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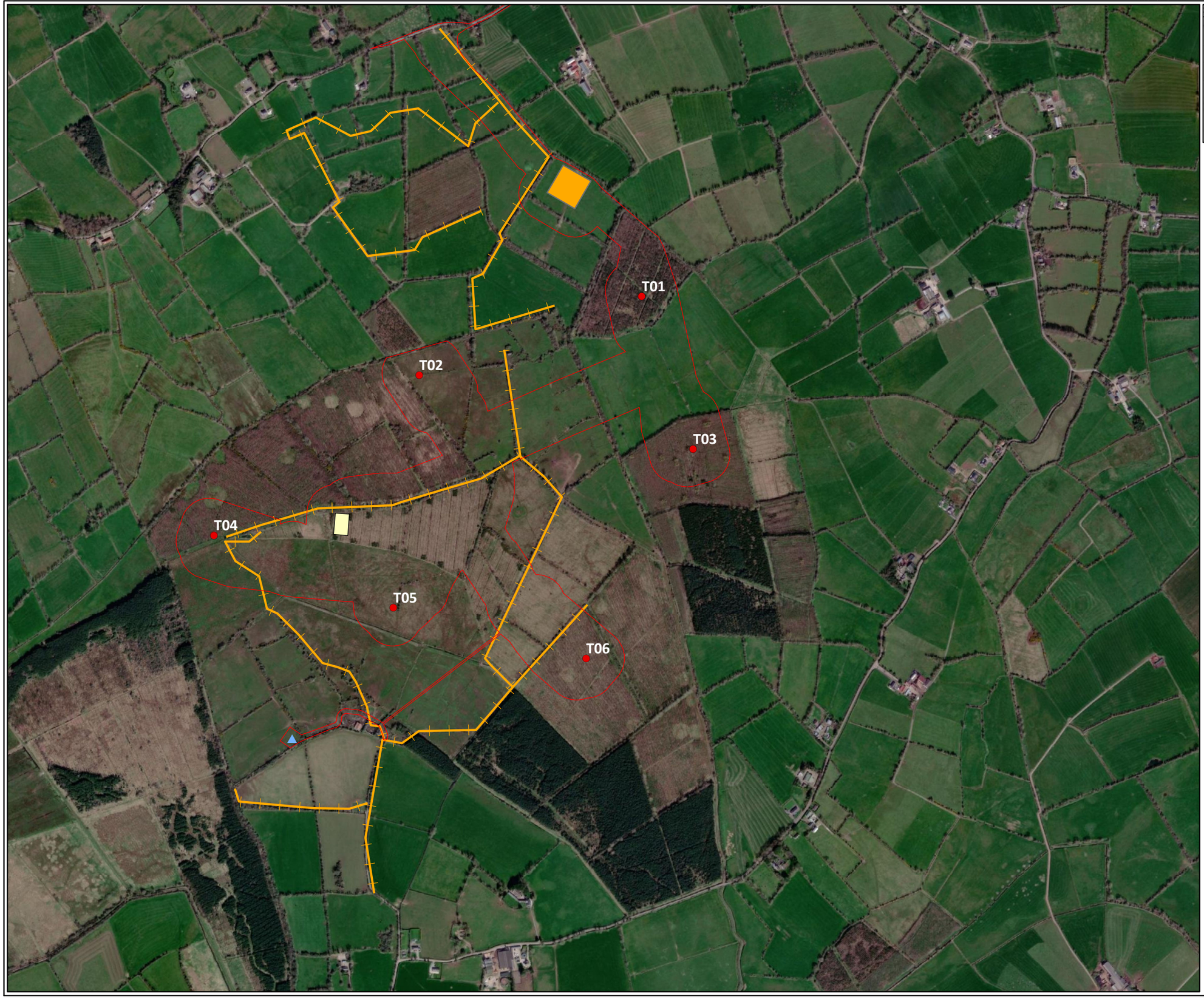

Legend

- Site Boundary
- Transect
- Turbine Layout
- Met Mast
- Substation
- Construction Compound

TITLE:	Bat Activity Survey Transects 2020		
PROJECT:	Annagh Wind Farm, Co. Cork		
FIGURE NO:	8.2		
CLIENT:	EMPower		
SCALE:	1:10500	**REVISION:**	0
DATE:	12/10/2021	**PAGE SIZE:**	A3

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Static Detector Surveys

Passive Static Bat Surveys involve leaving a static bat detector unit (with ultrasonic microphone) in a specific location and set to record for a specified period of time (i.e. a bat detector is left in the field, there is no observer present and bats which pass the monitoring unit are recorded and their calls are stored for analysis post surveying). The bat detector is effectively used as a bat activity data logger. This results in a far greater sampling effort over a shorter period of time. Bat detectors with ultrasonic microphones are used as the ultrasonic calls produced by bats cannot be heard by human hearing.

Song Meter SM4BAT Full spectrum bat recorders use Real Time recording as a technique to record bat echolocation calls and using specific software, the recorded calls are identified. It is these sonograms (2-d sound pictures) that are digitally stored on the SD card (or micro SD cards depending on the model) and downloaded for analysis. Full spectrum bat recorders were utilised for all of the static surveys as recommended in the revised SNH (2021) guidelines. These results are depicted on a graph showing the number of bat passes per species per hour/night. Each bat pass does not correlate to an individual bat but is representative of bat activity levels. Some species such as the pipistrelles will continuously fly around a habitat and therefore it is likely that a series of bat passes within a similar time frame is one individual bat. On the other hand, leisler's bats tend to travel through an area quickly and therefore an individual sequence or bat pass is more likely to be indicative of individual bats.

Per SNH (2021) guidance, static units (Song Meter SM4BAT) were programmed to commence half an hour before sunset and finish half an hour after sunrise to ensure that bat species that emerge early in the evening and return to roosts late are recorded. Detectors were left out for a minimum of 10 consecutive nights across three survey periods: spring (April-May), summer (June-mid-August) and autumn (mid-August-October). See Table 3.3 below for further details.

SNH (2021) guidance states that "Detectors should be placed at all known turbine locations at wind farms containing less than ten proposed turbines. Where developments have more than ten turbines, detectors should be placed within the developable area at ten potential turbine locations plus a third of additional potential turbine sites up to a maximum of 40 detectors for the largest developments".

At key-holed woodland/plantation sites (and other proposals involving extensive habitat alteration), pre-application survey data may not represent the situation post-construction, as the habitat available for bats will change following construction. Automated survey locations should therefore also include open areas including existing nearby rides/clearings in the forestry, to provide an indication of how bats may adapt to and use the new habitat created through turbine construction.

It should be noted that, due to the ongoing development of the project, the static detectors were not placed at known turbine locations. They were places in open areas within plantation woodland and felled woodland stands, as well as edge ecology, to assess the bat activity levels along these corridors and the potential activity levels for bats post felling. Therefore the baseline is a worst-case representation of the Site overall. The location of the static detectors are presented in Figure 3 2 below.

The data was analysed with Kaleidoscope 5.3.9g software (Bats of Europe 5.2.1).

The location of the static detectors is presented in Table 8-4 and Figure 8-3 below.

Table 8-4: Details of static detector deployment 2020/2021

Static Detector ID.	Habitat types at static location	Closest turbine number (final design)	Habitat types at turbine location	Spring		Summer		Autumn	
				Start Date	Number of nights deployed[2]	Start Date	Number of nights deployed	Start Date	Number of nights deployed
A2	Treeline/ hedgerow adjacent to stream and agricultural land	1	Plantation woodland	23/04/20	12	21/07/20	10	15/09/20	17
A3	Woodland edge adjacent to a grassed clearing within the plantation woodland	4	Wet grassland, marsh and plantation woodland	23/04/20	12	21/07/20	10	15/09/20	17
A5	Woodland edge at the northeast corner of plantation woodland	3	Plantation woodland	23/04/20	12	21/07/20	10	15/09/20	17
A6	On dead spruce within marsh habitat	4	Wet grassland, marsh and plantation woodland	23/04/20	12	21/07/20	10	15/09/20	10
A7	On hedgerow along the eastern boundary of the agricultural field	5	Wet grassland	23/04/20	12	21/07/20	10	15/09/20	10
A8	Small clearing within dense plantation woodland	6	Plantation woodland	23/04/20	12	21/07/20	10	15/09/20	10
AT1	Woodland edge at of plantation woodland	1	Plantation woodland	N/A	N/A	21/07/21	35	N/A	N/A

[2] Note that data will be recorded for the morning on the date of collection. Thus, if a detector was left out on 09/05/2020 and collected on 20/05/2020, the detector will have been left out for a total of 11 complete nights. However, there will be 12 unique dates where data was (potentially) recorded.

Static Detector ID.	Habitat types at static location	Closest turbine number (final design)	Habitat types at turbine location	Spring		Summer		Autumn	
				Start Date	Number of nights deployed[2]	Start Date	Number of nights deployed	Start Date	Number of nights deployed
	and junction with hedgerow at right angle to woodland								
AT2	Woodland edge at the southeast corner of plantation woodland	2	Agricultural field adjacent to plantation woodland			21/07/21	35	13/09/21	24
AT3	Treeline/ hedgerow adjacent to plantation woodland and grassland	3	Plantation woodland			21/07/21	13	13/09/21	24
AT4	Defunct hedgerow and wet grassland	4	Wet grassland, marsh and plantation woodland			N/A	N/A	13/09/21	24
AT5	Wet grassland and drainage ditch	5	Wet grassland			21/07/21	13	13/09/21	24
AT6	Path (clearing) between two plantation woodland stands	3 & 6	Plantation woodland			21/07/21	13	13/09/21	24

Static Detector Survey Analysis

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 (5.3.9) 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 (Bats of Europe 5.2.1).

In order to determine appropriate quality assurance a randomly generated 10% sample of the files were manually checked (including noise and noID files).

The data was then entered into Ecobat [3] and a report was subsequently generated. Ecobat is an online tool which makes assessments of bat activity levels by comparing data entered by the user with bat survey information from similar areas at the same time of year. Specifically, a median bat activity level is calculated which corresponds to a bat activity category (Table 8-5).

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 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.

Table 8-5: Median percentile range and corresponding bat activity category

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

The Ecobat analysis reports are presented in Appendices D and E of the bat report (EIAR Appendix 8.3).

Survey and Analysis Limitations

- It is not always possible to identify a bat call to species level due to the recorded call not being clear. Recorded files from automated detectors may contain only fragments of a call, or the bat may be calling from a distance (from the detector) in which case it may not be clear enough to assign the call to a specific species. In these cases the call has been assigned to genus level for the 2020/2021 survey results;
- Some caution must be taken when comparing activity levels between species, as bias can be shown towards those species with 'louder' or 'lower frequency' echolocation calls.

[3] http://www.ecobat.org.uk/

For example, Nyctalus species have louder and low frequency echolocation calls which carry further than the quieter and more broad-band brown long-eared bat echolocation calls;

- A bat contact is defined as a single detector file which contains at least one bat call. Multiple contacts at any given detector location do not necessarily indicate the presence of more than one bat and should therefore be interpreted as a level of activity rather than the number of bats recorded;
- For the purposes of this analysis, if more than 1 species was present within the recorded files the prominent species was identified as the species for the Ecobat analysis, therefore some species numbers may be under recorded;
- Guidelines in the use of Ecobat recommend a Reference Range of 200+ files of bat data to be confident in the relative activity level. The reference range is the stratified dataset of bat results recorded in the same region, at the same time of year, by which percentile outputs can be generated. This comprises all records of nightly bat activity across Ireland. Although there is an increased uptake in the use of Ecobat in Ireland, some of the reference ranges remain below 200, therefore the results are more conservative.
- Ecobat analysis regarding genus level identification is currently flawed. If a genus level ID has been entered into the spreadsheets, for example "Pipistrellus" then all identified pipistrellus species (including pipistrellus, pygmeaus and nathusius) will be included in the total for the date of the Pipistrellus genus entry. Therefore, all genus level results are over exaggerated for the 2020 results and have been omitted from the 2021 results.
- Due to the cattle rotation within the study area and the placement of static detectors, some of the units were deployed for longer periods than others during the 2021 surveys. However, in order to provide the best representation of activity on Site, the analysis has been conducted on all data obtained and not reduced to have all deployment schedules matching.
- Static location AT4 was not surveyed during the summer period due to cattle being present for the duration of the deployment. The impact assessment of the 2021 results at this location is based on the autumn results only.
- Static detector AT1 failed to record during the autumn survey period, therefore there are no results available. The impact assessment of the 2021 results at this location is based on the summer results only.

Bat Tracking (Vantage Point) Surveys

Bat tracking surveys were carried out on 9th and 31st August 2021 during clear weather conditions to search for a potential Leisler's bat roost indicated by Ecobat analysis to be present in the vicinity of the proposed site. Vantage Point surveys are particularly useful for observing early commuting and foraging species such as noctule bats whilst it is still light. surveyors observed the Site from vantage points providing clear views of the study area.

VP 1 550115, 616205 (ITM)
VP 2 550037, 616468 (ITM)

The surveys were carried out prior to and during dusk to search for bat emergence activity associated with buildings. The surveyors used infra-red scopes in line with Fawcett (2021) to improve detection of bats in low light conditions.

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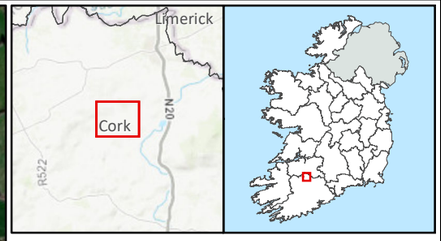

Legend

- Site Boundary
- Static Detector Locations
- Met Mast
- Turbine Layout
- Turbine Layout (original)
- Substation
- Construction Compound

TITLE:	Static Detector Locations 2020		
PROJECT:	Annagh Wind Farm, Co. Cork		
FIGURE NO:	8.3		
CLIENT:	EMPower		
SCALE:	1:10000	**REVISION:**	0
DATE:	12/10/2021	**PAGE SIZE:**	A3

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8.2.5.5 Avifauna

Study Areas

The study area for flight activity surveys was the vantage point viewsheds and 500m turbine buffers. The study areas for breeding waders, general breeding birds, Nightjar and Barn owl were within the wind farm land ownership boundary. The study area for the hinterland survey encompassed the region within 10 km of the proposed wind farm.

Target Species

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

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

In addition to the above, consideration was given to species identified locally as being of conservation concern, regionally or those particularly susceptible to impact from wind farm development. Note that not all species on the above lists would be categorised as target species, e.g. most passerine species and general lowland farmland birds are not considered to be particularly susceptible to impacts from wind farms (SNH, 2017). Target species identified during avifauna surveys can be found in Table 8-6 below.

In the Irish context, it has been suggested that target species should be taken from species of conservation concern in Ireland (BOCCI) (Gilbert et al., 2021), 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 (Gilbert et al., 2021).

To date four BoCCI lists have been published with the current list by Gilbert et al. (2021) superseding the three former lists by Colhoun and Cummins (2013), 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 (Gilbert et al., 2021).

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

Table 8-6 below outlines the target groups and species identified.

These were chosen based on their meeting one or more of the SNH (2017) criteria outlined above, potential sensitivity to wind farms, having been previously recorded within the 10km grid squares[4] (R41 and R51) which overlap the proposed Annagh wind farm site and/or the occurrence of suitable habitats at the proposed development site.

As the grid route will be underground and mainly under public roads, the probability of avian disturbance is low relative to existing disturbance from traffic. Also, there is no chance of collision with cables. The same is true for the TDR, and any disturbance relative to the baseline is low. The off-road section of the grid connection within the main wind farm site was encapsulated in the 10 km grid squares search. Assessment of habitat suitability for birds was undertaken during site walkovers, which re-confirmed these findings.

Table 8-6: Target Groups/Species and Associated Suitable Breeding Habitat

Group/Species	Suitable Breeding Habitat
All raptors and owls	Trees, buildings, cliffs/quarries
Hen Harrier (*Circus cyaneus*)	Uplands and bogs, heather moorland, young forestry plantations and coastal wetlands
All wild goose, swan and duck species	Wetlands, Lake/Lowland River Fringes
All wader species	Coastal and various inland wetland and bog habitats
Woodcock (*Scolopax rusticola*)	Woodland and bog woodland
Gulls (red or amber listed)	Coastal and various inland wetland habitats
Cormorant (*Phalacrocorax carbo*)	Coastal habitat and inland waterbodies
Heron (*Ardea cinerea*)	Trees near wetlands, rivers, streams and marshy ground
Little Egret (*Egretta garzetta*)	Trees near wetlands, rivers, streams and marshy ground
Nightjar (*Caprimulgus europaeus*)	Conifer plantations/clear felled forestry in uplands

Overview of methods of current surveys

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

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

- VP watches undertaken over one two years at 2 VPs (winter 2019/20, winter 2020/21, summer 2019, summer 2020)
- Transect/point count surveys (winter 2019/20, winter 2020/21, summer 2019, summer 2020)
- Hinterland surveys (winter 2019/20, winter 2020/21, summer 2019, Summer 2020)
- Evening/nocturnal transect survey and watch for Woodcock (summer 2020, summer 2021)
- Habitat assessment and nocturnal transect survey for Nightjar (summer 2021).

[4] National Biodiversity Data Centre (NBDC) website

Vantage Point (VP) Watches / Flight Activity Surveys

Vantage Point (VP) surveys were carried out at the Site from April 2019 to April 2021 inclusive, covering both the breeding and non-breeding seasons in accordance with the Scottish Natural Heritage Methodology (SNH, 2019; 2021). These surveys took place within the summer (April-September) 2019, 2020 and Winter (December - March) 2019-2020, 2020-21 seasons. A round of migration watches was undertaken in early April 2021.

Two fixed VP locations (VP1 and VP2) which overlook the proposed wind farm site and surrounding study area were used during these surveys. The vantage points when combined cover a comprehensive viewshed of all turbine locations, and also to allow observation of the wider area surrounding the Site. The viewshed encompassed a 500m buffer around the around the proposed turbine locations required by SNH (2019) Guidance.

The main purposes of vantage point survey watches are to collect data on target species that will enable estimates to be made of:

- The time spent flying over the defined survey area;
- The relative use of different parts of the defined survey area; and
- The proportion of flying time spent within the upper and lower height limits as determined by the rotor diameter and rotor hub height.

