occur as a result of water quality impacts arising through accidental pollution events including the increased erosion which may give rise to elevated suspended solids and siltation effects. The potential impact on these species in the catchment is assessed as being ***short-term Moderate Negative*** in the absence of mitigation. However, with the implementation of proposed mitigation measures it is considered that this impact would be reduced to ***short-term Imperceptible Negative*** (CIEEM, 2016).

There is a risk that machinery or materials imported onto the site could act as a vector for introducing or dispersing non-native invasive species in the absence of adequate controls.

12.5.2.9.3 Invasive Aquatic Species (Jenkin's Spire Snail)

Due to the use of directional drilling as the proposed stream crossing methodology at Kilnahown Bridge (aquatic survey site 1), no direct interaction with any aquatic receptor including Jenkin's Spire Snail will occur, while the other area this species was recorded (aquatic survey site 5) is not traversed by the proposed grid connection. As such there is no potential for works as proposed to result in the spread of this medium-impact invasive species.

12.5.2.10 Other Taxa present on site

Additional species such as common frog, smooth newt and invertebrates 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. An artificial pond will be lost as part of the proposed development.

There may be some potential loss of suitable habitat for common frogs and smooth newt in the form of drains and the aforementioned pond, however these are sub-optimal as breeding habitats and as such the impact is considered to be a ***Short-term Imperceptible Impact.*** 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 Impact.***

12.5.3 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 impacts on habitats; hence they are not discussed further.

12.5.3.1 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.

12.5.3.2 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 12.3.3.1 an NIS has been undertaken to identify any potential impacts to European sites (SACs and SPAs) as a result of the proposed development. In this section on designated sites, impacts to sites that are outside SPAs and SACs have been identified for appraisal.

One NHA and four pNHAs are present within 10 km of the proposed wind farm, while a further three pNHAs are present within 10 km of the proposed grid connection route. None of these are downstream of the proposed site and cable route. As further excavation works shall not be required during the operational phase of the proposed wind farm, only occasional maintenance works will be required (these shall be minimal without the need for large scale construction) and the use of hydrocarbons shall be minimal and the resultant risk to water quality shall be significantly less. No further impacts are envisaged to Clonreher Bog NHA (002357), Ridge of Portlaoise pNHA (000876), Slieve Bloom Mountains pNHA (004160), Emo Court pNHA (000865), Great Heath of Portlaoise pNHA (000881), Derries Wood pNHA (000416) or Grand Canal pNHA (002104) during the operational phase of the proposed wind farm; therefore, no impacts to these sites are envisaged during the operational phase.

While Raheen Lough pNHA (Site code: 000917) is not hydrologically linked to the proposed development, it is recognised as a wintering site for several wetland species including Whooper Swan, Greenshank, Goldeneye, Pochard, Mallard, Shoveler, Pintail and Jack Snipe. Other species recorded include Grey Heron, Kingfisher and Grebe species. The only species found at Raheen Lough also recorded (or likely to occur) at the proposed Dernacart site are Jack Snipe and Grey Heron . There were no observations of Kingfisher during ornithological surveys however there is the potential for the species to occupy habitats hydrologically connected to the site. The potential impact to these three species of avian fauna during the operational phase of the proposed development is discussed in section 12.5.3.5. The potential operational impacts for the other avian species is discussed here. The core winter foraging range (from night roosts) is < 5 km for Whooper Swan (SNH, 2016). As Raheen Lough is c. 6.3 km from the proposed Dernacart site, and no Whooper Swans were observed within or near the proposed site during flight activity surveys, this makes it unlikely that Whooper Swans from Raheen Lough would be exposed to any operational impacts such as collision with turbines at the proposed wind farm or any barrier effects. For dabbling ducks, such as Mallard and Pintail, a study in France found that the core foraging range was 1 km and 1.5 km for these species, respectively (Legagneux *et al.*, 2009), so the proposed Dernacart Wind Farm is at sufficient remove that operational effects to these species is unlikely.

Similar logic applies for waders such as Greenshank (core range 2 km; SNH, 2016) and Purple Sandpiper (core range for majority of birds between 0 – 5 km; Atkinson *et al.,* 1978). Grebe species are known for flying at low altitudes; for example, a study by Garthe and Hueppop (2004) showed that Great-Crested Grebes typically flew at heights of 5 – 10 m over the sea (no data exists for non-marine flights), which is below the turbine rotor envelope of 15 – 185 m for the proposed Dernacart Wind Farm. This effectively eliminates the risk of any operational impacts of the proposed wind farm on any grebe species at Raheen Lough.

As such, **no operational phase impacts** to Raheen Lough pNHA are predicted.

12.5.3.3 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 windfarm 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 Impact.***

12.5.3.4 Bats

Wind Farm Study Area

Collision risk is a potential issue in relation to bats, with certain species being at greater risk due to their foraging habits and flight characteristics.

Scottish Natural Heritage (SNH) has produced guidance on the impacts of windfarms to bats (SNH, 2019). In this guidance, the risk of collision to different species is classified placing different groups into low, medium or high-risk categories, based on factors such as flight patterns and foraging strategies. This guidance supersedes the previous guidance document (Natural England, 2014) and re-categorises common and soprano pipistrelle as high-risk rather than medium-risk, based on evidence from the National Bats & Wind Turbines study and Eurobats data (SNH, 2019)

This risk evaluation is summarised over in Table 12-51, which includes information on species that occur in Ireland only while UK species not occurring here are omitted. The species/genera recorded in the study area are highlighted in bold.

The Joint Nature Conservation Committee identifies *Myotis* spp. which exhibit swarming behaviour as having a high risk of collision (JNCC, 2001), however this is contradicted by subsequent guidance (Natural England, 2014; SNH, 2019). The more recent assessments are considered to be more accurate, while also noting that *Myotis* species are likely to exhibit swarming behaviour near hibernation sites and as such any increased risk in this regard for the genus *Myotis* would be dependent on the co-occurrence of a proposed turbine location and a roost/hibernation site, which is not the case at Dernacart. Furthermore, the presence of a swarming site if present within the study area would have been detected during activity survey transects.

Table 12-51: Evaluation of the likely level of risk to bat species occurring in UK, from collision with wind turbines (information on species that occur in Ireland extracted). Source: SNH (2019)

Risk of turbine impact			
Factor	**Low Risk**	**Medium Risk**	**High Risk**
Habitat preference	Bats preferring cluttered habitat	Bats able to exploit background cluttered space	Bats preferring to use open habitat
Echolocation characteristics	Short range High frequency Low intensity Detection distance ~15m	Intermediate – more plastic in their echolocation	Long range Low frequency High intensity Detection distance ~80m
Wing shape	Low wing loading Low aspect ratio Broadest wings	Intermediate	High wing loading High aspect ratio Narrow wings
Flight speed	Slow	Intermediate	Fast
Flight behaviour and use of landscape	Manoeuvre well Will travel in cluttered habitat Keeps close to vegetation Gaps may be avoided	Some flexibility	Less able to manoeuvre May avoid cluttered habitat Can get away from unsuitable habitat quickly Commute across open landscape
Hunting techniques	Hunt close to vegetation Exploit richer food sources in cluttered habitat Gleaners	Hunt in edge and gap habitat Aerial hawkers	Less able to exploit insect abundance in cluttered habitat Aerial hawkers Feed in open
Migration	Local or regional movements	Regional migrant in some parts of range	Long-range migrant in some parts of range
Conclusion	***Myotis* species** **Brown long eared-bat** Lesser horseshoe bat	[No Irish Species]	**Leisler's bat** Nathusius' pipistrelle **Common pipistrelle** **Soprano pipistrelle**

Given a relative population size for each species and the likely risk posed by turbines, it may be possible to determine the level of threat posed to populations of bats. Most effort should be expended on populations likely to be at high risk of collisions and that may be most threatened. Table 12-52 over lists the likely level of risk, considering the population size in the UK i.e. the resultant risk to the overall population of a more common species would be less than a rarer species. Therefore, due to the population size of the common and soprano pipistrelles the level of risk would be low. Species present in Ireland have been extracted from the Natural England's list. It should be noted that Leisler's bat are more common in Ireland due to the lack of competition from the Noctule bat which is absent from Ireland.

This population-scale threat assessment was not updated in the SNH guidance (2019). Despite the increased collision risk assessment for common and soprano pipistrelle, the 2014 population scale assessment (Natural England, 2014) is still considered to apply.

Table 12-52: Evaluation of the likely level of risk to the populations of bat species occurring in UK, from collision with wind turbines (information on species that occur in Ireland extracted). Source: Natural England (2014)

Low Risk	Medium Risk	High Risk
Myotis species	-	Leisler's bat
Long-eared bats	-	Nathusius' pipistrelle
Horseshoe bats	-	
Common pipistrelle	-	
Soprano pipistrelle	-	

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 four 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 T1, T3, T4, T5 and T6, while felling of hedgerows and sections of forestry/woodland not immediately adjacent to turbine locations is required at T2, T7 and T8. High Pipistrelle activity was recorded at T2, T3, T4, T5, T7 and T8, making T3, T4, and T5 the most likely 'bat/turbine conflict zones'.

The foreseen potential impacts during operation are as follows:

12.5.3.4.1 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.

12.5.3.4.2 Potential Indirect Impacts

- No indirect impacts envisaged due to the implementation of mitigation measures and absence of roosts or potential roosts within the proposed development footprint.

Common pipistrelle were the species most frequently recorded during surveys, followed by soprano pipistrelle and Leisler's bat. *Myotis* species and brown long-eared bat were also recorded. Given the lack of potential roosting habitat within the wind farm footprint, the resultant risk of significant impacts arising from turbine collision to bats is not considered to be high. Considering the potential for common and soprano pipistrelle to use new edge habitats opened up by turbine felling buffers, and the increased risk to Leisler's bat at the population scale, the impact to these species is considered to be ***long-term moderate*** prior to mitigation***.***

The impact to *Myotis* species and brown long-eared bat is considered to be ***long-term slight*** prior to mitigation***.***

Kilnahown Bridge

Roosting Daubenton's bats could potentially be subject to disturbance from noise and vibration caused by directional drilling under Kilnahown Bridge, which was confirmed to host roosting Daubenton's bats during 2019 bat surveys.

Since the bridge does not have the potential to host a maternity roost, and no works to Kilnahown bridge itself are proposed and potential disturbance will be limited to noise and vibration, the potential impact to Daubenton's bat arising from directional drilling is considered to be potential for a ***temporary-significant impact*** prior to mitigation.

12.5.3.5 Birds

12.5.3.5.1 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 & 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 15-185m (see Chapter 4 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 windfarm 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. 2019).

Collision Risk Model Analysis

The Collision Risk Model Report (See Appendix 12.7) presents the results of collision risk modelling for the proposed Dernacart wind farm, Co. Laois. This modelling used data from vantage point surveys carried out in the winter of 2018/19 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). 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 waterbird species were recorded in the vantage point surveys: Black-Headed Gull, Curlew, Golden Plover, Grey Heron, Herring Gull, Jack Snipe, Kestrel, Lapwing, Lesser Black-Backed Gull, Merlin, Peregrine, Sparrowhawk, Snipe and Woodcock.

The same 14 species were selected for collision risk modelling. These species have been selected because they were recorded within the 500 m buffers, 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 (79/409/EEC).

Passerines

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 significance of the risk of collision is considered ***near certain*** that the proposed impact of collision risk will be a ***long-term imperceptible impact***.

Non-Passerines

Potential collision risk to non-passerine target species is outlined in Table 12-53 over.

Table 12-53: Potential collision risk to non-passerine target species

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Golden Plover (Very High)	**Collision Risk:** 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 in regard to collision with turbines. In further support of a high micro-avoidance rate, a study in the Netherlands of three operational wind farms where golden plover were both diurnally and nocturnally active found no fatalities (Krijgsveld *et al.*, 2009). Golden plover were not recorded breeding within the 500 m turbine envelope during the survey period which reduces magnitude. The estimated number of potential collisions was 0.230 / year (or 1 collision every 4 years). This indicates a low collision risk to Golden Plover as a result of the proposed development. 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. The population-level consequences of predicted collision risk can be assessed by considering the additional mortality that would be caused (assuming that the collision risk is non-additive) relative to background mortality rates in the population, with a threshold level of a 1% increase in annual mortality used to determine whether the impact will be significant (Percival 2003). No data were available for the local population (no SPAs are designated for Golden Plover within 15 km and the species is not recorded at I-WeBS sites in the surrounding area), but the predicted CRM equates to a 0.001% increase in mortality to the national population, indicating a non-significant impact. When assessing the potential impact to golden plover a similar fully operational 15 turbine wind farm was considered for comparison with the proposed Dernacart Wind Farm. This wind farm located in Co. Tipperary and operational since 2014, shares many similar habitat types with the proposed development site. Large flocks of golden plover have been recorded during post-construction ornithological surveys at the Wind Farm. Flocks of up to 300 have been recorded flying between turbines within the wind farm site during survey in 2015 and 2016 and flocks of up to twenty were noted on an occasion roosting on the ground within the wind farm between turbines (FTC Pers. Comm, 2019). Fatality searches have been completed monthly around all turbines within the wind farm site, January to December annually.	**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 (15-185 m), published best scientific knowledge and moderate frequency of occurrence at the site. Overall significance considered **near certain** that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
	Despite the large numbers of golden plover noted within the wind farm during surveys only one golden plover fatality has been recorded over the 2 years and eight months of fatality surveys at the site. The only fatality was recorded during the first fatality search on the 4th of December 2014. The species have continued to use the site and no further fatalities have been recorded. While fatality searches provide only a sample of potential fatalities it does provide an indication of the avoidance of the species from turbines and their continued use of the site provides evidence of habituation.	
Black-Headed Gull (High)	**Collision Risk:** A published review of the number of avian fatalities attributable to collision with wind turbines across 46 European wind farms (Hoetker *et al.,* 2006), showed there have been 87 fatalities up to 2004. However, the published level of avoidance is 98% (SNH 2010), suggesting this species exhibits a high level of micro-avoidance at wind farms. The estimated number of potential collisions was 0.003 / year (or 1 collision every 305 years). This indicates a very low collision risk to Black-Headed Gull as a result of the proposed development.	**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 (15-185 m), published best scientific knowledge and low frequency of occurrence at the site. Overall significance considered **near certain** that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Curlew (High)	**Collision Risk:** Studies on the operational effects of wind farms have found curlews can exhibit avoidance 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 and Steinborn, 2011). This suggests impacts may vary from site to site, dependant on factors such as habitat. A total of 48 individuals were recorded on site over the course of surveys (in both summer and winter). No evidence of breeding Curlew was recorded. The estimated number of potential collisions was 0.017 / year (or 1 collision every 58 years). This indicates a very low collision risk to Curlew as a result of the proposed development.	**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 (15-185 m), published best scientific knowledge and low frequency of occurrence at the site. Overall significance considered **near certain** that the proposed impact of collision risk will be a **long-term imperceptible**