Vantage Point locations are shown in Table 8-7 and in Figure 2.1 in Appendix 8.5:

Table 8-7: Vantage Point Locations

VP	Location (ITM)
1	550115, 616205
2	550037, 616468

Vantage point locations were based on observations from walkover/reconnaissance surveys and viewshed analysis (using GIS). The number and locations of vantage points were selected to achieve visibility of the entire study area. In line with recommended best practice (Band et al. 2007, SNH 2019), viewshed analysis was undertaken using ArcGIS Desktop 10.4.1., to calculate a theoretical zone of visibility from each vantage point. Visibility is 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 (2019) 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, however it should be noted that the baseline should take account of any forestry or other features that will potentially obstruct the view.*

For example, forestry may be 10-30m high and if viewshed height is taken as 20-30m ground level the visible area could be overestimated if there is forestry within the viewshed. 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."

Data recorded included flight activity of target species (flight height, duration, directionality) in addition to metrics such as flock size (per recorded transit) and time of observation. Detailed notes of each observation of a target bird species was recorded including behaviour, gender (where possible), numbers, flight height, associated habitat and the period of time spent within the study area. Successful foraging events were also noted if they arose. Other bird species seen or heard during the VP surveys were also noted as incidental records and were considered separately as additional species. Flight activity was annotated onto field maps. The activity of target species is summarised in section 8.3.8 and detailed comprehensively in the ornithological reports included in Appendix 8.5, as are flight lines; survey details such as weather conditions, visibility, and duration are also detailed in Appendix 8.5. Binoculars and field scopes were used to scan the viewshed for target species.

Flight heights were estimated visually as allowed for in the SNH guidance. Flight height estimation using a clinometer or rangefinder is accepted as an alternative 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 do 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 will be able to record accurate observations at a higher frequency resulting in a larger dataset for analysis.

A total of 72 hours per VP was completed over the two-year survey period, fulfilling the requirement for 36 hours of VP in each survey season as required by the SNH (2019) guidance.

The proportion of survey time that activity was recorded inside and outside the 500m turbine buffer was used as part of the overall analysis and assessment of target species usage of the study area. All surveys were conducted during suitable weather conditions.

Hinterland Survey

Hinterland surveys were undertaken during winters seasons 2019-20 and 2020-21, and breeding seasons 2019 and 2020. The survey methodology for wetland sites followed the I-WeBS methodology which involves a 'look-see' style approach where the surveyor visited all known locations of feeding and/or roosting wildfowl and counted birds in situ. Non-wetland sites were also assessed for raptors and target species (e.g. potential hen harrier habitat), following using the same methodology, with the addition of short VP surveys (0.25 – 0.5 hours) for raptors as required.

The surveys were carried out in suitable upland, woodland and wetland habitats in the area surrounding the proposed wind farm site. This comprised 13 sites within 10 km of the proposed wind farm site. These sites were chosen as they had suitable habitat for the following target groups: raptors, waders, waterfowl and barn owl. The survey was refined to focus on potential Hen Harrier breeding habitat and wetland sites closer to the proposed site during summer 2020. Winter hinterland surveys were more intensive and extensive, covering a larger group of sites. The group of sites was refined throughout the survey period (less suitable sites were dropped, while more promising sites identified during desk studies and field visits were added; casual observations were also recorded as surveyors traversed the hinterland).

Surveys were carried out between April and September in the summers of 2019 and 2020, and October to March during winters of 2019-20 and 2020-21.

The following sites were checked regularly across this period: West Plantation (Aughrim), River Blackwater SAC/Annagh Bridge, River Awbeg, River Blackwater SAC/Buttevant Bridge, Eagle Lough pNHA, Glanmore Flats, Kilcolman Bog SPA, Ballinvonear Ponds pNHA, Ballyhoura Mountains pNHA, Ballyhoura Mountains SAC, Castle Lake (Milltown), Small Quarry Lake (Ballyroe), and Large Quarry Lake (Ballinadrideen). Opportunistic observations were made at flooded fields, while a Hen Harrier breeding habitat recce survey covering the Ballyhoura Mountains was carried out in May 2020 (also listed below in Table 8-8).

Table 8.8 details the locations of the survey sites and dates on which each site was surveyed:

Table 8-8: Hinterland Survey

Location	Coordinates (ITM)	Dates visited			
		Summer 2019	Winter 2019-20	Summer 2020	Winter 2020-21
West Plantation (Aughrim)	543767, 616842	02/05/2019 27/05/2019 23/06/2019 01/08/2019 27/08/2019	06/11/2019 28/11/2019 17/12/2019 28/01/2020 25/02/2020	Not surveyed	Not surveyed
River Blackwater SAC/Annagh Bridge	549814, 615638	02/05/2019 27/05/2019 23/06/2019 01/08/2019 27/08/2019	06/11/2019 28/11/2019 17/12/2019 28/01/2020 25/02/2020	27/04/2020 15/06/2020 16/06/2020 04/09/2020	22/10/2020 06/11/2020 26/11/2020 07/12/2020 16/12/2020 26/01/2021 15/02/2021 16/02/2021 26/02/2021 23/03/2021
River Awbeg	552564, 614751	02/05/2019 27/05/2019 23/06/2019 01/08/2019 27/08/2019	06/11/2019 28/11/2019 17/12/2019 28/01/2020 25/02/2020	Not surveyed	22/10/2020 06/11/2020 26/11/2020 07/12/2020 16/12/2020 26/01/2021 16/02/2021 23/03/2021
River Blackwater SAC/ Buttevant	554265, 609841	02/05/2019 27/05/2019 23/06/2019 01/08/2019 01/08/2019 27/08/2019	06/11/2019 28/11/2019 17/12/2019 28/01/2020 25/02/2020	Not surveyed	22/10/2020 06/11/2020 26/11/2020 07/12/2020 26/01/2021 16/02/2021

Location	Coordinates (ITM)	Dates visited			
		Summer 2019	Winter 2019-20	Summer 2020	Winter 2020-21
Eagle Lough pNHA	556064, 610328	02/05/2019 27/05/2019 23/06/2019 01/08/2019 27/08/2019	08/11/2019 28/11/2019 17/12/2019 28/01/2020 25/02/2020	Not surveyed	22/10/2020 06/11/2020 26/11/2020 07/12/2020 26/01/2021 26/02/2021 23/03/2021
Glanmore Flats	554616, 612847	02/05/2019 27/05/2019 23/06/2019 01/08/2019 27/08/2019	06/11/2019 28/11/2019 17/12/2019 28/01/2020 25/02/2020	Not surveyed	22/10/2020 06/11/2020 26/11/2020 07/12/2020 16/12/2020 26/01/2021 23/03/2021
Kilcolman Bog SPA	558072, 610856	02/05/2019 27/05/2019 23/06/2019 01/08/2019 27/08/2019	06/11/2019 28/11/2019 17/12/2019 28/01/2020 25/02/2020	27/04/2020 29/05/2020 16/06/2020 04/09/2020	22/10/2020 06/11/2020 26/11/2020 07/12/2020 26/01/2021 16/02/2021 26/02/2021 23/03/2021
Ballinvonear Ponds pNHA	556797, 613057	02/05/2019 27/05/2019 23/06/2019 01/08/2019 27/08/2019	06/11/2019 28/11/2019 17/12/2019 28/01/2020 25/02/2020	Not surveyed	22/10/2020
Ballyhoura Mountains pNHA	557289, 614688	02/05/2019 27/05/2019	28/11/2019 20/12/2019 28/01/2020 25/02/2020	27/04/2020	Not surveyed
Ballyhoura Mountains SAC	559159, 616959	Not surveyed	Not surveyed	29/05/2020 25/06/2020 04/09/2020	22/10/2020 06/11/2020 26/11/2020 07/12/2020 16/12/2020 26/01/2021 26/02/2021 23/03/2021

Location	Coordinates (ITM)	Dates visited			
		Summer 2019	Winter 2019-20	Summer 2020	Winter 2020-21
Castle Lake (Milltown)	550153, 619611	02/05/2019 27/05/2019 23/06/2019 01/08/2019 27/08/2019	08/11/2019 28/11/2019 17/12/2019 28/01/2020 25/02/2020	Not surveyed	22/10/2020 06/11/2020 26/11/2020 07/12/2020 26/01/2021 26/02/2021 23/03/2021
Small Quarry Lake (Ballyroe)	552833, 616762	02/05/2019 27/05/2019 23/06/2019 01/08/2019 27/08/2019	08/11/2019 28/11/2019 20/12/2019 28/01/2020 25/02/2020	Not surveyed	22/10/2020 06/11/2020 26/11/2020 07/12/2020 16/12/2020 26/01/2021 26/02/2021 23/03/2021
Large Quarry Lake (Ballinadrideen)	553853, 617143	02/05/2019 27/05/2019 23/06/2019 01/08/2019 27/08/2019	08/11/2019 28/11/2019 17/12/2019 28/01/2020 25/02/2020	15/06/2020 04/09/2020	22/10/2020 06/11/2020 26/11/2020 07/12/2020 16/12/2020 29/12/2020 26/01/2021 26/02/2021 23/03/2021
Flooded Field (Casual Obs.)	554293, 618683	Not surveyed	17/12/2019	Not surveyed	Not surveyed
Fields close to Glanmore Flats (Casual Obs.)	N/A	Not surveyed	28/11/2019	Not surveyed	Not surveyed
Ballyhoura Hen Harrier Recce Survey	Not surveyed	Not surveyed	Not surveyed	29/05/2020	Not surveyed
Flooded area along R522 south of Churchtown	550355, 611036	Not surveyed	Not surveyed	Not surveyed	16/02/2021 26/02/2021
Railway crossing north of Buttevant (Casual Obs.)	553336, 609845	Not surveyed	Not surveyed	Not surveyed	26/02/2021

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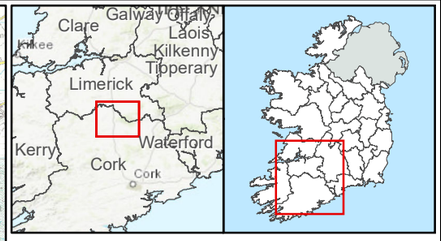

Legend

- Site Boundary
- Turbine Layout
- Met Mast
- Substation
- Construction Compound
- Underground Cable Route
- Hen Harrier Recce Survey

Hinterland Survey Sites

ID and Name:

1: Ballinvonear Ponds pNHA
2: Ballyhoura Mountains pNHA
3: Ballyhoura Mountains SAC
4: Castle Lake (Milltown)
5: Eagle Lough pNHA
6: Glanmore Flats
7: Kilcolman Bog SPA
8: Large Quarry Lake (Ballinadrideen)
9: River Awbeg
10: River Blackwater SAC/ Buttevant
11: River Blackwater SAC/Annagh Bridge
12: Small Quarry Lake (Ballyroe)
13: Western Plantation (Aughrim)

TITLE:	Hinterland Survey Area		
PROJECT:	Annagh Wind Farm		
FIGURE NO:	8.4		
CLIENT:	EMP Group		
SCALE:	1:90000	**REVISION:**	0
DATE:	12/10/2021	**PAGE SIZE:**	A3

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Breeding Bird Surveys

For general breeding birds the method utilised was based on the existing British Trust for Ornithology (BTO) Breeding Bird Survey (BBS or CBS; Bibby *et al*, 2000). The study area for this survey comprised a total of 2 no. 1 km transects during 2019. A 3rd transect was added in summer 2020 following an expansion of the proposed site boundary. The transects used were designed to obtain a representative sample of the habitats onsite and to provide coverage of the study area. See Figure 8-5 for the location of transects.

In both 2019 and 2020, birds were counted over two visits, each timed to coincide with the early part of the breeding season (April to mid-May) and later part of the season (mid- May to late June) with visits at least four weeks apart. Surveyors recorded all birds seen or heard as they walked methodically along the transect routes. Birds were noted in four distance categories, measured at right angles to the transect line (within 25 m, between 25 m-100 m and over 100 m from the transect line) and those seen in flight only. Recording birds in distance bands gives a measure of bird detectability and allows relative population densities to be estimated if required (BTO, 2018).

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 2017).

The summer breeding bird transect schedule is available in Table 8-9. The results are presented in Section 8.3.8.24:

Table 8-9: Breeding bird transect survey details

Date	Transects	Time	Weather Conditions
15/05/2019	TR1, TR2	07:30 – 09:25	Cloud: 4/8 oktas; rain: none; wind: F1; visibility: excellent
29/06/2019	TR1, TR2	10:00 – 12:30	Cloud: 3/8 oktas; rain: none; wind: F2; visibility: excellent
08/05/2020	TR1, TR2, TR3	09:50 – 12:25	Cloud: 5/8 oktas; rain: none; wind: F1-2; visibility: excellent
15/06/2020	TR1, TR2, TR3	10:53 – 13:30	Cloud: 5/8 oktas; rain: none; wind: F2; visibility: excellent

Winter Bird Transects

For the general wintering bird survey, the method utilised was the same as for the breeding bird transects, except it was undertaken in the winter season. A total of six rounds of winter transect surveys were completed during winter seasons 2019-20 and 2020-21.

The wintering bird transect schedule is available in Table 8-10. The results are presented in Section 8.3.8.24.

Table 8-10: Wintering bird winter transect survey details

Date	Transect	Time	Weather Conditions
20/12/2019	TR1, TR2	07:45 – 10:30	Cloud: N/A oktas, Rain: occ., showers, Wind: F1, Visibility: Excellent
21/01/2020	TR1, TR2	09:10 – 10:40	Cloud: 7/8 oktas, Rain: Dry, Wind: F1, Visibility: very good
14/10/2020	TR1, TR2, TR3	9:00 – 13:01	Cloud: 8/8 oktas, Rain: none, Wind: F1, Visibility: good
10/11/2020	TR1, TR2, TR3	12:30 – 15:15	Cloud: 8/8 oktas, Rain: none, Wind: F2, Visibility: good
29/12/2020	TR1, TR2, TR3	12:00 – 14:10	Cloud: 5/8 oktas, Rain: none, Wind: F3, Visibility: good
31/03/2021	TR1, TR2, TR3	15:01 – 16:38	Cloud: 8/8 oktas, Rain: none, Wind: F0-1, Visibility: excellent

Breeding Wader Surveys

Survey transects to assess the presence of breeding wader populations were completed during the months of April, May, July and August 2019, May, June and July 2020. Current wader surveys which commenced in April 2021 are also included. Breeding birds were surveyed using methodology of the breeding wader survey, following Bibby et al, (2000) and Gilbert et al, (1998). The area assessed was all wet areas within the study area.

All species encountered (seen or heard) were recorded and their abundance, behaviour, sex/age and breeding status noted. Any species occurring more than 100 m from the observer, or flying over the site and not using it, were recorded as 'additional' species to further inform the baseline survey. Table 8-11 below, details the survey dates and weather conditions.

Table 8-11: Breeding Waders Survey Details

Date	Location	Cloud (Okta)	Precipitation	Visibility	Wind
26/04/2019	Annagh WF	5/8	Dry	Excellent	F2
15/05/2019	Annagh WF	4/8	Dry	Excellent	F4
02/08/2019	Annagh WF	2/8	Showers	Excellent	F2-3
28/08/2019	Annagh WF	2/8	Light Shower	Excellent	F1-2
08/05/2021	Annagh WF	5/8	Dry	Excellent	F1-2
15/06/2020	Annagh WF	8/8	Dry	Excellent	F1-2
09/07/2020	Annagh WF	5/8	Dry	Excellent	F1-2
26/05/2021	Annagh WF	7/8	Showers	Good	F3-4
03/06/2021	Annagh WF	2/8	Dry	Good	F1
21/06/2021	Annagh WF	4/8	Dry	Good	F2

Woodcock and Nightjar Surveys

A dusk watch for Woodcock was carried out on 29th June 2020 from VP1 which overlooks an area of conifer plantation suitable for breeding woodcock. The survey methodology followed that used for the UCC Breeding Woodcock Survey (adapted from Hoodless et al. 2009).

A nocturnal survey using thermal imaging equipment was carried out near VP2 on 15th February 2021.

Night-time/dusk transect surveys were undertaken to detect evidence of breeding crepuscular/nocturnal species Woodcock and Nightjar. These were carried out between the hours of 19:40 – 23:10 on 3rd June and 21st June 2021. The transect survey route followed established transects and included any additional areas potentially suitable for Nightjar. The survey methodology for Nightjar followed Conway et al (2007).

Barn Owl Survey

The derelict farm buildings in the southern part of the site were searched for signs of Barn owl on 24th May 2021 during daylight. A dusk watch to search for Barn owl activity at this building was also completed on 24th May 2021. Barn owl activity was also searched for during dusk/nocturnal transects surveyed on 3rd June and 21st June 2021. Barn owl was also searched for during crepuscular flight activity surveys during winter 2020/21 and spring 2021.

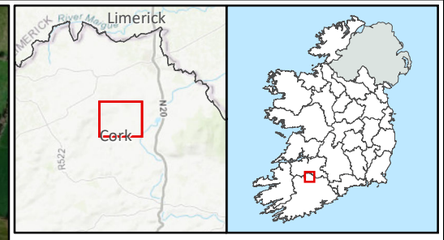
The TII guidance document 'Survey and Mitigation Standards for Barn Owls to inform the Planning, Construction and Operation of National Road Projects' (TII, 2021) was considered in determining Barn Owl survey methodology; however, the methodology selected aligned with Shawyer (2012) '*Barn Owl Tyto alba Survey Methodology and Techniques for use in Ecological Assessment*'.

Kingfisher Survey

Watercourses within the aquatic survey study area were searched for signs of Kingfisher where suitable habitat was present during aquatic surveys undertaken in September 2020.

The survey methodology followed Crowe et al. (2008) '*Assessment of the distribution and abundance of Kingfisher Alcedo atthis and other riparian birds on two SAC river systems in Ireland*' and NRA guidance (2009b) '*Ecological Surveying Techniques for Protected Flora and Fauna During the Planning of National Road Schemes'*.

Path: R:\Map Production\2020\P2359\Workspace\EIAR\P2359_GIS_Fig8-5_BirdSurveyTransects_A3.mxd



Legend

- Site Boundary
- Turbine Layout
- Bird Survey Transect
- Construction Access
- Internal Access Track
- Turbine Hardstanding Area
- Substation
- Construction Compound

TITLE:	Bird Survey Transects		
PROJECT:	Annagh Wind Farm, Co. Cork		
FIGURE NO:	8.5		
CLIENT:	EMPower		
SCALE:	1:12500	**REVISION:**	0
DATE:	12/10/2021	**PAGE SIZE:**	A3

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8.2.5.6 Aquatic Ecology

The following section summaries the results of aquatic surveys carried out for the proposed Annagh wind farm project. The full report is included in Appendix 8.6.

Surveys to inform the aquatic ecology assessment were completed during 2020 and 2021. The surveys included walkover surveys, catchment wide electro-fishing, White-clawed Crayfish Surveys (conventional methods and eDNA survey), Freshwater Pearl Mussel Survey, biological water quality surveys. Figure 8-7 gives the location of the proposed Annagh Wind Farm and GCR with respect to Blackwater River (Cork/Waterford) SAC (002170) and watercourses in the Awbeg catchment.

Selection of Watercourses for Appraisal

All freshwater watercourses which could be affected directly or indirectly by the proposed wind farm development were considered as part of the assessment. This included watercourses draining the proposed wind farm site as well as those crossed by the proposed grid connection route and turbine delivery route (where any works had potential to cause impacts). A total of *n*=11 sites were selected for detailed aquatic assessment (see Table 8-12Error! Reference source not found. and
Figure 8-6 below). The nomenclature for the watercourses surveyed is as per the Environmental Protection Agency's (EPA) online map viewer.

Surveys at each of these sites included a fisheries assessment (electro-fishing, habitat appraisal), white-clawed crayfish survey (sweep netting, hand searching) and biological water quality sampling (Q-sampling) (**Figure 2.1**). A Stage 1 freshwater pearl mussel survey was undertaken in September 2020. In addition to traditional surveys, environmental DNA (eDNA) analysis was also undertaken on water samples from the Awbeg River for white-clawed crayfish and crayfish plague (*Aphanomyces astaci*). This holistic approach informed the overall aquatic ecological evaluation of each site in context of the proposed wind farm development.

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

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
A1	Fiddane Stream	18F19	Annagh Bogs	549427	617248
A2	Ardglass River	18A23	Annagh Bogs	549606	616770
A3	Awbeg River	18A09	Annagh Bridge	549823	615649
B1	Milltown Stream	18M57	Milltown	550461	619714
B2	Oakfront River	18O02	Cooliney Bridge	550181	618654
B3	Oakfront River	18O02	Milltown	550651	617869
B4	Oakfront River	18O02	Springfort	550775	617421
B5	Oakfront River	18O02	Bridge at Coolcaum	551050	616256
C1	Rathnacally Stream	18R32	Clashganniv	552439	620511
C2	Rathnacally Stream	18R32	Bridge at Rathnacally	552633	619468
C3	Rathnacally Stream	18R32	Bridge at Ballynadrideen	552222	618157

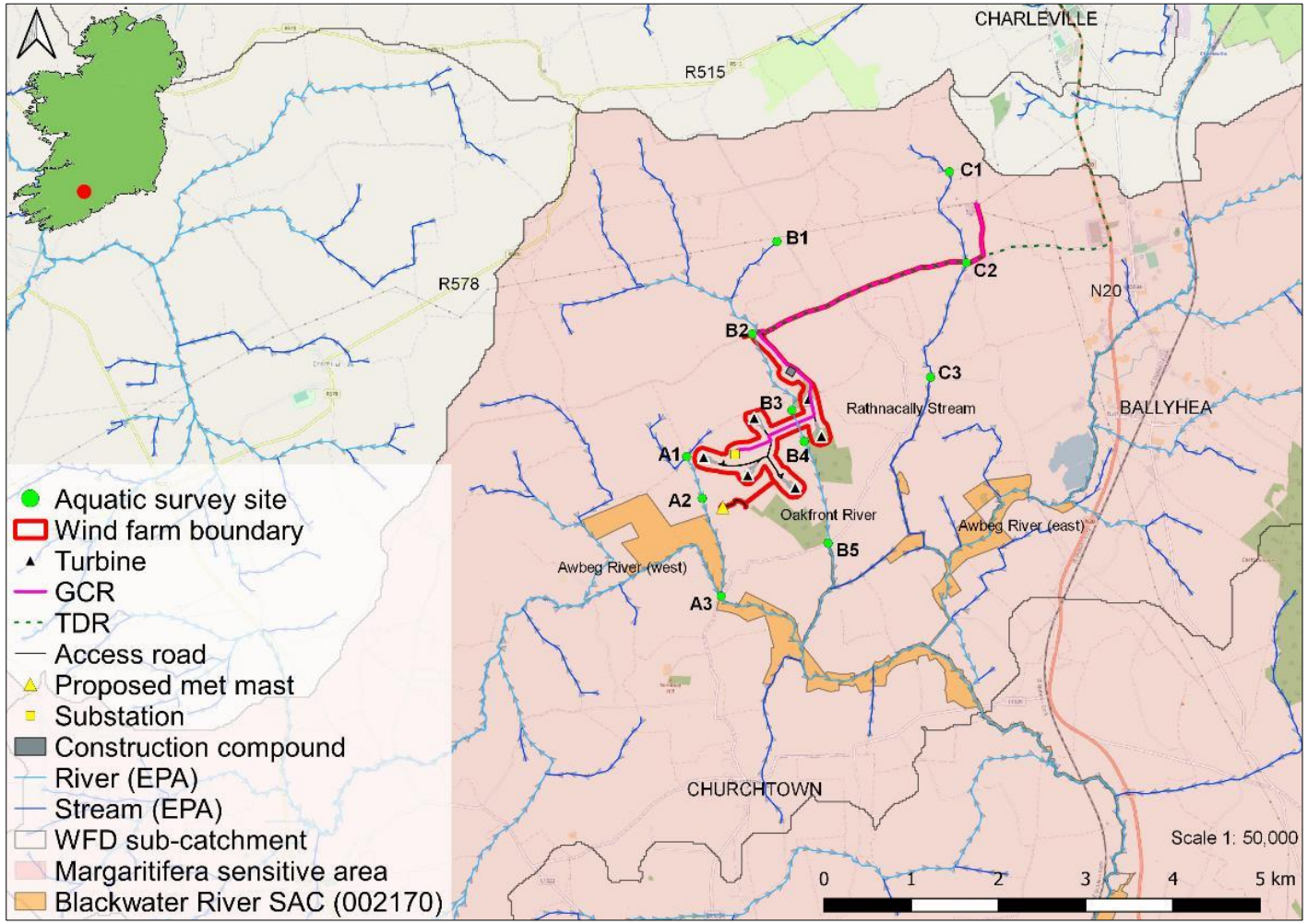

Figure 8-6: Aquatic Ecology Survey Sites

Walkover Surveys

Site surveys of the watercourses within the receiving environment of the proposed wind farm development were conducted in September 2020. Survey effort focused on both instream and riparian habitats approx. 150m upstream and 150m downstream of each sampling point (see **Figure 2.1** above). The watercourses at each survey site were described in terms of the important aquatic habitats and species. This helped to evaluate species and habitats of ecological value in the vicinity of each site. The aquatic baseline prepared informed mitigation for the wind farm development.

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

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

Catchment-wide electro-fishing

A catchment-wide electro-fishing (CWEF) survey of the watercourses within the footprint of the proposed wind farm (n=11 sites,
Figure 8-6) was conducted on the 2nd and 3rd September 2020, under authorisation from the Department of Communications, Climate Action & Environment (DCCAE) (letter dated 24th July 2020). The survey was undertaken in accordance with best practice: *Water Quality - Sampling of Fish with Electricity* (CEN, 2003); *Methods for the Water Framework Directive. Electric Fishing in Wadeable Reaches* (CFB, 2008) and *Moving from multiple pass depletion to single pass timed electrofishing for fish community assessment in wadeable streams* (Matson et al, 2018) and Section 14 licencing requirements.

Furthermore, a fisheries habitat appraisal of the watercourses in the footprint of the proposed wind farm development (
Figure 8-6) was undertaken to establish their importance for salmonid, lamprey, European eel and other fish species. The baseline assessment considered the quality of spawning, nursery and holding habitat within the vicinity of the survey sites using Life Cycle Unit (salmonids) and Lamprey Habitat Quality Index scores (lamprey).

For detailed survey methodology, please refer to accompanying fisheries assessment report in Appendix A of the Aquatic Ecology Report (Appendix 8.6 of this report)**.**

White-clawed crayfish survey

White-clawed crayfish (*Austropotamobius pallipes*) surveys were undertaken at the aquatic survey sites in September 2020 under a National Parks and Wildlife (NPWS) open licence (no. C79/2020), as prescribed by Sections 9, 23 and 34 of the Wildlife Act (1976-2012), to capture and release crayfish to their site of capture, under condition no. 5 of the license. As per Inland Fisheries Ireland recommendations, the crayfish license sampling started at the uppermost site(s) of the wind farm catchment/sub-catchments in the survey area to minimise the risk of transfer invasive propagules (including crayfish plague) in an upstream direction.

Hand-searching of instream refugia and sweep netting was undertaken according to Reynolds et al. (2010). Trapping of crayfish was not feasible given the small nature of most aquatic survey sites sampled.

An appraisal of white-clawed crayfish habitat at each site was also carried out based on physical channel attributes, water chemistry and incidental records in mustelid spraint. Additionally, a desktop review of crayfish records within the wider Awbeg River and Awbeg_SC_010 sub-catchment was undertaken.

eDNA analysis

To validate traditional surveys (outlined above) and to detect potentially cryptically-low populations within the study area, a total of *n*=2 samples from the Awbeg River (one on the western branch of the Awbeg draining the proposed wind farm and one on the eastern branch of the Awbeg) were analysed for white-clawed crayfish eDNA (see Figure 2.2 in Aquatic Report in Appendix 8.6 of this report). Furthermore, samples were also analysed for crayfish plague (hitherto unrecorded from the wider Munster Blackwater catchment). Samples were collected on 2nd April 2021, with the sites strategically chosen to maximise longitudinal (instream) coverage within the catchment (i.e. facilitating a greater likelihood of detection).

In accordance with best practice, composite (500ml) water samples were collected from each sampling point, maximising the geographic spread within each site (20 x 25ml samples at each site), thus increasing the chance of detecting the target species' DNA. Each composite sample was filtered on site using a sterile proprietary eDNA sampling kit. Fixed samples were stored at room temperature and sent to the laboratory for analysis. A total of *n*=12 qPCR replicates were analysed for each site. Given the high sensitivity of eDNA analysis, a single positive qPCR replicate is considered as proof of the species' presence (termed qPCR No Threshold, or qPCR NT). Whilst an eDNA approach is not currently quantitative, the detection of the target species' DNA indicates the presence of the species at and or upstream of the sampling point. Please refer to Appendix D of the Aquatic Ecology Report (included in Appendix 8.6 of this report) for full eDNA laboratory analysis methodology.

Freshwater pearl mussel survey

A freshwater pearl mussel (*Margaritifera margaritifera*) survey was undertaken in September 2020 at a total of *n*=14 sites on the Ardglass River, Oakfront River, Awbeg River (east and west branches) and Rathnacally Stream (under NPWS licence C201/2020). Methodology followed NPWS guidance (Anon, 2004) and included bathyscope and snorkel surveys, dependant on local water depths and flow regimes. Assessments were made of the habitat suitability for freshwater pearl mussels, based on the criteria of Hastie et al. (2000) and Skinner et al. (2003). Please refer to Appendix B of the Aquatic Ecology Report (included in Appendix 8.6 of this report) for detailed methodology.

Biological water quality (Q-sampling)

Given the unsuitability of some sites (lack of flow, lack of water or too deep), biological water quality was assessed at a total of *n*=7 aquatic survey sites through Q-sampling during September 2020 (see Figure 2.3 in the Aquatic Ecology Report included in Appendix 8.6 of this report). Macro-invertebrate samples were converted to Q-ratings as per Toner et al. (2005). All riverine samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a three-minute sample. Large cobble was also washed at each site where present and samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification. Any rare invertebrate species were identified from the NPWS Red List publications for beetles (Foster et al., 2009), mayflies (Kelly-Quinn & Regan, 2012), stoneflies (Feeley et al., 2020) and other relevant taxa (i.e. Byrne et al., 2009; Nelson et al., 2011).

Otter signs

The presence of otter (*Lutra lutra*) at each aquatic survey site was determined through the recording of otter signs within 150m upstream and downstream of the site.

These included holts, couches, spraints, latrines, slides and prints which are useful determinants of otter utilisation of watercourses. The location of signs was recorded via handheld GPS.

Aquatic ecological evaluation

The evaluation of aquatic ecological receptors contained within this report uses the geographic scale and criteria defined in the 'Guidelines for Assessment of Ecological Impacts of National Road Schemes' (NRA, 2009).

Biosecurity

A strict biosecurity protocol including the Check-Clean-Dry approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Surveys were undertaken at sites in a downstream order to minimise the risk of upstream propagule mobilisation. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced.

8.2.5.7 Other Species

Observations of other species and groups including Herpetofauna and invertebrates were recorded during the ecological walkover, and any incidental observations of other species made during surveys were recorded.

8.2.6 Ecological Resource Evaluation

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

This guidance provides ratings for resources based primarily on geographic context and allows for resources at International, National, County and Local (higher and lower value) levels. Key ecological receptors (for assessment) are those deemed to be above the 'Local Importance (lower value) evaluation. Evaluation criteria are outlined below in Table 8-13:

Table 8-13: 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.

Resource Evaluation	Defining Criteria
	Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive. Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or Species of animal and plants listed in Annex II and/or IV of the Habitats Directive. Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971). World Heritage Site (Convention for the Protection of World Cultural and Natural Heritage, 1972). Biosphere Reserve (UNESCO Man and The Biosphere Programme). Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979). Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979). Biogenetic Reserve under the Council of Europe. European Diploma Site under the Council of Europe. Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).
National Importance	Site designated or proposed as a Natural Heritage Area (NHA). Statutory Nature Reserve. Refuge for Fauna and Flora protected under the Wildlife Acts. National Park. Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park. Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Site containing 'viable areas' of the habitat types listed in Annex I of the Habitats Directive.
County Importance	Area of Special Amenity. Area subject to a Tree Preservation Order. Area of High Amenity, or equivalent, designated under the County Development Plan. Resident or regularly occurring populations (assessed to be important at the County level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance.

Resource Evaluation	Defining Criteria
	County important populations of species, or viable areas of semi-natural habitats or natural heritage features identified in the National or Local BAP, if this has been prepared. Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county. Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.
Local Importance (Higher Value)	Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared; Resident or regularly occurring populations (assessed to be important at the Local level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Sites containing semi natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality; Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.
Local Importance (Lower Value)	Sites containing small areas of semi natural habitat that are of some local importance for wildlife; Sites or features containing non-native species that are of some importance in maintaining habitat links.

8.2.7 Avifauna Receptor Evaluation

Avifauna resources are to be initially evaluated as to whether or not they constitute key receptors for the assessment following NRA guidance as outlined in Table 8-13**Error! Reference source not found.**, previously. F or the purposes of impact assessment, a receptor 'importance value' or sensitivity, following published guidance as in Percival (2007), SNH (2014, 2017) and literature review of published information on birds and wind farms (Pearce-Higgins J. L., 2009; Pearce-Higgins J. S., 2012; Drewitt A. L., 2006; Drewitt and Langston, 2008 and Masden, 2009) is calculated. Where provided receptor values from Percival (2007) are below those recommended in guidance within the Irish context (NRA, 2009a); then the evaluation has been increased in line with the recommended Irish evaluation as a precautionary principle. Table 8-14 illustrates the combined receptor evaluation criteria used to assign sensitivity levels to key receptors.

Table 8-14: 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	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;	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

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

8.2.8 Aquatic Receptor Evaluation

Ecological features are assessed on a scale ranging from international-national-county-local (see **Error! R eference source not found.**). The local scale is approximately equivalent to one 10 km square but can be operationally defined to reflect the character of the area of interest.

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

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

8.2.9 Assessing Effect Significance

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

Table 8-15 to Table 8-21 outline the EPA evaluation criteria utilised in this appraisal of the Environmental Factor, Biodiversity. This criteria is included in the Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA, August 2017).

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

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

Table 8-16: 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 8-17: Significance of Effects (EPA, 2017)

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

Table 8-18: Duration of Effects (EPA, 2017)

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

Table 8-19: 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

Type of Effect	Description
Cumulative Effects	The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects.
'Do Nothing' Effects	The environment as it would be in the future should the subject project not be carried out.
'Worst Case' Effects	The effects arising from a project in the case where mitigation measures substantially fail
Indeterminable Effects	When the full consequences of a change in the environment cannot be described.
Irreversible Effects	When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.
Reversible Effects	Effects that can be undone, for example through remediation or restoration
Residual Effects	The degree of environmental change that will occur after the proposed mitigation measures have taken effect
Synergistic Effects	Where the resultant effect is of greater significance than the sum of its constituents (e.g. combination of SOx and NOx to produce smog).

Table 8-20: Definition of Terms – Source, Pathway, Receptor (EPA, 2017)

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

Table 8-21: Confidence levels of predictions of impacts (NRA, 2009a)

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

Assessment of Effect Type and Magnitude

Assessment of effects takes into account construction, operational and decommissioning effects with reference to the potential for direct, indirect and cumulative effects. The assessment also takes account of any residual effects that may persist following the implementation of any mitigation or best practice design.

The characterisation of effects reflects the ecological structure and function upon which the key ecological receptors depend. Detailed assessment of effects takes into account the magnitude of effects affecting populations.

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

The criteria outlined in

Table 8-22 below has been developed by Percival (2003) to determine the magnitude of potential effects on a species. Methodology for assessing sites outside of European Sites (i.e. SPAs) state '*the test of significance of an impact will be whether the wind farm impact is causing a significant change to the population its range or distribution*' (Percival, 2003). It is important to consider availability of alternative habitat elsewhere during this assessment (Percival, 2003).

Table 8-22: Determination of Magnitude Effects (Percival, 2003)

Magnitude	Description
Very High	Total loss or very major alteration to key elements/ features of the baseline conditions such that the post development character/ composition/ attributes will be fundamentally changed and may be lost from the site altogether. *Guide: < 20% of population / habitat remains*
High	Major loss or major alteration to key elements/ features of the baseline (pre-development) conditions such that post development character/ composition/ attributes will be fundamentally changed. *Guide: 20-80% of population/ habitat lost*
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition/attributes of baseline will be partially changed. *Guide: 5-20% of population/ habitat lost*
Low	Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible but underlying character/composition/attributes of baseline condition will be similar to pre-development circumstances/patterns. *Guide: 1-5% of population/ habitat lost*
Negligible	Very slight change from baseline condition. Change barely distinguishable, approximating to the "no change" situation. *Guide: < 1% population/ habitat lost*

The significance of potential effects is assessed by cross tabulating the magnitude of effects and bird sensitivity to predict significance of each potential effect. Population status, distribution and trends of potentially affected species such as migratory winter birds should be taken into consideration when undertaking the assessment. Significant ratings are interpreted as follows, **very low** and **low** should not normally be of concern however normal design care should be undertaken to minimise effects, **medium** represents a potentially significant effect that requires careful individual assessment, while **very high** and **high** represents a highly significant effect on bird populations. A significance matrix table, combining magnitude and sensitivity to assess overall significance is presented in Table 8-23.