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
		impact (Criteria: EPA, 2017)**.**
Herring Gull (High)	**Collision Risk:** 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. The moderate to low numbers of Herring Gull flights at the proposed wind farm results in a low collision risk. The estimated number of potential collisions was 0.002 / year (or 1 collision every 647 years). This indicates a very low collision risk to Herring Gull as a result of the proposed development.	**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 (15-185 m), published best scientific knowledge and moderate frequency of occurrence at the site. Overall significance considered **near certain** that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Kingfisher (Very High)	**Collision Risk:** No Kingfisher fatalities have been recorded within the European Context in a review of 46 wind farms up to 2004 (Hoetker *et al*., 2006). No Kingfishers were recorded on site or in the surrounding area, so the effective collision risk 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 (15-185 m) and published best scientific knowledge. Overall significance considered **near certain** that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Lapwing (High)	**Collision Risk:** A total of 404 individuals were recorded within the study area during winter 2018/19, but none were recorded breeding on site. Records of Lapwing centred around Garryinch Bog rather than the wind farm site. In a published review of the number of fatalities owing to collision with wind turbines, only two Lapwing deaths were recorded across 46 European wind farms (Hoetker *et al.,* 2006). The published level of avoidance	**Collision:** Magnitude effects is assessed as **Negligible** (<1% population lost), species sensitivity is **High**, overall effect significance is

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
	is 98% (SNH 2010), suggesting high levels of micro-avoidance. The estimated number of potential collisions was 0.285 / year (or 1 collision every 4 years). This indicates a low collision risk to Lapwing as a result of the proposed development. The population-level consequences of predicted collision risk can be assessed by considering the additional mortality that would be caused (assuming that the collision risk is non-additive) relative to background mortality rates in the population, with a threshold level of a 1% increase in annual mortality used to determine whether the impact will be significant (Percival 2003). There was a 0.46% and 0.007% increase in mortality to the local and national populations, respectively, indicating a non-significant impact.	**Very Low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (15-185 m) and published best scientific knowledge. Overall significance considered **near certain** that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Merlin (Very High)	**Collision Risk:** Merlin mainly take prey from a perch, on the ground or low in flight (Gensbol 2008). 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). The estimated number of potential collisions was 0.005 / year (or 1 collision every 220 years). This indicates a very low collision risk to Merlin as a result of the proposed development.	**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 (15-185 m), published best scientific knowledge and moderate-low frequency of occurrence at the site. Overall significance considered **near certain** that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Peregrine (Very High)	**Collision Risk:** 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. Low levels of flight activity recorded within the 500 m turbine envelope results in a low collision risk estimate. The estimated number of potential collisions was 0.001 / year (or 1 collision every 771 years). This indicates a very low collision risk to Peregrine as a result of the proposed development.	**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 (15-185 m), published best

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
		scientific knowledge and low frequency of occurrence at the site. Overall significance considered **near certain** that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Woodcock (High)	**Collision Risk:** Only a single fatality was recorded as of 2004 in a published review of 46 wind farms in the European Context (Hoetker *et al.,* 2006), suggesting collisions with wind turbines is not a significant source of mortality to Woodcock populations. Two breeding territories were identified on site in 2019. The estimated number of potential collisions was 0.005 / year (or 1 collision every 196 years). This indicates a very low collision risk to Woodcock as a result of the proposed development.	**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 (15-185 m), published best scientific knowledge and moderate-low frequency of occurrence at the site. Overall significance considered **near certain** that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Jack Snipe (Medium)	**Collision Risk:** There are no recorded fatalities with turbines from a published review of 46 European wind farms (Hoetker *et al*., 2006). The very low density of birds (only one observation throughout the entire survey period) and lack of recorded breeding on site suggests a low collision risk probability. The estimated number of potential collisions was 0.0003 / year (or 1 collision every 3,659 years). This indicates a very low collision risk to Jack Snipe as a result of the proposed development.	**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 (15-185 m), published best scientific knowledge and low frequency of occurrence at the site. Overall significance considered **near certain** that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Kestrel (Medium)	**Collision Risk:** Two and five potential Kestrel breeding territories were recorded within the study area in 2018 and 2019, respectively. 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). The estimated number of potential collisions was 0.403 / year (or 1 collision every 2 years). This indicates a low collision risk to Kestrel as a result of the proposed development. The population-level consequences of predicted collision risk can be assessed by considering the additional mortality that would be caused (assuming that the collision risk is non-additive) relative to background mortality rates in the population, with a threshold level of a 1% increase in annual mortality used to determine whether the impact will be significant (Percival 2003). No data were available for the local population, but there was a 0.007% increase in mortality to the national population, indicating a non-significant impact.	**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 (15-185 m), published best scientific knowledge and moderate frequency of occurrence at the site. Overall significance considered **near certain** that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Lesser Black-Backed Gull (Medium)	**Collision Risk:** 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. The estimated number of potential collisions was 0.015 / year (or 1 collision every 68 years). This indicates a very low collision risk to Lesser Black-Backed Gull as a result of the proposed development.	**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 (15-185 m), published best scientific knowledge and low frequency of occurrence at the site. Overall significance considered **near certain** that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Snipe (Medium)	**Collision Risk:** Snipe are a resident species of the wind farm site, with three and five breeding territories recorded in 2018 and 2019, respectively. A review of 46 wind farms within the European Context (Hoetker *et al.,* 2006), found only a single instance of a Snipe fatality as a result of collision with a wind turbine. The estimated number of potential collisions was 0.009 / year (or 1 collision every 112 years).	**Collision:** Magnitude effects is assessed as **Negligible** (<1% population lost), species sensitivity is **Medium**, overall effect significance is **Very Low** (Criteria: Percival, 2003).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
	This indicates a very low collision risk to Snipe as a result of the proposed development.	Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope (15-185 m), published best scientific knowledge and moderate frequency of occurrence at the site. Overall significance considered **near certain** that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Sparrowhawk (Medium)	**Collision Risk:** 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). The estimated number of potential collisions was 0.025 / year (or 1 collision every 40 years). This indicates a very low collision risk to Sparrowhawk as a result of the proposed development.	**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 (15-185 m), published best scientific knowledge and moderate frequency of occurrence at the site. Overall significance considered **near certain** that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Buzzard (Low)	**Collision Risk:** 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. No flight lines were recorded and so collision risk analysis could not be conducted for this species. Two and four breeding territories were recorded within the site in 2018 and 2019, respectively.	**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 (15-185 m), published best scientific knowledge and low frequency of occurrence at the site. Overall significance considered **near certain**

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
		that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017)**.**
Grey Heron (Low)	**Collision Risk:** Three Grey Heron fatalities have been recorded within a review of 46 European wind farms (Hoetker *et al*., 2006). This is a very low number and is unlikely to represent a significant source of population decline for this green-listed species. The estimated number of potential collisions was 0.022 / year (or 1 collision every 45 years). This indicates a very low collision risk to Grey Heron as a result of the proposed development.	**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 (15-185 m), published best scientific knowledge and low frequency of occurrence at the site. Overall significance considered **near certain** that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).

The potential increases in annual mortality rates due to predicted collision mortality rates at the proposed Dernacart wind farm for Golden Plover, Lapwing and Kestrel are outlined below in Table 12-54.

Table 12-54: Calculations of potential increases in annual mortality rates due to the predicted collision mortality rates for Golden Plover, Lapwing and Kestrel

Parameter	Description	Source / Calculation	National Population			Local Population		
			Golden Plover	Lapwing	Kestrel	Golden Plover	Lapwing	Kestrel
pop	Population size	**National** (all-Ireland): wintering estimates of Golden Plover and Lapwing = Burke *et al.* (2018); year-round estimates of Kestrel = Crowe *et al.* (2014). **Local**: Lapwing = sum of mean counts from the following three I-WeBS sites between 2006-2016 (River Barrow: Mountmellick (Clonterry) in Co. Laois; Raheen Lough in Co. Offaly; and River Barrow (Monasterevin – Portarlington) in Co. Kildare).	92,060	84,690	19,970	N/A	212	N/A
surv	Annual survival rate	Adult survival rates from www.bto.org/understanding-birds/birdfacts accessed 03/10/2019	0.73	0.705	0.69	0.73	0.705	0.69
mort(back)	Annual background mortality	pop*(1-surv)	24,856.2	24,986.55	6190.7	N/A	62.54	N/A
mort(coll)	Predicted annual collision mortality	Predicted collision rates from collision risk model	0.23	0.29	0.41	0.23	0.29	0.41
Δmort	Percentage increase in annual mortality rate due to collisions	(mort(coll)/mort(back))*100	+0.0009%	+0.001%	+0.007 %	N/A	+0.46%	N/A

12.5.3.5.2 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.

12.5.3.5.3 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 12-55 below.

Table 12-55: Disturbance and Barrier effect on target species

Key Receptor (Sensitivity)	Operational Indirect 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. Numbers recorded on site are low in relation to National Threshold. 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).	**Disturbance:** Magnitude of effects is assessed as **Negligible;** species sensitivity is **Very High.** Overall impact is **Low** (Criteria: Percival 2003). Probability of disturbance ***Unlikely***; magnitude ***not significant***; overall significance considered ***Long-term, Not***

Key Receptor (Sensitivity)	Operational Indirect Impact Character	Significance without mitigation
	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.	***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). Probability of some barrier effect ***Unlikely***; 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).
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 windfarms 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). Probability of disturbance ***Unlikely***; 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 lost), species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival, 2003). Probability of some barrier effect ***Unlikely***; 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 Indirect Impact Character	Significance without mitigation
Curlew (High)	**Disturbance:** Low number of observations 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 low numbers of curlew were 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). Probability of disturbance ***Unlikely***; 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). Probability of some barrier effect ***Extremely Unlikely***; 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).
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 windfarms 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 **High**, overall effect significance is **Low** (Criteria: Percival 2003). Probability of disturbance ***Unlikely***; magnitude ***Not Significant*** due to published habituation to wind farms; overall significance considered ***Long-term Not Significant Impact*** (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Indirect Impact Character	Significance without mitigation
		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). Probability of some barrier effect ***Unlikely***; 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).
Kingfisher (Very High)	**Disturbance:** No operational disturbance due to buffer distances from rivers and fact that species was not recorded on site or in the surrounding area. **Barrier Effect:** No barrier effect due to buffer distances from rivers/streams and fact that species was not recorded on site or in the surrounding area.	**Disturbance**: Magnitude of effects is assessed as **Negligible,** species sensitivity is **Very High**, overall effect significance is **Low** (Criteria: Percival 2003). Probability of disturbance ***Unlikely,*** magnitude ***Not Significant,*** overall significance considered a ***Long-term Not Significant 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). Probability of some barrier effect ***Unlikely***; 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 Indirect Impact Character	Significance without mitigation
Lapwing (High)	**Disturbance:** Although birds may be displaced by up to 100 m by the presence of turbines (Pearce-Higgins *et al*., 2009; Reichenbach, 2011); overall distribution and aggregations within wind farms are more influenced by habitat parameters such as the availability of preferred breeding habitat (Reichenbach 2011). Additional literature suggests changes to densities from pre to post construction are not significant (Pearce-Higgins *et al*., 2012). As Lapwing are not breeding at the site, any displacement of up to 100 m will not be significant. **Barrier Effect:** Barrier effects have been recorded in a number of studies for Lapwing, although not at significant levels (Hoetker *et al*., 2006).	**Disturbance:** Magnitude of effects is assessed as **Negligible;** species sensitivity is **High**. Overall impact is **Very Low** (Criteria: Percival 2003). Probability of disturbance ***Unlikely***; magnitude ***Imperceptible***; overall significance considered an ***Imperceptible, Long-term 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). Probability of some barrier effect ***Unlikely***; 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).
Merlin (Very High)	**Disturbance:** Possible disturbance to wintering birds due to operational maintenance etc. No breeding/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 moderate in 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). Probability of disturbance ***Unlikely***; magnitude ***Moderate***; overall significance considered a ***Moderate, 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

Key Receptor (Sensitivity)	Operational Indirect Impact Character	Significance without mitigation
		impact is **Medium** (Criteria: Percival 2003). Probability of some barrier effect ***Low***; 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-Moderate, Long-term Impact*** (Criteria: EPA, 2017)
Peregrine (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). Probability of disturbance ***Unlikely***; 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). Probability of some barrier effect ***Unlikely***; 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)
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). Probability of disturbance ***Extremely Unlikely***; magnitude ***Not Significant;***