Table 8-23: Significance matrix: combining magnitude and sensitivity to assess significance (Percival, 2003)

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

8.3 Description of Existing Environment

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

8.3.1 Site Description

The proposed wind farm site is located north of Churchtown, Co Cork at Annagh, in a poorly drained level depression within the upper Awbeg River catchment west of the Ballyhoura Mountains. The proposed grid connection is also within the Awbeg catchment, which lies within the Muster Blackwater Catchment. The watercourses flowing through and adjacent to the proposed site drain to the Awbeg, which is located to the south of the proposed site and in turn drains to the (Munster) Blackwater south of Castletownroche.

The Annagh study area is underlain by calcareous bedrock composed of limestone & calcareous shale, while river alluvium and clayey drift with limestones are the predominant soils and subsoils. Siliceous subsoils (clayey shales and sandstone till) are present in fringing areas. The wind farm site is largely covered in broadleaved forestry plantation, with wet grassland and improved agricultural grassland also present. Land use practices throughout the study area are divided between improved agricultural pasture, broadleaved commercial afforestation and extensively grazed wet grassland.

8.3.2 Designated sites

8.3.2.1 Defining the Zone of Influence

The potential zone of influence ZoI for the wind farm and replant lands is defined by an initial search area of 15 km which was selected on the basis of national guidance which relates to plans (DEHLG, 2010) (adopted here on a precautionary basis to provide a wide initial search radius), in addition to any sites further afield with potential ecological links (i.e. hydrological links or mobile species). The ZoI is then refined further based on the potential impacts associated with the wind farm and replant lands and the conservation interests of individual sites. All sites identified in the initial search are detailed here.

The potential ZoI for the GCR and TDR is defined by a 500m buffer around the TDR Nodes and GCR alignment. The 500m buffer is informed by the limited scale of works required at TDR Nodes (vegetation clearance/trimming and placement of temporary load bearing surfaces are the most invasive works required) and the limited works footprint associated with the GCR. The 500m buffer has also been selected as this distance encompasses the buffering distances required for the most sensitive group (wetland and waterbirds) associated with designated sites.

The 500m buffer has been applied at all TDR Nodes and the GCR to maintain a consistent approach. Any sites outside the 500m buffer with potential hydrological links are also within the potential ZoI of the TDR and GCR. The ZoI is then refined further based on the potential impacts associated with works at particular TDR Nodes and the conservation interests of individual sites. All sites identified in the initial search are detailed here.

8.3.2.2 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 S.I. No. 477/2011 - European Communities (Birds and Natural Habitats) Regulations 2011.

There are two SACs within the potential Zone of Influence (ZoI) of the proposed Annagh Wind Farm Study Area. One of these is also within the potential ZoI of the GCR due to a hydrological linkage. See Table 8-24: and Figure 8-7 for details.

There are five SACs within the potential Zone of Influence (ZoI) of the TDR (including one SAC >500m from a TDR Node but with a hydrological linkage). See Table 8-24: and Figure 8-7 for details.

There are five SACs within the potential ZoI of the proposed replant lands at Emlagh, Co. Clare. See **Error! R eference source not found.**Table 8-25 for details.

The full NPWS site synopses for designated areas are available on www.NPWS.ie.

Special Protection Areas (SPAs)

Special Protection Areas (SPAs) are designated under the EU Birds Directive (2009/147/EC) ('The Birds Directive').

There are two SPAs within the potential Zone of Influence (ZoI) of the proposed Annagh Wind Farm Study Area. See Table 8-24: and Figure 8-7 for details.

There is one SPA within the potential Zone of Influence (ZoI) of the TDR. See Table 8-24: and Figure 8-7 for details.

There are three SPAs within the potential ZoI of the proposed replant lands at Emlagh, Co. Clare. See **Error! R eference source not found.**Table 8-25 for details.

The full NPWS site synopses for designated areas are available on www.NPWS.ie.

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

8.3.2.3 Sites of National Importance

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

While the Wildlife (Amendment) Act 2000 has been passed into law, pNHAs will not have legal protection until the consultative process with landowners has been completed; this process is currently ongoing.

No NHAs and seven pNHAs are present within 15 km of the proposed wind farm and proposed grid connection route (see Table 8-26).

A further four pNHAs and no NHAs are present within the potential ZOI of the TDR. One of these pNHAs is over 20 km downstream but has been included in the initial identification of site within the potential ZoI due to the hydrological linkage. See Table 8-26 and Figure 8-8 for details.

One NHA and nine pNHAs are within 15 km of the proposed replant lands. See **Error! Reference source not found.** for details.

Figure 8-7 and Figure 8-8 show the location of the designated sites in relation to the proposed turbine locations. The closest European site to the wind farm is Blackwater River (Cork/Waterford) cSAC (located c. 0.65 km from the nearest proposed turbine); see Table 8-24 for details. The closest (national) designated site to the wind farm is Ballyhoura Mountains pNHA, which is located c. 6.4 km east from the closest turbine. See Table 8-26 for more information.

Table 8-24: Summary of European Sites within potential ZoI of wind farm and GCR and TDR

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	Distance to grid connection (km)	Distance to TDR /Nodes (km)
Blackwater River (Cork/Waterford) cSAC	002170	• Estuaries [1130] • Mudflats and sandflats not covered by seawater at low tide [1140] • Perennial vegetation of stony banks [1220] • 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*	0.65 km	0.74 km	>500m (1.9 km straight line) (1.5 km in-stream)

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	Distance to grid connection (km)	Distance to TDR /Nodes (km)
		fluitantis and *Callitricho-Batrachion* vegetation [3260] • Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0] • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] • *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029] • *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]			
Ballyhoura Mountains SAC	002036	• Northern Atlantic wet heaths with Erica tetralix [4010] • European dry heaths [4030] • Blanket bogs (* if active bog) [7130]	8.2 km	6.8 km	>500m (5.5 km)
Kilcolman Bog SPA	004095	• Whooper Swan (*Cygnus cygnus*) [A038] • Teal (*Anas crecca*) [A052] • Shoveler (*Anas clypeata*) [A056] • Wetland and Waterbirds [A999]	9.1 km	9.5 km	>500m (9.2 km)
Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA	004161	• Hen Harrier (Circus cyaneus) [A082]	17.8 km	18 km	5 km
Lower River Shannon SAC	002165	• Sandbanks which are slightly covered by sea water all the time [1110] • Estuaries [1130]	>15 Km (28.9 km)	>15 Km (27.0 km)	0 m

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	Distance to grid connection (km)	Distance to TDR /Nodes (km)
		• Mudflats and sandflats not covered by seawater at low tide [1140] • Coastal lagoons [1150] • Large shallow inlets and bays [1160] • Reefs [1170] • Perennial vegetation of stony banks [1220] • Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] • *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] • Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410] • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae, Salicion albae*) [91E0] • *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029] • *Petromyzon marinus* (Sea Lamprey) [1095] • *Lampetra planeri* (Brook Lamprey) [1096] • *Lampetra fluviatilis* (River Lamprey) [1099] • *Salmo salar* (Salmon) [1106] • *Tursiops truncatus* (Common Bottlenose Dolphin) [1349] • *Lutra lutra* (Otter) [1355]			
River Shannon and River Fergus Estuaries SPA	004077	• Cormorant (*Phalacrocorax carbo*) [A017] • Whooper Swan (*Cygnus cygnus*) [A038]	>15 Km (34.5 km)	>15 Km (32.5 km)	0 m (TDR route)

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	Distance to grid connection (km)	Distance to TDR /Nodes (km)
		• Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] • Shelduck (*Tadorna tadorna*) [A048] • Wigeon (*Anas penelope*) [A050] • Teal (*Anas crecca*) [A052] • Pintail (*Anas acuta*) [A054] • Shoveler (*Anas clypeata*) [A056] • Scaup (*Aythya marila*) [A062] • Ringed Plover (*Charadrius hiaticula*) [A137] • Golden Plover (*Pluvialis apricaria*) [A140] • Grey Plover (*Pluvialis squatarola*) [A141] • Lapwing (*Vanellus vanellus*) [A142] • Knot (*Calidris canutus*) [A143] • Dunlin (*Calidris alpina*) [A149] • Black-tailed Godwit (*Limosa limosa*) [A156] • Bar-tailed Godwit (*Limosa lapponica*) [A157] • Curlew (*Numenius arquata*) [A160] • Redshank (*Tringa totanus*) [A162] • Greenshank (*Tringa nebularia*) [A164] • Black-headed Gull (*Chroicocephalus ridibundus*) [A179] • Wetland and Waterbirds [A999]			360m (TDR Node 5) 380m (TDR Node 6)
Barrigone SAC	000432	• Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) [6210] • Limestone pavements [8240] • *Euphydryas aurinia* (Marsh Fritillary) [1065]	>15 Km (37.2 km)	>15 Km (37.0 km)	0 m
Curraghchase Woods SAC	000174	• *Taxus baccata* woods of the British Isles [91J0] • *Vertigo moulinsiana* (Desmoulin's Whorl Snail) [1016] • *Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303]	>15 Km (31.5 km)	>15 Km (30.1 km)	0 m

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	Distance to grid connection (km)	Distance to TDR /Nodes (km)
Askeaton Fen Complex SAC	002279	• Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* [7210] • Alkaline fens [7230]	>15 Km (30.8 km)	>15 Km (29.7 km)	0 m

Table 8-25: Summary of European Sites within 15 km/potential ZoI of Replant Lands

Designated Site	Site code	Features of Interest	Distance to Replant Lands (km)
Tullaher Lough and Bog SAC	002343	• 7110 Active raised bogs* • Degraded raised bogs still capable of natural regeneration 7120 • Transition mires and quaking bogs 7140 • Depressions on peat substrates of the Rhynchosporion 7150	1.3 km
Lower River Shannon SAC	002165	• Sandbanks which are slightly covered by sea water all the time [1110] • Estuaries [1130] • Mudflats and sandflats not covered by seawater at low tide [1140] • Coastal lagoons [1150] • Large shallow inlets and bays [1160] • Reefs [1170] • Perennial vegetation of stony banks [1220] • Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] • *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*	1.8 km (1.7 km in-stream)

Designated Site	Site code	Features of Interest	Distance to Replant Lands (km)
		fluitantis and *Callitricho-Batrachion* vegetation [3260] • Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410] • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae, Salicion albae*) [91E0] • *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029] • *Petromyzon marinus* (Sea Lamprey) [1095] • *Lampetra planeri* (Brook Lamprey) [1096] • *Lampetra fluviatilis* (River Lamprey) [1099] • *Salmo salar* (Salmon) [1106] • *Tursiops truncatus* (Common Bottlenose Dolphin) [1349] • *Lutra lutra* (Otter) [1355]	
River Shannon and River Fergus Estuaries SPA	004077	• Cormorant (*Phalacrocorax carbo*) [A017] • Whooper Swan (*Cygnus cygnus*) [A038] • Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] • Shelduck (*Tadorna tadorna*) [A048] • Wigeon (*Anas penelope*) [A050] • Teal (*Anas crecca*) [A052] • Pintail (*Anas acuta*) [A054] • Shoveler (*Anas clypeata*) [A056] • Scaup (*Aythya marila*) [A062] • Ringed Plover (*Charadrius hiaticula*) [A137] • Golden Plover (*Pluvialis apricaria*) [A140] • Grey Plover (*Pluvialis squatarola*) [A141] • Lapwing (*Vanellus vanellus*) [A142] • Knot (*Calidris canutus*) [A143] • Dunlin (*Calidris alpina*) [A149]	1.8 km (1.7 km in-stream)

Designated Site	Site code	Features of Interest	Distance to Replant Lands (km)
		• Black-tailed Godwit (*Limosa limosa*) [A156] • Bar-tailed Godwit (*Limosa lapponica*) [A157] • Curlew (*Numenius arquata*) [A160] • Redshank (*Tringa totanus*) [A162] • Greenshank (*Tringa nebularia*) [A164] • Black-headed Gull (*Chroicocephalus ridibundus*) [A179] • Wetland and Waterbirds [A999]	
Kilkee Reefs SAC	002264	• Large shallow inlets and bays 1160 • Reefs 1170 • Submerged or partially submerged sea caves 8330	5.1 km
Mid-Clare Coast SPA	004182	• Cormorant (Phalacrocorax carbo) A017 • Barnacle Goose (Branta leucopsis) A045 • Turnstone (Arenaria interpres) A169 • Purple Sandpiper (Calidris maritima) A148 • Ringed Plover (Charadrius hiaticula) A137 • Dunlin (Calidris alpina) A149 • Sanderling (Calidris alba) Habitats Wetlands A144	6.2 km
Carrowmore Dunes SAC	002250	• Reefs 1170 • Embryonic shifting dunes 2110 • Shifting dunes along the shoreline with Ammophila arenaria (white dunes) 2110 • Fixed coastal dunes with herbaceous vegetation (grey dunes)* 2130 • Narrow-mouthed Whorl Snail (Vertigo angustior) 1014	6.3 km

Designated Site	Site code	Features of Interest	Distance to Replant Lands (km)
Carrowmore Point to Spanish Point and Islands SAC 001021	001021	• Coastal lagoons* 1150 • Reefs 1170 • Perennial vegetation of stony banks 1220 • Petrifying springs with tufa formation (Cratoneurion)* 7220	10.2 km
Illaunonearaun SPA	004114	• Barnacle Goose (Branta leucopsis) A045	11.6 km

Table 8-26: Summary of National Sites within Potential ZoI of wind farm and GCR and TDR

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	Distance to grid connection (km)	Distance to TDR /Nodes (km)
Ballyhoura Mountains pNHA/SAC	002036	• Wet Heath • Dry Heath • Blanket Bog	6.4 km	5.9 km	>500m (5.1 km)
Ballinvonear Pond pNHA	000012	• Golden Dock (*Rumex maritima*)	7.1 km	7.5 km	>500m (7 km)
Eagle Lough pNHA	001049	• Turlough/Fluctuating Lake over Limestone • Orange Foxtail (*Alopecurus aegualis*)	8.3 km	9 km	>500m (9.8 km)
Kilcolman Bog pNHA	000092	• Red Goosefoot (*Chenopodium rubrum*) • Golden Dock (*Rumex maritima*) • Wintering Waterfowl	9.2 km	9.7 km	>500m (9.1 km)
Mountrussel Wood pNHA	002088	• Wet Meadows • Wet Woodland • Oak Woodland Remnants	10 km	7.9 km	>500m (6.4 km)
Awbeg Valley (Above Doneraile) pNHA	000075	• Wooded River Valley over Limestone	11.7 km (c. 20 km downstream of wind farm)	12.5 km (c. 20 km downstream of Rathnacally GCR crossing)	>500m (c. 20 km downstream of TDR Node 10.5)
Ballintlea Wood pNHA	002086	• Wooded Ravine	12.7 km	11.5 km	>500m (10.2 km)
Castleoliver wood pNHA	002090	• Woodland	14.6 km	12.6 km	>500m (11.2 km)

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	Distance to grid connection (km)	Distance to TDR /Nodes (km)
Inner Shannon Estuary – South Shore pNHA	000435	• Mudflats • Waterbirds • Triangular Club-rush (*Scirpus triqueter*) • Summer Snowflake (*Leucojuin pestirum*)	>15 km	>15 km	0 m (TDR Nodes 5 & 6, TDR route)
Curraghchase Woods pNHA/SAC	000174	• Alluvial woodland • Yew Woodland • Desmoulin's Whorl Snail • Lesser Horseshoe Bat	>15 km	>15 km	0 m (TDR route)
Barrigone pNHA/SAC	000432	• Juniper formations on heaths or calcareous grasslands • Calcareous scrubland and grassland with orchids • Limestone pavement • Marsh Fritillary (*Euphydryas aurinia*)	>15 km	>15 km	0 m (TDR route)

Table 8-27: Summary of National Sites within 15 km/ potential ZoI of Replant Lands

Designated Site	Site code	Features of Interest	Distance to Replant Lands (km)
Tullaher Lough and Bog pNHA	000070	• Raised bog	1.3 km
Poulnasherry Bay pNHA	000065	• Saltmarsh • Estuary • Waders and waterfowl	1.5 km (straight-line distance) 1.7 km (in-stream distance)
Farrihy Lough pNHA	000200	• Brackish Lake • Waders	4.6 km
Scattery island pNHA	001911	• Tidal Lagoon • Species-rich grassland	7.6 km
White Strand/Carrowmore Marsh pNHA	001007	• Sand Dunes • Freshwater Marsh	7.7 km

Designated Site	Site code	Features of Interest	Distance to Replant Lands (km)
Carrowmore to Spanish Point and Islands pNHA/SAC	001021	• Coastal lagoons • Reefs • Perennial vegetation of stony banks • Petrifying springs with tufa formation	10 km
St. Senan's Lough pNHA	001025	• Acidic Lake • Marsh	11.2 km
Illaunonearaun NHA/SPA	004114	• Barnacle Goose	11.3 km
Beal Point pNHA	001335	• Sand Dunes • Saltmarsh	11.6 km
Ballylongford Bay pNHA	001332	• Waterfowl	12 km

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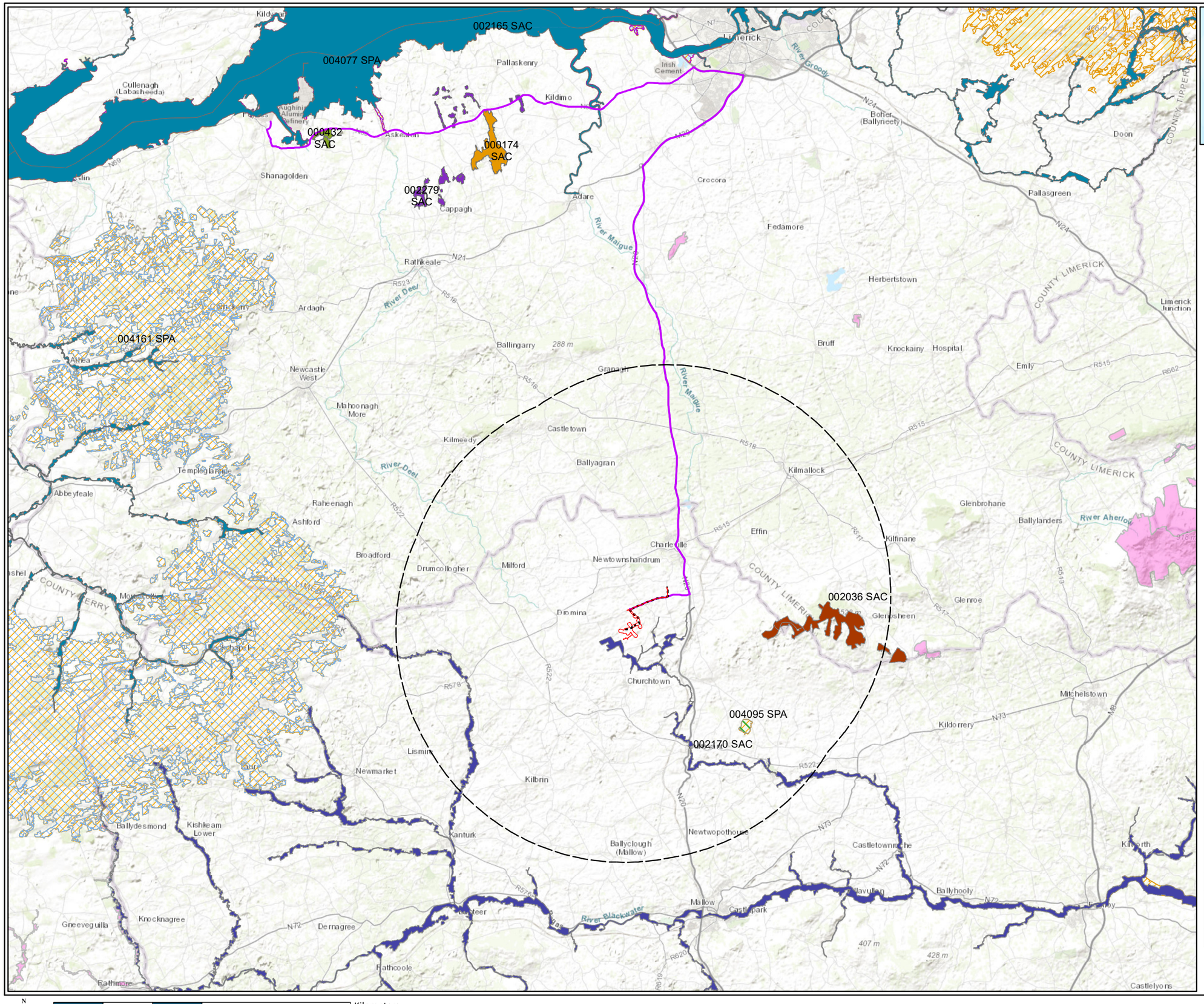

Legend

- Site Boundary
- 15km Buffer
- Underground Cable Route
- Turbine Delivery Route
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)

SACs within 15km Buffer

Site Code and Site Name:

- 002036: Ballyhoura Mountains SAC
- 002170: Blackwater River (Cork/Waterford) SAC

SACs within potential ZoI of TDR

- 000174:Curraghchase Woods SAC
- 000432:Barrigone SAC
- 002165:Lower River Shannon SAC
- 002279:Askeaton Fen Complex SAC

SPAs within 15km Buffer

Site Code and Site Name:

- 004095: Kilcolman Bog SPA

SPAs within potential ZoI of TDR

- 004077:River Shannon and River Fergus Estuaries SPA

SPAs of Interest

- 004161:Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA

N W E S

0 5 10 20 Kilometers

TITLE: European Sites within the Zone of Interest (ZoI)			
PROJECT: Annagh Wind Farm, Co. Cork			
FIGURE NO:	8.7		
CLIENT:	EMPower		
SCALE:	1:250000	**REVISION:**	0
DATE:	12/10/2021	**PAGE SIZE:**	A3

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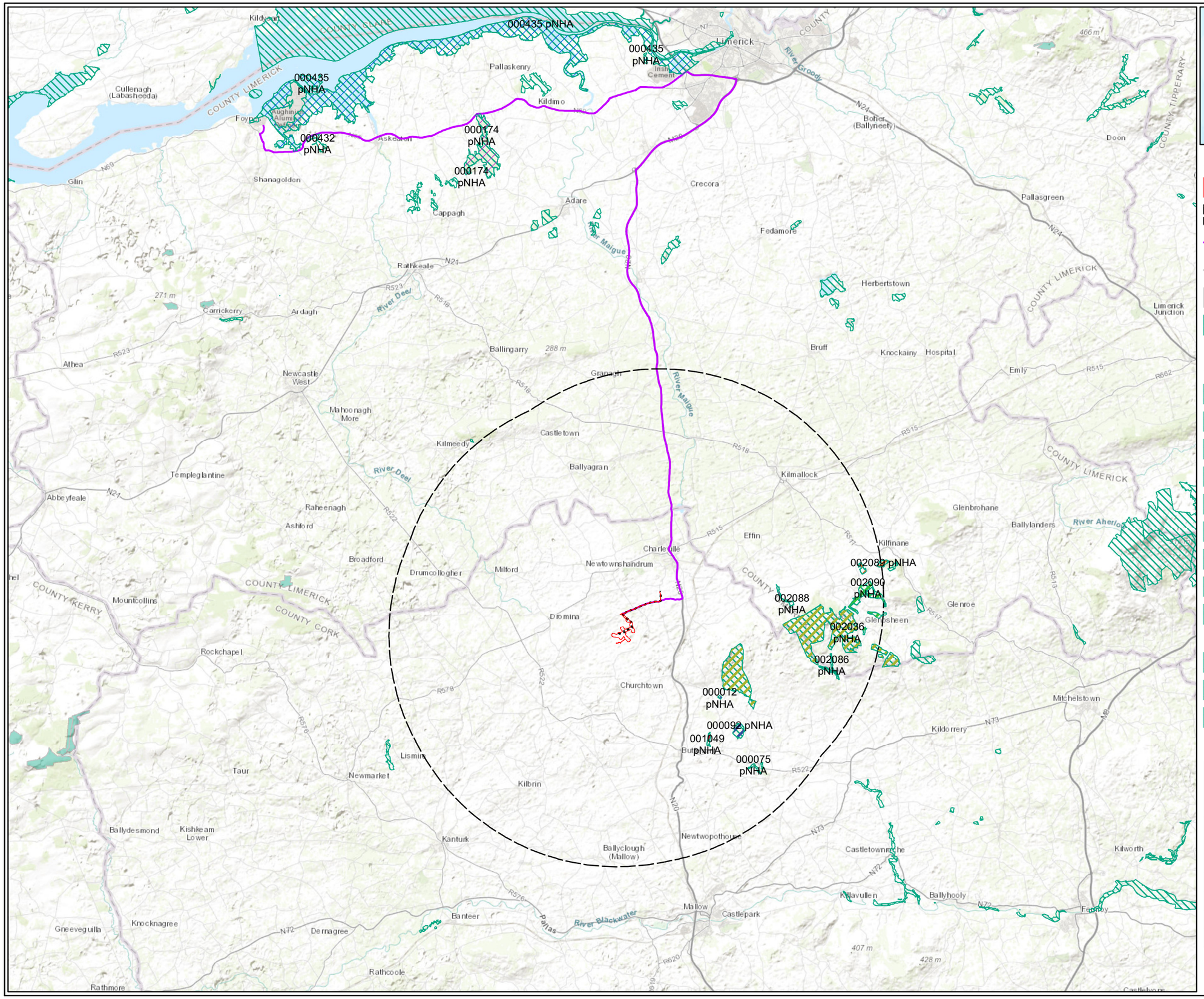

Legend

- Site Boundary
- 15km Buffer
- Turbine Delivery Route
- Underground Cable Route
- Natural Heritage Area (NHA)
- Proposed Natural Heritage Area (pNHA)

pNHAs within 15km Buffer

Site Code and Site Name:

- 000012: Ballinvonear Pond
- 000075: Awbeg Valley (Above Doneraile)
- 000092: Kilcolman Bog
- 001049: Eagle Lough
- 002036: Ballyhoura Mountains
- 002086: Ballintlea Wood
- 002088: Mountrussell Wood
- 002089: Ballyroe Hill & Mortlestown Hill
- 002090: Castleoliver Woods

pNHAs within potential ZoI of TDR

- 000174: Curraghchase Woods
- 000432: Barrigone
- 000435: Inner Shannon Estuary - South Shore

TITLE: National Sites within 15km			
PROJECT: Annagh Wind Farm, Co. Cork			
FIGURE NO:	8.8		
CLIENT:	EMPower		
SCALE:	1:250000	**REVISION:**	0
DATE:	12/10/2021	**PAGE SIZE:**	A3

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N W E S

0 5 10 20 Kilometers

8.3.2.4 Other Designated Sites

Nature Reserves

There is one nature reserve, Kilcolman Bog within 15 km of the proposed development. There are no other nature reserves within 15 km of the proposed development and TDR. As noted above, Kilcolman Bog is also an SPA and pNHA.

Ramsar Sites

There are no Ramsar sites within 15 km of the proposed development. The closest Ramsar site is The Gearagh, c. 48 km southwest of the proposed development.

There are no Ramsar Sites within 15 km of the TDR. The closest Ramsar Site to the TDR is Ballyallia Lough c. 29 km north of the Port of Foynes.

8.3.2.5 Other Sites of Interest

The national survey of native woodlands (NSNW) dataset obtained from NPWS indicates the presence of Ardglass Bog Woodland, an area of woodland c. 1 km north-west of the Site. Part of this woodland is also identified as being ancient/long-established woodland. Ardglass Bog Woodland is also identified in the Wetlands of Ireland dataset, which cites the NSNW as it's source of information. This woodland borders the Oakfront River, c. 1.6 km upstream of the proposed Site.

A number of other wetland sites in the area are identified in the Wetlands of Ireland dataset, namely Milltown lake, Coolmore Carrigeen, Clashganniv Pond and Leap Wetland.

Milltown Lake was included in the Hinterland bird surveys (see Site 4 in Figure 8-4). This small lake includes fringing reed beds and marsh. This lake is upstream of the proposed site.

Coolmore Carrigeen which is located upstream of the Site on a tributary of the western branch of the Awbeg River is noted as including lake, river, marsh, wet grassland and scrub habitats in the Wetlands of Ireland dataset.

Clashganniv Pond is an artificial pond with fringing scrub c. 1.9 km south-east of the site and is isolated from the hydrological network as indicated by EPA mapping and aerial imagery.

Leap Wetland is a small lake/pond located c. 2.6 km south-east of the site which is noted as including lake, river, marsh, wet grassland and scrub habitats in the Wetlands of Ireland dataset. This wetland drains to a tributary of the Awbeg which joins the Awbeg main channel downstream of the proposed Site, east of Chuchtown.

A such none of the nearby wetlands identified in the Wetlands of Ireland dataset are downstream of the proposed site. It is noted that excepting Ardglass Bog Woodland, the Wetlands of Ireland dataset categorises the above sites as requiring survey to establish their conservation importance.

8.3.3 Rare and Protected Flora

The results of botanical and habitat surveys carried out are described in Section 8.3.5.1. The Annagh wind farm site is located within Ordnance Survey National Grid 10km Squares R41 an R51.

These 10km grid squares were searched for records of plant species through the National Biodiversity Data Centre (NBDC) website (most recent search on 14th April 2021).

This list was then compared to the lists of species protected under the Flora (Protection) Order of 2015; the Ireland Red List No. 10: Vascular Plants (Wyse *et al*., 2016) and the Ireland Red List No. 8: Bryophytes (Lockhart *et al.*, 2012). In addition, data on rare/protected species recorded in 10km grid squares within a 10km radius of the wind farm site was obtained from NPWS (received 22nd March 2021); this encompassed grid squares R31, R32, R40, R41, R42, R50, R51, R5, 561 and R62. The 1 km grid squares overlapping the proposed grid route were also searched; there are no records of rare flora within these grid squares.

Table 8-28 presents details of the rare and protected plant species found within the 10km squares R31, R32, R40, R41, R42, R50, R51, R5, 561 and R62. Information on habitats was completed using; Streeter et al. *'Collins Wildflower Guide'* 2nd edition, 2018 and the British Bryological society's '*Mosses and Liverworts of Britain and Ireland a field guide*' 2010.

Records for three species are within the 10km grid squares (R41 and R51) which overlap the proposed wind farm site; Woodsy Thyme-moss *Plagiomnium cuspidatum,* Golden Dock *Rumex maritimus* and Hasselquist's Hyssop *Entosthodon fascicularis*.

Within the study area habitats broadly suitable for golden dock, orange foxtail and smooth brome are present, while there is some potential for woodsy thyme-moss habitat to occur. However, these species were not observed during the botanical survey. Suitable habitats for hasselquist's hyssop and killarney fern are not present. No rare or protected flora was found within the main wind farm site, the grid connection or the TDR during surveys.

The NPWS FPO Bryophyte Sites map viewer was also consulted. There are no FPO Bryophyte Sites at or near the proposed site (closest is Glonosheen in the Ballyhoura Mountains, c. 14 km east).

Table 8-28: Historic Records of rare and protected flora within the 10km Grid Squares (R31, R32, R40, R41, R42, R50, R51, R5, 561 and R62) within 10km of the Study Area (supplied by NPWS)

Species	Grid Square	Location of Record	Year of Last Record	Survey/Dataset	Conservation Status	Habitat	Result of surveys for Annagh
Woodsy Thyme-moss *Plagiomnium cuspidatum*	R41	Liscarroll	2012	Bryophytes of Ireland	Near Threatened	Soil, rock, stumps and tree bases in base-rich habitats (mainly lowland).	Not observed.
Golden Dock *Rumex maritimus*	R51	Ballinvonear Kilcolman Bog	1993	BSBI tetrad data for Ireland	Vulnerable	Margins of ditches, pools, marshy fields with standing water in winter.	Not observed.
Hasselquist's Hyssop *Entosthodon fascicularis*	R51	Kilcolman	2006	Bryophytes of Ireland	Near Threatened	Primarily on arable fields and other recently disturbed soil. Occasionally present on thin soil overlying limestone.	Not observed.
Orange Foxtail *Alopecurus aequalis*	R50	Eagle Lough	1992	NPWS Rare/Threatened Plants Database	Flora (Protection) Order, 2015; Near Threatened	Shallow water of ponds and ditches, wet meadows; especially on drying mud. Lowland.	Not observed.
Smooth Brome *Bromus racemosus*	R61	Not Recorded	1965	NPWS Scarce Plants Spreadsheet (Historic Records)	Near Threatened	Hay fields, old pasture, water meadows, field margins.	Not observed.
Killarney Fern *Trichomanes speciosum*	R61	Carrigeenamronety	2005	Herbarium and Literature Database 19/02/2013	Flora (Protection) Order, 2015	Damp, shaded acid rocks; ravines with constantly running water.	Not observed.

8.3.4 Invasive Non-native Flora

The invasive species listed in Table 8-29: have been recorded within the 10 km grid squares (R41 and R51) overlapping the main wind farm site. Four invasive plant species have been recorded in these 10km grid squares, one of which (Japanese Knotweed) is listed in Schedule III under Regulations 49 and 50 of the EC (Birds and Natural Habitats) Regulations 2011, which makes it an offence to cause the spread of plant species listed on the Schedule. None of these species were within the 2km grid squares which overlapping the proposed wind farm. Sycamore is a widely spread species of 'Medium Risk'. Cherry laurel is still widely planted and is associated with a 'risk of High Impact' however it is noted this risk refers specifically to semi-natural woodland habitats. Neither sycamore or cherry laurel are Schedule III listed.

Invasive species recorded within 1km grid squares which overlap the grid connection route are also detailed within Table 8-29:

Table 8-29: Invasive Species within 10km and 2 km grid squares overlapping Annagh Wind Farm and 1km squares overlapping grid connection route

Species	1km (Grid Cable Route)	2 km	10km	Invasive Impact	Legal Status	Recorded in study area
Cherry Laurel *Prunus laurocerasus*	R5219	-	R51	High Risk	None	Planted along northern boundary of study area.
Japanese Knotweed *Fallopia japonica*	None	-	R41	High Risk	Schedule III	No
Sycamore *Acer pseudoplatanus*	R5219	-	R41, R51	Medium Risk	None	Present in some treelines northern part of study area.
Russian-vine *Fallopia baldschuanica*	None	-	R51	Medium Risk	None	No

8.3.4.1 Invasive Species Recorded within the Study Area

The main wind farm site

Cherry laurel is present at the proposed site entrance. This species has been planted along the L1132 road/field boundary where an older hedgerow has been cut back.

Sycamore is present at the proposed site entrance.

Montbretia is present on the banks of the Oakfront river near the site entrance. This area is outside the proposed development footprint. The invasiveness of this species has not been assessed by the National Biodiversity Data Centre (NBDC), however this species is known to be a successful invader of grassy margins and other open habitats.

The non-native species Wilson's honeysuckle *Lonicera nitida* is also present at the proposed site entrance. The invasiveness of this species has not been assessed by the NBDC and as such it is noted here on a precautionary basis.

The grid connection

A total of three invasive species were recorded along the grid connection route. These were cherry laurel (high risk; one location), snowberry *Symphoricarpos albus* (low risk of impact; common along route) and sycamore (medium risk) which is also common along the route. The specific locations of cherry laurel and snowberry are shown on figure 8-7. No Schedule III listed species are present along the route.

In addition, two further non-native species whose invasiveness has not yet been assessed, Wilson's honeysuckle and flowering currant *Ribes sanguineum* are present in association with older dwellings along the route.

Table 8-30: Invasive and non-native species recorded along the proposed grid connection route

Species	Invasive Impact	Legal Status
Snowberry *Symphoricarpus albus*	Low Risk	None
Sycamore Acer pseudoplatanus	Medium Risk	None
Cherry laurel *Prunus laurocerasus*	High Risk	None
Wilson's honeysuckle *Lonicera nitida*	Not Assessed	None
Flowering currant *Ribes sanguineum*	Not Assessed	None

Turbine Delivery Route (TDR)

Botanical / Habitat surveys along the TDR was undertaken between 10th – 11th June 2021. Survey effort during the walkover of the TDR focussed on turbine delivery work locations (nodes) where vegetation trimming/clearance or enabling works are proposed to accommodate the TDR.