Key Receptor (Sensitivity)	Operational Indirect Impact Character	Significance without mitigation
		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). Probability of some barrier effect ***Extremely Unlikely***; 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).
Jack Snipe (Medium)	**Disturbance:** Possible disturbance during winter months from feeding or roosting locations; feeding is mainly in grassland and upland areas where invertebrates are present. Numbers recorded on site are low. 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), so as a precautionary approach, the same is assumed for Jack Snipe. **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 Jack 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)**.** It is considered ***near certain*** that the proposed impact of disturbance will be a ***Long-term Slight Impact*** (Criteria: EPA 2002)**.** **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). Probability of some barrier effect ***Unlikely*;** 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;

Key Receptor (Sensitivity)	Operational Indirect Impact Character	Significance without mitigation
		overall significance considered an ***Imperceptible Long-term Impact*** (Criteria: EPA 2017).
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). Probability of disturbance ***Unlikely***; 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). Probability of some barrier effect ***Unlikely*;** 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).
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 windfarms 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). Probability of disturbance ***Unlikely***; magnitude ***Not Significant*** due to published habituation to wind farms; overall significance considered ***Long-term Not Significant Impact*** (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Indirect Impact Character	Significance without mitigation
		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). Probability of some barrier effect ***Unlikely***; 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).
Snipe (Medium)	**Disturbance:** Possible disturbance during winter months from feeding or roosting locations; feeding is mainly in grassland and upland areas where invertebrates are present. Numbers recorded on site are low in relation to National Threshold. 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)**.** It is considered ***near certain*** that 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). Probability of some barrier effect ***Unlikely*;** 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 Indirect 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). **Barrier Effect:** Sparrowhawks are 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). Probability of disturbance ***Extremely Unlikely***; 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). Probability of some barrier effect ***Extremely Unlikely***; 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).
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). Probability of disturbance ***Unlikely***; 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

Key Receptor (Sensitivity)	Operational Indirect Impact Character	Significance without mitigation
		sensitivity is **Low**, overall effect significance is **Very Low** (Criteria: Percival 2003). Probability of some barrier effect ***Unlikely***; 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).
Grey Heron (Low)	**Disturbance:** In a review of the published impacts of wind farms on Grey Heron populations (Hoetker *et al*., 2006), it was found that overall, impacts on Grey Heron populations post-construction, across both winter and breeding seasons was not significant and that Grey Herons exhibit very low avoidance of wind farms, implying minimal disturbance impacts. **Barrier Effect:** Barrier effects on either migration or regular flights of Grey Heron have been shown for four out of seven studies 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 **Negligible**, species sensitivity is **Low**, overall effect significance is **Very Low** (Criteria: Percival 2003). Probability of disturbance ***Unlikely***; magnitude ***Imperceptible*** due to published habituation to wind farms; overall significance considered an ***Imperceptible Long-term Impact*** (Criteria: EPA 2017). **Barrier Effect:** Magnitude of effects is assessed as **Low** (1-5% of habitat/population lost), species sensitivity is **Low**, overall effect significance is **Very Low** (Criteria: Percival 2003). Probability of some barrier effect ***Unlikely***; 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).

12.5.3.6 Aquatic species and habitats

Operational wind farms are not normally considered to have the potential to significantly impact on the aquatic environment. The main risk to watercourses is when oils and lubricants are used on the site. If such substances leaked from the turbines or maintenance areas or were disposed of inappropriately, there is a risk of 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 result in a significant impact considering the low numbers of vehicles involved and the high quality standards that are implemented on a well-managed site. The potential impact on aquatic species in the catchment is assessed as being ***short-term Moderate Negative*** in the absence of mitigation. However, with the implementation of proposed mitigation measures it is considered that this impact would be reduced to ***short-term Imperceptible Negative*** (CIEEM, 2016).

There are no anticipated impacts on aquatic ecology due to the grid connection cable.

12.5.3.7 Other Taxa

No operational impacts are predicted on other taxa during the operational phase.

12.5.4 Potential Effects during the Decommissioning of the Project

Decommissioning activities of the Dernacart 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:

- European sites
- Designated Nature Conservation Sites
- Habitats and Flora
- Avifauna

- Mammals (excluding Bats)
- Bats
- Aquatic Ecology and Fisheries

12.5.4.1 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.

12.5.4.2 Natural Heritage Areas or Proposed Natural Heritage Areas

No direct impacts are predicted on NHAs or pNHA sites during decommissioning. A small number of trees along access roads may require trimming to facilitate turbine removal but they are not located within any NHA or pNHA.

No indirect impacts are envisaged to the designated sites during the decommissioning of the proposed development due to the lack of hydrological links with the proposed wind farm and cable route.

12.5.4.3 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 is would result in a ***short-term imperceptible impact***.

12.5.4.4 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.

Passerines

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 considered ***near certain*** this would result in a ***temporary imperceptible impact***.

Birds of Prey

Surveys conducted as part of the proposed development indicate that Kestrel and Buzzard are breeding within the study area. Tree trimming will not be carried out during the bird breeding season. Merlin, Peregrine and Sparrowhawk 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 passerine species due to increased human activity and noise. The resultant impact to birds of prey is considered ***near certain*** this would result in a ***temporary imperceptible impact***.

Waders, waterfowl, swans and geese

A number of waders and waterfowl species were noted as being present within the development study area. The increase in human activity and noise may result in a minimal temporary disturbance to 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, it is ***near certain*** the resultant impact to waders and waterfowl would be a ***temporary imperceptible impact***.

Kingfisher

It is possible that Kingfishers may use the north of the site, although they were not detected during field surveys. If present, the increase in human activity and noise may result in a minimal temporary disturbance to this species. 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, it is ***near certain*** the resultant impact to Kingfishers would be a ***temporary imperceptible impact***.

Potential Indirect Impacts

Table 12-56 over discusses the Indirect Impact assessment matrix for key avifauna receptors during Decommissioning.

Table 12-56: Potential indirect Decommissioning impacts on target species

Key Receptor (Sensitivity)	Decommissioning Indirect Impact Character	Significance without mitigation
Golden Plover (Very High)	Possible disturbance during winter months from feeding or roosting locations during daytime hours during decommissioning; feeding is mainly nocturnal and ample displacement habitat is available for during daylight hours. Literature suggests differences in densities pre and post construction of wind farms not significant (Pearce-Higgins *et al.,* 2012).	Probability of some temporary to short-term disturbance to winter birds. Sensitivity: **Very High**; magnitude **Low** due to availability of displacement habitats. Overall impact **Medium**. (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance will be a ***Short-term Moderate Impact*** (Criteria: EPA, 2017).
Black-Headed Gull (High)	Possible disturbance impact on areas of foraging habitat, such as grassland. Habitat is extensive surrounding the site.	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 will be a ***Short-term Imperceptible Impact*** (Criteria: EPA, 2017).
Curlew (High)	No disturbance to birds during decommissioning.	Probability appraised as **low**; magnitude assessed as **negligible** should disturbance occur; overall impact is assessed as **very low**. (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Herring Gull (High)	Possible disturbance impact on areas of foraging habitat, such as grassland. Habitat is extensive surrounding the site.	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 will be a ***Short-term Imperceptible Impact*** (Criteria: EPA, 2017).
Kingfisher (High)	If birds present, slight disturbance to birds during decommissioning is envisaged due to possible siltation of waterbodies surrounding the site.	Probability of some temporary to short-term impacts. Sensitivity: **Very High**; magnitude **Negligible** due to availability of displacement habitats and sub-optimal

Key Receptor (Sensitivity)	Decommissioning Indirect Impact Character	Significance without mitigation
		condition. Overall impact **Low**. (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance will be a ***Short-term Imperceptible*** Impact (Criteria: EPA, 2017).
Lapwing (High)	Possible disturbance to breeding birds during relevant breeding season. Studies on disturbance to nesting lapwing found that increased nest visits (i.e. disturbance) did not reduce Lapwing clutch survival (Fletcher *et al*., 2005). The level of disturbance associated with decommissioning will not be significant.	Probability of temporary to short-term impacts. Sensitivity: **High**; magnitude **Low** due to non-breeding population and ample displacement habitat available nearby. Overall impact is **Low.** (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Merlin (High)	Possible noise/visual intrusion disturbance to foraging breeding birds if present at Dernacart. Unlikely to be significant due to habitation over lifetime of wind farm.	Probability of temporary to short-term impacts. Sensitivity: **Very High**; magnitude **Low**. Overall impact is **Medium.** (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Peregrine (High)	Possible disturbance to foraging birds through noise, visual intrusion. No displacement from foraging areas or breeding sites. Disturbance unlikely as the species adapts to urban environments easily and is unlikely to be disturbed by machinery/personnel.	Probability of temporary to short-term impacts. Sensitivity: **Very High**; magnitude **Negligible**. Overall impact is **Low.** (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Woodcock (High)	Disturbance during decommissioning due to presence of machinery/personnel. Though strongly associated with deciduous woodland in most studies, areas of pre-thicket forestry with dense ground vegetation may also support breeding birds. Species was recorded breeding in the site in low numbers.	Probability of temporary to short-term impacts. Sensitivity: **High**; magnitude **Low**. Overall impact is **Low.** (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance will be a ***Short-term Slight Impact*** as no further felling shall be required (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Decommissioning Indirect Impact Character	Significance without mitigation
Jack Snipe (Medium)	Possible disturbance impact on areas of foraging habitat, such as grassland. Habitat is extensive surrounding the site.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low.** (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Kestrel (Medium)	Possible impacts include disturbance to breeding or foraging birds. Disturbance not likely are Kestrels are birds of open countryside and exhibit habituation to vehicle disturbance such as along motorways.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low.** (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Lesser Black-Backed Gull (Medium)	Possible disturbance impact on areas of foraging habitat, such as grassland. Habitat is extensive surrounding the site.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low.** (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Snipe (Medium)	Possible disturbance impact on areas of foraging habitat, such as grassland. Habitat is extensive surrounding the site. Recorded breeding in low numbers.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low.** (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Sparrowhawk (Medium)	Possible disturbance impact on territory within and encompassing the site. Decommissioning phase is likely to be short lived.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low.** (Criteria: Percival, 2003).

Key Receptor (Sensitivity)	Decommissioning Indirect Impact Character	Significance without mitigation
		It is considered ***Near Certain*** that disturbance will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Buzzard (Low)	Possible during decommissioning impact would disturbance to nest sites through noise/visual intrusion. Disturbance unlikely	Probability of temporary to short-term impacts. Sensitivity: **Low**; magnitude **Low**. Overall impact is **Very Low.** (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance will be a ***Short-term Imperceptible Impact*** (Criteria: EPA, 2017).
Grey Heron (Low)	Unlikely disturbance to birds through decommissioning.	Probability of temporary to short-term impacts. Sensitivity: **Low**; magnitude **Low**. Overall impact is **Very Low.** (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance will be a ***Short-term Imperceptible Impact*** (Criteria: EPA, 2017).

12.5.4.5 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.

Otter

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.

12.5.4.6 Bats

The possible direct effects on bats during the decommissioning phase of the wind development 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.

12.5.4.7 Aquatic Ecology and Fisheries

The decommissioning phase of the proposed wind farm site gives rise to similar potential impacts which can be realised during the construction phase; although the magnitude of the impact of decommissioning is normally reduced as all infrastructure is already in place on the site. With suitable planning and provision of adequate mitigation of potential impacts on the receiving aquatic environment during decommissioning can be minimised. It is assessed that the potential for impacts during decommissioning would be ***short-term slight Negative***. However, with the implementation of proposed mitigation measures for water quality, it is considered that this impact would be reduced to ***short-term Imperceptible Negative*** (CIEEM, 2019).

12.5.5 Potential Cumulative Impacts on Ecology

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 peatland, conifer plantation and agricultural land. The main damaging operations and threats to the greater regions ecological resources are afforestation, industrialised agriculture, overgrazing and peat cutting. Afforestation i.e. the planting of conifer crops, agriculture (primarily) and industrial peat extraction have all impacted the habitats within the study area.

Large portions of the site are dominated by conifer plantation, along 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 cutover raised bog, as well as birch dominated bog woodland, wet grassland, in areas where planting has failed, and along the margins (e.g. firebreaks) of conifer stands. Forestry creates habitat uniformity, negatively impacts lake and river catchments, and alters nesting and feeding habitats for animals. The above operations along with agriculture are the most extensive, but other threats and potentially damaging operations to valuable habitats include land drainage and reclamation, fertilisation, peat extraction 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.

12.5.5.1 Developments

Existing or Proposed Wind farms and Turbines

A number of operational or planned wind farms exist within 20 km of the subject site, these are detailed in Table 12-57 below as follows and discussed below:

Table 12-57: Wind Farms within the greater area of Dernacart Wind Farm

Wind Farm Name	Number of Turbines	Status	Distance from Subject Site
Moanvane WF	12	Permitted	7 km NE
Mountlucas WF	28	Operational	14 km NE
Cloncreen WF	21	Permitted	18 km NE

Mountlucas WF is in waterbody catchments of the Phillipstown River and the Wouge River, both tributaries of the Figile River. An additional access road serving the north The Figile and Cushina Rivers meet at Pollaghnagraigue and continue as the Black River to meet the River Barrow c. 27 km downstream of Mountlucas WF. Dernacart WF is in waterbody catchments of the Barrow. The hydrological distance from Dernacart WF to the Black River confluence is c. 20 km, making the total distance between the wind farms by Hydrological links 47 km. Due to the large in-stream distances between the sites and confluence of the 2 river networks, significant cumulative impacts are not likely to occur.

Moanvane WF is in waterbody catchments of the Cushina. The Cushina River and Figile River meet at Pollaghnagraigue and continue as the Black River to meet the to meet the River Barrow c. 15 km downstream of Moanvane WF. Dernacart WF is in waterbody catchments of the Barrow. The hydrological distance from Dernacart WF to the Black River confluence is c. 20 km. making the total distance between the wind farms by Hydrological links 35 km. Due to the large in-stream distances between the sites and confluence of the 2 river networks, significant cumulative impacts are not likely to occur.

A proposal for the grid connection cable route connecting the permitted Moanvane wind farm to the existing substation at Mountlucas wind farm to the north is currently in SID Pre-Application Consultation and is being assessed by An Bord Pleanála. Similarly, to the permitted Moanvane wind farm, the large in-stream distances between the sites mean significant cumulative impacts are not likely to occur.

Cloncreen WF is in waterbody catchments of the Phillipstown River and the Figile River. The Cushina River and Figile River meet at Pollaghnagraigue and continue as the Black River to meet the to meet the River Barrow c. 21 km downstream of Cloncreen WF. Dernacart WF is in waterbody catchments of the Barrow. The hydrological distance from Dernacart WF to the Black River confluence is c. 20 km. making the total distance between the wind farms by Hydrological links 41 km. Due to the large in-stream distances between the sites and confluence of the 2 river networks, significant cumulative impacts are not likely to occur.

A 75m tip height 500kW wind turbine is permitted at Laois Sawmills on the eastern edge of Portlaoise, c. 12.9 km south-east of the proposed wind farm.

Proposed Solar Farms

There are no solar farm applications in close proximity to the proposed wind farm. The three closest permitted solar farms are located at Sronagh (3.8 km) and Acragar (5.2 km) near Mountmellick Co. Laois, and Kilmallogue, Portarlington Co. Offaly (8km). Due to the lack of emissions generally from solar farms, cumulative impacts are not likely to occur.

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 Dernacart Wind Farm and are within the same catchment as this increases the likelihood of impacts acting cumulatively. While some of the projects above are hydrologically linked i.e. within the Barrow catchment, many of these are deemed to be insignificant due to the large distance between them.

Other development

Planning searches limited to 5 years prior to 11th December 2019 using the Laois (http://www.eplanning.ie/LaoisCC/searchtypes) and Offaly (https://www.offaly.ie/eplan5/SearchTypes) County Council online planning enquiry portals were undertaken to search for large-scale developments within 20km of the proposed wind farm. The Laois Co. Council planning portal was also searched for small-scale developments (domestic and agricultural) within the townlands overlapping the proposed development site (updated 11th December 2019).

A number of permitted commercial/industrial developments within 20km of the proposed wind farm site were also noted during planning searches. These are summarised in Table 12-58 below. Full details are provided in Appendix 6.1 (Population and Human Health).

In addition to these, a number of large-scale housing developments are permitted in towns in the surrounding area.

These consist of a 70-unit development in Mountmellick (5.5km south-east), 6 no. developments in Portlaoise (largest is 141 units), 4 no. developments in Portarlington (largest is 71 units), 2 no. developments in Mountrath (largest is 49 units), 4 no. developments in Tullamore (largest is 99 units) and 1 no. development in Geashill (23 units). These are detailed in Appendix 6.1 (Population and Human Health).

In addition, a number of small-scale industrial, commercial and healthcare developments are permitted in Portlaoise, Portarlington and Tullamore. These are also detailed in Appendix 6.1 (Population and Human Health).

Table 12-58: Other permitted developments within 20km

Applicant	Year	Decision	Address	Type	Description	Distance
Bord na Móna Powergen Limited	2016	Conditional	Garryhinch Bog, Clonyhurk, Co. Offaly	Permission	The erection of a guyed wind monitoring mast to access the suitability of the company's adjacent lands for wind farm development.	2.5 km East
Bord na Móna PLC,	2015	Conditional	Kyletalesha & Kyleclonhobert , Portlaoise , Co. Laois	Permission	Increase waste acceptance at the existing waste transfer and processing facility from the current permitted 40,000 tonnes per annum to 65,000 tonnes per annum; and the installation of an integrated constructed wetland (ICW) comprising 2 no. wetland cells of c. 70m2 each.	6.9 km South
Glanpower Ltd.	2016	Conditional	Derryclure, Tullamore, Co. Offaly	Extension of Duration Application	Integrated pollution prevention or control licence/waste licence. Industrial facility to accommodate an advanced pyrolysis system for the recovery of energy from biomass and waste. The approximate output will be 6 megawatts of renewable electricity for export to the national grid in line with Irelands' climate change strategy and 5 megawatts of heat.	10.5 km North West
Ammar Watfa	2015	Conditional	Clonminam Industrial Estate , Clonminam , Portlaoise Co. Laois.	Permission	End of life vehicle and waste metal processing facility along with the internal and external storage of such materials on site.	11.5 KM South
Greenfield Global LFS Ireland Limited	2019	Conditional	IDA Business Park , Mountrath Road , Portlaoise	Permission	Construct a blending and packaging facility, an electrical sub-station building, utilities area including sprinkler tank, tank farm and utility equipment, site infrastructure including car parking, 2 No. vehicular entrances, circulation roads, boundary fencing, and all associated site works.	11.6 km South
Glanbia Cheese EU Limited	2018	Conditional	Togher National Enterprise Park , Togher , Portlaoise Co. Laois	Permission	Develop a Cheese Manufacturing Facility within the Togher National Enterprise Park. The development will comprise of a main building which will facilitate a cheese blending process, an office block for admin. and technical support staff and external buildings to service the proposed facility.	12.9 km South
Pat McDonagh	2018	Conditional	Togher, Portlaoise, Co. Laois	Permission	Motorway service area and rest area adjacent to Junction 17 of the M7 at Togher, Portlaoise, Co. Laois.	13.6 km South
Advanced Environmental Solutions (Ireland) Limited	2017	Conditional	Material Recovery Facility, Bogtown, Cappancur, Tullamore, Co. Offaly	Permission	Development at our existing materials recovery facility at Bogtown, Cappancur, Tullamore, County Offaly. the development will consist of an increase in the amount of waste accepted annually from 60,000 tonnes to 80,000 tonnes. the proposed increase does not require the construction/provision of any new	14.4 km North West

Applicant	Year	Decision	Address	Type	Description	Distance
					buildings/structures or any alteration to the current site layout and operations.	
Bord Na Móna Powergen Ltd	2019	FI Requested	Cúil Na Móna Bog, within the townland of Clonboyne and Clonkeen, Portlaoise, Co. Laois	-	Renewable Gas Facility, associated peat deposition area and external and internal road upgrades at Cúil Na Móna Bog within the townland of Clonboyne and Clonkeen, Portlaoise, Co. Laois.	15 km South
Grid System Services Ltd	2018	Conditional	Derrynagall or Ballydaly, Tullamore, Co. Offaly	Permission	A grid system services facility within a total site area of 0.84 hectares, to include 1 no. single storey electrical substation building, 1 no. customer switchgear container, 17 no. 2mw electrical inverter/transformer station modules (skids), 10 no. containerised battery storage modules on concrete support structures, 40 no. heating, ventilation and air conditioning units (hvac units), access tracks and upgraded site entrance, associated electrical cabling and ducting, security gates and perimeter security fencing, cctv security monitoring system, landscaping works and all associated ancillary infrastructure.	16.7 km North West
Condron Concrete Ltd.	2015	Conditional	Ardan, Arden Road, Tullamore, Co. Offaly	Permission	A new high-density polyethylene (hdpe) reprocessing and pellet manufacturing facility. the building will consist of a single storey structure c. 1,400m2 and c. 9m high for the manufacture of hdpe pellets by reprocessing end-of-life recyclable hdpe materials (plastic cartons, containers, etc.).	17.5 km North West
Bord na Móna Powergen Limited	2018	Conditional	Esker More, Co. Offaly	Retention Permission	Continued use of an existing guyed wind monitoring mast, with instruments, 100m in height on its lands at esker more, Co. Offaly for a further period of three years. the purpose of the mast is to assess the suitability of the company's adjacent lands for wind farm development. previous planning application reference number: pl13/161.	19.6 km North East
Irish Water	2019	FI Requested	Ballyroan, Co. Laois	Permission	Upgrade the existing wastewater treatment plant to a capacity of 900 PE incorporating: selector tank, twin aeration tanks, three final settlement tanks, flow splitting chambers, sludge return and wastage pumps, air blowers, sludge storage tank, interconnecting pipework and ducting, welfare facilities and internal access road extensions. A Natura Impact Statement (NIS) has been prepared in respect of the proposed development and will be submitted to the planning authority with the planning application.	20 km South

While a number of these projects could potentially act cumulatively with the proposed wind farm development, they are subject to environmental controls during both construction and operation, making it unlikely they will have negative environmental impacts in their own right.

In addition, there are no projects which could potentially result in cumulative environmental impacts in close proximity to the proposed wind farm. As such the projects listed above are not considered to be likely to result in cumulative environmental impacts.

Potential operational-phase impacts arising from collision risk with wind turbines and met masts are considered in detail separately within the avifauna evaluation.

12.5.5.2 Forestry

Forestry is one of the main land uses within the proposed site and the greater area. Conifer plantation is one of the dominant habitats within the proposed site boundary. One of the impacts of this on the local environment is 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 both raised and, and most likely other peatland habitats such as wet heath and fen. 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.

There is potential for the proposed wind farm to contribute to a cumulative impact on water quality in local watercourses, within and downstream of the site, through the potential for sediments and other pollutants entering the watercourses, as a result of felling, in order to accommodate turbine buffer zones, new access tracks and construction activities in addition to ongoing forestry operations. Where wind farm construction and agricultural, forestry and peat extraction activities occur at the same time there is the potential for significant in-combination or cumulative impacts on local watercourses. 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 Barrow could occur. These could be ***short-term moderate*** prior to mitigation.

Replant Lands

As the replant lands are situated in a different area (Macroom, Co. Cork) located 169 km south west of the proposed development, no cumulative impacts in this regard are predicted.

12.5.5.3 Farming

Pastoral agriculture is also extensive within the study area, with grazing cattle and intensive grassland management noted within the proposed site boundary. 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 Barrow could occur. These could be ***short-term moderate*** prior to mitigation.

12.5.5.4 Peat extraction

Peat extraction has been occurring in the region for many decades. The expected ecological impacts from this activity would be loss of and alteration of peatland habitats. The drainage and cutting associated with peat extraction has in the past, resulted in loss of intact raised bog, which is likely to have dominated the area before human activities altered the habitat. The resultant activity has led to habitat alteration of raised bog to degraded cutover bog. However, because of the subsequent drying out of the peat through drainage, and the alteration of the peatland habitat through cutting, this has resulted in the formation of entirely different habitats such as wet grassland and birch dominated bog woodland.

Only a small proportion of the land within the site boundary is used for peat extraction, however an area of Garryhinch Bog abutting the proposed site to the north and east is still being harvested.

The main potential impacts of the proposed wind farm are habitat loss, habitat alteration and disturbance to wildlife. However, as the site farm layout is primarily within conifer plantation and agricultural grassland it is considered ***extremely unlikely*** that a negative cumulative impact to habitats will be ***significant*** on any timescale.

The primary area in which potential cumulative impacts could occur in combination with peat harvesting is in reduction of water quality in the watercourses running through and draining the proposed wind farm site. However, considering the already degraded state of these streams which is likely to be due to peat extraction activities, any limited sediment input caused by wind farm construction activities would have a negligible impact.

12.5.5.5 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
- Avifauna
- Mammals (excluding Bats)
- Aquatic Ecology and Fisheries
- Bats
- Other Taxa

Designated Nature Conservation Sites

As no direct impacts are predicted on Nature Conservation sites during construction 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.

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. The potential spread of the invasive species giant hogweed if unmitigated could lead to the spread of the species resulting in cumulative impacts with other construction projects.

Potential indirect impacts on riverine habitats could act cumulatively with other activities such as peat cutting and agriculture. These are addressed within the scope of Aquatic Ecology and Fisheries below.

Avifauna

Direct impacts on avifauna during construction are primarily land take related, mainly due to loss of nesting habitats of 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.

Key Receptors in the case of the subject site such as Golden Plover and Lapwing have been shown also to become habituated to wind farms (Hoetker *et al.*, 2006; Krijgsveld *et al.*, 2009) therefore the long term in combination impact is assessed as ***near certain*** this would result in a ***short-term imperceptible impact***.

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 breeding sites, red squirrel dreys, etc. However, with the implementation of best practice methods and mitigation measures during construction in regard to mammals such as otter, badger and red squirrel it is considered unlikely that any cumulative impacts will be significant.

Aquatic Ecology and Fisheries

The area of the proposed site is subject to additional pressures on water quality and aquatic ecology, particularly in relation to agricultural activities, peat extraction and commercial forestry activities. Where wind farm construction and agricultural, peat extraction and forestry activities occur at the same time there is the potential for significant in-combination or cumulative impacts on local watercourses.

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. The potential impact on White-clawed Crayfish, Atlantic Salmon and River/Brook Lamprey in the catchment is assessed as being ***short-term moderate negative*** in the absence of mitigation. However, with the implementation of proposed mitigation measures it is considered that this impact would be reduced to ***short-term imperceptible negative***.

Bats

Potential cumulative impacts on bats during construction would be as follows:

- Displacement of populations
- Abandonment of young
- Mortality

Bat surveys conducted as part of the planning application for the operational Mountlucas (14 km northeast) and permitted Cloncreen (18 km northeast) and Moanvane (7 km northeast) Wind Farms recorded low bat activity on these sites.

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 mitigation measures are specified for the permitted wind farms, it is ***near certain*** the proposed wind farm would result in a ***long term imperceptible impact***.