A total of nine invasive species were recorded across eleven locations along the TDR. Of these nine invasive species one is classified as High Risk, four are Medium Risk and four are Low Risk. See Table 8-31 over for more information. One of the Low-Risk species, Spanish bluebell, is also a Third Schedule listed species. This was located outside the TDR footprint however, c. 10m from the load bearing area at Node 4 Clarina Roundabout.

Table 8-31: Invasive & non-native species recorded along the TDR

Species	Invasive Impact	Location
Node 2 – Port Access Road/N69		
Red osier dogwood *Cornus sericea*	Low Risk	Node 2.0 - Ornamental planting in oversail area footprint
Old man's beard *Clematis vitalba*	Medium Risk	Node 2.0 - Growing in pine tree in oversail area footprint

Species	Invasive Impact	Location
Butterfly bush *Buddleja davidii*	Medium Risk	Node 2.3 - Ornamental planting immediately adjacent to outer extent of trailer path
Node 4 – Clarina Roundabout		
Norway maple *Acer platanoides*	Low Risk	Ornamental planting in load bearing footprint
Spanish bluebell *Hyacinthoides hispanica*	Low Risk/ Schedule III	Ornamental outside load bearing footprint (c. 10m away)
Node 5 -Mungret Interchange – Western Roundabout		
Norway maple *Acer platanoides*	Low Risk	Ornamental planting in load bearing footprint
Small-leaved lime *Tilia cordata*	Not assessed	Ornamental planting outside load bearing & oversail footprint
Node 6 -Mungret Interchange – Eastern Roundabout		
Norway maple *Acer platanoides*	Low Risk	Ornamental planting outside load bearing & oversail footprint
Small-leaved lime *Tilia cordata*	Not assessed	Ornamental planting outside load bearing & oversail footprint
Node 7 – M20/N20 Off-ramp Southbound		
Red osier dogwood *Cornus sericea*	Low Risk	Ornamental planting in oversail area footprint
Turkey oak *Quercus cerris*	Medium Risk	Ornamental planting in oversail area footprint
Node 8 – N20 Right Curve Ballymacrory		
No invasive species.	-	-
Node 9 – N20/L1322 Junction Ballyhea		
No invasive species.	-	-
Node 10 – L1322		
Sycamore *Acer pseudoplatanus*	Medium Risk	Node 10.3 – in hedgerow in oversail area footprint; Node 10.5 – grassy bank/hedgerow in oversail area footprint; Node 10.10 – grassy bank/hedgerow in oversail area footprint
Wilson's honeysuckle *Lonicera nitida*	Not assessed	Node 10.3 – in hedgerow in oversail area footprint Node 10.11 – in woodland in bell-mouth entrance footprint

Species	Invasive Impact	Location
Cherry laurel *Prunus laurocerasus*	High Risk	Node 10.6 – in garden immediately adjacent to oversail area footprint
Snowberry *Symphoricarpus albus*	Low Risk	Node 10.9 – in hedgerow in oversail area footprint; Node 10.10 – in hedgerow in oversail area footprint

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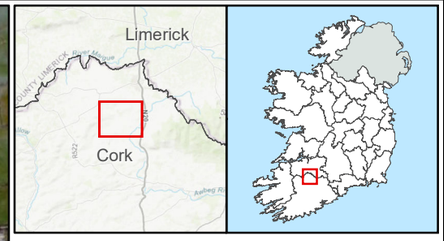

Legend

- Site Boundary
- Underground Cable Route

Invasive Species:

- Cherry Laurel
- Flowering Currant
- Montbretia
- Snowberry
- Sycamore
- Wilson's Honeysuckle

N W E S

0 0.25 0.5 1 Kilometers

TITLE:	Invasive Species at Site Entrance and along Grid Connection		
PROJECT:	Annagh Wind Farm		
FIGURE NO:	8.9		
CLIENT:	EMP Group		
SCALE:	1:18000	**REVISION:**	0
DATE:	13/10/2021	**PAGE SIZE:**	A3

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8.3.5 Description of Existing Habitats

8.3.5.1 Wind farm site

The habitat survey was undertaken between over 29th June and 22nd, 14th and 15th July 2021. No flora listed on the FPO or as threatened, vulnerable or endangered on the Irish Red list were recorded during site walkovers.

The wind farm site habitat survey study area encompasses a mixture of habitat types, with wooded habitats (Mixed broadleaved woodland WL1 and Immature woodland WS2) composed of broadleaved and mixed broad-leaf/conifer plantations forming a large portion. Agricultural land comprising Improved agricultural grassland GA1 and Wet grassland GS4 dominates the remainder.

Hedgerows WL1, Treelines WL2 and Drainage ditches FW4 delineate field boundaries, and Lowland depositing rivers FW2 flow through and adjacent to the study area.

Other habitats present, either in pure form or various mosaic combinations include Conifer plantation WD4, Marsh GM1, Dry meadows & grassy verges GS2, Scrub WS1, Recolonising bare ground ED3, Reed and large sedge swamps FS1, Artificial pond FL8 and Buildings and artificial surfaces BL3.

The habitats present within the wind farm site boundary and surrounding study area are mapped in Figure 8-10.

Improved Agricultural Grassland GA1

Intensively managed pastureland is present in the northern and southern sections of the study area. Observations of the site indicate the Intensively managed grassland onsite is primarily cut for silage.

The uniform sward is dominated by perennial ryegrass *Lolium perenne,* indicating re-seeding has been carried out. Other grasses such as Timothy *Phleum pratense* and cocksfoot *Dactylis glomerata* are present occasionally, while sweet vernal grass *Anthoxanthum odoratum* and false oat grass *Arrhenatherum elatius* are found along unmanaged margins.

A range of common forbs are present, including common mouse ear *Cerastium fontanum,* chickweed *Stellaria media,* broad leaved dock *Rumex obtusifolius,* creeping buttercup *Ranunculus repens,* meadow buttercup *Ranunculus repens,* dandelion *Taraxacum officinale* Agg., ribwort plantain *Plantago lanceolata,* red dead-nettle *Lamium purpureum*, curled dock *Rumex crispus,* greater plantain *Plantago major*, smooth sow-thistle *Sonchus oleraceus,* Thyme-leaved speedwell *Veronica serpyllifolia* and white clover *Trifolium repens*. The latter is planted with grasses as a nitrogen-fixer but is also beneficial to bees. A number of ruderal species including pineapple weed *Matricaria discoidea,* water pepper *Persicaria hydropiper,* fat hen *Chenopodium album* and knotgrass *Polygonum aviculare* were present in more open swards and disturbed ground.

Marsh ragwort *Jacobaea aquatica* and cuckoo flower *Cardamine pratensis* were common in lower-lying fields, demonstrating the dampness of soils in these areas.

While the self-seeded forbs listed above increase the diversity of this habitat somewhat and the presence of clover is beneficial to pollinators, it is predominantly an intensive monoculture crop managed for silage and grazing and as such is of limited biodiversity value.

This habitat is traversed by the proposed grid connection and site access route/TDR.

Plate 8-1: Improved Agricultural Grassland GA1

Wet Grassland GS4

Wet grassland dominates the central and south-eastern parts of the study area and is also present in forestry clearings. The wet grassland in the south-western area is grazed short and heavily poached in many areas, however thickets of taller vegetation are also present. The dominant graminoids in this area are Yorkshire fog *Holcus lanatus* and soft rush *Juncus effusus*; however, a diversity of other species including marsh foxtail *Alopecurus geniculatus,* creeping bent-grass *Agrosits stolonifera, velvet* bent-grass *A.capillaris*, crested dog's tail *Cynosurus cristatus,* rough meadow-grass *Poa trivialis*, and tufted hair-grass *Deschampsia cespitosa are also present*. Annual meadow-grass *Poa annua* was present in some drier margins, and perennial ryegrass *Lolium perenne* was also present. The latter is considered to have self-seeded from nearby Improved agricultural grassland fields. Hard rush *Juncus inflexus* and jointed rush *Juncus articulates* are also present, as are sedges including glaucous Sedge *Carex flacca* and oval sedge *C.leporina.*

A range of plants associated with damp ground including marsh cudweed *Gnaphalium uliginosum* lesser spearwort *Ranunculus flammula,* ragged robin *Silene flos-cuculi,* celery-leaved buttercup *Ranunculus sceleratus,* marsh ragwort *Jacobaea aquatica,* marsh thistle *Cirsium palustre,* yellow-flag iris *Iris pseudacourus,* water forget-me-not *Myosotis scorpioides*, field horsetail *Equisetum arvense,* marsh horsetail *Equisetum palustre,* silverweed *Argentina anserina,* common valerian *Valeriana officinalis,* purple loosestrife *Lythrum salicaria,* skullcap *Scutellaria galericulata,* marsh cinquefoil *Comarum palustre,* greater bird's fooot trefoil *Lotus pedunculatus* and water mint *Mentha aquatica* are present in these areas. Stunted fool's watercress *Helosciadium nodiflorum* was recorded in one heavily grazed field. A number of commonly occurring forbs including knapweed *Centaurea nigra*, yarrow *Achillea millefolium,* birds foot trefoil *Lotus corniculatus,* water pepper *Persicaria hydropiper,* creeping thistle *Cirsium arvense,* daisy *Bellis perennis,* redshank *Persicaria maculosa* white clover *Trifolium repens,* wild carrot *Daucus carota,* and creeping buttercup *Ranunculus repens* are also present in some parts.

Due to its semi-natural character and lack of management intervention this habitat is ***higher value locally important*.**

This habitat does not have links with the corresponding Annex 1 habitat *'Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) [6410].*

Turbine location T05 is within this habitat, and the proposed internal access track network and gird connection traverse this habitat.

Plate 8-2: Wet Grassland GS4

Wet Grassland GS4 (Wet Meadow)

The wet grassland present in the central part of the study area, consisting of three distinct fields, was less heavily grazed and less disturbed during habitat surveys, and more closely resembled wet meadow-type habitats. A similar range of plants to those described above are present, with the addition of selfheal *Prunella vulgaris*, ribwort plantain *Plantago lanceolata*, meadowsweet *Filipendula ulmaria*, common marsh bedstraw *Galium palustre*, square-stalked St John's-wort *Hypericum tetrapterum,* common sorrel *Rumex acetosa*, cat's ear *Hypochaeris radicata*, red clover *Trifolium pratense*, devil's-bit scabious *Succisa pratensis*, quaking grass *Briza media*, meadow thistle *Cirsium dissectum*, Common spotted orchid *Dactylorhiza fuchsia*, field woodrush *Luzula campestris*, sweet vernal grass *Anthoxanthum odoratum*, smooth hawksbeard *Crepis capillaris and* marsh lousewort *Pedicularis palustris*. A number of sedges including flea sedge *Carex pulicaris*, brown sedge *Carex disticha*, oval sedge *Carex leporina* and hairy sedge *Carex hirta* were also recorded in these fields.

The central field has similarities with the Annex 1 habitat *'Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) [6410].* As this habitat type is likely to be declining at a national level, it is potentially of **County Importance**. This field is outside the proposed development footprint.

The wet meadow-type fields to the north (overlapped by T02) do not correspond with the Annex 1 habitat *'Molinia meadows [6410].'* However, their semi-natural character, lack of management, low level of disturbance and light grazing regime means they are good-quality semi-natural grasslands. As such they are ***locally important higher value*****.** The footprint of the proposed turbine T02 hard standing and the internal site access track network are within this habitat type.

It was noted during subsequent casual observations of these fields (recorded during mammal surveys on 6th May 2021) that they have been grazed heavily since detailed habitat surveys were undertaken. This demonstrates how the habitats in this area are subject to the dynamic processes and random changes associated with free-roaming cattle.

Plate 8-3: Wet Grassland GS4 (Wet Meadow)

Wet Grassland/Marsh Mosaic GS4/GM1

A mosaic of wet grassland/marsh is present in the western part of the study area. The plant assemblage is similar to adjoining areas of wet grassland, however the vegetation is higher, pools of water are frequent and the ground quakes in parts. Yorkshire fog *Holcus lanatus* and soft rush *Juncus effusus* are dominant; other species present include marsh horsetail *Equisetum palustre*, yellow-flag iris *Iris pseudacourus*, watercress *Nasturtium officinale*, creeping buttercup *Ranunculus repens*, marsh foxtail *Alopecurus geniculatus,* common marsh bedstraw *Galium palustre,* lesser spearwort *Ranunculus flammula*, duckweed *Lemna minor*, common valerian *Valeriana officinalis*, marsh cinquefoil *Comarum palustre*, meadowsweet *Filipendula ulmaria*, floating sweet-grass *Glyceria fluitans* and slender tufted sedge *Carex acuta.*

Due to its semi-natural character this habitat is ***higher value locally important*.**

This habitat contains a number of characteristic species associated with the Annex 1 habitat '*Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]*' however the dominance of graminoids means it does not have true links with the Annex 1 habitat.

Part of the proposed T04 hard standing and internal access track network overlaps this habitat mosaic.

Plate 8-4: Wet Grassland/Dry Meadows & Grassy Verges Mosaic GS4/GS2

Wet Grassland/Dry Meadows & Grassy Verges Mosaic GS4/GS2

A mosaic of wet grassland and dry meadow vegetation is present in forestry clearings in the western/central part of the study area, and along woodland plantation rides and edges. Species associated with damp soils including marsh thistle *Cirsium palustre*, Yorkshire fog *Holcus lanatus*, tufted hair-grass *Deschampsia cespitosa*, meadowsweet *Filipendula ulmaria*, yellow-flag iris *Iris pseudacourus*, greater bird's fooot trefoil *Lotus pedunculatus*,common marsh bedstraw *Galium palustre*, silverweed *Argentina anserina*, water mint *Mentha aquatica* were present. Species associated with drier habitats such as meadow vetchling *Lathyrus pratensis*, lesser stitchwort *Stellaria graminea,* false oat-grass *Arrhenatherum elatius,* common sorrel *Rumex acetosa,* bush vetch *Vicia sepium*, knapweed *Centaurea nigra* and cat's ear *Hypochaeris radicata* were also present.

Due to its semi-natural character this habitat is ***higher value locally important*.**

This habitat does not have links with the corresponding Annex 1 habitats *'Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) [6410]* and '*Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis) [6510]'.*

This mosaic is outside the proposed development footprint.

Plate 8-5: Wet Grassland/Dry Meadows & Grassy Verges Mosaic GS4/GS2

Wet Grassland/Improved Agricultural Grassland Mosaic GS4/GA1

A number of drier, more heavily grazed fields in the central part of the study area are representative of a mix of wet grassland and improved agricultural grassland. These fields had a lower diversity of species than wetter areas. Yorkshire fog *Holcus lanatus*, crested dog's tail *Cynosurus cristatus*, bent grass *Agrostis* Sp. and perennial rye-grass *Lolium perenne* are present, in addition to a number of plants commonly occurring in pastureland including common mouse ear *Cerastium fontanum,* spear thistle *Cirsium vulgare* and creeping thistle *Cirsium arvense*. Ragged robin *Silene flos-cuculi* and glaucous Sedge *Carex flacca* which are usually found in less intensively managed grasslands are also present, while species characteristic of wet grassland such as yellow-flag iris *Iris pseudacourus*, marsh ragwort *Jacobaea aquatica*, soft rush *Juncus effusus* and marsh thistle *Cirsium palustre* are present in wetter parts.

Although more heavily grazed and less species-rich than wetter fields, these areas retain a semi-natural character and as such are ***locally important, higher value*****.**

The proposed internal access track network and gird connection traverses this habitat mosaic.

Plate 8-6: Wet Grassland/Improved Agricultural Grassland Mosaic GS4/GA1

Wet Grassland/Marsh/Conifer Plantation Mosaic GS4/GM1/WD4

An area of Wet grassland/Marsh which has been planted with sitka spruce *Picea sitchensis* is present in the eastern part of the study area. Although the presence of conifers triggers automatic classification as Conifer plantation WD4, the natural habitats present are also worthy of description, particularly as the conifer crop appears to be growing poorly due to the wetness of this area.

While young sitka spruce are present throughout, the dominant habitats are Wet grassland and Marsh. Drier parts are dominated by Yorkshire fog *Holcus lanatus* and soft rush *Juncus effusus,* with creeping buttercup *Ranunculus repens* on the ground layer. The floral assemblage becomes more diverse in wetter areas, with a number of plants found in both Wet grassland and Marsh present: meadowsweet *Filipendula ulmaria,* (dominant), water mint *Mentha aquatica,* marsh thistle *Cirsium palustre* and field horsetail *Equisetum arvense.* Also present were reed canary grass *Phalaris arundinacea* common valerian, *Valeriana officinalis,* marsh cinquefoil *Comarum palustre* meadow thistle, *Cirsium dissectum,* meadow veitchling *Lathyrus pratensis,* and knapweed *Centaurea nigra.*

Insect abundance was noticeably higher in this habitat than adjacent Improved agricultural grassland. Due to its semi-natural character and poor growth of the conifer crop this habitat is ***higher value locally important*.**

The marsh element of this mosaic may have links with the Annex 1 habitat '*Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]*' however it does not represent a good-quality example, with the presence of conifers reducing its value.

This mosaic is outside the proposed development footprint.

Plate 8-7: Wet Grassland/Marsh/Conifer Plantation Mosaic GS4/GM1/WD4

Wet Grassland/Scrub Mosaic GS4/WS1

A field in the central part of the study area contains a mosaic of these habitat types, with Yorkshire fog *Holcus lanatus*, soft rush *Juncus effusus*, marsh ragwort *Jacobaea aquatica*, marsh thistle *Cirsium palustre*, nipplewort *Lapsana communis* and nettle *Urtica dioica* in open parts, interspersed with bramble *Rubus fruticosus* Agg. and blackthorn *Prunus spinosa* thickets. Wet grassland and willow *Salix* Sp. scrub is present along the margin of a mixed broadleaved woodland plantation.

The semi-natural character of this habitat makes it ***locally important, higher value*.**

This mosaic is outside the proposed development footprint.

(Photograph not available).

Recolonising Bare Ground/Scrub Mosaic ED3/WS1

An area associated with a derelict farmhouse covered by ruderal species and scrub is present in the southern part of the study area. Nettle *Urtica dioica* and medium-flowered winter-cress *Barbarea intermedia* dominate this area, interspersed by elder *Sambucus nigra* and bramble *Rubus fruticosus* Agg. scrub. Shepherd's purse *Capsella bursa-pastoris*, chickweed *Stellaria media,* marsh woundwort *Stachys palustris* and wood speedwell *Veronica monatana* were also present. A muddy farm track runs through this area.