Other Taxa

Other taxa may be similarly affected by land take however given the large amount of displacement and alternative habitats available the overall in combination effect is assessed as ***near certain*** this would result in a ***short-term imperceptible impact***.

12.5.5.6 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

- Avifauna
- Mammals (excluding Bats)
- Aquatic Ecology and Fisheries
- Bats
- Other Taxa

Designated Nature Conservation Sites

As no direct impacts are predicted on Nature Conservation sites during 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.

Indirect impacts predicted during operation periods due to impacts such as increased siltation, nutrient release and/or contaminated run-off through drainage channels and watercourses do have the potential to combine with other sources of impact such as runoff from farming or forestry practices, contamination events etc.

An accompanying Natura Impact Statement (NIS) has been prepared for the proposed development. The NIS addresses potential impacts on European sites resulting from the proposed development.

Habitats and Flora

No direct impacts on habitats and flora are predicted during the operational phase of the development. Indirect impacts predicted during operation due to hydrological changes and impacts such as increased siltation, nutrient release and/or contaminated run-off through drainage channels and watercourses do have the potential to combine with other sources of impact such as runoff from farming or forestry practices, contamination events etc. Mitigation is therefore required to neutralise any potential impact from the proposed wind farm.

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 12-57 details the wind farm development within 20 km of the proposed Dernacart Wind Farm development. Three wind farms are either existing or permitted. 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.

In Combination Collision Risk:

A collision risk model was undertaken for the planning application for the permitted Moanvane Wind Farm to assess the potential collision risk to target species. The potential collision risk was considered a Long-Term Imperceptible Impact to: Whooper Swan (0.005 / year), Hen Harrier (0.001 / year), Merlin (collision risk was zero), Peregrine (0.01 / year), Greenland White-fronted Goose (collision risk was zero), Sparrowhawk (0.1 / year), Mute Swan (collision risk was zero) and Buzzard (collision risk was not calculated). The potential collision risk (0.5 / year) to local populations of Golden Plover was considered a Long-Term Significant Impact, but only a Long-Term Imperceptible Impact to either the county or the all-Ireland Golden Plover population. Based on the low number of collisions expected at Moanvane Wind Farm, the cumulative effects with this wind farm for all species except for Golden Plover are assessed to be of low concern.

Moanvane Wind Farm is located 7 km northeast from the proposed Dernacart Wind Farm. SNH (2016) guidance states that the core foraging range of Golden Plover during the breeding season is 3 km, with a maximum of 11 km, so it is unlikely that any breeding birds would commute between the two Wind Farm sites.

However, most of the recorded flight lines for Golden Plover at Dernacart are from the winter season and Golden Plover were not recorded breeding within the 500 m turbine envelope during the survey period. It is possible that wintering birds may commute between the two sites. The rotor envelope for Moanvane is 29-169 m, so there is considerable overlap between the 15-185 m envelope for Dernacart.

It must be emphasised that collision risk probabilities for Golden Plover typically exceed reported empirical collisions from operational wind farms. For example, Golden Plover have been recorded only in low numbers as collision fatalities at wind farms in the European context (Hoetker *et al*., 2006; Grunkorn, 2011); the published avoidance rate by SNH for collision risk modelling for the species is 98% (SNH, 2010), indicating a high micro avoidance rate in regard to collision with turbines.

A study in the Netherlands of three operational wind arms where Golden Plover were active both diurnally and nocturnally found no fatalities, providing further evidence of a high micro-avoidance rate (Krijgsveld *et al*., 2009).

When assessing the potential impact to Golden Plover a similar fully operational 15 turbine wind farm was considered for comparison with the proposed Dernacart Wind Farm. This wind farm located in Co. Tipperary and operational since 2014, shares many similar habitat types with the proposed development site. Large flocks of golden plover have been recorded during post-construction ornithological surveys at the Wind Farm. Flocks of up to 300 have been recorded flying between turbines within the wind farm site during survey in 2015 and 2016 and flocks of up to twenty were noted on an occasion roosting on the ground within the wind farm between turbines (FTC Pers. Comm, 2017). Fatality searches have been completed monthly around all turbines within the wind farm site, January to December annually. Despite the large numbers of golden plover noted within the wind farm during surveys only one golden plover fatality has been recorded over the 2 years and eight months of fatality surveys at the site. The only fatality was recorded during the first fatality search on the 4th of December 2014. The species have continued to use the site and no further fatalities have been recorded. While fatality searches provide only a sample of potential fatalities it does provide an indication of the avoidance of the species from turbines and their continued use of the site provides evidence of habituation.

There were rare occurrences of birds of high conservation concern recorded at the operational wind farm of Mountlucas during February and June 2006. Notable raptors and waterbirds detected during field surveys included Mallard, Water-Rail, Snipe, Sparrowhawk and Woodcock. Whooper swans were observed off-site in low numbers (maximum flock size of three individuals). Species assemblages were recorded in low densities at the permitted wind farm site. The majority of summer migrants observed comprised of small passerines with low collision risk potential with operating turbines. Based on the low number of records and transits recorded at Mountlucas Wind Farm, cumulative effects with this wind farm development are assessed to be of Long-Term, Not Significant Impacts.

A collision risk model was undertaken for the planning application for Cloncreen Wind Farm to assess the potential collision risk to target species. The potential collision risk was considered a Long-Term Slight Negative Effect to three species: Golden Plover, Lapwing and Kestrel. The result of the analysis showed that predicted collision risk for Golden Plover was 0.71101 / year, Lapwing was 0.09382 / year and Kestrel 0.14194 / year. The potential collision risk was considered a Long-term Imperceptible Negative Effect for Whooper Swan (0.00169 / year), Peregrine 0.00923 / year), Hen Harrier 0 / year), Kestrel 0.14194 / year), Sparrowhawk 0.00546 / year) and Buzzard 0.11957 / year). Based on the low number of collisions expected at Cloncreen Wind Farm, cumulative effects with this wind farm development are assessed to be of low concern.

Considering the distances of these three wind farm sites in relation to the Dernacart study area (7 km, 14 km and 18 km respectively), no cumulative collision risk on any avian receptors including whooper swan, golden plover or lapwing are foreseen. 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 considered ***near certain*** this would result in a ***long term imperceptible impact***.

In Combination Barrier Effect:

The development does have the potential to combine with other wind farms to provide an in-combination barrier effect in an additive manner, although this is unlikely to be synergistic.

Distance is important to note in this regard and the proposed Dernacart wind farm is c.7 km southwest from the permitted Moanvane Wind Farm, c. 14 km southwest from the operational Mountlucas Wind Farm and 10 km southwest from Cloncreen Wind Farm.

The main effect of barriers on birds is resulting energy expenditure (as a result of having to circumvent obstacles) and it has been suggested that multiple wind farms along migration routes may result in energy expenditure rates sufficient to affect breeding success (i.e. through loss of body condition; Masden *et al*., 2009).

Migratory species most likely to be affected by in-combination barrier effects are: Whooper Swans (recorded inside the site at Moanvane and Cloncreen Wind Farms and outside the site at Mountlucas Wind Farm) and Greenland White-Fronted Goose (recorded in the site at Moanvane Wind Farm).

Swans have been shown to exhibit both macro and micro avoidance of turbines; in one study in the Netherlands swans were noted flying through windfarms (Fijn *et al*., 2012), suggesting that in instances where the predicted rotor envelope is above typical flight heights, swans are not deterred from commuting through wind farms. It should be noted, in relation to the energetic capacity of swans for example, that Whooper Swans can make the crossing from Ireland to Iceland, a distance of 800-1200 km, in 1.5 days (Griffin *et al*., 2011). Therefore, the relative increase in energy expenditure and fuel loss through flying over or through an obstacle is important.

No Whooper Swans or Greenland White-Fronted Geese have been recorded either inside the proposed Dernacart or within the surrounding area. Therefore, the possibility of in-combination barrier effects owing to the proposed wind farm are extremely low.

In the case of the permitted Moanvane Wind Farm, four winters of surveys has identified the main roosting site as Raheen Lough, which is located 2.4 km west of the permitted development and c. 6.3 km northeast of the proposed Dernacart Wind Farm. It is probable that Raheen Lough is also the nearest roost site of Whooper Swans for the proposed Dernacart Wind Farm. In the event that Whooper Swans start to migrate across the Dernacart Wind Farm site in the future, the broadly western orientation of the proposed Wind Farm relative to Raheen Lough is favourable to the passage of birds. It has been suggested that orientation of wind farms parallel to main flightpaths is likely to reduce collision risk, especially where there is large scale bird movement in a predominant axis (Drewitt and Langston, 2008). This also applies to other species of migrating wildfowl such as Geese. Furthermore, the core foraging range from night roosts during the winter season is c.5 km for Whooper Swan (SNH, 2016), making it unlikely birds from Raheen Lough would travel to the proposed Dernacart Wind Farm, further reducing the probability of any in-combination barrier effects.

Any in combination collision risk due to the barrier effect of these wind farms is assessed as negligible and is assessed as ***near certain*** this would result at most in a ***long term imperceptible impact***.

In Combination Disturbance/Displacement

Disturbance or effective habitat loss indirectly is more difficult to quantify; especially as most species of birds may habituate to disturbance over time. Key receptors in the case of the proposed development site such as Golden Plover have been shown to become habituated to wind farms (Hoetker *et al*., 2006; Krijgsveld *et al*., 2009); therefore, the long term in combination impact is assessed as negligible and is assessed as ***near certain*** this would result at most in a ***long term imperceptible impact***.

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 impact*** is predicted.

Aquatic Ecology and Fisheries

Operational wind farms are not normally considered to have the potential to significantly impact on the aquatic environment. The main risk to watercourses is when oils and lubricants are used on the site.

If such substances leaked from the turbines or maintenance areas or were disposed of inappropriately, there is a risk of 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 its 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.

Upgrading of the site track/road network could allow increased public access to the site. This could potentially result in illegal dumping of domestic rubbish. Provision of access to off road vehicles (including quad bikes) is also a potential impact. These have the potential to act in combination with additional pressures on Aquatic ecology should they occur during the operational phase of the project.

Bats

Potential Cumulative impacts on Bats during operation would be as follows:

- Mortality
- Reduction of local populations

Bat surveys conducted as part of the planning application for the operational Mountlucas Wind Farm recorded low bat activity on the site, no evidence of roosts, and two bat species occurred common pipistrelle and soprano pipistrelle.

The following bat species were identified during the dedicated bat surveys undertaken at the for the planning application for Cloncreen Wind Farm: Common Pipistrelle, Soprano Pipistrelle, Leisler's bat, Natterer's bat, Daubenton's bat and *Myotis* species. The study area is not utilised by large populations of bats.

Overall the level of bat activity at the Cloncreen Bog site was assessed as being low and no bat roosts were identified within the Cloncreen Bog site.

Soprano and common pipistrelle, and Leisler's bats were recorded regularly during pre-planning surveys for the permitted Moanvane wind farm. A single instance of Natterer's bat was recorded. No roosts were recorded on-site or along the cable route.

The assessment of bat activity levels at these sites is not strictly objective since the Ecobat analysis tool was not used as standard practice when these applications were submitted. However, considering that Mountlucas and Cloncreen are largely un-vegetated, and that felling buffers which maintain a minimum distance of 50m between turbine blade tips and surrounding woodland/forestry plantations are specified as mitigation for bats for Moanvane wind farm, it is unlikely that a significant cumulative impact in terms of collision risk will occur.

Considering this, any cumulative impacts to bats during the operational phase would be ***long-term imperceptible***.

Other Taxa

Other taxa may be similarly affected by land take however given the large amount of displacement habitats available the overall in-combination effect is assessed as a ***long-term imperceptible impact***.

12.5.5.7 Cumulative Impacts during decommissioning on key receptors

The potential cumulative impacts during decommissioning are considered to be the same as those described for the construction phase of the proposed development.

12.6 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 unless otherwise agreed with the planning authority.

12.6.1 Mitigation measures during the construction phase of the project

12.6.1.1 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.

12.6.1.2 Project Ecologist

It is recommended that a Project Ecologist/Ecological Clerk of Works (ECoW) with appropriate experience and expertise 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 a level of authority and will be allowed to stop construction activity if there is potential for significant adverse ecological effects to occur.

12.6.1.3 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 to minimise excavation works.

No disturbance to habitats or flora outside the proposed development area will occur. All works and temporary storage of material will be restricted to the immediate footprint of the development, which will be wholly within the development site boundary. Designated access points will be established within the site and all construction traffic will be restricted to these locations.

12.6.1.4 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 (ISI, 2017).

Prevention

Giant hogweed was recorded at two locations within the site (two linear growths bordering conifer plantation to the south of the west-east access track leading towards T7 and T8). These growths are outside the footprint of the proposed development, c. 350m from the nearest infrastructure and c. 250m from the proposed wind farm site boundary.

As such based on the current extent of giant hogweed within the study area, there is no possibility of interaction with works.

A pre-construction survey will be carried out to confirm giant hogweed has not spread to any areas in or near the wind farm site. If this is the case, no further action is required. Mapping using GPS equipment will be carried out to document its location.

In the event giant hogweed has spread from its current location in the intervening period and threatens to interact with proposed works, further action will be required:

Containment, Treatment, Eradication

- The extent of giant hogweed will be mapped and marked out prior to any works commencing on-site.
- An invasive species management plan will be produced based on the results of the pre-construction survey
- Cordoning off the area – this shall include a buffer of 5m surrounding the area of infection to ensure that seeds are not be transported to other sections of the site.
- 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 an 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.

12.6.1.5 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).

Construction operations within the proposed Dernacart Wind Farm will take place predominantly during the hours of daylight 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) as is practical.

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.

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 than 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.

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.

12.6.1.6 Bats

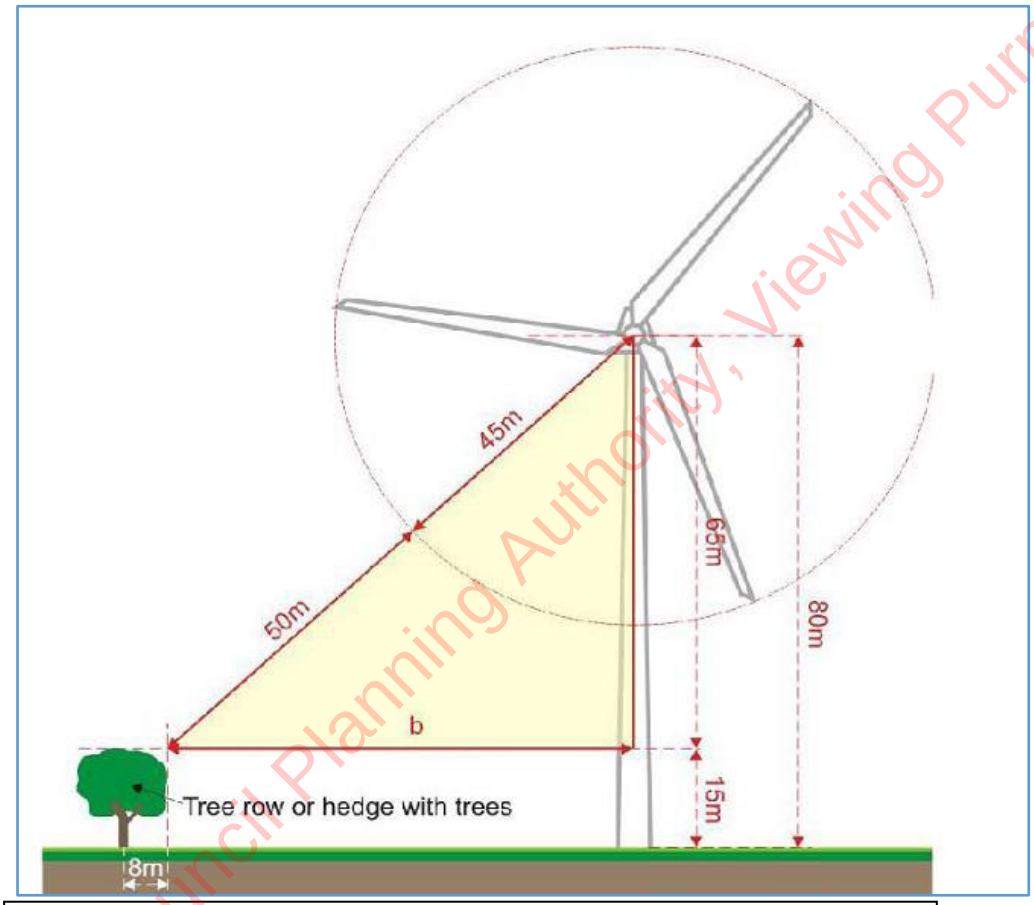
According to SNH (2019) guidance:

> *"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.*

A 50 m buffer distance should be applied as a basic standard mitigation measure for all bat species occurring at proposed wind farms, including all key-holed sites, which may present an increased risk of bat collisions (section 6.2). In practice, the 50m buffer should be applied universally, irrespective of whether curtailment is also considered necessary. Some higher risk species, notably the high-flying ones such as noctules and Leisler's bats frequently fly in open areas however and this form of mitigation is unlikely to be effective for these".

These distances were taken into account during the design phase of the proposed Dernacart 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)

$$b = \sqrt{\{(50 + 85)^2 - (100 - fh)^2\}}$$

*Note: **fh** for each turbine location is given in column 3 of Table 12-59 below*

Note: 85m is the maximum proposed blade length, which may not be used in the final design. As such this assessment using this dimension represents the 'worst case scenario'. Therefore, felling buffers may decrease if changes in turbine dimensions alter the calculation.

Each of the proposed locations of the 8 turbines was surveyed and the bat activity findings recorded informed the application of the 50m blade tip buffer described above at all 8 proposed turbine locations. Surrounding habitats, height of surrounding trees and felling buffer calculated using the above equation are included in Table 12-59 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 recommended for each turbine is presented in Table 12-59 and range from 95m to 99m depending on the heights of vegetation present. Where the boundary of the proposed development does not allow for this buffer distance, it is recommended that monitoring during the construction phase (1 year) using static units at specific turbines is undertaken to determine if the bat activity levels change due to the changes in the site. This should be reviewed prior to operation of turbines where the buffer cannot be achieved to determine if curtailment is required during operation.

Table 12-59: Assessment of potential turbine/bat conflict zones (based on maximum proposed turbine blade length 85m)

Turbine number	Habitats Requiring Felling	Surrounding Tree/Hedgerow Height (fh/m)	Felling Buffer Radius (m)
1	Conifer plantation	6 m	96.9 m
2	Hedgerow	5 m	95.9 m
3	Conifer plantation	5 m	95.9 m
4	Conifer plantation/ Birch woodland	6 m	96.9 m
5	Conifer plantation	8 m	98.7 m
6	Conifer plantation/ Birch woodland	6.5 m	97.4 m
7	Conifer plantation/ Hedgerow	9 m	99.7 m
8	Conifer plantation	9 m	99.7 m

Existing vegetation will be cleared around all 8 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 recommended:

- 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).
- 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).
- No upgrading works to bridge structures will be required as part of the proposed development. Bridges offer potential bat roosting habitat for bats and will be in accordance with best practice guidelines and statutory procedures.

Should any required works be identified in the future, the bridge shall require a preconstruction survey to assess if a bat roost is present and any mitigation measures carried out to mitigate the potential impact to bats must be conducted under the terms of an appropriate NPWS wildlife derogation licence.

- In addition, the following specific mitigation measures for bats are also now recommended:

Removal of deciduous trees

Any mature broadleaved trees that are to be removed, will first be surveyed for bat presence by a suitably experienced specialist. If bats are found, an application for a derogation licence should be made to the *National Parks and Wildlife Service* to allow its legal removal. Such trees should ideally be felled in the period late August to late October, or early November, in order to avoid disturbance of any roosting bats as per *National Roads Authority* guidelines (NRA 2006a and 2006b) and also to avoid the bird breeding seasons. The site is dominated by conifer trees and young birch trees which offer low value roosting habitat for bats.

For any mature ivy-covered trees offering potential roosting habitat the felling of these should be completed by mid-November at the latest as bats roosting in trees are very vulnerable to disturbance during their hibernation period (November – April).

Alternatively, a pre-felling roost survey could be carried out of mature ivy-covered trees prior to felling after this time. Trees with ivy (*Hedera helix*) cover, once felled, should be left intact onsite for 24 hours prior to disposal to allow any bats beneath foliage to escape overnight.

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 or are not directly impacted 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). Mitigation measures are recommended to compensate for the loss of these features that are used by bats as commuting routes. These measures will also compensate for habitat loss and provide continuity in the landscape.

Severed linear features such as hedgerows and treelines will be reconnected where feasible with saplings to compensate for the loss of treelines and hedgerows currently used by bats. Native species of Irish provenance should be used as they support more insect life than non-native varieties.

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, best practice design should aim to retain the quality of the landscape where possible and ensure its protection within the landscaping programme. Existing hedgerows and treelines, semi-natural scrub or semi-natural grasslands will be retained where feasible 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. 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).

Kilnahown Bridge

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 bridge remains 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

It is recommended that 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 should be completed according to best practice guidelines available.

12.6.1.7 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. Where this is not possible under special circumstances, a pre-felling survey shall be undertaken prior to felling, trimming, etc. of vegetation and shall be subject to approval with the local authority.

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. & 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 cable may require night-time operating hours; these will be detailed in the CEMP and 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 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).

Sections of hedgerow scheduled for removal and/or trimming and containing mature trees suitable for nesting barn owls will be surveyed prior to construction for occupancy by owls. Should owls be present then minimum protection zones as outlined in published guidance will be adhered to for the period of construction or until breeding has ceased (Shawyer, C.R., 2011).

Due to published impacts during construction on breeding snipe and woodcock and the assessment of significance, areas known to have had breeding snipe territories will be re-surveyed prior to the commencement of construction in order to reconfirm if the findings of the surveys carried out pre-consent remain accurate. If construction works commence in these areas of the site during the breeding season, an exclusion zone of 500 m will be placed around any recorded nest sites April to June, to reduce the possibility of disturbing birds during critical periods of the breeding season, as per published literature (Pearce-Higgins *et al*., 2012). The implementation of this measure will be monitored by the project ecologist/ECoW.

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 13 'Lands, Soils and Geology and Chapter 14 'Hydrology and Water Quality' of this EIAR, and Aquatic Ecology Mitigation, section 12.6.1.11 below, to minimise and prevent the identified indirect effects to water quality.

Merlin: Prior to scheduled commencement of construction; nest baskets suitable for merlin will be placed in suitable locations (such as isolated trees on high bog or trees within forestry compartments which are in clearings) as these are often preferred nest locations. Locations chosen shall be >500m from proposed turbines; this is to encourage any birds scoping territories to take up nest sites suitably removed from turbines.

A reconfirmatory survey (March) will be conducted of the proposed turbine locations to assess any evidence of merlin activity or taking up new territories. Should any new merlin 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).

12.6.1.8 Mitigation Measures for Tree Felling

A total area of 18.4 ha (17.43 ha of conifer plantation, 0.54 ha of mixed broadleaved woodland, 0.26 ha of bog woodland and 0.13 ha of mixed broadleaved/conifer plantation) or 13.5 % of the wooded habitats within the study area shall be lost due to the felling of trees. The proposed area of tree felling will be limited to:

- Areas adjacent to/surrounding turbines T1, T3, T4, T5, T6 and T8 so that the required infrastructure can be facilitated at these locations;
- Minimal trimming along existing access tracks to ensure that the widened footprint of these access tracks can be accommodated;
- Corridors along the proposed new access tracks to ensure that the footprint of these can be accommodated;
- Area surrounding the proposed on-site substation at Dernacart.

This tree felling will be the subject of a Felling Licence (17.43 ha of conifer plantation, 0.54 ha of mixed broadleaved woodland, 0.26 ha of bog woodland and 0.13 ha of mixed broadleaved/conifer plantation) from the Forest Service and will be in accordance with the conditions of such a licence. The planting of trees in replant lands in considered in the replanting impact assessment (Appendix 4.3).

To ensure a tree felling method that reduces the potential for sediment and nutrient runoff, the construction methodology will follow the specifications set out in the Forest Service Forestry and Water Quality Guidelines (2000) and Forest Harvesting and Environmental Guidelines (2000).

Before any felling commences on site all personnel, particularly machine operators, will be made aware of the following and will have copies of relevant documentation, including:

- The surface water management plan, the construction environmental management plan and any contingency plans;
- Environmental issues relating to this project and the site of the proposed development;
- The outer perimeter of all buffer and exclusion zones; and
- All health & safety issues relating to the site.

The harvester represents the first point of contact between machinery and the ground and therefore the layout of the extraction racks is critical. The layout of extraction racks or routes will be designed to:

- Avoid streams or other watercourses;
- Be as short as possible;
- Avoid any areas of poor crop or bare areas; and
- Generally, extract to access tracks with the extraction racks laid out at right angles to the road to prevent water flowing down wheel ruts.

The felling buffer around T3 overlaps an un-named tributary stream of the Forest Upper stream. In order to minimise impacts to this watercourse during felling, vehicle use within 10m of the stream will be limited to that required to extract felled timber. As such the following constraints will apply:

- Mechanical felling will be limited to areas within the reach of the harvesting machine while its wheels/tracks remain outside the 10m buffer
- Any felling outside this buffer zone (including the south-eastern bank) will be carried out by chainsaw operatives
- When removing felled timber, the collecting tractor will minimise the time spent within the 10m buffer, and limit intrusion on the buffer by using the longest reach possible.
- If trees felled on the opposite bank cannot be collected mechanically without damaging the bank, these should be left in place (to be cut by chainsaw and removed by hand if trees enter the stream).

Brash management will include the immediate removal of loosed material. In addition, dense, fresh brash mats will be utilised in order to minimise soil damage, erosion and sedimentation during felling.

These will be designed and installed to protect the underlying soil from damage and will be maintained throughout the felling operation. Their purpose is to prevent breaking of the ground surface thus preventing silt or nutrient run-off.

Brash mats will be topped up in sections when they become heavily used or worn. Where damage or serious rutting has started to occur extraction will be suspended immediately. Relocation of the extraction rack or additional brashing will be used to remedy the situation.

Extraction routes will be as short as possible and will avoid the crossing of watercourses. Trees will be felled away from aquatic zones. Branches, logs or debris will not be allowed to accumulate in aquatic zones and will be removed immediately to mitigate against nutrient losses, particularly phosphorus. Additional silt fencing will be erected along the banks of any streams at the location of the proposed tree felling to provide additional protection to the watercourses in this area. To ensure a tree clearance method that reduces the potential for sediment and nutrient runoff, the construction methodology will follow the specifications set out in the Forest Service Forestry and Water Quality Guidelines (2000) and Forest Harvesting and Environmental Guidelines (2000).

The brash will be bundled and recovered from the site as felling progresses in a process known as forest residue recovery. Double-wheeled machinery and corduroy rafts (close poling) will be used as necessary to maximise the recovery of brash and where the bearing capacity of the ground is poor. Extraction and cutting will be suspended during and following heavy rainfall periods.

As outlined above, felling will be conducted to accommodate infrastructure and will be limited to the criteria set out in Chapter 4 – Description of the Development. No significant increase in the rate of run-off is anticipated as a result of felling nor is the risk of downstream flooding or sedimentation due to erosion increased.