The semi-natural character and structural diversity of this habitat makes it ***locally important, higher value*.**

This proposed met mast access track runs along the existing farm track traversing this habitat.

Plate 8-8: Recolonising Bare Ground/Scrub Mosaic ED3/WS1

Hedgerows WL1

The hedgerows within the wind farm study area are of variable character and quality, ranging from mature hawthorn *Crataegus monogyna* and willow *Salix* Sp. hedges to the severely trimmed low hedgerows characteristic of over-zealous agricultural management.

In addition to hawthorn and willow, hedgerows also contained blackthorn *Prunus spinosa*, elder *Sambucus nigra* and ash *Fraxinus excelsior* trees, with dog rose Rosa canina and bramble *Rubus fruticosus* in the understory. Species such as cleavers *Gallium aparine*, scaly male fern *Dryopteris affinis*, soft shield fern *Polystichum setiferum*, hart's tongue fern *Asplenium scolopendrium*, hogweed *Heracleum sphondylium*, false brome *Brachypodium sylvaticum* and false oat-grass *Arrhenatherum elatius* were associated with the marginal areas of hedgerows.

The semi-natural character, structural diversity and usefulness to wildlife of this habitat makes it ***locally important, higher value*.**

A number of hedgerows are intersected by the proposed internal access track network and grid connection.

Plate 8-9: Hedgerows WL1

Treelines WL2

The established treelines marking field boundaries in drier parts of the study area are comprised primarily of ash *Fraxinus excelsior*, with occasional beech *Fagus sylvatica* and sycamore *Acer pseudoplatanus*. Alder *Alnus glutinosa* treelines flank sections of the Oakfront stream running through the study area. A mature aspen *Populus tremula* treeline is present in the southern-eastern part of the study area.

The treelines onsite are variable in character. Some have large gaps, due to cutting of lower-growing hedgerow species and retention of mature specimen trees during agricultural management. Treelines which are unmanaged are in a better state, with less gaps present.

This habitat is ***locally important, higher value*.**

A double alder treeline is intersected at one point by the proposed internal access track network and grid connection.

Plate 8-10: Treelines WL2

Hedgerows/ Treelines Mosaic WL1/WL2

Filed boundaries containing elements of both of these habitats as described above are present within the study area. These include alternating sections of hedgerow/treeline, and boundaries containing large mature trees but also a well-developed and bushy understory more characteristic of hedgerow structure.

Hedgerow/treeline mosaics are ***locally important, higher value*****.**

This mosaic is not within the proposed development footprint.

Plate 8-11: Hedgerows/ Treelines Mosaic WL1/WL2

Scrub WS1

An area of scrub fringes the ringfort in the southern part of the study area. The scrub is similar to surrounding hedgerows, with hawthorn *Crataegus monogyna*, willow *Salix* Sp. and bramble *Rubus fruticosus* Agg. making up the majority of vegetation.

The semi-natural character and structural diversity of this habitat makes it ***locally important, higher value*.**

This habitat is outside the proposed development footprint.

(Photograph not available).

Mixed Broadleaved Woodland/Scrub Mosaic WD1/WS1

This habitat mosaic is represented by a stand of sycamore *Acer pseudoplatanus*, Ash *fraxinus excelsior* and hawthorn *Crataegus monogyna* trees growing on a limestone outcrop in the centre of an improved agricultural grassland field.

This habitat is ***locally important, higher value.***

This habitat is outside the proposed development footprint.

(Photograph not available).

Immature Woodland WS1

This habitat is dominated by pedunculate oak *Quercus robur*, with intermittent rows of birch *Betula* Sp. The western extent of this habitat also contains groves of Scot's pine *Pinus sylvestris* along it's edges. The ground flora is dominated by grasses.

Examination of historical aerial imagery[5] indicates these more recent blocks of woodland were planted by 2012.

Proposed internal access tracks and the proposed onsite substation overlap this habitat type.

This habitat is ***locally important, higher value.***

Plate 8-12: Immature Woodland WS1

Mixed Broadleaved Woodland WD1

The broadleaved woodland onsite is predominantly composed of plantation woodlands made up of Ash *fraxinus excelsior,* pedunculate oak *Quercus robur* and Scot's pine *Pinus sylvestris* and alder *Alnus glutinosa*.

Ash plantations made up of trees ranging from 8 – 12m in height are present in the northern and south-eastern parts of the study area. In the south-eastern area, alder *Alnus glutinosa* is also present in wetter areas. The ground flora in these plantations ranges from a drier assemblage consisting of nettle *Urtica dioica*, hogweed *Heracleum sphondylium*, bramble *Rubus fruticosus* and rough meadow-grass *Poa trivialis* to wet grassland/marsh-type vegetation found in wetter areas. Reed canary grass *Phalaris arundinacea*, common valerian *Valeriana officinalis*, meadowsweet *Filipendula ulmaria*, tufted hair-grass *Deschampsia cespitosa*, purple loosestrife *Lythrum salicaria*, ragged robin *Silene flos-cuculi* and common marsh bedstraw *Galium palustre* are common in wetter parts, while gypsywort *Lycopus europaeus* and wood horsetail *Equisetum sylvaticum* were also recorded.

[5] http://map.geohive.ie/mapviewer.html

An area of the drier type ash plantation lies within the proposed footprint of turbine T03.

The plantations in the western and southern parts of the study area consist of alternating rows of pedunculate oak *Quercus robur* and downy birch *Betula pubescens.* Ground flora is grassy, with Yorkshire fog *Holcus lanatus,* creeping buttercup Rannunculus repens, nettle *Urtica dioica* and rough meadow-grass *Poa trivialis.* Tutsan *Hypericum androsaemum* and soft shield fern *Polystichum setiferum* and ivy *Hedera helix* were recorded in association with an old hedgerow subsumed by this habitat. Turbines T04 and T06 are located within this plantation type, as is a section of the felling buffer around T02.

A narrow strip of mixed broadleaved woodland is present at the proposed site entrance. This is dominated by sycamore *Acer pseudoplatanus* and also includes ash *Fraxinus excelsior*. Individual sitka spruce *Picea sitchensis* and cedar *Cedrus* Sp. trees are also present. Hart's tongue fern *Asplenium scolopendrium*, scaly male fern *Dryopteris affinis*, ivy *Hedera helix*, honeysuckle *Lonicera periclymenum* and the non-native Wilson's honeysuckle *Lonicera nitida* are present in the shrub and ground layers. This area is within the footprint of the proposed bell-mouth site entrance.

A plantation dominated by alder *Alnus glutinosa* is present in the southern part of the study area. No proposed infrastructure is located within this plantation type.

Examination of historical aerial imagery[6] indicates the more mature plantations were not present in 1995 but had been planted by 2000, with more recent blocks having been planted by 2012.

An area of self-seeded woodland is present in the northern part of the study area. This small woodland composed of Ash *fraxinus excelsior,* hawthorn *Crataegus monogyna* and elder *Sambucus nigra* has developed in a disused quarry pit. Ivy *Hedera helix* is present on some trees. The woodland is used for shelter by cattle and much of the ground is bare. Where ground vegetation is present around the edges and inaccessible slopes, wood dock, meadowsweet *Filipendula ulmaria,* rough meadow-grass *Poa trivialis* and selfheal *Prunella vulgaris* can be found. No proposed infrastructure is located within this woodland.

This habitat is ***locally important, higher value.***

The woodlands/plantations on site do not correspond to any Annex 1 habitat types.

[6] http://map.geohive.ie/mapviewer.html

Plate 8-13: Mixed Broadleaved Woodland WD1

Mixed Broadleaved/Conifer Woodland WD2

Plantations made up of alternating rows of pedunculate oak *Quercus robur* and Scot's pine *Pinus sylvestris* are present within the study area; this habitat type is overlapped by the footprint of turbine T01. A sparse ground flora is present in peripheral areas of these densely shaded plantations. Species in the ground layer include Timothy grass *Phleum pratense,* nettle *Urtica dioica,* common cleavers *Galium aparine* and ground elder *Aegopodium podagraria.* Fox-tail feather-moss *Thamnobryum alopecurum*, and lesser pocket-moss *Fissidens bryoides* were present around tree bases.

This habitat is ***locally important, higher value.***

The woodlands/plantations on site do not correspond to any Annex 1 habitat types.

Plate 8-14: Mixed Broadleaved/Conifer Woodland WD2

Conifer Plantation WD4

A mature Sitka spruce *Picea sitchensis* plantation is present at the south-western extremity of the study area. There is no other vegetation in the deeply shaded areas beneath these trees. The plantation was established on drained wetland habitats associated with the River Awbeg and its tributary the Ardglass which appear to have been canalised and diverted around this area. The remnants of these habitats are present in adjacent areas where Sitka spruce failed to establish (see reed and sedge swamp description below).

This area is of **International Importance** due to its inclusion in the SAC. However, it does not correspond with any Annex 1 habitat and has supplanted a natural riparian habitat, reducing the conservation status of the SAC in this area.

This habitat type is ***locally important, higher value*** due to its provision of food and cover to red squirrel and birds. Squirrel feeding remains (stripped cones) were observed in this habitat.

This area is outside the proposed development footprint.

Plate 8-15: Conifer Plantation WD4

Reed and Large Sedge swamps/Conifer Plantation Mosaic FS1/WD4

A reed and large sedge swamp which has been partly drained and planted with sitka spruce is present at the south-western extremity of the study area. Drains have been excavated throughout this area, which is within the Blackwater River (Cork/Waterford) SAC (002170), however drainage and establishment of trees was not successful in all parts. As such a mosaic of reed and large sedge swamp/conifer plantation is present in open/semi-open locations where conifer establishment was poor.

The wetter parts of the reed and large sedge swamp are dominated by species-poor stands comprised mainly of greater pond sedge *Carex riparia* and brown sedge *Carex disticha*. Other species present include marsh cinquefoil *Comarum palustre*, purple loosestrife *Lythrum salicaria*, yellow loosestrife *Lysmachia vulgaris* and soft rush *Juncus effusus*. The drier parts, which are likely to have been affected by drainage, include reed canary grass *Phalaris arundinacea*, soft rush *Juncus effusus*, common sedge *Carex nigra*, skullcap *Scutellaria galericulata*, water horsetail *Equisetum fluviatile*, yellow-flag iris *Iris pseudacourus*, common valerian *Valeriana officinalis* and meadowsweet *Filipendula ulmaria.* Occasional self-seeded birch trees are also present.

This area is of **International Importance** due to its inclusion in the SAC. However, reed and large sedge swamp does not correspond with any Annex 1 habitat.

This area is outside the proposed development footprint.

Plate 8-16: Reed and Large Sedge swamps/Conifer Plantation Mosaic FS1/WD4

Reed and Large Sedge swamps/Mixed Broadleaved Woodland Mosaic FS1/WD4

A section of the swamp has been planted with Birch *Betula* Sp. trees. The trees are widely spaced, with the underlying swamp habitat remaining below. This is dominated by reed canary grass *Phalaris arundinacea.*

This area is of **International Importance** due to its inclusion in the SAC. However, reed and large sedge swamp does not correspond with any Annex 1 habitat.

This area is outside the proposed development footprint.

(Photograph not available).

Artificial Pond FL8

A small pond is present along the northern boundary of the study area, in the corner of an improved agricultural grassland field. This waterbody appears to have been created by a depression left after extractive activities associated with farming. It is oblong, measuring approximately 20 by 14 metres and was completely covered in duckweed *Lemna* Sp. when surveyed. Floating sweet-grass *Glyceria fluitans* was present around it's margins.

This habitat is ***locally important, higher value*** due to its potential to develop into a breeding area for amphibians. Its current condition makes it sub-optimal for this purpose however.

This pond is outside the proposed development footprint.

Plate 8-17: Artificial Pond FL8

Drainage Ditches FW4

Drainage ditches are ubiquitous throughout the study area. They vary in character and scale, ranging from small swales carrying trickles of water through old established channels carrying stream-like flows to large arterial ditches holding high volumes of stagnant water.

Plant species associated with drainage ditches included duckweed *Lemna* Sp. and floating sweet-grass *Glyceria fluitans,* while a wider range of plants including marsh thistle *Cirsium palustre*, hemp agrimony *Eupatorium cannabinum*, slender st. John's wort *Hypericum pulchrum*, purple loosestrife *Lythrum salicaria,* common marsh bedstraw *Galium palustre,* common valerian *Valeriana officinalis,* remote sedge *Carex remota* and pendulous sedge *Carex pendula* are present along the banks of drainage ditches.

The larger drainage ditches in the study area habitat are ***locally important, higher value*** due to their potential to host breeding amphibians.

A number of drainage ditches are intersected by the proposed internal access track network.

The Fiddane Stream (18F19), immediately upstream of the Ardglass River confluence represents a small, narrow drainage channel (FW4) that averaged <1m wide and 0.1m deep. Flow was imperceptible at the time of survey (stagnant channel), with stagnant pool habitat to a maximum of 0.2m. The stream likely runs dry for much of the year. The stream had been historically straightened and deepened, with varying bankfull heights of 1-2m. The substrata were composed exclusively of deep silt, often >0.3m in depth. Livestock poaching was evident throughout the survey site. Riparian shading was high given a mature treeline dominated by ash *Fraxinus excelsior* and sycamore *Acer psuedoplatanus* with often dense bramble *Rubus fruticosus* agg., ivy *Hedera helix* and fern scrub. Tunnelling was frequent, with abundant woody debris instream, causing regular, significant blockages to flow. Consequently, macrophyte growth was limited to only occasional marginal fool's watercress.

The Fiddane is not of fisheries value and had no suitability for white-clawed crayfish or freshwater pearl mussel given low flows, heavy siltation and its diminutive nature. Aquatic ecology Site A1 was not suitable for Q-sampling during the survey period due to its shallow depth and lack of flow. Thus, it was not possible to assess biological water quality for this stream.

The Ardglass River Ardglass River (18A23) has been extensively straightened and over-deepened, historically, with a 1.5-2m wide channel with a deep U-shaped profile and 2-2.5m bankfull heights. The river represented a drainage channel (FW4), with an imperceptible flow at the time of survey. The channel averaged 0.7-0.8m deep with a bed composed exclusively of deep silt (often >0.5m in depth). The banks were heavily overgrown with dense bramble-dominated scrub (WS1). To the east was an area of wet grassland (GS4), with coniferous plantation (WD4) adjoining to the west. Terrestrial encroachment of the channel was often high. Instream macrophyte coverage was very high, with abundant reed canary grass *Phalaris arundinacea* in addition to common duckweed *Lemna minor* and water mint *Mentha aquatica*. As a result, open water areas were sparse. Common water starwort *Callitriche stagnalis* was occasional in more open areas of channel.

Three-spined stickleback (*Gasterosteus aculeatus*) was the only species recorded during electro-fishing on the Ardglass. The site was not of value for salmonids or lamprey given the heavily-silted, heavily-vegetated and low flow nature of the channel. Whilst some low suitability existed for European eel, none were recorded. The site had poor suitability for white-clawed crayfish and none were recorded. The site had no suitability for freshwater pearl mussel given low flows, heavy siltation and its diminutive nature.

Biological water quality for the section of the Ardglass River surveyed, based on Q-sampling, was calculated as Q2-3 (poor status).

The aquatic ecological evaluation of the sampling sites on the Fiddane and Ardglass watercourses was that both are of **Local importance (lower value)**.

Plate 8-18: Drainage Ditches FW4

Lowland/Depositing Rivers FW2

The Oakfront river is a large stream flowing from north-south through the eastern side of the study area. Is has a wet width of c. 2-3m and depth ranging from c. 5cm to 0.4m. The bed contains fine gravel and sand. Flows are dominated by shallow glides, with occasional riffles and pools. Parts of the stream had been extensively straightened historically although some limited natural features by way of meanders remained (some good recovery of riparian areas also). The stream has been impacted by cattle and machinery access, as well as runoff from surrounding farmland and forestry. Large accumulations of mud are present at and downstream of fording points. Bankside vegetation varies from recovering riparian vegetation (recently cleared) to dense riparian hedgerows and alder treelines. The stream is relatively highly shaded where the latter are present.

Four fish species including brown trout, European eel, three-spined stickleback and *Lampetra* sp. (ammocoetes) were recorded via electro-fishing at the sampling sites along the Oakfront. Some suitable habitat for White Clawed Crayfish was present along this river, however none were recorded. The river has no suitability for freshwater pearl mussel given historical straightening and heavy siltation pressures.

Biological water quality at the sampling sites on the Oakfront River ranged from Q2-3 to Q3 (poor status).

This habitat type is intersected by the proposed internal access track footprint, however the crossing methodology selected (clear span bridge) selected will avoid habitat loss. The watercourses within the study area could be subject to indirect effects arising from pollution associated with wind farm construction.

This Oakfront stream is ***locally important, higher value*** where it flows through the habitat survey study area. Aquatic ecology Site B5 is classified as ***Internationally Important*** due to its location within the Blackwater River (Cork/Waterford) SAC.

Plate 8-19: Lowland/Depositing Rivers FW2

Buildings and Artificial Surfaces BL3

This habitat is represented by derelict houses and farm buildings, and occupied houses. These buildings may range in their value from ***locally important, lower value*** to ***locally important, higher value*** depending on their suitability for and animals such as bats, barn owl and swallows.

This habitat type is not overlapped by any proposed infrastructure.

Plate 8-20: Buildings and Artificial Surfaces BL3

Refuse ad Other Waste ED5

This habitat type is represented by a grassed over slurry pit north of the derelict farmhouse in the south of the study area. This habitat is of limited ecological value.

This habitat type is not overlapped by any proposed infrastructure.