12.6.1.9 Lights on Turbines

It appears that the lighting on top of wind turbines may effect 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. It is recommended that lighting will be fitted with baffles to ensure that the light is directed skywards and will not be discernible from the ground.

12.6.1.10 Water Quality Measures during the Construction Phase

Mitigation by Design

During the iterative design process for the proposed Dernacart Wind Farm Development, cognisance was taken of the locations of existing watercourses in the vicinity of the site. To reduce the potential impacts on these watercourses a minimum buffer of 50m from watercourses has been adopted for all new site tracks where possible that run parallel to a watercourse, and a minimum buffer of 50m will be provided between temporary stockpiles and the nearest watercourse.

Where existing tracks are present cable routes will be installed in these corridors. Where new site access tracks to turbines are required, the cable will be laid in or on the edge of those tracks.

One existing crossing (EXC1) within the proposed wind farm site will be upgraded to carry a widened access road. This upgrade will be implemented by removal of the existing pipe culvert and replacement with a precast bottomless box culvert (1m depth x 4.5m width).

The proposed grid connection cable will be laid in or at the edge of existing public roads.

Watercourses will be crossed via directional drilling along the grid connection route at the following points:

- Culvert over the Forrest lower stream, tributary of the Cottoner's Brook stream
- Culvert over White(W) Hill stream, tributary of the River Barrow
- Culvert/Arch Bridge over White(W) Hill stream, tributary of the River Barrow
- Bridge over Cottoner's Brook stream, tributary of the River Barrow
- Bridge over Clonygowan stream, tributary of the River Barrow
- Bridge over Unknown stream, tributary of the River Barrow
- Bridge over Rathmore stream, tributary of the River Barrow
- Bridge over River Barrow

There is a potential impact during construction in the absence of mitigation measures of sediment run-off in surface water from the ground surface surrounding the cable trench. This potential impact is avoided by laying the cable in existing roadways for the majority of the route.

The potential for sediment ingress carried by surface runoff resulting from works near watercourse crossings also exists; this will be reduced by the setback of drill entry points for directional drilling, and general water quality protection measures such as silt fencing as outlined below.

The upgrade of EXC1 within the proposed wind farm site will require a section 50 licence to obtain consent of the OPW for the design of the stream crossing at EXC1. The IFI will also be consulted at the detailed design stage. Standard water quality measures as detailed below will be used in addition to any specific mitigation required by IFI.

Proposed Mitigation Measures for the Construction Stage of the project

Under Section 173 of the Fisheries (Consolidation) Act, 1959, it is an offence to '*obstruct the passage of the smolts or fry of salmon, trout, or eels or injure or disturb the spawn or fry of salmon, trout or eels or injure or disturb any spawning bed, bank or shallow where the spawn or fry of salmon, trout or eels may be'*.

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.

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 any substance that is liable to injure fish; 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 the European Community (Surface Water) Regulations, 2009, it is noted under Part III, Section 33 that '*Failure to achieve good ecological status, or where relevant, good ecological potential or to prevent deterioration in the status of a body of surface water resulting from new modifications or alterations to the physical characteristics of a surface water body, or failure to prevent deterioration of a body of surface water from high status to good status resulting from new sustainable human development activities shall not be a breach of these Regulations when all the following conditions are met:*

(1) All practicable steps are taken to mitigate the adverse impact on the status of the body of surface water.

(2) The reasons for those modifications or alterations are specifically set out and explained in the river basin management plan required under Article 13 of the 2003 Regulations and the objectives are reviewed every six years.

(3) The reasons for those modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the objectives established by Article 28 of these Regulations are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development, and

(4) The beneficial objectives served by these modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option'.

It is therefore imperative that no significant impacts (direct, indirect or cumulative) occur on the streams on the site or the downstream catchment areas during the construction, operation of decommissioning phases of the proposed wind farm project.

Proposed drainage measures to reduce and protect the receiving waters from the potential impacts during the construction of the proposed development are as outlined in Section 14.7 Chapter 14 Hydrology and Water Quality. These include measures to prevent runoff erosion from vulnerable areas and consequent sediment release into nearby watercourses to which the proposed development site discharges. The mitigation measures proposed to reduce potential direct and indirect impacts from the construction of the turbine foundations and associated infrastructure and impacts from the turbine delivery route, cable route and grid connection route are outlined below.

This section should be read in conjunction with the aquatic ecology assessment (Appendix 12.6) and Sections 4.3.4 and 4.3.5 of the CEMP (Appendix 4.2).

In advance of any works taking place, a detailed Construction Environmental Management Plan will be devised. An CEMP has been prepared as part of this EIAR (see Appendix 4.2). This CEMP will include Construction Method Statements along with a Surface Water Management Plan for protecting watercourses on the proposed wind farm site and along the proposed grid connection. These will be drawn up by engineers with experience in protection of water quality and agreed with the IFI and NPWS. It is recommended that a geotechnical study also be carried out in advance of the work by personnel of suitable qualification in order to assess the risk of a landslide that could block / and or pollute watercourses in the study area.

The Construction Method Statement will be distributed and discussed with all parties involved in the construction of the wind farm site (including any sub-contractors) in order to protect aquatic conservation interests within the study area. The Surface Water Management Plan will set out measures to avoid siltation, erosion, surface water run-off and accidental pollution events which all have the potential to adversely affect water quality within the site during the construction phase. The Surface Water Management Plan and detailed method statements for watercourse crossings will include preparatory works on the site, including installation of silt fences and bunds. The preparatory work including assessment of existing bridge crossings will be undertaken in advance of any excavations on the site. A sealed silt fence will be placed at both sides of the crossing points and to a minimum of 10m upstream and downstream of each crossing at both sides of the road. All measures provided for the protection of aquatic ecology and fisheries within the proposed development site, in addition to the mitigation measures for water quality protection as detailed in the outline Surface Water Management Plan in the CEMP (see Appendix 4.2), must ensure effective protection of aquatic ecological interests downstream of the proposed development, particularly the habitats of salmon, lamprey and white-clawed crayfish.

The CEMP and method statement for stream crossings follows the guidelines set out in the following documents:

- 'Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes' (NRA, 2008a).
- IFI (2016) Guidelines on Protection of Fisheries during Construction Works in and adjacent to waters.
- 'Maintenance and protection of the inland fisheries resource during road construction and improvement works. Requirements of the Southern Regional Fisheries Board' (Kilfeather, 2007); and
- *'Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites*' (Murphy, 2004).

All access tracks will be designed to minimise excavation on the site and reduce the risk of sediment runoff. Swales for turbine bases and hard standings will be constructed. It is not expected that overland flows will be obstructed to any great extent as a result of the layout of the wind farm, however where required, interceptor channels will collect overland flows on the upslope side of the access tracks and hard standing areas. The interceptor channels will cross the access tracks in cross-drains which will be provided at regular intervals.

- The increase in the rate of runoff along the route of the site access roads and hard-standings areas will be mitigated by the proposed drainage system which includes provision of stilling ponds to reduce concentration of suspended solids in the runoff from these areas. This has been further mitigated by avoidance through design, in the utilisation of existing tracks and existing drainage systems where possible.
- Stilling ponds with a diffuse outflow detail will be put in place in advance as construction progresses across the site. Erosion control and retention facilities, including stilling ponds will be regularly maintained during the construction phase. The three-stage treatment train (swale – stilling pond – diffuse outflow) proposed to retain and treat the discharges from hard surface areas as a result of the development will reduce any risk of flooding downstream.
- Where haul roads pass close to watercourses, silt fencing will be used to protect the streams. Silt traps will also be provided at outfalls from roadside swales to existing drains. Silt traps will be kept upstream of outfalls to allow a buffer zone to the outfall.
- A suitably qualified person will be appointed by the developer to ensure the effective operation and maintenance of drainage and other mitigation measures during the construction process. The operations management of the subject development will include regular monitoring of the drainage system and maintenance as required.
- Standing water, which could arise in excavations, has the potential to contain an increased concentration of suspended solids as a result of the disturbance to soils. Water will be pumped into the site drainage system (including stilling ponds), which will be constructed at site clearance stage, in advance of excavations for the turbine bases.
- Drains around hard-standing area will be shallow to minimise the disturbance of sub soil.
- The developer will ensure that erosion control, namely silt-traps, silt fencing and swales are regularly maintained during the construction phase.
- Interceptor cut-off drains will be provided on the upslope site of the access roads to prevent the mixing of overland flows with the drainage for the proposed development. These interceptor drains will discharge diffusely over land to avoid concentration of runoff. The roadside drains will therefore only carry the site access road runoff and so avoid carrying large volumes of water and concentrating flows.
- Cross drains of 450 mm will be provided to prevent a risk of clogging for drainage crossings and conveying flow from agricultural drains and forestry drains over access track roads.
- Roadside swales will serve to attenuate any increase in surface water runoff.
- Where new cross-drains are proposed on this site to convey surface water from roadside swales to outfalls, these will be sized at a minimum of 225 mm diameter to avoid blockages.
- Silt fencing will be erected at the locations of the drain crossings for the duration of the construction period.
- Site access tracks roads have been laid out to reduce longitudinal slope of roadside drains where possible. Where roadside drains are laid at slopes greater than 2%, check damns will be provided. This will reduce effective slope and runoff velocities and any consequent potential for erosion.

- Where agricultural tracks and forestry roads will be used to access the development, the roadside drains alongside these roads will be cleared of obstructions, should it be found that debris and vegetation are impeding flows.
- Any other diesel, fuel or hydraulic oils stored on site will be stored in bunded storage tanks – the bund area will have a volume of at least 110 % of the volume of such materials stored.
- Refueling of plant during construction will only be carried out at designated refueling station locations on site.
- Prior to leaving the site, every truck delivering concrete to the site must wash the chute only to a lined pit provided at each turbine location.
- Silt fencing will be erected at the location of stream crossings along the cable route.
- Cables will be installed in trenches adjacent to the site access roads, or laid within the access road line, where required. Trenches will be excavated during dry periods where possible in short sections and left open for minimal periods, to avoid acting as a conduit for surface water flows.
- The temporary storage of excavated material on site will be placed at least 50 m from watercourses.
- Wet concrete operations are not required for this site within or adjacent to watercourses. However, if wet concrete operations are required, a suitable risk assessment will be completed prior to works being carried out and strategically located concrete washout areas will be provided.
- Portaloos and/ or containerised toilets and welfare units will be used to provide toilet facilities for site personnel. Sanitary waste will be removed from site via a licenced waste disposal contractor.

The following mitigation measures are proposed for the grid connection construction stage:

- Weather warnings will be monitored, and no construction will take place during extreme events to mitigate against potential flooding.
- Mitigation measures will be provided where surface water flows may be temporarily prevented from reaching gullies during trench excavation. Typical mitigation measures will include the provision of temporary overground surface water channels using sand bagging for example to divert flows to downstream gullies.
- Trenches will be excavated during dry periods where possible in short sections and left open for minimal periods, to avoid acting as a conduit for surface water flows.
- Any excavated material will be used in the reinstatement of the cable trenches subject to approval. Surplus material will be removed from the site to an appropriate facility. There will be no stockpiling of excavated material.
- All excavated soil material will be managed on site in accordance with the CEMP.
- Silt fencing will be provided around any exposed areas to prevent the ingress of suspended solids into adjacent watercourses. These mitigation measures will prevent surface water contamination and will prevent subsequent flows of contaminated water into watercourses.
- Additional protection will be provided in the form of silt fencing downslope where required during construction, to further ensure that there is no impact from the development to streams and rivers downslope of the site.
- Daily visual inspections of drains and streams will be performed during the construction period to ensure suspended solids are not entering the streams and rivers alongside the work area, to identify any obstructions to channels, and to allow for appropriate maintenance of the existing roadside drainage regime. If excessive suspended solids are noted, construction work will be stopped, and remediation measures will be put in place immediately.

As discussed in Section 14.3.6 Chapter 14 Hydrology and Water Quality the grid cable route crosses seven watercourses. The proposed crossing method is horizontal directional drilling (HDD). Proposed mitigation measures are listed below:

- An Environmental Engineer with a "stop work" authority will be engaged to monitor the construction phase of the development when the water crossing is being undertaken.
- The working area around the bridge/culvert crossings will be fenced off prior to the commencement of works to avoid damage to bankside habitat

- Siltation of watercourses will be mitigated using silt traps and by avoiding operating within watercourses where feasible
- Watercourses will be visually inspected
- Should increase levels of siltation be recorded within the watercourses during the course of the construction phase, the environmental auditor will seek to halt construction works until the source of the pressure can be found and remediated
- Surplus material will be removed from the site to an appropriate facility. There will be no stockpiling of excavated material. A setback distance of at least 20 m from watercourses will be adhered to when storing temporary spoil
- Prior to any works taking place near water courses the Inland Fisheries Ireland will be consulted
- Construction works onsite will be timed to occur outside periods where heavy rainfall would be expected
- Silt traps will be regularly maintained during the construction phase. All personnel working onsite will be trained in pollution incident control response.
- Appropriate signage will be place along the proposed route outlining the spillage response procedure and a contingency plan to contain silt. A regular review of weather forecasts of heavy rainfall is required, and the contractor is required to prepare a contingency plan for before and after such events
- HDD operations to be limited when low levels of rainfall are forecast.
- Visual inspection to take place at all times along the bore path of the alignment.
- Silt fences will be constructed around proposed work areas prior to commencement of works.
- No refueling will take place within 50m of the stream zone or any sensitive habitats.
- During the drilling process, a mixture of a natural, inert and fully biodegradable drilling fluid will be used.

An Outline Construction and Environmental Management Plan (CEMP) is included in Appendix 4.2. This contains an Outline Site Drainage Management Plan. The Site Drainage Management Plan shall be finalised in accordance with this outline plan following the appointment of the contractor for the main construction works.

Proposed Mitigation Measures for Replant Lands

The replanting impact assessment can be seen in Appendix 4.3. Mitigation will be provided in accordance with the Forestry and Water Guidelines provided by The Forest Service. Careful mapping of existing site drainage and vulnerabilities (wet ground, preferential flow paths) prior to planting will be carried out and the appropriate drainage design and management will be employed. This includes the provision of collector drains which will disperse drainage water with low velocity through sediment traps. fencing will be erected where deemed to be required by the Environmental Clerk of Works or the Drainage Engineer.

Site preparation for replanting will be carefully managed to prevent loss of silt and sediment conveyed in surface water run-off to receiving waters.

This reduces potential sources of sediment and reduces the risk of sediment and sediment bound nutrient run-off from the site to neutral impact.

Replanting will be undertaken in accordance with the Forestry and Water Quality Guidelines and the Forestry and Archaeological Guidelines.

Proposed Mitigation Measures for the Construction of Watercourse Crossings

The existing pipe culvert (EXC1) will be replaced with a pre-cast bottomless concrete culvert in order to allow a more natural hydromorphology to establish on the Forest Upper stream bed at the crossing point. This will minimise interference with the bed of the channel.

The use of a bottomless culvert will not damage fish habitat or create blockages to fish and macroinvertebrate passage. This section of stream is not considered to be a key ecological receptor; however, this culvert type will be used as a precaution.

Proposed Mitigation Measures during Construction for the Cable Route and temporary alterations for the Turbine Delivery Route

Silt fencing will be erected at the location of stream crossings along the cable route. Silt curtains and floating booms will also be used where deemed to be appropriate, in consultation with IFI and this will be assessed separately at each individual location.

Further mitigation measures in relation to the grid connection cable route are outlined in the CEMP in Appendix 4.2.

As set out in the Turbine Delivery Route Assessment presented in Appendix 10.2, there will be mainly minor works required along the Turbine Delivery Route. Works at Nodes 1-4 require tracks through grassed roundabout islands (GA2) and street furniture removal. Node 5 requires an area of load bearing at the edge of Clonminch Roundabout and street furniture removal. Hedge trimming to reduce the level of the southern hedgerow to 1m above road level is required at Node 6 at Moneyquid along the N80. The turning area near the site entrance (Node 7) requires scrub clearance and placement of load bearing surface on agricultural grassland. Once deliveries are completed the areas/boundaries will be reinstated.

Proposed Mitigation Measures for Maintenance of the Wind Farm

It is not envisaged that the maintenance period will involve any significant impacts on the hydrological regime of the area. Further, the maintenance of the wind farm will incorporate effective maintenance of the drainage system.

The maintenance regime will include inspecting the following:

- drains, cross-drains and culverts for any blockages
- outfalls to existing field drains and watercourses
- existing roadside swales for any obstructions
- swales and stilling ponds
- progress of the re-establishment of vegetation

The maintenance regime will also include implementing appropriate remedial measures as required after the above inspections and testing the water quality at the outfalls at appropriate intervals.

Maintenance will be in accordance with CIRIA C753 (The SuDS Manual). Monitoring will be undertaken as outlined in Section 14.7.3, Chapter 14 Hydrology and Water Quality.

12.6.1.11 Other Fauna

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 ponds/drains are within the development footprint. Protection of existing hydrological conditions where breeding ponds/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.

12.6.2 Mitigation measures during operation

12.6.2.1 Designated Nature conservation sites

Implement mitigation measures outlined in Chapter 14 'Hydrology and Water Quality' of this EIS/EIAR, in addition to the NIS to minimise and prevent the identified indirect impacts on water quality as outlined previously.

12.6.2.2 Habitats and Flora

Implement mitigation measures outlined in Chapter 13 'Land, Soils & Geology' and Chapter 14 'Hydrology and Water Quality' of this EIAR, to ensure that there will be no contamination of water bodies due to siltation or contaminated run-off during the operational phase.

Wheel washes, draining to silt traps will be implemented at the site entrance to prevent the possible spread of any invasive species. The location of the giant hogweed south of the access track to T7 and T8 shall be resurveyed annually (until two consecutive years with no records onsite are achieved) to monitor if any spread occurs.

To prevent the spread of Montbretia *Crocosmia x crocosmiiflora* from the replant lands site, the entire stand will be excavated and buried at a depth of at least 2m, incinerated or disposed to a licensed facility. Regular follow up treatment with appropriate herbicide will be required for up to 2 years to control re-growth from corms.

The spread of Snowberry *Symphoricarpos albus* from the replant lands site will be prevented spraying with a strong glyphosate-based herbicide, which must be applied when the plant is in full leaf (late-spring, or summer). Several applications may be required, and care will be taken to avoid non-target species (cowslips, violets and other woodland flora may occur nearby). Where the plant must be removed to enable clearance works, the entire stand will be excavated and buried at a depth of at least 2m, incinerated or disposed to a licensed facility.

12.6.2.3 Aquatic Ecology (Water Quality)

The operational wind farm will have a negligible effect on aquatic ecological interests and fisheries, as there are no further potential impacts on surface water run-off or watercourses within the site. During the operation phase, oils will be required for cooling the transformers giving rise to the potential for oil spills within the site. However, the transformers will be bunded to over 110 % of the volume of oil within them.

It is not envisaged that maintenance will involve any significant impacts on the hydrological regime of the area. Weekly inspections of the erosion and sediment control measures on site will be required during the construction period, followed by quarterly inspections during the 1st year post-construction. Yearly inspections will be carried out thereafter.

12.6.2.4 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 Dernacart 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.

12.6.2.5 Bats

Feathering of Blades

Turbines should 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 recommended 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).

An assessment of static data gathered during operational surveillance should be completed using the online analysis tool Ecobat as recommended by SNH (2019) or other equivalent as dictated by up-to date standards and practices.

Where required, cut-in speeds restrictions should 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.

Due to the elevated levels of bat activity at T2, T3, T4, T5, T7 and T8, increased cut-in speeds may be required at these locations. Intensive surveillance over the first 3 years of operation is necessary to determine if this is required. If, flowing the first year's surveillance, Leisler's bat activity increases above the baseline and remains consistently high at high-risk locations and carcass searches indicate fatalities are occurring, increased cut-in speeds should be implemented immediately.

For all other turbines, operation without cut-in speed limits carried out in parallel with 3 years of surveillance is necessary to determine if increased cut-in speeds are required at any turbine locations.

If curtailment is implemented, its effectiveness needs to be monitored in order to determine whether it is working effectively (i.e. the level of bat mortality is considered to be incidental), and (b) whether the curtailment regime can be fine-tuned 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 should 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 12-60 over. ***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 different turbine dimensions are used, felling buffers may decrease.

Table 12-60: Vegetation Free Buffer Zones for Bats (based on maximum proposed blade length of 85m)

Turbine number	Felling Buffer Radius (m)
1	96.9 m
2	95.9 m
3	95.9 m
4	96.9 m
5	98.7 m
6	97.4 m
7	99.7 m
8	99.7 m

Monitoring of mitigation measures

The success of the implemented mitigation measures for bats on the project should be monitored for a period of three years after construction and appropriate measures taken to enhance these if and where required. A recommended schedule for monitoring is given in Table 12-61 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 for the first three years of operation. A comprehensive onsite avian fatality monitoring programme is to be undertaken following published best practice. This fatality monitoring programme should be extended and duplicated for bat fauna.

The primary components of the bird mortality programme are outlined below, and an assessment of bat mortality would essentially follow the same methodology.

a) Carcass removal trials to establish levels of predator removal of possible fatalities. This should 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 should be used for subsequent fatality monitoring.

b) Turbine searches for fatalities should 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 should be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

Table 12-61: Monitoring schedule recommended for bat mitigation measures

Mitigation measure	Monitoring required	Description	Duration
Newly planted hedgerows and treelines	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 should 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 12-62: Summary of Operational-phase Mitigation Measures for Bats

High Level Bat Mitigation – Leisler's bats Applies to all turbines (*note: application of curtailment is pending further monitoring.*)	**High Level Bat Mitigation – Other species** Applies to T2, T3, T4, T5, T7 & T8	**Moderate-High Level Bat Mitigation** Applies to T1	**Moderate Level Bat Mitigation** Applies to T6
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).	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).

High Level Bat Mitigation – Leisler's bats Applies to all turbines (*note: application of curtailment is pending further monitoring.*)	**High Level Bat Mitigation – Other species** Applies to T2, T3, T4, T5, T7 & T8	**Moderate-High Level Bat Mitigation** Applies to T1	**Moderate Level Bat Mitigation** Applies to T6
Monitoring the first three years of operation to determine bat activity levels post construction. Review the results of monitoring at individual High Risk turbines after Year 1. Determine if curtailment is required. Operate the 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). Operate wind farm with specific cut-in speeds from Day 1 of Year 2, if required, and review after surveillance/monitoring is completed.	Monitor the first 3 years of operation to determine bat activity levels post construction. If bat activity levels/monitoring results deem necessary, then implement cut-in speeds (coupled with carcass search results). If deemed required implement curtailment. Operate the 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).	Put in a monitoring programme for the first year of operation 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.	Put in a monitoring programme for the first year of operation 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 for 3 years post operation of the wind farm to determine whether a higher cut-in speed of the blades is required. Review after Year 1 along with bat activity monitoring.	Undertake a carcass search for 3 years post operation of the wind farm to determine whether a higher cut-in speed of the blades is required.	Undertake a carcass search for 3 years post operation of the wind farm to determine whether a higher cut-in speed of the blades is required.	Undertake a carcass search for 3 years post operation of the wind farm to determine whether a higher cut-in speed of the blades is required.
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.	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.	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.

12.6.3 Mitigation Measures during the Decommissioning of the project

The same mitigation measures will apply for the decommissioning phase as for the construction phase.

12.7 Residual Ecological Impacts

The design of the proposed development has taken the ecology of the existing environment into consideration. Provided all mitigation measures are implemented in full, no significant residual impacts on the nearby designated sites, habitats or fauna are expected from the development of the proposed wind farm.

12.7.1 Natural Heritage Areas or Proposed Natural Heritage Areas

There are no upstream hydrological links between the proposed development and any of the national sites located within 10 km. With the implemented mitigation measures residual impacts as a result of the proposed development are assessed as negligible and adverse effects on the integrity of designated sites are not predicted. A potential significant impact to Raheen Lough pNHA in terms of collision risk in not envisaged as a result of the proposed wind farm.

12.7.2 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 such as at roundabouts 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 measure as outlined in the current chapter and Chapter 14 'Hydrology and Water Quality' as well as the use a bottomless culvert for crossing EXC1 and use of directional drilling at grid connection watercourse crossings shall ensure no significant loss of aquatic habitat.

No interaction with invasive plant species is anticipated. Measures to manage invasive species should they become an issue are specified in 12.6.2.4 above.

With the application of the appropriate mitigation measures as outlined in the current chapter, it is considered that the impacts of the proposed development will be minimised to an acceptable level, resulting in ***no residual effects***.

12.7.3 Mammals

Potential impacts to pygmy shrew, fallow deer, Irish hare, Irish stoat, and hedgehog arising from construction activities are predicted to be ***short-term imperceptible*** prior to mitigation. As such, mitigation measures are not required for these species. 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 woodland habitat which could be used by foraging and breeding red squirrel and by badgers and Irish stoat 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 ***imperceptible negative effects***.

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.

12.7.4 Birds

Golden Plover

Of the bird species recorded as part of this study, golden plover was considered to be of the highest significant conservation concern. The conservative estimate from the CRM indicates that collision mortality may have a long term imperceptible impact on the all-Ireland golden plover population. In combination effects, in particular in regard to the other wind farms proposed in the greater area, have also been considered and found to be of low significance. In addition, monitoring measures have been proposed to minimise the potential negative impacts of the development on golden plover. Habituation to the site is likely to also reduce the proposed risk. It is considered that overall the proposed wind farm will have ***an imperceptible residual effect*** on golden plover at an all-Ireland level.

Other Birds

Of the remaining bird species recorded at the subject site, mitigation measures have been proposed to minimise effects on those species which the literature suggests can be negatively impacted, in particular breeding waders such as Snipe and Woodcock, which may be affected during construction and lapwing and kestrel during operation. 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. The implementation of a monitoring programme is within recommended best practice mitigation measures.

It is considered that with the implementation of mitigation, the proposed wind farm development will have a ***slight-imperceptible residual effect*** on birds.

12.7.5 Aquatic Ecology

The proposed wind farm will have a ***slight negative effects*** on aquatic ecology and fisheries during the construction phase in a local context in the absence of mitigation measures. However, this will be effectively reduced to an ***imperceptible negative effects*** with the mitigation measures proposed; direct loss of riparian habitat shall be minimal. The use of a bottomless culvert for upgrade of existing crossing EXC1 also reduces the potential for direct loss of aquatic habitat. The limitation of indirect impacts arising from water quality pollution events such as siltation and run-off of suspended solids will significantly reduce the potential for impacts affecting aquatic ecological interests within the catchment.

Localised water quality impacts as a result of construction will be reduced with the implementation of the water management measures detailed in as outlined in the current chapter and Chapter 14 'Hydrology and Water Quality'. With the mitigation measures proposed, residual impacts are evaluated to be limited to a local context and will not affect the conservation status of aquatic ecology receptors in the receiving waters.

12.7.6 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 effects*** with the favourable conservation status (FCS) of bat species being unaffected and all species confirmed or expected on or near the study areas are anticipated to persist.

12.7.7 Other Taxa

Residual effects are assessed as ***not significant.***

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