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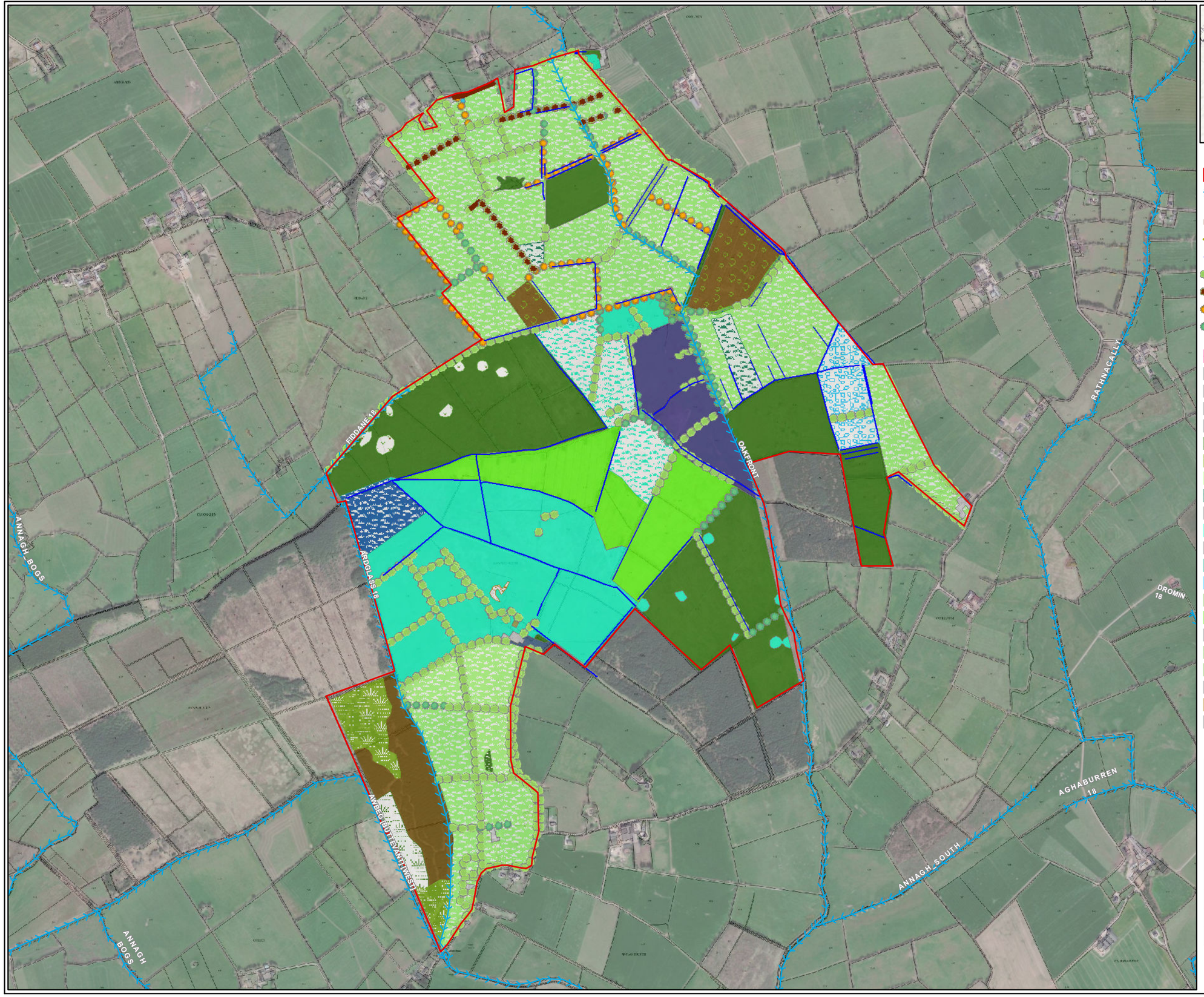

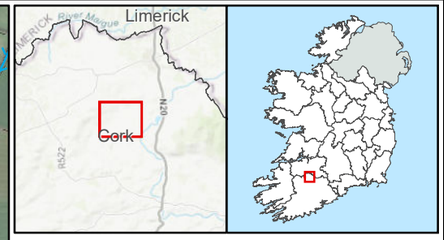

Legend

- Study Area
- Rivers

Linear Habitats

- BL2 Earth banks
- ED2 Spoil and bare ground
- FW4 Drainage ditches
- WL1 Hedgerows
- WL1/BL2 Hedgerows / Earth banks
- WL1/WL2 Hedgerows / Treelines
- WL2 Treelines

Habitat Areas

- BL1 Stone walls and other stonework
- BL3 Buildings and artificial surfaces
- ED3/WS1 Recolonising bare ground / Scrub
- ED5 Refuse and other waste
- FL8 Other artificial lakes and ponds
- FS1/WD1 Reed and large sedge swamps / (Mixed) broadleaved woodland
- FS1/WD4 Reed and large sedge swamps / Conifer plantation
- GA1 Improved agricultural grassland
- GA1 Improved agricultural grassland (Rank)
- GS4 Wet grassland
- GS4 Wet grassland [Wet Meadow]
- GS4/GA1 Wet grassland / Improved agricultural grassland
- GS4/GM1 Wet grassland / Marsh
- GS4/GM1/WD4 Wet grassland / Marsh / Conifer plantation
- GS4/GS2 Wet grassland / Dry meadows and grassy verges
- GS4/WS1 Wet grassland / Scrub
- WD1 (Mixed) broadleaved woodland
- WD1/WS1 (Mixed) broadleaved woodland / Scrub
- WD2 Mixed broadleaved/conifer woodland
- WD4 Conifer plantation
- WS1 Scrub
- WS2 Immature woodland

TITLE: Habitats			
PROJECT: Annagh Wind Farm			
FIGURE NO:	8.10		
CLIENT:	EMP Group		
SCALE:	1:12500	**REVISION:**	0
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8.3.5.2 Grid Connection

The grid connection originates within the proposed wind farm site and traverses plantation woodland and agricultural fields before exiting the site to join the L1322. As such the section within the main wind farm study area was surveyed during habitat surveys on 2nd, 14th and 15th July 2020. A walkover survey of the remainder of the grid connection (section along L1322 and un-named local road) which included a habitat survey was carried out between the 10th – 11th June 2021. No flora listed on the FPO or as threatened on the Irish Red list were recorded during this survey.

The section within the main wind farm study area originates within Immature woodland WS2, and then traverses Wet grassland GS4, Wet grassland/Improved agricultural grassland mosaic GS4/GA1, Improved agricultural grassland GA1, Mixed broadleaved woodland WD1 and Mixed broadleaved/conifer woodland WD2. The linear habitats intersected along this section comprise Hedgerow WL1, Treelines WL2, Lowland rivers FW2 (Oakfront Stream), and Drainage ditches FW4. The habitats traversed by the grid connection before leaving the main wind farm study areas are described above (8.3.5.1).

Upon exiting the agricultural holdings in which the main wind farm is located, the grid connection traverses the L1322 and an un-named local road until it reaches Charleville 110 kV substation. The dominant habitat along this section is Buildings and artificial surfaces BL3 represented by road surfaces, however the road verges which contain Dry meadows and grassy verges GS2 would also be traversed by the grid connection.

The roads are bounded by Hedgerows WL1, Treelines WL2 and a mosaic of these habitats. Other habitats abutting the grid connection include Improved agricultural grassland GA2, Scrub WS1, Amenity grassland GA1, Flower beds and borders BC4, Spoil and bare ground ED2, Dry meadows and grassy verges/Earth banks mosaic GS2/BL2 and Buildings and artificial surfaces BL3.

This section of the grid connection intersects Lowland rivers FW2 at one point (Rathnacally Stream). The associated bridge is categorised as Buildings and artificial surfaces BL3.

Buildings and artificial surfaces BL3

After leaving the main wind farm site, the grid connection follows existing local roads. These are paved and have no biodiversity value. Adjacent to the existing roads lie residential properties, agricultural buildings, surrounding grounds, and other structures which also represent this habitat type. Older buildings may present some nesting habitat for birds and roosting habitat for bats. Older residential buildings have the potential to support bat roosts whilst agricultural buildings have the potential to support roosting birds such as Swallow *Hirundo rustica* and may be Locally Important (Higher Value). These are outside the proposed grid connection footprint, however. The existing roads are of no value to wildlife.

Dry Meadows & Grassy Verges GS2

This habitat is present along road verges bordering the local roads traversed by the grid connection. Species present include Yorkshire fog *Holcus lanatus*, rough meadow grass *Poa trivialis*, false brome *Brachypodium sylvaticum,* nettle *Urtica dioica*, dock *Rumex* Sp., bush vetch *Vivia sepium*, cow parsley *Anthriscus sylvestris,* creeping buttercup *Ranunculus repens*, spear thistle *Cirsium vulgare*, pineapple weed *Matricaria discoidea,* hogweed *Heracleum sphondylium* and cleavers *Galium aparine.*

Due to its semi-natural character this habitat is ***higher value locally important*.**

This habitat does not have links with the corresponding Annex 1 habitat '*Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis) [6510]'.*

Hedgerows WL1

The hedgerows bordering the section of the grid connection along public roads vary in character and quality, ranging from thick mature hawthorn *Crataegus monogyna* hedges to grassy banks with intermittent shrubs.

In addition to hawthorn, the hedgerows along this section also contained sycamore *Acer pseudoplatanus*, blackthorn *Prunus spinosa*, and ash *Fraxinus excelsior* trees. A short length of cherry laurel *Prunus laurocerasus* hedge borders a domestic garden. Hedgerows contained cleavers *Gallium aparine*, scaly male fern *Dryopteris affinis Dryopteris affinnis* and bramble *Rubus fruticosus* in the understory, while ivy *Hedera helix* was present in both the understory and in some tree crowns.

This habitat is ***locally important, higher value*****.**

No hedgerows bounding the grid connection along public roads are within the proposed footprint.

Treelines WL2

Ash *Fraxinus excelsior* treelines are present in some areas, with occasional sycamore *Acer pseudoplatanus* also present.

This habitat is ***locally important, higher value*****.**
No treelines bounding the grid connection along public roads are within the proposed footprint.

Hedgerows/Treelines Mosaic WL1/WL2

Treeline/hedgerow mosaic containing ash *Fraxinus excelsior* and hawthorn *Crataegus monogyna* treelines are present in some areas.

This habitat is ***locally important, higher value*****.**
No treeline/hedgerow mosaics bounding the grid connection along public roads are within the proposed footprint.

Plate 8-21: BL3, GS2, WL1 and WL1/WL2 along the proposed Grid Connection

Improved agricultural grassland (GA1)

Improved agricultural grassland GA1 fields adjacent to the grid connection traversing public roads were either grazed by cattle or used for silage. Perennial Rye-grass *Lolium perenne*, Yorkshire Fog *Holcus lanatus*, and White Clover *Trifolium repens* were the dominant species. This habitat is species poor and common in the area and is assessed as being ***locally important, lower value*.**

This habitat type is not within the proposed footprint where the grid connection traverses public roads.

Scrub WS1

An area of hawthorn *Crataegus monogyna* and willow *Salix* Sp. scrub adjacent to the section of the grid connection traversing public roads is associated with a derelict dwelling. This habitat is ***locally important, higher value*.**
It is not within the proposed footprint where the grid connection traverses public roads.

Amenity grassland GA1

Amenity grassland is represented by regularly mowed lawns associated with domestic gardens where the grid connection traverses public roads. This intensively managed artificial habitat is ***locally important, lower value*.**

It is not within the proposed grid connection footprint.

Flower beds and borders BC4

This habitat is associated with domestic gardens abutting the grid connection where it traverses public roads. This habitat is ***locally important, higher value*** due to it's potential to provide food for pollinators.

It is not within the proposed grid connection footprint.

Spoil and bare ground ED2

This habitat is represented by driveways and yards surfaced with aggregate. It is of no ecological value and is not within the proposed grid connection footprint.

Watercourse Crossing

Lowland rivers FW2

The grid route traverses the Rathnacally stream via a cast concrete box culvert. Wet width and depth are c. 0.6m and 0.4m respectively. The stream is deeply shaded along most sections in this area. Reed canary grass *Phalaris arundinacea* and nettle *Urtica dioica* fringe the banks in open areas near the culvert. The bottom is heavily silted in deeper parts, while shallow riffle stretches retain some gravel on the bed. The upstream section runs along a pasture field boundary, and there is a cattle access/fording point c. 150m upstream. The downstream section is polluted and stagnant in parts and contains significant amounts of refuse associated with the adjacent dwelling. An outfall from a nearby meat plant wastewater treatment plant also discharges to the Rathnacally downstream of the crossing point.

Despite its degraded state, this habitat is ***locally important, higher value*** due to its connection with larger watercourses downstream, and less degraded stretches up and downstream.

Buildings and artificial surfaces BL3

The existing bridge structure carrying the Rathnacally Stream over the L1322 is a cast concrete structure consisting of a flat deck supported by concrete abutments on either side. The parapets are also constructed from concrete and are not vegetated. No potential bat roosting features (PRFs) are present.

The invert level is low and close to the water. This, combined with the lack of vegetation and PRFs, and small size and poor condition of the stream means the structure is not of any value to roosting bats or nesting dipper *Cinclus cinclus*. The densely vegetated stream does not provide suitable foraging habitat for Daubenton's bat.

Plate 8-22: Rathnacally Stream Downstream of Crossing Point

Plate 8-23: Rathnacally Stream Crossing Point/Bridge Structure

8.3.5.3 Turbine Delivery Route (TDR)

A walkover of the TDR was undertaken at the TDR Nodes (points of interest along the route where accommodation works and/or special trailer manoeuvres may be required) on 10th June 2021. Additional works are required in 18 locations (identified by TDR Node numbers). No flora listed on the FPO or listed as threatened on the Irish Red list were recorded during site walkovers.

Node 2 – Port Access Road/N69

This area includes Buildings and artificial surfaces BL3 (roads and modern stone wall), Improved agricultural grassland GA1, Ornamental/non-native shrub WS3, Hedgerows WL1 and Mixed broadleaved woodland WD1.

The oversail footprint overlaps Ornamental/non-native shrub comprised of red osier dogwood *Cornus sericea* and a strip of Mixed broadleaved woodland of recent origin comprised of birch *Betula* Sp., black pine *Pinus nigra*, hazel *Corylus avellana*, alder *Alnus glutinosa* and Atlantic cedar *Cedrus atlantica*. The oversail footprint also extends over a section of stone wall (BL3) and another area of Ornamental/non-native shrub comprised of domesticated cultivars of the genera *Philadelphus, Potentilla, Hypericum* and *Rosa*.

The Hedgerow and area of Mixed broadleaved woodland is ***locally important, higher value***, while the other habitats are ***locally important, lower value.***

Plate 8-24: Node 2

Node 4 –Clarina Roundabout

This node comprises Amenity grassland GA2 and Mixed broadleaved woodland WD1 of recent origin comprised of the invasive non-native tree Norway maple *Acer platanoides* (low risk of impact). The invasive non-native species Spanish bluebell *Hyacinthoides hispanica* is present under trees on the southern side of the roundabout, c. 10m outside the load bearing footprint.

One tree on the southern side of the roundabout has a split trunk, potentially providing bat roosting opportunities. Other trees were observed to be prone to splitting around branch nodes and to have limited spit/peeling bark. None of these features provided PRFs when observed due to their limited space, however the observed tendency of Norway maple to form such features means more suitable PRFs could develop as the trees mature. The urban setting, lack of surrounding vegetation and connectivity with the surrounding landscape reduces the likelihood the area would be used by bats however.

The Mixed broadleaved woodland is ***locally important, higher value*** due to being of some use to foraging birds and possibly bats, however the wooded area itself is not of value in it's own right, being recently planted and comprised of non-native (low-risk) invasive species.

Plate 8-25: Node 4

Node 5 – Mungret Interchange Western Roundabout

This roundabout supports Dry meadows and grassy verges GS2, Amenity grassland GA2 and Immature woodland WS2. Amenity grassland is present around the outer edge, which is mowed, however the remainder has been allowed to be colonised naturally by graminoids such as sweet vernal grass *Anthoxanthum odoratum*, Yorkshire fog *Holcus lanatus*, cocksfoot *Dactylis glomerata*, bent-grass *Agrostis* Sp. and oval sedge *Carex leporina.* Forbs including broadleaved dock *Rumex obtusifolius*, ribwort plantain *Plantago lanceolata*, great willowherb *Epilobium hirsutum*, red clover *Trifolium pratense* and autumn hawkbit *Scorzoneroides autumnalis* are also present.

The immature woodland in the centre of the roundabout is comprised of Norway maple *Acer platanoides* and a smaller amount of small-leaved lime *Tilia cordata.* No PRFs were evident in these young trees.

The Dry meadows/grassy verge and Immature woodland habitats are ***locally important, higher value***, and are within the load bearing footprint.

Plate 8-26: Node 5

Node 6 – Mungret Interchange Eastern Roundabout

This roundabout is very similar to Node 5, supporting Dry meadows and grassy verges GS2, Amenity grassland GA2 and Immature woodland WS2. The grassland species present are similar, with the addition of cuckooflower *Cardamine pratensis*, knapweed *Centaurea nigra*, creeping cinquefoil *Potentilla reptans* and glaucus sedge *Carex flacca*.

The immature woodland in the centre of the roundabout has the same species composition and age as Node 5. Similarly, no PRFs were evident in the young trees.

The Dry meadows/grassy verge and Immature woodland habitats are ***locally important, higher value***. Only Dry meadows and grassy verges and Amenity grassland and are within the load bearing footprint.

Plate 8-27: Node 6

Node 7 – M20/N20 Off-ramp Southbound

This area includes Buildings and artificial surfaces BL3 (roads), Ornamental/non-native shrub WS3, Dry meadows and grassy verges GS2 and Hedgerows/Mixed broadleaved woodland mosaic WL1/WD1.

Ornamental/non-native shrub comprised of red osier dogwood *Cornus sericea* is present within the oversail footprint on the northern side of the road. A mosaic of Hedgerows/Mixed broadleaved woodland comprised of willow *Salix* Sp., birch *Betula* Sp., rowan *Sorbus aucuparia*, hawthorn *Crataegus monogyna* and blackthorn *Prunus spinosa* is present within the oversail footprint on the southern side of the road. Small Turkey oak *Quercus cerris* trees are also present in the southern part of this area.

Cowslip *Primula veris* is present in the grassy verge on the southern side, however this will be oversailed only and as such will not be affected.

The Hedgerows/Mixed broadleaved woodland is ***locally important, higher value***, while Ornamental/non-native shrub is ***locally important, lower value.*** Both will require vegetation trimming to facilitate oversail.

Plate 8-28: Node 7

Node 8 - N20 Right Curve Ballymacrory

Buildings and artificial surfaces BL3 (roads) and Hedgerows WL1 are present in this area. The hedgerows are made up of hawthorn *Crataegus monogyna,* wild privet *Ligustrum vulgare,* ash *Fraxinus excelsior* and ivy *Hedera helix*. The hedgerow on the western side is taller at c. 2.5-3m, while the eastern hedgerow is c. 2m high.

No PRFs were visible in trees within the oversail footprint, however a hawthorn tree on the eastern verge was densely covered in ivy and as such not fully visible from the ground. The sections of hedgerow within the oversail footprint are ***locally important, higher value***, although the high level of traffic disturbance reduces their value to wildlife.